Marlborough Salmon Working Group

Advice to the Minister of Aquaculture

23 November 2016

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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.

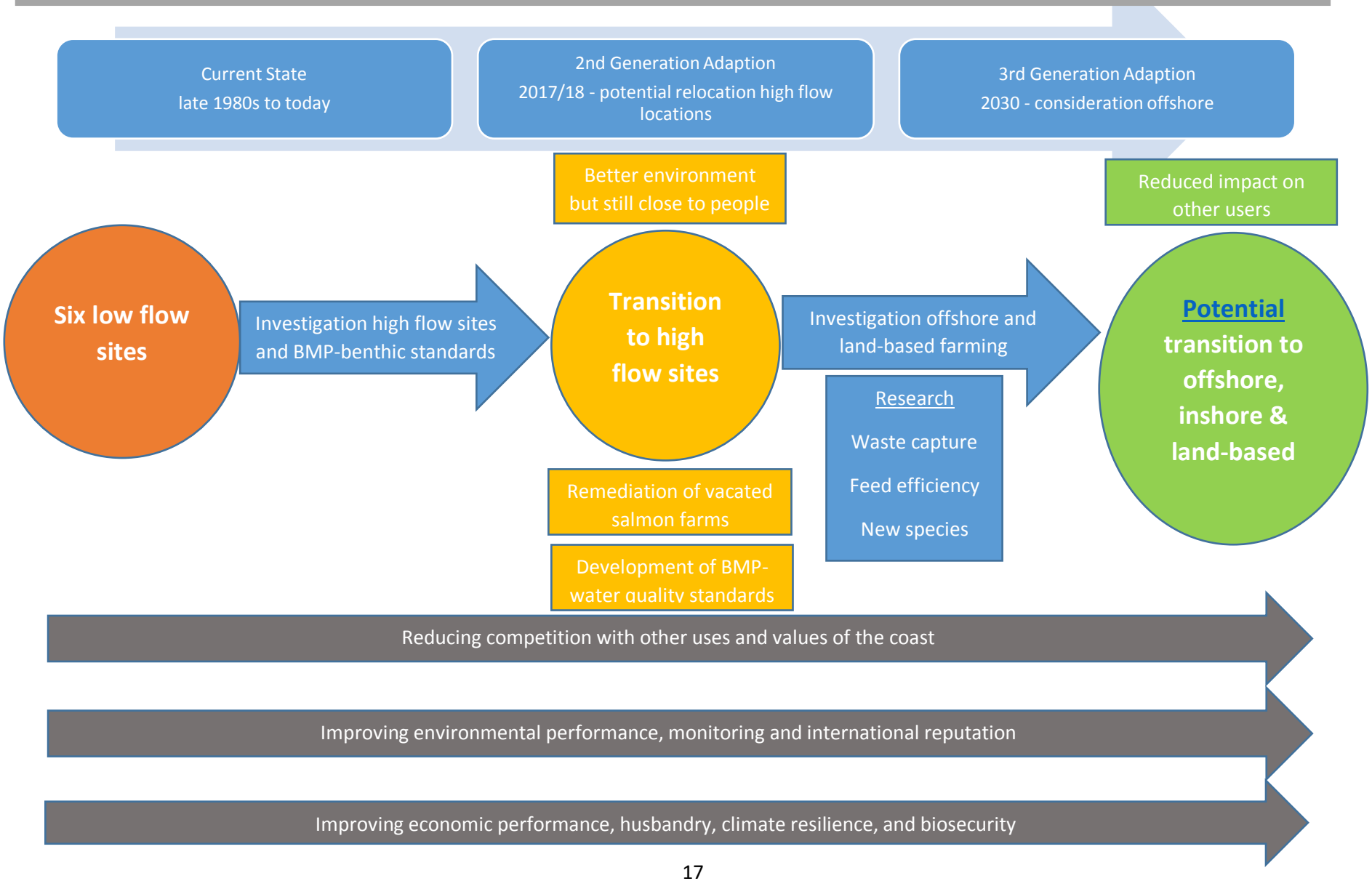
Land-based aquaculture	
Technology is well developed to grow salmon within a land-based farming environment using flow through or recirculation of freshwater or seawater. However, the economic viability of this option is largely determined by the availability of sufficient land and water resources, and 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.

TIO POINT (#156)	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) 0.21 (2) 0.23	13.1-15.9	18-44	1,600	Rectangular	4.5	0.739

- 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.

Seafloor habitats and communities

- 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.

Landscape and natural character

- 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

SWG concerns about the potential site

- 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.

TE WEKA BAY (#47)	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) 0.20	9.92-16.29	10-47	1,800	Rectangular	6.5	0.467

- 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.

Why is this site eliminated

- 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.

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.

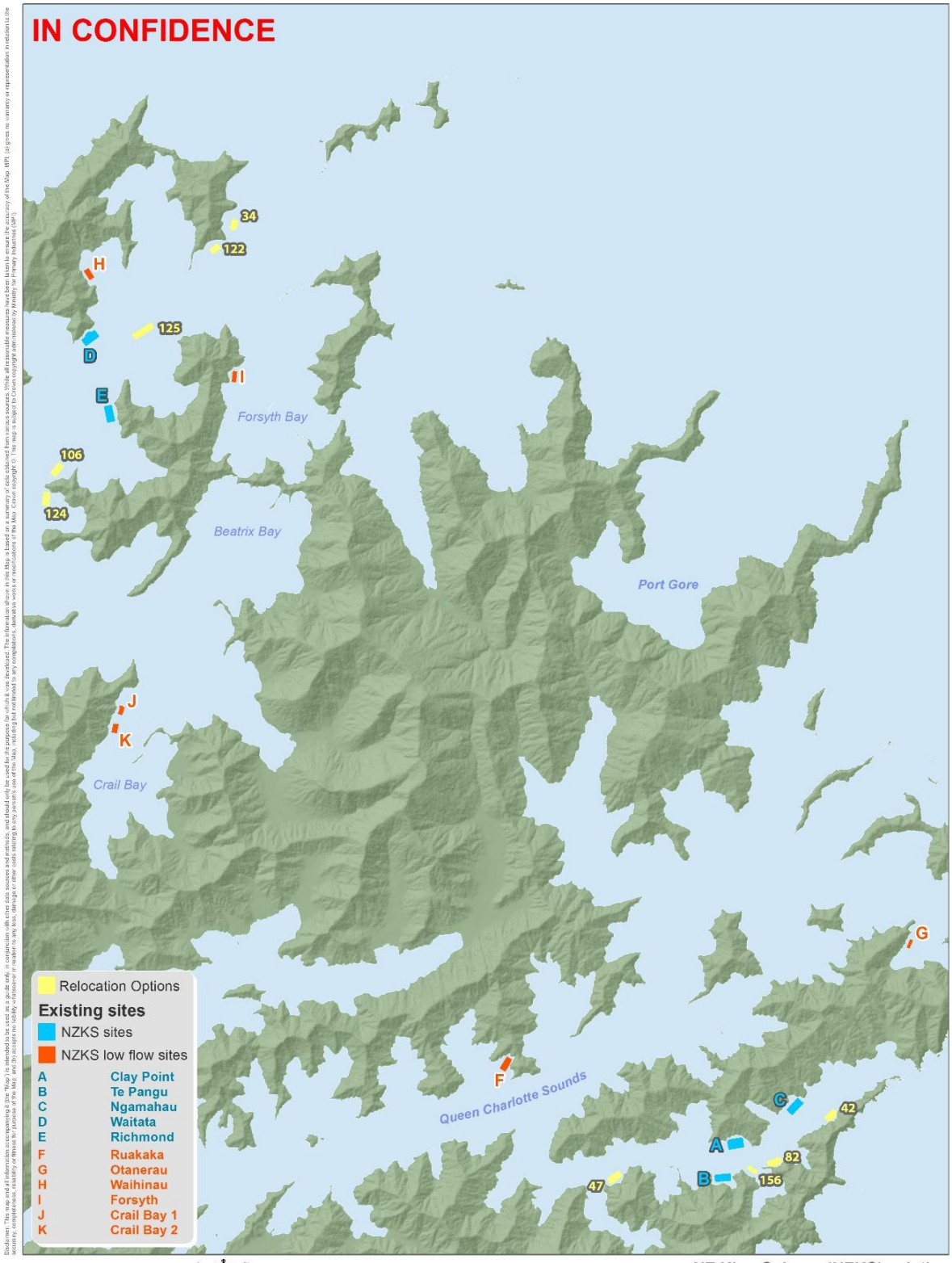
Principles of public consultation

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



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.

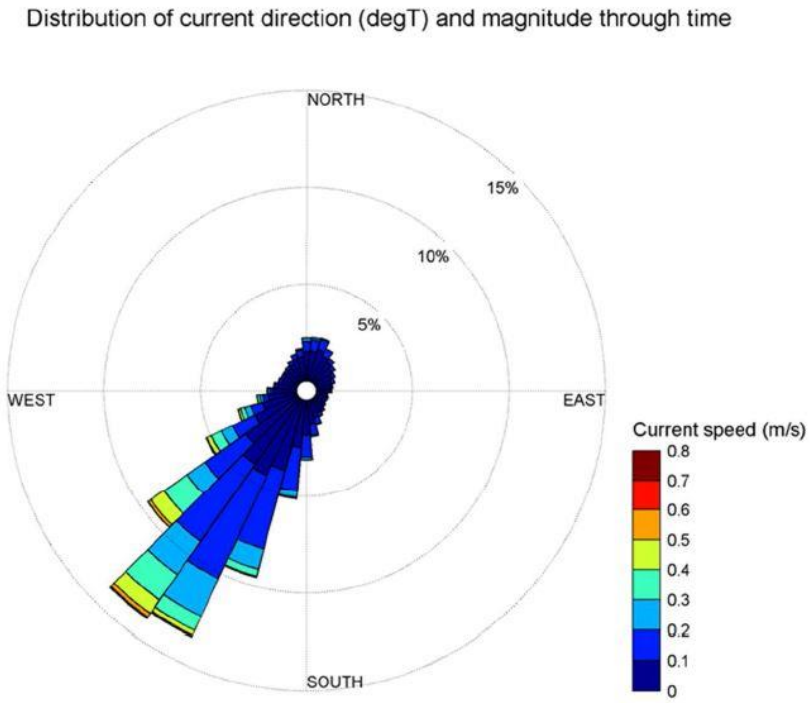


Figure 3-2: Current rose showing current directions and magnitudes for all bins at Blowhole Point North.

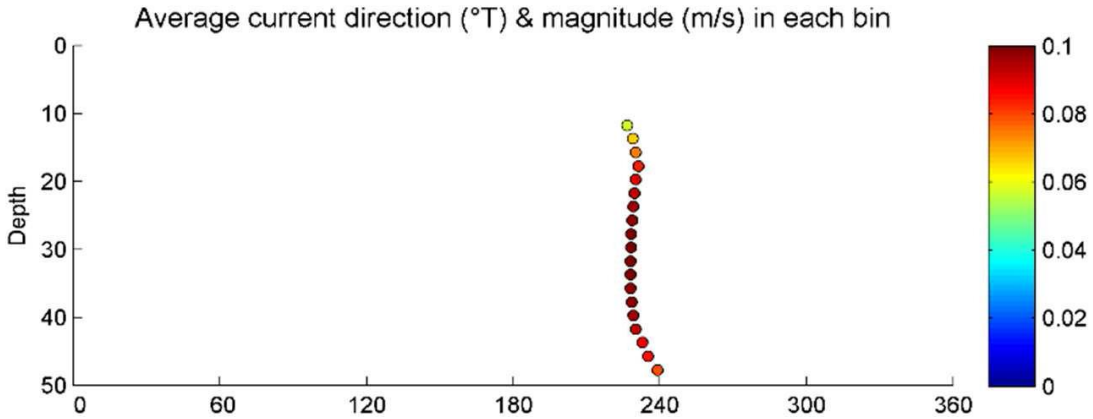


Figure 3-3: Time-averaged profile magnitude and direction (bottom panel) at Blowhole Point North.

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.

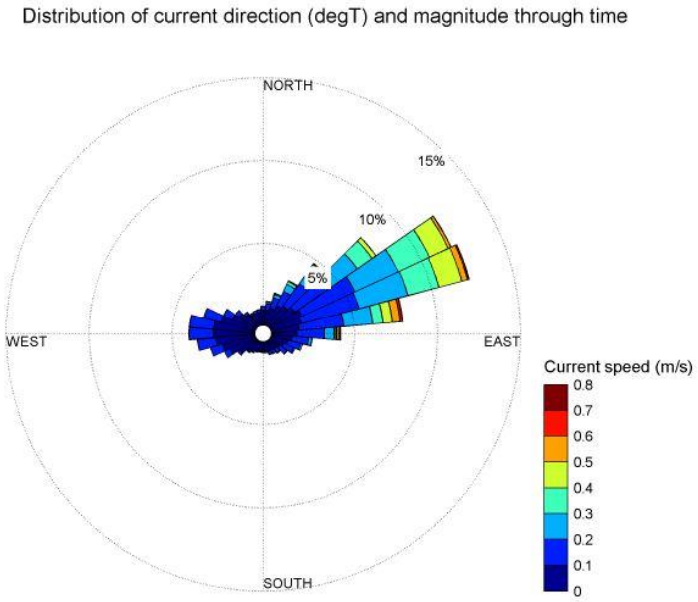


Figure 3-7: Current rose showing current directions and magnitudes for all bins at Blowhole Point South.

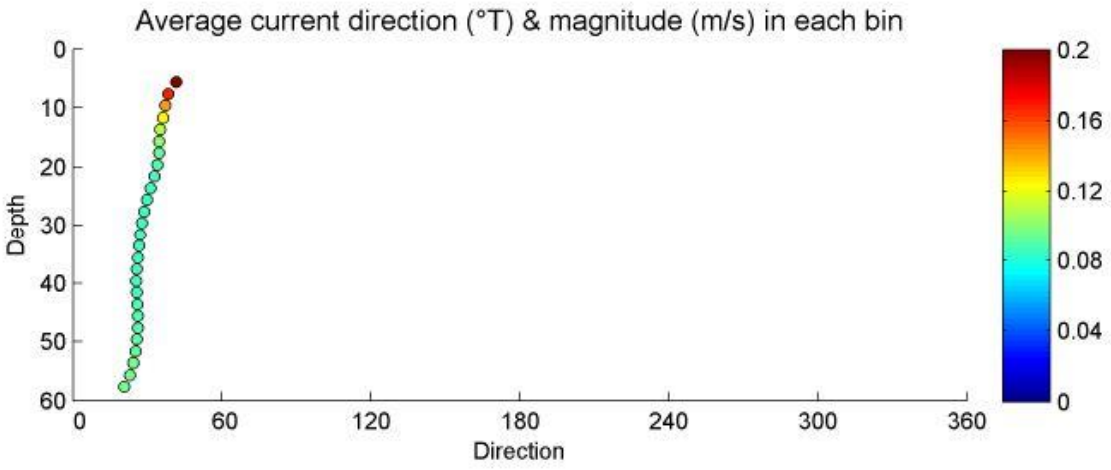


Figure 3-8: Time-averaged profile of magnitude and direction (bottom panel) at Blowhole Point South.

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}.

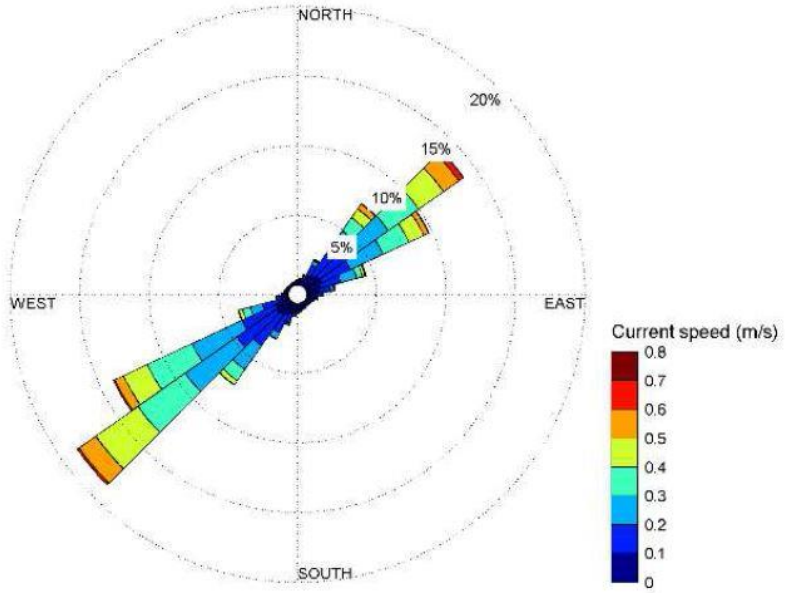


Figure 3-12: Current rose showing current directions and magnitudes for all bins at mid Waitata Reach.

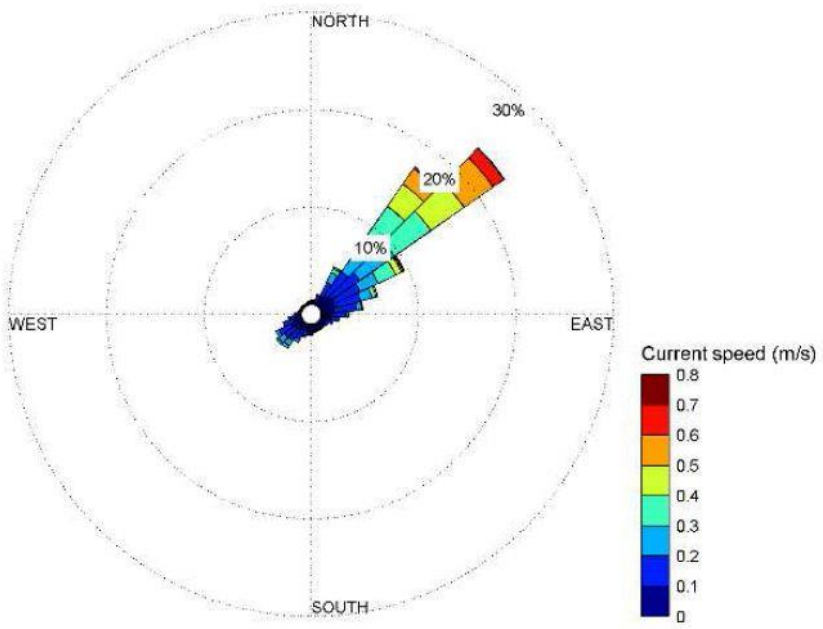


Figure 3-13: Current rose showing current directions and magnitudes for the top four bins at mid Waitata Reach.

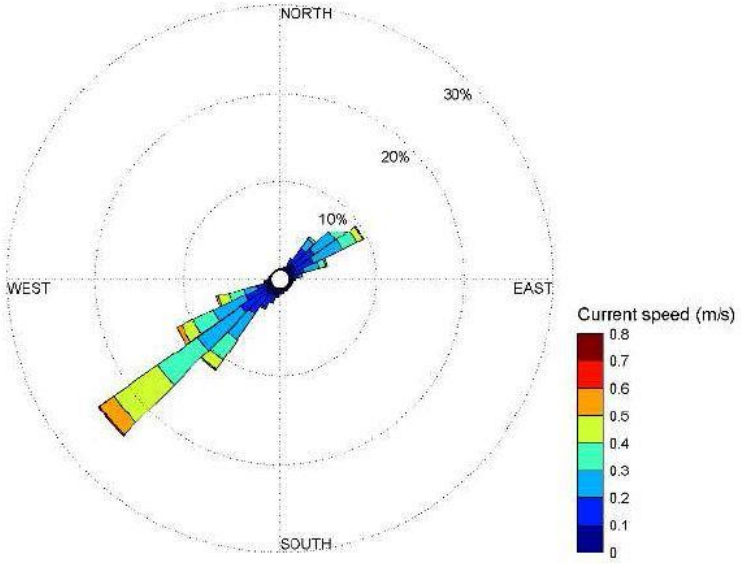


Figure 3-14: Current rose showing current directions and magnitudes for the lowest four bins at mid Waitata Reach.

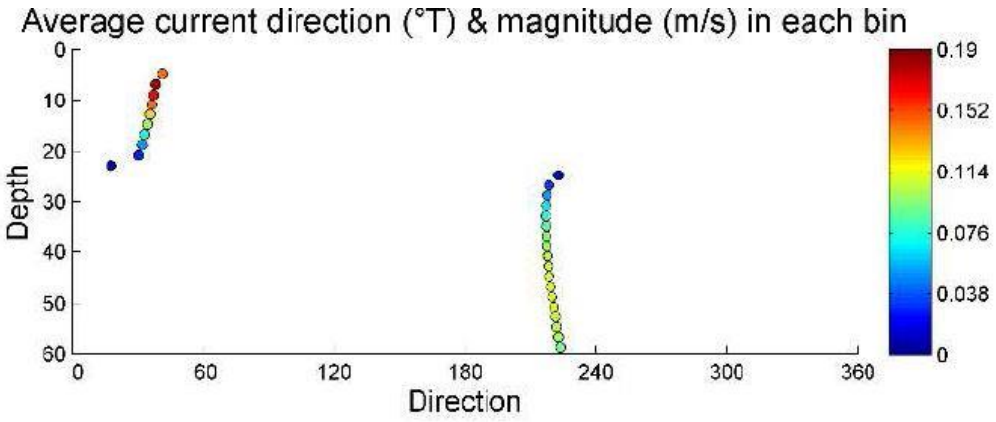


Figure 3-15: Time-averaged profile magnitude and direction (bottom panel) at mid Waitata Reach.

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.

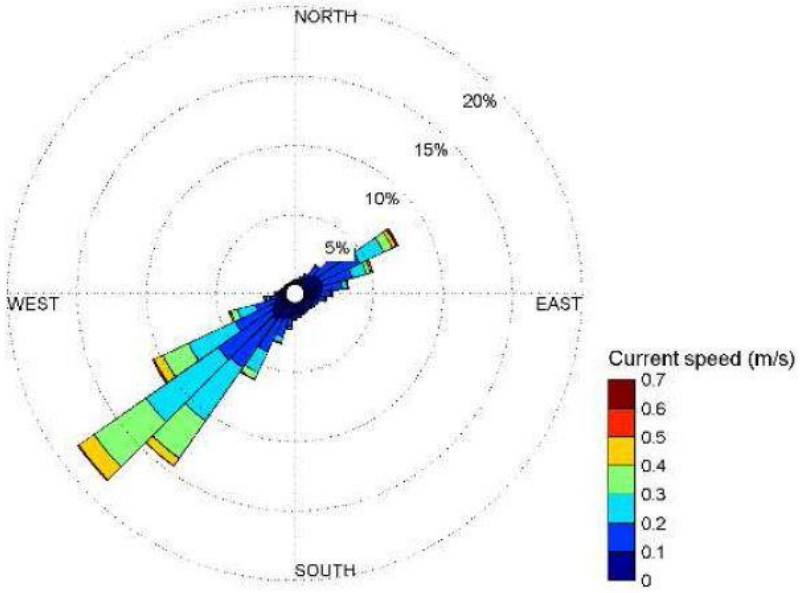


Figure 3-19: Current rose showing current directions and magnitudes for all bins at Richmond South.

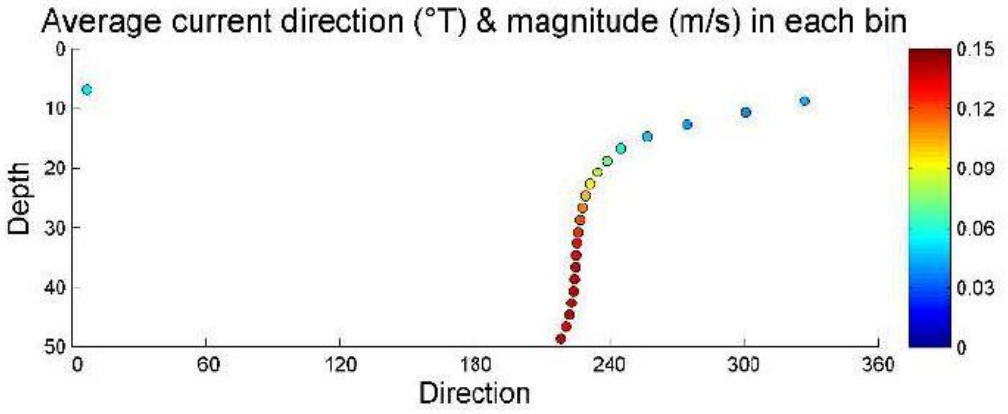


Figure 3-20: Time-averaged profile magnitude and direction (bottom panel) at Richmond South.

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.

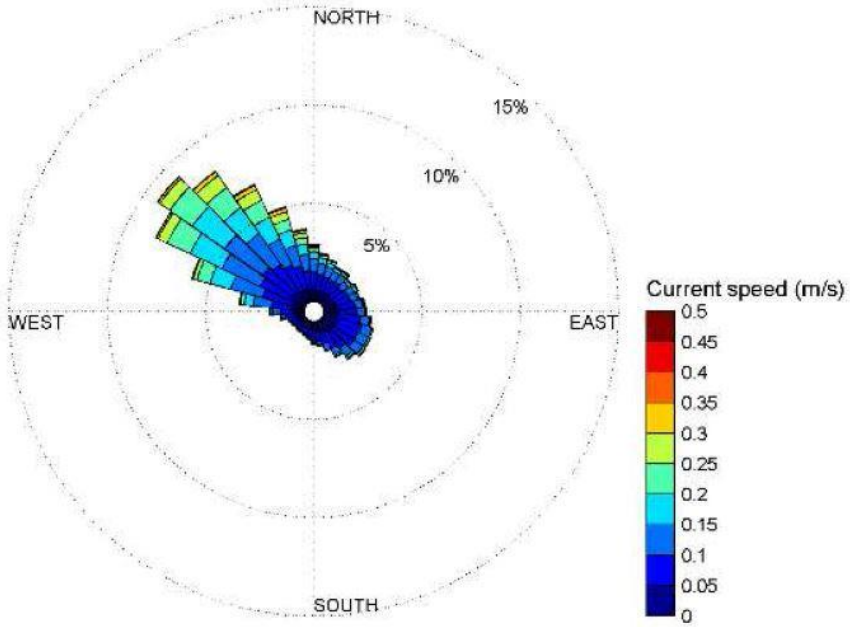


Figure 3-24: Current rose showing current directions and magnitudes for all bins at Horseshoe Bay.

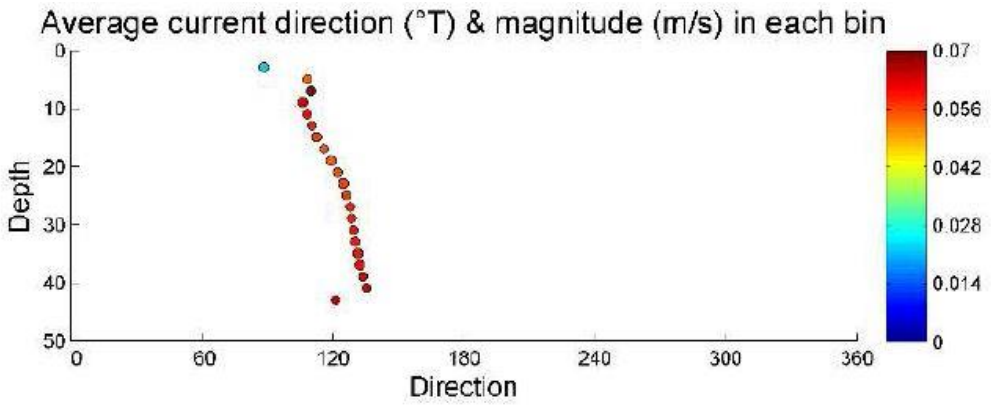


Figure 3-25: All observations of current magnitude and direction (top panel) and time-averaged profile magnitude and direction (bottom panel) at Horseshoe Bay.

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.

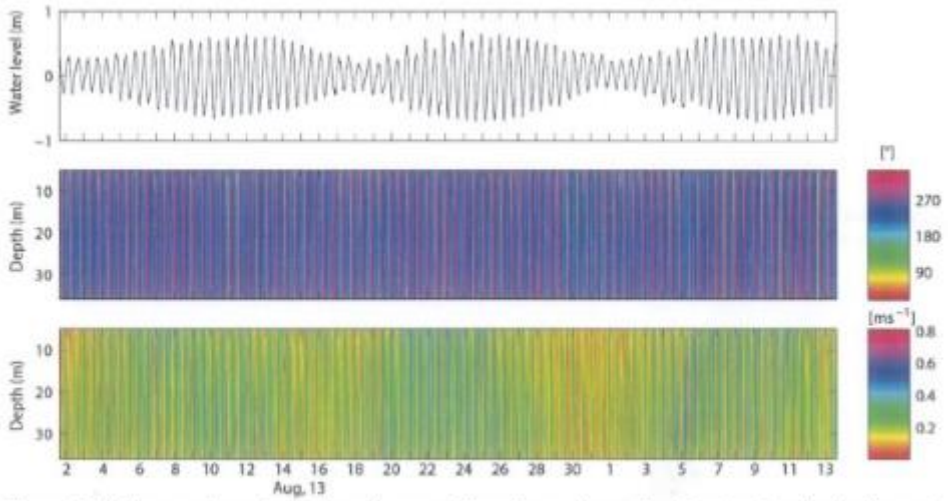


Figure 3-4: Time series of water level, current direction and speed at Oyster Bay during August and September 2013.

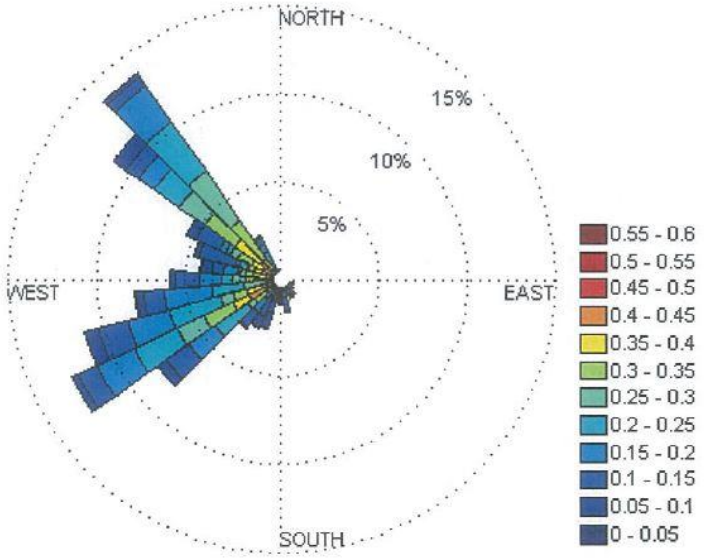


Figure 3-5: Current roses showing percentage distribution of speeds and direction at 5 m in the water column. .

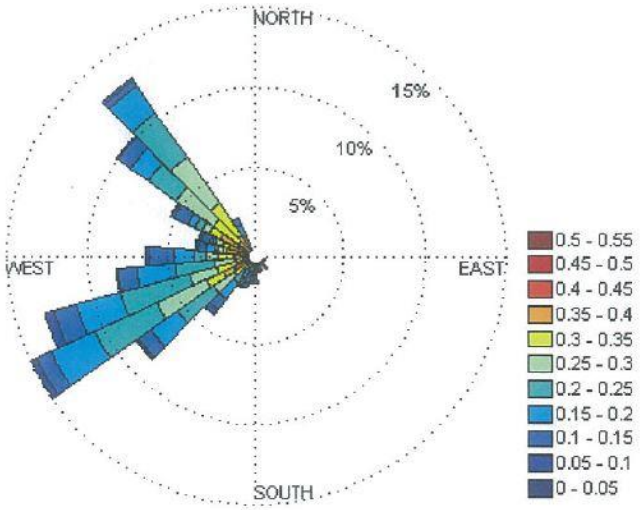


Figure 3-6: Current roses showing percentage distribution of speeds and direction at 12 m in the water column.

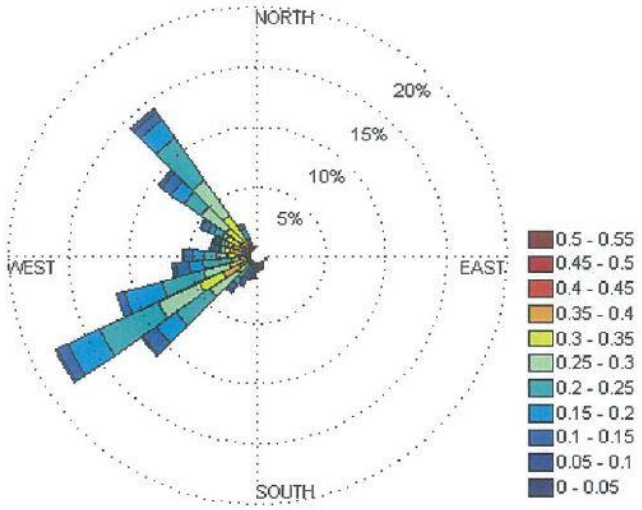


Figure 3-7: Current roses showing percentage distribution of speeds and direction at 20 m in the water column.

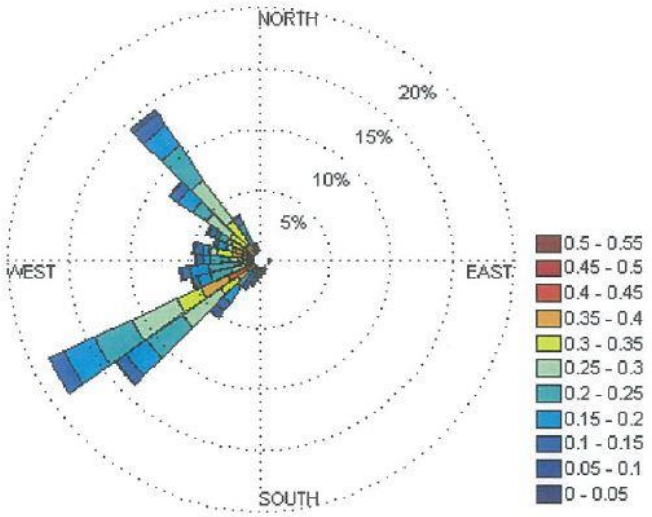


Figure 3-8: Current roses showing percentage distribution of speeds and direction at 26 m in the water column.

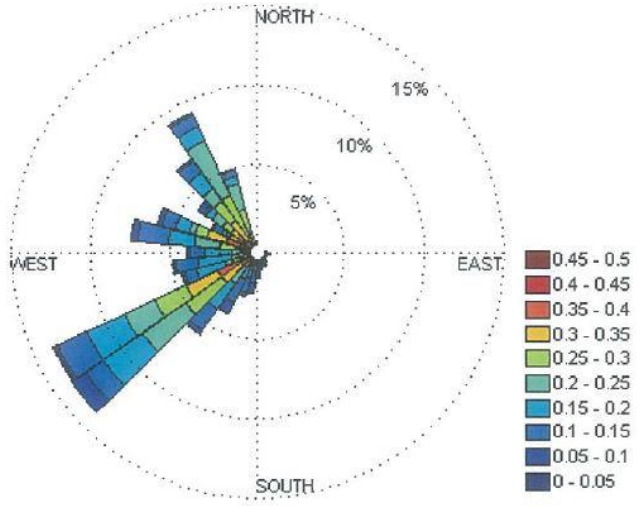


Figure 3-9: Current roses showing percentage distribution of speeds and direction at 34 m in the water column.