APPENDIX M: Landscape and Natural Character Report

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Proposed Marlborough Offshore Salmon Farm

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Introduction

1. The New Zealand King Salmon Company Limited (NZKS) have a vision for the expansion of their industry and are actively looking to adapt to climate change. This has led to the exploration of offshore farming as a likely option. A benefit of this is that the separation distance from land-based users/viewpoints helps alleviate perceptual concerns.

2. Hudson Associates has been engaged by NZKS to provide a Landscape and Natural Character Assessment in relation to a potential Offshore Salmon Farm location in Marlborough. This assessment is intended to be used in order to obtain a resource consent and our brief has three discrete aspects. Firstly, to provide a framework of design controls that will assist the preservation (NZCPS Policy 13) and protection (NZCPS Policy 15) of offshore coastal locations, secondly to describe the existing environment (landscape and natural character) and identify the specific characteristics of the application site, and thirdly to assess the likely effects that may arise in this location from a large-scale salmon farming activity.

   - Part A - Design Guide for Offshore Salmon Farms ("Design Guide")
   - Part B - Description and characterisation of the existing environment
   - Part C - Assessment of landscape and natural character effects

3. Part A (Design Guide) needs to acknowledge that offshore farming, of this type and scale, is only just emerging as a viable option worldwide. The design of potential salmon farming infrastructure is difficult to ascertain as each theoretical structure/pen design will respond to oceanic conditions (e.g. wave height and current) differently. In relation to offshore aquaculture developments projects, NZKS has considered a range of other developments, including ten in Norway and one in Australia (Attachment 1), but at this stage do not want to specify the exact technology that will be implemented. Therefore a set of performance standards are sought to control the potential landscape and natural character effects and these will provide the framework for Part C (Assessment of Effects).

4. Part B has unique complexities due to developing case law related to proposed activities within an area identified as an 'Outstanding Natural Feature or Landscape'. This is something that NZKS is acutely aware of in relation to other applications in the Marlborough Sounds and will be addressed in the assessment below.

Assessment Methodology

5. The methodology used for this assessment has been undertaken with reference to the NZILA Best Practice Note: Landscape Assessment and Sustainable Management 10.1[1] and Landscape Assessment from the Quality Planning website.[2]

6. It is current practice to undertake evaluations using biophysical (natural science) attributes, perceptual/sensory attributes, and associative attributes (which comprise matters such as cultural, historical and recreational values). The existing environment (the site and its wider context) is described and characterised in this assessment according to these attributes or values.

7. The assessment of effects is based on expert judgement and considers physical modifications and subsequent effects on the biophysical environment, as well as effects on the existing character of the site and its locality, the site's resilience and capacity, and its sensitivity and vulnerability to the proposed change. Effects may arise from changes such as a new use (new or different activities), and/or changes to the existing elements, patterns and processes in the landscape. Such changes can affect existing character and alter overall amenity and/or people's appreciation of an area. Visual changes are also considered from identified viewpoints to determine effects on visual amenity.

8. The nature and scale of the proposed changes (often referred to as the magnitude of change) are assessed against the characteristics and values identified in the existing environment to determine the actual and potential effects the proposed changes will have on the existing qualities of the landscape. It is important to note that a large magnitude of change does not necessarily constitute a high level of adverse effect, depending on the qualities and character of the existing environment.

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[1] https://nzila.co.nz/media/uploads/2017_01/nzila_ldas_v3.pdf
[2] http://www.qualityplanning.org.nz/index.php/planning-process-plan-topics-land-landscape/landscape-1

9. An assessment of cumulative effects will be undertaken for landscape and natural character above 40,000mt of feed.

10. Hudson Associates made a number of visits to area in question, and the wider Marlborough Sounds over a period of time from 2015 to 2018, as part of a wider body of work for the MPI Relocation Proposal put forward in 2017. Visits were by boat as well as via aerial flyovers. A large number of photos of the area were recorded as part of these visits.

11. The assessment uses a seven-point scale to rate effects:

Negligible	Very Low	Low	Moderate	High	Very High	Extreme

12. The NZILA Best Practice Note: Landscape Assessment and Sustainable Management 10.1 does not make comment on how to relate effects rating scales to RMA terminology. This assessment takes the following view as being logical:

Table 1 - Rating of effects and RMA and case law terminology

Effects rating scale	RMA terminology
Extreme	Significant adverse effects.
Very High	Significant adverse effects.
High	More than minor (moderate) adverse effects.
Moderate	More than minor (moderate) adverse effects.
Low	Minor adverse effects.
Very Low	Less than minor adverse effects.
Negligible	Less than minor adverse effects.

Landscape character effects assessment

13. In the NZILA Best Practice Note[3] landscape is defined as *"the cumulative expression of natural and cultural features, patterns and processes in a geographical area, including human perceptions and associations."* By this definition, we consider that landscape also encompasses seascape.

[3] https://nzila.co.nz/media/uploads/2017_01/nzila_ldas_v3.pdf

14. For the assessment of landscape effects consideration is given to effects on all attributes (biophysical, perceptual, and associative) in coming to an overall conclusion. Weighting between these three will not necessarily be equal as one factor may be of particular importance and be weighted more strongly than one or both of the other attributes.

15. To determine the existing level of landscape character, the application area will be assessed using the rating scale in Table 2.0. The table gives examples for each level of rating, however, these are not exclusive. Additionally, not all characteristics and attributes of a landscape will necessarily be weighted evenly, therefore, some factors may have more influence on the rating assigned to the existing landscape character.

16. Amenity values are defined in the RMA as "those natural or physical qualities and characteristics of an area that contribute to people's appreciation of pleasantness, aesthetic coherence, and cultural and recreational attributes." Amenity includes a combination of factors, including ambient noise, air quality, and recreational and cultural attributes. For the purposes of this assessment, a change to visual amenity that the proposal would bring to the outlook of the viewing audience will be considered within the perceptual component of the landscape assessment. This will contemplate effects arising from the physical arrangement of the proposal within the existing environment and how a change in this composition is perceived, the scale, type and intensity of change, and the nature of the audience who would experience the change.

Table 2 - Existing landscape character

SCALE	DESCRIPTION
Outstanding	Areas of outstanding landscape character are those landscapes which fulfil the criteria described in "Very High" but that also qualify as eminent, which is determined using overall professional judgement.
Very High	Natural and cultural features, patterns and processes are exceedingly recognised for their biophysical, perceptual or associational attributes. These may include (but not be limited to) factors relating to geology, hydrology, ecology, aesthetics, legibility/expressiveness, transience, wildness, history, tangata whenua and other shared and recognised associations. For example, the area is especially important for public education, has legible formative processes that are dominant, is exceedingly memorable and coherent, has an overarching presence of native communities, displays a dominant sense of

	wildness, is associated with a historical, natural or cultural event which is exceedingly important, and has substantial importance to tangata whenua.
High	Natural and cultural features, patterns and processes are distinctly recognised for their biophysical, perceptual or associational attributes. These may include (but not be limited to) factors relating to geology, hydrology, ecology, aesthetics, legibility/expressiveness, transience, wildness, history, tangata whenua and other shared and recognised associations. For example, the area is particularly important for public education, has legible formative processes that are prominent, is distinctly memorable and coherent, has a distinctive presence of native communities, displays a prominent sense of wildness, is associated with a historical, natural or cultural event which is distinctively important, and has particular importance to tangata whenua.
Moderate	Natural and cultural features, patterns and processes are obviously recognised for their biophysical, perceptual or associational attributes. These may include (but not be limited to) factors relating to geology, hydrology, ecology, aesthetics, legibility/expressiveness, transience, wildness, history, tangata whenua and other shared and recognised associations. For example, the area is reasonably relevant for public education, has legible formative processes that are obvious, is clearly memorable and coherent, has an obvious presence of native communities, displays an apparent sense of wildness, is associated with a historical, natural or cultural event which is of reasonable importance, and has apparent importance to tangata whenua.
Low	Natural and cultural features, patterns and processes are noticeable for their biophysical, perceptual or associational attributes. These may include (but not be limited to) factors relating to geology, hydrology, ecology, aesthetics, legibility/expressiveness, transience, wildness, history, tangata whenua and other shared and recognised associations. For example, the area has limited relevance for public education, has legible formative processes that are discernible, is noticeably memorable and coherent, has an appreciable presence of native communities, displays a noticeable sense of wildness, is associated with a historical, natural or cultural event which has limited importance, and has slight importance to tangata whenua.
Very Low	Natural and cultural features, patterns and processes are faintly recognised for their biophysical, perceptual or associational attributes. These may include (but not be limited to) factors relating to geology, hydrology, ecology, aesthetics, legibility/expressiveness, transience, wildness, history, tangata whenua and other shared and recognised associations. For example, the area is barely

	relevant for public education, has legible formative processes that are hard to discern, is inconsequentially memorable and coherent, has a minimal presence of native communities, displays an inconsequential sense of wildness, is associated with a historical, natural or cultural event which has minimal importance, and has very slight importance to tangata whenua.
Negligible	Natural and cultural features, patterns and processes are not recognised for their biophysical, perceptual or associational attributes. These may include (but not be limited to) factors relating to geology, hydrology, ecology, aesthetics, legibility/expressiveness, transience, wildness, history, tangata whenua and other shared and recognised associations. For example, the area is not relevant for public education, does not have legible formative processes, is not memorable or coherent, has an absence of native communities, displays no sense of wildness, is associated with a historical, natural or cultural event which is not important, and has no importance to tangata whenua.

17. To assess landscape character effects both the magnitude of the change and the sensitivity of the landscape to change are considered and scaled according to the descriptions given in Table 3.0. The assessment of landscape character effects includes mitigation measures mentioned in this report.

Table 3 - Landscape character effects

SCALE	DESCRIPTION
Extreme	Loss/alteration of key characteristics will be fundamental, such that the post-development landscape character will be completely changed.
Very High	Loss/alteration of key characteristics will be dominant, such that the post-development landscape character will be substantially changed.
High	Loss/alteration of key characteristics will be prominent, such that the post-development landscape character will be distinctly changed.
Moderate	Loss/alteration of key characteristics will be apparent, such that the post development landscape character will be obviously changed.
Low	Alteration of key characteristics will be noticeable, such that the post-development landscape character will be slightly changed.
Very Low	Alteration of key characteristics will be unobtrusive, such that the post-development landscape character will be inconsequentially changed.
Negligible	Alteration of key characteristics will be indiscernible, such that the post-development landscape character will be unchanged.

18. The approach to assessing landscape character has been undertaken at two scales; a broader scale assessment, and at a more detailed site scale assessment. Landscape character is a distinctive combination of landscape attributes, including landform, land cover, use, sensory qualities, and cultural and social associations, which make one area different from another and gives an area its identity. Change can potentially affect existing patterns and processes, for instance landform, waterbodies (or the ocean), vegetation and settlement patterns.

Natural character effects assessment

19. Natural character as defined in the RMA (section 6(a)) relates to the coastal environment and to waterbodies and their margins. Natural character is the extent to which natural elements, patterns and processes occur, and the nature and extent of modification to the ecosystems and landscape/seascape. Natural character ranges from pristine to modified, with the degree of natural character being highest where there is the least modification.

20. For the natural character assessment both biophysical modifications and the perceptual component of naturalness are considered. Associative attributes are not taken into consideration as these do not determine levels of natural character. Weighting between these two will not necessarily be equal as one factor may be of particular importance and weighted more strongly than the other attribute.

21. To determine the existing level of natural character, the application area will be assessed using the rating scale in Table 4.0. The table gives examples for each level of rating, however, these are not exclusive nor do some or all examples need to be present. Additionally, not all characteristics and attributes of natural character will necessarily be weighted evenly, therefore, some factors may have more influence on the rating assigned to the existing natural character.

Table 4 - Existing natural character

SCALE	DESCRIPTION
Outstanding	Areas of outstanding natural character are those landscapes which fulfil the criteria described in "Very High" but that also qualify as eminent, which is determined using overall professional judgement.

Very High	Inconsequential change to pre-modified natural character due to modifications to natural elements, processes and patterns. For example, this may include (but not be limited to) minimally reduced water flow, minimal amounts of impurities caused by human activities detected in water quality, built form is unobtrusive, very slight modification to indigenous community composition and extent, inconsequential levels of light pollution, dominant sense of wildness and remoteness, and unobtrusive human influences.
High	Noticeable change to pre-modified natural character due to modifications to natural elements, processes and patterns. For example, this may include (but not be limited to) slightly reduced water flow, discernible amounts of impurities caused by human activities detected in water quality, built form is noticeable, slight modification to indigenous community composition and extent, discernible levels of light pollution, prominent sense of wildness and remoteness, and limited human influences.
Moderate	Obvious change to pre-modified natural character due to modifications to natural elements, processes and patterns. For example, this may include (but not be limited to) reasonably reduced water flow, obvious amounts of impurities caused by human activities detected in water quality, built form is apparent, obvious modification to indigenous community composition and extent, apparent levels of light pollution, reasonable sense of wildness and remoteness, and obvious human influences.
Low	Prominent change to pre-modified natural character due to modifications to natural elements, processes and patterns. For example, this may include (but not be limited to) distinctively reduced water flow, prominent amounts of impurities caused by human activities detected in water quality, built form is prominent, distinctive modification to indigenous community composition and extent, prominent levels of light pollution, noticeable sense of wildness and remoteness, and prominent human influences.
Very Low	Substantial change to pre-modified natural character due to modifications to natural elements, processes and patterns. For example, this may include (but not be limited to) exceedingly reduced water flow, water channel natural shape and course substantially modified, substantial amounts of impurities caused by human activities detected in water quality, built form is dominant, excessive modification to indigenous community composition and extent, substantial levels of light pollution, inconsequential sense of wildness and remoteness, and dominant human influences.

Negligible	Fundamental change to pre-modified natural character due to modifications to natural elements, processes and patterns. For example, this may include (but not be limited to) complete removal of water flow, water channel natural shape and course completely modified, fundamental amounts of impurities caused by human activities detected in water quality, only built form is present, complete modification to indigenous community composition and extent, no natural darkness of the night sky present, no sense of wildness and remoteness, and fundamental human influences.

22. To assess natural character effects both the magnitude of the change and the sensitivity of the landscape to change are considered and scaled according the descriptions given in Table 5.0. The assessment of natural character effects includes mitigation measures mentioned in this report.

Table 5 - Natural character effects

SCALE	DESCRIPTION
Extreme	Loss/alteration of key characteristics will be fundamental, such that the post-development natural character will be completely changed.
Very High	Loss/alteration of key characteristics will be dominant, such that the post-development natural character will be substantially changed.
High	Loss/alteration of key characteristics will be prominent, such that the post-development natural character will be distinctly changed.
Moderate	Loss/alteration of key characteristics will be apparent, such that the post development natural character will be obviously changed.
Low	Alteration of key characteristics will be noticeable, such that the post-development natural character will be slightly changed.
Very Low	Alteration of key characteristics will be unobtrusive, such that the post-development natural character will be inconsequentially changed.
Negligible	Alteration of key characteristics will be indiscernible, such that the post-development natural character will be unchanged.

23. The approach to assessing natural character has been undertaken at the same two scales as the landscape assessment i.e. broad scale and site scale. The process to assess natural character involves an understanding of several systems and their associated attributes, including biotic, abiotic and experiential factors. As such, input from a range of disciplines is required. Information provided by the wider project team, with reports referred to in the AEE, contributed to the natural character assessment.

PART A

Design Guide (Offshore Salmon Farming)

24. New Zealand King Salmon Ltd (NZKS) has tasked Hudson Associates with the preparation of a set of design guidelines for the ongoing development of offshore salmon farming. The intention of these guidelines is to provide a consistent approach to the appearance of their offshore farms at a range of locations throughout New Zealand. Based on existing knowledge of salmon farming operations, in conjunction with current practices nationally and internationally, the following Salmon Farming Design Guidelines (SFDG) will establish a set of design provisions for NZKS offshore developments.

25. The placement of structures in an area of open ocean is, by its nature, going to appear as an introduced element within the otherwise uninterrupted ocean setting when viewed from nearby water based locations. An important factor in reducing the potential visual impact for land based views (and the corresponding landscape and natural character values) of the offshore salmon farm proposals, is the separation distance from shore. While this separation reduces visibility of the salmon farm operation from the land based viewing audience, additional mitigation measures can be implemented which further reduced the visual prominence from long distance views as well as controlling the scale of visual dominance from nearby, water based, views.

26. In relation to a suggested separation distance from shore, it is relevant to note the visibility tables developed In 2011 by Boffa Miskell Ltd to assess the visibility of salmon farms from various distances. These were prepared for the NZ King Salmon Plan Change application heard by the Board of Inquiry (BOI) in 2012 (final BOI decision issued February 2013). Although the ratings for the 'impact on view' of salmon farms over distance were based on light steel cage structures with white, black and green netting (being the Clay Point, Te Pangu and Forsyth Bay salmon farms at the time), the distances and ratings in the tables' below can still provide a useful reference point for consideration of future offshore NZKS developments.

27. The tables described visibility of salmon farms as:

Table 6 - Viewed from water:

Distance	<0.5km	0.5–1km	1-2 kms	2-3kms	>3kms
Impact on View	Dominant	Prominent	Visible Partially	Visible or minor part of the view	Components become difficult to see

Table 7 - Viewed from elevated land-based views:

Distance	<1km	1-2.5kms	2.5-5kms	>5kms
Impact on View	Dominant	Prominent	Visible	Partially visible or minor part of the view.

28. The following design objectives and principles have been designed to assist with the visual absorption of salmon farm operations into their open water settings by promoting a high quality design aesthetic for salmon farming equipment and structures located in the coastal marine area. Consideration has been given to Table 1 and 2 of the MSRMP Appendix 1. The descriptors used within these tables have helped in the development of the design guide provisions. For example the application site is considered to be an open landscape/seascape, and therefore the primary expressions of form, line, texture, pattern and colour have been incorporated into the design guide provisions.

29. These provisions are not intended to impose rules on new development, or to prescribe specific design solutions. Rather, they outline a flexible framework within which NZKS can work to achieve good design outcomes.

Design Intentions

30. The design intentions are to:

- Encourage high quality development of salmon farming components (e.g. pens/barges);
- Provide an adaptive framework that allows for the future growth of offshore salmon farming sites through consistency of built form outcomes; and
- Facilitate the landscape and natural character effects assessment component of planning applications through the development of performance based guidelines;

Design Objective

31. The design objective is:

- To achieve design simplicity through the selection, placement and operation of all components required for offshore salmon farming.

Design Policy

32. The design policy is:

- To implement design simplicity through either the use of circular/spherical form (e.g. circular pens rather than square pens) or the use of a nautical/maritime aesthetic (e.g. the design of vessels which would be anticipated within this setting), in conjunction with other construction tools which reduce visibility.

Design Principles

33. The following design principles can each be thought of as factors on a linear sliding scale between high impact and low impact. There may be situations where certain aspects of the salmon farm have functional requirements (e.g. safety) precluding the implementation of lower impact design outcomes. Where possible, there is a preference in relation to visual effects to tend toward the low impact end of the scale. The design principles include:

Setbacks (Distance from shore)

- Low Impact (greater distance) - High Impact (less distance)

34. The overall distance from shore, as mentioned above, is considered to be one of the important factors in accommodating large scale salmon farming where landscape and natural character values are a key consideration. This is because visual impacts generally diminish as viewing distance increases. The distances indicated in the visibility tables outlined above provide some guidance for differentiating the level of impact associated with various setbacks of salmon farm developments. There will be a decreasing visual impact from land as the farm location is pushed further out to sea, with the tables indicating that the benefit of additional separation diminishes at distances beyond 5km.

35. The linear separation distance (between shore and salmon farming operations) is only one variable of visual prominence and a number of other factors have been considered below.

Appearance (of both the pens and the associated working vessels)

- Low Impact (recessive/subdued) - High Impact (bold/bright)

36. While many of the details around appearance result in a negligible change when viewed from significant distances, they do promote a much more visually recessive outcome when viewed in close proximity. This may include; material/colour selection (to reduce vibrance or reflectivity), design style (to reduce prominence or complement the setting), limitations to lighting (maintain night sky darkness), or any other detail considerations which reduce visual prominence.

37. Where feasible, a subdued/desaturated colour scheme (with a preference for black) will promote a reduced visual presence, while the use of non-reflective surfaces, paints and coatings on the salmon farm structures will reduce reflection and glare. Use of unpainted (e.g. galvanized) metallic surfaces is acceptable in situations where this does not result in a noticeably high degree of reflectivity or stronger visual contrast (e.g. pipe collars and stanchions).

38. Consideration of minimise the glare from glazing through recessing the windows into walls (creating an overhang) or through sloping the windows outward (directing reflected light downward) is also preferable.

39. The design style of the offshore salmon farm development is an important component of reinforcing simplicity. There is a preference for the use of circular shaped pens as the perimeter simplicity is considered to reduce the visual prominence of the pens when compared to square pens which can appear more regimented/harsh.

40. In relation to the vessels associated with offshore salmon farming, whether they be a feed barge, service vessel or an alternative pen option (e.g. the Havfarm One design), the intention is to have a boat which has a maritime aesthetic. The design and construction of vessels which are nautical in style, as opposed to a floating shed, contributes to an acceptance of the activity within the open ocean setting.

41. It is anticipated that the implementation of navigational lighting will be required by the Harbour Master for offshore salmon farm sites. This is likely to include corner marks for each farm cluster as well as corner marks on the overall site boundary. The low level of visual impact associated with navigational lighting is likely to be negligible, as this type of lighting (typically synchronised flashing) is not strong enough to have a perceptible influence over the darkness of the night sky.

42. Lighting of the feed barge is also likely, which should be minimised as much as feasibly possible. Where parts of vessels are required to be illuminated, it is suggested that exterior lighting be directed downward to reduce light spill.

43. Modulation of the boat exterior (through form or colour) can further reduce the perceivable scale of individual vessels, which may be a consideration (e.g. good modulation and colour variation can be observed in the Wavemaster series of vessels - Attachment 2). While it is not considered necessary to go to the design extreme of ship camouflage (as implemented in both World Wars[4]), these examples help to illustrate how visually breaking up a large hull can help to reduce the visual prominence of a vessel.

Overall Height

- Low Impact (lower/horizontal profile) - High Impact (higher/vertical profile)

44. In relation to all components related to salmon farms, a lower elevation is preferable (with submerged components being the most visually unobtrusive). If the range of design principles are consistently implemented, then the overall height of each individual component is not considered to be a restrictive matter for the offshore salmon farming operation due to the expansive scale and separation from shore. A low-lying structure is preferred, regardless of height, when compared to a tall vertical 'tower' which contrasts the horizontal plane of the open ocean.

Clustering/Arrangement

- Low Impact (clustered & ordered) - High Impact (sprawling and messy)

45. As a general principle, the creation of well-organised clusters or groupings of salmon farm components has the influence of reducing visual clutter. This is achieved by separating overly long lines of pens while retaining distinct visual groups with a relatively condensed

[4] https://en.wikipedia.org/wiki/Ship_camouflage

overall footprint. In relation to both pen and vessel placement, an organised arrangement is preferable to ad-hoc development. The mooring of vessels associated with salmon farm production should be within or adjacent to pen arrangement.

46. This density associated with clustering must also be balanced with impact on enrichment levels within the water column, as a more compact grouping of pens will generally result in a more intensified enrichment.

Consistency (Shape, size, colour)

- Low Impact (uniformity) - High Impact (variability)

47. There is a preference to use a single type of pen construction (shape and size) within each cluster, as this promotes a degree of visual uniformity within the development. Where multiple designs are used within the same development area, it can increase the perceived contrast in elements resulting in a more complex setting.

48. It is acknowledged that in an industry with emerging technologies there needs to be scope for trialing new systems and processes. While uniformity of individual components may not always be achievable, common aspects (e.g. material, shape, colour and arrangement) should be encouraged as this can improve the overall cohesion of the development and promote simplicity. In order to maintain design consistency while allowing some flexibility, no more than 20% of the consented surface area may be used to trial alternative pen designs.

49. Where there is the use of multiple colours, a consistent design scheme within the application area will aid in the reduction of visual complexity and colour contrast. This also creates a type of branding which illustrates an intentional and coherent design aesthetic.

Efficiency (Surface Area and Space Usage)

- Low Impact (efficient) - High Impact (superfluous elements/wastage)

50. One way of delivering efficiency is to minimise the overall footprint of each required component. For example, the use of circular pens keeps the ‘perimeter:area’ ratio low (e.g. a circular pen has the lowest possible perimeter:area ratio of any shape). We also understand this helps to eliminate the unutilised swimming space in the corners of a square pen due to the rotational swimming pattern of the fish.

51. Efficiency of the above water netting for the salmon enclosure can also be achieved by using the centre support or hamster wheel options, which reduce the amount of netting required (when compared to the fiberglass support pole option (Figure 1). This reduces both the above water netting surface area as well as the visual bulk of the netting.

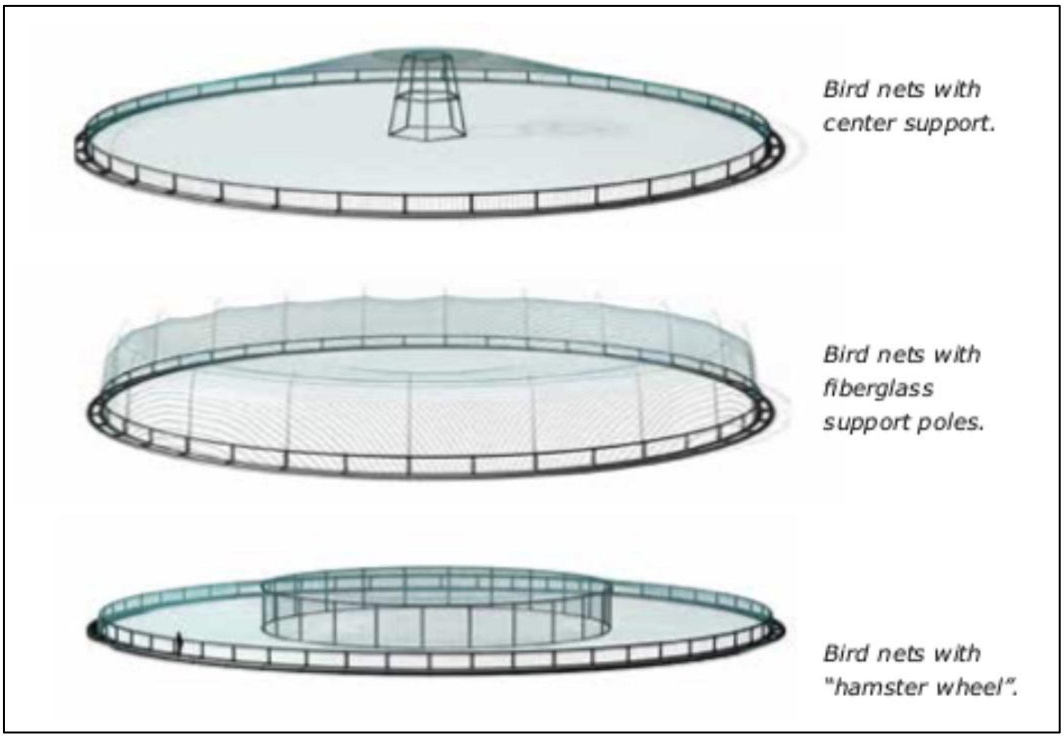

Figure 1 – Various netting options for a circular pen

52. As a general principle, it is preferable to use fewer structures, which are larger, in order to achieve the desired production levels.

Design Guide Summary

53. The above considerations have been documented as a way to direct appropriate development of offshore salmon farming. It is proposed that prior to approval of any new structures within the application site, a 'Statement of Compliance' be prepared by a suitably qualified person. This statement should confirm how the additions or variation to the marine farm structures will achieve the Design Intentions, Design Objective and Design Principle by referencing the Design Guide.

PART B

Planning Context

54. The statutory planning context for the proposal is provided by the Resource Management Act, New Zealand Coastal Policy Statement 2010, Marlborough Regional Policy Statement, Marlborough Sounds Resource Management Plan, and Marlborough Environment Plan.

Resource Management Act

55. Those parts of the RMA most relevant to this assessment are:

- *Section 6 Matters of National Importance:*

  6(a) the preservation of the natural character of the coastal environment (including the coastal marine area), and its protection from inappropriate subdivision, use, and development;

  6(b) the protection of outstanding natural features and landscapes from inappropriate subdivision, use, and development;

- *Section 7 Other Matters*

  7(c) the maintenance and enhancement of amenity values.

New Zealand Coastal Policy Statement 2010 (NZCPS)

56. The most pertinent objectives and policies from the NZCPS are listed below. These should also be considered with the enabling provisions of Objective 6 and Policies 6 and 8.

- *Objective 2: To preserve the natural character of the coastal environment and protect natural features and landscape values through:*
  - *recognising the characteristics and qualities that contribute to natural character, natural features and landscape values and their location and distribution;*
  - *identifying those areas where various forms of subdivision, use, and development would be inappropriate and protecting them from such activities; and*
  - *encouraging restoration of the coastal environment.*

- *Policy 15: Natural features and natural landscapes*

  To protect the natural features and natural landscapes (including seascapes) of the coastal environment from inappropriate subdivision, use, and development:

(a) avoid adverse effects of activities on outstanding natural features and outstanding natural landscapes in the coastal environment; and
(b) avoid significant adverse effects and avoid, remedy or mitigate other adverse effects of the activities on other natural features and natural landscapes in the coastal environment;

- *Policy 13: Preservation of natural character*

  (1) To preserve the natural character of the coastal environment and to protect it from inappropriate subdivision, use, and development:

  (a) avoid adverse effects of activities on natural character in areas of the coastal environment with outstanding natural character; and

  (b) avoid significant adverse effects and avoid, remedy or mitigate other adverse effects of activities on natural character in all other areas of the coastal environment.

Marlborough Regional Policy Statement (RPS) and Marlborough Sounds Resource Management Plan (MSRMP)

57. The site is located in the coastal marine area administered by the Marlborough District Council (MDC) unitary authority. MDC's planning documents relating to this site, the RPS and MSRMP, are under review. The new single MEP (refer below) was notified in June 2016 and is currently progressing through the Council hearing phase. There are a number of provisions relevant to activities within the coastal marine area (CMA) which are contested and are currently being considered by the MEP Hearings Panel and, as such, are not yet operative.

58. At this stage the proposed MEP does not include provisions relating to aquaculture, as this section is yet to be notified.[5] Therefore, marine farming is still governed by the provisions in the RPS and MSRMP. The application area is located within Coastal Marine Zone Two (CMZ2) with this application being considered as a Non-Complying Activity, due to its location beyond 200m from the shoreline. It is however noted under Section 9.2.2 (Methods of Implementation) of the MSRMP that:

    Within Coastal Marine Zone 2 out to 50 metres from mean low water mark, and beyond 200 metres from mean low water mark, marine farms are non-complying activities. In those areas marine farming involving fin fish farming may be appropriate and it is recognised that consent may be granted by a resource consent application.

[5] Latest indications are that this may occur later in 2019.

59. The assessment criteria for Marine Farms in CMZ2 (Discretionary activities) are considered relevant, with the pertinent criteria listed under 35.4.2.9.1.4 and 35.4.2.9.1.5. Further relevant provisions of the MSRMP relating to aquaculture and most pertinent to this assessment are set out at Attachment 3.

60. MSRMP Volume 1 Appendix 1 and Appendix 2 have also been considered and key aspects have been appended to this report[6]. The site is not within any ecology area or any area of outstanding landscape value as mapped under the MSRMP (refer to Figure 2, below).

Figure 2 – MSRMP Area of Outstanding Landscape Value Overlay (purple) and Ecology/Riparian Overlay (green hatch). Proposal Site outlined in yellow.

Marlborough Environment Plan (MEP)

61. The proposed MEP contains mapping overlays relevant to landscape and natural character values which will be addressed in the following section of this assessment. The MEP assessment and mapping are still not resolved, with many aspects being subjects of submissions. This offshore salmon farm application site is an area of disagreement in relation to the mapping and identification of both Outstanding Natural Features and Outstanding Natural Character.

[6] Appendices 5 & 6

62. When considering the level of effect on both landscape and natural character values, Volume 3 Appendix 4 to the MEP sets out Criteria for Determining Significant Adverse Effects. These are listed as:

1. Character and degree of modification, damage, loss or destruction;

2. Duration and frequency of effect (for example long-term or recurring effects);

3. Magnitude or scale of effect (for example number of sites affected, spatial distribution, landscape context);

4. Irreversibility of effect (for example loss of unique or rare features, limited opportunity for remediation, the costs and technical feasibility of remediation or mitigation);

5. Resilience of heritage value or place to change (for example ability of feature to assimilate change, vulnerability of feature to external effects).

Landscape

63. The landscape mapping notified in the MEP (Volume 4) identifies the entirety of the wider sounds as both a high amenity landscape (Marlborough Sounds Coastal Landscape) and an outstanding natural landscape at a national scale. Both of these overlays are illustrated in Figure 3 (ONL – orange solid, High Amenity Landscape – orange hatching).

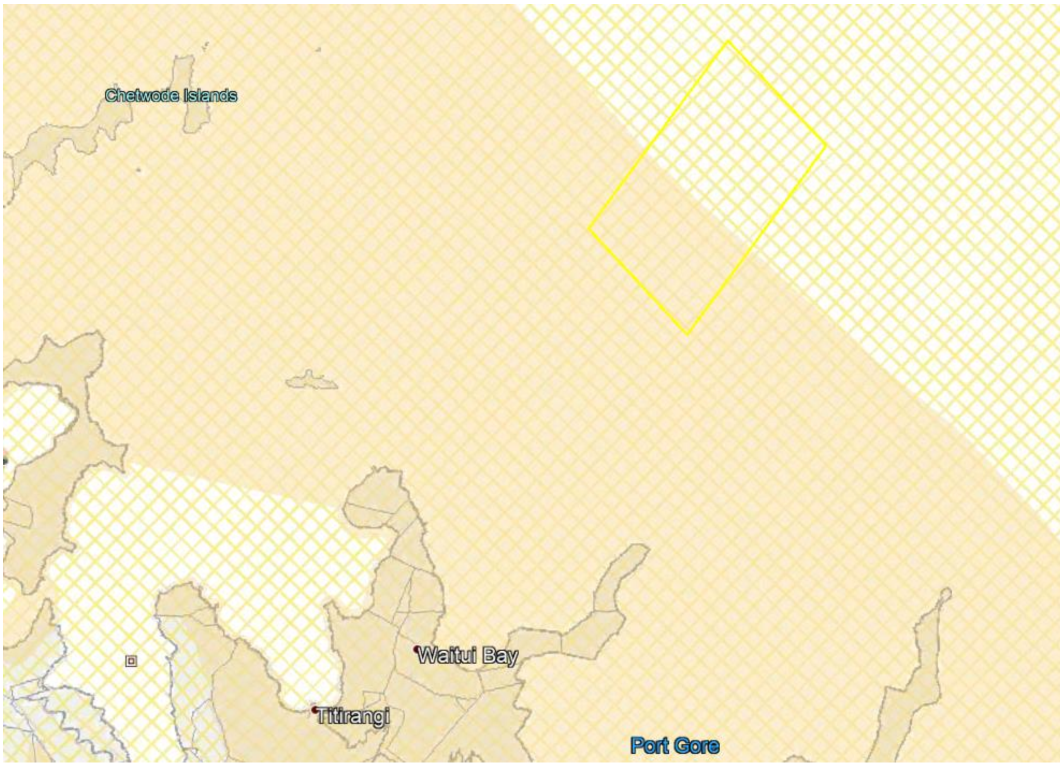

Figure 3 – MEP Volume 4 Landscape Overlay

64. Provisions relating to landscape are set out in Chapter 7 of the MEP. Objectives and Policies relevant to this assessment are included at Attachment 4, and cross-referenced where relevant. Values identified by the MEP as contributing to the high amenity of the Marlborough Coastal Landscape are detailed later in this report, under "Existing Environment: Landscape Evaluation" (refer below).

65. The site is located within the "Outer Sounds Landscape" (Area 1), "Chetwode Islands, Titi Island and Sentinel Rock" (Area 4), and "Cape Jackson, Cape Lambert and Alligator Head" (Area 12) landscapes, within Volume 3, Appendix 1, of the MEP. The schedule of values associated with that landscape is included as Attachment 5 to this assessment.

66. There are a number of policies that consider amenity values in Volume 1, Chapter 13 – Use of the Coastal Environment, including policies 13.2.4, 13.2.5, and 13.2.6. However, the beginning of Chapter 13 expressly states that "This chapter does not contain provisions managing marine farming." In relation to visual amenity, this will be addressed as part of the perceptual component of the assessment.

<u>Natural Character</u>

67. Under the Proposed MEP mapping of natural character, the proposed offshore salmon farm site has approximately 45% within an overlay (Figure 4), being a combination of high and very high/outstanding levels with this mapping being discussed in the section below.

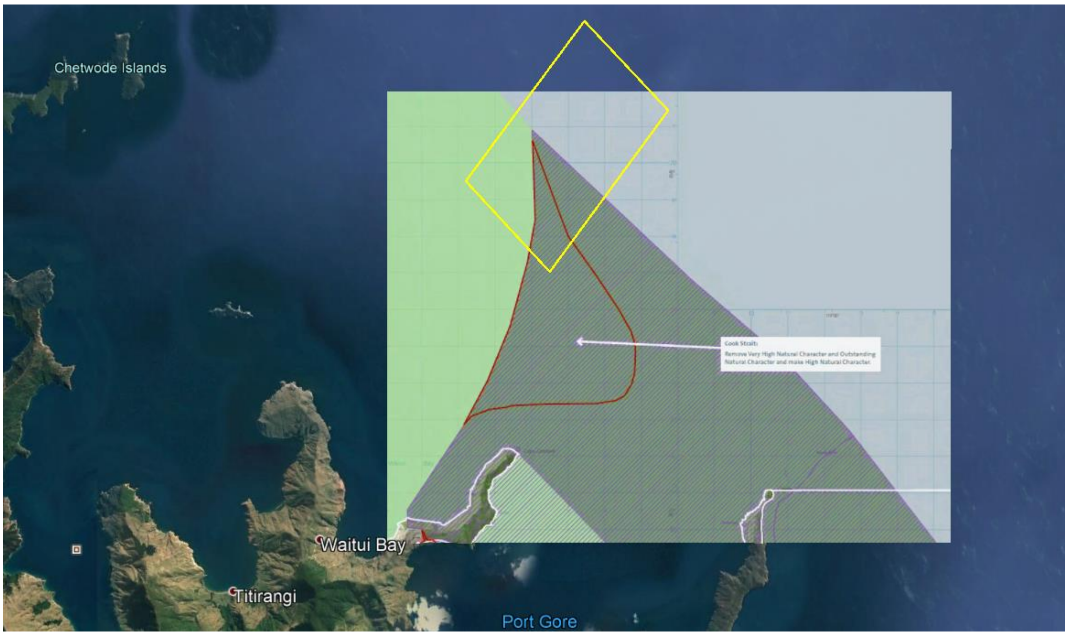

Figure 4 – MEP Volume 4 Natural Character Overlay

68. Provisions relating to the preservation and protection of natural character are contained in Chapter 6 of the MEP, set out in Attachment 6 of this assessment. The assessment of ecological factors near the proposal site has been undertaken by the Cawthron Institute, with these findings informing the assessment of natural character. It is worth noting that the proposal area does not have any recognized ecologically significant marine sites within its boundary, with the closest being McManaway Rocks (approximately 1.3km away from the boundary).

69. Values identified by the MEP as contributing to the natural character of the Marlborough Sounds Coastal Landscape near the application site are detailed further in this report, under "Existing Environment: Natural Character Evaluation".

Contention over MEP Landscape and Natural Character Mapping

70. There are a number of issues that we raised, in relation to the validity of the MEP mapping of landscape and natural character areas, during the MEP Hearings such as; the ineffectual division of mapped areas, uncertainty over mapping scale, overuse of descriptions rather than identification of the key characteristics/values, and biases around terrestrial vs. marine modifications.

71. Despite these issues, it is accepted that the entirety of Marlborough Sounds warrants recognition as an ONL at the national scale as well as a high amenity coastal landscape, as both of these overlays relates to the overall character and identity of the Sounds. This includes both pristine natural areas (e.g. Tenneson Inlet) and built-up urban areas (e.g. Picton Township).

72. At a District (and site) scale, the partial recognition of this proposal site as an ONL and area of ONC is however disputed. An overview of the relevant mapping overlays (Figure 5 and Attachment 7) identifies this mapping in relation to the salmon farm boundary.

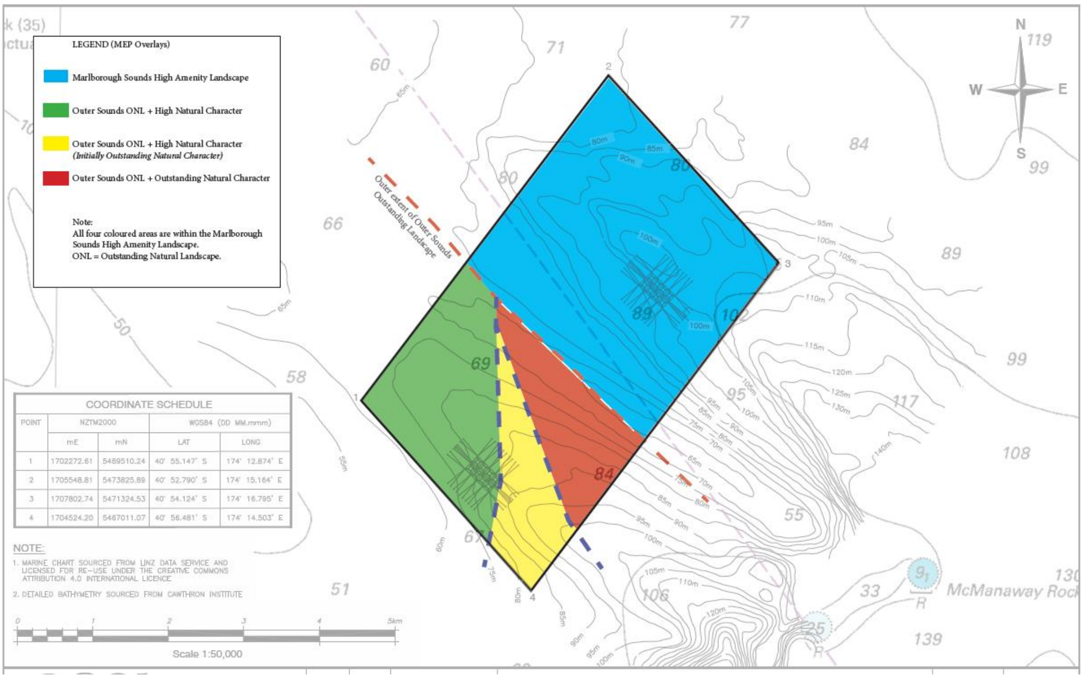

Figure 5 – MEP Landscape and Natural Character Overlays on the proposal site

73. The primary contention with the inclusion of approximately 45% of the application site being within an ONL or natural character overlay (combination of the green, yellow and red areas in Figure 5 above) is in relation to the separation distance from the Marlborough Sounds landform, with the nearest land (Cape Lambert) located approximately 5km to the south. The MEP mapping of landscape values in this location had adopted the 'seascape approach'[7], which is further discussed in the Marlborough Coastal Study[8], stating that;

The present study therefore focused on the marine environment closer to the shore, specifically:

- *All enclosed waters of the Marlborough Sounds*
- *The outer Marlborough Sounds bounded by the main headlands and offshore islands and stacks;*
- *Out to 2km offshore from the outer coast (including from offshore islands and stacks around the outer Sounds).*

[7] Marlborough Landscape Study – Pg 21, Diagram Six.
[8] Marlborough Coastal Study – Pg 316, Appendix 6

74. Both the natural character and landscape extents have been generally mapped out to 2km on the north-western and south-eastern Sounds (outer coast) coastlines (Figure 6 – red line), while the north-eastern Sounds boundary has adopted a boundary line around the headlands, islands and rock stacks. It is this differentiation in mapping approach which was submitted against as being an inconsistent means of determining the interrelationship between land and sea.

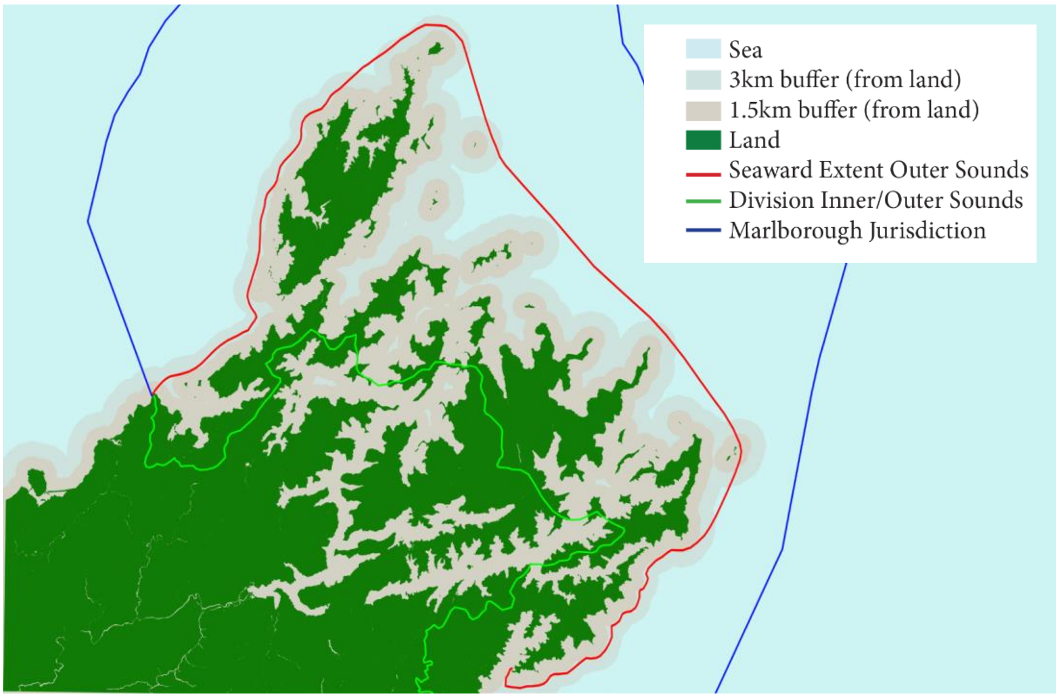

Figure 6 – Seaward Extent Mapping Analysis

75. A simplified buffer distance was proposed by Hudson Associates at the MEP Hearing (Figure 6) which illustrates the theoretical extent of the Outer Sounds ONL should either a 1.5 or 3km buffer be implemented around the Sounds land features. This is preferable, in my opinion, because it promotes a consistent approach around the entire Sounds perimeter. It would also bring the experiential aspect of NC into consideration (NZCPS 13(2)(h)), and is an appropriate distance off shore where discernment of the landscape changes from general impression (the broad view into the Sounds from Cook Strait) to legibility of its expressiveness (the detail of the cliffs and headlands) (NZCPS 15(c)(iii)). The Boffa Miskell Visibility Tables mentioned earlier in this assessment consider that the visibility, albeit of salmon farm components, at distances greater than 3km "become difficult to see'.

76. It is of note that James Bentley, key author of the Marlborough Landscape Study 2015 and co-author of the Natural Character of the Marlborough Coast Study 2014, stated in his Section 42A Hearings Report[9] that;

Within the Coastal Report, the seaward boundary of the natural character mapping is blurred, indicating that the extent fades away. Unfortunately, this hasn't been indicated in the MEP maps, where a hard line is used. The blurred line indicates where information is less readily available (and less specific).

77. This indicates that the hardline boundary relating to the seaward extent of both the landscape and natural character mapping was intended to be more of a transitional space as the distance from shore increased.

<u>Landscape</u>

78. The values listed within the Outer Sounds Landscape[10] (Attachment 8) largely relate to terrestrial characteristics (e.g. *Impressive and weathered coastal cliffs and rocky windswept islands)* or the interplay between land and sea (e.g. *High sensory values associates with the wild windswept coast and high winds, rough seas, high-energy waves and associated sea spray*). It could be argued that only 3 of the 24 identified values even warrant consideration against a salmon farm proposal and, as will be discussed in greater detail in the effects assessment below, even these values are unlikely to be altered by a proposal for offshore salmon farming. The three relevant values include;

- *Nationally significant seascape (Cook Strait)*
- *Expansive views of the open sea broken up by the outer peninsulas, rocky outcrops, steep exposed seacliffs and islands*
- *Very High levels of perceived naturalness due to limited modification.*

[9] Section 42A Hearings Report for Hearing Commencing 19 February 2018. Report on Submissions and further submissions, Topic 5: Natural Character – Technical Mapping, Values and Overlays. Pg 23

1. [10] MEP Vol 3 – Appendix 1: Area 1

79. The majority of values associated with the Outer Sounds Landscape are understandably linked to the appreciation of the Sounds as a coastal landform. The biophysical values offshore are not as evident as their terrestrial counterparts, simply because they are hidden beneath the surface of the water. This also generally applies to the perceptual values, which have a limited range of activities that allow an experience of the subtidal environment (e.g. Scuba diving locations). The offshore associational values tend to relate to a much wider scale cultural narrative, which rely on the context of the nearby landform to be appreciated.

80. Furthermore, it would be questionable to treat the southern 45% and northern 55% of the proposal site as being different in relation to the planning framework. Despite the large site coverage of almost 1800ha, the experience of and from any particular location within the site is practically the same as any other location. While recognition of the Sounds as an ONL at a national scale can be accepted, identification of this offshore salmon farm site as an Outstanding Natural Landscape or Feature at either the District or site scale is not.

Natural Character

81. Figure 7 indicates the initial extent of MEP mapping for outstanding (pink hatching), very high (pink solid) and high (blue solid) natural character in the vicinity of the proposal area. Then prior to the MEP Hearing, the assessor (Boffa Miskell) produced the following image indicating an overlay shift in the Very High and Outstanding levels of natural character, north of Cape Lambert (Figure 8).

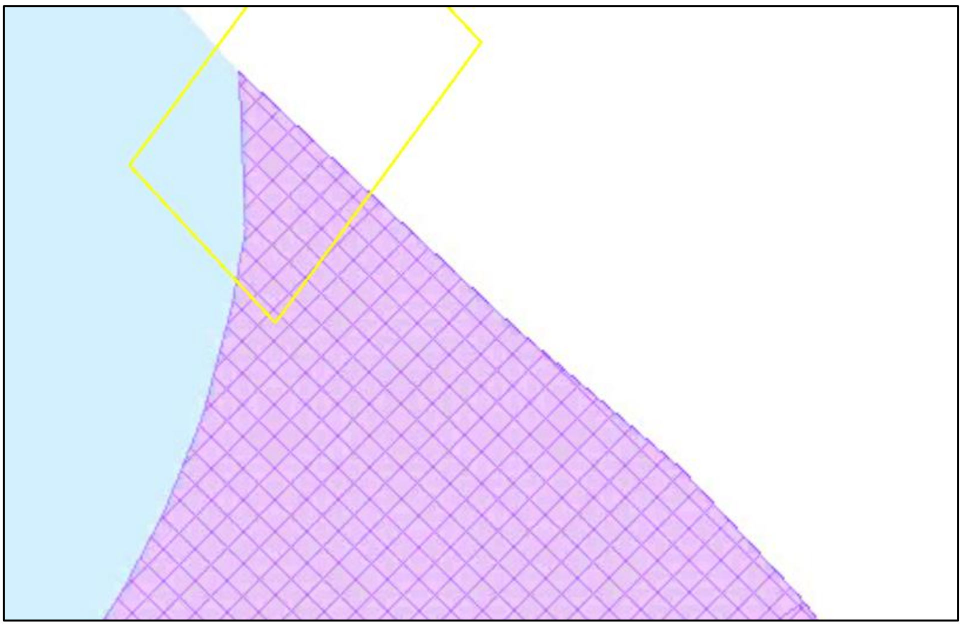

Figure 7 – MEP Volume 4 Natural Character Overlay (Application site in Yellow)

Figure 8 – MEP Topic 5 – Natural Character Mapping Suggestion (Application Site in yellow)

82. The revised boundary between ONC and HNC in this location is questionable. When overlaying (Attachment 9) the Trawl Fishing Events[11] and Events Set Net Fishing[12], a spike in the number of Trawl Fishing events within a 4 square kilometers data pixel off Cape Lambert is observable, however it is unclear how the proposed amendment to the ONC area appropriately reflects this information.

Existing Environment

Broader Scale: Outer Sounds Description

83. The Marlborough Sounds, located at the top of the South Island, is a distinctive and scenic landscape characterised by its series of interconnected waterways resulting from the drowned river valley landform. The Outer Sounds[13] wraps around the perimeter of this landscape, incorporating approximately half of the Marlborough Sounds landmass, and is heavily influenced by the exposed waters around Cook Strait (Figure 9). At the Outer Sounds scale, the characteristics of this highly legible coastal environment are often generic. The Marlborough Coastal Study and Marlborough Landscape Study have provided a good overview of this context.

[11] MEP Natural Character Mapping Recommendations – Boffa Miskell, Figure 2: Trawel Fishing Events
[12] [12] MEP Natural Character Mapping Recommendations – Boffa Miskell, Figure 3: Trawel Fishing Events
[13] As defined by the MEP – Appendix 1, Pg 29

Figure 9 – Example of Marlborough Sounds landform (Guards Pass in view)

Biophysical Attributes (Abiotic, biotic)

84. The marine environment located off the Marlborough Sounds coast is highly diverse, which is to be expected in a location with such complex geological forms (both above and below the water) and the variable hydrology of the variably exposed Cook Strait waters. This area, identified as part of Coastal Marine Area B (D'Urville Island – Northern Cook Strait), has identified key values relating to[14]; variable exposure, numerous ecologically significant marine sites, Scenic Reserves (D'Urville Island, Chetwode Island, Titi Island, Cape Lambert) and for adjoining Marine Area G (Eastern Cook Strait & Outer Queen Charlotte Sound).

85. While D'Urville Island provides some shelter for the north-eastern edge of the Marlborough Sounds, these waters are exposed, with a moderate-high tidal range and strong currents/winds throughout the Cook Strait area. The water turbidity typically associated with the inner Sounds is efficiently dissipated by the open waters and there is typically low sedimentation.

86. At this wider scale, much of the existing marine information[15] relates to near shore communities. The more sheltered stretches of coastline are similar to the communities found within Pelorus and Queen Charlotte Sound displaying fewer reef dwelling invertebrates, while the more exposed coastlines have varied macroalgae along with a variety of mobile invertebrates. The offshore sediments support large areas of horse

[14] MEP Volume 3, Appendix 2, pg 1-2
[15] Natural Character of the Marlborough Coast; MDC, June 2014, pg. 65-66.

mussel, brachiopod and dog cockle beds, along with a diverse fish species. However, as noted in the Marlborough Coastal Study[16], this area has places of commercial trawling and scallop dredging which have compromised the natural state.

87. There is also an abundance of seabird species[17] and marine mammal species[18] which inhabit these waters, with the **bottlenose and dusky dolphins, New Zealand fur seals, orca, southern right whale, humpback whale** and king shag being of note.

88. The Ministry of Primary Industries has produced information on its website relating to fisheries activity in this area. Both trawling and set net events are common around the Outer Sounds, and along with clusters of near shore aquaculture, there is a noticeable presence of marine based industry.

89. In 2011 the Marlborough District Council commissioned a report on the marine sites of ecological significance[19]. The open coastal waters of the Outer Sounds were assessed as Biogenic Areas 1, 2 and 7 of that report, and identified a number of significant sites (Figure 10).

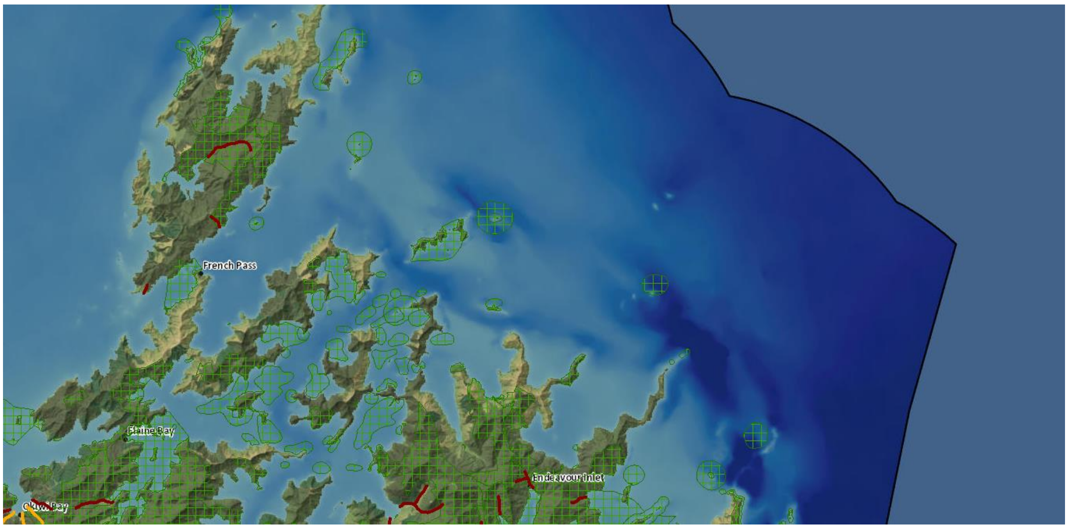

Figure 10: Sites of Ecological Significance indicated in green hatching

[16] Natural Character of the Marlborough Coast; MDC, June 2014, pg. 67.
[17] Potential Effects on Seabirds of Open Ocean Fish Farming, Cook Strait (July 2019). McClellan, R., Wildlands Consultants,
[18] Marine Mammal Assessment for a Proposed Salmon Farm Offshore of the Marlborough Sounds (July 2019). Clement, D., & Elvines, D.

[19] Ecologically Significant Marine Sites in Marlborough – Coordinated by Davidson Environmental (2011)

90. The context of the proposal site is influenced by nearest landforms and landcover which provide a visual backdrop. The coastal edge of the Outer Sounds is typically rocky and abrupt. The geological information relating to this area[20] indicates that a grey sandstone-siltstone of the Caples Group is the predominant rock type, with this resulting in a scattering of undifferentiated landslide deposits. The underlying landform is largely unmodified, with the prominent descending ridge spines and steep slopes dominating the characteristics at the wider scale. The landform pattern is further reinforced by the wider landcover, with the widespread low growing coastal herb and shrub species often highlighting the landform pattern, rather than hiding it. There vegetation patterns also include a fragmented mix of established native vegetation, regenerating native vegetation and modified grasslands.

91. The Geopreservation Society Inventory[21] recognizes a number of sites, of both regional and national importance, scattered around the outer sounds and they all relate to terrestrial geological occurrences.

92. Work undertaken by the Marlborough District Council has described collective biophysical characteristics of this area of the Outer Sounds as follows:

<u>*Marine*</u>[22]
Variably exposed; waters relatively warm, clear and nutrient rich: strong currents: offshore reefs, stacks, and islands; deep subtidal reefs; rich reef communities; bryozoan and horse mussel beds; tube worm colonies; extensive mud/sand areas offshore; highly diverse marine environment.

<u>*Terrestrial*</u>[23]
Taupata, Ngaio, Rengarenga, Tuatara, Diving Petrel, Exposed, Dry, Maritime Ecosystem

This Coastal Terrestrial Area is highly exposed and maritime with a high coherence of cliff face landforms and a collection of jagged stacks and harsh rocky islands. Steep, exposed and imposing sea cliffs, peninsulas and headlands are dominant landforms creating a wild and scenic sea coast. Dry climate is coupled with small catchment areas and few streams. Elevation is low and rocks are predominantly a range of schists and sedimentary strata.

[20] Begg, J.G.; Johnston, M.R. (compilers) 2000: Geology of the Wellington area: scale 1:250,000. Lower Hutt: Institute of Geological & Nuclear Sciences. Institute of Geological & Nuclear Sciences 1:250,000 geological map 10. 64 p.
[21] Marlborough Landscape Study, MDC; August 2015, pg 28-29
[22] Natural Character of the Marlborough Coast; MDC; June 2014; pg 64.
[23] Natural Character of the Marlborough Coast; MDC, June 2014; pg. 108.

Exposure and maritime influence is extreme. Brutal exposure to maritime elements has shaped a unique Cook Strait vegetation. The sheer nature of the topography and its inaccessibility has left some areas, especially islands, predominantly in a natural state. There is a high aesthetic coherence of pastoral landcover. Numerous island sanctuaries (Stephens, Chetwode, Titi and Brothers Islands) supporting many nationally threatened species including Tuatara on Stephens and North Brother Islands, and king shags on rock stacks.

Perceptual Attributes

93. One of the main perceptual aspects of this location relates to the expansive views of the open ocean that are either back-dropped, or framed, by the outer sounds peninsulas and islands. The exposure to the open ocean is highly memorable and is expressed through the evident coastal erosion, such as the weathered cliffs and jagged rock stacks.

94. There is a high level of overall coherence presented by the outer extent of this drowned valley/ridgeline system, which is illustrated by the consistent landform pattern and retreat of numerous headlands and peninsulas onto the Strait. There are also the ephemeral qualities such as, currents, wind, salt spray, wildlife and various lighting conditions which contribute to the scenic amenity and perception of naturalness in this location. Although a human presence is recognisable, there is a sense of remoteness due to the limited landform modification and general absence of structures.

95. Vessels traversing the outer sounds form an expected part of this experience, although it is one of the less frequented areas of the wider sounds. The light to moderate activity that occurs within the proposal site is relatively small in comparison to the three natural transit routes which are located beyond the site boundaries. These natural transit routes are indicated in Figure 11 below and include[24] the:

- Inshore coastal route – The traffic following the natural transit route created by the dangers extending from Cape Jackson and the entrance to Pelorus Sound
- Coastal transit route – The traffic following the natural transit route from the North of Stephens Island and the entrance to the Cook Strait, passing to the South of Witts Rock and the North of McManaway Rock.
- Offshore transit route – The traffic following the natural transit route from the North of Stephens Island and the entrance to the Cook Strait, passing to the North of Witts Rock.

[24] North Marlborough Farm Development Navigational Risk Assessment (July 2019). Navigatus Consulting Ltd. Section 4.5.3.

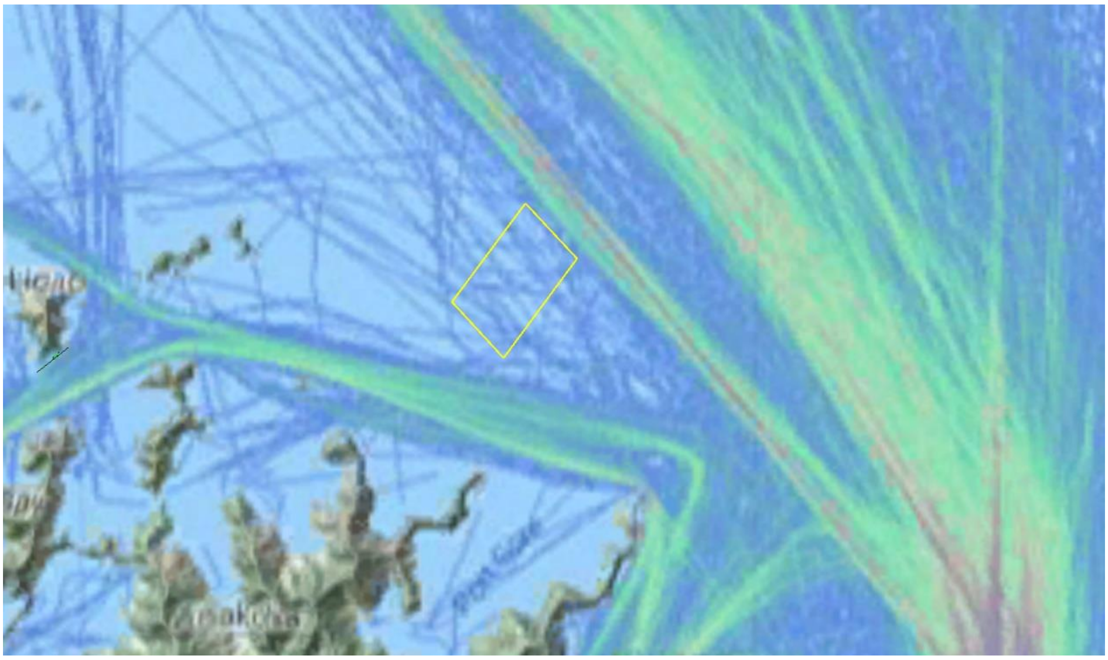

Figure 11 – Natural Transit Routes (Extracted from the Navigation Risk Assessment – Figure 4)

96. In calm weather conditions the area is popular for recreational fishing, although in relatively limited numbers. Wildlife such as whales, seals and dolphins are often encountered in this area, and also contribute the overall experience. There were also comments in relation to the wildlife experience presented at the Relocation Advisory Panel Hearing wishing to protect them [dolphins] "*… as they enhanced the experience of people visiting the area and they were amazing to watch*"[25].

97. The MEP outer sounds has been categorized as an Outstanding Natural Landscape and an area of High Amenity Landscape[26], as well as having high, very high and outstanding natural character. Despite, as discussed earlier in this assessment, disagreeing with some of the MEP mapped area boundaries, it is certain that the outer sounds holds high scenic qualities and high amenity value.

Associative Attributes

98. The outer sound has a rich cultural heritage overlay relating to both Māori and European occupation. Sites of significance include; archaeological sites, prehistoric quarries, historical buildings, pa sites, copper mines and whaling sites.

[25] Report and Recommendations of the Marlborough Salmon Farm Relocation Advisory Panel, pg 76
[26] Marlborough Landscape Study, MDC; August 2015, pg 168-169

99. There are long-standing mana whenua, mana moana and tangata whenua associations throughout the Sounds, which is evident at a glance when considering the Recorded Cultural History Map[27]. This is clearly illustrated by the myriad of Māori archaeological sites scattered throughout the Sounds. The vast interconnected, and sheltered, reaches of the Sounds not only provided an abundance of resources, but also an excellent means of travel in an age where the canoe was the main form of transport.

100. One Māori legend in particular that plays an important role in both the identity of New Zealand and the Marlborough Sounds, is the story of the great voyager Kupe and the Wheke (Octopus). In one version of this Māori legend, the ancestor Kupe chassed Te Wheke o Muturangi across the Pacific Ocean from Hawaiki. After weeks of chasing across the ocean, Hine-te-Aparangi (Kupe's wife) saw a long cloud in the distance and named it Aotearoa (land of the long white cloud). The following conflict between Kupe, his warriors and the octopus culminated in a battle around the Marlborough Sounds which gouged out the land and was instrumental in the formation of the Sounds landform. There are many landform features in the outer sounds which have been named to commemorate Kupe (Figure 12).

Figure 12 – Place names commemorating Kupe

[27] Marlborough Landscape Study, MDC; August 2015, pg 43

101. There is also a strong early European associations throughout the area. Abel Tasman (Dutch) was the first European explorer to reach New Zealand and took shelter east of D'Urville Island around the Christmas of 1642. Captain James Cook (British) visited Ship Cove (Meretoto), at the entrance to Queen Charlotte Sound, on five separate occasions across 3 voyages to New Zealand in the 1770's. The explorers Bellingshausen (Russian) and D'Urville (French) followed after Cook in the 1820's and began charting the Sounds Waters, which was further refined in the mid 1800's by subsequent British voyages.

102. There were also many whaling stations set up throughout the sounds and over the years a number of vessels have been wrecked around the Sounds coastline, which has many offshore reefs and rock stacks which are hazardous even in good weather conditions. This has influenced the erection of lighthouses around the sounds such as at Stephens Island, the Chetwode Islands, Cape Jackson and Brothers Islands. More recently (1986) a Russian cruise ship, named the Mikhail Lermontov, was torn on the rocks north of Cape Jackson and is now a popular recreational diving location resting around 30m below sea level in Port Gore.

103. The Marlborough Sounds is a popular tourist destination with a number of retreats, baches for hire, public walkways (e.g. Queen Charlotte Track) and campsites along with clusters of settlement and scattered residences. The Sounds is highly valued for recreational activities such as boating, fishing and eco-tourism.

Summary of Key Attributes - Broader Scale (Table 8)

	Key Attributes	*Rating*
Biophysical	• Highly legible drowned valley/ridge system; • Deep with strong currents; • A number of features of marine ecological significance; • Salt tolerant low growing native plant species; • Ecologically significant terrestrial island communities; • Historical and current dredging and trawling; near shore marine farms	High

Perceptual	• Highly coherent and simple water context; • Expansive views of open ocean; with the scale being set by the distant horizon; • Exposed, wild and rugged; • High perceived naturalness; within a largely regenerating but mixed character terrestrial backdrop; limited modification; • High legibility and coherence of geomorphology and coastal erosion; • Very High transient qualities; extremely variable weather conditions; • The composition of the key biophysical and perceptual attributes is highly memorable.	Very High
Associative	• Physical and spiritual values associated with mana whenua, mana moana, and tangata whenua taonga, mauri, customary practices and the exercise of kaitiakitanga; • Traditional and contemporary waka routes throughout the Outer Sounds; • Numerous historical sites of both Māori and European significance; • Wide mix of uses and activities, particularly for recreation; • DOC conservation areas.	High

Broader Scale: Landscape Evaluation

104. The following landscape evaluation is based on the description of the existing environment given in this assessment, and defines characteristics and values relating to the context provided by the Outer Sounds.

105. The Outer Sounds holds a high level of biophysical values, with the transition from this drowned valley/ridge system out into the open ocean being an identifiable geomorphological characteristic. There are also numerous areas of high ecological value, both terrestrial and marine, scattered throughout the Outer Sounds which contribute to the biophysical values. Although there is a significant proportion of established or regenerating native areas, there remain extensive areas of modified pastoral grasslands which reduce the overall ecological value. The presence of ongoing fisheries activity also means that this is not a pristine marine environment, despite many areas of significance.

106. The area has very high perceptual values that are expressed through the rugged and exposed coastal margins in conjunction with the expansive open water context. There is a very high degree of perceived naturalness due to the geographic isolation, evident coastal erosion processes and dominance of geomorphology. This very high level of perceived naturalness is complemented by high transience and the experience of an open, wild, remote seascape, which remains despite the presence of human modification (marine and terrestrial farming, lighthouses, farm tracks buildings etc).

107. The Outer Sounds hold high levels of associational values. This is strongly linked to the historical context of both Māori and European settlement/exploration, as well as having many current recreation opportunities and conservation areas. The Sounds landform is highly legible and acts as a distinct gateway to the South Island for travelers entering or exiting by boat.

108. Overall, the biophysical, perceptual and associational characteristics are considered to rank as having Very High landscape value.

Broader Scale: Natural Character Evaluation

109. The following natural character evaluation is based on the description of the existing environment given in this assessment, and defines characteristics and values relating to the context provided by the Outer Sounds.

110. The coastal terrestrial extremities (peninsulas and islands) of the Outer Sounds have typically been mapped[28] as having a very high natural character rating, while the marine environment is almost entirely mapped[29] as either having a high or very high rating. These two components have subsequently resulted in much of the Outer Sounds being mapped[30] as having Outstanding Natural Character (ONC). This 'Outstanding' recognition is understandable in relation to the terrestrial component and adjacent waters, due to the extensive native vegetation and expressive coastal processes, but it is difficult to accept the seaward extent to which these identified areas protrude (as discussed earlier in this assessment).

111. The overall level of natural character in the Outer Sounds is influenced by the mix of highly natural attributes and presence of human modifications. The dominant biophysical attributes relate to the geomorphology, areas of ecological significance (marine and terrestrial), and the resulting habitat/ecosystem that they enable. The dominant perceptual attributes relate to the coherence and expansiveness of this highly transient exposed coast.

112. The biophysical and perceptual values are somewhat reduced by the presence of pastoral grasslands, lighthouses, dwellings/settlements and the fisheries industry. However, the

[28] Natural Character of the Marlborough Coast; MDC; June 2014; pg 116.
[29] Natural Character of the Marlborough Coast; MDC; June 2014; pg 63. 69 & 95.
[30] Natural Character of the Marlborough Coast; MDC; June 2014; pg 263.

attributes have combined to create a very distinctive environment which has excellent examples of natural elements, patterns and processes that are of a scale which dominate the aspects of modification. The almost vacant simplicity of the coastal waters help to promote and reveal the essential characteristics of the Outer Sounds. In relation to the perceptual character, it is important to note that it is primarily the terrestrial component which contributes to the perceived naturalness, as the submarine environment is obscured from majority of users/viewers.

113. The biophysical and perpetual factors combine to result in an outstanding level of natural character for the terrestrial extremities and their immediately surrounding waters. The subsequent wider waters are considered to hold either high or very high levels of natural character.

Site Scale: Proposal Area Description

114. The proposed NZKS Offshore salmon farm site is approximately 1800ha in size and located 5km north of Cape Lambert. When describing and evaluating the existing environment at the site scale, it is considered that this also includes the waters adjacent to the site (within approximately 3km). The site and its more immediate context is an open ocean setting, with Figures 13 and 14, illustrating the views back toward the Marlborough Sounds landform.

Figure 13 – Water based photo looking in toward the Sounds from the application site

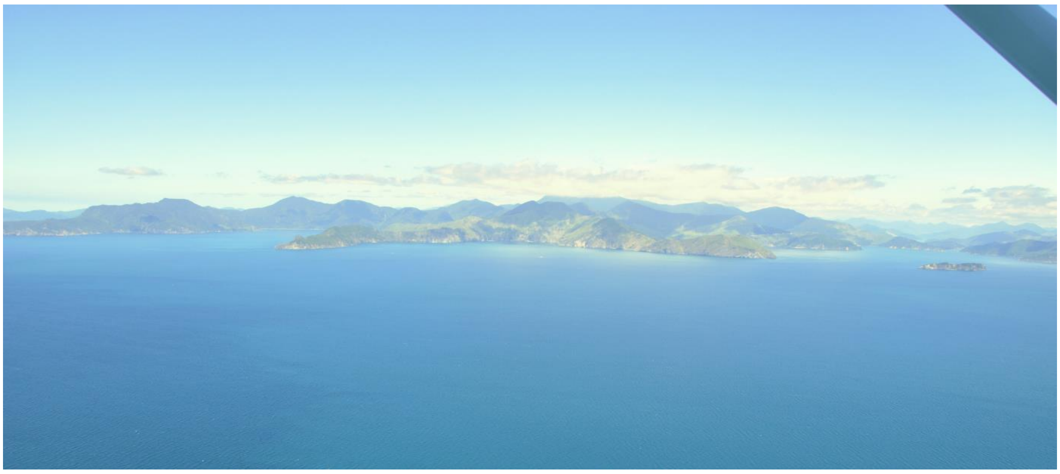

Figure 14 – Aerial photo looking in toward Sounds from above the application site

115. For thoroughness, the key values identified within the natural character assessment and landscape assessment, produced for MDC and replicated in the MEP, have been considered and included in Attachments 5, 7 & 8. However, inspection of these collective key values indicates a strong pull toward terrestrial factors, which has limited relevant to the offshore location.

116. The report 'Ecologically Significant Marine Sites in Marlborough' identifies a subtidal area in the vicinity of the application site which should be addressed. This is the McManaway Rocks, located approximately 1.5km east of the application site and situated along the alignment of tidal currents (in relation to the application site).

Biophysical Attributes

117. A comprehensive site specific assessment of potential effects on the seabed has been undertaken by the Cawthron Institute. This report[31] has a much finer scale of analysis than information available for the MDC assessments[32] which have informed the MEP. The survey base data covers over 5000ha, and utilising the traditional drop camera and tow sled (video), while also employing the modern Multibeam echosound (MBES) technology. This is the same technology that was used in the collection of data for the recent Seabed Habitat Maps for Queen Charlotte Sound and Tory Channel. The following information is presented in Executive Summary of the Cawthron Institute report (Figures 15 & 16);

[31] Assessment of Seabed Effects from an Open Ocean Salmon Farm Proposla in the Marlborough Coastal Area – Cawthron Institute. Elvines, D., McGrath, E., Smeaton, M., and Morrisey, D.
[32] Natural Character of the Marlborough Coast (June 2014) and Marlborough Landscape Study (August 2015).

The main findings of our seabed assessment are as follows:

- *A range of sediment types were observed at the study area, grading from sandy-mud through to coarse sand and gravels with high amounts of shell debris. Bathymetry and sediment type within the area appeared to be influenced largely by scouring from water movement around McManaway Rock on the edge of the survey area. The sediment was well oxygenated with low organic content (2.4–4.5%). Rich infaunal communities were present within sediments across the area, and are typical of those present at deep high-flow areas within the Marlborough Sounds. There were also distinct habitat classes (strata) based on the visual seabed biological characteristics. The strata were: biogenic habitat (horse mussels [and/or horse mussel debris/biogenic clumps]) and brachiopod mixed communities, soft bryozoan fields, reef-edge assemblages, and areas where epifauna were sparse. The reef edge communities flanked McManaway Rock, an area of which is classified as a significant marine site in the Marlborough coastal area.*
- *The proposed site has water depths of 60 to 165 m. Water current velocities at the site are strong (mean and maximum near-seabed currents of 31 and 86 cm/sec, respectively; mean and maximum mid-water, 35 and 110 cm/sec) and the predominant axis of flow is southeast/northwest. The proposal area is a high-flow environment where wastes will be readily dispersed and assimilated, but the trade-off is a larger, more diffuse footprint. …*

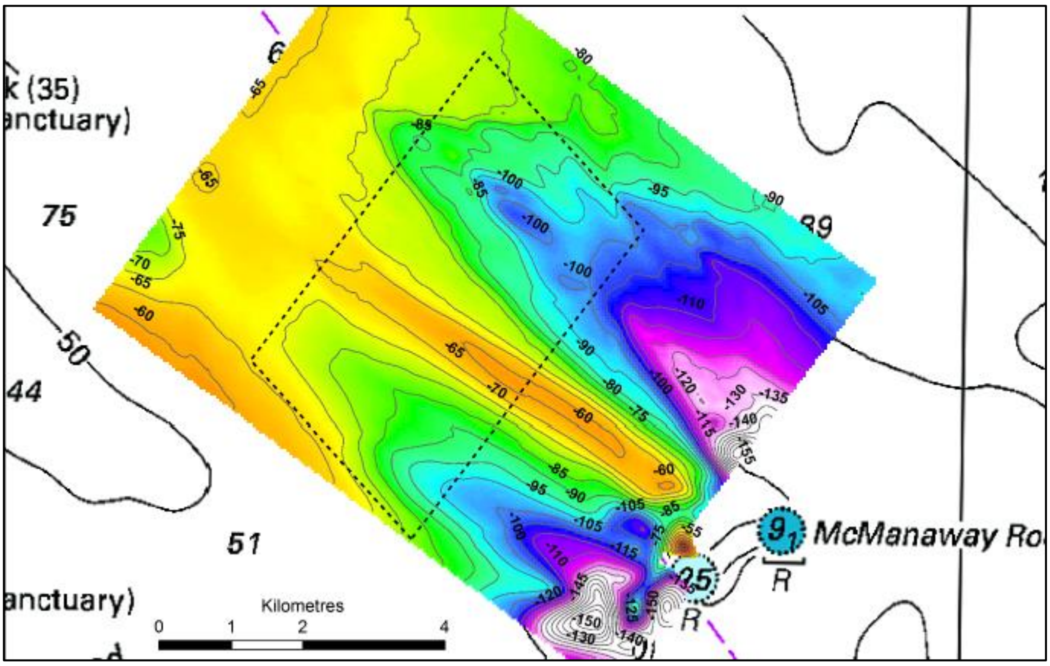

Figure 15 – Bathymetry data as illustrated within Figure 3 of the Cawthron Institute Report

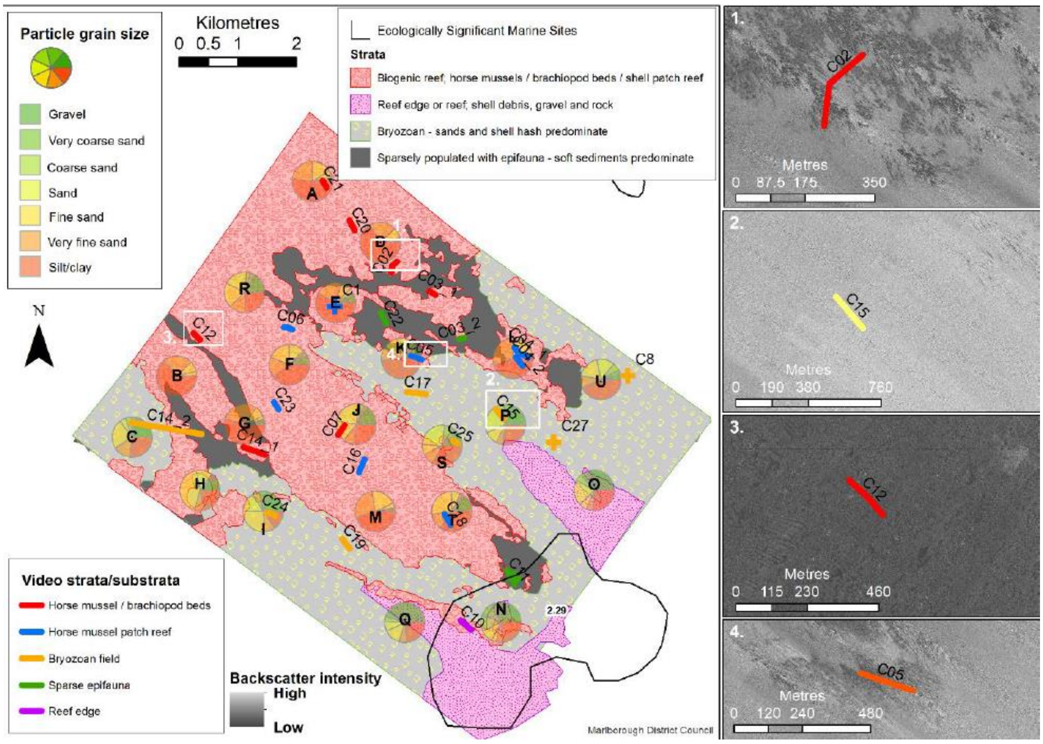

Figure 16 – Approximated habitat map data as illustrated within Figure 7 of the Cawthron Institute Report

118. In relation to the biogenic habitat, horse mussel/brachiopod beds comprise over 45% of the surveyed area with a variety of other species also present within these areas[33]. The remaining benthos is a mix of reef edge (shell debris, gravel and rock), Bryozoan (sands and shell hash) and soft sediments (mud). While horse mussels may be considered a sensitive species, they are not a species protected by the NZCPS Policy 11 or mapped within the MEP. Existing human intervention in the area includes commercial fishing, trawling and dredging (all permitted activities) of which horse mussels are one of the quota species.

119. Cawthron have also undertaken an assessment of the water column which has stated that[34];

Nutrient concentrations were also unremarkable and within the range of concentrations measured at an existing farm in Port Gore. Water samples contained mostly diatoms characteristic of a moderately-nutrient enriched and well-mixed water column.

[33] Assessment of Seabed Effects from an Open Ocean Salmon Farm Proposla in the Marlborough Coastal Area – Cawthron Institute. Section 2.5.2, Biogenic Habitat.

[34] Water Column Assessment for a Proposed Salmon Farm Offshore of the Marlborough Sounds – Cawthron Institute. Executive Summary, pg i.

120. The waters south of the proposal site are considered to be in proximity to an area of outstanding natural character (ONC). However, this ONC is considered to relate to terrestrial values of the Outer Sounds Coastline at the land/sea interface. Landform and its adjacent waters south-west of the application site are considered to hold outstanding levels of natural character.

121. The biophysical value at the site scale is considered to have a high rating.

Perceptual Attributes

122. The Cook Strait waters are expansive and open to the elements, with the proposal site context only being anchored by the distant rugged and dramatic landforms of the Outer Sounds. This highly exposed site, with virtually no sense of enclosure, is heavily influenced by the weather conditions and exhibits a coherent flat plane (water's surface), which is experienced either in distant views from land of over 5km, or on-water, from boats. The transient value of this location is contributed to by wildlife; changing character of the surface of the water; wind and exposure; long open views; sense of remoteness and expansiveness; and boat traffic.

123. The perceived naturalness is arguably high as the current setting has no visible modification (e.g. structures) and displays a simple, expansive horizontal element. However, the specific location is no more memorable than any other patch of open water in the Outer Sounds/Cook Strait seascape. It is a void that vessels may pass through when traversing the Outer Sounds, only identifiable through reference to the distant landforms.

124. The submarine environment is expressive of formative processes, with sediment scouring identified on the sea floor. This is however not perceptible to the majority of individuals visiting the area.

125. The perceptual attributes are considered to have a very high ranking.

Associative Attributes

126. While the associative values outlined in the broader scale description above are of some relevance, at the more focused site scale there is nothing to tie those historical/cultural values to this specific location. This results in a number of loose associations, still relevant, but with a significantly reduced level of sensitivity/importance.

127. That being said, for all of the iwi and hapu who have ancestral links to the Te Tau Ihu area, there is a physical and spiritual connection to Te Moana o Raukawakawa (Cook Strait). This is succinctly summed up by the following statement[35];

> *The relationship of iwi with the coastline and associated resources is as important to present day whānau as it was to our tūpuna. This connection is due to many reasons, such as the creation pūrākau [Mythology], the length of occupation, the abundance of natural resources and the ancient coastal trails across Te Tau Ihu.*

128. We have been informed that those iwi with mana whenua have been contacted in relation to this proposed salmon farm and at this stage, have received one response from Ngāti Koata Trust who "*applaud the potential development of Open Ocean Salmon Farming as a significant environmental and social benefit to our nation*." While there has been no direct input into this assessment from the local community, information relating to other work undertaken in the Sounds has been considered. This has looked at the social impact of salmon farms in the Sounds, and recently completed Cultural Impact and Tourism and Recreation assessments.

129. The main recreational activities include sightseeing cruises, fishing and sailing. While, on a larger scale, commercial fishing operations frequent these waters and shipping routes navigating Cook Strait are nearby.

130. Overall, the associational characteristics at the site scale are ranked as low.

Summary of Key Attributes - Site Scale (Table 9)

	Key Attributes	*Rating*
Biophysical	• Diverse benthos with well oxygenated sediment and rich infaunal communities; • Bathymetry pattern aligned on a northwest/Southeast axis (parallel to prevailing tidal currents); • Proximity to the McManaway Rock complex; • Deep with strong currents; • Extensive biogenic reef communities of horse mussels and brachiopods (typical of the Sounds waters); • Historical and current dredging and trawling permitted within proposal area;	High

[35] Treaty Settlement - Te Tau Ihu Statutory Acknowledgements, Pg 83

Perceptual	• Highly coherent and simple water context; • Expansive views of open ocean; with the scale being set by the distant horizon; • Exposed, wild and remote; • High perceived naturalness; limited modification; • Very High transient qualities; extremely variable weather conditions; • Submarine environment has expressive characteristics.	Very High
Associative	• Physical and spiritual values associated with mana whenua, mana moana, and tangata whenua taonga, mauri, customary practices and the exercise of kaitiakitanga; • Traditional and contemporary waka routes throughout the Outer Sounds; • Recreational activities such as scenic tours, fishing and sailing.	Low

Site Scale: Landscape and Natural Character Evaluation

131. At the site scale of this offshore location, the similarities between a landscape assessment and natural character assessment can result in repetition of information. Both landscape and natural character assessments factor in the biophysical (rated high) and perceptual (rated very high) attributes, with the landscape assessment also considering the associational attributes, which have only been rated as low.

132. In relation to the biophysical component, the benthos is typical of the offshore Marlborough Sounds water's. There may have been a change to the existing submarine environment as a result of the continued commercial fishing (e.g. trawling and set net events), as "*trawling can directly impact on biological diversity*"[36] and bottom fishing generally "*decreases the density and diversity of benthic communities*"[37]. This can shift the baseline rating away from the pre-modified natural state. The biophysical value here relates to the ongoing natural patterns and processes.

133. In relation to the perceptual component, the submarine characteristics are difficult to perceive. The water surface is simply a flat expansive section of open ocean and the value that does exist here is derived from the distant landforms (which provide a scenic

[36] https://www.fisheries.govt.nz/dmsdocument/35184-review-of-sustainability-measures-for-top-of-the-south-island-trawl-fishery-for-201920
[37] https://www.mpi.govt.nz/dmsdocument/34854-aquatic-environment-and-biodiversity-annual-review-aebar-2018-a-summary-of-environmental-interactions-between-the-seafood-sector-and-the-aquatic-environment

backdrop), combined with the sense of wildness that is inherent in such a remote location at the mercy of the elements.

134. The associational component, in this instance, is no more relevant to this location than any other offshore area of the Outer Sounds/Cook Strait. The associational values that remain are broader cultural values.

135. Overall, the landscape ranking is considered to be moderate and the natural character rating is high.

PART C

The Proposal

136. The proposed NZKS Offshore salmon farm site is approximately 1800ha in size and located approximately 5km north of Cape Lambert, with a detailed description of the application contained within the AEE. Essentially, the NZKS application is seeking to undertake commercial scale salmon farming in an offshore location. The precise implementation of salmon farming components is not intended to be specified. Due to the pioneering nature of this undertaking, NZKS do not wish to be precluded from alternative construction methods as a result of progressing technologies or adaptations to site conditions.

137. While it is likely that clusters of 200m circumference circular pens are going to be the preferred implementation method, this assessment has also considered the prospect of alternative designs when assessing the level of adverse effect. This ranges from adjustments in the size of the circular pens to the inclusion of a Havfarm vessel system. While the specific pen design has not been determined, the confirmed limits relate to the quantity of feed that will be used on site. The proposal can be considered to have four stages, with each subsequent stage being reliant on the demonstrable implementation, management and monitoring of potential adverse effects. These stages are;

- Stage 1 - Up to 20,000 tonnes of feed
- Stage 2 - Up to 40,000 tonnes of feed
- Stage 3 - Up to 60,000 tonnes of feed
- Stage 4 - Up to 80,000 tonnes of feed

138. The exact configuration of components associated with the farm (e.g. pens, feed vessels and service vessels) can respond to functional requirements of this operation, provided the feed limit for each stage is not exceeded. The feed limit is such an important threshold in this location because of the importance that the biophysical environment plays on both landscape and natural character value.

139. For Stage 1 and 2, it is also proposed that there be some flexibility provided to trial different construction/pen options. So a limit of 20% of the pen surface area associated with Stage

1 and 2 will be enforced. This is considered to provide enough scope to trial new and alternative design options, while still maintaining a high degree of consistency and simplicity across the entire farm. However, the implementation of Stage 3 and 4 will not increase the space allocation for trialing new technologies without additional specific assessment of the potential effects.

140. Navigational lighting will also be a component of the proposed farm. It is understood that each cluster of salmon farm pens will be required to have corner markers, as well as corner markers on the overall site boundary. There will be underwater lighting, similar to that used at other NZ King Salmon existing farms.

141. It is also assumed that Stages (1-4) are outer limits of the proposal. An annual feed discharge of 22,000 tonnes (e.g. 22x 200m circumference pens) is likely to have less of an effect than a discharge of 38,000 tonnes (e.g. 38x 200m circumference pens), however each stage of development has been assessed at its maximum capacity. Any amount less than the consented discharge is also acceptable.

142. The remainder of this assessment will consider the effects of Stages 1, 2 and 3. Although the deposition modelling has not been completed for the Stage 3, the consideration of Stage 3 landscape and natural character effects has assumed a similar recommendation in relation to the overall appropriateness and monitoring requirements. Despite this initial assumption, it is suggested that a cumulative effects and further assessment of landscape and natural character effects be undertaken prior to Stage 3, as the pen construction method may very well have been refined to a specific solution by this time.

Mitigation

143. The implementation of the Design Guide, as outlined in Part A of this assessment, is one of the main methods mitigating adverse effects. The other main method is to implement the recommendations put forward within the Cawthron Report[38]. This Cawthron Report has been a critical consideration in reaching a conclusion on potential landscape and natural

[38] Assessment of Seabed Effects from an Open Ocean Salmon Farm Proposal in the Marlborough Coastal Area. Cawthron Institute.

character effects due to the importance of the ecological (biophysical) information relating to the application site. The Cawthron Report[39] has identified;

- *Far-field waste dispersal, and possible associated effects are difficult to predict, but are an important consideration in monitoring at this site, due to the dispersive nature of the site and the potentially large farming area that it may be able to support.*
- *Two key considerations to reducing the likelihood and consequence of ecological effects are:*
    - *avoiding overlap of the footprint with sensitive horse mussel and brachiopod beds, and the McManaway Rock fringing strata,*
    - *monitoring and effects-based management whereby the potential effects of concern can be monitored, and farming practices adapted to minimise the risk of unacceptable effects as the activity progresses.*
- *In addition, there are other operational management practices that can help to reduce some of the effects.*
- *A robust, long-term management plan should be prepared prior to any structure installation. This should include clearly defined limits on 'effect acceptability', intervention framework and feedback pathways for adaptive management and monitoring, and details of a well-designed monitoring programme that measures effects. Additional depositional modelling is recommended to inform the monitoring design, once the final farming configuration is known. This modelling should include a higher number of released particles, and particle resuspension.*

144. As outlined in Part A of this assessment, the Design Guide has been developed in order to assist with the visual absorption of salmon farm operations into their open water settings. This will be achieved by following design objectives and principles which promote a high quality design aesthetic for salmon farming equipment and structures, along with requiring a few design absolutes. While all of the design intentions outlined in the Design Guide assist

[39] Assessment of Seabed Effects from an Open Ocean Salmon Farm Proposal in the Marlborough Coastal Area. Cawthron Institute.

in reducing the impact of the salmon farm, at a minimum the following constraints should apply as mitigation measures:

- Use black netting for all nets above the waterline.
- Use black colour on the surfaces of pens. This excludes pens which are designed to look like vessels (e.g. the Havfarm);
- Structures above the water line in this location will be located a minimum of 5km from shore;
- Metallic surfaces must be coated in order to reduce reflectivity;
- Permanent vessels must be painted with a muted colour scheme, applying a colour reflectivity value of less than 30%;
- No more than 20% of the consented surface area (of Stage 1 and 2) may be used to trial alternative pen designs;
- *Avoiding overlap of the footprint with sensitive horse mussel and brachiopod beds, and the McManaway Rock fringing strata*[40];
- *Monitoring and effects-based management whereby the potential effects of concern can be monitored, and farming practices adapted to minimise the risk of unacceptable effects as the activity progresses*[41].

Assessment of Effects

145. There are two fundamental aspects to the offshore salmon farm proposal which help to reduce potential adverse effects. Firstly, *"there are better waste dispersal capabilities at dynamic offshore locations such as the proposed site (compared to those further inshore), and this is a clear advantage for mitigating seabed effects"*[42]. Secondly, the offshore location becomes removed from the highly valued Sounds landform and softens perceptual effects through isolation and placement within an expansive context.

[40] Assessment of Seabed Effects from an Open Ocean Salmon Farm Proposal in the Marlborough Coastal Area – Cawthron Institute. pg. ii, Executive Summary
[41] Ibid
[42] Ibid - pg. I, Executive Summary

146. The Cawthron Report[43] has undertaken a detailed evaluation of the potential impact of both 20,000 tonnes of feed (Stage 1) and 40,000 tonnes of feed (Stage 2). Their findings include;

- *…Our depositional modelling shows that the site has capacity to support a large salmon farm development.*
- *At the initial proposed production level of 10,000 tonnes per year (20,000 tonnes of feed discharge) depositional modelling indicated that the maximum depositional flux within the primary footprint would be on the order of 2.44 kg solids/m2/yr (moderate enrichment), with a total footprint area of 453 ha. Scaling up the production to 40,000 tonnes of production resulted in depositional flux of up to 9.0 kg solids/m2/yr, with a total footprint of 658 ha. Fine farm waste material will also be dispersed, through water column transport and sediment resuspension processes, to the far field (e.g. outside of the total and primary footprints). Through these processes, dispersal is estimated to be on the order of kilometres beyond the primary footprint modelled in this assessment, although accumulation will be at low levels that may not be easily discernible.*
- *Based on the initial production level, in the most intensely affected area (moderate enrichment conditions), more tolerant and opportunistic taxa will begin to dominate infaunal communities, and sensitive taxa will be displaced. As a result, taxa richness, and total abundance will be reduced from background conditions. There will be slight changes to sediment chemistry (total free sulphides and redox potential) due to increased microbial activity, and patches of bacteria may be visible. Some more sensitive (sessile suspension feeding) epifauna may show reductions in density, while more tolerant taxa may increase (e.g. mobile deposit feeders may aggregate in these areas). It is highly unlikely that levels of copper and zinc will reach an adverse biological threshold at this level of production. With increasing proximity to the edge of the footprint (~1.5–2 km downstream of the pen edges), infaunal communities will grade to background conditions, with a large proportion of the footprint containing communities with enhanced taxa richness and abundances, akin to a 'fertilisation' effect.*

[43] Ibid

- *The tolerance of horse mussels and brachiopods to farm-related deposition is not known, but it is likely to be low. Thus, depending on the location of the structures within the proposal area, epifaunal communities may show sub-lethal effects, or be displaced, even at relatively low depositional levels (mild to moderate enrichment). The significant marine site and reef-edge assemblage areas also contain taxa likely to be sensitive to deposition.*

147. Furthermore, in relation to the other reports prepared as part of this offshore salmon farm application, the following conclusions have contributed to the assessment of adverse landscape and natural character effects:

- The proposed high production salmon farm could be operated without exceeding the enrichment threshold (ES5) which is allowed beneath other salmon farms within the Marlborough Sounds[44].

- Changes to levels of dissolved oxygen (DO), total nitrogen (TN) and the cumulative impact of nutrient dispersion are unlikely to cause issues at Stage 1, with the potential for additional monitoring beyond the Stage 1 feed quantities[45];

- The effects of the submerged lighting will be small on the physical and biological characteristics[46];

- The site is not within a navigationally complex area and, with the suggested mitigation, the navigation risk can be adequately mitigated. The presence of this farm may actually reduce the existing danger associated with Witts Rock and McMannaway Rocks by becoming an aid to navigation[47];

[44] Assessment of Seabed Effects from an Open Ocean Salmon Farm Proposal in the Marlborough Coastal Area – Cawthron Institute. pg. 40, Section 3.4
[45] Water Column Assessment for a Proposed Salmon Farm Offshore of the Marlborough Sounds – Cawthron Institute. Executive Summary, pg ii.
[46] Water Column Assessment for a Proposed Salmon Farm Offshore of the Marlborough Sounds – Cawthron Institute. Executive Summary, pg ii.
[47] North Marlborough Farm Development Navigational Risk Assessment (July 2019). Navigatus Consulting Ltd. Section 1.4 to 1.5.

- *"While the overall likelihood of any adverse effects is considered low, the consequences of a rare event such as the fatal entanglement of threatened species warrants appropriate mitigation actions"*[48];

- *"the overall effects of the salmon farms on marine mammal species within outer Marlborough Sound waters are assessed as less than minor when considered with the recommended mitigation actions"*[49];

- Provided that a Seabird Management Plan is developed, the adverse effect of habitat exclusion and smothering of the benthos caused by the proposal, "*is likely to have minimal effect on Cook Strait and Marlborough Sounds seabird populations because species that feed offshore have extensive foraging ranges"*[50];

Discussion

148. The shift to an offshore location for the implementation of new salmon farms is considered to be an appropriate response in relation to the control of adverse biophysical, perceptual and associational effects. The deep water, high flow rate and generally dispersive nature of this location allow the farm waste deposition to be managed to an acceptable level. The separation distance from shore places the structures into a remote and isolated position with key attributes of expansiveness and coherence that are less influenced by this scale of development than locations closer to shore.

149. In relation to reversibility of effects from the proposed structures, the structures can be removed without leaving significant long-term adverse effects in a biophysical sense, with visual effects being immediately reversible. The site is considered resilient by benthic experts, in terms of ability to recover from the proposal, if the salmon farm structures were to be eventually removed.

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[48] Marine Mammal Assessment for a Proposed Salmon Farm Offshore of the Marlborough Sounds (July 2019). Cawthron Institute. Executive Summary - Pg i.
[49] Marine Mammal Assessment for a Proposed Salmon Farm Offshore of the Marlborough Sounds (July 2019). Cawthron Institute. Pg 30.
[50] Potential Effects on Seabirds of Open Ocean Fish Farming, Cook Strait (July 2019). McClellan, R., Wildlands Consultants. Section 6, Pg 30.

150. In relation to the visual component of the perceptual attributes, at this location, the setting is dominated by the expansive open waters. Views of the offshore salmon farm will, for the most part, be transitory in nature from boat traffic. Boat traffic may include water taxis, tour operators, workboats servicing marine farms, cargo boats, logging boats and recreational vessels (fishing/diving/transport to holiday homes). The farm will be seen by boat traffic travelling along the outer northern edge of the Sounds. Boat traffic is likely to be predominantly work boats, although there will be a presence of recreational boats as well.

151. The impact on individual views within close proximity to the salmon farm (Ref to Table 6) will range from a minor part of the view to a dominant part of the view depending on the exact distance from the structures. However, the visual effect will be reduced by the expansiveness of the setting and the implementation of the design controls within the Design Guide.

152. Perceptions of salmon farms by recreational boaties were surveyed in 2015. Results showed that just over half the boatie respondents reported no effect of salmon farms on their experience of the Sounds, while almost one-third reported a negative effect. The most common negative effect reported by boaties was visual blight (12 percent), a feeling of displacement from the bay (10 percent), and course change or navigational risk (6 percent). The positioning of this salmon farm is considered to have less of an impact on these most common concerns. The 'visual blight' has been shifted out to a far less scenic position, the 'displacement from the bay' is far less likely to occur offshore (but is understandable within the Sounds where the scale of channels/reaches is significantly reduced) and navigation concerns should be alleviated, as there is substantial space to give the farm a wide berth (unlike in some of the other locations within the sounds).

153. People's responses to the presence of salmon farms varies a great deal, depending on the experiences, personalities and attitudes of the individuals concerned[51]. The adverse effects from lighting are also considered to be reduced at this offshore location. Lighting is already present within the broader scale context, as there are a few lighthouses along this stretch of coastline. Navigational lighting and the lights on the associated vessels may be faintly

[51] The Social and Community Effects of Salmon Farming & Rearing: A Case Study of the Top of the South Island; Taylor Baines & Assocs & Quigley & Watts Ltd; Nov 2015, pgs. 37 - 40.

discernible at night from isolated land based locations, however the impact is not considered significant enough to alter the appreciation of the night sky in this location.

Effects at the National and District Scale

154. The proposed offshore salmon farm is to be located within the Coastal Marine Area of the Marlborough Sounds, approximately 5km north of Cape Lambert. The entirety of Marlborough Sounds has been identified as an Outstanding Natural Landscape, at a National Scale[52]. A portion of this proposal site has been mapped within the Outer Sounds ONL, as recommended by the MEP, however we dispute the relevance of the seaward extent of this mapping.

155. It is considered that the proposed offshore site will not adversely affect the key values that caused the Marlborough Sounds to be identified as outstanding at that national level, due to the indiscernible change to the large scale of the Marlborough Sounds ONL. This is also the case for the Outer Sounds ONL, which comprises roughly half of the Marlborough Sounds.

156. Despite our questioning of the seaward extent of the Outer Sounds ONL and the ONC finger which protrudes into the southeast corner of the application area, it is considered that the values of the MEP ONL and ONC mapping, will be retained at the District scale should the offshore salmon farm be implemented at either the Stage 1 (20k tonne), Stage 2 (40k tonne) or Stage 3 (60k tonne) feed levels.

157. At this much wider scale, the adverse effect for both landscape and natural character across Stage 1-3 is considered to be negligible.

Effects at the Broader Scale (Outer Sounds)

158. Assessment of effects at this scale considers the effects arising from the proposal on the broader scale values of the Outer Sounds context. Based on the technical information provided within the assessment of seabed effects it is likely that the effect will be negligible on the biophysical values at the Stage 1 feed discharge.

[52] Marlborough Landscape Study 2015 – pg 106 and 108

159. It is also considered that the implementation of the Design Guide and mitigation options will reduce the potential perceptual effects, while not compromising the wider associational values of the Outer Sounds.

160. At the outer sounds scale, the adverse effect for both landscape and natural character for Stage 1 is considered to be negligible.

Effects at Site Scale (Application site and surrounding waters)

161. With the mitigation options outlined in this assessment, in conjunction with those of the other disciplines involved in this proposal (in particular the mitigation measures discussed in Section 4 of the Cawthron Report), then *"the ecological significance of the effects could be reduced to the extent that the site could support a salmon farm development of a substantial size"* [53] . Furthermore, the perceptual and associational effects can be accommodated, as the site is considered to have a low sensitivity to change due to the absorption capacity of the expansive and remote setting.

Summary of Effects

162. Overall, it is considered that the effects for Stage 1 (20,000 tonnes of feed) will be negligible at the broader scale for both landscape and natural character, while the Stage 1 effects at the site scale are considered to be very low. The level of effect incrementally increased (as outline in Table 11 below) with a moderate level effect occurring at the site scale for Stage 3. This is the threshold for where we consider there to be a more than minor adverse effect.

Table 10: Site and Localised Vicinity Baselines

BASELINES	Biophysical	Perceptual	Associative	Landscape	Natural Character
Broader Scale	High	Very High	High	Very High	Outstanding (Terrestrial), High and Very High (Marine)
Site Scale	High	Very High	Low	Moderate	High

Table 11: Effect across the Scales

Scale	*National*	*District*	*Broader Scale (Outer Sounds)*	*Site Scale*

[53] Ibid – pg. 42, Section 4.

	Landscape & Natural Character	Landscape & Natural Character	Landscape & Natural Character	Landscape & Natural Character
Stage 1	Negligible	Negligible	Negligible	Very Low
Stage 2	Negligible	Negligible	Very Low	Low
Stage 3	Negligible	Negligible	Low	Moderate

Conclusion

163. It is considered that the Marlborough offshore salmon farm site can accommodate the proposed level of production, including all associated structures, in relation to both landscape and natural character effects. It is only once the feed discharge will exceed 40,000 tonnes (Stage 3) that the effects will be considered to be more than minor (at the site scale).

164. This conclusion had been informed by the detailed assessment of seabed effects undertaken by the Cawthron Institute, in conjunction with the site analysis and evaluation undertaken within this assessment. A key factor in ensuring the appropriateness of the proposed salmon farm in this setting, is the implementation of the Design Guide objectives and policies, in conjunction with the mitigation requirements section above.

Attachment 1 – Other Offshore Farm Options

Offshore developments and proposals as at 12 September 2017

Project name	Company	Country	Design	Dimensions	Individual rearing units	Tonnage (mt)	Description	Status
Fortress Pen	Huon	Australia	HDPE circular	Up to 240m circumference	78m dia	1,400	Large robust circular plastic pens, does not include ancillary equipment	Operating Tasmania
Ocean Farm 1	Salmar	Norway	Solid semi submersible			6,240	Oil industry technology	Built, being commissioned in Norway
Havfarm one	Nordlaks Oppdrett	Norway	Solid line of 6 pens	430mx54m		7,800/10 ,000	Rotates around a single mooring	10 Licences granted
Havfarm two	Nordlaks Oppdrett	Norway	Solid line of 6 pens	430mx54m		7,800/10 ,000	Limited manoeuvrability	Licences rejected. Under appeal
Havfarm three	Nordlaks Oppdrett	Norway	Solid line of 6 pens	430mx54m		7,800/10 ,000	Able to manoeuvre further offshore	Licences rejected. Under appeal
FjiordMAX		Norway	Solid 3 circles	165mx153mx6 m	66m dia.	7,020		Application for licences. Design stage
Atlantis Subsea	AKVA	Norway	Circular submerged pen					Approved for further discussion
Marine Harvest 'donut' concept	Marine Harvest	Norway	Circular solid structure					Approved for further discussion
Marine Harvest 'Beck cage' concept	Marine Harvest	Norway	Flexible, submersible offshore pen					Inadequate documentation. Licences declined
Marine Harvest 'egg cage' concept	Marine Harvest	Norway	Closed system with 90% below water	H44mxW33m		1,000		Approved for further discussion
Marine Harvest	Marine Harvest	Norway	Converted freighter	65,000m3		5,000		Pending decision

Attachment 2 –Boat Example

AKVA Group – Cage Farming Aquaculture Brochure

Wavemaster Feed Barge – AC600PV

Attachment 3 – Relevant Provisions (NZCPS, MSRMP)

New Zealand Coastal Policy Statement

Key Provisions

Objective 2: *To preserve the natural character of the coastal environment and protect natural features and landscape values through:*

- *recognising the characteristics and qualities that contribute to natural character, natural features and landscape values and their location and distribution;*
- *identifying those areas where various forms of subdivision, use, and development would be inappropriate and protecting them from such activities; and*
- *encouraging restoration of the coastal environment.*

Policy 15: *Natural features and natural landscapes*

To protect the natural features and natural landscapes (including seascapes) of the coastal environment from inappropriate subdivision, use, and development:

(a) avoid adverse effects of activities on outstanding natural features and outstanding natural landscapes in the coastal environment; and

(b) avoid significant adverse effects and avoid, remedy or mitigate other adverse effects of the activities on other natural features and natural landscapes in the coastal environment;

Policy 13: *Preservation of natural character*

(1) To preserve the natural character of the coastal environment and to protect it from inappropriate subdivision, use, and development:

(a) avoid adverse effects of activities on natural character in areas of the coastal environment with outstanding natural character; and

(b) avoid significant adverse effects and avoid, remedy or mitigate other adverse effects of activities on natural character in all other areas of the coastal environment.

Marlborough Sounds Resource Management Plan (MSRMP)

Chapter 9 Coastal Marine

9.1.2 Aquaculture Management

Objective 1 - The accommodation of appropriate activities in the coastal marine area whilst avoiding, remedying or mitigating the adverse effects of those activities.

- *Policy 1.1 - Avoid, remedy and mitigate the adverse effects of use and development of resources in the coastal marine area on any of the following:*

  a) Conservation and ecological values;

  b) Cultural and iwi values;

  c) Heritage and amenity values;

  d) Landscape, seascape and aesthetic values;

  e) Marine habitats and sustainability;

  f) Natural character of the coastal environment;

  g) Navigational safety;

  h) Other activities, including those on land;

  i) Public access to and along the coast;

  j) Public health and safety;

  k) Recreation values; and

  l) Water quality

- *Policy 1.2 - Adverse effects of subdivision, use or development in the coastal environment should as far as practicable be avoided. Where complete avoidance is not practicable, the adverse effects should be mitigated and provision made for remedying those effects to the extent practicable.*

- *Policy 1.14 - To enable a range of activities in appropriate places in the waters of the Sounds including marine farming, tourism and recreation and cultural uses.*

9.4.1 Alteration to the Foreshore and Seabed

Objective 1 Protection of the coastal environment by avoiding, remedying or mitigating any adverse effects of activities that alter the foreshore or seabed.

- *Policy 1.1 - Avoid, remedy or mitigate the adverse effects of activities that disturb or alter the foreshore and/or seabed on any of the following:*

  a) Conservation and ecological values;

b) Cultural and iwi values;

c) Heritage and amenity values;

d) Landscape, seascape and aesthetic values;

e) Marine habitats and sustainability;

f) Natural character of the coastal environment;

g) Navigational safety;

h) Other activities, including those on land;

i) Public access to and along the coast;

j) Public health and safety;

k) Recreation values; and

l) Water quality.

Chapter 2 Natural Character

2.2 Objectives and Policies

Objective 1 - The preservation of the natural character of the coastal environment, wetlands, lakes and rivers and their margins and the protection of them from inappropriate subdivision, use and development.

- *Policy 1.1 - Avoid the adverse effects of subdivision, use or development within those areas of the coastal environment and fresh-water bodies which are predominantly in their natural state and have natural character which has not been compromised.*

- *Policy 1.2 - Appropriate use and development will be encouraged in areas where the natural character of the coastal environment has already been compromised, and where the adverse effects of such activities can be avoided, remedied or mitigated.*

- *Policy 1.3 - To consider the effects on those qualities, elements and features which contribute to natural character, including:*

a)Coastal and freshwater landforms;

b)Indigenous flora and fauna, and their habitats;

c) Water and water quality;

d)Scenic or landscape values;

e)Cultural heritage values, including historic places, sites of early settlement and sites of significance to iwi; and

f) Habitat of trout.

- *Policy 1.4 - In assessing the actual or potential effects of subdivision, use or development on natural character of the coastal and freshwater environments, particular regard shall be had to the policies in Chapters 3, 4, 5, 6, 12,13 and Sections 9.2.1, 9.3.2 and 9.4.1 in recognition of the components of natural character.*

- *Policy 1.6 - In assessing the appropriateness of subdivision, use or development in coastal and freshwater environments regard shall be had to the ability to restore or rehabilitate natural character in the area subject to the proposal.*

- *Policy 1.7 - To adopt a precautionary approach in making decisions where the effects on the natural character of the coastal environment, wetlands, lakes and rivers (and their margins) are unknown.*

- *Policy 1.8 - To recognise that preservation of the intactness of the individual land and marine natural character management areas and the overall natural character of the freshwater, marine and terrestrial environments identified in Appendix Two is necessary to preserve the natural character of the Marlborough Sounds as a whole.*

Chapter 5 Landscape

5.3 Objectives and Policies

Objective 1 - Management of the visual quality of the Sounds and protection of outstanding natural features and landscapes from inappropriate subdivision, use and development.

- *Policy 1.1 - Avoid, remedy and mitigate adverse effects of subdivision, use and development, including activities and structures, on the visual quality of outstanding natural features and landscapes, identified according to criteria in Appendix One.*

Attachment 4

Marlborough Environment Plan (MEP) – Volume 1

Chapter 7 - Landscape

Objective 7.2 – Protect outstanding natural features and landscapes from inappropriate subdivision, use and development and maintain and enhance landscapes with high amenity value.

Policy 7.2.3 – Control activities that have the potential to degrade the amenity values that contribute to those areas of the Marlborough Sounds Coastal Landscape not identified as being an outstanding natural feature and landscape by:

…

(b) setting standards/conditions that are consistent with the existing landscape values and that will require greater assessment where proposed activities and structures exceed those standards; …

Policy 7.2.4 – Where resource consent is required to undertake an activity within an outstanding natural feature and landscape or a landscape with high amenity value, regard will be had to the potential adverse effects of the proposal on the values that contribute to the landscape.

Policy 7.2.7 – Protect the values of outstanding natural features and landscapes and the high amenity values of the Wairau Dry Hills and the Marlborough Sounds Coastal Landscapes by:

(a) In respect of structures:

> *(i) avoiding visual intrusion on skylines, particularly when viewed from public places;*
>
> *(ii) avoiding new dwellings in close proximity to the foreshore;*
>
> *(iii) using reflectivity levels and building materials that complement the colours in the surrounding landscape;*
>
> *(iv) limiting the scale, height and placement of structures to minimise intrusion of built form into the landscape;*
>
> *(v) recognising that existing structures may contribute to the landscape character of an area and additional structures may complement this contribution;*
>
> *(vi) making use of existing vegetation as a background and utilising new vegetation as a screen to reduce the visual impact of built form on the surrounding landscape, providing that the vegetation used is also in keeping with the surrounding landscape character; and*
>
> *(vii) encouraging utilities to be co-located wherever possible; …*

Policy 7.2.8 – Recognise that some outstanding natural features and landscapes and landscapes with high amenity value will fall within areas in which primary production activities currently occur.

Chapter 6 - Natural Character

Policy 6.1.1 – Recognise that the following natural elements, patterns, processes and experiential qualities contribute to natural character:

(a) areas or water bodies in their natural state or close to their natural state;

(b) coastal or freshwater landforms and landscapes (including seascape);

(c) coastal or freshwater physical processes (including the natural movement of water and sediments);

(d) biodiversity (including individual indigenous species, their habitats and communities they form);

(e) biological processes and patterns;

(f) water flows and levels and water quality; and

(g) the experience of the above elements, patterns and processes, including unmodified, scenic and wilderness qualities.

Objective 6.2 – Preserve the natural character of the coastal environment, and lakes and rivers and their margins, and protect them from inappropriate subdivision, use and development.

Policy 6.2.2 – Avoid significant adverse effects of subdivision, use or development on coastal natural character, having regard to the significance criteria in Appendix 4.

Policy 6.2.3 – Where natural character is classified as high or very high, avoid any reduction in the degree of natural character of the coastal environment or freshwater bodies.

Policy 6.2.4 – Where resource consent is required to undertake an activity within coastal or freshwater environments with high, very high or outstanding natural character, regard will be had to the potential adverse effects of the proposal on the elements, patterns, processes and experiential qualities that contribute to natural character.

Policy 6.2.5 – Recognise that development in parts of the coastal environment and in those rivers and lakes and their margins that have already been modified by past and present resource use activities is less likely to result in adverse effects on natural character.

Policy 6.2.6 – In assessing the appropriateness of subdivision, use or development in coastal or freshwater environments, regard shall be given to the potential to enhance natural character in the area subject to the proposal.

Policy 6.2.7 – In assessing the cumulative effects of activities on the natural character of the coastal environment, or in or near lakes or rivers, consideration shall be given to:

(a) the effect of allowing more of the same or similar activity;

(b) the result of allowing more of a particular effect, whether from the same activity or from other activities causing the same or similar effect; and

(c) the combined effects from all activities in the coastal or freshwater environment in the locality.

Attachment 5

Marlborough Environment Plan Volume 3, Appendix 1 – Landscape

Values contributing to areas with outstanding natural features and landscapes and areas with amenity value high

Area 1 – Outer Sounds Landscape

Biophysical (Abiotic and Biotic)

- *Northernmost part of the highly legible drowned narrow ridge system, noticeably at Cape Jackson.*
- *Numerous Geopreservation Sites of National and Regional Importance, including the submerged ridgeline under French Pass.*
- *Nationally significant seascape (Cook Strait).*
- *Swirling high flow currents of French Pass, Allen Strait, and Tory Channel.*
- *Salt tolerant low growing herb and shrub species.*
- *Island communities nationally and internationally important with distinct rare biotic assemblages (i.e. Motuara, Brothers and White Rocks, Long Island Kokomohua).*
- *Many predator-free island sanctuaries (Motuara Island, Blumine Island and Stephens Island/Takapourewa Island).*
- *Extensive areas of vegetated elevated slopes, notably of D'Urville, Mt Stokes, Mt Furneaux, Bobs Peak.*
- *Extensive areas of modified grasslands.*
- *Subalpine vegetation of Mt Stokes.*
- *Nationally significant broadleaf species and nationally significant endemic cliff vegetation on Arapawa Island.*

Perceptual

- *Expansive views of the open sea broken up by the outer peninsulas, rocky outcrops, steep exposed seacliffs and islands.*
- *Exposed, remote and rugged seascape.*
- *All islands have very low modification levels.*
- *High legibility and visual coherency of the grasslands on the drowned ridge coastline.*
- *High sensory values associated with the wild windswept coast and high winds, rough sea, high-energy waves and associated sea spray.*
- *Very high levels of perceived naturalness due to limited modification.*
- *Impressive and weathered coastal cliffs and rocky windswept islands.*
- *Prevalent high winds from Cook Strait and extreme weather conditions providing highly transient conditions.*

Associative

- *Rich in past Māori and European cultural use including prehistoric quarries and copper mines, whaling and pa sites.*
- *Strong tangata whenua association and spiritual affinity with outer Sounds seascape and coastline. Many linked to Kupe's visit.*
- *Noted 'entrance points' into Tory Channel, Queen Charlotte Sound and Pelorus Sound.*
- *Strong recreational areas, including walking, boating, fishing and diving.*
- *Noted DOC conservation areas.*

Area 4 – Chetwode Islands, Titi Island and Sentinel Rock

Biophysical (Abiotic and Biotic)

- *Highly exposed islands, which hold steep and exposed sea cliffs and wind-swept rocky coastlines.*
- *The Chetwode Islands are considered the most ecologically significant predator-free islands in the Sounds, harbouring the yellow-crowned parakeet, robin, kaka, rare vegetation species and coral reef habitat for a high diversity of fish species.*
- *Titi Island and Sentinel Rock are also of national significance due to their predator-free status.*
- *All islands hold very low level of modification.*
- *The islands contain endemic shrublands, herbfields and tussockland communities.*
- *All islands and their associated coastal waters harbour unique species and support no or very low levels of modification. All hold outstanding levels of natural character.*

Perceptual

- *Many spectacular rock stacks are present at the southern end of the Chetwode Islands.*
- *The outer islands are the most exposed to the sea of any areas in the Sounds and act as visual reference points from Cook Strait.*
- *Rugged and exposed in appearance.*

Associative

- *A number of Māori pits, middens and terraces are located on the Chetwode Islands.*

Area 12 – Cape Jackson, Cape Lambert, and Aligator Head

Biophysical (Abiotic and Biotic)

- *Geopreservation site: Cape Jackson drowned ridge crest.*
- *Cape Lambert headland vegetation, exceptional biodiversity on both Cape Lambert and Cape Jackson.*
- *Steep eroded cliffs and rocky shores, dominated by high energy waves define this exposed landscape.*
- *Cape Jackson, Cape Lambert and the interconnecting outer waters hold outstanding levels of natural character.*

Perceptual

- *Cape Jackson is a superb example of a drowned ridge crest.*
- *Impressive ridgeline of the forested high peaks above Guards Bay and Port Gore, leading to Mount Stokes.*
- *Cape Jackson, Cape Lambert and Alligator Head have wild and rugged forms that are extremely legible and assist in defining the two outer Sounds bays of Port Gore and Waitui Bay.*
- *Largely unmodified coast.*
- *Cape Jackson marks the western entrance to Queen Charlotte Sound. The lighthouse is very memorable and used as a reference point.*
- *High experiential values, which are due to remote and expansive seascape vistas of a wild and exposed nature.*
- *The darkness of the night sky adds to the sense of remoteness.*

Associative

- *Popular areas for open ocean fishing.*
- *Headlands act as navigational landmarks for boaties.*

Area A – Marlborough Sounds Coastal Landscape

- *Distinctive, fractured pattern of the Marlborough Sounds coastline.*
- *Slender peninsulas and range of islands provide distinctive landscape containing very high aesthetic values.*
- *Combination of rocky coastlines, vegetated and grassy ridges and small coves, bays and inlets portrays an overwhelming sense of naturalness.*
- *The area is imbued with cultural and historic values. It is extremely memorable.*
- *Outer Sounds are more rugged and exposed to the varying climatic conditions in the Cook Strait.*
- *Inner Sounds more sheltered and visually defined by forest-clad ridges and mountain tops which promote the intimacy experienced from within the waters.*
- *Many of the smaller bays in Inner Sounds show little evidence of human intervention, and the level of visual intactness remains high.*
- *Small settlements, generally nestled closely at the head of a bay, retain a high level of aesthetic coherence, contained by the steep, often vegetated sides of the enclosing ridge.*
- *High levels of naturalness, recreational values and visual coherence.*

Attachment 6

Proposed Marlborough Environment Plan Volume 3, Appendix 2 – Natural Character

Coastal Marine Area B: D'Urville Island – Northern Cook Strait

[Relevant Extract]

Eastern D'Urville Island - Waitui Bay (High Natural Character)

Near shore areas, including around the Trio Islands, Chetwode Islands and Titi Island, retain high natural values.

- *Variable exposure.*
- *Numerous ecologically significant marine sites.*
- *D'Urville Island Scenic Reserve; Chetwode Island Nature Reserve; Titi Island Nature Reserve.*

Additional Comments

- *Offshore banks between the island groups are commercially trawled, in places relatively intensively.*
- *Some commercial scallop dredging in Waitui Bay and northwest of Nukuwaiata Island.*

Cape Lambert-Cape Jackson (Very High Natural Character)

Largely unmodified section of coast with exposed rocky bluffs, headlands and reefs.

- *Cape Lambert Scenic Reserve.*
- *Adjoins Coastal Marine Area G*

Additional Comment

- *Some commercial trawling offshore*
- *Offshore areas in Waiutu Bay are commercially dredged for scallops.*

Outstanding Coastal Natural Character Areas

Area 9 – The Capes

Abiotic Values

- *Cape Jackson is a superb example of a drowned ridge crest.*
- *Cliffs and very steep slopes flank the sea and are being continually eroded by high energy waves.*
- *Strong tidal currents off headlands.*
- *Reefs fringe the shore and extend into deeper water, especially off the headlands.*

Biotic Values

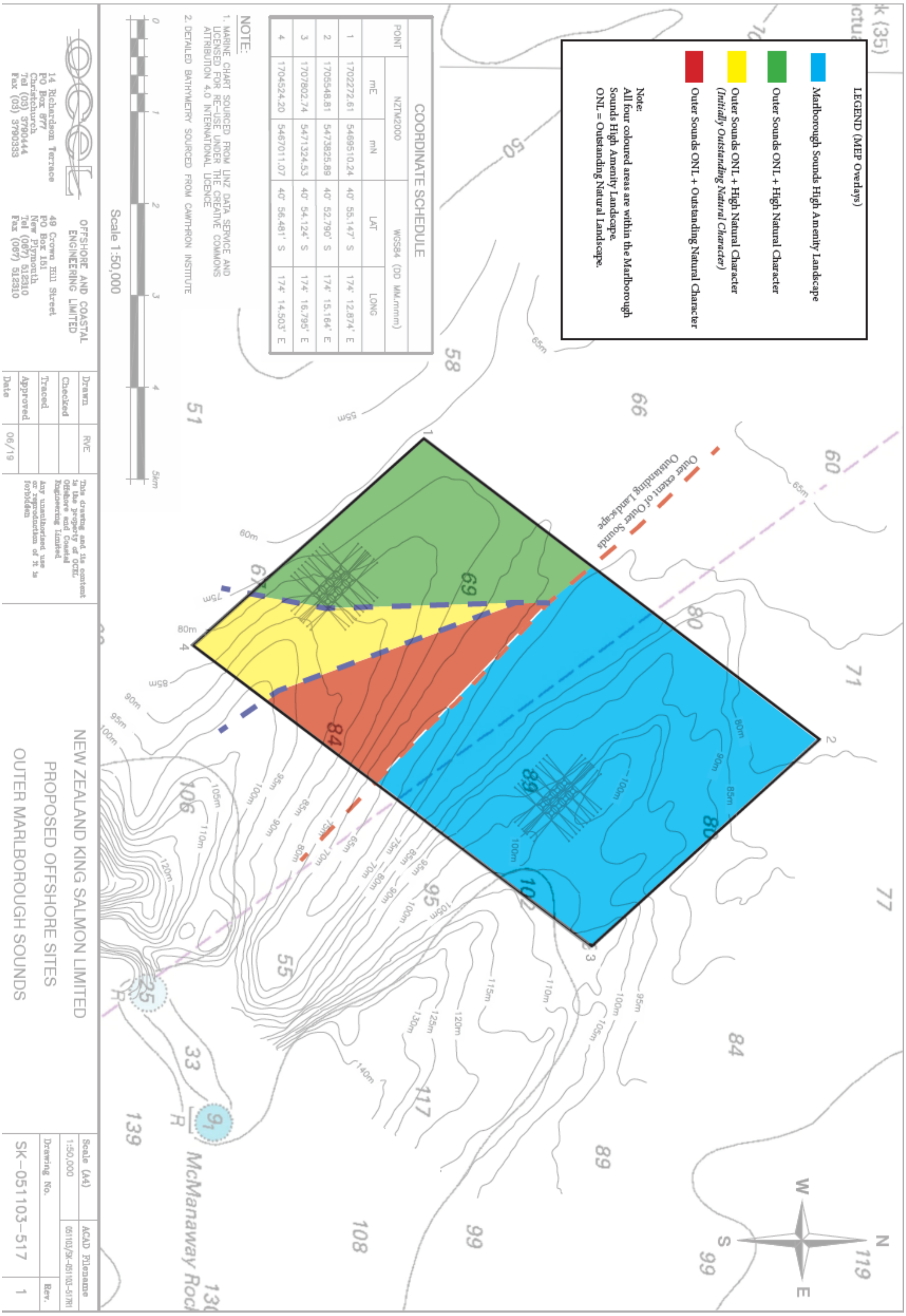
- *Brutal exposure to the elements has shaped unique Cook Strait vegetation on the headlands of Ca Jackson.*
- *Largely unmodified section of coast with exposed rocky bluffs and headlands and reef communities ex water.*
- *Cape Lambert Scenic Reserve.*
- *High current communities in the vicinity of The Capes.*

Experiential Values

- *The Capes and the waters they enclose are remote and retain a wild and exposed nature due to their narrow and rugged form.*
- *They act as the outer 'arms' of Port Gore, where rocky outcrops and partially submerged platforms extend into the sea and offer opportunities for fishing.*
- *Cape Jackson forms the western entrance to Queen Charlotte Sound where biotic patterns extend from Mt. Stokes and Mt. Furneaux further inland.*

Attachment 7

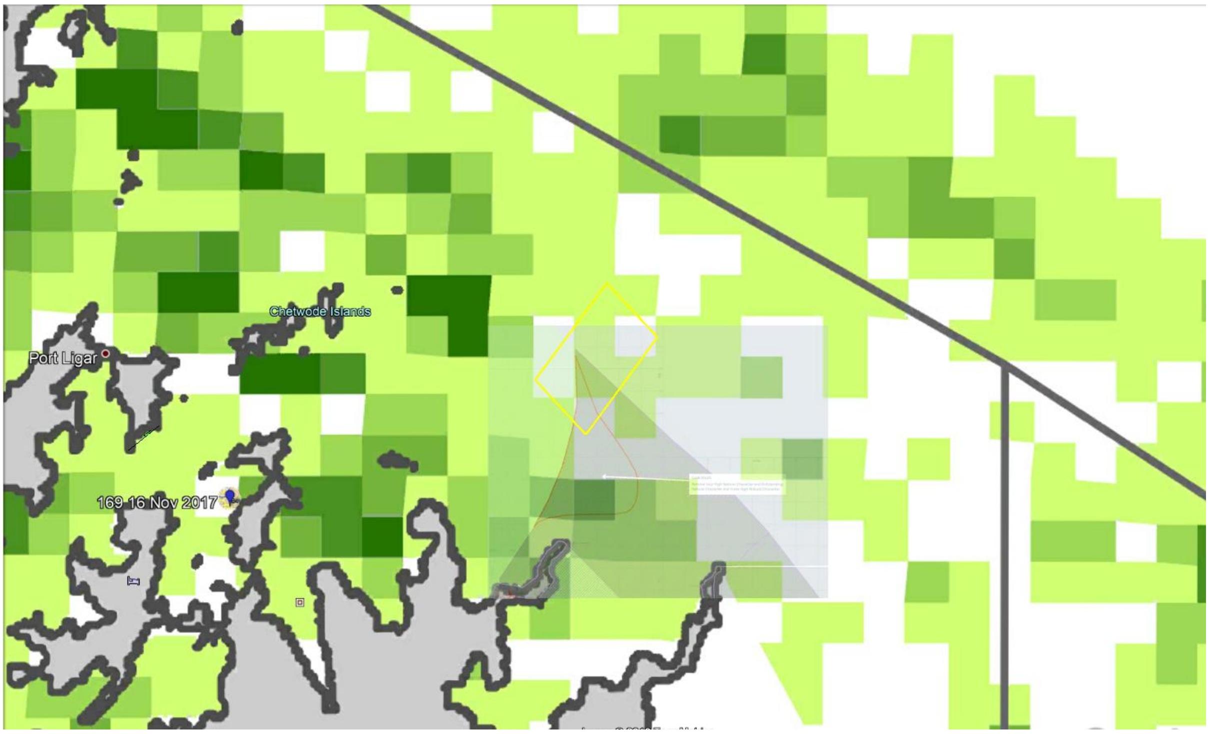
Proposed Marlborough Environment Plan Volume 3, Appendix 2



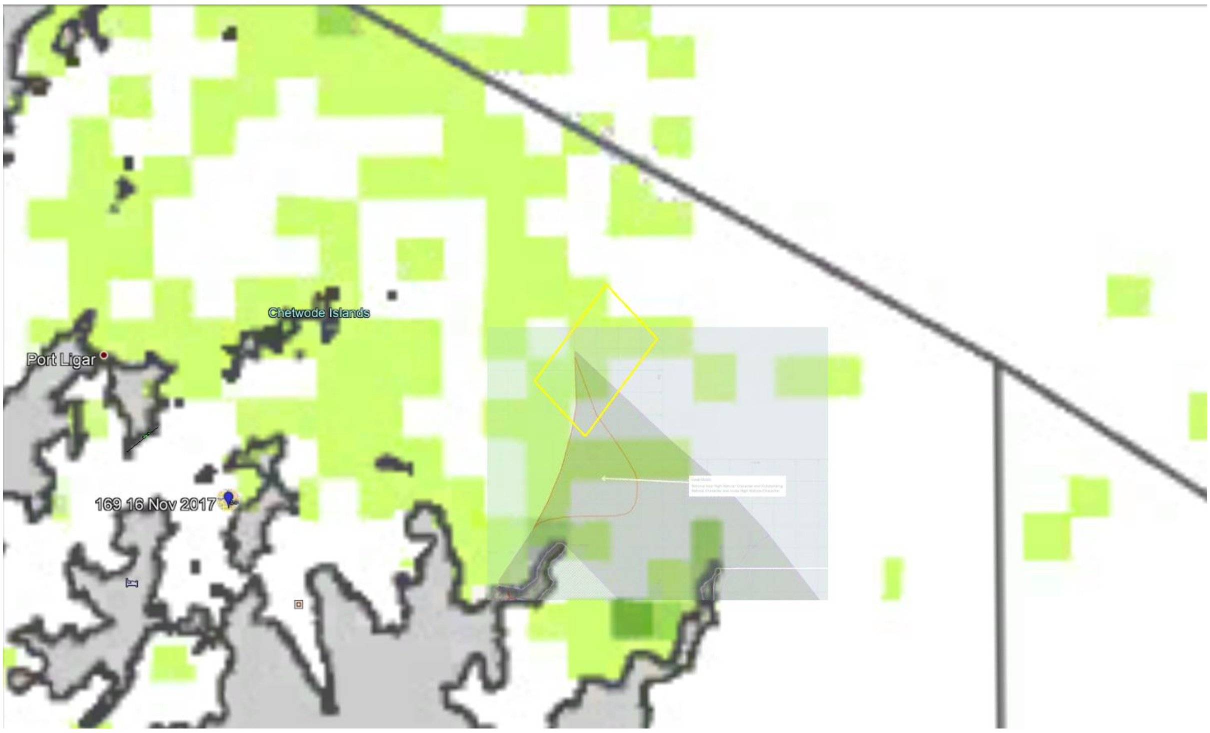
Attachment 8

Proposed Marlborough Environment Plan Volume 3, Appendix 2

Trawl Fishing Event Extract – (Application site and ONC Area faint overlay)



Set Net Event Extract - (Application site and ONC Area faint overlay)



MEP Provision	Evaluation
Policy 7.2.11 – Liaise with the Department of Conservation regarding any landscape issues on land administered by the Department and identified as having outstanding natural features and landscapes (including within the Marlborough Sounds Coastal Landscape). [R, C, D]	The site is partially in an area identified in the Proposed Plan as very high/outstanding natural character. A comprehensive landscape report has been prepared (**Appendix M**). The nearest land is at least 6 to 12 kms away. The site's remoteness reduces the potential for adverse effects on landscape.
Policy 7.2.12 – Encourage landowners and resource users to consider landscape qualities in the use or development of natural and physical resources in landscapes with high amenity value.	Landscape qualities have been considered extensively in this application, such as by engaging a landscape architect to prepare the landscape report (**Appendix M**).
Objective 8.1 – Marlborough's remaining indigenous biodiversity in terrestrial, freshwater and coastal environments is protected.	NZ King Salmon has commissioned reports assessing the effects of the proposal on indigenous biodiversity. A combination of the form of the application itself, and the conditions volunteered will protect Marlborough's indigenous biodiversity around the site.
Objective 8.2 – An increase in area/extent of Marlborough's indigenous biodiversity and restoration or improvement in the condition of areas that have been degraded.	The application will have a mild positive effect on some of surrounding area by increasing food availability without changing species composition. For a smaller area adjacent to the farm, there will be a change in species composition. Some indigenous species may be displaced in favour of others. This change is managed through the conditions to ensure that it is appropriate.
Policies 8.1.1 to 8.1.3 – Identification of sites, areas and habitats with significant indigenous biodiversity value.	McManaway Rock is identified as an ecological site under the Proposed Plan. Conditions have been proposed to avoid adverse effect on this site. Effects on king shag and other threatened seabirds have been considered in the seabirds report. The Seabirds Management Plan will be prepared to control risks of any potential adverse effect on seabirds. Similarly, in respect of marine mammals the placement of the farm has been chosen to minimise interaction with marine mammals. Beyond that, a Management Plan will control risks of any potential adverse effects on marine mammals.

MEP Provision	**Evaluation**
	There is a theoretical possibility that there is threatened indigenous fish present on the site. At the farm's small scale when compared with the wider environment and the lack of any known interaction between threatened fish species and aquaculture, adverse effects will be avoided.
Policies 8.2.1 to 8.2.13 – Protecting and enhancing indigenous biodiversity.	As above.
Policy 8.3.1 – Manage the effects of subdivision, use or development in the coastal environment by: (a) avoiding adverse effects where the areas, habitats or ecosystems are those set out in Policy 11(a) of the New Zealand Coastal Policy Statement 2010; (b) avoiding adverse effects where the areas, habitats or ecosystems are mapped as significant wetlands or ecologically significant marine sites in the Marlborough Environment Plan; or (c) avoiding significant adverse effects and avoiding, remedying or mitigating other adverse effects where the areas, habitats or ecosystems are those set out in Policy 11(b) of the New Zealand Coastal Policy Statement 2010 or are not identified as significant in terms of Policy 8.1.1 of the Marlborough Environment Plan.	As addressed in the AEE.
Policy 8.3.2 – Where subdivision, use or development requires resource consent, the adverse effects on areas, habitats or ecosystems with indigenous biodiversity value shall be: (a) avoided where it is a significant site in the context of Policy 8.1.1; and (b) avoided, remedied or mitigated where indigenous biodiversity values have not been assessed as being significant in terms of Policy 8.1.1	As above.
Policy 8.3.3 – Control vegetation clearance activities to retain ecosystems, habitats and areas with indigenous biodiversity value.	Very minimal vegetation clearance is anticipated to occur and such will only be temporary and limited to the site, to facilitate the installation of the farm structures. Once installed, the marine farm structures will protect adjacent habitats from physical disturbance.

MEP Provision	Evaluation
Policy 8.3.5 – In the context of Policy 8.3.1 and Policy 8.3.2, adverse effects to be avoided or otherwise remedied or mitigated may include: (a) fragmentation of or a reduction in the size and extent of indigenous ecosystems and habitats; (b) fragmentation or disruption of connections or buffer zones between and around ecosystems or habitats; (c) changes that result in increased threats from pests (both plant and animal) on indigenous biodiversity and ecosystems; (d) the loss of a rare or threatened species or its habitat; (e) loss or degradation of wetlands, dune systems or coastal forests; (f) loss of mauri or taonga species; (g) impacts on habitats important as breeding, nursery or feeding areas, including for birds; (h) impacts on habitats for fish spawning or the obstruction of the migration of fish species; (i) impacts on any marine mammal sanctuary, marine mammal migration route or breeding, feeding or haul out area; (j) a reduction in the abundance or natural diversity of indigenous vegetation and habitats of indigenous fauna; (k) loss of ecosystem services; (l) effects that contribute to a cumulative loss or degradation of habitats and ecosystems; (m) loss of or damage to ecological mosaics, sequences, processes or integrity; (n) effects on the functioning of estuaries, coastal wetlands and their margins; (o) downstream effects on significant wetlands, rivers, streams and lakes from hydrological changes higher up the catchment; (p) natural flows altered to such an extent that it affects the life supporting capacity of waterbodies;	The proposed conditions have the purpose of avoiding, remedying or mitigating potential adverse effects (including in relation to these matters in this policy) from the activity. This policy is met.

MEP Provision	Evaluation
(q) a modification of the viability or value of indigenous vegetation and habitats of indigenous fauna as a result of the use or development of other land, freshwater or coastal resources; (r) a reduction in the value of the historical, cultural and spiritual association with significant indigenous biodiversity held by Marlborough's tangata whenua iwi; (s) a reduction in the value of the historical, cultural and spiritual association with significant indigenous biodiversity held by the wider community; and (t) the destruction of or significant reduction in educational, scientific, amenity, historical, cultural, landscape or natural character values.	
Policy 8.3.7 – Within an identified ecologically significant marine site fishing activities using techniques that disturb the seabed must be avoided.	The site is not located within an identified ecologically significant marine site, and it is more than two kilometres from McManaway Rocks. Conditions are proposed to avoid overlap with McManaway Rocks ecologically significant marine site and avoids significant effects on its fringing strata.
Policy 8.3.8 – With the exception of areas with significant indigenous biodiversity value, where indigenous biodiversity values will be adversely affected through land use or other activities, a biodiversity offset can be considered to mitigate residual adverse effects. Where a biodiversity offset is proposed, the following criteria will apply: (a) the offset will only compensate for residual adverse effects that cannot otherwise be avoided, remedied or mitigated; (b) the residual adverse effects on biodiversity are capable of being offset and will be fully compensated by the offset to ensure no net loss of biodiversity; (c) where the area to be offset is identified as a national priority for protection under Objective 8.1, the offset must deliver a net gain for biodiversity; (d) there is a strong likelihood that the offsets will be achieved in perpetuity; (e) where the offset involves the ongoing protection of a separate site, it will deliver no net loss and preferably a net gain for indigenous biodiversity protection; and	Given the proposed conditions and management strategy, risk of adverse effects on indigenous biodiversity values are considered reduced to an appropriate level. A biodiversity offset is not considered necessary. Nevertheless, the application will have mild benefits to a number of fish species and benthic dwelling species. This is not offered as a formal offset.

MEP Provision	Evaluation
(f) offsets should re-establish or protect the same type of ecosystem or habitat that is adversely affected, unless an alternative ecosystem or habitat will provide a net gain for indigenous biodiversity.	
Objective 9.1 – The public are able to enjoy the amenity and recreational opportunities of Marlborough's coastal environment, rivers, lakes, high country and areas of historic interest. [RPS, R, C, D]	The area sought for exclusive occupation is only that which is considered reasonably necessary for NZ King Salmon to undertake the activity should consent be granted. There will be no other effects on public access. There are no navigation effects (as discussed in the Navigation Report prepared with the application). The public will still be able to use the area for recreational opportunities such as fishing, and to enjoy the amenity (effects on such have been assessed above in this document and in the Landscape Report prepared with the application).
Policy 9.1.1 – The following areas are identified as having a high degree of importance for public access and the Marlborough District Council will as a priority focus on enhancing access to and within these areas: … (b) high priority waterbodies for public access on the Wairau Plain and in close proximity to Picton, Waikawa, Havelock, Renwick, Seddon, Ward and Okiwi Bay; (c) coastal marine area, particularly in and near Picton, Waikawa and Havelock, Kaiuma Bay, Queen Charlotte Sound (including Tory Channel), Port Underwood, Kenepuru Sound, Mahau Sound, Mahikipawa Arm and Croiselles Harbour, Rarangi to the Wairau River mouth, Wairau Lagoons, Marfells Beach and Ward Beach; … [RPS]	The site is not within any of the list in (b) of Policy 9.1.1. The site is not in any close proximity to any of the locations listed in (c) of Policy 9.1.1.
Policy 9.1.2 – In addition to the specified areas in Policy 9.1.1, the need for public access to be enhanced to and along the coastal marine area, lakes and rivers will be considered at the time of subdivision or development, in accordance with the following criteria: (a) there is existing public recreational use of the area in question, or improving access would promote outdoor recreation;	Such criteria has been considered in preparing this application. The only effect on access under the proposal is the limited exclusive occupation for the farm structures area itself.

MEP Provision	Evaluation
(b) connections between existing public areas would be provided; (c) physical access for people with disabilities would be desirable; and (d) providing access to areas or sites of cultural or historic significance is important. [RPS, C, D]	
Policy 9.1.5 – Acknowledge the importance New Zealander's place on the ability to have free and generally unrestricted access to the coast. [RPS, C, D]	The only limitation on public access will be for the area of the farm structures. This is for public health and safety and to allow the efficient operation of the farm, as is limited to that reasonably necessary for such purpose.
Policy 9.1.6 – Continue to assess the need to enhance public access to and along the coastal marine area, lakes and rivers. [RPS, C]	See above.
Policy 9.1.13 – When considering resource consent applications for activities, subdivision or structures in or adjacent to the coastal marine area, lakes or rivers, the impact on public access shall be assessed against the following: (a) whether the application is in an area identified as having a high degree of importance for public access, as set out in Policy 9.1.1; (b) the need for the activity/structure to be located in the coastal marine area and why it cannot be located elsewhere; … (d) the extent to which the activity/subdivision/structure would benefit or adversely affect public access, customary access and recreational use, irrespective of its intended purpose; (e) in the coastal marine area, whether exclusive rights of occupation are being sought as part of the application; (f) for the Marlborough Sounds, whether there is practical road access to the site of the application; (g) how public access around or over any structure sought as part of an application is to be provided for; (h) whether the impact on public access is temporary or permanent and whether there is any alternative public access available; and	The impact on public access has been assessed above in this document, in the AEE and in the Navigation Report prepared with the application. The site is not considered to be in an area identified as having a high degree of importance for public access as set out in Policy 9.1.1. By its nature, the farm is required to be located within the coastal environment. The only limitation on public access will be for the area of the farm structures. This is for public health and safety and to allow the efficient operation of the farm. Access around the farm will be maintained. Road access is not available to the site.

MEP Provision	Evaluation
(i) whether public access is able to be restricted in accordance with Policies 9.2.1 and 9.2.2. [C, D]	
Policy 9.1.14 – Where existing public access to or along the coastal marine area, lakes and rivers is to be lost through a proposed use, development or structure, alternative access may be considered as a means to mitigate that loss.	The access all around the farm will be retained, it is just the space where the structures will be that is sought to have exclusive access. Mitigation of that small amount of area lost to public access is not considered necessary.
Objective 9.2 – Identification of circumstances when public access to and along the coast and the margins of lakes and rivers can be restricted. [RPS, C, D]	N/A – this application doesn't involve land along the coast, it involves the open ocean. Public access all around the site will remain.
Policy 9.2.1 – Public access to and along the coastal marine area and the margins of lakes and rivers may be restricted to: (a) ensure a level of security consistent with the purpose of a resource consent or designation; … (e) protect public health and safety and animal welfare and to manage fire risk; … [RPS, C, D]	This is why the exclusive occupation area for the structures is sought: it is necessary to ensure a level of security consistent with the purpose of a resource consent (i.e. to allow NZ King Salmon to use the consent if granted). It is also necessary to ensure public health and safety.
Policy 9.2.2 – Aside from the circumstances in Policy 9.2.1 above, constraints on public access shall not be imposed unless: (a) there is no practical alternative; and (b) the effects on public access would be no more than minor.	The minor exclusive occupation sought is considered to be required for the proposed activity, for practicality (i.e. to enable the consent to be given effect to). Further, the effects on public access are considered to be no more than minor.
Policy 9.3.2 – Seek diversity in the type and size of open spaces and recreational facilities to meet local, district, regional and nationwide needs, by: … (d) recognising and protecting the value of open space in the coastal marine area, high country environments and river beds.	The open space of the coastal environment will be retained if consent is granted for this application. The small area of exclusive occupation sought is not considered to impact upon this, in the bigger picture of the Cook Strait space.

MEP Provision	**Evaluation**
[RPS, C, D]	
Objective 13.1 – Areas of the coastal environment where the adverse effects from particular activities and/or forms of subdivision, use or development are to be avoided are clearly identified. Policy 13.1: Avoid adverse effects from subdivision, use and development activities on areas identified as having: (a) outstanding natural character; (b) outstanding natural features and/or outstanding natural landscapes; (c) significant marine biodiversity value and/or are a significant wetland; or (d) significant historic heritage value.	The proposed activity is considered appropriate at the site. This has been assessed elsewhere within this document and the AEE. The site is partially located within an outstanding natural feature or landscape. Although that mapping is under challenge in the MEP process. The site is partially within the overlay for high or very high coastal natural character. Although that mapping is under challenge in the MEP process. Irrespective of that, there are adverse effects from development is avoided. There are no significant marine biodiversity value areas which will be affected by the development. Biodiversity effects are assessed in the various expert reports and the AEE.
Objective 13.2 – Subdivision, use or development activities take place in appropriate locations and forms and within appropriate limits. Policy 13.2.1: The appropriate locations, forms and limits of subdivision, use and development activities in Marlborough's coastal environment are those that recognise and provide for, and otherwise avoid, remedy or mitigate adverse effects on the following values: [criteria listed in the Plan]	The proposed site is considered appropriate for the proposed farm. The natural character of the area and anticipated visual/landscape/amenity effects from the proposed farm have been assessed in the AEE and in the expert reports prepared with the application. The matters in Policy 13.2.1 have been considered in determining that the site is an appropriate location for the proposed farm. Iwi have been sought to consult with during the preparation stages of this application. To date, no issues have been raised by iwi. Ngati Koata support the application. The area of exclusive occupation sought for the structures is small in comparison to the rest of space which will remain available for public access in and around Cook Strait, including for recreational activity such as fishing.

MEP Provision	Evaluation
Policy 13.2.2: In addition to the values in Policy 13.2.1, the following matters shall be considered by decision makers in determining whether subdivision, use and development activities in Marlborough's coastal environment are appropriate at the location proposed and of an appropriate scale, form and design: [criteria listed in the Plan]	These matters have been considered in preparing this application (particularly in terms of determining the appropriate location/site, scale of the farm and design of the farm).
Policy 13.2.3: To enable periodic reassessment of whether activities and developments are affecting the values of the coastal marine area, to encourage efficient use of a finite resource and in consideration of the dynamic nature of the coastal environment: (a) lapse periods for coastal permits will be no more than five years; and (b) the duration of coastal permits granted for activities in the coastal marine area for which limitations on durations are imposed under the Resource Management Act 1991 will generally be limited to a period not exceeding 20 years.	This has been accounted for in the proposed conditions. A 35 year consent term has been sought as the RMA allows this.
Policy 13.2.4: Attributes that may be considered when assessing any effects on coastal amenity value in a particular location include natural character, biodiversity, public access, visual quality, high water quality, recreational opportunities, structures and activities, open space, tranquillity and peacefulness.	These have been assessed elsewhere in this document and in the AEE and supporting expert reports. Section 7(c) of the RMA has been assessed in the AEE.
Policy 13.2.5: Amenity values of the coastal environment can be maintained and enhanced by: [criteria listed in the Plan]	These have been considered in the preparation of this application. They are assessed elsewhere in this document and the AEE, including supporting documentation.

MEP Provision	Evaluation
Policy 13.2.6: In determining the extent to which coastal amenity values will be affected by any particular subdivision, use and/or development, the following shall be considered: (a) individual and communities values about the area subject to application; (b) the amenity related attributes of the area; and (c) in regard to the changing nature of the coastal environment, the extent to which amenity values would be so affected by the proposed subdivision, use or development that those values could no longer be maintained or enhanced.	These have been considered in preparing this application. The applicant seeks public notification of the application and that will allow for community input into the application process (to assist to determine individual and community values about the area subject to this application). The landscape report (**Appendix M**) considers amenity of the area and the existing natural character and attributes/associations of and with the site.
Objective 13.3 – Recreation continues to make a significant contribution to people's health and wellbeing and to Marlborough's tourism industry, whilst avoiding adverse effects on the environment. Policy 13.3.1: A permissive approach to recreational activities will be adopted, except where these: [criteria listed in the Plan]	As assessed elsewhere in this document and in the AEE, limitations on public access and recreation from the proposed farm are only to the extent of the exclusive occupation sought for the farm structures area. Recreational activity such as fishing will still occur in this area.
Policy 13.3.2: Maintain and enhance opportunities for recreational use of the coastal marine area.	As above. The site does not involve the coastline so does not affect access to and along the coastline. The presence of experienced mariners in Cook Strait will positively benefit mariners in distress.
Policy 13.3.3: Ensure that the use of recreational vessels and vehicles does not create a public nuisance, compromise the health and safety of other users or result in adverse effects on the coastal environment.	This is aimed at recreational vessels and vehicles (not commercial ones), however compliance with the policy is assessed here. The vessels to be used to service the farm are not anticipated to create a public nuisance. Noise levels are imposed in the proposed conditions, and in any event the site is remote thereby reducing potential noise conflicts. The area of exclusive occupation sought for the farm structures is partly to ensure public health and safety.

MEP Provision	Evaluation
Policy 13.3.4: Ensure recreational use has priority over commercial activities that require occupation of the coastal marine area in Queen Charlotte Sound, including Tory Channel. (This policy does not apply to areas zoned Port or Marina.)	Given that the site is a small area in the bigger picture of Cook Strait, and given the limited exclusive occupation area sought, recreational activity can still occur all around the farm. There are no existing farms in this area so no anticipated issue with ensuring that recreational use around this part of Cook Strait can occur.
Objective 13.4 – The sustainable management of fisheries in the Marlborough Sounds. Policy 13.4.1: Support and advocate for intensive management of recreational and commercial fishing within the enclosed waters of the Marlborough Sounds. Policy 13.4.2: Support community groups working towards a sustainable fishery for the Marlborough Sounds.	This is an application for a site in the open ocean, not within the enclosed waters of the Marlborough Sounds. Nonetheless, given the proposed conditions the commercial fishing activity is proposed to be intensively managed. The proposal is also for the most sustainable farm practicable at the site.
Objective 13.10 – Structures in the coastal environment including jetties, boatsheds, decking, slipways, launching ramps, retaining walls, coastal protection structures, pipelines, cables and/or other buildings or structures are appropriately located and within appropriate forms and limits to protect the values of the coastal environment. Policy 13.10.1: Enable structures to be located within the coastal marine area where these are necessary for the purposes of assisting with navigation of ships/vessels or are temporary in nature for scientific monitoring or research purposes.	As emphasised throughout this document, the AEE, and the supporting documentation (expert reports) the site is considered to be appropriately located, and the extent of the proposed farm operation is also considered appropriate. The purpose of the sustainability of the farm is to protect (as far as is possible) the existing values of the coastal environment in this area. The farm and its structures, by its nature, is required to be located within the coastal marine area. This policy is aimed at structures with the purpose of navigation.
Policy 13.10.2: Other than as provided for in Policy 13.10.1, proposals to locate structures within the coastal marine area will be required to be assessed through the resource consent process.	This is acknowledged and the resource consent sought.
Policy 13.10.3: Efficient use of the coastal marine area can be achieved by using the minimum area necessary for structures.	Only the area reasonably necessary for the structures is sought for occupation.

MEP Provision	Evaluation
Policy 13.10.5: When assessing applications to locate structures within and immediately adjacent to the coastal marine area, the following matters will be considered in determining whether the structure is appropriate: [criteria listed in the Plan]	These matters have been considered in preparing this application. The structures to be installed will only be those necessary for the farm to operate. In considering these matters the conclusion is reached that the structures are appropriate. Section 6 RMA has been addressed in the AEE.
Policy 13.10.6: Structures should be in an appropriate location and of an appropriate scale, design, cladding and colour to avoid or mitigate adverse effects on the landscape and amenity values of the coastal environment.	What is proposed in terms of structures is considered to align with this. Conditions are proposed regarding limitations around farm structures.
Policy 13.10.7: Structures shall be designed and located allowing for relevant dynamic coastal processes, including sea level rise.	Given the site characteristics (such as current and water depth) at this site it is important for the farm structures to be designed for the conditions. NZ King Salmon has engaged OCEL to look at structures options and requirements. Conditions have been proposed regarding the requirements for structures at this site.
Policy 13.10.8: Where consent is granted for a structure, the coastal permit will generally tie the structure to the property for which the use was intended. On sale of the property, or in the case of structure(s) granted resource consent for commercial purposes where the structure is related to the business being sold, the transfer of coastal permits for structures to the new owners of the property/business will be required.	N/A
Policy 13.10.9: Coastal structures shall be maintained in a way that protects public safety, including for safe navigation.	This is provided for in the conditions (**Appendix B**).
Policy 13.10.10: Coastal structures shall be required to be removed from the coastal marine area in the following circumstances: (a) where there is no longer a need for the structure; (b) when a coastal permit for a structure expires and no new permit has been sought; or (c) where consent to authorise an existing structure is refused.	This is provided for in the conditions (**Appendix B**).

MEP Provision	Evaluation
Objective 13.13 – The effects of disturbance to the foreshore or seabed not provided for elsewhere are appropriately managed.	The conditions proposed are intended to manage, amongst many other matters, the disturbance of the seabed/benthic environment.
Policy 13.13.4 – Where disturbance of the foreshore and seabed will occur as a result of structures being fixed to the seabed (for example, during the construction of jetties, boatsheds or retaining walls, or when placing moorings on the seabed), this shall be regarded as appropriate where the effects are short-term, reversible and/or minor.	This is the seabed disturbance anticipated: minor and temporary disturbance from the installation of the structures. Other potential effects on the benthos are assessed in the benthic report (**Appendix D**) and the AEE.
Policy 13.13.7 – Proposals for an activity involving disturbance of the foreshore or seabed not otherwise provided for shall demonstrate that: (a) there will only be short-term adverse effects on plants, animals or their habitat and the area will be naturally recolonised by a similar community type; (b) the disturbance will be undertaken in a way that: (i) does not result in any significant increase in water turbidity or elevated levels of contaminants; (ii) does not result in significant adverse changes to bathymetry, foreshore contours, sediment particle size or physical coastal processes; (iii) does not have any off-site adverse effects; and (iv) is unlikely to cause or exacerbate shoreline instability or coastal erosion on adjacent coastal land.	As above and in the benthic report (**Appendix D**). This policy is considered to be met.
Objective 15.1a – Maintain and where necessary enhance water quality in Marlborough's rivers, lakes, wetlands, aquifers and coastal waters, so that: (a) the mauri of wai is protected; (b) water quality at beaches is suitable for contact recreation; (c) people can use the coast, rivers, lakes and wetlands for food gathering, cultural, commercial and other purposes; … (f) coastal waters support healthy ecosystems.	This has been addressed elsewhere in the AEE and in the water column report (**Appendix E**). The potential for adverse effects on water quality (whilst limited due to the site characteristics such as water depth and current) are to be managed. As discussed above, recreational activity and access will be retained around the farm.

MEP Provision	Evaluation
[RPS, R, C]	
Policy 15.1.1 – As a minimum, the quality of freshwater and coastal waters will be managed so that they are suitable for the following purposes: (a) Coastal waters: protection of marine ecosystems; potential for contact recreation and food gathering/marine farming; and for cultural and aesthetic purposes; … [RPS, R, C]	This policy is considered to be met given the conclusions in the AEE and water column report (**Appendix E**) and the proposed conditions.
Policy 15.1.31 – Recognise that disturbing the seabed or the wet bed of a lake or river results in a discharge of sediment that has the potential to cause adverse effects on water quality.	Water column/sediment is addressed in the water column report (**Appendix E**). This is a recognised effect, particularly in that it will be temporary and limited to the site (particularly given turbidity at the site and mixing and dispersal of sediment that will occur).
Policy 15.1.32 – In considering any resource consent application for the disturbance of a river or lake bed, or the seabed, or land in close proximity to any waterbody, regard will be had to: (a) whether the disturbance is likely to result in non-compliance with the clarity standards set for the waterbody, after reasonable mixing; (b) in the event of possible non-compliance with the clarity standards set for the waterbody, after reasonable mixing: (i) the purpose for undertaking the disturbance and any positive effects accruing from the disturbance; (ii) the scale, duration and frequency of the disturbance; (iii) the extent to which the bed disturbance is necessary and adverse water quality effects caused by the disturbance are mitigated; and	As above. The nature of this site itself will reduce potential adverse effects from the temporary sediment to be generated from the farm structures installation.

MEP Provision	Evaluation
(iv) for freshwater, the potential effects of increased turbidity on the values of the waterbody set out in Schedule 1 of Appendix 5 of the Marlborough Environment Plan or on the natural character values of the coastal environment in relation to water quality as set out in Appendix 2 of the Marlborough Environment Plan.	
Policy 19.1.3 – Enable primary industries to adapt to the effects of climate change. [R, C, D]	The aquaculture industry is a primary industry. Salmon are sensitive to increases in temperature. A trend of increasing temperature has been recorded in the Pelorus Sound in recent years. This application enables NZ King Salmon to adapt to the effects of climate change.

APPENDIX P: Assessment Against Marlborough Regional Policy Statement

APPENDIX P

RESOURCE CONSENT APPLICATION BY NEW ZEALAND KING SALMON FOR OPEN OCEAN SITE NORTH MARLBOROUGH

Analysis of Consistency with the Marlborough Regional Policy Statement

Objective	Policy	Evaluation
5.3.2: That water quality in the coastal marine area be maintained at a level which provides for the sustainable management of the marine ecosystem.	5.3.5: Avoid, remedy or mitigate the reduction of coastal water quality by contaminants arising from activities occurring within the coastal marine area.	There will be discharge from feed as part of the farm operations. The water column report prepared as part of this application (Cawthron, Report No. 3313 – **Appendix E**) provides for measures to be undertaken as part of farm operations at this site to manage risk of adverse effects on water quality. Given the depth of water at this site, and given the current rates, any increased dissolved nutrients from the farm operations will become part of the background environment. Enrichment, algal blooms and dissolved oxygen reductions are considered unlikely to occur in this open ocean environment. There are no other marine farms in the vicinity of the proposed location so no cumulative effects in this regard are considered to be relevant. The farm will be cumulative with the activity in the environment but will be generally less than 1 percent of background levels. Overall, the site characteristics are considered to reduce the likelihood of adverse effects on water quality in the area and beyond. This policy is met.
5.3.10: The natural species diversity and integrity of marine habitats be maintained or enhanced.	5.3.11: Avoid, remedy or mitigate habitat disruption arising from activities occurring within the coastal marine area.	The relevant reports are: • The seabirds report (Wildland, Report No. 4594 – **Appendix H**) • Marine mammals (Cawthron, Report No. 3316 – **Appendix G**) • The water column report (Cawthron, Report No. 3313 – **Appendix E)** • Seabed report (Cawthron, Report No. 3317 – **Appendix D**)

Objective	Policy	Evaluation
		• Fish report (Statfishtics – **Appendix J**) The seabirds report finds that of the potential effects on seabirds from the farm (habitat exclusion, smothering of benthos, changes in abundance of prey, provision of roosts, disturbance, ingestion of foreign objects, entanglement, and collusion with farm structures) no risk of any such effect is unacceptable. The site represents a small part of seabird environment/foraging area, and the depth of waters makes it more unlikely seabirds would use the benthic environment for foraging. One such management option will be to continue with NZ King Salmon's processes to have as little feed loss as possible. That will attract less seabirds to the site and in turn reduce potential effects on seabirds. Such will be incorporated into the Seabirds Management Plan to be created for this site. The purpose of this plan is to avoid, remedy or mitigate potential for habitat disruption of seabirds, from the farm, at this site. The marine mammals report finds that the proposed farm area represents a very small fraction of the total habitat available to support marine mammal species. It does potentially form part of the winter habitat for southern right whales and part of the humpback whale's northern migration corridor. The potential effects are habitat displacement and entanglement. The Marine Mammal and Shark Management Plan will be prepared for this site, with the same objective as the Seabirds Management Plan. NZ King Salmon will adopt best management practices to further reduce risk of habitat disruption/adverse effects on marine mammals and sharks. The water column report finds that potential depletion of dissolved oxygen (which could affect biological processes for fish) would be localized (given the site characteristics) and unlikely to occur in this open ocean environment. The conclusion is that this policy is met. There are management options to be incorporated into the operation of the farm at this site.

Objective	Policy	Evaluation
7.1.2 – Quality of Life: To maintain and enhance the quality of life of the people of Marlborough while ensuring that activities do not adversely affect the environment.	7.1.7 – Amenity Values: Promote the enhancement of the amenity values provided by the unique character of Marlborough settlements and locations.	Given its remote location there are no amenity effects anticipated for any neighbouring landowners. The nearest dwelling to the site is at least 8kn away. Visual effects are addressed in the landscape report at **Appendix M** of this application. Given the mitigation proposed, there is therefore no conflict with this policy from the proposed farm identified.
7.1.9: To enable present and future generations to provide for their wellbeing by allowing use, development and protection of resources provided any adverse effects of activities are avoided, remedied or mitigated.	7.1.10: To enable appropriate type, scale and location of activities by: • Clustering activities with similar effects; • Ensuring activities reflect the character and facilities available in the communities in which they are located; • Promoting the creation and maintenance of buffer zones (such as stream banks or 'greenbelts'); • Locating activities with noxious elements in areas where adverse environmental effects can be avoided, remedied or mitigated.	The location is considered to be suitable for the proposed activity (in terms of the location of the farm proposed, the scale of the operations proposed and the type of activity proposed at the site). This is reflected in the various expert reports and the conclusions that risks of adverse effects can be managed for this site. There are effects which are reversible. Consequently, future generations retain the choices as the present generations enjoy.
	7.1.12: To ensure that no undue barriers are placed on the establishment of new activities (including new primary production species) provided the life supporting capacity of air, water, soil and ecosystems is safeguarded and any	The application is for a primary production activity (aquaculture farming) and for a new type of farm in this environment (being an open ocean farm). The proposed farm is not an "undue barrier" on the establishment of other new activities. The area of exclusive occupation proposed is limited to the physical area where the farm structures would be, and is for public health and safety reasons, and to allow the farm to be operated in accordance with the best practices and policies to be developed for the farm.

Objective	Policy	Evaluation
	adverse environment effects are avoided, remedied or mitigated.	The life supporting capacity of the air, water, soil and ecosystems is to be safeguarded. The effects of the farm can be avoided, remedied or mitigated. This is reflected in the conditions proposed. This policy is met.
7.2.7: The subdivision use and development, of the coastal environment, in a sustainable way.	7.2.8: Ensure the appropriate subdivision, use and development of the coastal environment.	The use of the coastal environment for the proposed farm is considered to be an appropriate use because risk of adverse effects can be appropriately managed. The site is located outside of the Marlborough Sounds, and is in the open ocean environment. Its isolation reduces visual effects. Other mitigation is proposed by NZ King Salmon to reduce visual effects further. There are no other farms near the site, nor any other activities considered to conflict with the farm. There are no cumulative effects considered to exist from the farm.
	7.2.10(a) – (d)	Public access and recreational use will still be available around the farm structures. It is only the reasonable space of the farm structures that is sought for exclusive occupation. The exclusive occupation is only sought to enable the safe (public safety) and efficient operation of the farm. There are benefits to the public from the farm, in terms of economic benefits from the farm's contribution to GDP and employment. The assessment above in this document, in the assessment of environmental effects document and in the various expert reports prepared as part of this application show that the proposed farm at this site is not anticipated to: prevent marine habitat sustainability and protection; prevent navigation and safety; and, is compatible with other adjoining activities as it is remote from other activities. The policies are met.

Objective	Policy	Evaluation
7.3.2: Buildings, sites, trees and locations identified as having significant cultural or heritage value are retained for the continued benefit of the community.	7.3.3: Protect identified significant cultural and heritage features.	There are no identified heritage sites in the area. Nor are there any known significant cultural features in or near the site. The only identified ecological site near the proposed farm is McManaway Rocks, which is assessed in other parts of this document, the assessment of environmental effects, and expert reports. NZ King Salmon has consulted with iwi within whose rohe the site is located. To date, no concerns have been expressed.
7.3.5: Recognise and accommodate the diversity of cultural values that exist within the community.	7.3.6: Provision will be made for iwi consultation during the plan preparation and administration process.	Resource consent applications are considered to engage the administration process of the resource management plan(s). As stated above, NZ King Salmon has engaged iwi in the process of preparing this application. To date, no concerns have been expressed.
8.1.2: The maintenance and enhancement of the visual character of indigenous, working and built landscapes.	8.1.3: Avoid, remedy or mitigate the damage of identified outstanding landscape features arising from the effects of excavation, disturbance of vegetation, or erection of structures.	The landscape report (**Appendix M**) provides that mitigation measures can be incorporated at this site and the site is in a less scenic area (i.e. is not within the Marlborough Sounds) where visual effects are less than might be at an inshore site. The site is not within an outstanding natural landscape or feature area under the MSRMP. It is partly within the overlay for outstanding natural feature/landscape under the MEP. The site is in the context of an open ocean environment, no within the inner Marlborough Sounds where amenity is more relevant. Vegetation disturbance is limited to that associated with installation of the farm structures, which will be a temporary and localized event.
	8.1.5: Promote enhancement of the nature and character of indigenous, working and built landscapes by all activities which use land and water.	See above. There are no conflicts with this policy identified.

Objective	Policy	Evaluation
	8.1.6: Preserve the natural character of the coastal environment.	The landscape report (**Appendix M**) provides that the existing natural character of this site is not pristine. Dredging and trawling have occurred here. Taking this into account, and with the proposed mitigation, the visual effects on natural character can be managed. The existing natural character will be preserved as far as is practicable.

APPENDIX Q: NZ King Salmon Operations Report (2016)

New Zealand King Salmon

OPERATIONS REPORT

NZKS Operations Report

INTRODUCTION

The Marlborough District Council and Central Government are working with NZ King Salmon and community representatives on options to implement the Best Management Practice guidelines (BMP) for salmon farms in the Marlborough Sounds.

Options to enable adoption of BMP include the potential relocation of some existing low flow farms to more environmentally appropriate locations to ensure the guidelines can be met in the future. Other less likely options might include an additional number of similar sites to allow for rotational management of the benthos, in water collection of faecal material that is as yet unproven commercially, or remediation of the seabed also as yet unproven.

Six existing low flow salmon farms are currently positioned in sites not ideally suited to modern salmon farming. These are Crail Bay (2), Forsyth Bay, Waihinau Bay, Otanerau Bay and Ruakaka Bay. Relocating these farms on an equivalent space for space basis to more suitable locations will result in better environmental, social and economic outcomes.

Low flow farms contribute approximately 9 hectares of surface structures in these locations.

NZ King Salmon has seafarm sites with attributes showing a range of values for water depth, temperature profile and current speed. Sites that are colloquially referred to as "low flow" generally have average flows of less than 10cm/sec, are usually in a shallower location and are generally warmer through summer than sites such as those in Tory Channel where high flows and cooler temperatures (<16.5C) prevail.

Low flow sites will be difficult if not impossible to farm cost efficiently if BMP is adopted on these sites. One estimate is that production will need to be reduced by some 50-60% from current and historical levels in order to comply fully.

Nine potentially suitable sites have been identified; these now require an Assessment of Environmental Effects (AEE) for each site to determine if they are suitable. This Report contributes to the preparation of the AEE.

A very significant volume of environmental information is available on salmon farming in the Marlborough Sounds and where necessary this has been updated. The AEE will use the updated information including this updated report where appropriate for its assessment.

Of the potential suitable sites, all will require new infrastructure as existing infrastructure on the low flow sites does not possess the design characteristics suitable for more exposed and higher flow locations.

This is an opportunity to adopt not only BMP Benthic but also Best Management Practice guidelines for salmon farms in the Marlborough Sounds: Operations.

OVERVIEW OF NEW ZEALAND KING SALMON

New Zealand King Salmon is the world's largest aquaculture producer of the King salmon species, accounting for more than 50% of global aquaculture production. King salmon (Oncorhynchus tshawytscha) is a Pacific salmon species, comprising only 0.7% of total global salmon aquaculture production and wild catch. King salmon is generally regarded as the premium salmon species in terms of taste and nutritional quality, possessing superior colour, fat and Omega-3 oil content, fillet size and desirable texture characteristics.

We have consent for eleven seafarm sites in the Marlborough Sounds. We operate eight seafarms including three new seafarms consented in 2014 with a 35 year term. Seven of these are currently stocked with fish and the three other sites are fallowed.

New Zealand King Salmon was a pioneer in marine salmon farming in New Zealand, utilising King salmon stock introduced from California over 100 years ago. We have been growing and selling salmon to consumers in New Zealand and overseas for over 30 years. We have a well-established domestic market presence and share along with a history of successfully selling our products in offshore markets including Australia, North America, Japan, Asia (ex Japan), Europe and others. During the last financial year, 44% of our revenue was generated from international sales.

We believe New Zealand King Salmon's key points of difference are the rare species of salmon that we produce and the high quality premium brands that we have developed. We believe that under our Ōra King brand, we are one of the first protein companies in the world to achieve branding all the way through to the restaurant menu. Our retail products also have strong brand recognition in New Zealand.

New Zealand King Salmon has three key brands under which we produce a range of products from whole fresh fish to value added products including fillets and portions, cold smoked and wood roasted product. Where these key brands are not used, we generally sell our products under the New Zealand King Salmon label. Our products are sold to international and domestic retail (supermarket) and foodservice customers, such as restaurants, caterers and hotels.

OUR BRANDS

OUR HISTORY

1976

A NEW ZEALAND FIRST

Fry introduced to Bubbling Springs hatchery at Takaka. This was the first time salmon had been cultivated in New Zealand commercially.

1976

1983

SEAFARM FARMING LEGALISED

Legislation passed allowing the raising of salmon in seafarms.

1983

TENTBURN FUNDED

The New Zealand Salmon Company lists on the stock exchange, raising capital to fund a hatchery at Tentburn.

1986

REGAL SALMON FORMATION

The South Island Salmon Partnership and South Island Salmon Company merged to form Regal Salmon.

1992

REGAL SALMON ACQUIRES NZ SALMON'S DOMESTIC SALMON FARMS

1992

Mid 1990's

ENTRY INTO THE USA MARKET

Mid 1990's

ENTRY INTO THE AUSTRALIAN MARKET WITH FRESH PRODUCTS

1996

NEW ZEALAND KING SALMON FORMATION

New Zealand King Salmon formed from the merger of Regal Salmon and Southern Ocean Seafoods. New Zealand King Salmon controls over half the domestic salmon market.

1996

OREGON GROUP FIRST INVESTS IN NEW ZEALAND KING SALMON

1996

2000

Early 2000's

WE BECOME THE FIRST NZ SALMON COMPANY TO ACHIEVE FULL YEAR ROUND HARVEST

Focus on using breeding programme to produce higher harvest weight fish and year round harvest.

2008

2008

DIRECT CAPITAL INVESTMENT IN NEW ZEALAND KING SALMON

2008

CLAY POINT

In a joint venture with Te Atiawa, our new generation seafarm at Clay Point became operational.

2008

INTERNATIONAL PREMIUM POSITIONING

We secured the first premium frozen portion business with a high-end restaurant group.

2010

INTERNATIONAL RETAIL

We secured our first major overseas retailer outside Australia with cold smoked product into Migros, Switzerland.

2011

2011

WAIAU HATCHERY ACQUISITION

We acquired our third hatchery allowing improved freshwater risk management.

2012

ŌRA KING

Ōra King, our premium foodservice brand, launched. Inspired by, and created for, fine-dining chefs around the world.

2013

ŌRA KING AWARDS

Inaugural Ōra King awards event held celebrating Ōra King and leading chefs'

Dec 2014

SEAFARM LICENCES

We were granted three new licences for 35 years which allow us to double existing production over time.

2016

Jul 2016

FIRST HARVEST FROM NEW FARMS

FULL VERTICAL CONTROL

We believe a key component to ensuring the highest possible quality and brand positioning is retaining complete vertical control, enabling year round production, processing and supply of high quality salmon.

We control all elements of the value chain from breeding and growing through to harvest and processing. Fish are harvested and processed on the same day with fresh whole fish generally dispatched to customers within 24 hours of harvest.

1

We operate three hatcheries. For broodstock, smolt and as risk mitigation.

2

Broodstock is tagged and monitored throughout its life – we assess the best female and male salmon.

3

Following transfer from freshwater hatcheries, salmon are grown in one of our seawater farms.

4

Salmon are humanely harvested at sea and transferred back to our processing facilities in Nelson on the same day.

5

Salmon are weighed, gutted and gilled. Depending on final use, further processing can take place (including cutting into fillets or smoking).

6

Ultra premium fish are branded Ōra King and individually numbered for traceability. Relationships with chefs and restaurateurs allow us to participate in "menu poetry".

OUR COMMITMENT TO THE ENVIRONMENT

New Zealand King Salmon is firmly committed to sustainability and managing our resources for the long term. Quality and sustainability are achieved through managing several key factors: maintaining a clean rearing environment; ensuring healthy salmon using proactive aquaculture management; sourcing sustainable and nutritious feed ingredients; and practicing careful and humane harvesting methods.

New Zealand King Salmon, the Marlborough District Council, the Ministry for Primary Industries and other key stakeholders and experts have worked together to develop the Best Practice Guidelines for salmon farming in the Marlborough Sounds. These Best Practice Guidelines will help protect the environment while including the local community and industry, and are standards we can proudly promote to the world.

The New Zealand salmon industry was the first and only ocean-farmed salmon producing region to attain the 'Best Choice' (green) accreditation in the Monterey Bay Aquarium Seafood Watch sustainability guide in 2015. Monterey Bay is generally regarded as a global leader in sustainable seafood guides and has rated approximately 90% of global seafarmed salmon aquaculture systems. Of those reviewed, less than 1% have been rated green.

[8] Source: As to Atlantic salmon, Chicken, Pork and Beef, data from the Global Salmon Initiative Sustainability Report (2010); as to Lamb, data from Bjorkli, J. Protein and energy account in salmon, chicken, pig and lamb. M.Sc. Thesis, Norwegian University of Life Sciences (UMB), Norway (2002), cited by

SEAFARM CONSENT CONDITIONS AND BEST PRACTICE GUIDELINES

In New Zealand, consents and regulations for fish farming are primarily legislated under the Resource Management Act 1991 and the Fisheries Act 1996. The Ministry for Primary Industries and the Marlborough District Council administer the regulatory requirements and monitor consent holder activity and effects.

To monitor compliance with consent conditions, reviews of the environmental effects are undertaken annually by independent scientists and reported to Council. Those reports are then subject to scrutiny by scientific and technical officers and often subject to external peer review. A number of consent conditions provide for an adaptive management process, which allow us to respond to monitoring results by adapting our operations in a manner that will ensure we are or will be compliant with consent conditions within agreed timeframes.

Monitoring results have shown that our seafarms are in overall compliance with the environmental quality standards contained in individual current consents.

With our support, the Best Practice Guidelines have been developed to apply across all of our seafarms, drawing on international science, and are now in the process of implementation. These guidelines will form part of consent conditions, at the latest when existing consents are renewed. To facilitate the transition to best practice, all seafarms are already tested against this performance criteria.

There is currently technical non-compliance against consent conditions at certain test locations at Clay Point and results at Te Pangu demonstrate a need for further sampling in the next 12 months. The monitoring shows effects that are not biologically significant, and non-compliance is localised. An application has been lodged in respect of Clay Point to adopt the Best Practice Guidelines at that site (in place of existing consent conditions), with which we believe the site would currently comply. Minor operational adjustments are being implemented at Te Pangu (which do not adversely affect the economics of the operation of the seafarm).

While the Otanerau and Forsyth seafarms are recognised as complying with their consent conditions (and have been rated compliant by the Marlborough District Council), those farms do not comply with the Best Practice Guidelines at the present time. The Ministry for Primary Industries and the Marlborough District Council are working with New Zealand King Salmon and the community to improve the environmental, social and economic performance of these seafarms.

In order to comply with Best Practice guidelines a significant reduction in feed discharge is required to reduce benthic effect. Another option would be to move the farms to other areas that give a better environmental outcome yet allows the business to continue.

New Zealand King Salmon's practice has been to work closely with the Marlborough District Council to ensure acceptable environmental performance at our seafarms. That practice will continue.

BIOLOGY OF KING SALMON IN NEW ZEALAND

Salmon is the common name for several species of fish in the family Salmonidae. Typically, salmon are anadromous; that is they are born in fresh water, migrate to the ocean, then return to fresh water to reproduce. However, there are populations of several salmon species that are restricted to fresh water throughout their lives.

Species of salmon are generally divided into two main groups: the single Atlantic Ocean species and a number of Pacific Ocean species (e.g. King salmon, Steelhead (Rainbow) trout, Cherry, Chum, Coho, Pink and Sockeye salmon).

DESCRIPTION OF KING SALMON

King salmon, Oncorhynchus tschawytscha from the Greek words onkos (hook), rynchos (nose) and tschawytscha (pronounced shaw-witch-shaw) comes from the Kamchatka Peninsula in Russia where, as in Alaska, it is the common name for the species and is thought to refer to their distinctive black gums. King salmon are the largest of the Pacific salmon and are also referred to as 'Quinnat' or 'King' salmon.

Native to the northwest coast of North American and northeast Asia, King salmon range from Kotzebue Sound, Alaska, to Santa Barbara, California to north Asia from Japan to the Kamchatka Peninsula in the Russian far east and the Chukchi Sea. They have not spread into the Arctic drainages, nor are they found in the warmer waters south of the Sacramento River. It is likely that their range is limited by water temperature.

The King salmon is blue-green or purple on the back and top of the head with silvery sides and white ventral surfaces. It has black spots on its tail and the upper half of its body. Its gums are often black/dark purple. Adult fish typically range in size from 840 to 910mm and the average size range is from 4.5 to 23kg.

LIFE CYCLE

The optimum water temperature range for King salmon is 6-17°C, with maximum growth achieved in temperatures between 12-17°C. Rapid changes in temperature within this range can cause death, and most fish adapt to a narrow temperature and salinity range.

In the wild, King salmon may spend one to eight years in the ocean (averaging three to four years) where they grow to maturity, before returning to their home rivers to spawn. The fish tends to lose condition as they migrate upstream.

In all species of Pacific salmon, the mature individuals die within a few weeks of spawning, a trait known as semelparity. Salmon that are not killed by other means, show greatly accelerated deterioration (phenoptosis or "programmed aging") at the end of their lives. Their bodies rapidly deteriorate right after they spawn as a result of the release of massive amounts of corticosteroids.

King salmon spawn during autumn in larger and deeper waters than other salmon species and can be found on the spawning redds (gravel nest) from September through December in their northern hemisphere native habitat. In New Zealand the main salmon runs into the rivers occurs in March with spawning occurring in April/May.

After laying eggs, females guard their redd for four to 25 days before dying, while males seek additional mates. King salmon eggs hatch, depending on water temperature, 90 to 150 days after deposition. Spawning is timed to ensure that young salmon fry emerge during an appropriate season for survival and growth. In the northern hemisphere, young fish can live in freshwater for three to 18 months before travelling downstream to estuaries, where they can remain as smolt for several months. In New Zealand, by far the majority of juvenile King salmon pass directly to the ocean at the relatively young age of three to six months.

HISTORY OF KING SALMON IN NEW ZEALAND

Following several unsuccessful attempts in the 1870s to introduce King salmon for a recreational fishery by various Acclimatisation Societies, they were successfully introduced to New Zealand by the Marine Department, who hoped to initiate commercial rod fishing and canning industry (although this never eventuated).

A hatchery was built on the banks of the Hakataramea River (a tributary of the Waitaki) and between 1901 and 1907 salmon were imported from the Baird Fish Station, located on a tributary of the Sacramento River in California. That operation was a success with, not only fish being successfully released but the fish adopting the Waitaki River and returning there to spawn.

King salmon became established, with sufficient numbers of adults returning that the population was self-sustaining in rivers on the east, and to a minor extent west, coasts of the South Island. Since 1907 imports of salmon ova into New Zealand have not been permitted, so all King salmon in New Zealand are the descendants of those original fish.

In the wild King salmon are restricted to the South Island, the major runs being on the east coast in the Clutha, Waitaki, Rangitata, Rakaia and Waimakariri Rivers, although smaller runs occur in many other East Coast rivers such as the Hurunui, the Ashley and the Ashburton. Other small stocks of sea-run King salmon are found on the South Island's West Coast, particularly in the Taramakau, Hokitika and Paringa Rivers. There are also a few landlocked stocks of King salmon in some South Island lakes. Although juvenile fish have been caught in some North Island rivers, there are no consistent runs of King salmon in the North Island.

Since the early days of salmon introductions, the Government, anglers and acclimatisation societies have operated hatcheries which boosted stocks in rivers where runs had been established and from whence attempts were made to stock new rivers. Even today, the so called 'wild' fishery is supplemented by these operations.

DIFFERENCES BETWEEN KING SALMON AND ATLANTIC SALMON

Atlantic salmon, as the name suggests, are the species of salmon which reproduce in northern rivers on both the coasts of the Atlantic Ocean. Atlantic salmon (Salmo salar), are not closely related to King salmon but are also generally anadromous; however unlike Pacific species, they are iteroparous, meaning they can spawn more than once. King salmon are more closely related to Rainbow trout (Oncorhynchus kisutch) being of the same genus.

Atlantic salmon accounts for over 99% of all farmed salmon and is the predominant species farmed in Norway, Chile, and Scotland. While attempts have been made to farm this species in New Zealand, these were unsuccessful.

Of all the salmon species King salmon are the most difficult to grow. In their native range in the northern hemisphere they suffer from a range of serious diseases such as bacterial kidney disease (BKD). King salmon can be difficult to handle without causing damage to the fish and subsequent fish losses, in addition they tend to panic easily, especially if crowded, scales are easily lost and secondary infection can set in.

King salmon do not convert feed as efficiently as for example Atlantic salmon. The New Zealand farmers achieve a feed conversion ratio (FCR) of ~1.8 in seawater, compared to reported FCR's of 1.0 to 1.4 in Atlantic salmon. This primarily occurs for a number of reasons, as follows:

a. King salmon have higher flesh oil (typically 25% at harvest in the fillet) than Atlantic salmon (17%). Because the tissue of King salmon contains more energy than Atlantic salmon, they require more feed energy to build each kilogram of tissue.

b. Atlantic salmon diets are manufactured to contain more energy (>35% oil is common) than King salmon diets (26% oil maximum). This is because King salmon are naturally oily fish, and too much oil in the diet can cause flesh quality problems in this species.

c. Energy partitioning calculations show that the points noted in (a) and (b) above account for at least 80% of the difference in FCRs between Atlantic salmon and King salmon.

d. Despite the higher FCR of King salmon, because they use lower-oil diets and retain more oil in the flesh, the efficiency with which Atlantic salmon and King salmon retain oil and energy is similar.

HOW WE PRODUCE WHAT WE SELL

PRODUCTION PROCESS

We are a fully vertically integrated operation with key infrastructure located in the Marlborough Sounds, Nelson, Golden Bay and Canterbury. Our 30 year history, and experience producing the King salmon species, have meant we have generally been able to adapt to changing farming challenges and conditions over time, and this remains an ongoing focus for us.

The production process can be split into three areas:

HATCHERIES

- This is where we breed salmon and grow smolt to 130 grams for transfer to our seafarms.
- 3 hatcheries across the South Island.
- Approximately 28 employees.
- Existing hatcheries have capacity to put approximately 3.5 million smolt to sea annually, or to support an annual harvest volume of some 11,500 MT.

SEAFARMS

- This is where we grow smolt to harvest weight salmon.
- 8 operational seafarms throughout the Marlborough Sounds.
- Approximately 85 employees.
- Existing seafarms support annual production volumes of approximately 6,000 MT, with the three new seafarms consented in 2014, the eventual annual production capacity is expected to increase to more than 12,000 MT.
- Further opportunities are available to improve environmental and fish performance including swapping low flow sites for higher flow locations.

PROCESSING FACILITIES

- This is where we process harvested salmon into finished products.
- Processing operations are based in Nelson.
- Approximately 239 employees.
- Core processing infrastructure capacity (for gutting, gilling and grading) is currently estimated at 7,500 MT per annum. This could be doubled by adding an extra shift for limited additional spend.

BREEDING, HATCHING AND GROWING

The New Zealand King Salmon business is operated in a manner that allows for year round production.

Our unique point of difference begins with our breeding programme. We have been running a breeding programme at our hatcheries for more than 20 years across 8 generations of salmon, with approximately 115 families of fish and records on more than 200,000 fish. The fish we use for breeding are referred to as "broodstock".

We believe the output of this programme, which crosses the traits of observed families for beneficial inherited characteristics, is a fish with superior characteristics to wild King salmon. Our primary focus has been on developing fish that are bred for culinary excellence and that grow faster, and therefore larger, than wild King salmon, with a higher fat content. Externally conducted studies show that, after two months, New Zealand King Salmon's fry have grown more than 50% larger than wild King salmon.[11]

Fry typically spend around 8 months in the hatchery at which time they are mature enough to undergo smoltification (the ability to exist in salt water). After smoltification, they are transferred to specific seafarms which will ensure the appropriate nurturing to a harvest weight and quality on a year round continuous basis. Typically, our salmon spend around 16 months at the seafarms before harvest.

Illustrative King salmon lifecycle

1 Spawning to Alevin — Month 1 - 4/5

2 Fry transferred to outside races — Month 4/5 – 8

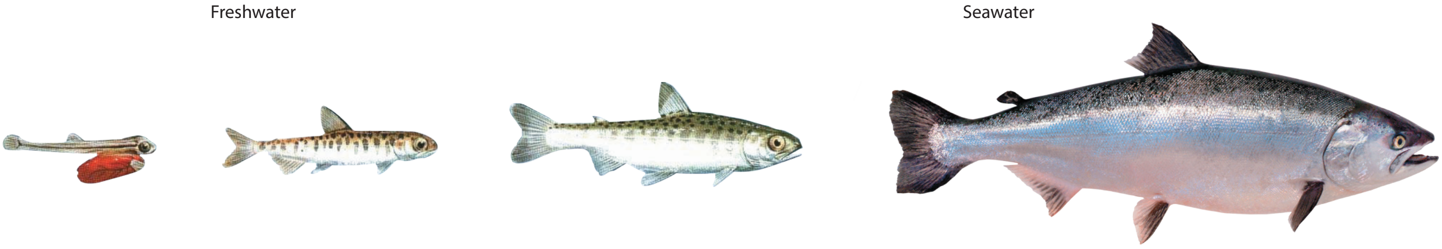
3 Smolt arrives at seafarms — Month 8 - 13

4 Seafarms grow out — Month 13 - 16

5 Harvest — Month 16

Freshwater

Seawater



[11] Source: Nelson Marlborough Institute of Technology – Salmon Rearing Project, 2013.

OUR HATCHERIES

We operate three hatcheries across the South Island in Takaka, Tentburn and Waiau. The wide geographic dispersion of our hatcheries acts to mitigate the risk of disease or natural disaster. Our key hatcheries have ample water supply which we believe will facilitate any future expansion beyond our eight operational seafarms.

HATCHERY	LOCATION	ACTIVITIES	CONSENT EXPIRY DATES
Takaka	Golden Bay	Production of broodstock and eggs	Fish farm licence currently in renewal process Water permit expires in 2034
Tentburn	Canterbury	Smolt production	Various licences and permits expiring between 2026 and 2038
Waiau	North Canterbury	Backup for broodstock and smolt	Fish farm licence currently in renewal process Water permits expire between 2028 and 2039

TAKAKA BROODSTOCK FACILITY

Located immediately downstream from the Waikoropupu Springs in Golden Bay, the Takaka hatchery benefits from one of the clearest sources of freshwater in the world, bubbling from the ground at approximately 14,000 litres per second at a relatively stable temperature of just under 12oC - a great temperature for rearing salmon.

The facility was established by a private individual in the mid-1970s, and in 1977 a diversion of Springs River into the farm was established and permits were granted to increase the water take and discharge. Water take and discharge permits currently allow NZ King Salmon to take and use water from downstream of the Waikoropupu Springs for the purposes of salmon farming, as well as to discharge water and salmon farming effluent via a settling pond to the Springs River. A further discharge direct to the Springs river is allowed when the settling pond is being maintained.

Operating under these consents conditions, the hatchery is NZ King Salmon's broodstock facility producing up to 7 million ova annually from the selective breeding programme and currently provides all of the ova requirements that are then hatched and on-grown in freshwater at the Tentburn and Waiau hatcheries to the smolt stage before being transported to the seafarms.

The Takaka hatchery employs a farm manager, nine full-time and one part-time staff members.

TENTBURN HATCHERY

Close to the mouth of the Rakaia River, Tentburn was developed during the mid-1980s by The New Zealand Salmon Company Ltd. It was initially conceived as an ocean-ranching site whereby the salmon would be hatched and released to the ocean with the intent that they would return three years later as harvestable salmon. During this time, the facility came close to achieving the 1% return of salmon required to ensure profitability, but never quite succeeded. A number of factors led to the ultimate failure of Tentburn as an ocean-ranching site and these included the presence of trawlers fishing off the coast of New Zealand, shags, seals and predatory fish, as well as recreational fishers who lined the culvert leading into the hatchery. There were also difficulties maintaining the fish ladder across a beach that is frequently affected by gravel movement.

Tentburn is however a great facility for producing smolt for sea pen growout, with the main advantages being plentiful land area, good access and suitable freshwater supply.

Using technology developed in the United States, the Tentburn hatchery has 60 raceways, and water is continuously pumped from two spring fed streams. Two wells are also used at Tentburn to obtain better quality water for incubation and development of the smolt during the early stages of the lifecycle.

The Tentburn hatchery currently employs a farm manager, 13 full-time permanent, one permanent part-time staff member, and produces approximately 2,500,000 smolt annually.

WAIAU HATCHERY

Located between Rotherham and Waiau on SH70 in North Canterbury, the Waiau Hatchery was established in 1987 by the Amuri Salmon Company. For the next 20 years it produced up to 100 tonnes of 2kg+ freshwater salmon per year, which were grown in a combination of raceways and ponds. The main water supply originates in springs 1km upstream that are fed from the Waiau river catchment and in addition there are three wells on site. The hatchery was purchased by NZ King Salmon in 2011. NZ King Salmon currently uses the hatchery to rear 300,000 smolt per annum as well as broodstock, but it has the potential to produce up to 1,000,000 smolt. There is one manager and two full-time permanent employees located at Waiau.

SMOLT PRODUCTION

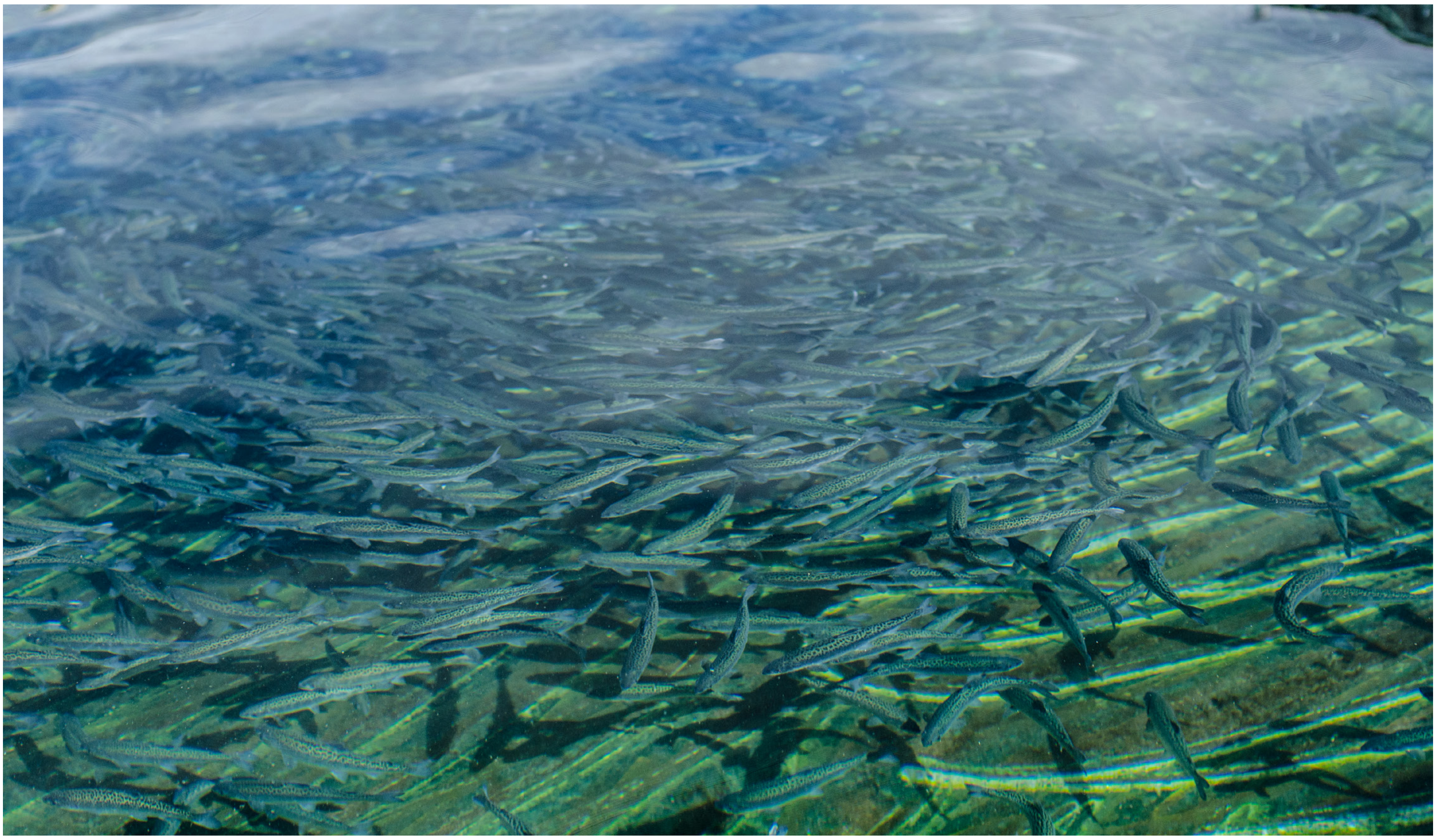
NZ King Salmon's world class selective breeding programme, which breeds for grow-out performance and marketing qualities in the fish, is similar to those run for land-based farm animals. King salmon spawn in freshwater and therefore the breeding programme is located at the Takaka hatchery with a back up of broodstock and eggs in Waiau. However the Tentburn, Takaka and Waiau hatcheries are run together as one operation. At any one time there may be three year classes of brood stock and these are currently located at Takaka.

Through photoperiod technology NZKS is able to spawn broodstock from December to July. Weighing between 7-15 kg they are stripped of eggs at three years of age; producing ~6,500 eggs each; resulting in the production of ~10 million eggs in total. About 85% of the eggs survive.

Using the latest technology, each broodstock fish carries a PIT identification tag (microchip) which is recovered from the female fish post-spawning and used to identify her eggs. Also we are able to identify our broodstock through genotyping technology. Following collection of the eggs, the milt from a predetermined male is collected, chilled and the PIT number of that male is recorded to enable appropriate 'matches' to be made as part of the breeding programme.

The PIT tags and genotyping enable NZ King Salmon to keep track of the individual fish and the 120 family lines currently used as part of the breeding programme. In addition, maintaining the families from each cohort at both locations is a risk management tool to ensure that the company is protected in the event of significant fish loss at one site. There are also 20,000 fish from the family lines that are reared in a net pen, enabling NZ King Salmon to assess family and individual performance in the seawater environment. The siblings (growing in freshwater) of the best performing fish in seawater, are then identified and used for further selective breeding of the broodstock lines.

NZ King Salmon utilises various controls (e.g. feeding, lights, chilling the fertilised eggs, grading out small fish and selective breeding) to enable staff at the hatchery to regulate the growth and maturation rate of the juvenile salmon. This enables the company to stagger entry of the fish to the net pens and therefore assists NZ King Salmon to produce fish that are consistent and predictable in size, and able to be harvested year round.



SMOLT TRANSFER

Smolt transfer to the net pens occurs on two occasions during the year; in spring (October to December) and again in autumn (April to June). Pursuant to the Freshwater Fish Farming Regulations, a Fish Transfer Authorisation is obtained prior to transfer of the smolt.

Pumps at the hatchery are used to pass the smolt through an electronic counter to custom-made insulated tanks on truck and trailer units, which are fitted with an aeration system and supplied with oxygen. Oxygen levels are monitored and computer controlled in the tanks. The units are fitted with a top opening for loading, and chutes at the bottom for release.

Following arrival at either Picton or Havelock, the truck and trailer units are loaded onto a barge and taken to the sea pens, a journey which can take up to four hours. During this journey seawater from a deck hose is flushed through the tanks to help the smolt acclimatise to the seawater growing environment. Once the truck and trailer units arrive at the farm, the smolt are discharged directly into the seawater.

To ensure year round market supply, New Zealand King Salmon operate different strategies of selectively bred fish which, along with the environmental characteristics of each farm site, determine where the final destination of the smolt will be.

SEAFARM OVERVIEW

This description applies to New Zealand King Salmon's existing and proposed farms.

As at June 2016 New Zealand King Salmon is farming eight of the eleven currently consented farms in Marlborough, to on-grow the fish from smolt (~50-200g) to a harvestable size of approximately 4kg, in which one of the eight is currently fallowed.

While each sea farm has its own environmental characteristics, the seven operational farms plus one currently fallowed but to be restocked in 2017 are currently managed as one integrated system, rather than independent production units.

New Zealand King Salmon farms can be categorised as:

- Higher flow sites with cooler water temperatures located in Tory Channel (Clay Point, Ngamahau and Te Pangu).
- Higher flow warmer water temperatures (Waitata and Kopaua)
- Lower flow sites with warmer water temperatures (Crail Bay, Waihinau, Otanerau, Ruakaka and Forsyth)

Salmon are distributed between these sites according to the site characteristics in terms of water flows, temperature profiles, smolt growth strategy and forecast harvest requirements. Generally the cool water sites in Tory Channel receive smolt in spring, while the warmer sites receive smolt during the autumn transfer period.

Fish are transferred between sites by counting them across from the grower nets at the farm they are being transferred from, into another net pen that is moored alongside the farm. That net pen unit is then very carefully towed by tug using tidal flows to propel them to the new site.

Each component of New Zealand King Salmon's farm management strategies, processes and techniques has been tried and tested over the years. New Zealand King Salmon has comprehensive operating and training manuals and management plans which are regularly updated.

Since the early development of the industry in New Zealand, salmon farming technology and processes have evolved and New Zealand King Salmon has a wealth of institutional knowledge gained over many years of first-hand experience in the marine environment. However, many challenges have arisen along the way, and acknowledgment of these challenges and taking actions to implement a satisfactory response is one of the reasons why NZ King Salmon is the successful company it is today.

OUR SEAFARM SITES

Until recently, we operated five seafarms based in the Marlborough Sounds. In December 2014 three new consents were issued, each with a 35 year term, and we recently harvested the first of these seafarms, Waitata, in July 2016. Unlike some of the existing seafarms (which are converted mussel farms), the new consents are for sites that were selected specifically for King salmon production, with characteristics (such as higher water currents) that will provide better production and environmental outcomes. We expect these new consents will enable us to approximately double existing production over time.

The map opposite shows the location of New Zealand King Salmon's seafarms and the table below provides key information on each seafarm. In the past we have successfully renewed all consents. The consent for our largest existing seafarm, Te Pangu, was successfully extended in January 2016 for a further 20 years to 2036.

SEAFARM	LOCATION	MAXIMUM SURFACE STRUCTURE AREA (HA)	MAXIMUM FEED DISCHARGE [1] (MT / P.A.)	CONSENT EXPIRY
Existing Seafarms				
Te Pangu	Tory Channel	1.5	6,000	2036
Clay Point	Tory Channel	2.0	4,000	2024
Otanerau Bay	Queen Charlotte Sound	2.0	4,000	2024
Ruakaka Bay	Queen Charlotte Sound	2.0	4,000	2021
Waihinau Bay	Pelorus Sound	2.0	3,000	2024
Forsyth Bay	Pelorus Sound	2.0	4,000	2024
Crail Bay x 2	Pelorus Sound	Not in use – currently fallowed		2024
New Seafarms				
Waitata	Pelorus Sound	1.5	3,000 (current), 6,000 (maximum eventual limit)	2049
Ngamahau	Tory Channel	1.5	1,500 (current), 4,000 (maximum eventual limit)	2049
Kopāua	Pelorus Sound	1.5	1,500 (current), 4,000 (maximum eventual limit)	2049

Notes to table and map:

[1] New Zealand King Salmon will often choose to farm well within the maximum consent limits, particularly at low flow sites.

MAP OF OUR SEAFARMS (Marlborough Sounds)

0 8 km

1:225,000@ A4

Data Sources:
Topographical Map sourced from LINZ. Crown Copyright Reserved

Legend

NZ King Salmon Farms
- Active
- Fallowed

RUAKAKA FARM

The Ruakaka Bay farm, in Queen Charlotte Sound was established in 1985 as a small research based, approx. 0.5 ha farm by the South Island Salmon Partnership (the precursor to Regal Salmon). It is located on the site of the first registered mussel farm in New Zealand and still retains Marine Farm Licence 1 (MFL1) status. The site, the oldest of New Zealand King Salmon's farms, is characterised by water depths of around 35m and low current flows (average mid-water current speed of 3.7 cm/s). Over an annual period, water temperatures at this site generally range from ~11-18°C (however can peak at up to 20°C). Salmon are raised in 20 steel net pens (20mx20m) and the site currently produces approximately 1,000mt of salmon per annum.

OTANERAU FARM

Prior to considering Tory Channel as a safe place to locate salmon net pens, Regal Salmon obtained a salmon farming permit in Otanerau Bay, the southern extension of East Bay in the north of Arapawa Island. The site, which was developed late 1989, is adjacent to mussel farms and the two industries have been compatible since that time. Water depth at this site ranges from 37m-39m and current flows are characterised as 'low' (average mid-water current speed of 6 cm/s). Water temperature generally ranges from ~11.5-18°C (but can exceed 18°C for an extended period), but due to the consistently higher warmer temperatures in summer at this site, salmon are only grown here for nine months of the year (April to January). In 2009, Otanerau was significantly reduced in size with a number of net pens removed from the farm and shifted to other NZ King Salmon sites. Currently Otanerau has an annual harvest of ~800mt of salmon which are grown in 12, 20mx20m steel net pens at this site.

WAIHINAU FARM

The Waihinau farm was originally located in Hallam Cove, the then owners Newhaven Salmon Company moved to the cooler waters of Waihinau Bay in 1989-90. Newly formed Southern Ocean Seafoods Ltd took over the site in 1990. Water depth at the site ranges from 28m-30m, and water flow is categorised as 'low' to 'moderate' (average mid-water current speed of 8.4 cm/s). Currently the Waihinau Bay farm site is fallow with anticipated use as a smolt farm in 2017. Over an annual period, water temperature generally ranges from ~12-17.5°C (but can exceed 18°C for an extended period).

FORSYTH BAY FARM

The farm at Forsyth Bay was originally a mussel farm and was developed by Southern Ocean Seafoods in 1994. Water depths at the site are around 35m and as with Ruakaka, current flows are classified as 'low' (average mid-water current speed of 3.1 cm/s) and average water temperatures range from ~12-17.5°C. (but can exceed 18°C for an extended period).

THE CRAIL BAY SITES

These sites are located in water depths ranging from 19m-31m, and with low mid-water current flows ranging from 2.5-3.5cm/s and water temperature ranging from 11-20°C. The more northern site (Li48) currently is fallow. The southern site (Li32) has mussel lines only.

The Crail Bay sites are seen to have been of transitional assistance to the company as they are suboptimal in terms of production ability.

TE PANGU FARM

In their search to find deeper sites and cooler water temperatures Regal Salmon obtained a permit to farm salmon in the cooler, high current flow Te Pangu Bay site (Tory Channel) in the early 1990's. The motivation behind this was to reduce the mortality of smolt during spring, which at times could reach 50% if the spring water temperature rose in conjunction with the smolt introduction into the seawater. At Te Pangu this phenomenon did not occur because of the cooler oceanic water in Tory Channel. In 2009 New Zealand King Salmon significantly upgraded the farm, installing larger net pens, much improved mooring systems, new barge facilities and a number of other innovations including modern feeding systems, net cleaning technology and mooring line tension monitoring. Water depth at this site ranges from 27m-31m, and current flows are characterised as 'high' (average mid-water current 15 cm/s). Water temperatures generally ranging from ~11.5–16.5 °C. Currently there are 12, 25mx25m and six 30mx30m steel net pens at this site, producing approximately 2,000mt of salmon per annum.

CLAY POINT FARM

Following the success of the Te Pangu farm, New Zealand King Salmon sought further suitable areas within Tory Channel to establish farms. In the initial years, development at the Clay Point site was limited because of restructuring and the challenges posed by such a deep and fast moving water force. The farm was eventually officially opened in 2007, operating under a marine farm licence shared with local Iwi Te Atiawa Manawhenua Ki Te Tau Ihu Trust. This site is located in water depths ranging from 30m-40m and it has the highest water velocities of all of New Zealand King Salmon's farms with average mid-water flows of 19.6 cm/s. The high water flows, and cooler water temperatures (~10.5-16.5°C) compared to farms in Pelorus and Queen Charlotte Sounds make this site ideal for growing salmon. Currently there are twelve, 30mx30m steel growing sea pens at this site which produce 2000mt of salmon per annum.

NEW EPA SITES

New Zealand King Salmon obtained three new sites as a result of an EPA appointed BOI process and subsequent challenges in the High and Supreme Courts. Nine sites including one that had been granted a consent were applied for. Four were granted by the BoI and the decision upheld by the High Court. However appeal to the Supreme court on one of the sites (Papatua) overturned the decision resulting in only three sites being approved.

NGAMAHAU FARM

The Ngamahau farm was commissioned in October 2015 and currently consists of three 40mx40m net pens, a feed and accommodation barge and total maximum discharge of 4,000mt, initially 1,500mt per annum with potential 3 yearly increases of 500mt . The water depth ranges between 25m-35m. The flows are high with average mid-water current flows of 22 cm/sec and water temperatures ranging between 10.5-16.5°C. Harvest of approximately 700mt is expected later in 2016.

WAITATA FARM

The Waitata farm was commissioned on site in January 2016 and currently consists of four 40mX40m net pens, a feed and accommodation barge and total maximum feed discharge of 6000mt, initially 3,000mt per annum with potential 3 yearly increases of 1000mt. The water depth ranges between 30m-60m. The flows are high with average mid-water current flows of 19-21 cm/s and water temperatures ranging between ~12-18.0°C. The first harvest was in July 2016 of 625mt.

KOPĀUA

The Kopāua (Richmond) farm was placed on site in April 2016 and currently consists of two 40mX40m net pens, a feed and accommodation barge and total maximum feed discharge of 4,000mt, initially 1,500mt per annum with potential 3 yearly increases of 500mt. The water depth ranges between 30m-52m. The flows are high with average mid-water current flows of 13-24 cm/s and water temperatures ranging between ~12-18.0°C. The first smolt were introduced to the farm in May/June 2016, with a harvest of approximately 700mt expected in 2017.

SOCIALLY RESPONSIBLE CORPORATE

In recent years New Zealand King Salmon has increased participation in environmental based initiatives in the Marlborough region as this fits well with the New Zealand King Salmon sustainability ethos. For example New Zealand King Salmon supports a range of programmes in conjunction with Marlborough Department of Conservation, the Link Pathway connecting Picton with Havelock, the Marlborough Sounds Restoration Trust wilding pine project, the Kaipupu Point Sounds Wildlife Sanctuary, the Paper4Trees schools recycling programme and the Nelmac Garden Marlborough festival.

New Zealand King Salmon supports a range of educational institutions including the Aquaculture Unit at Queen Charlotte College in Picton, the 1st XV rugby team at Marlborough Boys College, annual scholarships for aquaculture students at NMIT (Nelson Marlborough Institute of Technology), and the KiwiCan programme run by the Graeme Dingle Foundation at Picton School. Upcoming support includes a comprehensive education resource for Marlborough schools, which will also be online for global access, as well as a range of support for Marlborough Girls College.

New Zealand King Salmon also supports numerous community events, normally with product for functions and fundraising. Some examples of events and organisations that the company supports are: Nelson/Marlborough Rescue Helicopter, the Waikawa Boating Club; Queen Charlotte Yacht Club Sailing Regatta, Marlborough Book Festival, Picton Maritime Festival, Marina 2 Marina annual Picton run, Havelock Mussel Festival, The Grape Ride, the conservation tent at the Marlborough A&P Show.

For the past three years New Zealand King Salmon has run the popular 'Sounds, Salmon & Songbird' cruises in conjunction with Marlborough Tour Company and Kaipupu Point Sanctuary, to enable locals to visit a salmon farm and experience the Marlborough Sounds at an accessible price point.

New Zealand King Salmon is a strategic partner of Destination Marlborough, with a view to driving the visitor economy and the region's international reputation through the promotion of local food and beverage products and experiences. The company is regularly contacted by Destination Marlborough, other tourism groups, such as Tourism New Zealand, and food and beverage partners, to undertake promotional tours with visiting television programme makers and other VIPs who visit the region. Participating in these promotional activities allows New Zealand King Salmon to assist with lifting the profile of Marlborough within New Zealand and overseas. For example, in late 2015, company staff participated in the filming of a number of television programme shoots that were screened in New Zealand and overseas.

New Zealand King Salmon gets involved in Marlborough business networks including sponsoring the environmental section of the Marlborough Chamber of Commerce annual awards. Support is also given to the Marlborough chapter of the Institute of Directors to deliver a series of speaker events to the business community.

New Zealand King Salmon has also recently joined the Sustainable Business Network (SBN), a national organisation helping businesses succeed through becoming more sustainable and delivering benefits to communities, employees and our natural environment as well as shareholders – profit fit for the 21st century.

BARGES & MOORING SYSTEMS

BARGES

Barges are used instead of boats as they provide a good stable working platform, allow more effective use of the deck area, are more cost effective and can be custom made in accordance with NZ King Salmon specifications.

A standard barge comprises a floating two storey building attached to the farm structures. The lower floor consists of the large feed storage area, feeding equipment, a workshop, freshwater holding tank, shower, diesel storage and generator room. The upper level houses the offices, including a feeding station where the feeding process is closely monitored; a staff kitchen area, shift worker bedrooms, shower and toilet. It is proposed that a non standard low profile (<3m) "circular appearance" barge containing feed storage and feed distribution equipment is located on the proposed mid Waitata Reach site. Feeding will be controlled remotely.

The three farms granted through the EPA process have an on-site barge that must be built with a nautical-style design.

The farm staff usually communicate via cellphones, but each farm also has an alternate source of communication, including Wifi.

Freshwater is delivered to the farm holding tanks on a delivery barge.

The discharge of up to 500m3 of grey water, (from showers and other personal hygiene uses, food preparation and clothes washing) is a permitted activity in the Marlborough Sounds, under the Marlborough Sounds Resource Management Plan (Rule 35.1.2.8). As at 2016, the discharge of grey water from New Zealand King Salmon farms remains well below 500 m3 per day.

Black water or sewage is contained in tanks on the barge, and regularly collected by Marlborough Waste Collection on the servicing barge.

Diesel is also contained on the barge in large under floor tanks. This supplies the fuel to run the feeding equipment and domestic requirements.

MOORING SYSTEMS

While typically the net pens and barge on a salmon farm will only occupy 1-1.5 ha of surface area, the farm moorings do not lie directly beneath the net pens. Ensuring the structural integrity of the farm, means that the moorings (with mooring lines attached) need to be located a sufficient distance from the structures so as to provide adequate tension to hold the farm securely in place. This is the reason why salmon farm consents are typically for an area approximately 10-times greater than the area covered by the surface structures alone.

There are a number of different types of net pen anchoring systems available to salmon farmers. Screw anchors (auger type steel anchors) are now used routinely as a secure and proven means of mooring salmon farms.

Each farm mooring line and mooring layout is designed by a qualified engineer. An agreed mooring maintenance programme forms part of the consent conditions and operating policy of each farm. Tension measuring devices, known as load cells, are fitted to the chain and used to monitor and manage the mooring systems to ensure safe working loads are maintained at all times.

NETS

NETS PENS

Currently, most New Zealand King Salmon's fish are grown using steel pens of a range of different sizes from 42 x 42m with 20x20m nets, to single structures of approximately 125m x 65m with 30x30m nets. Older pens comprise of a floating structure, which consists of a perimeter of spirally welded steel pipe (up to 1m diameter), with an internal surface area that is divided into sections using the same steel pipe.

More recent pens at Waitata and Kopāua use a multi hinged steel frame supported by plastic floats (Wavemaster). It is anticipated that the Wavemaster style of pens will be used should there be suitable space available in areas that are less exposed.

The grower nets are made of nylon, and the mesh size varies from 12.5 to 35mm on the bar (knot to knot). New Zealand King Salmon has utilised various mesh size options in the past and experience has shown the best mesh size to use. In order to contain the smolt when they are first introduced to the net pen, a smaller mesh size is required, however smaller mesh constrains water flow and enhances biofouling. To reduce the effects of biofouling and maintain water circulation, which replenishes dissolved oxygen levels and assists with waste removal from the net pen, it is important to move the fish to grower nets with a larger mesh size as soon as possible.

Typically the steel net pens will have a walkway attached to the top of the structure, with associated handrails attached to the walkway. At some of the existing farms there is also a suspended walkway across the centre of the pen.

Small older circular plastic net pens were used at the Crail Bay farms. Recent industry trends show that larger plastic pens of up to 240m circumference (approx 76m diameter) are prefered; for these net pens. Welded HDPE pipe provides the flotation. Circular plastic pens are very commonly used overseas. It is proposed that in future this type of net pen will be used at more open sites where fetch or landscape issues require either a more flexible (to cope with wave action) or less visible structure.The pens are low profile and the dark colour blends well in to the surrounding environment. There are no interconnecting walkways and where serious landscape issues may prevent locating a stationary barge on site the pens may be serviced by boat or motorised barge. This is not an option that New Zealand King salmon prefers as it creates a relatively inefficient and costly feeding scenario that requires daily vessel visits.

BIRD NETS

Salmon farms tend to be attractive structures for birds; fish feed is appealing to gulls and a range of shags species use the net pens for drying and roosting.

On occasion for no apparent reason large numbers of gulls may decide to roost on a salmon farm for a period of days then equally without apparent reason leave. We suspect this may have something to do with storm conditions and the birds are using the farm as a safe haven.

Bird access to feed and/or smolt has been an issue in the past. Acoustic orchard bird scarers were trialled over a decade ago on the farms, however they were found to attract, rather than deter, seabirds. A gas cannon similar to those used on orchards was also trialled, but was determined to be ineffective as the birds became used to it.

Overhead nets exclude birds from the net pen structure. The black polyethylene bird nets are still under development, as while generally effective, birds are still observed over the farm.

New Zealand King Salmon has undertaken mesh size trials to determine the best option for the bird nets and as a result of these trials; the 47.5 mm has been determined to be the most effective mesh size.

In addition to the use of bird netting, New Zealand King Salmon has a seabird policy in place. In order to minimise the attraction of seabirds to the farm sites, all salmon feed held on the farms must be covered. Floating dead fish are collected as soon as they are noticed, and the mortality bins are covered at all times.

PREDATOR NETS

A range of predator netting configurations have been trialled by New Zealand King Salmon over the years, including predator nets around the farm. The preferred predator net system currently utilised by New Zealand King Salmon, is a combination nylon/polyethylene net that surrounds the whole farm structure. This net extends for over 2m above the water and acts as a deterrent to both seals and sharks.This type of exclusion net was first installed on company farms in 2000.

While seals are still a common sight around the edge of the predator nets, and very occasionally they manage to obtain a reward for their attention, predator nets are by far the most effective method of excluding seals and other predators. They have the added advantage of distancing the fish from predators, thereby reducing stress in the fish.

The grower and predator nets are cleaned in-water by remotely controlled pressure washing systems. This ensures fouling does not restrict the flow of water through the nets nor allow mussel biomass to exceed the flotation capacity of the net pen structures.

Although New Zealand King Salmon currently holds a coastal permit that provides for the use of antifouling paints, apart from a trial at the Te Pangu farm, it does not use antifouling paint on its nets and has not done so since 2011. The coastal permit requires that annual monitoring be undertaken to determine the effects of any discharge of the anti-fouling paint on the seabed and benthic community composition, particularly in relation to copper.

MARINE MAMMALS

The New Zealand fur seal should not be under-estimated in terms of their intelligence. They are observant and very able to assess opportunities and take advantage of any compromise in predator defence systems on salmon farms. Seals are protected under the Marine Mammal Protection Act 1978, administered by the Department of Conservation (DoC).

New Zealand King Salmon has worked with DoC for a number of years in order to come up with the best solution for seal interaction. Trials have included attempts to transport the tagged seals to another colony in Kaikoura, or the South Island West Coast, however these same animals were usually back to the Marlborough Sounds (and place of capture) within a few days of being released.

New Zealand King Salmon has a permit from DoC which allows seals entering the net pens to be caught and released. The permit also allows farm staff to deter seals from entering the net pens. The killing of any seal is not permitted.

New Zealand King Salmon also has a specific Marine Mammals and Sharks Policy in conjunction with DoC, which, in addition to providing guidelines for the handling of seals that do enter the farm, aims to minimise the risk of seal entry to farms.

The seal policy includes recording and reporting seal activity around the farm to company management and DoC (Picton office). Inspection dives and video observations made while in water net cleaning can assist in locating seal access points. Seals inside the farm predator net generally indicate a hole in the net that requires location and repair.

NET CLEANING

In order to achieve maximum growth rates, farmed salmon require clean water which contains high levels of dissolved oxygen, and low levels of contamination. Any restrictions to the water flow through the netting results in less water flowing through the net, this in turn has a negative impact on dissolved oxygen and waste levels in the net pens.

Unfortunately, salmon nets suspended in the marine environment provide an ideal growing structure for small marine organisms (e.g. algae, barnacles, tubeworms, hydroids, mussels etc) which are collectively referred to as biofouling. This biofouling not only reduces water flow, but also makes the nets heavy, which means they are difficult to handle, adds additional strain to the mooring and floatation structures and cause wear and tear on the equipment, net pen structures and the net mesh. In order to prevent this, regular net cleaning is a critical and significant part of New Zealand King Salmon's operations.

The grower nets are not treated with antifouling products so need to be cleaned approximately once a month, especially during the summer months. The older 20m x 20m grower nets are cleaned when there are no fish in the pen; this is generally done by having one empty pen for every seven pens in use, which means that the fish can be rotated around the eight net pens to allow cleaning to occur. At the older farms the nets are spread and lifted above the water so that they can be walked over and water-blasted clean. Nets are then left to dry to ensure that all biofouling organisms have died. A shower of rain or freshwater further assists with killing off biofouling.

NZ King Salmon has developed an automated net cleaner and uses off the shelf remotely controlled equipment which cleans the grower nets in the water (in-situ). These cleaners use high pressure water directed through rotating discs. The 'head' which contains the discs slides up and down the sides of the net and blasts off the fouling organisms. The cleaning heads of the remotely controlled machines are controlled using feedback gained from in-water cameras. Not only is the in situ cleaning much quicker, it also reduces farm noise by minimising the use of water blasting equipment. In situ net cleaning is carried out with fish in the net pen.

Predator nets are cleaned in water on a required basis to keep fouling to a minimum.

The predator nets are no longer treated with a copper-based antifouling paint (apart from a trial on the Te Pangu farm). When due for a change out these nets are brought to the surface and crushed through a mussel crusher to remove the larger biofouling organisms which settle on the net over time. They are then taken to the land-based facility to dry out and the remaining biofouling is removed.

Discharges from net cleaning activities are covered by resource consent which allows NZ King Salmon to discharge biofouling organisms and copper based anti-fouling from nets and structures. Copper levels under the farms are independantly monitored and reported on annually.

New Zealand King Salmon uses the principle of satiation feeding to ensure that the fish are fed an amount that matches their appetite, which varies throughout the salmon life cycle.

SALMON FEED

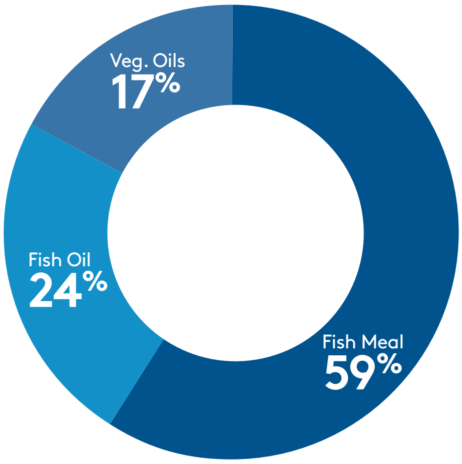
Our most significant cost is feed, which annually accounts for ~40% of all cash expenses. Historically, the two most important ingredients in fish feed have been fish meal and fish oil, however, through time the use of these ingredients has been reduced and replaced by agricultural products and poultry by-products. The Global Salmon Initiative, a global salmon industry body of which New Zealand King Salmon is a member, is focused on continuing to reduce the use of fish meal and oil in salmon feed.

We seek to replicate a wild salmon diet while ensuring the feed we use contains a range of key nutrients, vitamins and trace elements beneficial for salmon growth and human consumption.

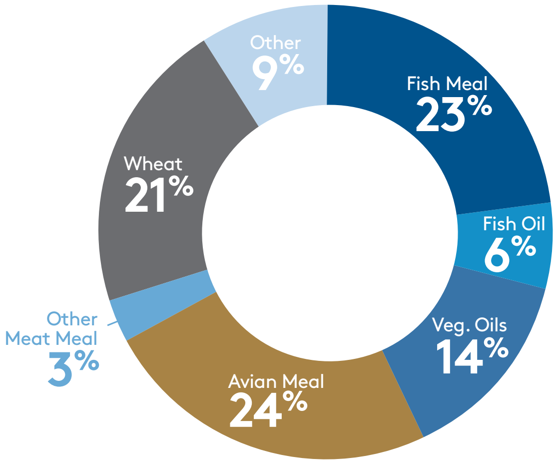
No feed company offers a feed composition developed specifically for King salmon and accordingly we have invested in feed development initiatives. We continue to undertake and commission research and work with our suppliers to further understand and refine feed composition to optimise FCR. For example, we are currently working with private science providers and the Government to conduct a four year study into King salmon nutrition that is expected to conclude at the end of 2018.

Feeding the salmon is one of the most important operations on a salmon farm, with the main objective being to achieve maximum growth of the salmon while minimising feed wastage and ensuring all nutritional requirements of the salmon are met.

Global salmon aquaculture – components of feed (1990)[12]



New Zealand King Salmon – components of feed (Current)

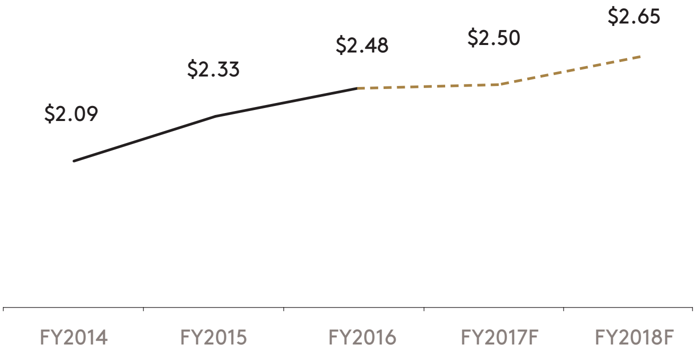


Percentages are approximate and based on our most commonly used feed type.

[12] Source: Marine Harvest – Salmon Industry Handbook 2016.

Feed is made by a range of international manufacturers, and we endeavour to source our feed from multiple manufacturers to enable robust performance benchmarking and ensure adequate price tension. We target a balanced spread of suppliers at any point in time, however from time to time there may be transition periods which result in greater concentration with a supplier or suppliers for a period during transition. We are currently in such a transition period, but expect to return to the targeted mix across a range of suppliers within the Prospective Period. The chart below shows that feed prices, in New Zealand dollars per kilogram, weighted across all feed types have increased in recent years, primarily due to changes in feed composition (particularly between FY2014 and FY2015), foreign exchange rates and inflation in the costs of the underlying feed components, and are expected to continue to increase for similar reasons.

Weighted average feed cost (NZ$ / kg)



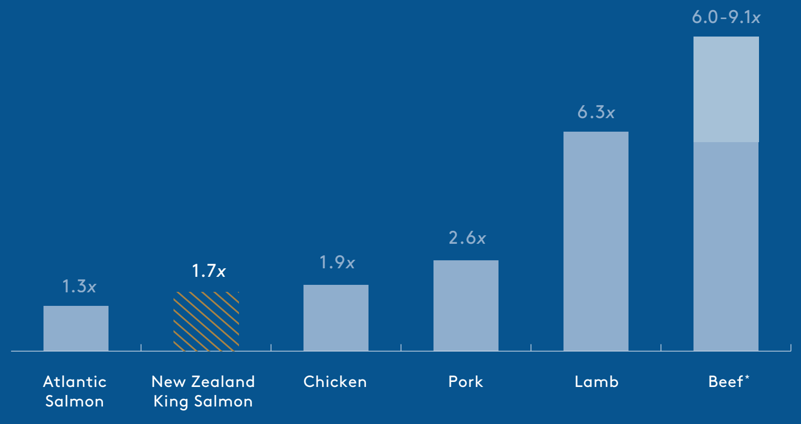
SUSTAINABILITY AND ENVIRONMENTAL IMPACT

Farmed salmon are an efficient form of protein production relative to other animal protein alternatives. Salmon are efficient to farm because they are cold-blooded and virtually weightless in water. Feed conversion ratio (FCR) measures the efficiency of different protein production methods, calculated as the mass (in kilograms) of feed needed to increase the animal's bodyweight by one kilogram. The lower the FCR, the more efficiently feed is being converted to live weight.

With increasing global protein consumption, it makes sense for producers and consumers to focus on efficient conversion of feed to live weight to meet the growing demand for food.

Our average FCR over the last five years of 1.7x outperforms land based animal farming alternatives such as pork, sheep and beef. However, the King salmon species has a less efficient FCR than Atlantic salmon, in part due to its higher fat content. The components of New Zealand King Salmon's feed have evolved over time. In 1990, fish meal and fish oil comprised 83% of global salmon aquaculture feed. Our feed currently comprises only 31% of these components, with the remainder substituted by vegetable and land-based animal by-products.

Feed conversion ratio of farmed animal protein production[8]



*The FCR of beef production has a range due to the varying types of feed used.

Salmon farming generally benchmarks favourably against its animal protein alternatives on most sustainability metrics, with the lowest arable land and irrigation water requirements of the farmed animal protein producers, and lower carbon footprint.

HISTORY OF FEED

Types of feed for farmed salmon have evolved markedly over the years, as described in the following paragraphs.

The first manufactured food in the salmon industry were steam pressed pellets. These pellets contained dry, ground materials (e.g. fishmeal, flour) that are processed through a pellet press, with steam applied. Some oils can also be incorporated into the pellets, and the resulting pellet is dry (<10% moisture) and shelf stable. However this technology struggles to deliver pellets containing more than 12% oil and typically results in 5% chip and dust (which fish do not eat). FCR's of 2 to 3 were common in the NZ industry on steam pressed pellets. Those diets continued to contain mostly fishmeal and fish oil.

In the 1990's extruded pellets became available. Increasing the oil content (and thus energy content) of diets greatly improves the efficiency of which protein is used in the diets. This was the key motivation for the global shift to extruded pellets. By the mid to late 1990's these were common in New Zealand and today are used almost exclusively.

Extruded pellets are made using highly technical production lines that incorporate a cooking extruder. Extruded pellets can be made that contain high oil levels – above 40% oil is possible. Compared to steam pressed pellets, extruded pellets are also durable (little chip and dust, which reduces feed wastage) and have increased nutrient digestibility, due to the increased level of cooking that occurs during production.

Increasing the oil content also allows the protein content of the diet to be reduced. It can be considered that low oil steam-pressed pellets contain "too much" protein per unit of energy, i.e. more protein than the fish need in order to build their own tissue. In this situation the surplus protein is used by the fish for energy. Using protein for energy is costly and increases nitrogen excretion into the environment. The concept of using oil to supply energy to prevent protein being used for energy is known as "protein sparing".

Extruded King salmon diets used in the NZ industry today typically contain 25% oil and 38% protein. While affected by growing conditions and a range of other factors, the industry-wide FCR is currently around 2.0. This is higher than is commonly seen in the Atlantic salmon industry (which has average FCRs of approximately 1.3). This difference is likely primarily due to the following:

- King salmon have higher flesh oil (typically 25% at harvest in the fillet) than Atlantic salmon (17%). Because the tissue of King salmon contains more energy than Atlantic salmon, they require more feed energy to build each kilogram of tissue.
- Atlantic salmon diets are manufactured to contain more energy (>35% oil is common) than King salmon diets (30% oil maximum). This is because King salmon have a different nutritional requirement for protein and energy (oil) than Atlantic salmon.
- Energy partitioning calculations show that the points noted in above account for at least 75% of the difference in FCRs between Atlantic salmon and King salmon.

Despite the higher FCR of King salmon, because they use lower-oil diets and retain more oil in the flesh, the efficiency with which Atlantic salmon and King salmon retain oil and energy is similar.

NUTRITIONAL REQUIREMENTS OF SALMON

King salmon are carnivorous fish, and as such the primary macronutrients in a salmon diet are protein and fat; they have only limited capacity to utilise carbohydrate. Salmon also require a range of micronutrients, for example vitamins C and E, selenium and zinc.

As an anadromous species (born in freshwater but spend the majority of their life in seawater), wild salmon juveniles start feeding in freshwater, on a range of freshwater invertebrates. After salmon migrate to sea, their diet consists mainly of crustaceans (e.g. krill) and small fish.

The diet of salmon in the wild also contains astaxanthin, a carotenoid and strong antioxidant. Astaxanthin gives salmon flesh its pink colour. Salmon cannot synthesise astaxanthin but instead astaxanthin is accumulated from natural sources in the diet, such as krill and other crustaceans. Astaxanthin is required for egg and fry development and for fish health. It is also redistributed when fish sexually mature in order to pigment the skin and protect the oil in their eggs.

The diet of wild salmon in seawater is also high in the long-chain Omega-3 fatty acids DHA and EPA. Salmon have a limited ability to synthesise long-chain Omega-3 in any quantity, so must obtain it from the diet.

SUBSTITUTION OF MARINE RAW MATERIALS IN SALMON FEED

Early diets contained mostly fishmeal and fish oil, which has resulted in the criticism that salmon farming consumes far more fish than it produces.

Two sources supply fishmeal and fish oil for use in salmon diets:

- Reduction fisheries; these are fish specifically caught for fish meal production; and
- Trimmings; these are by-products of fish caught for human consumption.

Skretting Australia supplies over 85% of the feed to the New Zealand salmon farming industry and over 90% of New Zealand King Salmon's feed. Diets supplied by Skretting (and other suppliers) to the New Zealand industry source >80% of the fishmeal used from reduction fisheries (primarily Peruvian anchovy).

There are both economic and environmental drivers to reduce the level of marine raw materials used in salmon feed. While volatile, the long term trend in fishmeal and fish oil prices has shown a steady rise. Aside from absolute price, avoiding the volatility of fishmeal and fish oil prices is also a strong commercial incentive to reduce their use in fish feed.

Index price of fishmeal and fish oil since 1998 (USD per tonne), from Crystal Ocean/Kilpatrick.

Fishmeal prices have risen due to the following:

- Increasing demand from aquaculture, particularly from China;
- Strong demand from agriculture (pig farming, poultry farming) - although currently fishmeal is usually priced out of this market;
- In the case of fish oil, the rise of the nutraceuticals industry (Omega-3 health supplements); on current trends, it is possible by 2020 this industry will consume all the world's production of fish oil;
- Static supply. While the key reduction fisheries are tightly controlled and relatively stable, they are fully exploited. There is no opportunity to increase harvests.

As a result, the major salmon feed producers have invested heavily in research to determine how the use of marine raw materials in fish feeds can be reduced, while still retaining fish health, performance and product quality and flavour. Skretting, for example, currently spends approximately NZ$10m per annum researching this field, including some money spent directly on research into fishmeal and fish oil substitution in King salmon feed for New Zealand King Salmon.

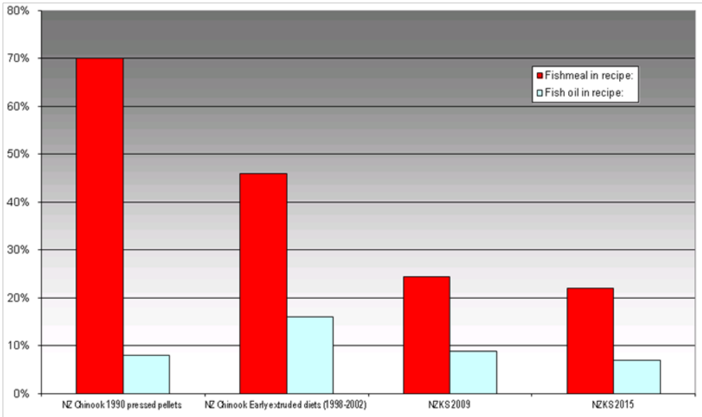
This research has resulted in significant progress. Marine oil has been replaced by other animal or vegetable oils, while marine protein has been replaced by land animal proteins and vegetable proteins. This substitution of products has led to lower cost fish feeds and an improvement in the raw material sustainability of the diets without compromising fish performance and product quality.

A recent advance in knowledge on fishmeal replacement has allowed a further step in fishmeal replacement with no loss in fish performance or product quality. Diets currently supplied to New Zealand King Salmon contain slightly less than 25% fishmeal, in contrast to 1990 diets that contained 70% fishmeal. In addition, the total amount of 1990 diet required per tonne of fish produced was greater than is needed with modern, energy-dense extruded diets. The amount of fishmeal and fish oil used historically and today in New Zealand King salmon diets is shown in below.

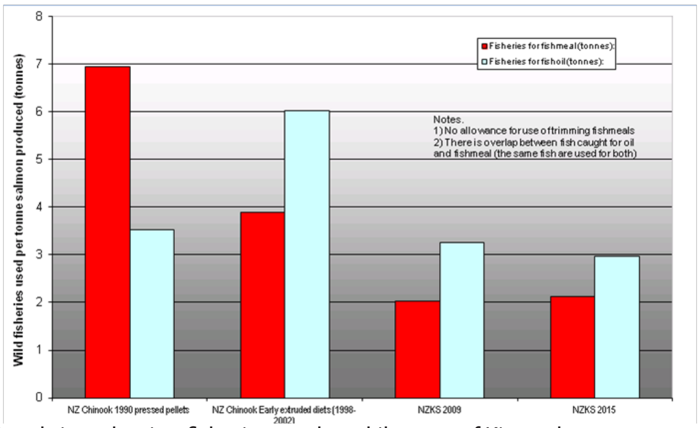
Combining the information from above with industry FCR's and reduction fishery yields of fishmeal and fish oil, allows the calculation of the kilograms of reduction fisheries consumed to produce each kilogram of farmed King salmon. Such calculations are commonly referred to as "FIFO calculations" ("Fish-In / Fish-Out") and the results are shown in below. This is a worst-case scenario, as it does not allow for the use of trimming meals.

It can be seen that the tonnes of marine resources used per tonne of King salmon produced has more than halved over the last 20 years. Currently, for each tonne of New Zealand King Salmon produced, 2.7 tonnes of anchovy is used for fish oil. Because the fishmeal from only 0.8 tonnes of anchovy is required, in addition to the tonne of salmon produced, a surplus of 422kg of fishmeal remains, which can be used for other productive purposes. By comparison, a wild salmon is estimated to require 10-20 kg of wild fish per kg of salmon produced.

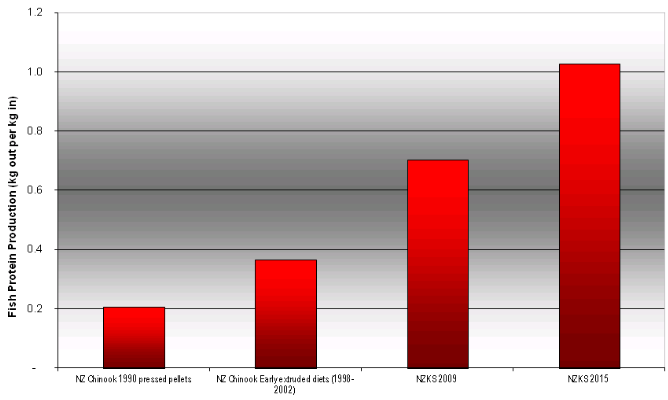
New Zealand King Salmon now produces more fish protein and fish oil than is consumed, and thus is a net producer of fish protein and fish oil. This is in marked contrast to the situation for King salmon production only 10 years ago, when two to three times more fish protein and fish oil was consumed than was produced.



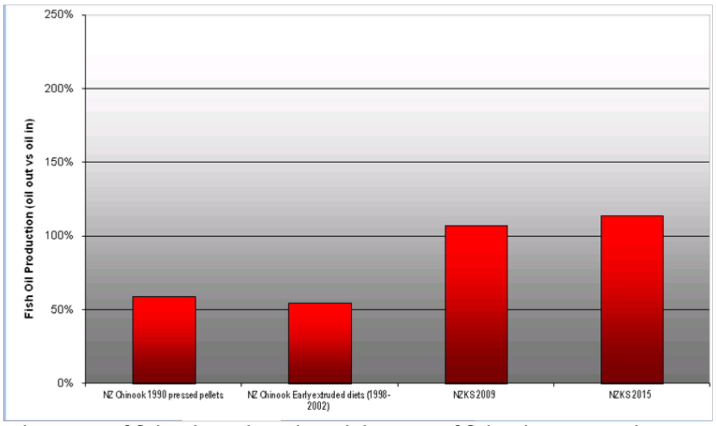
Trends in fishmeal and fish oil used in New Zealand King salmon diets. Amounts shown are weighted averages for whole-of-life production.



Trends in reduction fisheries used per kilogram of King salmon production (separate requirements for fishmeal and fish oil).



Kilograms of fish protein produced per kilogram of fish protein consumed in NZ King Salmon farming, historically and today.



Kilograms of fish oil produced per kilogram of fish oil consumed in NZ King Salmon farming, historically and today.

PROTEIN SOURCES

The proteins contained in fish food are a mixture of fish meal, land animal proteins and vegetable proteins.

It has been determined that fish do not require any particular protein raw material (such as fishmeal) per se, rather they require an appropriate mix of digestible amino acids (the building blocks of protein). The necessary mix of amino acids can be derived from a varied mix of different raw materials. Understanding the amino acid availability from specific raw materials is an important topic of research at fish feed companies.

The choice of protein source varies with cost and availability. Protein in New Zealand diets is typically derived from:

- Fishmeal; primarily Peruvian anchovy;
- Poultry meals (meatmeal, bloodmeal, feathermeal); these rendered products are a by-product of poultry slaughtered for human consumption in Australia. These products are excellent nutritional materials for carnivorous fish.
- Mammalian meals (meatmeal, bloodmeal); these rendered products are a by-product of cattle, sheep and pigs slaughtered for human consumption in Australia. Currently only bloodmeal can include porcine products due to New Zealand import restrictions.
- Plant protein meals; faba bean meal, lupin meal, corn gluten, wheat gluten and soya protein concentrate.

Bovine Spongiform Encephalopathy (BSE) has been raised as a concern around the use of mammalian meals in fish diets. This concern is unwarranted for the following reasons:

- Molecular studies indicate that fish prion proteins (PrP) have low similarity to mammalian PrP's, indicating a high species barrier.

- No transmissible spongiform encephalopathies (TSE's, of which BSE is an example) have been found in any fish species. Scientific committees of the European Union have concluded that there is no evidence of TSE's existing in any wild or farmed fish.
- Transmission studies have found no evidence that TSE agents can replicate or persist in fish, or pass from mammals to fish or from fish to mammals. Comparable studies in susceptible mammalian species readily demonstrate replication and transmission of TSE agents.
- It has been shown that trout do not absorb prions from their intestines and that prions cannot be detected in the tissues of trout that have been experimentally fed high loads of infectious prions.
- All mammalian products fed to fish in New Zealand must derive from only Australia or New Zealand – both of which are regarded by the World Health Organisation as being free from BSE.

Concerns around the presence of antibiotics and banned substances (e.g. growth hormones) in poultry products included in salmon diets have been raised. However these concerns are unwarranted, as poultry by-products used in New Zealand King Salmon diets derive from poultry slaughtered for human consumption in Australia. As such they are subject to strict controls on residues and a comprehensive residue monitoring program. For example, the Australian Government's National Residue Survey (NRS) for 2009-10 tested 330 commercial poultry samples (9570 analyses) and found no residues (including antibiotics) or environmental contaminants above the Limits of Reporting for products for human consumption.

OILS

It was traditionally thought that fish required fish oil in their diet. However research has shown that fish have a digestible fatty acid requirement that can be met from a variety of oil sources. Fish oil is still used extensively in salmon diets, but primarily to introduce long chain Omega-3 fatty acids (mostly EPA and DHA) into the salmon fillet. The fatty acid composition of a salmon fillet is strongly influenced (and to an extent mirrors) the fatty acid composition of the diet. At present fish oil is the only practical source of EPA and DHA.

Fish oil is a by-product of fishmeal production, although due to the rise of the nutraceutical industry it is now considered a particularly valuable commodity in its own right.

Poultry oil, a by-product of poultry slaughtered for human consumption, is used to replace fish oil in New Zealand salmon diets. This poultry oil is sourced from Australian poultry. Poultry oil acts as an energy source for the fish and has the same saturated fat content as fish oil.

The principal reason poultry oil is used in New Zealand is because of price and quality. In both Australasia and North America poultry oil is less expensive than the available vegetable oils. In some parts of the world, especially Europe and also Chile, vegetable oils are used in salmon diets. Neither vegetable oils nor poultry oil contain appreciable levels of EPA and DHA.

The proportion of marine oil used compared with the total oil added to the feed determines the proportion of long-chain Omega-3 expected within the oil in a salmon fillet. As the amount of marine oil used falls, the EPA and DHA in the diet is retained more efficiently; salmon retain Omega-3 more efficiently when there is less in their diet.

Expected long-chain Omega-3 content of King salmon fillets grown on different diet oil blends.

Fish oil as % of total oil added to feed	L-C Omega expected per 100g of fillet, harvest-size fish	Relative to requirement for FSANZ* claim "Good Source of Omega 3"	Fillet needed for Recommended Daily Intake of 500mg L-C omega-3 per day
100%	5000 mg	167 X	10 g
50%	2750 mg	92 X	18 g
30% (Current NZKS Diets)	1500 mg	50 X	33 g

*Food Standards Australia and New Zealand

Fillets remain a very good source of long-chain Omega-3, requiring the consumption of only 33 grams of fillet per day to meet the human recommended daily intake.

CARBOHYDRATE

Carbohydrate in the diet supplies a limited amount of energy to the fish, but in extruded diets is useful as a binding agent (it holds the pellets together).

The sources of carbohydrate used in diets to NZ King Salmon are typically:

- Australian wheat;
- Faba bean meal (which contains both protein and carbohydrate);
- Potato starch.

MICRONUTRIENTS

A number of vitamins and minerals are required to maintain fish health; most are not discussed individually in this document. Research over many decades has identified these requirements, with refinement in understanding continuing today. A vitamin and mineral premix is added to all modern diets, at an inclusion rate below 1%.

To allow salmon to develop normal flesh colour and for fish health, astaxanthin is added to diets at amount of less than 80ppm. Astaxanthin accumulation is a biological requirement of salmon, as demonstrated by the fact that salmon muscle contains binding sites specific to astaxanthin, unlike the muscle of most other fish species. These binding sites cause salmon to capture and store ingested astaxanthin. When astaxanthin is fed to species of fish that lack these binding sites, their flesh remains white. The astaxanthin used is synthesised chemically, but is chemically identical to that which exists in nature.

Zinc is an essential micro-nutrient in salmon diets. Insufficient zinc leads to cataract formation and other fish health problems. Zinc can be supplemented in the diet in two forms – inorganic zinc (for example zinc sulphate) or organic zinc (generally complexed with an amino acid, e.g. zinc methionine). While both can meet the zinc requirements of fish, organic zinc is absorbed much more efficiently by fish than inorganic zinc. The raw materials in the New Zealand King Salmon diet contains about 50-70 ppm zinc. This zinc is associated with calcium and as such is unavailable to the fish and is not considered to be able to meet any of the zinc requirement of the salmon. Currently diets are supplemented with 100ppm inorganic zinc, resulting in a total diet zinc content of about 160ppm.

Dietary zinc has a potential environmental impact because some of the zinc in the feed is excreted and can accumulate in the sediments under and around a fish farm. In August 2011 NZ King Salmon switched to using organic zinc in their feed; this will be supplemented at 37.5ppm, and will reduce the total zinc content in the diet to approximately 95ppm. In addition, use of organic zinc will mean a greater percentage of the zinc remaining in the diet will be absorbed, rather than excreted. The overall result will be much reduced zinc output from the fish into the environment.

Experience of organic zinc at Canadian salmon farms indicates it produces very marked reductions in sediment zinc, compared to the use of inorganic zinc, with improvements of between 40-60% observed. It is expected that similar improvements will be observed at the New Zealand King Salmon farms.

SUSTAINABILITY OF FISH SPECIES USED FOR MARINE OIL AND MARINE PROTEIN

Reduction fishery species are often small, bony and not favoured (or readily caught and processed) for direct human consumption. Species caught in reduction fisheries (such as Peruvian anchovy) are generally fast-growing and short-lived. As a result they are considered generally resilient to fishing pressure.

However reduction fisheries can be over-fished. The Peruvian anchovy fishery, from which most New Zealand King Salmon fishmeal and fish oil currently derives, was increasingly over-fished through the 1960's and effectively collapsed in the early 1970's. It did not show significant recovery until the 1990's, when strict controls supported by research were introduced.

Since the 1990's the fishery has shown generally stable biomass despite natural environmental swings (particularly due to El Niño). Government authorities apply tight monitoring and control to this fishery, regularly restricting or halting fishing when biomass surveys indicate this is necessary.

ABSENCE OF GMOs, ANTIBIOTICS, MERCURY, POP'S

Feed supplied to New Zealand King Salmon does not contain genetically modified organisms (GMOs) according to legislation in the EU, Japan and Norway.

Under Australian and New Zealand regulations the feed is deemed "GMO DNA-free". While the feed contains no GM organisms, some of the vitamins included as micro-additions have been manufactured by GM organisms. The organisms themselves are not present in the feed.

Unwanted contaminants, or residues (e.g. heavy metals, antibiotics, persistent organic pollutants (POPs, such as dioxin)) can potentially enter feed primarily through raw materials. To control the risk from residues, feed companies operate a comprehensive residue monitoring program. Skretting for example has the following contaminant residue monitoring programme in place:

- Consists of global analysis (shared results tested at specially selected overseas laboratories) and local analysis (additional tests chosen by Skretting).
- The global tests are decided each year by Nutreco's Food Safety specialists (Nutreco is Skretting's parent company) who have an understanding of which contaminants are the most important scientifically, politically and socially.
- Skretting tests many samples of feed and raw materials for a profile of residues each year. Hundreds of results are collected each year mainly focussed on heavy metals, antioxidants, dioxins, polychlorinated biphenyls (PCB's), nitrosamines and pesticides.
- EU limits are applied to all tests, as these are the most thorough and stringent.

Results from these monitoring programmes enable feed companies to purchase their raw materials from low risk regions and suppliers, and to obtain a thorough understanding of food safety risk in the aquaculture industry around the world.

Skretting publishes a Residue Report biannually, which is available to customers on request. These monitoring systems have shown residues in all Skretting feed to be far below all FDA, EU and Australian limits.

As with terrestrial agriculture, antibiotics may be applied in aquaculture to control disease. In the rare case that they may be used in aquaculture, they can be administered either via feed or injection. Under New Zealand law, they can only be included when prescribed by a veterinarian and will require consent if added to the food.

Due to the lack of salmon diseases in New Zealand coastal waters, antibiotics are not required in the New Zealand salmon industry, and as such, Skretting has never supplied salmon diets that contain antibiotics to any New Zealand customer. However, it should be recognised that although this is the current enviable situation for New Zealand salmon farmers, there may be a requirement to use an animal remedy at some point in the future. Management of this use will be under the Agricultural Compounds and Veterinary Medicines Act 1997, and the Hazardous Substances and New Organisms (HSNO) Act 1996.

Similarly, there is no need for lice treatments or anthelmintics (also sometimes supplied via feed) in the New Zealand salmon industry, and such products have never been used in commercial production. However, if the need arose, antibiotics, lice treatments, anthelmintics or other animal remedies could be added to the feed.

FEED AND FAECES

The majority of benthic nutrient enrichment around a well-managed salmon farm derives from faeces excreted by the salmon. With poor feed management , uneaten feed pellets can also contribute to benthic enrichment. Poor feed raw materials and production processes can also affect digestibility and thus contribute to benthic effects. Old-fashioned steam-pressed pellets resulted in the release of uneaten chip and dust to the seabed. Modern farms that use waste feed detection systems (such as feeding cameras) when feeding extruded diets, avoid most uneaten pellet loss.

There is some scope to influence the release of faecal nutrients into the environment by manipulating feed composition. Switching to higher-energy diets could potentially reduce faecal dry matter output by 20% or greater. This is likely to be the subject of research in the next few years. It is expected that, for New Zealand King Salmon's current feed range, about 20% of the dry matter consumed is excreted as faeces.

Technology is already being applied to manipulate the physical properties of fish faeces for some applications (e.g. hatchery systems). This could potentially be used to assist faeces to disperse from around seafarms, diluting them, or to concentrate faeces directly under farms to limit the size of effect footprints (or to assist collection). Such manipulation will require further research before commercial application in a seafarm setting.

FEEDING THE SALMON

Salmon feeding behaviour is complex, and the appetite of the fish varies over time, in addition they feed to a depth of at least 7-10m making feeding behaviour difficult to monitor from the surface. There are two key parts to New Zealand King Salmon's feeding system; the feed delivery equipment which delivers the food to the net pens, and the feed monitoring equipment which monitors feed consumption and pellet wastage.

On New Zealand King Salmon farms 'spinner' and 'Akva' systems are used to deliver the feed. These systems have been developed to minimise feed wastage and maximize salmon satiation. They ensure adequate distribution of the pellets in the net pen to enable every fish to have access to them.

Feed pellets are delivered to the farm in large bags (~1mt) and stored in the barge until required. Newer barges such as that currently at the Waitata farm have hoppers into which the feed is placed on delivery. On the older barges bags are stacked in the storage area then emptied into a hopper or feed silo as required and the feed is either delivered to the net pens via a mobile hopper (older spinner system), or propelled from the feed silos in the barge through pipes by air to the individual net pens (Akva system). The newer barges use the Akva blower system.

An older spinner system is used at Ruakaka. Feed is delivered to the spinners via transportable hoppers. Pellets are fed into the system from these transportable hoppers suspended above each net pen; the pellets fall into a motorised spinning disk that spins them out via a restriction plate (to control the rate of feed delivery) over a wide area of the net pen.

Salmon feeding systems; (a) transportable hopper; (b) spinning disk; (c) Aquasmart buoy and feeder; (d) AKVA camera.

The Akva system, used at most sites, is used as a means to move feed pellets which have been emptied into the feed silos in the barge.

The feed is transported in plastic (HDPE) pipes using airflow to the appropriate net pen where it is spread around using a roto-spreader which is attached to the end of the feed pipe in the net pen. The rate and quantity of feed delivered to the net pens is controlled using the AkvaSmart computer programme . An underwater video-camera is placed in the water under the feed drift zone; this is connected to a television monitor in the farm office, which is watched constantly during feeding to enable the feed rate to be adjusted based on the number of pellets drifting past the camera.

When the fish reach the required harvest weight, at 10-15 months, feeding is stopped for approximately three days to ensure their stomachs are empty prior to harvest.

REDUCING WASTE FEED

Feed costs are the most expensive component of producing salmon, accounting for up to 60% of production costs. In addition, the high organic content of feed means that an accidental deposit of waste feed on the seabed over time will have a greater environmental impact than the faecal matter that is deposited in the farm footprint. The minimisation of waste feed is therefore both a commercial and environmental objective of New Zealand King Salmon.

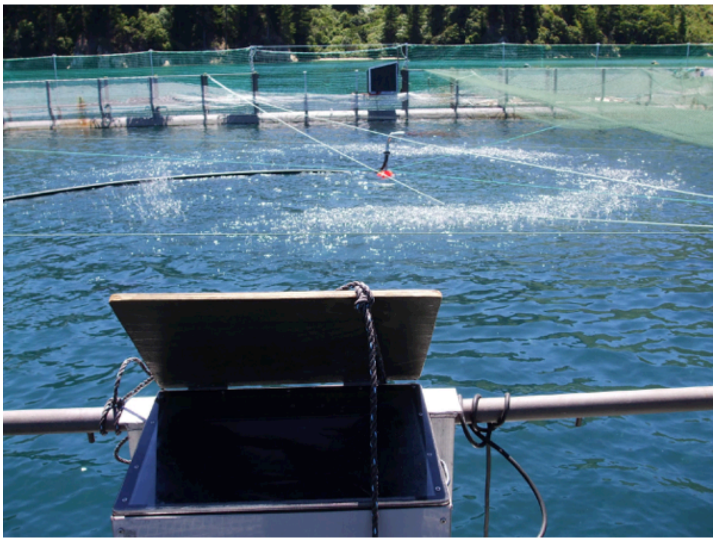
Although very minimal, feed lost to the environment may occur as a result of:

- Too much feed delivered to the fish during a feeding period as a result of incorrect settings and/or monitoring of feed delivery systems.
- Fish swimming activity during feeding causing feed to be dispersed/lost through the netting net pen.
- Failure of control mechanisms in feed delivery system, leading to non-programmed feed delivery.
- Predator activity during feeding causing fish to go off their feed as pellets are passing through the water column.
- Small fish such as mullets and spotties may enter the net pens through the mesh and feed along with the salmon; however this has not been observed to be a major issue at NZ King Salmon's farms.

New Zealand King Salmon has addressed all the points above and continues to work to further reduce feed wastage. Measures to reduce feed wastage include:

- Continual evolution of feeding strategies and feeds with better understanding leading to reduced wastes. In particular, NZ King Salmon has observed considerable reductions in feed wastage by constantly monitoring net pens with cameras in them to ensure feeding is stopped before feed is wasted. As a result, all camera monitored pens are continuously monitored by New Zealand King Salmon staff during feeding in order to reduce feed pellet waste.
- Feed is delivered to each net pen either by a spinning disc on the hopper or rotating blower system (roto-spreader). Salmon feeding activity is kept away from the outside edges of the net pen by adjusting the spread of the feed; this reduces the risk of feed in the water being dispersed out of the net pen through the netting while fish move energetically within the net pen.
- Feeders, hoppers and delivery systems are checked at least once a day to ensure that they are working properly, and audits on the spinners are conducted regularly.
- Feed is transported to the farm using a fit for purpose vessel. The crane and forklift used are certified to lift in excess of the weight of a feed bag. Lifting strops and chains comply with OSH requirements for the task of off-loading from the transfer vessel to the barge at the site. On older barges the feed is stored in an area where spillage cannot directly enter the sea. Feed is moved within the barge by electric hand forklifts and chain hoists are used to lift the feed into the silos or hoppers. Newer barges have silos loaded directly from the delivery vessel so does not need to be moved within the barge.

Roto-spreader in operation feeding the fish.



In addition, New Zealand King Salmon has carried out initial experiments to measure feed loss at two of its farms using existing feeding equipment. The trials were conducted at Te Pangu, a high flow site where the Akva camera feeding equipment is used, and Ruakaka, a lower flow site where the spinners are employed. The methodology and results of these assessments were as follows:

- Te Pangu: the airlift system, generally used to assist with the retrieval of morts was activated in the test net pens during feeding, to direct any waste pellets into a multilayer net where they were trapped. The quantities of trapped pellets were counted and recorded daily. At the end of the month long trial, the percentage waste was calculated as a proportion of the total amount fed, and was found to be far less than 0.1%, or a handful of pellets over the course of a month.
- Ruakaka: Divers checked the bottoms of the nets after every feed for a week. These initial trials found no evidence of feed pellets caught in the nets, which were fouled enough to prevent pellets falling through the net.

ENVIRONMENTAL MANAGEMENT

It is important that salmon farms are managed sustainably to ensure long term tenure and stewardship through not compromising the environment and fish health, thereby ensuring that the quality of the fish is good and economics of the business is sound.

New Zealand King Salmon works within the environmental constraints at each farm site by managing production levels to ensure compliance with its agreed consented conditions. Older consent conditions will eventually be reviewed and BMP benthic guidelines will be adopted across all pre EPA sites prior to or during 2024.

Following completion of the annual monitoring, Cawthron provides New Zealand King Salmon and MDC with an annual monitoring report which is independently peer reviewed. New Zealand King Salmon operates its farms using an adaptive management process. This ensures that, in the event that any farm exceeds the agreed environmental quality standards, a farm management response is immediately activated to bring the farm back within the agreed standard. This response is clearly identified in the EPA site consent conditions and also in the BMP benthic guidelines that have already been adopted on the Te Pangu farm and about to be adopted on the Clay Point farm

The New Zealand King Salmon Board, management team and staff are fully aware and committed to the need to act responsibly to ensure the ongoing environmental integrity of the Marlborough Sounds. An Environmental Policy for Aquaculture Operations has been in effect for a number of years. A Board appointed committee, which includes an external expert, has been appointed to oversee the implementation and management of this policy.

Salmon farming does result in an environmental footprint, but this is kept to a minimum by modern and effective farming practices and technical innovations. The objectives of the Environmental Policy are a commitment by New Zealand King Salmon to:

- Implement sustainable and environmentally sound business practices.
- Work in harmony with our unique environment.
- Meet the requirements of the relevant legislation and the Aquaculture New Zealand environmental code of practice for salmon farms "A+".
- Continuous improvement to strive for world class environmental standards.
- Take organisational and personal ownership for the Environmental Policy.
- Ensure that New Zealand King Salmon's environmental footprint is well managed.
- Work within the principles and implementation of sustainability and environmental awareness.
- Provide corporate leadership in environmental awareness.

CONSOLIDATED FARM MANAGEMENT

One of the strengths of New Zealand King Salmon from a market perspective is the ability to produce fish year round that are consistent in quality and size. Recognition of the various attributes of each of the farm sites, and managing these sites in conjunction with one another is an important aspect that contributes to the company's ability to achieve consistent production.

Each of New Zealand King Salmon's existing and proposed sites have slightly different attributes, in particular with regards to water temperature and current flows. In order to maximise the attributes of each site, New Zealand King Salmon uses an integrated management strategy, whereby all the existing farms are treated as one integrated system to farm salmon. This allows New Zealand King Salmon to utilise resources efficiently, whilst minimising risk, as well as to achieve year-round production of a consistent product for customers.

New Zealand King Salmon acknowledge that ideally the farms would be managed in three discrete geographic areas to minimise the potential for disease or pest species introduction and transference around the Sounds. However this strategy is not practical from an operational perspective, and given the low likelihood of disease outbreaks or the transfer of pest species as a result of salmon farming, the company has chosen to operate the farms as an integrated unit, although with separation distances that are in excess of overseas norms. In the event of a disease outbreak or marine pest infestation, New Zealand King Salmon would implement a management response to ensure that salmon farming operations are not responsible for spreading disease or marine pests throughout the Sounds.

Water temperature has the strongest effect on salmon growth, so managing the sites according to their temperature profiles enables New Zealand King Salmon to achieve greater growth rates of the young fish during the warmer summer months. Examples of this approach include:

- Only introducing smolt into the cooler Tory Channel sites (Clay Point and Te Pangu) during spring, in order to avoid warmer water temperatures over summer (which results in high smolt mortalities). The young salmon are held at these two sites until around April, when water temperatures have dropped sufficiently at the other sites so as not to impact on growth or survival. The fish are then transferred, by towing them in sea pens, to these sites where they will stay until harvested.
- In the cooler autumn month's smolt can be introduced to any of the operating sites, as water temperatures are well within the optimum range of the fish.
- Water temperatures at Otanerau in summer exceed the maximum temperature for optimum growth of the salmon (18°C), so salmon are only grown on this site during the cooler eight or nine months of the year. During summer the designated Otanerau smolt are held at one of the Tory Channel sites with cooler water temperatures.

Other specific methods utilised internationally for managing a group of salmon farms include the following:

- Fallowing: There are options for the use of fallowing as a management strategy, as follows:
- Disease management: Fallowing could potentially be used by New Zealand King Salmon to manage disease, as removing disease hosts (i.e. fish) from the site results in the disease cycle being broken.
- Single Year Class: This is a good strategy in salmon farming areas where disease is an issue, as it prevents diseases from being transferred across the generations.
- Geographic Spread of Farms: In salmon farming areas where disease is prevalent, this is a good strategy. However in New Zealand, salmon farms are widely spread, particularly in areas where water currents are slower and therefore the farm is 'flushed' less often.

BIOSECURITY

Salmon genetic material (i.e. eggs, milt, broodstock) is not imported to New Zealand, so there is no biosecurity risk posed by that means. New Zealand King Salmon's Biosecurity Management Plan includes on-farm, as well as vector-based, management measures to reduce the risk of spread, including:

- Methods to manage vectors that could spread marine pests and disease agents to or from salmon farms;
- Routine practices to manage fouling of nets and structures;
- A passive surveillance regime to facilitate early detection of unusual or suspicious organisms associated with farm structures;
- An effective disease surveillance regime for salmon stock;
- The use of husbandry and harvesting methods consistent with best practice for the minimisation of disease risk;
- On-farm management measures to prevent, control or contain biosecurity risks to the extent practicable.

RISK MANAGEMENT

New Zealand King Salmon have undertaken an assessment of the potential risks to farming operations. In addition the company has the following emergency response plans in place:

- An Emergency Response Plan has been prepared in consultation with the Harbourmaster that deals with potential issues such as navigation and tsunamis.
- A detailed Oil Spill Plan is included as part of the Seapen operations manual. This instructs farm workers on specific protocols that must be followed to enable a planned response to an oil or hydrocarbon spill from any of the farm sites.
- Net pens are able to be towed to a 'safe' location in the event of a toxic algae bloom.
- Jellyfish can be 'attracted' to the grower nets by the vortex created by the salmon swimming behaviour. This is not a problem if the jellyfish are present in small numbers, but if the jellyfish bloom as a result of favourable environmental conditions, 'jellyfish strike' can occur. Sheer numbers of jellyfish block off the water exchange to the net pens (by blocking the mesh), thereby depleting oxygen and causing the net sides to contract. This causes the fish to panic and increase their swimming speed, thus creating a vortex and 'attracting' more jellyfish to the walls of the net pen. A process for preventing and resolving such an event, should it occur, is detailed in the Seapen operations manual.

SEABED REMEDIATION OPTIONS

Salmon farming is known to cause a localised impact to the seabed within the 'footprint' of the farm. Remediation of this impact by natural processes can only occur if the farm stops production, or waste matter falling to the seabed from the farm is much reduced or ceases.

Numerous attempts have been made by the global aquaculture industry to minimise the environmental effects of salmon farming operations. Some of the options assessed by Cawthron for the Ministry for Primary Industries (MPI) and New Zealand King Salmon, to minimise the environmental impact include :

- Collection of organic wastes before they reach the seabed, or physical remediation of impacted sediments. A number of solutions have been proposed or trialled overseas, including: collection of particles falling to the seabed; deployment of artificial reefs beneath net pens to process farm waste before deposition; collection of detritus from the seabed using submersible pumps; and harrowing of enriched seabed sediments to enhance oxygenation and organic matter processing.
- Microbial and chemical remediation. Techniques that involve adding a mixture of bio-fixed bacterial species (bio-augmentation) and oxygen release compounds (bio-stimulation) as a means of enhancing the rate of decomposition of organic matter in sediments have been trialled beneath fish farms overseas. These trials have indicated the potential for enhancing recovery rates in organically rich sediments, but they are yet to be tested at full farm scale.

New Zealand King Salmon along with other salmon farmers employed the Cawthron institute to carry out a seabed remediation trial on its Forsyth Bay salmon farm. Four options were trialed on a relatively small scale including aeration, injecting water, harrowing and removal of the sediment. Only removal appeared to have any benefit, however a further trial on a commercial scale will be required before the effectiveness and practicality of that technique can be determined. A further trial is proposed, however New Zealand King Salmon maintains a watching brief on developments in this area.

FISH HEALTH AND WELFARE

FISH WELFARE

King salmon are naturally shoaling animals, and as such being contained in a net pen is not contrary to their natural instinct. New Zealand King Salmon's maximum stocking rates result in only 2.0% of the net pen volume being occupied by fish, with seawater comprising the remaining volume.

Salmon producers globally suffer from significant diseases and parasites, however New Zealand is fortunate in that our coastal waters are currently free of major salmon pathogens such as bacterial kidney disease (BKD), the skin parasite Gyrodactylus salaris, and infectious salmon anaemia (ISA). While sea lice species such as Caligus sp. are a major concern to salmon farmers in the northern hemisphere, parasitic sea lice are not an issue for New Zealand raised King salmon.

Every fish in the farm is valuable to New Zealand King Salmon, and fish welfare is therefore very important. New Zealand King Salmon have a detailed section on King salmon (biology, life-cycle, diseases) in their Training Manual, which is used as a resource for all new staff joining the Aquaculture team. New Zealand King Salmon complies with animal ethics legislation.

The likely cause of death is determined for all morts as a preventative measure to identify trends and potential problems (e.g. algae bloom, disease outbreak, poor water quality). New Zealand King Salmon also has a protocol that must be followed by farm staff in the event that elevated numbers of morts are observed. This includes detailed instructions for taking samples of the morts and healthy fish for histological and bacteriological analysis so that the cause of the increased mortalities can be accurately determined.

New Zealand King Salmon harvest their fish when they are still immature, as once mature they have very little market value. The Humane Slaughter Association, based in the UK, has visited NZ King Salmon operations and approved the harvesting techniques employed.

MANAGING MORTALITIES

Mortalities are a fact of life when raising animals, and salmon that die in the net pens are colloquially known as "morts". The deaths occur for a number of reasons, such as age, from lesions, predator damage, congenital defects, secondary infections, runting or natural attrition. These impacts naturally occur in the wild.

Morts collect at the bottom of the net pens and are retrieved by divers at least twice a week, or on the new farms by running the air lift equipment which creates air flow and sucks the fish to the top of the net where they can be collected.

Mort collection is important for a number of reasons:

- To count to maintain accurate production records
- To classify them according to cause of death
- To ensure early detection of problems with the fish, and if necessary implement a management response to prevent further losses
- To minimise attraction of predators to the net pen such as sharks, which can feed on the morts and damage the nets
- To minimise the potential spread of disease from morts to the living salmon
- To minimise waste and additional weight in the net pen from the morts.

New Zealand King Salmon has secure storage units on all farms for holding mortalities. The morts are regularly collected by one of the service vessels and disposed of by rendering hereby minimising any odour associated with fish mortalities.

HARVEST AND PROCESSING

Fish are humanely harvested and transferred to the processing operation in Nelson on the day of harvest. In Nelson, all fish are gutted and gilled, inspected, graded and weighed. Premium fish are graded Ōra King based on a stringent set of quality requirements.

Processing commences on the night of harvest, ensuring the freshest possible products are packed for all global markets with despatch of whole fresh fish generally the following morning. Fish will either be sold whole, or go on for further value-added processing. New Zealand King Salmon's processing operations include wood roasting, cold smoking, marinating, filleting and portioning of salmon.

Further planned capital investment is targeted at improving harvesting and processing efficiency, and providing increased capacity for value-added and premium product processing.

New Zealand King Salmon has a specialist harvesting team of nine staff who commute on a dedicated vessel to the farm they are harvesting from. During the harvest period at a given farm, the team harvests up to 50-60 tonne per day, five days a week (Sunday to Thursday), which ensures continuance and consistent supply to all customers.

In order to collect the fish for harvest, the harvest team drop a 'snatch' net into the net pen that the fish are to be harvested from and a proportion of the fish in that net pen are confined. The net then holds these fish at the surface and is used to guide them to a floating pontoon which has been placed in the net pen by the harvest team.

Once guided into the pontoon, the fish pass through a number of compartments containing anaesthetic (Aqui-S) to sedate them. and finally into a compartment containing carbon dioxide saturated water which renders them comatose. This series of compartments ensures that the fish are anaesthetised prior to death and is designed to make the harvest process as stress free and humane as possible for the fish with the added benefit of maintaining quality out-turn.

Once comatose, the salmon are lifted by a brailer onto a table on the 'dumb' barge moored alongside the farm during harvest operations. The main artery in the throat of the fish is cut by hand and they are placed into insulated bulk tankers and bins filled with ice slurry where they continue to bleed. The harvested fish are then collected by a motorised barge and transported back to the closest port (Picton or Havelock) and trucked to the New Zealand King Salmon factory for immediate processing. The blood and water is contained in the insulated bulk tankers and bins and disposed of appropriately at New Zealand King Salmon's primary processing plant along with other waste.

INFRASTRUCTURE

NZ King Salmon has a range of infrastructure requirements necessary to support farming operations.

NZ King Salmon only utilises the ports of Havelock and Picton to support its net pen operations; it is very rare for the company to access alternative port facilities such as those at Elaine Bay, Pelorus Sound. It is not envisaged that this will change with the development of the proposed sites.

The Havelock and Picton facilities are well placed to support marine farming operations, and at each of these ports NZ King Salmon utilises the following:

- Port facilities to transfer feed, ice, equipment,
- Port facilities to transfer live and harvested fish;
- Barge services;
- Light engineering and utility services;
- Vessel repair and maintenance services;
- Dive industry services.

The factories in Nelson currently undertake all of NZ King Salmon's processing; however in the event that production is markedly increased, it is likely that NZ King Salmon will develop a processing factory in Picton, closer to the Marlborough Sounds farms and to major transportation routes.

Currently all salmon feed is imported; however the feed companies have indicated that should the total New Zealand requirement for feed exceed 30,000mt then construction of a feed mill in New Zealand would be seriously considered with Marlborough as the prime candidate if that is the area where fish production is greatest.

NZ King Salmon currently air freights whole fresh gilled and gutted fish from Nelson airport, however at times this puts pressure on the freight capacity of the airport and charter planes have been used on occasion. The development of a primary processing factory in Picton, and the potential for increased air freight requirements would strongly support the case for Blenheim airport to utilise larger planes, which would also benefit tourism operators and other primary producers in the Marlborough region.

REGIONAL SPILL-OVER BENEFITS

The June 2015 ASB Regional Economic Scoreboard rated the economic performance of Marlborough as near the bottom of the pack.

As part of its operations, NZ King Salmon is linked to other supply sectors; therefore any growth has 'ripple' effects whereby increased expenditure can deliver additional benefits elsewhere in the regional economy.

There are also a number of local servicing companies who benefit significantly from NZ King Salmon's operations; these include:

- Barge services;
- Wharf and port facility providers
- Engineering suppliers;
- Science providers;
- Tourism and travel operators;
- Professional service providers (e.g. information technology, employment/human resources, etc).

As the most significant growing area in New Zealand for King salmon, the Marlborough region will receive significant profile worldwide as NZ King Salmon evolves the 'provenance' proposition. While it is hard to assign a dollar value to this in terms of benefit to the region, there is no denying the benefits received from the Marlborough region's profile as a producer of 'sauvignon blanc'.

LABOUR

We employ approximately 440 people, of whom approximately 350 are involved in production (breeding, growing, harvesting and processing fish).

Fish breeding and growing typically requires access to skilled labour which can be difficult to source domestically. At times, we have recruited offshore when we have needed to replace skilled aquaculture positions.

OPERATIONAL VESSELS

NewZealand King Salmon has a range of vessels that are used by team members for transportation to and from the sea farms. Health and Safety is of the utmost importance to New Zealand King Salmon and the company has a detailed Vessel Operation Policy, including a maintenance plan, to ensure the vessels are operated in a safe and responsible manner so as to minimise risk to New Zealand King Salmon personnel and property.

New Zealand King Salmon currently utilises three distinct types of vessel, as follows:

- Farm tenders for use in the enclosed water limits of the Marlborough Sounds, operations restricted to particular areas depending on the farm they are based at.
- Water taxis for use by commuting staff in the enclosed water limits of the Marlborough Sounds.
- Larger work vessels, also for use within the enclosed water limits of the Marlborough Sounds.

All staff operating the vessels must have undertaken appropriate training to enable them to operate the vessel safely and responsibly. There is a fully qualified skipper and first aider on board at all times, and staff in the vessels can communicate with the farms and land-based operations via cellphone. The vessels are also fitted with marine radios and emergency locator beacons. In addition New Zealand King Salmon has a Designated Person Ashore who is responsible for the appointment, training and management of vessel skippers and vessel operations.

New Zealand King Salmon's Safe Ship Management programme requires all vessels to keep logbooks. In addition, any damage, accident or incident that occurs to or on the vessels is reported in accordance with New Zealand King Salmon accident and incident reporting procedures. Following an accident/incident, a review of the event is undertaken, and operating procedures are modified if necessary.

In addition to the vessels owned by New Zealand King Salmon, a number of other specialist vessels are utilised during salmon farming operations, these include:

- Large barges to transport the truck and trailer units carrying smolt for the farms, bulk bags of feed, harvested fish and other large freight. These barges are operated by O'Donnell Park Barging Ltd (Picton) and Johnsons Barge Service Ltd (Havelock).
- Barges for special activities such as predator net changes. These barges are usually supplied by Kenny Barging Ltd.
- Tugboats are used for towing the net pens between sites.

New Zealand King Salmon vessel activity varies seasonally, with the main activity as follows:

- During harvest (which lasts approximately three months at any given farm), the harvest barge and harvest crew vessel commute daily from Sunday to Thursday.
- Commuter vessels travel to and from the farms Monday to Friday.
- Barges transporting food, and carrying out other logistical work (e.g. net changing, moving equipment etc) usually travel to the farms twice a week.
- Tugs and barges are utilised to move net pens/fish once or twice a year.
- Vessels carrying customers, television crews and other one-off visitors.

PROCESSING & DISTRIBUTION

The newly harvested fish are transported via truck to New Zealand King Salmon's main primary processing plant in Nelson, where they are gilled, gutted and undergo a quality control inspection. The Picton factory, to be developed once volume threshold is obtained, is also intended to be a primary processing plant, which will eventually receive a proportion of the newly harvested fish.

At the primary processing plant fish are then graded and, if not being dispatched whole as gilled and gutted (G&G) product, they are sorted and either processed for fillets at the main factory, or sent to one of the other three processing plants where the 'value-added' processing (e.g. hot smoked, cold smoked, gravalax, portion control etc) is undertaken.

ALTERNATIVES TO NET PENS

There are several ways in which salmon may be harvested:

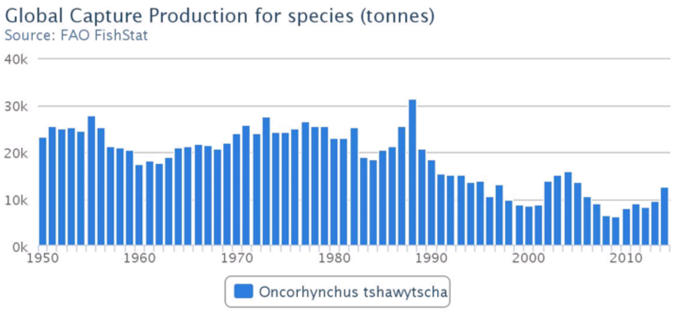
- Wild fishing using lines and nets;
- Ocean ranching whereby the salmon are hatched in a hatchery, released to the wild, and caught during their run back up the river to spawn (generally considered a form of wild fish);
- Closed containment salmon aquaculture, also known as re-circulating aquaculture systems, whereby either a land or sea-based containment system of some description is used and the water recycled through the system.

WILD FISHING

The indigenous King salmon population in the northern Pacific Ocean and southern Arctic Ocean is heavily fished. FAO Fisheries statistics for the global capture production for King salmon show a steady decline in wild catch.

Wild fishing of salmon commercially is not an option as salmon is not part of the New Zealand quota management system; all wild salmon in New Zealand are reserved for amateur fishing, and any salmon caught at sea must be landed as bycatch. In addition it is not likely that there are sufficient wild stocks in this country to sustain a regular commercial salmon harvest.

The declining quantities of wild salmon caught can be contrasted with the increasing demand for the species. Wild King salmon are at risk of overfishing and global aquaculture and New Zealand aquaculture alone, which produced ~12,500mt liveweight of King salmon in 2015, exceeds the King salmon global capture industry (12,441mt in 2014).



Global capture production for Oncorhynchus tshawytscha (FAO Fisheries statistics).

OCEAN RANCHING

Ocean ranching is the method by which much of the wild salmon fisheries in New Zealand and in other parts of the world remain stocked. First attempts at ocean ranching in New Zealand were carried out in the 1980s in Golden Bay, and on the Waitaki and Clutha Rivers (as part of the ICI/Wattie Salmon project). The first major commercial attempt was at Tentburn, a 6.7 hectare site on the Canterbury Coast which was originally established for this purpose, however, this site failed as an ocean ranching facility due to fishing pressure and predators such as seals. The Tentburn site is currently one of New Zealand King Salmon's three hatcheries.

Internationally, ocean ranching was attempted in countries like the US, Canada and Scandinavia before sea pens were introduced in the 1960's and 1970's. However, because the fish are "wild" the hatchery has no proprietary interest until the grown salmon are back within the facility, limiting a company's chances of benefiting financially from their investment.

Because of this, the method has mainly been used by public authorities and non-profit groups as a way of artificially increasing salmon populations in situations where they have declined due to over-harvest, the construction of dams and habitat destruction or disruption. Unfortunately, there can be negative consequences of this sort of population manipulation, including genetic 'dilution' of the wild stocks. Many jurisdictions are beginning to discourage supplemental fish planting in favour of harvest controlled habitat improvement and protection. As New Zealand does not have native stocks this is not an issue.

LAND BASED SYSTEMS

There are two main types of land based systems for raising salmon, as follows:

1. Flow-through (single pass) freshwater systems, employed by salmon farmers such as in the hydro-electric canals and rivers of the central South Island. The three New Zealand King Salmon hatcheries are flow through.

2. Closed containment systems, where seawater is pumped ashore or use limited amounts of freshwater. Such systems are not common in areas where land has a high value and energy costs are high. This precludes the majority of New Zealand for this type of farming.

New Zealand King Salmon has had firsthand experience with growing fish to a harvestable size in a freshwater land-based facility. Prior to 1998, the Waikoropupu Springs, Takaka site was producing up to 367 mt of harvest salmon per annum. Quality issues, including fish size, along with an increased need by the company for space and water for smolt and broodstock rearing resulting in New Zealand King Salmon ending land-based rearing of adult fish.

Internationally, there are a number of small-scale operators that use closed containment systems to grow salmon to harvest. These include:

- Aqua Sea Corporation in Washington State; who grow Coho salmon in a land-based freshwater system and market the product as 'Sweet Spring' salmon.
- Swift Aquaculture in British Columbia, produce Coho in freshwater systems on land.
- Agrimarine in British Columbia grow Atlantic salmon in a freshwater system on land, and recently launched a floating seawater system.
- Danish company, DTU Aqua is currently developing technologies to produce large trout (and potentially salmon) in a land-based seawater system.

Currently there are no large scale land-based seawater farms in New Zealand, as they are generally not suited to the New Zealand way of farming. The risks associated with the water intake system collapsing and/or breaking, disease management and disposal of effluent trapped in the settlement tanks remain problematical for this type of land based farming system.

While favoured by some environmental groups and those opposed to net pen farming, closed containment and re-circulating aquaculture systems are mainly limited to hatcheries and small producers. The primary reason for this is that both land based marine farms and re-circulating water systems require large amounts of capital and a high degree of technical skill and high running costs. Fish quality such as taste and texture can also be quite different from the prefered marine farm grown product.

NZ King Salmon is not aware of any recirculation system that is commercially viable and operating without subsidy or similar financial support.

In February 2011 at the Seafood Summit in British Columbia, a panel discussion on closed containment systems was attended by major industry players, who conceded that these systems would have a role to play in the future of aquaculture. As such, there may come a day when closed containment systems are considered economically viable in New Zealand; however New Zealand King Salmon do not consider this method a viable option for the foreseeable future.

CONCLUSIONS

This report has provided an overview of New Zealand King Salmon operations. It details the history and information regarding current facilities and sites.

It discusses opportunities for improvements including moving to higher flow sites, the operational requirements, employment opportunities and spill over benefits of maintaining or increasing production and achieving an environmentally better outcome.

Operational details of fish production including policies, management plans and responses to issues are addressed.

Environmental management is a key factor when considering operation of a salmon farm. The report explains how voluntarily New Zealand King Salmon has worked with various parties including Marlborough District Council to develop Best Management Practice guidelines and has agreed a timeline to incorporate across all of its farms.

This report also discusses how farms are not operated in isolation but rather as part of an integrated management strategy.

Infrastructure requirements, alternative fish farming options and detailed feed information is given.

Maintaining or increasing production through improved environmental practice is critical to ensure ongoing proven performance with its associated social, economic and environmental benefits. Moving existing low flow farms to areas more suitable for salmon farming will achieve all of these benefits.

Update on New Zealand King Salmon "OPERATIONS REPORT" as provided for the MPI led salmon relocation process 2016

Introduction

In 2106 the Ministry for Primary Industries (MPI) led process to relocate salmon farms in the Marlborough Sounds to deeper locations with higher flows and adopt Best Management Practice guidelines for the seabed began, part of that process involved consultation and presentations from all parties before a Hearings Panel.

The Hearings Panel prepared a report with recommendations. Those recommendations did not provide an outcome that would have agreement from iwi nor provide NZ King salmon with a satisfactory economic solution.

NZ King Salmon is proposing a review of the recommendations in relation to the mid Waitata location in particular and a final package proposal involving swapping Ruakaka, Forsyth and the two Crail Bay consents for Richmond South, Tio Point and Mid-Waitata with three extra pens. These extra pens are as a result of negotiations between iwi and the government around settlement space, as each of the proposed sites are considered "new" space. To balance the surface structure space swap a small area on either Waihinau or Otanerau may also need to be given up. A significant change from the initial proposal for Mid-Waitata is that the pens will be semi or fully submerged, thus reducing their visual impact. The site has also been rotated slightly to improve navigational safety.

In order for the Minister and his colleagues to favourably consider the proposition, a full review of the available information is necessary, as there are changes to the Mid-Waitata site, several issues identified by the Panel require attention, a couple of years have passed since reports were written, and processes have evolved. NZ King Salmon's "OPERATIONS" report is one of the documents requiring review.

Changes to Operations Report

This document should be read in conjunction with the "OPERATIONS REPORT", which was written in 2016, to identify changes since that time.

Page 5, para 3 "During the last financial year, 44% of our revenue was generated from international sales." That figure for FY18 is 50%.

Page 11: para 5 The Clay Point Consent has been granted and now includes BMP guidelines.

Page 15: Our history is now close to 35 years and our employee numbers are now - Hatcheries 32, Seafarms 104 and Processing 246. Our production tonnage is now 8300 MT, up from 7,500 MT.

Page 16: para 2 The breeding programme is now over 23 old years and has 150 families, up from 115 in 2016

Page 17: Table. The Takaka hatchery farm licence is currently on hold pending a review of the Fresh Water Fish Farm Regulations. Waiau hatchery has a new fish farm licence.

Page 18: para 4 Takaka also has two fixed term team members (in addition to the nine full time and one part time employee(s)).

Page 22: para 2 Harvest size is average 4.5kg - 5kg live.

Page 23: Table. Max feed CP 4500T, Waitata – current 4000T, Ngamahau – Current 2000T (assuming benthic conditions met)

Page 25: para 3 Waihinau farm is now in use as a smolt farm and is usually stocked from April to Dec

Page 26: para 5 The Waitata farm has eight 40mx40m pens, up from four pens in 2016.

Page 26: para 6 Kopāua now has three 40mx40m pens, up from two in 2016.

Page 27: Para 1 NZ King Salmon was a founding sponsor of the Marlborough Sounds Relocation Trust Wilding Pine Project, however, we currently have no active involvement in this project. We have an ongoing relationship with Tui Nature Reserve Wildlife Trust and have recently added sponsorship of their Koru Native Wildlife Centre, based at Linkwater, to our portfolio.

Page 27: Para 3 We are no longer actively involved in the Marlborough A&P show, however, we do have a presence in the MFA industry tent at the Havelock Mussel festival, Maritime festival and Seafood festival, and are actively involved in 'Aquaculture Week' leading up to the festival itself. We also play an active part in the Marlborough Smart & Connected groups and initiatives.

Page 29: para 1 Clay Point is largest single structure at 14 x 30m pens which is 218 X 62m

Page 29: para 3 Most grower nets are made of Polyester

Page 29: para 5 A semi-submerged or fully submerged circular pen design may be used for Mid Waitata and we now believe servicing these pens can be done efficiently.

Page 30: para 4 We are no longer trialling antifoul at Te Pangu or anywhere else.

Page 31: para 6 We no longer use antifoul at any of our farms including Te Pangu.

Page 31: para 3 Grower nets are cleaned in-situ approx. every 7 days; predator nets with larger mesh are every 30 days (summer KPI) and net changed farms are approx. every 18 days

Page 32: para 1 Feed contributes typically 35% total operating expenses of our company.

Page 33: Update of feed cost graph FY2017 was $2.32 and FY2018 $2.20.

Page 34: Table note difference in FCR reported between species. Biological FCR for NZ King Salmon vs Commercial FCR others, makes comparison difficult. BFCR is the total amount of salmon grown for every kilogram of feed used and CFCR is the useable salmon that is sold for every kilogram of feed used.

Page 41: para 7 "Akvasmart" computer programme is no longer used. We now use cameras and video to manage our feeding.

Page 43: In addition to the Aquaculture New Zealand Environmental Code of Practice A^{+}, we have four star BAP Certification, Monterey Bay Green tick and are well on the way to achieving ASC Certification in 2020. Each of these international independent certifying bodies place significant emphasis on environmental management.

Page 47: para 6 and 7 Our processes have evolved since 2016. Once guided into the pontoon, the fish are transferred by vacuum immediately delivering them to a percussion stunner that renders them comatose. They are then delivered to a bleeding table where a secondary check is carried out prior to the main artery in the throat of the fish being severed and placed into insulated bulk tankers and bins filled with ice slurry. This is designed to make the harvest process as stress free and humane as possible with the added benefit of maintaining a high-quality product.

Page 51: Although NZ King Salmon still holds to its opinion regarding the viability of land-based RAS operations for production growout of salmon, there is a trend overseas to use this technology to produce large (e.g. 0.5kg) smolt before introducing them to seafarms to reduce the time spent at sea and reduce risk from stressors such as sea lice. Additionally, we see very large production RAS systems proposed in the US, in China and other locations. These are in their early stages of development with a significant amount of media hype and propaganda associated with them. We believe some of the early RAS systems in Europe have really struggled for viability. NZ King Salmon has a longer-term view that a RAS system may be a good option to increase production smolt capacity for introduction to its seafarms and in particular when open ocean salmon farming becomes a reality.

Page 38: Our oil inclusion is now approx. 28%

Page 39: We use organic zinc in our diets.

APPENDIX R: Engineering Detail

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2nd July 2019

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Attention Amanda Hills

Dear Madam

OPEN OCEAN MARINE FARMING – STRUCTURE CERTIFICATION

In response to your question as to what process an engineer would follow in order to certify open ocean marine farming structures I have to respond as follows. Although open ocean marine farming aquaculture structures are a relatively new development as farms move offshore from their inshore beginnings in search of cooler water and more marine space there is much in terms of offshore experience with computer based modelling, calculation and analysis of wave and current induced hydrodynamic forces on marine structures that is available and directly applicable to aquaculture structures. This experience is chiefly derived from offshore oil and gas developments and dynamic analysis software such as ORCAFLEX, developed for use in the offshore oil and gas sector, has direct application to offshore marine farming. OCEL used ORCAFLEX for the initial analysis work undertaken for the first farm proposed for Waitata Reach where the possibility of open ocean swell had to be allowed for, in addition to high tidal current loads, in the design of the farm. The Norwegian AQUASIM dynamic analysis software was specifically developed for the analysis of floating aquaculture structures. There is also a growing body of international experience available for offshore aquaculture structures, in particular plastic circle structures which have been proven in offshore conditions. This type of structure could be used for the first NZ King Salmon (NZKS) open ocean farms but given the rapid development of offshore farm technology other types of structure may be selected.

The first deployment is likely to be in Cook Strait. While Cook Strait is a relatively wild stretch of water with maximum wave heights up to 16 m with relatively high AEP (Annual Exceedance Probability) values, or correspondingly low return periods, the proposed location is west of Cape Jackson and the maximum wave heights will be much lower than H_{max} = 16 m. The significant wave height at the location is H_s = 5.5 m, the maximum H_{max} will be less than 11 m. The farm structure will be a surface floating structure, the wave energy environment is not that severe that a submerged farm would be required to reduce the hydrodynamic loads sufficiently to ensure survival in the design storm event.

While the ORCAFLEX program could be used for the dynamic analysis of the farm in the design storm event the AQUASIM program developed in Norway specifically for the analysis of aquaculture structures would likely be used.

With regard to applicable standards for the design of the structure the Norwegian Standard NS 9415.E is applicable. There is also an American Bureau of Shipping (ABS) Guide for Building and Classing Offshore Fish Farming Installations 2018 but this is essentially an extension of the ABS rules for ships and marine structures that only covers steel structures not plastic structures. The Norwegians are industry leaders in aquaculture, in particular salmon farms, so the NS standard is the most appropriate one for the proposed NZKS farms.

The path for certification of the structure would be as follows. First derive the environmental design parameters, wave heights, H_s, H_{max}, wave periods, T_p, and maximum current and wind speeds with return periods, from wave hindcasting using the global wind model, plus monitor and record the environmental parameters on site. Companies such as Metocean Services Limited and NIWA can provide these services.

The design is to be undertaken by experienced engineers with offshore design experience either in the oil and gas and energy (wind and wave energy) industries or open ocean marine structure design. The structure design is to be in accordance with NS 9415.E supplemented by other more detailed design standards such as Det Norske Veritas (DnV) offshore design standards/guides where appropriate. In accordance with normal IPENZ procedures the design would be signed off/certified by a Chartered Professional Engineer (CPEng) with the requisite design experience and a Producer Statement (PS1) issued. A PS4 would be issued following installation confirming that the installation was in accordance with the approved plans. The manufacturer/fabricator of the floating structure would provide the PS3.

An offshore farm structure from an experienced, reputable manufacturer based outside NZ is likely to be used for the NZKS farms. That farm structure should have its own certification and track record of success and guarantee. It would then be for the NZ based engineer essentially to peer review and confirm design suitability, responsibility to be retained by the manufacturer with a peer review PS2 issued by the NZ CPEng.

Throughout New Zealand the issue of a PS1 by a CPEng qualified engineer is a condition of the resource consent for any type of structure. Councils are invariably looking for accountability, someone who takes responsibility for the work and is backed by Professional Indemnity insurance cover. OCEL works throughout NZ because of the nature of the work the consultancy undertakes and the requirement for a minimum level of PI and CPEng signoff is standard across NZ local bodies. None of them would want to change that to become an outlier and get caught out. Depending on the size and risk profile of the work intended Councils often ask for a PS2 from a CPEng in a separate consultancy. That was a condition for the initial Waitata Reach deployment and is standard on all the container wharves OCEL has designed in NZ. In the case of the Waitata farms a PS2 was obtained from Houlder Ltd. in London a firm of marine engineers and naval architects that the undersigned has had a long association with. That was accepted by the Marlborough District Council after OCEL reported the difficulty of obtaining the specified PS2 from another NZ CPEng with relevant experience. A long established professional consultancy firm like Houlder with international PI could be accepted for the PS1 but in OCEL's experience it is highly likely that the Council would still want some local scrutiny of the proposal and signoff by an NZ CPEng.

OCEL understand from Alan Cook the NZKS COO, following a meeting with him earlier this year, that NZKS will be looking for a turnkey type solution for a new farm system the manufacturer of which would take total responsibility for the installation. The manufacturer/provider of that system should have an easily verifiable international track record and offer a guarantee for the system. That could conceivably cover the PS1 aspect provided that the Council had confidence in the company and the company could be easily pursued through the Courts in the event of failure. A substantial bond might be required. To boost their confidence given the absence of experience with and knowledge of the technology the Council would most likely require a second opinion or backup from a NZ based consultancy with significant PI cover.

The use of screw anchors to hold aquaculture structures is unique to NZ, OCEL is not aware of anywhere else in the world where this type of anchoring is used. MSNZ (Marine Services NZ) and OCEL have been jointly approached about using screw anchors for a kelp farm structure off the North East coast of the US. The developers of the proposed farm for the US Dept. of Energy identified the NZ anchoring solution as unique and best suited for what they want to do. Normally conventional anchors and chain are used for plastic circle farms and other offshore aquaculture structures. These require large footprints for the farm, areas unlikely to be consented for NZ farms, although the size of the location proposed for the North Marlborough farm is such that the area constraint on the farm does not apply. The consequence of a limited space footprint for a farm is inclined mooring lines and uplift on the anchors which rules out the use of conventional anchors. It is likely that screw anchors would be used for the proposed new farms in which case the normal mooring arrangement for the structure would need to be modified to use screw anchors. In addition to the ability to accommodate uplift forces the screw anchors can be installed diverless and relatively easily proof load tested. In the event screw anchors were used two PS1s would be required, one for the anchors and one for the structure. For Waitata Reach OCEL signed a PS1 covering both the moorings and the structure given that the structure was covered by the manufacturer AKVA.

Yours faithfully

OCEL - Offshore & Coastal Engineering Limited

G C Teear

CPEng 34736

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Attention Amanda Hills

Dear Madam

NORTH MARLBOROUGH OPEN OCEAN: MOORING DEPTHS

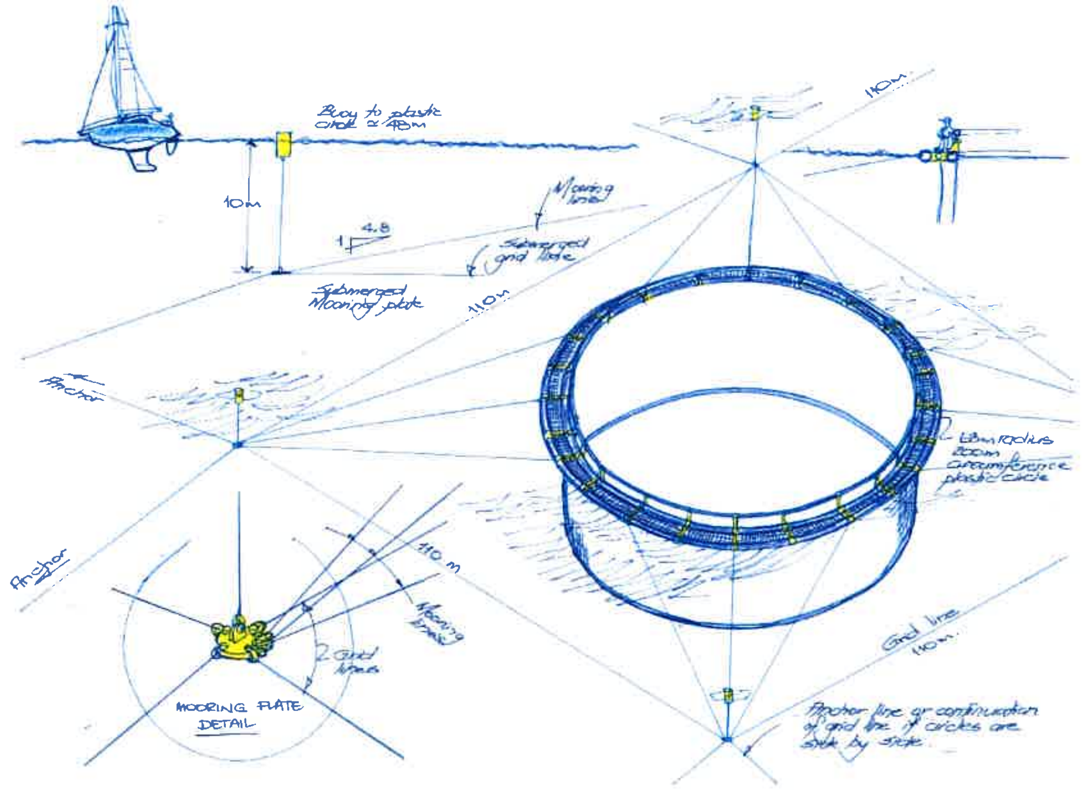
Your letter of the 9th of May notes that many of NZ King Salmon's (NZKS) existing farms have a consent condition to the effect that that no mooring line is to be within 4 metres of the surface of the water beyond 20 metres from any surface structure and asks if a similar set of conditions might be viable in an open ocean context *to give some comfort to vessels of varying draughts*. The answer is yes, subject to qualification, because the design of the farms in particular their mooring configuration determines the available clearance to individual mooring line elements.

The existing farms both in the high current Tory channel and Waitata Reach areas have relatively simple mooring arrangements. Each mooring line has its own dedicated screw anchor and the line runs straight from the structure to the anchor. For the Waitata Reach farms initially each one had a MarineFlex bungy element incorporated in the mooring line arrangement to provide elasticity to accommodate the high tidal range. The MarineFlex elements have subsequently been replaced by twin buoys located close to the structure to provide the required elasticity through the introduction of a dogleg into the mooring assembly. The buoys also take the vertical component of the mooring line tension off the structure.

It is likely that plastic circle cages will be used for the proposed North Marlborough open ocean farm. This type of farm has a more complicated mooring system than the existing in Sounds NZKS farms. The mooring lines from each circle connect to a submerged rope grid formed by longitudinal and lateral lines running orthogonal to each other. The lines to the anchors which take the loads out of the grid are attached to the grid perimeter at the intersection of the lateral lines with the outside longitudinal line forming the perimeter and at the ends of the longitudinal lines. The mooring lines from each plastic circle run to connection points suspended 10 m below surface buoys positioned at the corners of a 110 m x 110 m square grid encompassing each 63.7 m diameter (200 m circumference) plastic circle. The mooring lines are attached to connection points on the brackets connecting the two concentric HDPE pipe circles, the width of the external walkway apart, which form the surface support structure. The toroidal shape of the floating pipe structure gives stiffness in the horizontal plane while allowing the pipes to flex in the vertical plane. The mooring lines are spaced uniformly around the circumference of the outer floating ring. The minimum slope down to the connecting point below the outer buoys is 10 m V over approximately 45 m H, 1V : 4.5 H. The depth to the mooring lines is a minimum of 20/4.5 = 4.4 m 20 m off the plastic circles.

The circles constituting a complete farm are either placed in line one behind the other or arranged as two parallel lines side by side and share the buoy supported mooring connection for buoys between circles. The farm arrangement is shown in Sketch No 1.

The anchor warps run from the buoy suspended connection points to the anchors. The anchor scope will below (1V : 5H) for conventional chain and anchor moorings to avoid uplift on the anchors but will be less for screw anchors which can accommodate uplift loads.



Sketch No.1

The buoys supporting the connector plates and rope grid at 10 m depth define the natural perimeter of the farm and while there are good draught clearances inside the perimeter better to keep marine traffic out of the area marked out by the surface buoys. The buoys provide a good visual reference even in rough conditions with a good margin of error available for vessels that get too close to the buoys and come on the inside.

The proposed criteria you outline in point 4 of your letter can be satisfied with the proviso that for point a – *beyond 40 m from any surface structure no mooring line is to be within 5 m of the surface of the water* – the 40 m can be both within and outside the perimeter defined by the mooring buoys. It would be better to exclude marine traffic from inside the perimeter.

Yours faithfully
OCEL - Offshore & Coastal Engineering Limited

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CPEng 34736

APPENDIX S: Marlborough Salmon Working Advice to Minister

Marlborough Salmon Working Group

Advice to the Minister of Aquaculture

23 November 2016

Contents

Executive summary

1. There are 11 consents in the Marlborough Sounds to farm King salmon. Six consented sites are located in low-flow areas. These sites are Ruakaka and Otanerau in Queen Charlotte Sound and Forsyth, Waihinau and Crail Bay (2x) in Pelorus Sound. Four of the low-flow sites are currently being used by NZKS[1]. The two Crail Bay sites have not been used since 2011.

2. Monitoring of the benthic environment below the active low-flow sites suggests that, at current consented feed levels these farms are unlikely to comply with the *Best Management Practice Guidelines for Salmon Farming in the Marlborough Sounds: Benthic environmental quality standards and monitoring protocols* (the Benthic Guidelines). These Guidelines specify Environmental Quality Standards to provide the environmental 'bottom lines' against which effects of salmon farming on seabed enrichment will be assessed. While these sites are currently being managed to meet their existing consent conditions, Marlborough District Council (MDC), New Zealand King Salmon Ltd (NZKS) and government want all sites to comply with the Benthic Guidelines.

3. In mid-2016, the Ministry for Primary Industries (MPI), supported by the Marlborough District Council (MDC), convened the Marlborough Salmon Working Group (SWG) to consider options to implement the Benthic Guidelines so that better environmental[2] outcomes (ecological, social, cultural and economic) for salmon farming in Marlborough could be realised in the medium-term.

4. Options to implement the Benthic Guidelines include:
   - reducing stocking density,
   - waste capture
   - seabed remediation
   - improving feed efficiency
   - land-based aquaculture
   - offshore farming, and,
   - potential farm relocation.

5. This report presents the SWG's views, opinions, and recommendations to enable farms to meet the standards in the Benthic Guidelines. The SWG acknowledges that there are two viable short-term options to enable low-flow sites to comply with the Benthic Guidelines at this time – reducing stocking density and farm relocation to higher-flow sites. The other options above have potential, but there are questions and/or constraints identified around their economic viability, logistics and timeframes for technology to be developed.

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[1] Forsyth and Waihinau have recently been stocked and fallowed in alternate years.

[2] RMA definition of "environment" - from the Resource Management Act
"**Environment**" includes—
(a) Ecosystems and their constituent parts, including people and communities; and
(b) All natural and physical resources; and
(c) Amenity values; and
(d) The social, economic, aesthetic, and cultural conditions which affect the matters stated in paragraphs (a) to (c) of this definition or which are affected by those matters.

6. Nine candidate sites have been discussed as part of the relocation option using information commissioned by MPI on biophysical, environmental, social, cultural and economic factors. All sites have significant issues on multiple aspects.

7. SWG considers:
   - There are three potential relocation sites to proceed to public consultation – Richmond Bay south (#106), Horseshoe Bay (#124), and Tio Point (#156).
   - There are three potential relocation sites where members have divergent views on whether they are appropriate to proceed to consultation – Blowhole Point north (#34), Blowhole Point south (#122) and the Waitata mid-channel (#125).
   - There are three potential relocation sites the SWG agree should be eliminated from consideration - Tipi Bay (#42), Te Weka Bay (#47) and Motukina (#82).

8. Some SWG members note that the limitations with some technical reports and the relatively constrained timeframes for the group to consider the information has meant that the analysis of all options has been insufficient. The public consultation period must provide an opportunity to address these concerns. The SWG's recommendations are below.

SWG recommendations

9. The Salmon Working Group (SWG):
   1. **NOTES** that six existing consented low-flow salmon sites are unlikely to comply with the *Best Management Practice Guidelines for Salmon Farming in the Marlborough Sounds: Benthic environmental quality standards and monitoring protocols* (the Benthic Guidelines) under existing stocking densities.

   2. **RECOMMENDS** the Minister of Aquaculture (the Minister) consults with the public on two options to meet the Benthic Guidelines – reduce stocking density at existing low-flow sites and relocate to higher-flow sites.

      In relation to the potential relocation option the SWG considers:

      - There are three potential relocation sites to proceed to public consultation – Richmond Bay south (#106), Horseshoe Bay (#124), and Tio Point (#156).
      - There are three potential relocation sites where members have divergent views on whether they are appropriate to proceed to consultation – Blowhole Point north (#34), Blowhole Point south (#122) and the Waitata mid-channel (#125).
      - There are three potential relocation sites the SWG agree should be eliminated from consideration - Tipi Bay (#42), Te Weka Bay (#47) and Motukina (#82).

   3. **NOTES** relocation to higher-flow sites may enable increased salmon production above current levels. Some members support increased production providing it is sustainable. Other members consider increased production is not appropriate due to potential environment effects.

   4. **RECOMMENDS** that if the Minister decides to consult the public on the two options to meet the Benthic Guidelines, it applies the Principles of Consultation outlined in this document.

5. **NOTES** there are a number of risks, concerns and unresolved Resource Management Act (RMA) Part 2 matters set out in this paper that the Minister needs to consider when making a decision on whether to proceed to public consultation.

6. **NOTES** there is a risk of judicial review if the Minister does not have regard to the decisions of the Board of Inquiry and Environment Court on the cumulative effects of aquaculture in Waitata Reach and effects thresholds.

7. **RECOMMENDS** that all relocated farms adopt an adaptive management approach involving staged development and environmental monitoring. And, in addition to the existing Benthic Guidelines, Best Management Practice-Water Quality Guidelines need to be developed.

8. **RECOMMENDS** that if existing salmon farms are relocated then the coastal space previously occupied by the farms should not be made available for future aquaculture.

9. **RECOMMENDS** research to facilitate seabed remediation where farms have been vacated.

10. **RECOMMENDS** that the Marlborough salmon farming industry is encouraged to continue research into waste capture, improved feed efficiency, land-based aquaculture and offshore farming to ensure ongoing environmental and social improvements.

11. **RECOMMENDS** research initiatives on endangered King shag and improved state of the environment monitoring.

12. **RECOMMENDS** that government explores options to close the enclosed Marlborough Sounds to any further new salmon farming space. Options would need to consider iwi settlement obligations and growth aspirations.

13. **RECOMMENDS** that government and MDC need to develop more coordinated and strategic cross-sector approaches to the environmental management of the Marlborough Sounds. This includes improving State of the Environment Monitoring to better measure and manage the cumulative effects of aquaculture and other activities.

14. **RECOMMENDS** that the SWG provide additional advice to the Minister following the public consultation process.

Purpose

10. This report presents the SWG's views, opinions and recommendations to the Minister of Aquaculture to implement the Benthic Guidelines for up to six low-flow consented salmon farm sites using MPI commissioned information available to the group. It is important that this advice is considered within the context of the "*Other considerations and risks"* section in this report.

11. The report considers a range of options, to provide better environmental outcomes (ecological, social, cultural and economic) over the medium-term.

12. Central government agencies (led by MPI) will seek a decision from the Minister of Aquaculture on whether to proceed to consultation in the new year with iwi and the public. This Advice Paper sets out relevant matters for the Minister to consider in reaching that decision

13. The recommendations will also help inform future planning on salmon farming in Marlborough.

Introduction

14. Salmon farming has been occurring in the Marlborough Sounds for more than 30 years. NZKS is now the only company farming salmon within the Sounds, with 11 consented farm sites (refer to Appendix 1 for map)

15. Six of the 11 consented sites are located in low-flow areas. These sites are Ruakaka and Otanerau in Queen Charlotte Sound and Forsyth, Waihinau and Crail Bay (2x) in Pelorus Sound. Four of the low-flow sites are currently being used by NZKS[3]. The two Crail Bay sites have not been used since 2011.

16. Monitoring of these active low-flow sites shows consented feed levels often exceed benthic impacts that are non-compliant with the Benthic Guidelines. Non-compliance is not ideal from an environmental, social and economic perspective. Farming in low-flow areas can result in a greater level of localised deposition and seabed enrichment beneath a salmon farm.

17. In 2014, the Marlborough District Council,central government, industry, scientists and the local community worked together to develop the Benthic Guidelines. In addition, BMP Operational Guidelines have been written. The BMP-Water Quality Guidelines are a work in progress.

18. The primary purpose of the Benthic Guidelines is to provide consistent and clear requirements for independently conducted annual benthic monitoring and management of existing salmon farms in Marlborough. The Benthic Guidelines specify Environmental Quality Standards to provide the environmental 'bottom lines' against which effects of salmon farming are assessed in respect to the seabed. These Guidelines can be reviewed and updated where necessary.

19. Monitoring of benthic effects beneath NZKS's farms since 2012 has indicated that while four consented low-flow farmed sites comply with existing consent requirements, decreases in feed input levels are likely required for these sites to comply with the accepted maximum *Enrichment Scale* (ES) 5 in the zone of maximum effects and ES<3 in the outer limit of effects as specified in the Benthic Guidelines. It is also likely that while farming has not recently occurred at the two

[3] Forsyth and Waihinau have recently been stocked and fallowed in alternate years.

low-flow Crail Bay consented sites, their existing consents would likely not comply with the Benthic Guidelines. MDC and NZKS have agreed that *all consented farmed sites* will be eventually managed between ES3 and ES5 as appropriate.

20. NZKS is committed to adopting the Benthic Guidelines across all sites prior to re-consenting in 2024. The current process is voluntary whereby adoption of the Benthic Guidelines can achieve better ecological outcomes much sooner.

21. Some SWG members contend that because the Crail Bay sites were destocked in 2011, they should not be considered for relocation. Other members consider these sites are still capable of producing salmon and should be considered for relocation.

22. The six sites are:
    - Ruakaka in Queen Charlotte Sound
    - Otanerau in Queen Charlotte Sound
    - Forsyth in Pelorus Sound
    - Waihinau in Pelorus Sound
    - Crail Bay 2x in Pelorus Sound

23. No changes to the Ngamahau, Waitata and Kopaua salmon sites are needed to comply with the Benthic Guidelines, although technically the Benthic Guidelines are not fully consented on those sites. While there was a technical non-compliance at Clay Point, it was not considered biologically significant. MDC is currently processing an application to adopt the Benthic Guidelines for Clay Point. This will address the technical non-compliance issue. NZKS has also recently obtained consent from MDC to shift its Te Pangu farm slightly seaward to ensure compliance.

24. In mid-2016, MPI supported by MDC, convened the SWG to consider options to implement the Benthic Guidelines to ensure sustainable salmon farming in Marlborough. Further work to develop BMP-Water Quality Standards is also proposed but has not yet been advanced.

SWG – Role and Membership

Role

25. The role of the SWG is to provide non-binding recommendations to government in developing advice on options to implement the Benthic Guidelines.

26. The aims of the SWG[4] are:
    - *to consider options for existing salmon farms in Marlborough to adopt the Guidelines; and*
    - *to ensure the enduring sustainability of salmon farming in Marlborough, including environmental outcomes and landscape, amenity, social and cultural values.*

27. The recommendations will also help inform future planning on salmon farming in Marlborough. The SWG process and this report will not replace statutory consultation processes required to establish any potential new salmon aquaculture space under the Resource Management Act 1991 (RMA).

[4] As per SWG Terms of Reference

28. The Terms of Reference for the SWG is provided in Appendix 2.

Membership

29. The SWG includes nominated individuals from local and central government, key community and interest groups, iwi, and the aquaculture industry. Membership is voluntary and brings a wide range of skills, knowledge and experience to the table on a number of different dimensions. These include knowledge of various iwi and stakeholders' perspectives with an interest in the marine environment of the Marlborough Sounds.

30. The group consists of the following members:

Ministry for Primary Industries	Ben Dalton (Convenor)[5], Luke Southorn & Dan lees
Marlborough District Council	Pere Hawes
Department of Conservation	Jeff Flavell and Jane Gunn
Te Tau Ihu Forum	Richard Bradley[6] & Richard Paine[7] & Raymond Smith[8]
Aquaculture New Zealand	Gary Hooper
Marine Farming Association	Graeme Coates[9]
New Zealand King Salmon	Mark Gillard
Guardians of the Sounds	Paul Keating
Sounds Advisory Group	Eric Jorgensen, Rob Schuckard & Judy Hellstrom
Kenepuru & Central Sounds Residents Association	Ross Withell & Hanneke Kroon

Iwi representatives on the SWG were selected by the Te Tau Ihu Forum. In addition, Laura Goudie and Paul Creswell from MPI attended the workshops to assist the SWG, provide secretariat services, and prepared reports. Various technical experts from MPI, DOC and MDC also attended to provide scientific and technical input where appropriate.

Workshop outcomes and supporting information was also provided to Raewyn Peart (Environmental Defence Society, EDS) given her past involvement with the NZKS Environmental Protection Authority (EPA) application. EDS were invited to join the SWG, but were unable to participate due to other commitments.

31. The independent chair and facilitator was Ron Crosby. When Ron was unavailable Graham Allan acted in his place.

[5] Ben Dalton (convenor) attended the first two workshops only.
[6] Representative attended first workshop only.
[7] Representative has withdrawn as a representative of Te Tau Ihu Forum given Totaranui's commercial interest in Tio Point site, and is now just representing Te Atiawa.
[8] Te Tau Ihu Forum has put forward Raymond Smith to represent them given Richard Bradley's lack of attendance and Richard Paine's conflict. Raymond attended the seventh workshop on 27 and 28 October.
[9] Graeme Coates only attended the first workshop due to Illness.

Workshops

32. The SWG met on seven occasions. These workshops were as follows:

14 July 2016	• Confirmed purpose and role of SWG. • Confirm problem definition and Terms of Reference. • NZKS provided an overview of past and current salmon industry in Marlborough. • Potential options to meet BMP were identified. • Map of existing salmon farms and proposed relocation sites was provided.
21 July	• Site visit to potential relocation sites in Pelorus Sound. • Initial discussion around key issues. • Summary of Benthic Guidelines provided and explained by MDC.
9-10 August	• Process and key project milestones and events. • Information of impact of salmon farming presented. • Information on salmon mortalities presented. • NIWA presented benthic and water quality results. • Outline of proposed adaptive management approach. • Information presented on benthic, waste capture and navigation reports. • Site visit to potential relocation sites in Tory Channel. • Initial discussion around key issues. • John Hudson presented draft landscape work.
8-9 September	• Discussion around feasibility of waste capture technology. • Reported farm discharge levels in recent years discussed. • Brief explanation of possible plan change approach. • Cawthron overview of water quality information provided • Initial development of relocation sites SWOT analysis.
22 September	• Discussion around process and next steps. • Cawthron overview of mussel farm deposition synergistic effects. • Discussion with NZKS Chief Financial Officer regarding commercial viability of salmon farming in Marlborough. • Further development of SWOT analysis of potential sites.
14 October	• Discussion around improved timeframe and proposed consultation process. • Examination of legal analysis on threshold issue. • Group discussions and input of revised Advice paper.
27-28 October	• Discussion around economic analysis and viability for existing low-flow farms to comply with Benthic Guidelines. • Research updates on options to comply with Benthic Guidelines (e.g. feed efficiency, offshore). • Feedback on advice report and further development and discussion.

Government's role

33. The Government supports well-planned and sustainable aquaculture growth in New Zealand and the industry's goal to grow to a $1 billion annual sales a year by 2025[10]. With this comes the potential for significant job creation in regional New Zealand. However, an essential part of this support is to ensure growth takes place within acceptable environmental limits and respects other users and values of our waterways and marine environment.

34. Councils administer the RMA on a regional and district basis. However, the government has a role overseeing the whole RMA regime, to work with councils, Maori, the aquaculture industry and community on opportunities for regional growth and environmental management.

Best Management Practice Guidelines

35. The NZKS application to the EPA in 2012 for new salmon farms in Marlborough highlighted the need for co-operation between industry, MDC and the community when it comes to managing the effects of salmon farming on the marine environment.

36. MDC, NZKS, scientists, local community (including the Sounds Advisory Group) and international aquaculture experts (Professor Kenny Black and Dr Catriona Macleod) worked together in 2014 to develop the Benthic Guidelines to provide guidance on existing salmon farming practices. The public were also consulted on the draft Benthic Guidelines before being finalised.

37. The current guidelines consist of:
    - *Best Management Practice Guidelines for Salmon Farming in the Marlborough Sounds: Benthic environmental quality standards and monitoring protocols* (Benthic Guidelines), and
    - *Best Management Practice Guidelines for Salmon Farming in the Marlborough Sounds: Operations*.

38. These Guidelines generally provide a framework for consented farm development and operational management, including detailed directives for assessment of farm effects on the environment (such as monitoring and environmental standards). The Guidelines set out performance expectations in eight key operational aspects – ecosystem, environmental management, resources, community, community relations, waste, food security, and certification. As such, the Guidelines provide a framework for salmon farm development in Marlborough.

39. The Benthic Guidelines were finalised in November 2014, but have yet to be implemented in full. The *Benthic environmental quality standards and monitoring protocol* was implemented in November 2014 and has been applied to Te Pangu site and an application for the Clay Point site is in process. Monitoring across all farms is consistent with Benthic Guidelines and reporting is against current consent conditions. The three new Ngamahau, Waitata, and Kopaua sites have a precursor monitoring and management system in place from which the Benthic Guidelines were developed.

[10] The Economic Contribution of Marine Farming in the Marlborough Region: A Computable General Equilibrium (CGE) Analysis, *NZIER report to Marine Farming Association,* September 2015.

Benthic environmental quality standards and monitoring protocol

40. The Benthic Guidelines provides guidance on the development and implementation of benthic monitoring programmes and environmental quality standards for salmon farming in Marlborough. Its primary purpose is to provide consistent and clear requirements for seabed monitoring and management of existing salmon sites.

41. The key element of the Benthic Guidelines is the use of an ES5 in the zone of maximum effect and ES3 in the outer limit of effects to set a maximum permitted level of enrichment ('bottom lines') for a salmon farm. At ES5, species diversity has declined and abundance of seabed life such as worms and nematodes is at its maximum. With these organisms turning over and irrigating the seabed, the organic matter from a farm (ie, uneaten feed and faeces) is able to be processed at the rate it is deposited. Exceeding ES5 means the seabed receives too much organic matter, and this may reduce the availability of oxygen in the seabed sediments. The decline in oxygen and rise in sulphides can lead to an anoxic environment, which can result in a hostile environment for marine invertebrates. This is evident in the further collapse of species abundance of the most-pollution tolerant organisms. In the worst case scenario, outgassing of methane and hydrogen sulphide can occur.

Current compliance with the Benthic Guidelines

42. NZKS undertakes independent monitoring of its salmon farms per consent conditions. All farms are monitored according to the Benthic Guidelines and reported to MDC against the relevant consent conditions as a measure of compliance. Additionally, the ES levels can be used to assess benthic enrichment against the Benthic Guidelines.

43. The following table and graph provides a summary of farm compliance (low-flow sites) against ES5 for the 2012-2015 period.

Maximum Enrichment Stage (95%CI)by consented site for 2012-2015				
	2012	2013	2014	2015
Otanerau	6.15 (0.05)	5.60 (0.3)	5.70 (0)	5.90 (0.4)
Ruakaka	5.37 (0.16)	5.00	5.60 (0.1)	5.30 (0.3)
Waihinau	4.31	5.10 (0.1)	5.40 (0.2)	4.60
Forsyth	4.80	5.60 (0.2)	5.60 (0)	6.00 (0.3)
Crail Bay (x2)	na	na	na	na
Maximum average score refers to the maximum ES average station score across each sampling site beneath a farm. This score is used to assess compliance with ES5.				

Maximum Enrichment Stage (95%CI) assessed per Benthic Guidelines. Actions required:				
	2012	2013	2014	2015
Otanerau	Destocking	Minor	Destocking	Major
Ruakaka	Minor		Major	Minor
Waihinau		Alert	Minor	
Forsyth		Major	Major	Destocking
Crail Bay (x2)				
Alert – Written Management Response Plan Minor – 24 months to compliance, improvement within 12 months required Major – More significant response to bring to compliance required. 12 months improvement Destocking – 4 months or end production cycle.				

44. No recent monitoring has been undertaken for the two Crail Bay sites as these have been not been used to grow salmon following destocking in 2011.

45. Given that the existing low-flow farms have exceeded ES5 during the 2012-2015 period, it is likely that these farms may not be able to be re-consented under current feed discharge rates.

46. Ruakaka and Waihinau may only require a small decline in feed levels to become compliant. However, there are additional mitigating measures which would be required (i.e. fallowing of 2-5 years and gradual restocking over an undefined period).

Options to implement the Benthic Guidelines

47. The SWG considered seven options to implement the Benthic Guidelines for the existing salmon sites in Marlborough. These options were:
    - Reducing stocking density
    - Waste capture
    - Seabed remediation
    - Improving feed efficiency
    - Land-based aquaculture
    - Offshore farming
    - Farm relocation

48. A summary of each option and the views of the SWG are summarised below.

Option	SWG views
Reducing stocking density	
Nutrient enrichment of the seabed is the direct result of deposition of fish faeces and minor amounts of uneaten food. Reducing stock density within sea pens reduces the amount of feed required, and hence leads to an eventual reduction in seabed enrichment. Reducing stock density at low-flow sites to meet ES5 would have a significant impact on fish production and economic farm viability (returns and jobs).	The SWG generally supports reducing stock density to comply with ES5, but recognise that lower feed levels would not fully resolve the environmental, fish health, and biosecurity issues at low-flow sites. There is also uncertainty about feed level reductions required to become compliant. The SWG also acknowledges the potential that this option may not be commercially viable at this time for the majority of low-flow sites, and would likely cause economic impacts including job losses as set out in the section below. This option needs to be canvassed further and additional information and discussion is necessary on commercial and environmental viability of these sites if they are to achieve the Benthic Guidelines.
Waste capture	
There is ongoing international research on developing technology to capture wastes before they fall onto the seabed. There is the potential to use this waste for secondary uses such as fertilizers and methane production.	The SWG has considered the report by Professor Black on waste capture within a NZ context and supports this option as part of a package of wider and longer-term solutions. However, members agree that waste capture technology is not at a stage for implementation within the acceptable timeframes (i.e. before farm

	consent expiry in 2024) for farms to meet the Benthic Guidelines and technology is still unproven at a scale to match the existing marine based farms. Members agree that further research is necessary as part of the continued improvement and evolution of NZ salmon farming practices. The SWG notes that research on this option is ongoing and should be looked at again if and when it is demonstrated to be beneficial, and operationally and economically feasible. This could be looked as a requirement as part of any revised coastal plan.
Seabed remediation	
There is growing local and international research on exploring ways to remediate seabed conditions directly underneath and adjacent to salmon farms. Options involve removal of the uppermost layer of the seabed for disposal on land and pumping oxygen into the seabed. Seabed remediation may improve ecological outcomes by accelerating seabed recovery. This approach could be used in conjunction with fallowing and relocation.	The SWG supports this option as part of a package of wider and longer-term solutions. Members agree that seabed remediation technology is not at a stage for implementation and there is insufficient evidence that seabed remediation provides better long-term recovery outcomes than leaving the seabed to recover naturally. Members agree that further research is necessary as part of the continued improvement and evolution of NZ salmon farming practices. The SWG notes that research on this option is ongoing and will be looked at again if and when it is demonstrated to be beneficial, and operationally and economically feasible.
Improving feed efficiency	
Nutrient discharges from salmon farms are largely determined by the efficiency of fish to consume and metabolise feed. Improving feed efficiency can improve ecological outcomes through improvements in feed composition. This has the potential to reduce nutrient input to the seabed by up to 20%[11]. However over the next 5 years, the Cawthron Institute suggests realistic improvements of up to 5-10%. Commercial fish feed producers are constantly researching ways to improve fish feeds, however efficiency gains are difficult to achieve and will take time to be realised.	The SWG supports this option as part of a package of wider and longer-term solutions. Members agree that improving feed efficiency should be an ongoing initiative as part of the continued improvement and evolution of NZ salmon farming practices. The SWG notes that research on this option is ongoing and viable improvements will be adopted. A $12 million research grant has recently been allocated to the Cawthron institute to investigate improvements in feed efficiency.

[11] Wybourne, B. 2012. Brief of Evidence of Ben Armour Wybourne in Relation to Feed Discharge for the New Zealand King Salmon Co. Ltd.

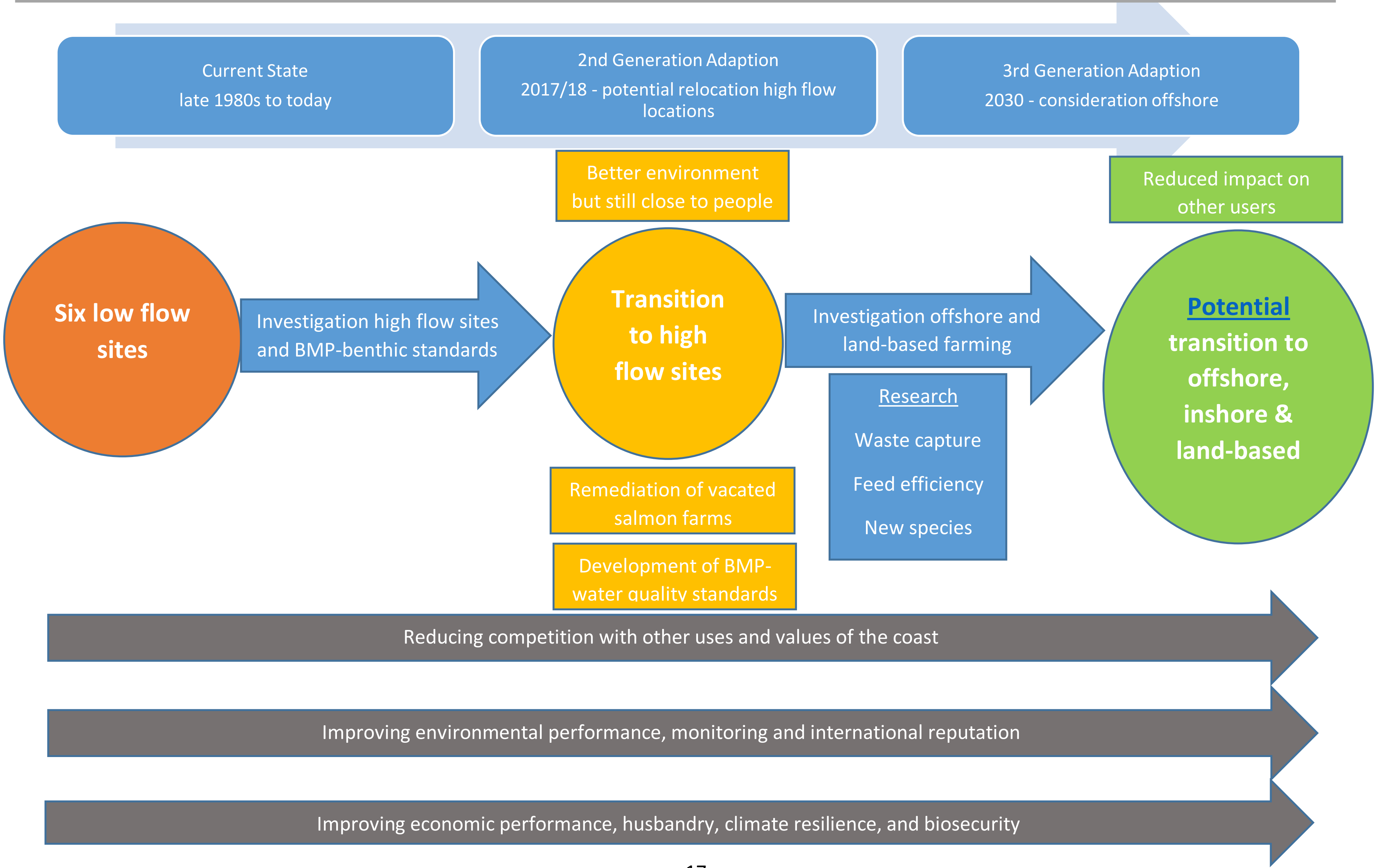
Land-based aquaculture	
Technology is well developed to grow salmon within a land-based farming environment using flow through or recirculation of freshwater or seawater. However, the economic viability of this option is largely determined by the availability of sufficient land and water resources, and has higher risks. As such, existing land-based salmon farms in NZ are small scale and produce small volumes of fish.	The SWG generally agrees that it is currently not logistically possible and uneconomic to transfer low-flow sites to land-based operations under existing production levels. There are significantly higher establishment and operational costs, as well as issue of scale for this option to be operationally and economically viable at this time.
Offshore farming	
Given competing users and values in the coastal environment, offshore has become an emerging approach to marine farming. Offshore farms are located in deeper and less sheltered waters with stronger currents. However, NZ waters are prone to much greater wave extremes than many other locations where offshore farming has proven viable. More research is required to develop offshore technology that can withstand NZ's higher energy locations and provide confidence to any future investor.	The SWG generally agrees that offshore farming is an attractive option in concept. Offshore farming technology is not available yet at a commercial scale or level of engineering robustness required for NZ conditions. Together with very high upfront investment capital and high operating costs makes this option prohibitive at this time. Members agree that further research into offshore farming technology is necessary as part of the continued improvement and evolution of NZ salmon farming practices. The SWG notes that research on this option is ongoing and will be looked at again if and when it is demonstrated to be beneficial and operationally and economically feasible. Some SWG members believe this option has not received sufficient attention.
Farm relocation	
Relocating existing salmon farms to high-flow sites could lead to a range of ecological, cultural, social and economic benefits in the medium-term. Relocation will enable low-flow sites to be commercially viable and comply with the Benthic Guidelines. Moving farms to high-flow sites can reduce seabed and water quality effects, improve fish health, resilience and husbandry, improve biosecurity management, and enable better monitoring and adaptive management, and can lead to an increase in production. Also, farming salmon in high-flow sites, more remote sites may be more acceptable to the community than existing locations.	Members generally agree that shifting existing farms to high-flow sites may enable NZKS to comply with the Benthic Guidelines within an acceptable timeframe, while remaining operationally and commercially viable. Members agree that relocation must not lead to an increase in total surface structure area, and **must** lead to a gain in environmental outcomes (ecological, social, cultural and economic) Some SWG members do not agree that relocation should allow increased production over current levels. Some members do not agree that relocating farms would result in better environmental outcomes. Potential benefits of site relocation need to be carefully assessed.

49. The SWG acknowledges that there are two viable short-term options to enable low-flow sites to comply with the Benthic Guidelines at this time – reduce stocking density and farm relocation to higher-flow sites. An assessment of the two options is provided in the section below.

50. The SWG also recognises that the options of waste capture, seabed remediation, land-based farming and offshore farming could have potential for the future, but are not currently viable as part of a short to medium-term solution. Improved feed efficiency is a matter for continuous improvement, but does not in itself provide a viable solution.

51. SWG members agree if relocation occurs that salmon farmers must be encouraged to undertake ongoing research on the alternative options within a New Zealand context so that these can be later considered as a package of wider and longer-term solutions to ensure ongoing environmental improvements (ecological, social, cultural and economic) (Figure 1).

Figure 1: Conceptual framework for developing a vision for salmon farming in Marlborough



Assessment of remaining viable options to comply with Benthic Guidelines

(1) - Reducing stocking density

52. This section outlines the economic impacts of reducing stocking density of the six low-flow consented sites. This option involves the removal or significantly reduction of salmon held in sea pens to either discontinue or reduce waste feed discharge. This will cause a decrease in seabed deposition beneath and adjacent to the farm.

53. This option will potentially have a significant negative impact on the commercial viability of the farm. This economic analysis is presented below and has been prepared by PwC (October, 2016). Given the limited time available after the report was produced and questions raised, the SWG considers that the PwC economic analysis needs to be independently reviewed to ensure the accuracy and appropriateness of the economic predictions. The assumptions below must be considered draft.

Potential economic impacts (PwC)

54. Currently, NZKS produce about 6,000t of salmon annually and create about 321 jobs in Nelson and Marlborough. PwC has calculated that every 100t of salmon produced each year could be expected to lead to approximately $0.45m in increased annual value add or GDP in the Nelson and Marlborough regional economies, and would support approximately 4.7 FTEs annually.

55. The economic impact from the six low-flow sites operating under maximum production Benthic Guidelines, incorporating commercial viability compared to baseline production is an estimated decrease in annual vale add/GDP of **$4.6m** and an estimated reduction of **48 FTEs** supported annually**.**

56. In addition, PwC have estimated a one-off loss relating to additional mitigation requirements recommended by the Cawthron Institute to implement the Benthic Guidelines. These requirements include a fallowing period of two to five years (which would clearly have a profoundly negative operational impact) and then a gradual increase in production. The total one-off reduction in economic activity is estimated to be in the range of **$24-60m** in GDP and 126 FTEs for up to five years over the mitigation period assuming production at the maximum Benthic Guidelines ranges.

57. NZKS has provided PwC with financial data that calculates the 'break even' at EBIT[12] production for each site to model commercial viability. This was verified against NZKS's audited financial year 2016 statement. They note that a break even low-flow salmon farm is not a scenario where the operator is able to invest in best practice, but a commercially viable high-flow site is.

58. The constraints on continuing to operate would include current operational factors reflected in existing (baseline) production (Column A), as well as the site by site commercial viability of operating under BMP maximum production levels (Column B). The economic analysis assumes that the resulting production (Column C) reflects the result of both of these constraints and calculates the associated loss. The estimates are shown below.

[12] EBIT – earnings before interest and tax

	Column A Existing baseline (now) production		Column B BMP max production, incorporating commercial viability		Column C Total annual loss	
Farm	Value add ($m)	FTEs	Value add ($m)	FTEs	Value add ($m)	FTEs
Otanerau	3.1	32	2.0	21	1.1	11
Ruakaka	3.5	37	0	0	3.5	37
Forsyth	1.7	18	1.7	18	0	0
Waihinau	1.7	18	1.7	18	0	0
Crail Bay 32 (2)	0	0	0	0	0	0
Crail Bay 48 (1)	0	0	0	0	0	0
TOTAL	10	105	5.4	57	**4.6**	**48**

59. Column B reflects the following:

- **Otanerau** – production would be constrained by BMP and the site would only be commercially viable near maximum feed discharge levels.
- **Ruakaka** – is not commercially viable to operate under BMP in any format, particularly relating to the higher cost of fish production at that site.
- **Forsyth and Waihinau** – these sites are not considered commercially viable under the historic full grow out model, so NZKS's baseline production plan incorporates usage only as seasonal smolt sites and only at breakeven EBIT and relying on NZKS' ability to subsidise production via the use of high-flow sites to grow the smolt out. Waihinau is more likely to be able to operate under BMP maximum feed discharge levels, as the consent permits moving the farm around on site. However, Forsyth is less clear – NZKS is hopeful it could operate Forsyth as a smolt site, but only if BMP maximum feed levels applied.
- **Crail Bay 1** and **2–** are likely to operate as smolt sites, but only without Benthic Guidelines feed discharge constraints. These are the most marginal sites hence not currently in use, and thus shown as zero in baseline production column. The sites would not be commercially viable to operate under BMP, even at maximum Benthic Guidelines feed discharge levels.

60. NZKS considers none of these sites are commercially viable at the minimum production volume set out in the Cawthron Institute assessment, this would thus result in a nil economic impact.

(2) - Potential Farm Relocation

61. This section considers the option to relocate up to six consented low-flow sites to alternative higher-flow sites in Waitata Reach and Tory Channel. The section outlines key principles that will apply for relocation to be considered as a viable option, and include key findings of technical reports commissioned to help inform the SWG's analysis along with critical discussions of those and possible mitigations.

Principles of farm relocation

62. The SWG agrees that the following principles shall apply to any proposed farm relocations:
    - Salmon farming is a legitimate and viable commercial industry in the Marlborough Sounds.
    - There shall be no increase in total surface structure area for any farms that are relocated.
    - Any relocation of sites must lead to a net gain in environmental outcomes (ecological, social, cultural and economic) in the medium-term.
    - All relocated farms must comply with the current Benthic and Operational Guidelines. BMP-Water Quality Guidelines also need to be developed.

- All relocated farms must apply a staged adaptive management approach consistent with the principles below to be measured using an appropriate baseline.
- All management of farms must look for continued improvement to reduce ecological effects including exploring a package of options such as waste capture, seabed remediation, improved feed efficiency, and offshore technology.

Principles of adaptive management

63. The SWG is keen to ensure appropriate adaptive management of both water quality and benthic effects. To give effect to the precautionary approach, at the very least, adaptive management must have[13]:
    1. A clear baseline against which future effects can be measured;
    2. A means of reliably measuring the nature and extent of future adverse effects;
    3. A means of knowing that a given adverse effect is the product of a known cause;
    4. Certainty that the identified cause can be stopped and that any adverse effect attributable to it can be reversed.

64. For adaptive management to be considered appropriate, there must be an adequate evidential foundation to have a reasonable assurance that the regime would sufficiently reduce uncertainty, and adequately manage residual risk. [14]

65. It needs to be acknowledged that in a hysteresis[15], after an initial trajectory of change, only a small additional change in a parameter variable can result in a catastrophic shift in a state variable (e.g. benthic enrichment). The catastrophic shift cannot be reversed by a correspondingly small reversal of the parameter variable; i.e. the trajectory of recovery is very different from the pathway of decline. In simple terms: if the system tips, the causal factor needs to be changed by a large amount to bring it back – this means it is more expensive and difficult to restore than it is to protect. Adaptive management must ensure farms meets the Benthic Guidelines. The Benthic Guidelines have been developed. BMP-Water Quality Guidelines need to be developed. The water quality objectives set by the Board of Inquiry are in Appendix 3.

66. Once a final scenario of potential relocation sites has been identified, the NIWA model should be re-run to test underlying assumptions. An appropriate feed discharge baseline also needs to be established.

67. Initial scientific advice from the Water Quality Technical Working Group (TWG) on the design of an adaptive management approach is attached as Appendix 4.

Process to find suitable relocation sites

68. In 2012, MPI began a process to identify potential aquaculture space (finfish, mussels and oysters) in the Marlborough Sounds to deliver the Crown's Treaty aquaculture obligations to iwi. An initial list of over 100 sites was identified, and this was subsequently refined down to a very

[13] Friends of Nelson Haven and Tasman Bay Inc v MDC - (2016) NZEnvC 151

[14] Friends of Nelson Haven and Tasman Bay Inc v MDC - (2016) NZEnvC 151

[15] Definition of hysteresis: the phenomenon in which the value of a physical property lags behind changes in the effect causing it.

small number of potential sites following constraint analysis using environmental, biophysical, hydrological, fisheries and RMA constraints. This process demonstrated that suitable new space in Marlborough to grow salmon was extremely limited.

69. In 2015, MPI began work with DOC to explore options to enable Marlborough salmon farms to comply with the Benthic Guidelines. The initial work to identify suitable aquaculture space for settlement was used as a baseline to identify potential suitable salmon space. Nine potential high-flow candidate sites (four in Tory Channel and five in Waitata Reach) were eventually identified for detailed investigations on their suitability to grow salmon as part of an Assessment of Environment Effects (AEE) process. MDC and MFE have been kept informed of this work.

70. These nine candidate sites are:

Waitata Reach, Pelorus Sound	Tory Channel
Blowhole Point north (#34)	Tipi Bay (#42)
Blowhole Point south (#122	Motukina (#82)
Mid-channel (#125)	Tio Point (156)
Richmond south (#106)	Te Weka Bay (#47)
Horseshoe Bay (#124)	

71. A map showing the location of potential relocation sites is provided in Appendix 1.

72. An AEE process reflects research investigations as required to support a plan change under the RMA. MPI commissioned a wide range of research investigations and comprised of the following:

Research	Provider
Navigation	Navigatus Consulting Ltd
Landscape and natural character	Hudson and Associates
Tourism and recreation	TRC Tourism Ltd
Seabirds	NIWA
Marine mammals	Cawthorn and Associates
Pelagic fish	Statfishtics
Benthic	NIWA and Cawthron Institute
Water quality	NIWA and Cawthron Institute
Discharges (Cu/Zn, greywater)	Cawthron Institute
Disease and pests	DigsFish and Cawthron Institute
Biosecurity	Cawthron Institute
Underwater lighting	Cawthron Institute
Noise	Marshall Day Acoustics
Cultural impact assessment	Maximize Consulting Ltd
Heritage impacts	Heritage Works
Social impacts	Taylor Baines & Associates
Economic analysis	PwC
Operations	NZKS
Engineering	OCEL

73. MPI also commissioned a peer review of reports where deemed appropriate.

74. The SWG has considered the majority of the reports as part of the SWG process and has had sessions with a number of authors. The highly technical nature of many of these reports, together with a constrained SWG timeline and use of external expertise has prevented some members from undertaking a full analysis and or review.

75. The confidentiality requirements of the group meant that the reports have been limited in terms of stakeholder and community engagement. This shortfall would need to be addressed through an appropriately structured public consultation and decision making process, and continued discussions with Te Tau Ihu. SWG views on these reports are set out later in this document.

Summary of SWG analysis of potential sites

76. MPI commissioned a number of technical reports to inform an Assessment of Environmental Effects for the potential relocation of up to six low-flow farms to higher-flow sites. Much of this information is generic in nature and applies across all or most of the potential candidate sites. To avoid repetition, the following sets of tables (Assessment of potential relocation sites) provide a summary of key issues and findings raised by SWG members.
    - Marlborough Sounds considerations and findings
    - Pelorus Sound and Tory Channel specific considerations and findings
    - Individual site analysis summaries.

77. Based on the analysis presented below, the SWG found all sites had significant issues on multiple aspects, but considers:
    - There are three potential relocation sites to proceed to public consultation – Richmond Bay south (#106), Horseshoe Bay (#124), and Tio Point (#156) (marked in yellow in map below).
    - There are three potential relocation sites where members have divergent views on whether they are appropriate to proceed to consultation – Blowhole Point north (#34), Blowhole Point south (#122) and the Waitata mid-channel (#125) (marked in blue in map below).
    - There are three potential relocation sites the SWG agree should be eliminated from consideration - Tipi Bay (#42), Te Weka Bay (#47) and Motukina (#82).

Map of Pelorus Sound sites

Map of Tory Channel sites

Other considerations and risks

78. This section notes that in providing SWG views, opinions and recommendations within this advice paper there are several other matters (considerations) and associated risks that readers need to be aware of when determining how to proceed. These are described below.

Consideration(s):

a. The prepared technical reports are voluminous and complex and there has been limited time and ability to thoroughly consider, question/test content, provide feedback and draw resulting conclusions with regards to their content and findings.
b. There has been, to date, an inability to engage independent technical experts to test and validate the content and findings of the Technical Reports. This may be further compounded if the S360A process is used without the ability to independently test information.
c. Analysis of options for existing sites to comply with the Benthic Guidelines (*e.g.* reducing feed levels) and the ramifications (including economic impacts) of possible scenarios enabling this to occur has not received sufficient attention to date.
d. There remain some instances of non-reconciled information (*e.g.* feed input levels) and technical reports are not always consistent across such information.

Risk(s):

a. If consultation does not adequately address the above matters, then the risk is that the any decision regarding the future of salmon farming in the Marlborough Sounds may be based upon incomplete or incorrect information.

Consideration(s):

a. A number of technical reports have been prepared by the same individuals and/or companies that presented evidence through the Board of Inquiry process on behalf of NZKS. This may raise questions in some quarters with regards to potential conflicts of interest for the reports writers and the independence of the findings and conclusions of such reports (though specifically excluding Benthos and Water Quality).
b. Some members of the SWG believe that the divergence of legal opinion with regards to the threshold test for the Waitata Reach as identified in the decision of the Board of Inquiry, is a matter that must be resolved prior to proceeding.

Risk(s):

a. Some members of the SWG believe that these two matters may provide an adequate basis for a judicial review of any resultant decision made through this process.

Consideration(s):

a. This paper, and any subsequent decision, considers (and may give effect to) the future planning and development of salmon farming within the Marlborough Sounds. The process to draft and consult the aquaculture chapter of the Marlborough Environment Plan (MEP), which will deal with overarching and integrated marine farming provisions in the Marlborough Sounds, is only just commencing. That process will likely not make any substantive progress until well into 2017.

Risk(s):

b. There is risk in terms of a lack of alignment created by planning for salmon farming in isolation to the broader review of planning for the sustainable management of natural and physical resources in the Marlborough Sounds (as reflected in the Proposed MEP), including the ongoing review of marine farming provisions that the Council is about to commence.

Assessment of potential relocation sites

Marlborough Sound scale considerations and findings ***These issues are equally applicable at Tory Channel and Pelorus Sound scales*** **The key issues at a Marlborough scale for all the potential relocation sites are to ensure that net environmental gains are realised over the medium term, water quality is maintained, benthic effects are appropriate and meet the Benthic Guidelines, biosecurity is well managed, and the community's views are appropriately sought and considered**				
Key Issues	**Research report**	**Review by**	**SWG considerations**	**SWG findings**
Cumulative effects on Water Quality	NIWA Water Quality Report	Aquatic Environment Working Group and Cawthron Institute.	The NIWA water quality model is based on international best practice. However, a model is a guide only and must be treated with caution. The model is stretched because it predicts the effects of feed discharges far greater than the receiving environment has previously experienced. The current feed levels of low flow sites are between 4,300 and 4,800 tonnes (2012-2015, assuming Forsyth and Waihinau operating alternately, excluding averages from fallowed years) but could increase to a maximum of 24,600 tonnes based on site production figures (ES5). There are also concerns about the various feed discharges used in different baseline models that need to be resolved. Relocating farms to higher-flow sites may result in increased production.	There is a need to exercise caution when considering the results of the NIWA water quality model. Adaptive staged management and monitoring is required to ensure appropriate production levels. The receiving environment has not previously been subject to these levels of discharges or the effects that could potentially occur. Adaptive management[16] should include regular monitoring of toxic algae. Some SWG members do not agree that increased production is appropriate and should not be allowed at relocated sites. Once a final scenario of potential relocation sites are identified then the NIWA model should be re-run to ensure appropriateness to test underlying assumptions and an appropriate feed discharge baseline needs to be developed.

[16] The principles of adaptive management are provided in paragraphs 63 to 67 above.

Benthic (seafloor) impacts	NIWA benthic impact assessments Cawthron Institute report for the Tio Point site	Aquatic Environment Working Group The Fisheries and Aquaculture Centre, University of Tasmania	The reports appropriately identify the deposition footprints of the potential relocation sites and the seafloor habitats and species. Farms should be located over mud and away from reefs and other ecologically important habitats. The reports estimate feed discharges to meet ES5, however, adaptive management and monitoring in accordance with the BMP is still required. The SWG notes the declining biodiversity in the Sounds (MDC State of the Environment 2015 report) and the need to maintain, restore and enhance biodiversity.	Adaptive management and monitoring in accordance with the BMP guidelines is required to ensure seafloor effects remain within ES5. Additional monitoring of reef systems in the vicinity of some sites is also necessary to mitigate adverse effects. This is discussed in the site reports. The effects of potential site relocations on biodiversity need to be carefully considered. Some SWG members are of the view that there is an ecological cost of introducing a salmon farm to a new area. It increases the area of seabed that is affected, as the existing low-flow farm sites will take years to recover ecologically, even after being vacated. Potential benefits of site relocation need to be carefully assessed.
Noise	Marshall Day Acoustics	Not reviewed	No change to existing farms in terms of noise emissions. Noise considered appropriate in accordance with EPA settings. Potential farms are also further from dwellings.	Noise rules need to be applied consistent with the EPA findings and consent conditions. Public consultation should seek views on noise disturbance and intrusion at the potential sites.
Tourism and recreational assessment	TRC Tourism Limited	Not reviewed	The report only spoke with some commercial operators and DOC, no recreational users were consulted.	There should be engagement with commercial tourism operators and recreational users.

Marine Mammals	Cawthorn and Associates	DOC marine mammal expert provided comments	Risks of relocating salmon farms are negligible to low. But, it is important to continue managing marine mammal interactions appropriately.	DOC approved marine mammal management plans must be implemented for any relocation sites. Whether the attraction of seals could impact on biodiversity needs to be addressed.
Pelagic fish & Underwater lighting	Statfishtics and Cawthron Institute	MPI aquatic environment expert	Relocating sites is unlikely to increase effects on pelagic fish above the effects of existing farms in terms of underwater lighting, and feed discharges. There is a relationship that has been identified between underwater lighting, attraction of wild fish to pens and bait fish.	Accepts findings of the reports. Cawthron provided recommendations and options for mitigation and monitoring (report number 1982 – August 2011) as evidence to the Board of Inquiry (BOI) and these need to be adopted.
Grey water, copper and zinc	Cawthron Institute	MPI aquatic environment expert	Grey water discharges are low and dilute, the potential farms will not use copper antifouling, the effects of zinc in feed and faeces are less than minor and better mitigated at high-flow sites.	Accepts findings of the reports.
Biosecurity	Cawthron Institute – biosecurity report Digsfish Services -disease report	MPI biosecurity	The reports find that farm relocation does not increase biosecurity risks. Higher-flow sites could result in healthier more resilient fish. The SWG notes however that increasing production and concentrating into smaller geographical areas could result in increased biosecurity risk. NZKS should work towards single year class production and site fallowing to meet international best biosecurity practice.	MPI should continue to work with NZKS to ensure improvements to biosecurity management are realised through the potential relocation process.

Social impacts	Taylor Baines and Associates	Quigley and Watts Ltd	International best practise (IAIA) was not followed in the social impact assessment whereby individuals, groups, communities and societies that are affected by change are appropriately consulted. Social impact assessment focuses on site specific neighbours.	Effective public consultation is required to seek community views on the social impacts of potential farm relocations, including cumulative stressors on social values. Recommendations on principles for consultation are included later in this document.
Maori	Cultural impact Assessment prepared by Steven Wilson	Report reviewed by Te Tau Ihu Forum	Iwi have concerns about the cumulative effects of salmon farming particularly in Pelorus Sound. This includes effects on Waka Routes and a Waaihi Tapu site and Kaitiakitanga. The Board of Inquiry and Environment Court have noted serious concerns about cumulative effects of salmon farming on Maori values needs careful consideration.	Council and the Crown need to continue to work closely alongside Te Tau Ihu Forum to inform decisions.
Economic	PwC	First draft reviewed by MPI economist	The PwC report provides estimates of the economic impacts of the existing farms meeting Benthic Guidelines and for the potential relocation sites. The SWG is concerned to ensure economic analysis are robust and the need for independent expert review. The PwC report is based on audited accounts.	The final report was received on the eve of the last SWG workshop. The PwC economic analysis needs to be independently reviewed to ensure the accuracy and appropriateness of the economic predictions.

Pelorus Sound specific considerations and findings

Key issues for Pelorus Sound are the cumulative effects on king shags, the natural character and landscapes of the Waitata Reach and 'gateway' entrance to the Sound, cultural values, the heritage values of the gun emplacement on Maud Island, and ensuring safe navigation.

Key Issues	**Research report**	**Review by**	**SWG considerations**	**SWG findings**
King shags	NIWA Seabirds Report	DOC (ornithologist) provided comments on the draft reports	Although the report suggest the impacts of relocation on king shags are minimal, this species is endangered with a population of less than 1000 birds and is on the ICUN red list. Most of the 2500 ha of aquaculture since the 1970's took place in the feeding habitat of 64% of total population. In general aquaculture has already had cumulative effects on king shag feeding and foraging areas.	The small population of king shags must not be put at any additional risk. Expert caucusing is required to independently assess the information and ensure relocation does not adversely impact this species. There is also a need to begin a proper research programme on this species – expert caucusing should make recommendations on this matter.
Landscape and Natural Character	Hudson Associates Landscape Architects	Drakeford Williams Ltd.	The Hudson Report considers landscape effects of the sites in Pelorus are acceptable. The report takes into account the operative MSRMP and proposed MEP landscape and natural character layers. The Board of Inquiry and Environment Court have upheld the importance of the Waitata Reach; as one of the remaining pristine areas in the Pelorus Sound. [17] The cumulative effects of marine farms need to be carefully considered.	There are concerns and questions as to whether this is a correct interpretation. Further expert caucusing is required to ensure relocation into Waitata Reach is appropriate. Consultation needs to seek public views on the importance of the Waitata Reach landscapes and natural character, the "gateway" entrance, and long views to Maud Island.

[17] Board of Inquiry on the New Zealand King Salmon (NZKS) applications and *KPF Investments Ltd v Marlborough District Council* [2014] NZENVC 152

			The two Blowhole Point sites and the mid channel farm are also in the 'gateway' entrance to Pelorus Sound, in an ONL area in the proposed MEP.	
Navigation	Navigatus	Not reviewed	The report concludes relocation of farms would have minimal effects. However, the MDC Harbour Master is highly concerned about the mid-channel Waitata farm. Some group members are concerned about specific sites as mentioned below in the report.	There needs to be further discussion between Navigatus and the MDC Harbour Master. The Harbour Master noted the need for consultation with the community on the mid-channel salmon farm on large vessels (which would include cruise ships). Site specific navigational effects are in the site reports.
Heritage	History Works	Not reviewed	Generally, heritage effects would be low. However the potential effects of the mid-channel Waitata, Horseshoe bay and Richmond South sites on the visual and perception effects on the Maud Island and Post Office Point gun emplacements need to be considered.	Potential impacts on the gun emplacements need to be raised as a question at consultation.
Sea temperature	MSQP depth average summary	N/A	Summer temperatures can be above the optimal growing range for salmon.	Strategies and selective breeding can be applied to manage farming appropriately. Temperature effects are also offset by higher-flows and deeper water.

Tory Channel specific considerations and findings The key issues at the Tory Channel scale are the cumulative landscape and natural character impacts of salmon farming and safe ferry navigation				
Key Issues	**Research report**	**Review by**	**SWG considerations**	**SWG findings**
Landscape and Natural Character	Hudson Associates Landscape Architects	Drakeford Williams Ltd.	The Hudson Report considers landscape effects of the sites in Tory Channel are acceptable. The report takes into account the operative MSRMP and proposed MEP landscape and natural character layers. However, the cumulative effects of marine farms need to be carefully considered.	There are concerns and questions as to whether this is a correct interpretation. Consultation needs to seek public views on the cumulative effects of salmon farming in Tory Channel.
Navigation	Navigatus	Not reviewed	The report concludes the farms would have minimal effects. However the Harbour Master and ferry operators are concerned about safe ferry navigation	Tio Point is the only potential site now being put forward for public consultation in Tory Channel and the navigation risks from this site are commented on below.

BLOWHOLE POINT NORTH (#34)	Divergent views on whether appropriate to proceed to consultation

Biophysical suitability for salmon farming

Mean current (m/s) for (1) near-bottom & (2) mid-water[18]	Temp (°C)	Depth (m)	Discharge (t) within ES5	Cage type	Benthic Footprint[19] (ha)	Surface structure area incl. barge (ha)
(1) 0.12 (2) 0.13	11.9-18.2	28-80	4,500	Polar circles	~15	1.402

- This site is in a wide, open character east facing bay located south of Harris Bay and Oke Rock in the outer Pelorus Sound. This site is offshore from three existing mussel farms.
- The site is biophysically suitable for growing salmon and modelled to produce approximately 1,980 t of annual salmon production within ES5.
- Economic analysis suggests value add/GDP would generate about $9m and 94 FTEs[20].

Seafloor habitats and communities

- The sandy mud seafloor beneath the farm site supports an epifaunal community that is sparse and mostly composed of common taxa. Small biogenic clumps of associated organisms mainly comprising ascidians and hydroids are present in a scattered distribution. Brachiopods are found at various locations within the site, and scallops are relatively abundant. Reef patches and kelp communities fringing the shoreline provide habitat for paua and kina and blue cod.
- The primary depositional footprint extended does not extend as far as the extensive reef at Blowhole Point nor to the inshore reef and kelp communities. This assessment takes into account the deposition from the adjacent mussel farms. Monitoring of the seabed in accordance with Benthic Guidelines and monitoring of the nearby reef and inshore areas will be necessary; including potential cumulative effects on the extensive reef if the two Blowhole Point sites are both developed.

Landscape and natural character

- The landscape assessment undertaken states that at a site specific scale the landscape is high to moderate and natural character is moderate.
- However, the site is within the proposed Outer Sounds Outstanding Natural Landscape and within a proposed Outstanding Natural Feature (with Port Ligar, Forsyth Island and Kaitira Headland), and part of the Pelorus Sound 'gateway'.

Salmon Working Group concerns

- The landscape report suggests a salmon farm at this location would not compromise the outstanding landscape and natural feature values. However, some members have questioned as to whether this is a correct interpretation. The farm is located in the 'gateway' and will be lit at night. Cumulative effects need to be considered both for the' gateway' entrance and for the relatively pristine Waitata Reach as a whole.
- The wider public use of the area is unclear and will be investigated through consultation. The presence of scallops may suggest the area could be important for recreational fishing.
- The navigation report states boaties may need to take a wider berth; MDC Harbour Master does not raise navigation concerns; some SWG members query whether the site could impact on boats entering Waitata Reach at night or during inclement weather.
- Ngati Kuia raises specific concerns that the area is waahi tapu. The SWG highlights the need for the Crown and MDC to work closely with Ngati Kuia on how a salmon farm would impact cultural values and whether mitigation is possible.
- The site is within an area likely used by endangered king shags as a feeding and foraging ground. Cumulative effects of relocation need to be carefully considered. Part of the farm falls within the preferred foraging depth. The footprint of the farm is overlapping with king shag foraging habitat.

[18] For a fuller description of water currents for non-eliminated sites, refer to Appendix 6.

[19] Benthic footprint ES3 - 5

[20] Combination of direct, first-round and industry support based on economic impact of 100 tonnes of salmon production

BLOWHOLE POINT SOUTH (#122)	Divergent views on whether appropriate to proceed to consultation					
Biophysical suitability for salmon farming						
Mean current (m/s) for (1) near-bottom & (2) mid-water	Temp (°C)	Depth (m)	Discharge (t) within ES5	Cage type	Benthic Footprint (ha)	Surface structure area incl. barge (ha)
(1) 0.15 (2) 0.14	11.9-18.2	38-65	5,000	Polar Circles	~20	1.402

- This site is located in a small, enclosed wide-mouthed south-facing bay which is open to the main channel of the entrance to Pelorus Sound – opposite Kaitira headland and the entrance to Forsyth Bay. The site is offshore from a mussel farm.
- The site is biophysically suitable for growing salmon and modelled to produce about 2,200 t of annual salmon production within ES5.
- Economic analysis suggests value add/GDP would generate about $10m and 104 FTEs.

Seafloor habitats and communities

- Most of the site is positioned over a sandy mud/shell gravel habitat supporting a moderately abundant mixed community of macroalgae and diverse invertebrates. Two species of brachiopods are present, but no dense beds were detected. A large reef extends to the southeast of Blowhole Point and provides habitat for a diversity of macroalgae, and sessile and mobile fauna, and associated reef, demersal and pelagic fish species. This reef, with smaller patches of bedrock, cobble and sand along the shoreline is blue cod habitat.
- Some deposition (between 1 and 4 kg solids m^{-2} yr^{-1}) will extend over a portion of the reef, indicating that there is potential for some effect on the reef communities. This assessment takes into account the deposition from the adjacent mussel farms. Monitoring of the seabed in accordance with Benthic Guidelines and monitoring of the nearby reef and inshore areas will be necessary; including potential cumulative effects on the reef between the two Blowhole Point sites if both sites are developed.

Landscape and natural character

- The landscape assessment undertaken states at a site specific scale the landscape is high to moderate and natural character is moderate.
- However the site is within the proposed Outer Sounds Outstanding Natural Landscape and within a proposed Outstanding Natural Feature (with Port Ligar, Forsyth Island and Kaitira Headland), and part of the Pelorus Sound 'gateway'.

SWG concerns about the potential site

- The landscape report suggests a salmon farm at this location would not compromise the outstanding landscape and natural feature values. However, some members have questioned as to whether this is a correct interpretation. The farm is located in the 'gateway' and together with Blowhole Point North will be lit at night. Cumulative effects need to be considered both for the' gateway' entrance and for the relatively pristine Waitata Reach as a whole.
- The wider public use of the area is unclear and will be investigated through consultation.
- The site is within an area likely used by endangered king shags as a feeding and foraging ground. Cumulative effects of relocation need to be carefully considered. Part of the farm falls within the preferred foraging depth. The footprint of the farm is overlapping with king shag foraging habitat.
- Application U161142 has been made to farm mussels over the same coastal space as the potential relocation space.

MID-CHANNEL WAITATA (#125)	Divergent views on whether appropriate to proceed to consultation					
Biophysical suitability for salmon farming						
Mean current (m/s) for (1) near-bottom & (2) mid-water	Temp (°C)	Depth (m)	Discharge (t) within ES5	Cage type	Benthic Footprint (ha)	Surface structure area *without barge* (ha)
(1) 0.22 (2) 0.24	10.7-18.5	61-64	7,000	Polar Circles	~45	2.29

- This site lies in the middle of the Waitata reach between Waihinau Bay to the northwest and Post Office Point to the southeast. There are two nearby salmon farms.
- The site is biophysically suitable for growing salmon and modelled to produce about 4,620 t of annual salmon production within ES5. It is one of the best sites for salmon farming
- Economic analysis under a feed discharge scenario of 7,000t (as per maximum under the water quality report) suggests value add/GDP would generate about $13.9m and 144 FTEs.

Seafloor habitats and communities

- There are no ecological features of special significance within or in the vicinity of the potential site. Habitats and taxa occur widely in the greater area of Waitata Reach and Pelorus Sound.
- As this site is deep and is subject to strong currents, depositional material is likely to be dispersed more widely and the effects is likely to be reduced.
- Monitoring of the seabed will be required in accordance with Benthic Guidelines.
- None of this potential site falls within the preferred king shag foraging depth (>60m).

Landscape and natural character

- The landscape assessment undertaken states at a site specific scale the landscape is high and natural character is moderate.
- However, the site is within the proposed Outer Sounds Outstanding Natural Landscape and part of the Pelorus Sound 'gateway'.

Salmon Working Group concerns

- The landscape report suggests a salmon farm at this location would not compromise the outstanding landscape values of the outer sounds. However, some members have questioned as to whether this is a correct interpretation. The farm is located in the long view from the Pelorus 'gateway' entrance to Maud Island and will be lit at night. The farm is in close proximity to other sites (Kaitira and Taipipi) declined by BOI for site specific landscape reasons. Cumulative effects need to be considered both for the 'gateway' entrance and for the relatively pristine Waitata Reach as a whole. There is also potential for visual impacts on users of the Tui Nature Lodge (5km away and in direct line of sight).
- In respect of heritage, the potential effects of this site on the visual and perception values of the gun emplacements on Post Office Point need consideration.
- The wider public use of the area is unclear and will be investigated through consultation.
- The navigation report did not raise navigation issues for this site. However, the MDC Harbour Master expressed concern that the site would make it navigationally unsafe for cruise ships and superyachts to visit this region. The Harbour Master also raised concerns about the methodology used by Navigatus to assess the potential effects on recreational boat users. Some SWG members have also queried whether this site could have a navigational impact on less experienced boaties and larger vessels.

HORSESHOE BAY #124	Proceed to consultation

Biophysical suitability for salmon farming

Mean current (m/s) for (1) near-bottom & (2) mid-water	Temp (°C)	Depth (m)	Discharge (t) within ES5	Cage type	Benthic Footprint (ha)	Surface structure area incl. barge (ha)
(1) 0.12 (2) 0.11	10.7-18.5	18-45	1,500	Rectangular	~5.5	0.739

- This site is located on the south-side of the headland between Horseshoe Bay and Richmond Bay, on the northern edge of the bay. The site is located offshore of three mussel farms.
- The site appears biophysically suitable for growing salmon, although shallow in parts, and is modelled to produce about 660 t of annual salmon production within ES5.
- Economic analysis suggests value add/GDP would generate about $3m and 31 FTEs.

Seafloor habitats and communities

- The cage area and most of the potential farm site is situated over sandy mud seabed. A zone of shell rubble habitat and associated epibiota considered to be an uncommon ecological feature in the context of the Pelorus Sound region is located approximately 90 m north of the northwest corner of the site. Scallops are relatively abundant beneath the cage area and wider site. There is extensive bedrock reef supporting diverse biotic communities in the vicinity, but not within the proposed farm boundaries or predicted footprint of benthic effects
- Ecological effects would be unlikely to be significant, and wider depositional footprint within ES3. This assessment takes into account the deposition from the adjacent mussel farms.
- Because this site is surrounded by important benthic areas, monitoring of the seabed accordance with Benthic Guidelines and the reef systems will be necessary.
- Ecologically significant sites (Tapapa point (3.11) and Maud Island (3.5)) are nearby.

Landscape and natural character

- The landscape assessment undertaken states at a site specific scale the landscape and natural character are both high to moderate.
- The site is also in the vicinity of an outstanding natural feature.

SWG concerns about the potential site

- The landscape report suggests a salmon farm at this location would be acceptable. However, some members have questioned as to whether this is a correct interpretation. Cumulative effects need to be carefully considered for the relatively pristine Waitata Reach as a whole, and for this site in close proximity to the proposed site at Richmond Bay South.
- In respect of heritage, the potential effects of this site on the visual and perception values of the gun emplacements on Maud Island need consideration, although the extent of this effect may be limited due to being 2.5km away.
- The wider public use of the area is unclear and will be investigated through consultation. The presence of scallops suggests the area could be important for recreational fishing.
- One SWG member has queried whether the site could have a navigational impact.
- All of this farm could be exploited by foraging king shags and cumulative effects need to be carefully considered. The footprint of the farm is overlapping with king shag foraging habitat.
- Some SWG members question the value of relocating to Horseshoe Bay given its small size.

RICHMOND BAY SOUTH #106	Proceed to consultation					
Biophysical suitability for salmon farming						
Mean current (m/s) for (1) near-bottom & (2) mid-water	Temp (°C)	Depth (m)	Discharge (t) within ES5	Cage type	Benthic Footprint (ha)	Surface structure area incl. barge (ha)
(1) 0.18 (2) 0.18	10.7-18.5	30-56	5,000	Rectangular	~22	0.933

- This site is located adjacent to the headland between Richmond Bay and Horseshoe Bay, northeast of Te Kaiangapipi in Outer Pelorus Sound. It is offshore of a single mussel farm.
- The site appears biophysically suitable for growing salmon and is modelled to produce about 2,200 t of annual salmon production within ES5.
- Economic analysis suggests value add/GDP would generate about $10m and 104 FTEs.

Seafloor habitats and communities

- There are no particularly notable communities or taxa recorded on the muddy seabed in the immediate vicinity of this site. Scallops are relatively abundant. Reef features are located inshore of the farm, but should not be impacted. The site will meet ES5.
- Monitoring of the seabed in accordance with Benthic Guidelines and the reefs will be necessary.

Landscape and natural character

- The landscape assessment undertaken states at a site specific scale the landscape and natural character are both high to moderate

SWG concerns about the potential site

- The landscape report suggests a salmon farm at this location would be acceptable. However, some members have questioned as to whether this is a correct interpretation. Cumulative effects need to be carefully considered for the relatively pristine Waitata Reach as a whole, and for this site in close proximity to the proposed site at Horseshoe Bay.
- In respect of heritage, the potential effects of this site on the visual and perception values of the gun emplacements on Maud Island need consideration, although the extent of this effect may be limited due to being 2.5km away.
- The wider public use of the area is unclear and will be investigated through consultation. The presence of scallops suggests the area could be important for recreational fishing.
- Some SWG members raise concerns about the ecological importance of water mixing between Maud Island and Pauanui and the need to avoid stratification and associated issues.
- The footprint of the farm is overlapping with king shag foraging habitat. 2/3rds of this farm is within preferred king shag foraging depth. Cumulative effects need to be carefully considered.

<table>
<tr><td colspan="2">TIO POINT (#156)</td><td colspan="5">Proceed to consultation</td></tr>
<tr><td colspan="7">Biophysical suitability for salmon farming</td></tr>
<tr><td>Mean current (m/s) for (1) near-bottom & (2) mid-water</td><td>Temp (°C)</td><td>Depth (m)</td><td>Discharge (t) within ES5</td><td>Cage type</td><td>Benthic Footprint (ha)</td><td>Surface structure area incl. barge (ha)</td></tr>
<tr><td>(1) 0.21
(2) 0.23</td><td>13.1-15.9</td><td>18-44</td><td>1,600</td><td>Rectangular</td><td>4.5</td><td>0.739</td></tr>
<tr><td colspan="7">• This site is located on the northeast side of Tio Point which sits between Te Pangu Bay and Oyster Bay in the Tory Channel. The site is near a consented but undeveloped mussel farm.
• The site appears biophysically suitable for salmon, although shallow in parts and is modelled to produce about 704 tonnes of annual salmon production within ES5.
• Economic analysis suggests value add/GDP would generate about $3.2m and 33 FTEs.</td></tr>
<tr><td colspan="7">Seafloor habitats and communities</td></tr>
<tr><td colspan="7">• Benthic habitats in the vicinity of the potential site are predominantly sand/mud and shell hash with relatively sparse epibiota. These habitats are widespread in the Sounds.
• Epibiota is patchy, with species such as brittle stars and cushion stars common throughout the area, but other species such as ascidians, hydroids, sponges and bryozoans concentrated in clumps. The biogenic clumps present around the potential site do not appear to be as abundant as elsewhere in Tory Channel.
• A reef is located inshore of the farm, but should not be impacted. The site will meet ES5.
• Monitoring of the seabed in accordance with Benthic Guidelines and the inshore reef will be necessary.
• This site is at or beyond the flying foraging range for the nearest king shag colony.</td></tr>
<tr><td colspan="7">Landscape and natural character</td></tr>
<tr><td colspan="7">• The landscape assessment undertaken states at a site specific scale the landscape is moderate and natural character is moderate.
• Tory Channel itself is considered to have high values as the entrance to Queen Charlotte</td></tr>
<tr><td colspan="7">SWG concerns about the potential site</td></tr>
<tr><td colspan="7">• The landscape report suggests a salmon farm at this location would be acceptable. However public views need to be sought on the cumulative effects of salmon farming in the Channel
• The wider public use of the area is unclear and will be investigated through consultation.
• Concerns that Oyster Bay has some similar hydrological and enrichment characteristics as Onapua Bay where toxic algae blooms are of concern.
• Tio Point is located closer to the nominal ferry path than existing farms, however both navigatus and the MDC Harbour Master are comfortable that the risks are manageable.</td></tr>
</table>

<table>
<tr><td colspan="2">TE WEKA BAY (#47)</td><td colspan="5">Eliminated site</td></tr>
<tr><td colspan="7">Biophysical suitability for salmon farming</td></tr>
<tr><td>Mean current (m/s) for (1) near-bottom & (2) mid-water</td><td>Temp (°C)</td><td>Depth (m)</td><td>Discharge (t) within ES5</td><td>Cage type</td><td>Benthic Footprint (ha)</td><td>Surface structure area incl. barge (ha)</td></tr>
<tr><td>(1) 0.16
(2) 0.20</td><td>9.92-16.29</td><td>10-47</td><td>1,800</td><td>Rectangular</td><td>6.5</td><td>0.467</td></tr>
<tr><td colspan="7">• This potential site is located in the west end of Tory Channel.
• This site appears biophysically suitable for salmon, although parts of the site are very shallow and is modelled to produce about 792 t of annual salmon production within ES5.
• Economic analysis suggests value add/GDP would generate about $3.6m and 38 FTEs.</td></tr>
<tr><td colspan="7">Why is this site eliminated</td></tr>
<tr><td colspan="7">• Beneath the potential site biota was relatively sparse. A macroalgal bed comprised of diverse red seaweeds is found at the southwest end of the site in the vicinity of the inshore boundary. Offshore, in the vicinity of the offshore site boundary, are unusual wave-like biogenic mounds comprising semi-consolidated aggregations of whole shell rubble and shell hash bound together by a diverse assemblage of sponges, hydroids, ascidians and bryozoans. Stands of kelp including the giant kelp grew on broken rock, cobble and low relief bedrock habitat along the shoreline adjacent.
• This site is the closest to Te Weka Bay, which has experienced harmful algal blooms in the past. This puts this site at risk in terms of susceptibility to algal blooms.
• The MDC Harbour Master expresses significant concern over this site, although the navigation report states risk is comparable with existing Tory Channel farms.
• There is potential for intrusive residential amenity effects on one nearby dwelling.
• This site is near a urupa and iwi have concerns about discharge from a farm following past the urupa. Rangitane note Moioioi Island was first inhabited during Ngai Tara Rangitane ‘fish hook wars’ with Ngai Tahu.</td></tr>
</table>

TIPI BAY (#42)	Eliminated site

Biophysical suitability for salmon farming

Mean current (m/s) for (1) near-bottom & (2) mid-water	Temp (°C)	Depth (m)	Discharge (t) within ES5	Cage type	Benthic Footprint (ha)	Surface structure area incl. barge (ha)
(1) 0.17 (2) 0.22	9.92-16.29	3-31	1,000	Rectangular	~3.2	0.370

- This potential site within close proximity to the entrance of Tory Channel.
- The site appears biophysically suitable for salmon, although parts of the site are very shallow, and the site is modelled to produce about 440 t of annual salmon production within ES5.
- Economic analysis suggests value add/GDP would generate about $2m and 21 FTEs.

Why is this site eliminated

- A wide range of habitat types and communities is seen at this site, including whole shell, shell hash and muddy sands. Zones of low-relief broken rock and bedrock patches are present and support diverse encrusting biota and biogenic aggregations comprising bryozoans, various sponges, ascidians, hydroids, macroalgae and associated invertebrates including polychaetes. Associated with these habitats is a diverse range of fishes including butterfly perch, tarakihi and blue cod. Also, ecologically important stands of giant kelp are present within the inshore portion of the site. Kina and paua are also present. Small areas of seagrass habitat occurred in places inshore of the site.
- This site may have some impact on heritage values of old Perano Tipi Bay whaling station. However, essential meaning or character of Tipi Bay whaling site may not be affected.
- MDC Harbour Master expressed significant concern over this site; although navigation report states risk is comparable with existing Tory Channel farms.
- Te Atiawa was previously denied an opportunity to pursue a commercial opportunity at this site. Salmon farming should not occur here unless iwi are given an opportunity to directly benefit from any salmon farm, and this would require further discussions.

MOTUKINA #82	Eliminated site					
Biophysical suitability for salmon farming						
Mean current (m/s) for (1) near-bottom & (2) mid-water	Temp (°C)	Depth (m)	Discharge (t) within ES5)	Cage type	Benthic Footprint (ha)	Surface structure area incl. barge (ha)
(1) 0.16 (2) 0.18	9.92-16.29	3-45	1,000	Rectangular	~3.8	0.467
• The potential site is located between Oyster Bay and Te Rua Bay. • The site appears biophysically suitable for salmon, although parts of the site are very shallow, and the site is modelled to produce about 440 t of annual salmon production within ES5. • Economic analysis suggests value add/GDP would generate about $2m and 21 FTEs.						
Why is this site eliminated						
• Much of the potential site lies over sand/shell hash habitat inhabited by a sparse to moderately dense epibenthic community. Near the eastern site boundary and the southwestern corner are areas of broken rock/cobble supporting encrusting communities and large biogenic aggregations comprised of diverse taxa including a reef building bryozoan species and various hydroids, ascidians and sponges. Associated with this habitat are reef fishes including schools of tarakihi and butterfly perch. Hydroid trees are within the site boundary. Inshore of the site and extending into the site in places are patches of kelp, including the ecologically important giant kelp and relatively dense algal beds comprising a diverse range of red and green algae. Patches of kina are noted. • While comparable or slightly higher risk compared to existing Tory Channel farms according to navigation report, the MDC Harbour Master and some SWG members express significant concerns over this site as it is located within a 'pinch point' in the channel where ferries turn and may be a navigational hazard in inclement weather. • Potential for intrusive residential amenity effects on one significant nearby permanent dwelling.						

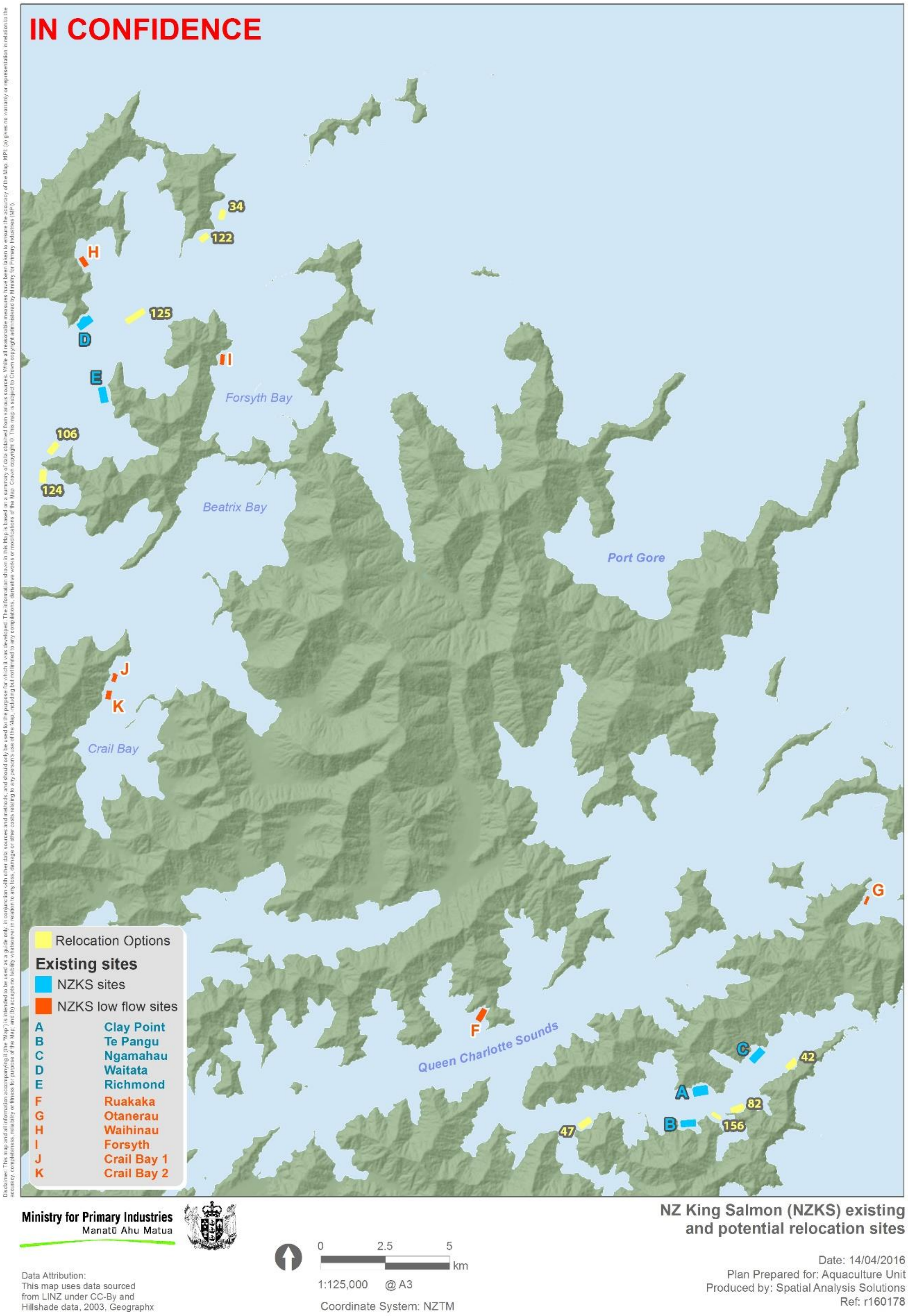
Principles of public consultation

79. Dependent on the Minister of Aquaculture's decision to proceed to public consultation, the SWG acknowledges the importance of an effective consultation process that would be consistent with the Environment Court's *Principles of consultation* in Appendix 5.

80. This process was also informed using SWG input on what a good consultation process should look like (SWG meeting 14 October).

81. Key components of this process are as follows:
    1. Independent testing of the information consistent with RMA processes. Options could include:
        i. Expert workshops – to enable key science providers to meet and discuss key issues with other experts where appropriate.
        ii. Consideration to an independent panel, or similar.
    2. Iwi engagement – will be ongoing and tailored to meet iwi needs.
    3. Appropriate methods to allow for the range of views and values to be expressed through pubic consultation. Options include:
        i. 10-week consultation period
        ii. Use of drop-in sessions/targeted meetings to enable people to be better informed about the proposal
        iii. Use of social and local media – ensure the proposal is well known within the community and nationally.

Appendix 1 – Map of consented NZKS sites and potential relocation sites



Appendix 2 – SWG Terms of Reference

Marlborough Salmon Working Group

Terms of Reference

11 August 2016

Overview

The Marlborough District Council and the Ministry for Primary Industries have established a Marlborough Salmon Working Group to consider options to implement the *Best Management Practice Guidelines for Salmon Farming in the Marlborough Sounds* (the guidelines).

These guidelines were developed by local and central government, industry and scientists in 2014 to set out recommendations for sustainable salmon farming in the Sounds. It is also important to acknowledge that while implementing the guidelines, wider issues need to be considered such as water column, landscape, navigation, amenity and cultural values, and the New Zealand Coastal Policy Statement.

The working group will be involved in the next step, which is to look at options to implement the guidelines so that the best environmental, social and economic outcomes are being realised.

The working group will begin meeting in July and provide recommendations to the Marlborough District Council and central government on implementing the guidelines.

Marlborough Salmon Working Group

Role

The role of the Marlborough Salmon Working Group (MSWG) is to provide recommendations to implement the guidelines.

The aims of the MSWG are:

- to consider options for existing salmon farms in Marlborough to adopt the guidelines; and
- to ensure the enduring sustainability of salmon farming in Marlborough, including environmental outcomes and landscape, amenity, social and cultural values.

While non-binding, the recommendations will inform the future planning work on salmon farming in Marlborough. The group will not replace statutory consultation processes required to establish any potential new salmon aquaculture space under the Resource Management Act 1991.

Meetings

The MSWG will meet in Blenheim on the following dates:

- 14 July
- 21 July
- 10 August
- 31 August

Additional meetings may be organised if required.

An agenda and meeting venue details will be sent to members before each meeting.

Membership

The MSWG group consists of individuals who bring a wide range of skills, knowledge and experience to the table on a number of different dimensions. These include knowledge of various iwi and stakeholders' perspectives with an interest in the marine environment of the Marlborough Sounds.

The group will receive and provide information, discuss and debate issues to provide recommendations.

Members will work towards a shared understanding of the issues to implement the guidelines on salmon farming in Marlborough and identify solutions to these issues. This does not mean that members necessarily agree about the issues and solutions, but that they understand each other's positions well enough to have constructive discussions and exercise their collective thinKing to identify unbiased, best practicable solutions.

The MSWG consists of the following members:

Ministry for Primary Industries	Ben Dalton (Convenor) & Luke Southorn
Marlborough District Council	Pere Hawes
Department of Conservation	Jeff Flavell
Te Tau Ihu iwi	Richard Bradley & Richard Paine
Aquaculture New Zealand	Gary Hooper
Marine Farming Association	Graeme Coates
New Zealand King Salmon	Mark Gillard
Guardians of the Sounds	Paul Keating
Sounds Advisory Group	Eric Jorgensen, Rob Schuckard & Judy Hellstrom
Kenepuru & Central Sounds Residents Association	Ross Withell & Hanneke Kroon
Environmental Defence Society	Raewyn Peart

The working group includes representation from local and central government, key community and interest groups, iwi, and the aquaculture industry.

No substitution of members is permitted for occasions when a member is unable to attend a meeting, unless under exceptional circumstances.

Agency representatives (including technical sub-group as needed) will attend meetings to provide secretariat, technical and expertise assistance and input.

Independent Facilitator

The MSWG will be assisted by the appointment of an Independent Facilitator.

The Independent Facilitator to the MSWG is Ron Crosby, Consultant. The role of the Independent Facilitator is to provide direction to the MSWG and encourage constructive and well informed discussion by all members.

The Independent Facilitator will be independent of the process and not take a particular position on the topic being discussed. Independent Facilitator will be independent from the funding agencies, and from any interest, business, or other relationship that could interfere with independent judgement.

The Independent Facilitator acknowledges and ensures that all information used as part of the process is kept confidential and not to be shared with any other party.

Marlborough Salmon Working Group Members

Responsibilities

The MSWG will be committed to consider all options to implement the guidelines in a timely, open, and fair process. Members will be dedicated to an examination of available information thoughtful dialogue, and carefully crafted advice to provide the Marlborough District Council and central government with recommendations. In particular, members should:

- openly share relevant information, thoughts and ideas with other members
- work to identify appropriate options and openly discuss and evaluate those options
- acknowledge and accept that the process by necessity has budget, resourcing, and time constraints, and to work to the best of their ability within those constraints.

Confidentiality of information

Members acknowledge and ensure that all information used as part of the process is kept confidential and not to be shared with any other party.

The process for members who have obligations to report back to their constituent organisations will be discussed at the first meeting.

Media Contact

No MSWG member shall speak on behalf of the MSWG other than Ben Dalton, Convenor.

All media requests are to be directed to Ben Dalton.

Resourcing

Information, advice and support will be given to the MSWG to ensure it is well informed and supported in its role. Administrative support will be provided to book meeting rooms and take notes.

All reasonable travel costs and disbursements to members to attend meeting will be met by MPI and MDC.

Appendix 3 – Board of Inquiry (BOI) water quality objectives

1. To not cause an increase in the frequency, intensity or duration of phytoplankton blooms (i.e. chlorophyll a concentrations >5mg/m3)
2. To not cause a change in the typical seasonal patterns of phytoplankton community structure (i.e. diatoms vs. dinoflagellates), and with no increased frequency of harmful algal blooms (HAB's) (i.e. exceeding toxicity thresholds for HAB species)
3. To not cause reduction in dissolved oxygen concentrations to levels that are potentially harmful marine biota.
4. To not cause elevation of nutrient concentrations outside the confines of established natural variation for the location or time of year, beyond 250 m from the edge of the net pens.
5. To not cause a statistically significant shift, beyond that which is likely to occur naturally, from oligotrophic/mesotrophic state towards a eutrophic state
6. To not cause an obvious or noxious build-up of macroalgae (eg sea lettuce) biomass.

Appendix 4 – Water Quality Workshop Summary notes

The following summary notes on adaptive management are extracted from Notes from Aquaculture review meeting 3 October 2016.

Summary points

- Deviation of impacted sites from control sites are a useful means of attributing causality in adaptive management
- It was stressed that defining adaptive management objectives clearly is critical, and that adaptive management is not necessarily a 'one way' process with regard to feed levels. A successful adaptive management framework ensures a pathway for both the increase and decrease in farm nutrient input based on staged development and environmental monitoring.
- Benthic effects (near farm) and pelagic effects of Nitrogen (at larger scales) were both judged as impacts that could be adaptively managed, as pelagic impacts on phytoplankton are reversible over relatively short time periods. But if thresholds were surpassed for longer time periods, effects may be expected upon larger organisms, where the time scale of reversibility will be longer.
- The minimum time period accepted by the TWG between development steps (following monitoring without breaching thresholds) was three years, as this should capture some climatic variation.
- Adaptive management goals could be set for the Sounds at approximately the scale of the water quality modelling.
    - Scientifically it is better to set different goals for different parts of the Sounds that are similar (physiographic units, e.g. channels versus embayments of a sound, or subsections of a sound). Presently we may be data limited in determining these units. Correlation of chlorophyll patterns between sites could be used to help determine physiographic units.
- It is hard to attribute causality to individual farms in the sounds, as pelagic Nitrogen effects are lagged in time and space, and the modelling indicates there will be overlapping effects from individual farms. Therefore salmon farm based Nitrogen inputs could be managed to the Outer Pelorus Sound as one unit. However, at those regional scales nitrogen inputs from other sources (e.g. riverine, run-off, oceanic) would likely need to be considered as well.
- Monitoring is best focused where modelling indicates greatest effects are likely and at the ends of the Sounds (which will also help inform future modelling).
- Consent monitoring, with careful design could be integrated with state of the environment monitoring to enable cost savings and potentially improved ability to indicate causality (particularly regarding land-based impacts).
- Science can inform thresholds, but setting them should be a social decision (informed by the scale of natural variation), and once set thresholds should be able to be reviewed.
- For pelagic adaptive management a suite of indicators will give better information than any single indicator. Correlations could be examined in historical data sets to determine which indicators would provide the most useful. Dissolved Oxygen decrease (at depth) is a clear indicator of eutrophy. But if a single indicator for Nitrogen needed to be chosen the group agreed Total Nitrogen was the most acceptable.
- If thresholds were known for the impact of an adaptively managed stressor (which they are not) then development stages should be smaller approaching this threshold. So development steps should be precautionary compared to modelled predictions of affects.
- The staging of development should consider all farms within a management unit in a coordinated way.

- The 5mg m^{-3} threshold for chlorophyll a suggested by the Board of Inquiry was a good indicator of a shift towards eutrophy and soundly based on monitoring results to date. Five mg of chlorophyll was pointed out as a level that would affect clarity, and a level that gets exceeded periodically in some bays due to natural processes. This exceedance has not been well captured with the MDC state of the environment monitoring to date.
- The interim water quality standards for the BOI granted farms (Waitata, Richmond and Ngamahau) were informed by analysis by NIWA of TN and Chlorophyll-*a* levels from recent monthly monitoring results and baseline data collected for NZKS by NIWA. The interim water quality standards are <3.5mg m^{-3} for Chl-*a*; <300 mg/kg for TN; and $\geq$90% DO concentration 250m beyond the edge of salmon net pens. A process of determining compliance similar to the Benthic BMP has been devised (see Appendix).
- Thresholds should be treated as limits not targets.
- The use of real-time monitoring buoys should:
    - enable collection of data on temperature, salinity, dissolved oxygen, chlorophyll and turbidity (and perhaps Nitrate) much more frequently than discrete sampling.
    - not completely replace the use of physical water samples. Water samples will provide greater spatial coverage, allow measurement of more variables and provide calibration data for the monitoring buoys (as this is needed).
    - provide more frequent data at the buoy locations, which will better characterise the environment at those sites, but thresholds should be reconsidered in light of this, or potentially time-averaged to make these thresholds compatible between infrequent and more frequent water quality sampling.

Appendix 5 – Environment Court Principles of consultation

The Environment Court has developed a statement of principles of consultation. These principles have been primarily developed through case law relating to resource consents and notices of requirement.

The Environment Court's statement of principles for consultation are:

- The nature and object of consultation must be related to the circumstances.
- Adequate information of the proposals is to be given in a timely manner so that those consulted know what is proposed.
- Those consulted must be given a reasonable opportunity to state their views.
- While those consulted cannot be forced to state their views, they cannot complain, if having had both time and opportunity, they for any reason fail to avail themselves of the opportunity.
- Consultation is never to be treated perfunctorily or as a mere formality.
- The parties are to approach consultation with an open mind.
- Consultation is an intermediate situation involving meaningful discussions and does not necessarily involve resolution by agreement.
- Neither party is entitled to make demands.
- There is no universal requirement as to form or duration.
- The whole process is to be underlain by fairness.

These principles can be further drawn on from other decisions of the Court to include that:

- there is an overall duty on the part of both parties to act reasonably and in good faith, because consultation is not a one-sided affair
- consultation has overlapping requirements of reasonableness, fairness, open mind, freedom from demands, and the need to avail oneself of the consultation opportunity
- consultation is as much about listening as it is about imparting information, and is more about the quality of information imparted than it is about the quantity
- consultation is not an end or an obligation in itself, it is just one possible method of gathering views from those affected so that they can be taken account of in the decision-making process. The primary obligation is to ensure that the decision-maker has sufficient material before it to make the necessary decisions about Part 2 issues.

Councils also have to consider how consultation principles under the Local Government Act 2002 are addressed when undertaking consultation on resource consent matters.

Appendix 6 – Current data for potential relocation sites

NIWA Report - Benthic Ecological Assessments for Proposed Salmon Farm Sites - Part 2: Assessment of Potential Effects (September 2016)

Blowhole Point North (34)

The ADCP deployed at Blowhole Point North measured currents from 11m below the surface to 3m from the sea bed. The dominant direction of flow was to the south-west (Figure 3-2). Approximately 17% of profiles exceeded 0.2 m s^{-1} and 5% of profiles exceed 0.34 m s^{-1} over the 36-day ADCP deployment. Examining all of the observations by magnitude and direction, higher current speeds up to 0.65 m s^{-1} were associated with the flows towards the SW (Figure 3-3). Mean current speed from 20m depth to the seabed was 0.13 m s^{-1}, so this site would be considered a dispersive site in terms of transport of farm waste particles.

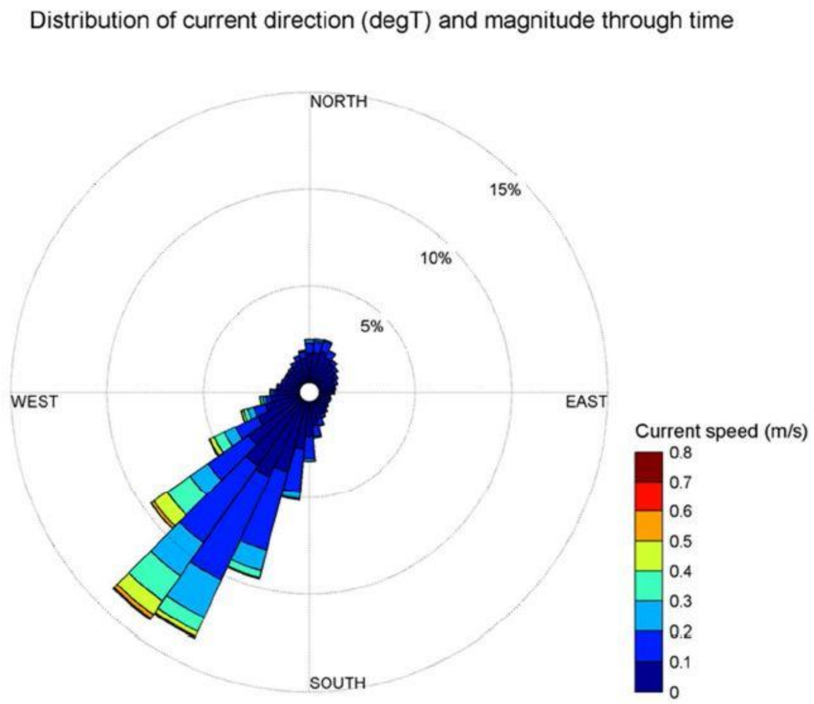


Figure 3-2: **Current rose showing current directions and magnitudes for all bins at Blowhole Point North.**

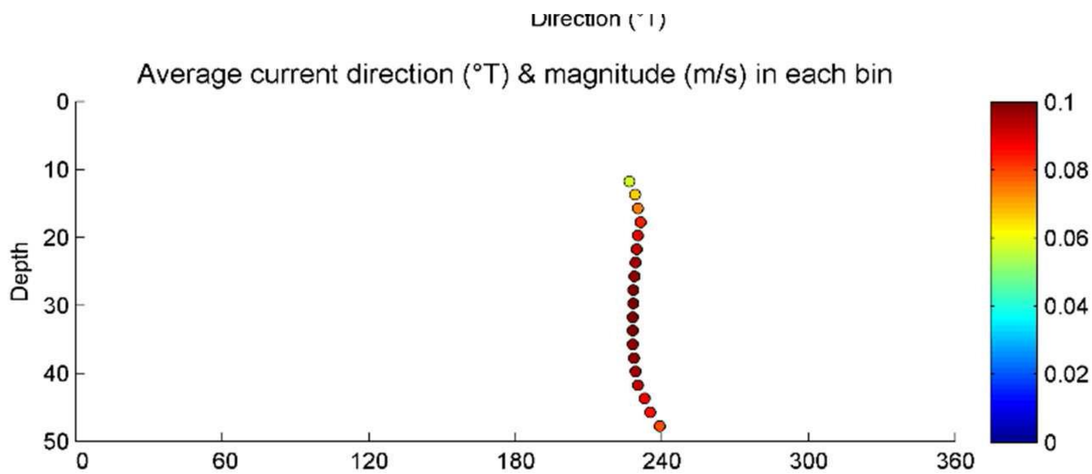


Figure 3-3: Time-averaged profile magnitude and direction (bottom panel) at Blowhole Point North.

Blowhole Point South (122)

The ADCP profiles at Blowhole Point South span from 5m below the surface to 2m from the sea bed. Current speeds exceeded 0.2 ms_{-1} for 20% of the deployment and were directed towards the NE and ENE direction (Figure 3-7). The fastest currents of 0.38 ms_{-1} occurred for around 5% of the 36-day observation period. Any currents flowing towards the west (into the Bay) were weak at less than 0.1 ms_{-1} . The time-averaged profile showed weaker near-bed flows that increased towards the surface, where currents of 0.2 ms_{-1} were directed to the NE (Figure 3-8). Mean current speed from 20m depth to the seabed was 0.14 m s_{-1}, so this site is considered to be a dispersive site in terms of transport of farm waste particles.

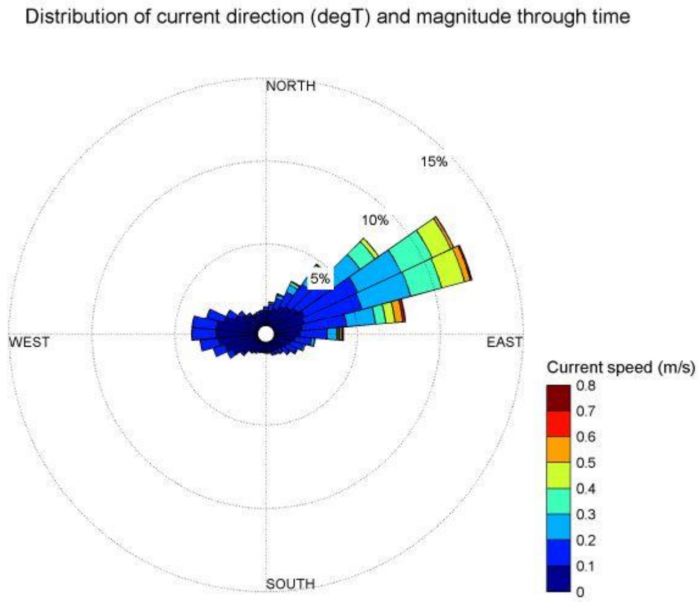


Figure 3-7: Current rose showing current directions and magnitudes for all bins at Blowhole Point South.

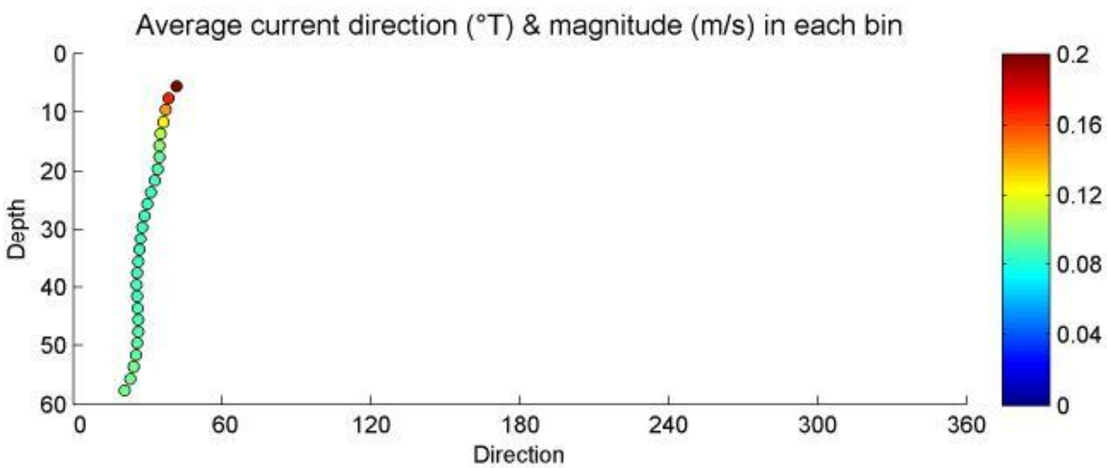


Figure 3-8: Time-averaged profile of magnitude and direction (bottom panel) at Blowhole Point South.

Waitata Reach Mid-Channel (125)

Current observations at the Waitata Reach site span from 5m below the surface down to 59 m. Figure 3-12 shows that the current flows were oriented in a NE/SW direction, with very few exceptions. Current speeds were greater than 0.2 ms^{-1} for 52% of the 36-day deployment, and 10 % of the currents exceeded 0.4 ms^{-1}. Separating currents into associated depths showed the top 8m were directed out of Pelorus Sound (NE direction, Figure 3-13). A corresponding inflow was present in the lower 4 bins (SW direction, Figure 3-14). This two-layer flow is a typical estuarine flow that is set up by the density stratification in the system. While the strongest time-averaged flows were directed out of Pelorus Sound (Figure 3-15), a moderate average inflow (up to 0.1 ms^{-1}) in the lower water column would move any material below 30 to 40m into Pelorus Sound. This site exhibits the strongest current profiles with a mean current speed in the water column between 20m depth and the seabed of 0.24 m s^{-1}.

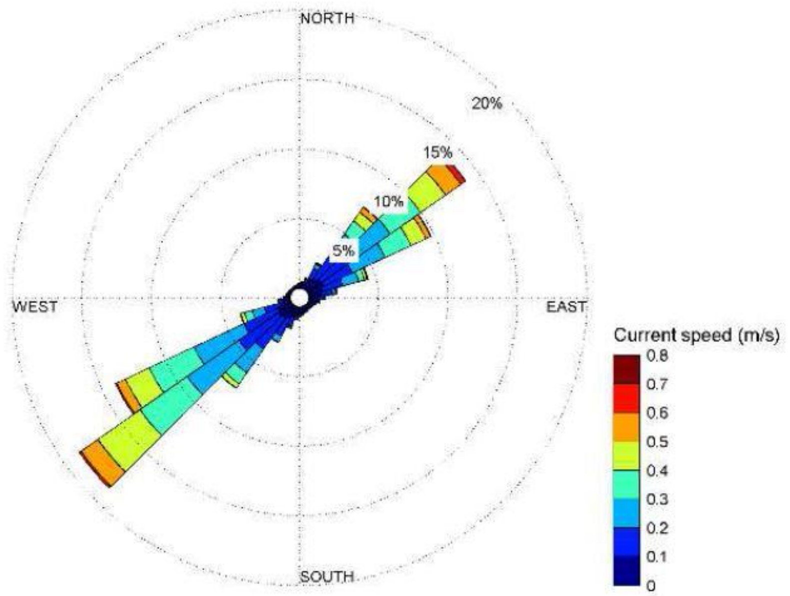


Figure 3-12: Current rose showing current directions and magnitudes for all bins at mid Waitata Reach.

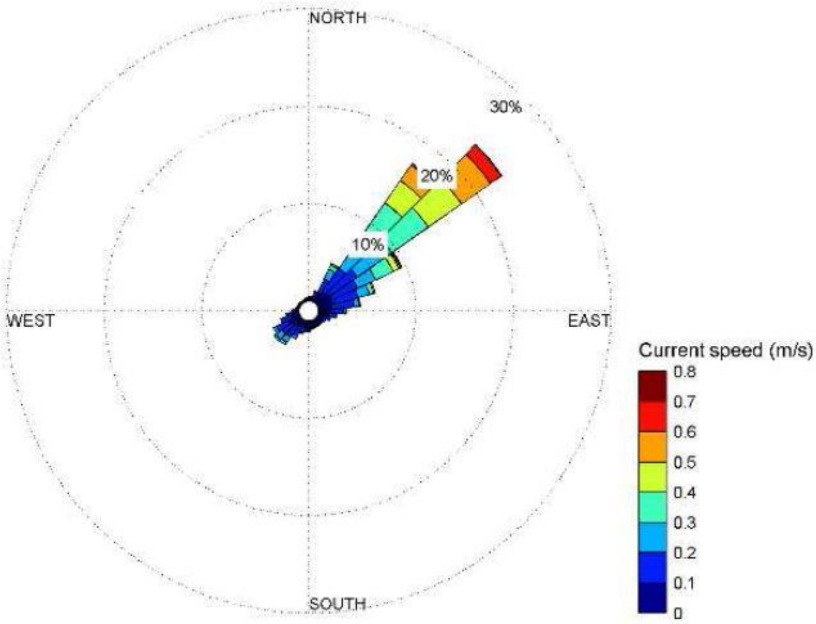


Figure 3-13: Current rose showing current directions and magnitudes for the top four bins at mid Waitata Reach.

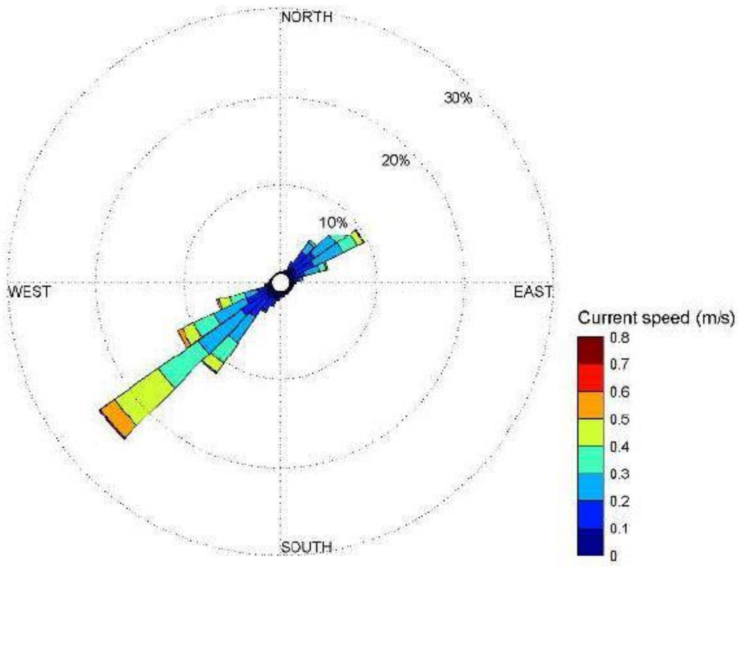


Figure 3-14: Current rose showing current directions and magnitudes for the lowest four bins at mid Waitata Reach.

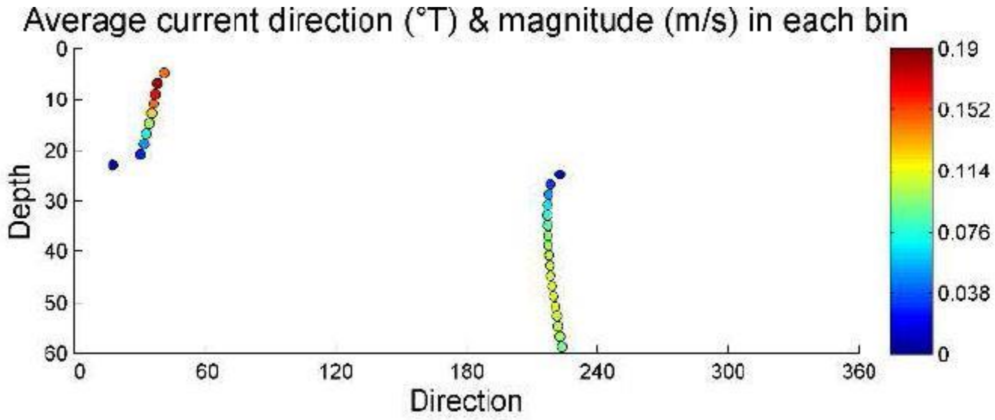


Figure 3-15: Time-averaged profile magnitude and direction (bottom panel) at mid Waitata Reach.

Richmond Bay South (106)

Currents at the Richmond South site were directed along a NE/SW trajectory with stronger near-bed flows directed into Pelorus Sound (Figure 3-19). The time-averaged near bed currents Richmond Bay were 0.15 ms^{-1} towards the SW (Figure 3-20) and much faster than surface flows which were dominated by tidal oscillations.

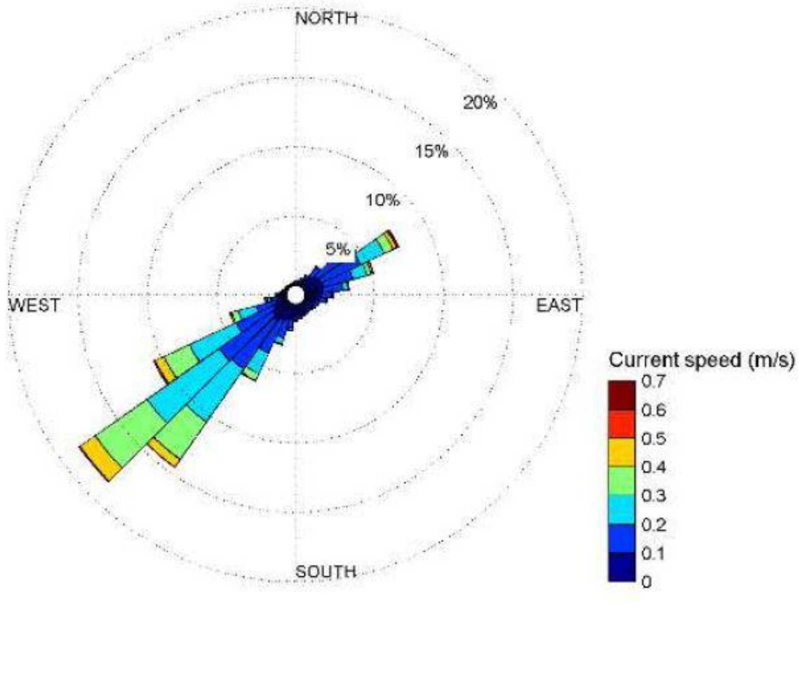


Figure 3-19: Current rose showing current directions and magnitudes for all bins at Richmond South.

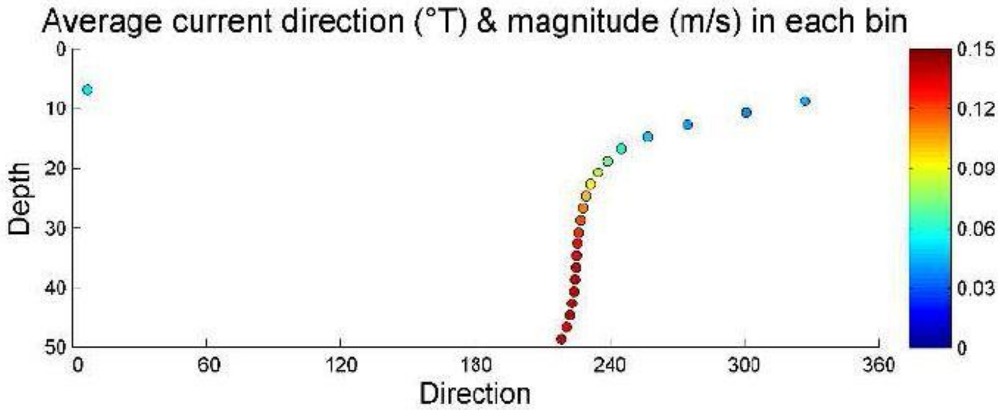


Figure 3-20: Time-averaged profile magnitude and direction (bottom panel) at Richmond South.

Horseshoe Bay (124)

The mean near-bottom current speed at this site was 0.12 m s^{-1} and more than 5% of the currents were measured above 0.25 m s^{-1}, even at the lowest recorded depth. This indicates that current speeds there are moderate to high, and that organic material from salmon farming would be likely to be resuspended periodically. The current rose plot for all measured depth bins in Horseshoe Bay (Figure 3-24) indicates a weak tidal signature with net movement of water to the northwest.

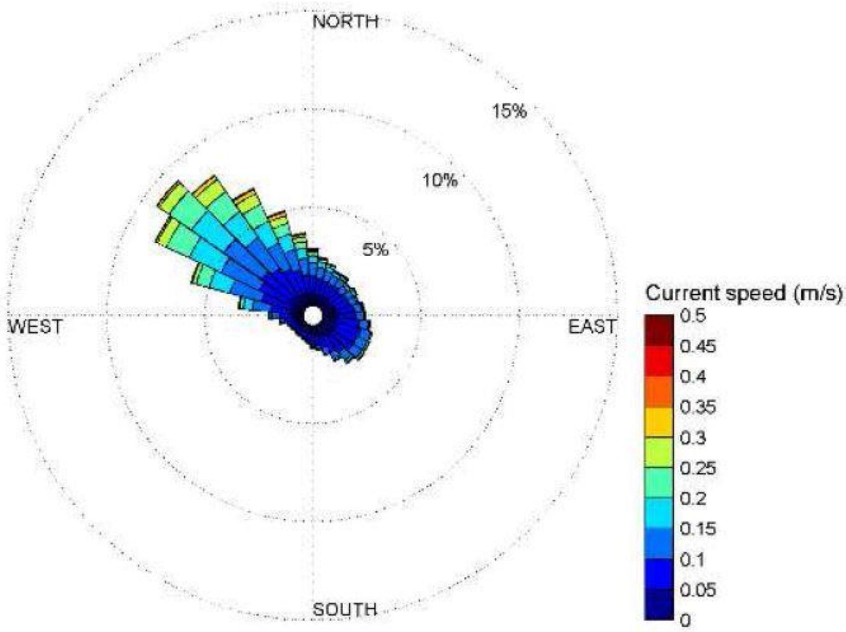


Figure 3-24: Current rose showing current directions and magnitudes for all bins at Horseshoe Bay.

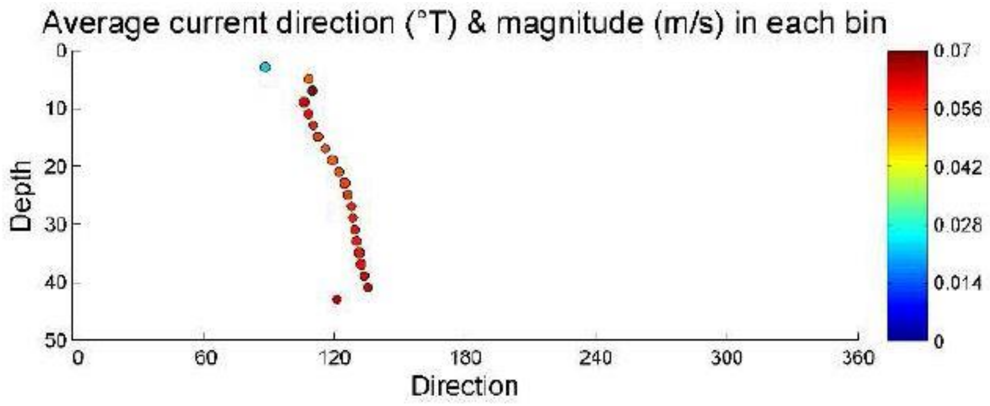


Figure 3-25: All observations of current magnitude and direction (top panel) and time-averaged profile magnitude and direction (bottom panel) at Horseshoe Bay.

Tio Point (156)
NIWA Report – Site Assessment for Potential finfish site: Oyster Bay, June 2014.

Water level and current meter data cover three spring-neap cycles during August and September 2013 (Figure 3-4). Mean current speeds were between 0.2 and 0.25ms^{-1} for the duration of the deployment, with similar speeds throughout the water column (5 to 34 m water depth). Spring tides occurred near to 10/8, 22/8 and 6/9. For several days around the larger tidal range, faster current speeds of around 0.45 ms^{-1} were recorded. The timing of the faster flows was at two different times in the tidal cycle with 1) at low water when there was an abrupt shift in flow direction from 310^{o} to 260^{o}, and 2) at mid-flood in the lower 20 m of the water column.

During neap tides, current speeds ranged from 0.1 to 0.2 ms^{-1} and oscillated between similar directions of 310^{o} and 250^{o}. The lowest speeds were present at high water and for several hours of the ebb tide, directed towards the south west.

Five 'bins' of data were extracted from the ADCP time series for more in-depth analysis (see Appendix 1). Current rose plots that combine speed and direction with percentage occurrences of these were generated for 5, 12, 20, 26 and 34 m water depths. The convention for ocean currents is that direction shows where the water is moving towards. Near-surface current rose at 5m (Figure 3-5) shows ebb flows of up to 0.15 ms^{-1} that were directed to the northwest (310^{o}). Higher flow of 0.25 ms^{-1} flowed towards the south-west (200^{o} to 240^{o}) during the flood tide. A similar response was observed at 12 m (Figure 3-6). These top two bins showed a greater spread of both speeds and associated directions. This is most likely due to the shedding of tidal flows from the nearby headland.

Deeper in the water column at 20 and 26 m (Figure 3-7), currents flowed in the same two main directions of 310^{o} and approx. 240^{o} for the ebb and flood tides, respectively. Of interest for material transport was the higher southwest flows observed on the mid-flood in the lower water column. These current speeds ranged from 0.25 to 0.4 ms^{-1}, depending on the stage of the spring-neap cycle. The nearbed current rose (Figure 3-9) showed slowed currents toward the northwest during the ebb, but similar speeds of 0.3 to 0.4 ms^{-1} towards 240^{o} persisted during the flood tides.

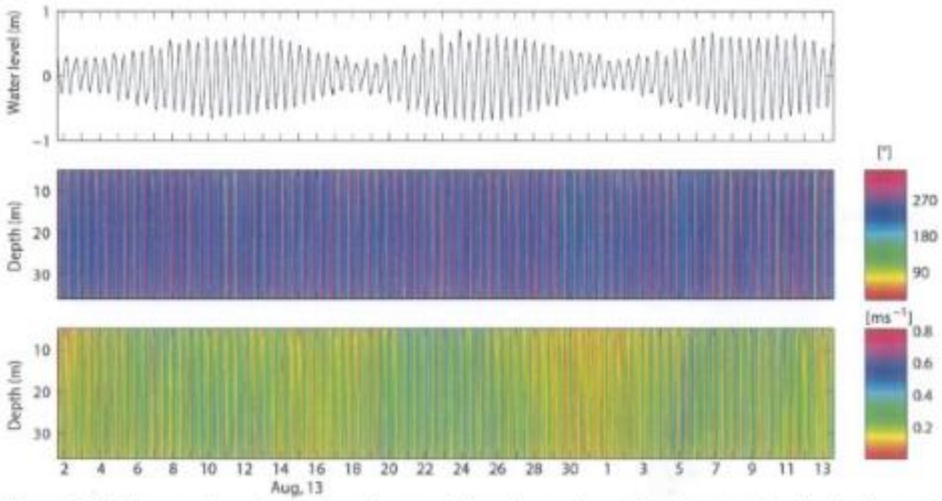


Figure 3-4: Time series of water level, current direction and speed at Oyster Bay during August and September 2013.

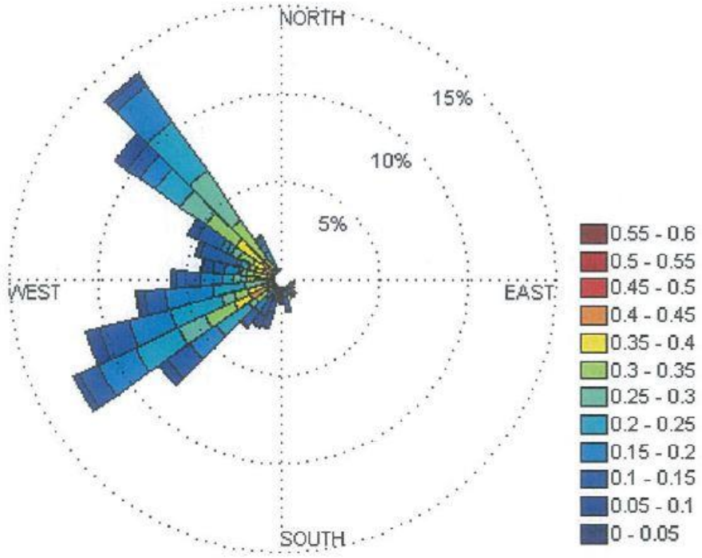


Figure 3-5: Current roses showing percentage distribution of speeds and direction at 5 m in the water column. .

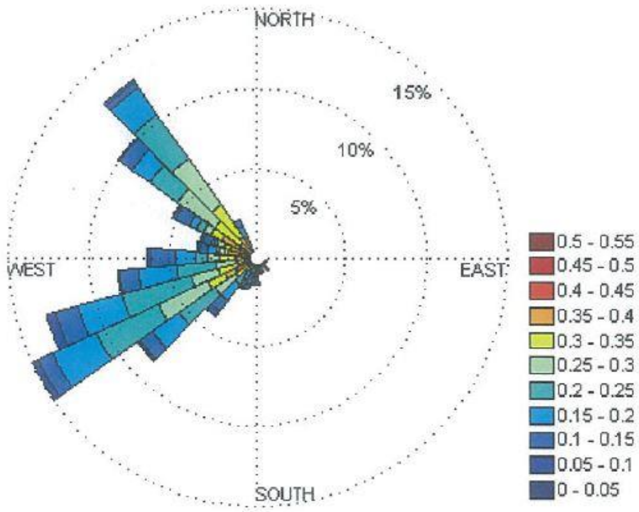


Figure 3-6: Current roses showing percentage distribution of speeds and direction at 12 m in the water column.

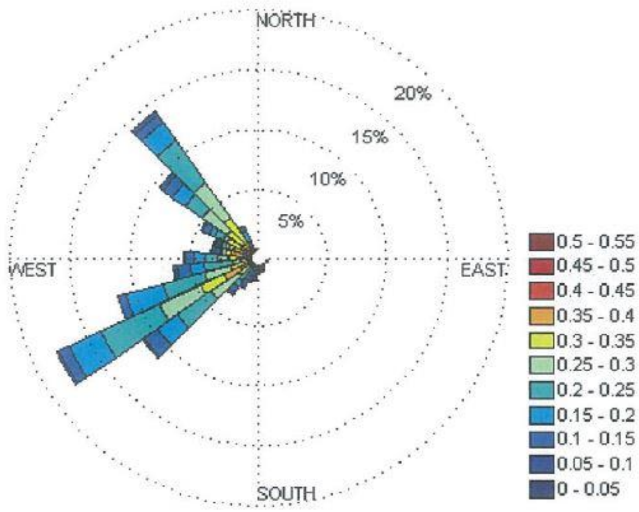


Figure 3-7: Current roses showing percentage distribution of speeds and direction at 20 m in the water column.

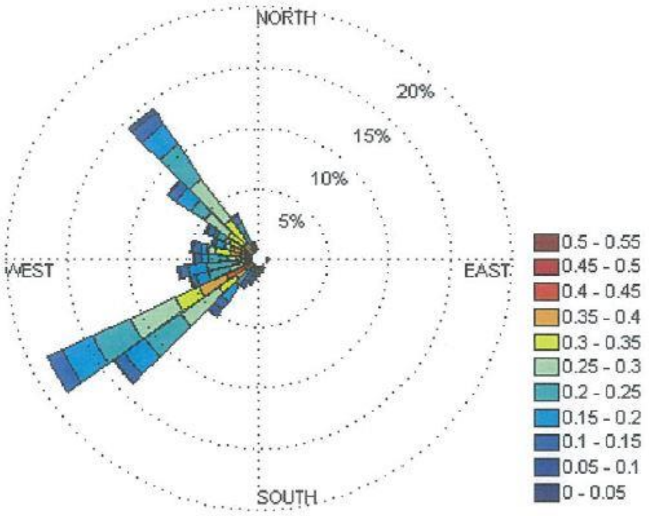


Figure 3-8: Current roses showing percentage distribution of speeds and direction at 26 m in the water column.

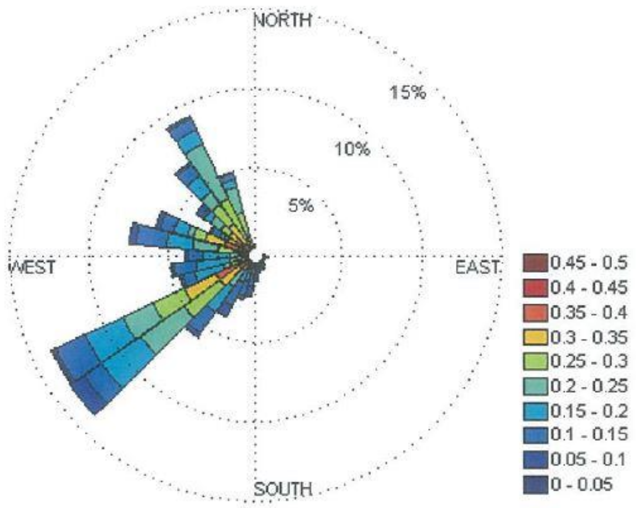


Figure 3-9: Current roses showing percentage distribution of speeds and direction at 34 m in the water column.