

**BEFORE ENVIRONMENT SOUTHLAND
AT INVERCARGILL**

**IN THE MATTER OF A HEARING UNDER S100A OF THE RESOURCE
MANAGEMENT ACT 1991**

BETWEEN JIM MAASS-BARRETT & ZANE SMITH

Applicants

**AND TE RŪNANGA o AWARUA, DEPARTMENT OF
CONSERVATION, MINISTRY FOR PRIMARY
INDUSTRIES, SANFORD LTD, EEC LTD, and
BLUFF OYSTER MANAGEMENT CO. LTD.**

Submitters

REBUTTAL EVIDENCE OF JIM MAASS-BARRETT

31 OCTOBER 2019

INTRODUCTION

1. My rebuttal evidence is on behalf of Zane Smith and myself as the applicants. It will address the following:
 - a statement about the context of the application and the matters that have been raised by the submitters;
 - navigation and safety;
 - carrying capacity in Big Glory Bay; and
 - other matters, being a response to some specific points made by the submitter.

OPENING STATEMENT

2. Zane and I have now had the opportunity to review all of the information that was provided at the hearing and as was required by the Commissioner subsequent to the adjournment. Before responding to it, we wish to have it noted that two of the main issues raised by Sanford Ltd are, firstly, outside the scope of its submission, in the case of the carrying capacity of Big Glory Bay; and secondly, totally new in regard to the existing environment, particularly in regard to the requirements for moving salmon cages around the bay. The latter is within the scope of the submission but the submission provides no details or any indication that it is in regard to moving cages.
3. The first point will be addressed later in my rebuttal evidence. In regard to the second, we wish to have it noted that:
 - a. in regard to the assessment of the existing environment, the amendments to Sanford's consents were granted after our application was notified (see para. 82 below);
 - b. the information relating to the consent amendments was considered during the preparation of our application and some of it was used in the assessment of environmental effects;
 - c. none of Sanford's information addressed the navigation requirements for moving cages around the bay as it currently exists;
 - d. none of Sanford's information addressed the effect of each of the new salmon cages on the hydrodynamic processes in the bay; and

- e. despite Sanford staff meeting with me after the application was notified, and after being provided with the correct version of the site map for the proposed mussel farms early in the process, the issue of navigating salmon cages around the bay was not discussed at all.
4. We accept that the onus is on the applicant to provide information on the effects of the proposed activity but the lack of any information coming from Sanford about the cage navigation issues when the opportunity was provided means the chance to make changes at an earlier stage in the process has been lost. We are now in the position of being locked in to what has been applied for and only able to make changes that are considered to be within the scope of the application.
5. Notwithstanding the matters raised in our rebuttal, changes to the sites are put forward that are considered to address the navigation issues raised. The result is a loss of area that will impact on potential earnings but we acknowledge that Sanford have a significant investment in the bay and we do not wish to obstruct the successful operation of the farms as it now intends to manage them.

NAVIGATIONAL SAFETY

6. The focus here is now on the Navigational safety aspects of the application with regard to Sanford's ability to safely move their salmon cages, as a unit, about the bay when following its following plan. My evidence sets out to respond to and address the matters raised by the submitter and Environment Southland's Harbourmaster notwithstanding the response provided by Mr Engel in his rebuttal evidence.
7. The other points brought up by the submitters such as increased busyness in the bay, and vessels moving through and around farms rather than using the navigational channel, should have been accepted as non-issues by the submitters, as they are not identified by the Reporting Officer or the Harbourmaster as such, and have been addressed.
8. Transporting fish from the smolt farm to the grower farms should not cause any navigational issues as the size of the transporter cage is only 30 metres square. There are no situations involving our proposed sites that will limit Sanford's access for this activity, and the issue seems to have fallen off the radar.
9. The remaining objection to the application relates to the "navigational safety" issues of relocating the salmon farm in complete blocks of cages, while following the following plan agreed to as part of the recent amendment to Sanford's salmon farming consents.

10. It should be noted that there is a profound difference between moving mussel lines off a mussel farming site to accommodate a salmon farm onto the same site, which is an operational matter, compared to having to move mussel lines from a different Sanford site to allow passage of the salmon farm, then re-instating the mussel line on its original site. Unfortunately, this point has not been made properly clear in the comments by the submitters, and has led to the Reporting Officer and the Harbourmaster incorrectly assuming that during a salmon farm relocation, it has required mussel lines not on the destination farm to be moved to allow the farm relocation.
11. The exception here is a situation where the brood stock farm on Site 338 have been moved sideways onto Site 321 and mussel lines have been in the way of this shift. Because the brood farm has such relatively low stocking density, Sanford is able to place some mussel lines on the outer parts of these two sites and some were in the way, blocking the planned farm move. This is entirely an operational matter, unrelated to the presence or not of the proposed application sites.
12. In the recent past Sanford has shifted its main grower farm from Site 320 to Site 249 after removing the mussel lines on Site 249 that occupied the space where the salmon cages were to be placed. In 2016, the farm was again shifted down towards the mouth of the bay to Site 246 after the mussel lines were moved off that site to accommodate the fish cages.
13. At no time were mussel lines moved from any other unrelated site farmed by Sanford, nor will it be necessary in the future, with or without the proposed application sites. This point is no doubt the reason the submitters “overlooked” the Reporting Officers suggestion that moving mussel lines on unrelated Sanford sites could provide an alternative navigation route for farm relocations.

Application Site 1

14. If Site 1 was rotated slightly and the northern side moved southwards by reducing the size of the site, it would open the northern navigational passage to about the same distance as the existing channel, as suggested by Mr Cleaver (Page 4 of Reporting Officer’s Final Recommendation) so there should be no navigational safety issues to be considered against the Regional Coastal Plan (see amended plan attached)
15. I note the concerns mentioned by Mr Eriksson in his submission, Pg 16, Table 2 “ Salmon Farm Locations that will be affected by this proposal”. He makes a lot of the difficulty about accessing Sites 366 and 474 **IF** our Site 1 was in place. This is bunkum and he proves it himself with the comment:

“... as the part of the area closest to the shore is too shallow. (Access to this site would be extremely difficult if Site 1 were in place,) as we cannot get our vessels around the landward side of those consent areas”.

16. Access to the landward side of those sites has no relationship to our proposed Site 1, or its presence. Further on Mr Eriksson states:

“ In addition, laying and stretch(ing) moorings will become difficult.... The lack of clear water for manoeuvring also poses safety risks.”

17. None of these concerns are related in any way to the presence or not of the application Site 1. Mr Eriksson has not said openly the true nature of his concern, i.e. there is insufficient room between the boundary of Site 149a, and Sites 366 and 474, to position anchors, and the water is too shallow, with anchor warps obstructing access to the inshore cages for the transporter cage if a salmon farm could ever be located on these sites.
18. Access to Site 320 will not be impeded in any way if we change Site 1’s shape and dimension to align with the northern access channel.
19. We are unsure why Mr Mitchell appears so uncharitable about even a reduced Site1 in his comments (Page 4 Reporting Officers Final Recommendation), but reflecting on the lack of substance in what appear to be specious arguments by Mr Eriksson, one would imagine his conclusion would now mirror ours.

Application Site 2

20. We do agree with Mr Cleaver’s and Mr McLennan’s assessment of Site 2. However, an increase in the size of this site is proposed to compensate for the loss of Site 3 (see below). The change is not considered to be excessive and does not raise any different issues that have not been considered. If accepted, the benthic area under the extension will be visually assessed before any lines are installed. However, based on my diving experience in this area, the sea bed is not expected to be any different to what has already been surveyed.

Application Site 3

21. As noted at the start, the pity of this adversarial type approach with submissions is we are locked into the position where we are unable to move our application sites around to accommodate Sanford’s needs, as used to happen in the past when potential conflicts arose.

22. We are convinced we have fulfilled the requirements for assessing carrying capacity, water flows, etc., and because we were unaware that Sanford could not move their farms in smaller “pieces” until just before the hearing, we were unable to change the application to satisfy all parties. One could wonder why during the course of discussions, as noted in Jaco Swart’s submission (page 54), *“Over the last year with Alison Undorf-Lay I have personally attended several informal chats with Mr Maass-Barrett”*, we never seriously broached the subject of any of the Sanford concerns except one. The wrong map was explained and the correct one was supplied to Ms Undorf-Lay. I was under the impression that was the end of Sanford’s concerns about adverse navigational effects to do with Site 1 and the northern access channel, which was the only navigational issue I was aware of.
23. To resolve the navigation issues, we are submitting two amended site lay-outs options. Option 1 is preferred and only reduces the total area applied for by 1.5 ha but it involves shifting Site 3 approximately 200m northwards. Site 1 is reduced in size so that the northern boundary aligns with the sites adjacent to it to the west.
24. Option 2 is provided in the event that Option 1 is considered to be beyond the scope of the application. It eliminates Site 3 and increases the size of Site 2 to provide some compensation for lost area. John Engel’s evidence provides information on the resource management issues associated with these proposed amendments.
25. In support of maintaining the possibility of having a Site 3, Sanford has shown in the farm layout plans provided in Mr Swart’s submission (page 45, Figs. 3 and 4) configurations that are smaller than the current 8 x 2 cage long grower farm. There will be a planned split of this farm into a 6 x 2 and a 5 x 2 cage farm mid 2020, so one would imagine the split would be prior to the planned relocation, reducing the risks when compared to moving the much longer current farm. According to the layout plan, by 2022, the grower farm will have expanded to a 7 x 2 and 6 x 2 cage configuration, with the smolt farm in 5 x 2 cage and 3 x 2 cage units.
26. These farms should be easier to relocate and should be taken into account when assessing the potential navigational impacts of the application sites. We are unsure why/how the split can be accomplished to make the farms into smaller units when required, yet this is not considered to make the “navigational safety” issue redundant when relocations are being undertaken.
27. As noted at the start of this evidence, this information on the salmon farm having to be shifted as one unit has only become available to us immediately before the hearing. It should also be noted that we had our application publicly notified before the Sanford decision was concluded and have therefore been unable to change the position of our sites to accommodate Sanford’s requirements.

28. No contrary expert evidence has been offered by the applicant until now as we were waiting to hear comments from the Harbourmaster and the Reporting officer before making a response.

ECOLOGICAL CARRYING CAPACITY

29. We, the applicants, agree with the Officer's assessment and, combined with our comments and investigation of Dr Hartstein's parameters, we are adamant there is sufficient carrying capacity in Big Glory Bay to hold three more mussel farms. We agree with Dr Stenton-Dozey's view that there is much in-bay production of phytoplankton, as evidenced by what occurs with mussel condition in the bay, i.e. building up in spring and early summer, then maintaining that condition right through until winter.
30. Key 2001¹ agrees: *"Although growth of mussels is slow, condition is good compared to the other major farming areas in NZ. Condition was greater than 9.5 (good quality mussels) for 7 months from November to May"*
31. *I have also been advised that "... Big Glory Bay mussels are sought after in the marketplace as best on average in NZ", - pers com. from Merv Moody, Southern Seafoods factory manager.*
32. Mike Mandeno of Sanford also said something to that effect at the hearing in response to a question from the Commissioner, though he could have been referring to taste rather than condition.
33. With the projected increase in salmon production and associated rise in nitrogen inputs from approximately 1,100kg/day to approximately 1,800kg/day, there is little chance that phytoplankton levels and mussel condition will suddenly plummet in Big Glory Bay.

Response to Mr Hartstein's statement of evidence 16 October 2019,

34. In para. 13 of his evidence, Mr Hartstein states, *" After reading the sections provided by Dr. Plew, I generally agree with his conclusions in that currents will be reduced in the bay and this reduction will be small in terms of flow speed. I also agree that the proposed farms will have little impact on over all bay circulation and flushing time. However, I think he has understated the potential localised effects in the immediate vicinity of the proposed new farms, that remain unknown and unassessed."*
35. My opinion is that these will have minor cumulative effect (as Plew and Stenton-Dozey note). The effects on circulation patterns of individual mussel and salmon farms were not considered in the modelling of currents by Harstein and others in the information supplied for the recent Sanford

¹ Thesis entitled "Growth and Condition of the Greenshell Mussel, *Perna canaliculus*, in Big Glory Bay, Stewart Island: Relationships with environmental parameters" - J M Key, 2001.

consent amendment. There is no doubt that the effects of having 6, 7 or even 8 cage-long salmon farm structures in the bay will have a much more disruptive effect on localised currents than a relatively “porous” mussel farm of lesser dimension.

36. in para. 14, we partly agree with Mr Hartstein’s assertion that Dr Stenton-Dozey has made errors. The first, mentioned in Hartstein’s para. 18, is an obvious typo and was picked up straight away as such. The other matter was the interpretation of the way to calculate the number of mussels in the bay. Counter intuitively, it counted every mussel of every size and then ascribed filtration rates for harvest size mussels for all. We see now this adds a high level of conservatism to the model, which helps account for the consumption by all the other filter feeders in the bay, including zoo plankton.
37. At para. 17 Hartstein states, *“If the ratio is 1 or below the ASC suggests that further study should be undertaken... i.e. physically sampling of chlorophyll-a concentrations as there is the possibility the carrying capacity may be breached.”*
38. Mr Hartstein will know from the information supplied in the recent Sanford amendment application that the information is already available (pages 18 & 19 AEE Expanding salmon farming in BGB, Part 1 26 April 2018). It shows the Chl-a levels have remained relatively consistent over the period 1998 to 2017 (see also our comments above in relation to increasing nitrogen inputs in Big Glory Bay). It would be remarkable if predicted Chl-a levels did not increase in line with the increased nutrient inputs.
39. Mr Hartstein also states in the same paragraph, *“... CT/RT values of less than 1 indicate that the embayment in question cannot incorporate additional mussel farms in a sustainable fashion.”*
40. He appears to be deliberately ignoring the fact the ASC criterion for pelagic effects does accept in-bay Primary Production is feasible, but it does not take account of inputs from other sources, such as the salmon farms in this case. It gives Big Glory Bay a completely different outcome as evidenced by what is observed “on the ground” here, such as constantly good mussel meat condition for 7 months of the year.
41. Also, we have determined completely different CT/RT ratios using Mr Hartstein’s own figures from the above AEE that confirm the ratio is well within limits for all the tested scenarios. We used these figures rather than accept the ones in the rushed attempt by Mr Harststein in his 16 October 2019 evidence to show the ratios were not acceptable.

42. For example, the all-important volumes at low and high tide, and the average depth were noticeably lower than they should have been. A figure of 15 m average depth was used rather than the one of 15.9 m Mr Hartstein provided in the Sanford AEE (page 13, Section 3.1 General).
43. This lower value gave his high tide figure a value of about 180 million cubic metres and low tide 165 million m³ when they should have been a low tide of about 180 million m³ and high tide about 201 million m³.
44. This error is unacceptable for such an exercise that may well have been the critical factor to deny our application. In the part of Mr Hartstein's report labelled "Conclusions", para. 34 he states, "*My own calculations ... confirm that the carrying capacity of the embayment has been exceeded.*" I have carried out my own calculation, which is attached to this evidence, along with the data I used to do it.
45. Then in para. 35, "*This conclusion is reinforced by the very slow mussel growth rates experienced in Big Glory Bay, as previously addressed in the evidence of Mr Culley and Mr Schofield*". Hartstein has conveniently not even acknowledged what we provided as evidence of temperature as being primarily responsible for slower growth rates in BGB. We will add to this now.
46. From Key 2001, "*This study found a good relationship between growth and temperature, with growth being highest over the summer months and NEGLIBLE IN WINTER*" (our emphasis). We found Big Glory Bay water temperatures were much lower over-all than elsewhere - July 2015 – Aug. 2016 went from a low of 8.4°C to a high of 15 °C, and Sept. 2016 – April 2017 from low of 8.14 °C to a high of 14 °C. Key 2001 noted that Big Glory Bay temperatures were about 1.5°C lower than the waters of Foveaux Strait in winter during 1999 – 2000.
47. With the knowledge of Flaws 1975² claiming little reproductive activity occurred below 13 °C in the Marlborough Sounds, it is reasonable to assume reproduction in Big Glory Bay is likely to also be constrained. We find little evidence of much spawning in Big Glory Bay mussels in most years as there is no issue of over settlement from self- seeded spat. The spat for Big Glory Bay is sourced from warm water on the west coast of the upper North Island and they really are at the southern end of their range, which is why the consistently lower temperatures have such a pronounced effect on growth rates.

² "Aspects of the biology of mussels in the Cook Strait area" – Flaws, D E – 1975 - Victoria University, Wellington.

48. As early as 1979, Hickman³ identified, “ *Even before commercial mussel farming began in Stewart Island, there was evidence to suggest the length of time taken to produce a marketable crop in southern NZ might be double that of areas from the Marlborough Sounds northwards*”.
49. And from Key 2001, “*Hickman 1979, held water temperature accountable for the distinctly lower growth rates of Perna canaliculus measured in Bluff compared to that of the rest of the country.*”
50. Mr Hartstein (and Mr Mitchell) mention the concerns of Mr Schofield over slow mussel growth in Big Glory Bay, suggesting it was because of too many mussel farms in the bay. This matter was also mentioned by Mr Gorton whose letter was attached to Mr Culley’s submission. These two individuals, Mr Gorton and Mr Schofield, were some of the earliest mussel farmers in the bay and witnessed a perfect storm around mussel growth without anyone realising what was going on.
51. From Pridmore and Rutherford⁴, “*Phytoplankton in BGB are limited by nutrient supply in the summer months at present.*”
52. In Key 2001, Pridmore was reported to have recorded very high and prolonged levels of Chl-a (phytoplankton) during 1993 and 1994, which would have meant extraordinary mussel growth with so few mussel lines being in the water at that time.
53. Key also notes, “*... and so nutrients supplied by the salmon farms would be sorely missed by the mussel farmers were they to decrease or be halted*”.
54. This comment was no doubt made in the context of Regal Salmon having stopped salmon farming about mid 1998 and, when they left, Sanford’s salmon farm “inherited” Regal Salmon’s seal problem. For several years, they gave the salmon no rest and production suffered badly. The talk was of the farm having to close if the fish growth did not improve. Key would be very aware of what would happen to mussel farming in the bay if the last salmon farmer in the bay disappeared.
55. Mr Gorton and Mr Schofield enjoyed the short period of little competition and high food levels, then the sudden drop off in nutrients as one half of the salmon farms disappeared in ‘98. About this time,

³ “Management problems in mussel farming” – R W Hickman – 1979 – New Zealand Vet journal Volume 28, Issue 11, pages 226 – 230.

⁴ “Modelling phytoplankton abundance in a small enclosed bay used for salmon farming” – R D Pridmore & J C Rutherford – September 1992.

there were a number of newly consented mussel farms being developed, seven for Sanford and six for EEC, all of varying sizes amongst others. ##

56. The strong El Nino weather pattern reversed in late 1998 and a period of relatively strong La Nina influence started, which generally means lower nutrient levels in Foveaux Strait, Paterson Inlet and Big Glory Bay. This “perfect storm”, combined with extremely high re-seeding densities that were used at that time, would have seemed to the uninformed as if there were too many mussel farms in the bay as growth rates dropped.
57. Happily this scenario is a distant memory with the salmon production currently at about three times the earlier level, and with the consequent increase in nutrients and phytoplankton set to rise dramatically soon as salmon farming moves to a higher level again. We have previously mentioned this period of slower mussel growth, which affected the Marlborough Sounds as well. It was not identified as being caused by large scale climatic factors at the time (Cawthron Report 1476⁵).

OTHER MATTERS

58. Most of these final points come from Ms Appleyard’s submission dated 16 October 2019. The paragraph references are from that submission. Comments in response to other witnesses is also provide at the end.
59. Para. 2 - Ms Appleyard is correct, I am not an expert on phytoplankton carrying capacity in BGB, but I have enough knowledge of the bay gained through working there for the last 34 years to be an expert on BGB. With my, until recently, limited knowledge of the ASC Pelagic Effects criterion, I was able to quickly spot the inaccuracies in Mr Hartstein’s supposedly expert witness assessment of the criteria as they relate to BGB (see para.s 33 – 44 above).
60. Para. 3 - The submitter should be aware of NIWA’s standing in the scientific community and a quick search of the author’s credentials and long involvement with BGB could be illuminating. Dr Stenton-Dozey was, in fact, the author of our original benthic assessment.
61. Para.s 5 – 6 - Dr Hartstein made an attempt to discredit the report requested of Dr Stenton-Dozey and shot himself in the foot by using patently incorrect information. Information he had relied upon

⁵ “Review of the ecological effects of farming shellfish and other non-fish species in New Zealand” – N Keely et al – Cawthron Report No. 1476, prepared for Ministry of Fisheries – 1 August 2009

in the work he produced for Sanford's recent Consent amendment application was carelessly reduced in magnitude to give results that were sure to work against our application.

62. Para.s 9 -12 re Incorrect map - Sanford's ongoing concerns regarding the "incorrect map" and farm locations has been a convenient topic for them to mine, but much of the responsibility for this confusions lies with their own staff inactions. We, the applicant, had supplied the correct map for the benthic survey that was reported on in December 2017. In early August 2018, it became apparent that Andrew McLennan (Environment Southland contracted Reporting Officer) had been sent the incorrect map when he had taken over the application from an Invercargill based Consents Officer. Immediately John Engel, the Applicants consultant, contacted Environment Southland and Mr McLennan alerting him to the error and the correct co-ordinates.
63. Unfortunately the public notification on 7 February 2019 somehow also contained the incorrect map. As soon as it was noticed, Environment Southland was alerted to the fact, as was Ms Undorf-Lay, who was sent the correct version. We are not sure what happened next or how he informed the submitters to the application.
64. As we know, one of the matters that Sanford submitted on was "safe navigation around and out of Big Glory Bay". Alison Undorf-Lay, who I had met through their open day on Stewart Island, had informed me that she would be "doing" our application and I should send any further information to her. We eventually arranged a (casual pre-hearing) meeting to discuss their submission on 5 May 2019, with Jaco Swart also present.
65. Because of the wrong map issue that was foremost in my mind, I produced a copy of the correct map and we discussed options only for Site 1 and how that it could be moved or changed to give Sanford the access it required. No mention was made of requirements to shift whole farms in one piece. I arranged for them to be emailed the correct map as Alison Undorf-Lay requested and this was done by John Engel on the following Monday 8 May (see below for more on this meeting).
66. We had no way of knowing who, if any, Sanford staff would make a further submission and had to rely on Mrs Undorf-Lay to make sure the correct map was distributed. There appears to be knowledge of the correct map as it is mentioned in the submissions of Messrs Jason Eriksson and Jaco Swart, but they did not seem to concern themselves with the differences.
67. I have apologised for the error at the hearing and the inconvenience it had caused every one, but did not accept responsibility for the error.

68. Para. 14 re service on affected parties - Ms Appleyard submitted some emails between Andrew McLennan and Lacey Bragg (ES) in which Mr McLennan presents a list of all the parties to be notified. The names of Peter Schofield and Jeff Walker are not on the list.
69. Jeff Walker had already been appraised of the application by Zane Smith and was unconcerned with the Site 1 position (in its correct place), nor was Mr Cave from EEC Ltd, whose farm is the only one in immediate proximity. Helen Cave, EEC Ltd, did submit but on an entirely different issue that has now been resolved.
70. Mr Gorton had been appraised of the application verbally for Sites 2 and 3 by myself but somewhere the conversation got distracted and Site 1 was accidentally forgotten about. Mr Gorton's farm is at least 200 m from the closest point to Site 1.
71. Mr Schofield was the only marine farmer in BGB who was not contacted in some way for which I apologised. His name was not on the list of adjacent farmers and he missed the public notification.
72. While our application was in the early stages and we hoped for it to be processed without notification, we had been advised by the Reporting Officer that we needed to consult with "adjacent" farmers only, so we had set about contacting those people. However, Council eventually decided to publicly notify the application and it never occurred to us that one farmer had fallen through the cracks, so to speak.
73. No criticism of the Officer or Council is intended, however, an officer with local knowledge and experience in Big Glory Bay may well have provided a better outcome. We contacted ES after Mr Schofield approached me and said that we had no objection to him having a late submission, but at least he has been provided with the opportunity to speak through Sanford's submission.
74. Para. 18 – 19 re Response to Harbourmasters comments - see para's 23-24.
75. In relation to Mr Eriksson's submission regarding "navigational issues" around Site 1 and its effects on accessing Sites 366 and 474, we see nothing of substance in his evidence and suggest it be disregarded completely – see para. 15 – 19 above.
76. Para. 20 - See John Engel's response to this point.
77. Para.s 22 & 23 See para.s 24 – 26 of this evidence above.
78. Para. 24 - Much as Mr Eriksson states the dangers and difficulty of moving stock in the transporter cage, it must not be confused with moving the whole farm. The transporter cage measures only 30

metres wide. There are no areas around the proposed sites where the transporter cage would be restricted in any way. It goes without saying the operation should always be undertaken with the greatest care.

79. Para. 25 By my estimate from the information provided by Sanford, it will in fact be four movements in two years.
80. Para. 26 - 28 - See our comments re Jaco Swart and Mr Eriksson's misleading statements on removing mussel lines in para.s 10 – 13 above.
81. Para. 31 - There are no adverse effects on navigation with the amendments proposed to this application.
82. Para. 36 - Our application was notified on 7 February 2019. The decision on Sanford's amendment was not granted until 26 April 2019, therefore the existing conditions when we applied were those in place at the time of our application. We only found out about Sanford cage moving requirements on 12 September 2019, just prior to our hearing and are trying to accommodate them at this late stage.
83. Para. 37 – Debunked – see para.s 33 - 44. Mr Hartstein has provided incorrect information on which to base his assessment. Our calculations show the carrying capacity of the bay will not be exceeded.
84. Para. 38 - The Pelagic Effects criterion are so conservative that the calculations can take into account the natural populations of shellfish and things such as zooplankton and their requirements.
85. Para.s 39 - 42 Mr Mitchell's position relies on the evidence and submissions made on behalf of Sanford. The information provided by ourselves as the applicant and that provided by Environment Southland disagrees with much of what has been provided. The situation has changed and it is submitted that the Commissioner can come to a different decision in favour of myself and Mr Smith.

Response to submission of Mr Ted Culley

86. Para. 22 - the figure of \$500,000 has been gifted to Bluff and Stewart Island communities combined.
87. Para. 30 – '161.5 hectares' should read '97.5 hectares'.
88. Para. 45 - "*... has provided no evidence to alleviate our concerns... nor responded to our various requests to discuss them.*" This statement is untrue. We have had several "informal" chats with Jaco

Swart and Alison Undorf-Lay (see Jaco Swart submission, para. 54) and Sanford had every opportunity to discuss various issues. The fact they chose largely not to was their doing.

Response to submission of Jaco Swart

89. Para. 23 - we never asserted that Sanford cannot place mussel lines/farms on fallowing salmon sites. We just took Mrs Undorf-Lay at her word that Sanford would not, which is from her statement of evidence in the recent Sanford amendment application.
90. Para. 24 - we cannot understand how Mr Swart can be so vague about the correct map. He was present at the meeting with Mrs Undorf-Lay on May 5, 2019, where the correct map was provided and discussed.
91. Para. 36 - Sanford has previously been forced to address the problem of low oxygen levels in its salmon cages for various reasons as this paragraph notes. Our proposed sites are relatively distant from the fish cages and so would not be to blame for future low levels.
92. Para. 54 - I cannot agree with Mr Swart's comments. I understand that Mrs Undorf-Lay said that Sanford had no more concerns about navigational issues after the discussion over Site 1. No other navigational issues were brought up, and salmon farm relocations were not mentioned at this meeting nor at any other meetings.

Response to submission of Jason Eriksson

93. Table 1: Vessel movements - this table shows how little vessel traffic will be encountered in BGB on a daily basis. This bay is not busy. On the days that matter, i.e. those where a salmon farm relocation is taking place, the bulk of the vessels are Sanford owned and will be engaged in the movement.
Where is the problem?
94. Para. 13 - Sanford farm approximately 80 Ha of mussels with a year round crew of 5 so why would 16 ha require the same number of crew? At this time , the actual staff numbers are uncertain but it will be less than five.
95. Photograph 1: "The San Hauraki manoeuvring between mussel lines" - the *San Hauraki* is actually moving comfortably at speed past mussel lines, as can be seen by the size of the bow wave created.
96. Para. 51 - previously challenged the last sentence here as being misleading – see evidence above.

97. Para. 53 - the amended size of Site 1 will now not impede anything. The channel width will remain as wide as the current one between LI 322 and MF 274.
98. Para. 56 - as noted in Zane Smith's evidence, NZTM co-ordinates can be readily converted to WGS84.

Jim Maass-Barrett

Attachment 1 Calculations for Parameters in ASC Criterion Model

Smith-Barrett 21 October 2019

Table 1 - Average unfarmed area of some mussel farm sites, Big Glory Bay

SITE	Dimensions	No. Backbones	Consented area	Ha	Backbone Spacing
247	163 X 152 m	9	200 X 150 m	3	150/8 = 18.75 m
317	170 X 148 m	9	200 X 150 m	3	150/8 = 18.75 m
248	160 X 150 m	9	200 X 150 m	3	150/8 = 18.75 m
475	153 X 150 m	9	200 X 150 m	3	150/8 = 18.75 m
325	150 X 151 m	8	200 X 150 m	3	150/7 = 21.42 m
316	143 X 151 m	8	200 X 150 m	3	150/7 = 21.42 m

AVE	156.5 X 150 = 23,475	30,000/23,475 = 78.25% farmed	i.e. 21.75 unfarmed
SITE 1	180 X 280 = 50,400m ²	15 200 X 300 = 60,000m ²	60,000/50,400 = 16% unfarmed
SITE 365	180 X 500 = 90,000m ²	25 200 X 520 = 104,000m ²	= 13.5% unfarmed
SITE 274	160 X 400 = 64,000m ²	21 200 X 400 = 80,000m ²	= 20% unfarmed

All these values are higher than that given by Mr. Hartstein, even so, we will choose a conservative number for our Pelagic Effects Criterion calculation of 16% and deduct 16% of the remaining hectares from the calculation.

Farm Footprint Dimensions.

According to the salmon farm layout diagrams in Jaco Swart's submission for Sanford, in a little over two years from now, there will be two smolt farms and two grower farms being rotated around their salmon sites. Despite what Ted Culley says in his submission (para.14) about Sanford's world leading process of growing mussels in close proximity to their salmon farms, the overriding concern will be to have maximum water flow through and around their cages. Jaco Swart identifies this fact in his submission at para. 42:

"... we are concerned that the proposed new mussel sites have been located such that water flows in Big Glory Bay will inevitably be restricted, to the detriment of our ability to farm salmon. These

concerns about water flow in Big Glory Bay are very real. If mussel farming activity occurs close to, and “up-current” of our salmon farming operations, ... those farms could block the water flow.”

And again in para. 43, “As a salmon farmer I need flowing water through the water column at all depths of my pens to bring oxygen to my fish and for fish health.”

I do not believe that there will be any mussel lines anywhere near highly stocked cages of fish – it has not been done in the past and I cannot see it happening in the future given the dissolved oxygen problems that are present. It is another part of the consented water space in Big Glory Bay that cannot farm mussels.

In terms of physical constraints, the area of the pens and the associated mooring warps and anchors are the absolute minimum area unable to be farmed with mussels. On some of the salmon sites with room for several farm footprints, it may be possible to have some mussel lines but the risk to fish is great and it is hypocritical to suggest that Sanford mussel lines would be acceptable and ours, sited much further away from the fish cages, are not.

We have worked out the approximate dimensions of the new farm structures and the associated anchors and moorings. In the farm layout plans, it shows smolt and grower farms in configurations of 6, 10, 12 and 14 cages, doubled in a side by side arrangement, giving farms of 3, 5, 6 and 7 cages long.

Each cage is 30 metres square plus walkways and ancillary barges, with mooring warps going out 70 metres each side. For the sake of simplicity, each cage and walkway will measure 32 m long and wide with another walkway running down the centre and across the end of the cages. The barge and connecting walkway measure about 18 metres more.

A 6 cage unit is therefore $3 \times 32 \text{ m} = 96 + 2 + 18 = 116 \text{ m}$ long and $2 \times 32 = 64 + 2 = 66 \text{ m}$ wide.

Anchor warps run out 70 m either side and also off one end.

Therefore length is $116 + 70 \text{ m} = 186 \text{ m}$ X width of $66 + 140 \text{ m} = 206 \text{ m}$ $186 \times 206 = 38,316 \text{ m}^2$

A 10 cage unit measures $186 + 64 = 250 \text{ m}$ X width of 206 m $250 \times 206 = 51,500 \text{ m}^2$

A 12 cage unit measures $250 + 32 = 282 \text{ m}$ X width of 206 m $282 \times 206 = 58,092 \text{ m}^2$

A 14 cage unit measures $282 + 324 = 314 \text{ m}$ X width of 206 m $314 \times 206 = 64,684 \text{ m}^2$

TOTAL 212,592 m²

Therefore 21.26 Ha can be deducted from the farming area.

On some salmon sites capable of containing several farm “footprints”, e.g. Site 249, the farm could lie close to one edge of the consented site with much of the anchor warps and anchors on that side lying beyond the “surface boundary” but still within the “spider” shape which is the true consented area. According to Jason Eriksson’s submission, this site has 6 farm footprints or sub-sites within its 12 Ha, so on 2 of those 6 positions the above situation could occur.

In theory, a swathe of the area containing these anchors on the two positions could be excluded from the area that cannot farm mussels. I consider this area negligible and does not need to be considered because

Sanford will not endanger water flow to their valuable fish stocks by placing mussel lines right up to the edge of the anchors, even if they technically can do so.

Another reason for this area to be ignored is the physical restrictions on fish transporter movements to either side of the farm, if mussel lines are installed too close to the cage sites. Much was made of this issue by Jaco Swart, and particularly Jason Eriksson, in their respective submissions, claiming that our proposed farm sites (at greater distance from their cages) would unreasonably affect their ability to move fish by transporter cage.

Attachment 2 Comparison of ASC Parameters used by N Hartstein and Smith-Barrett

Parameter	Hartstein	Code	Smith-Barrett value	
Total Surface Area (ha)	1200.14		1200.14	
Total Surface Area (square metres)	12,001,400		12,001,400	
Est. Ave. Depth (metres)	15.0	A	15.9	
Cubic metres water	180,021,000	B	201,203,450	
Litres water	180,021,000,000	C	201,203,450,000	
Total Mussel Farm Coverage (Ha)	162.783076	D	161.9	
Reduction for Warp line area	12.5%	E	16%	
Cultured Occupational Area (Ha)	145	F	122.758*	
Surface Structures as %age of Bay	12.08%	G	-	
Length of Backbone per Ha (metres)	1300	H	900	
Depth of Dropper Lines (metres)	15	I	12	
No. of Dropper lines/m of B/bone	1.14	J	1.33	
Total Metres Dr Line per Ha of Farm	14,500	K	14,400	
From this point, the number of columns is expanded to provide for different mussel densities				
No. Mussels per Metre of Dr Line	120	L	150	120
Total Mussels per Ha of Farm	1,740,000	M	2,160,000	1,792,627
Filtration Rate (litres/day)	150	N	150	150
Water Filtered /day/Ha (Litres)	261,000,000		324,000,000	268,894,080
Water Filtered/day all Farms	37,845,000,000		39,773,592,000	33,008,899,472
Clearance Time CT (days)	4.76	O	5.059	6.095

Average Tidal change (metres)	1.7	1.7	1.7
Average Water Vol. Low Tide (m ³)	165,352,622	180,621,070	180,621,070
Average Water Vol. High Tide (m ³)	180,021,000	201,023,450	201,023,450
Retention Time	6.37	4.83	4.83
CT/RT ratio	4.76 / 6.37 = 0.75	5.059/4.83=1.05	6.095/4.83=1.26

Explanations of Codes from above:

A – C Taken from AEE for Expanding Salmon Farming in BGB, Part 1 Description of Aquatic Ecology 26 April 2019. Authors; M. James, N. Hartstein, H. Giles.

Pg.13 - 3.1 General - "...the volume at mid tide is 0.189 km³, and the tidal range is 1.34 for a neap tide and 1.95 m for a spring tide ... and an average depth of 15.9 m."

Using Hartstein's tidal range average of 1.7 m gives an average of 0.85 m, and using Hartstein's own figures, the volume at high tide would be 15.9 + 0.85 X 12,001,400 m²

Volume High Tide 16.75 X 12,001,400m² = 201,023,450,000 L

Volume Low Tide 15.05 X 12,001,400m² = 180,621,070,000 L

D. Our figures for total hectares farmed in BGB are derived from the chart handed out by Sanford lawyers at the hearing on 16 September 2019.

If 0.4 Ha is added to the 10 Ha allocated to Maass-Barrett, the accurate total is 161.9 Ha maximum farmed water space in Big Glory Bay.

From this area, deduct 4 Ha (Site 149, which is in two parts. Site 149a is 2 ha which is farmed, and the remainder, Site 149, is 4 Ha, which is too shallow for farming - much of it dry at low tide. The total farmed area is therefore reduced to 157.9 Ha.

The next deduction is 21.26 Ha, which is the area taken up by the footprint of 4 salmon farms (two grower and two smolt farms, which will be present from 2022 according to Sanford's submission on future farm layout by Jaco Swart). The area only utilises the footprint of the farm plus anchor warps and anchors. The total farmed area is now 136.64 Ha.

I am assuming Sanford would not place any mussel lines across the salmon anchors as they would have to be installed after the salmon farm is in place, and then removed before the mussels are ready to be harvested, as the salmon farm will require relocating after two years on that site. In reality the area in close proximity to any salmon farm will not contain any mussel lines, as Jaco explains, for fear of blocking water flow to the cages, so the area that is not farmed with mussels is actually greater than the figure above.

The final deduction is 1.5 Ha for the space on Site 321 that will be permanently used by the brood farm, which is apparently to stay on that site. The farmed area is now 135.41 Ha.

If the new applied for sites of 11 ha is added to this area the total becomes 146.14 Ha

- E. Hartstein uses a figure of 12.5% for consented space occupied by warp lines, therefore not farmed. We have worked out some values for various sites and found figures that range from 13.5% at the low end, to 16% for our Site 1 water space, and to 21.75% for a group of 6 other similar sites. We conservatively chose 16%. Deducting that 16% gives a total farmed area of 122.76 Ha.
- F. Cultured occupational area equals 122.76 Ha with appropriate deductions as above.
- * This figure relates to 11Ha being granted of the original 16 Ha applied for. We have now changed this to an amended 10.75 Ha for Version 2 map which is a more probable figure if we are granted Consent, however we have also suggested a Version 1 which is for 14.5 Ha so this would need reworking.
- H. Length of Backbone per Ha in metres. Hartstein gives a figure of 1300 m, which is very high. Our Site 1 gives a figure of 936 m. Information from Graeme Coates of the Mussel Farmers Association, the Marlborough Sounds has an average of 2.5 to 3 backbones per Ha, many of which are only 140 m long. The figure could therefore be in the order of 700 m to 840 m. However many of the small 3 Ha sites have been added to or joined so it is hard to find any accurate details today. Our existing current site has 900 m/Ha.
- I. Dropper length. Hartstein gives a figure of 15 m, which is incorrect. In Big Glory Bay, the droppers are now 12 m maximum and many sites have much shorter droppers on some or all of their lines. Site 474 and 366 have short droppers on the ends of their inside lines and I think the same applies to Site 319. EEC Site 149a has only 5.0 m droppers. I believe that Sanford sites on the northwest side of the bay, Sites 324 and 418 for example, have only 5 or 6 m droppers and 8 or 9 m respectively. Site 337 at the SW end of the bay has about 8 or 9 m droppers now.

Note - I am aware of these as I used to help out on the mussel farm in the very early days around 1987-89, and at later times. While working on the salmon farm, I was called upon to skipper the mussel harvest vessel and barge if Simon Marwick, Big Glory Seafood's Mussel Manager, was away or on annual leave. Simon did experiment with 15 to 20 m mussel droppers, but could not get enough flotation on the backbone to support the crop. Also, the meat quality was often not so good at depth.

It would be tedious to work out all the different dropper lengths and hectares of farm space that each length represented to get a figure that was accurate in terms of metres of dropper farmed per hectare. I do not think it will be required to 'prove our case' in terms of the ASC requirements.

- J. We use a figure of 1.33 for dropper spacing per metre and down to 1.66 for spat lines of which there are few.
- K. We use a figure of approximately 6,000 m per backbone, i.e. $360 \text{ m} \times 1.33 = 480 \times 12 = 5760 \text{ m} \times 2.5 = 14,400\text{m}$

Our application site 1 has 2.5 backbones per hectare. $15 \text{ backbones}/6 \text{ Ha} = 2.5$

- L. Hartstein uses 120 mussels per metre, whereas we normally seed at approximately 150/metre. I have not considered how many have dropped off during the growing period though we know it happens. Anecdotal information indicates that, in Marlborough Sounds, seeding densities are approximately 180/m, which can decrease to about 120 by the time mussels reach harvestable size.

For this reason, we looked at a range of values derived from using the 120 and 150/m figures.

- M. Mussel numbers /Ha using both above figures.
- N. Using 150L/mussel/day gives two alternative values.
- O. Clearance time (days) is shown with two corresponding values.