19 The Crescent, PO Box 1262,
Invercargill 9840, NEW ZEALAND
Telephone: 03 218 2546
Facsimile: 03 214 4285
Email: admin@bonischenvironmental.co.nz
Web: www.bonischenvironmental.co.nz

17 August 2018

Consents Division
Environment Southland
Private Bag 90116
Invercargill 9840

Attention - Andrew Maclennan, Incite.

Dear Andrew,

APP-20181316 – Zane Smith & Jim Maass Barrett – response to a request for further information for an application for a coastal permit for marine farming

I understand from Matt Hoffman that you are now processing this application. The information that follows is in response to the request for further information dated 5 June 2018.

Before addressing the information request, I wish to submit an amended plan for the location of each of the proposed sites. The co-ordinates used for the original application were incorrect due to a misunderstanding and, in part, due to the use of differing chart grids for those co-ordinates. The changes are very minor and do not impact on the assessment of environmental effects. In one case (Site 1), it widens the gap between other sites that will enable salmon cages to move between them should it be necessary.

The new corner locations for each site are set out in Table 1 below (co-ordinates in NZTM grid).

Site	Corner	Eastings	Northings
Site 1	NE	1229203.93	4786581.20
Site 1	SE	1229236.61	4786261.04
Site 1	SW	1229043.82	4786190.15
Site 1	NW	1229016.70	4786488.97
Site 2	NE	1228804.62	4784931.42
Site 2	SE	1228762.07	4784787.58
Site 2	SW	1228570.29	4784844.31
Site 2	NW	1228612.84	4784988.15
Site 3	NE	1229226.68	4785067.47
Site 3	SE	1229184.13	4784923.64
Site 3	SW	1228992.34	4784980.37
Site 3	NW	1229034.89	4785124.21

Table 1 – co-ordinates of the proposed sites.

The changes are not considered to be significant, nor do they change the assessment of environmental effects. One of the problems with the original locations is that they did not actually overlay the sampling points for the benthic survey, which is obviously incorrect. The new plan attached as Appendix 1 includes the location of the sampling points for the NIWA report.

In regard to the information request, the responses to each item are as follows:

Description of the Activity

1. *In order to establish the full nature and extent of the proposed marine farming activities, please confirm the likely density of shellfish to be grown on each proposed marine farming site;*

   Response: When first introduced onto a site, spat could be as many as 3-4,000 per metre but they have very little biomass. Between 6 months and 1 year old the spat would have an intermediate re-seed to lower the density to about 700-800 per metre.

   Between 12 and 18 months of age, lines will be re-seeded at final grow-out density of about 150-160 per metre. The biomass changes, not the density, once final reseeding has been done and the crop grows.

   Site 1 (15 backbones proposed) would produce about 4 backbones per year for harvesting once mussels have grown to harvest size, i.e. about 160 tonnes per year.

   Sites 2 and 3 would have about 6 of the 20 backbones harvested in any one year, approximately 240 tonnes, starting at least 3 years after final re-seed. A maximum of about 400 tonnes over the three sites would therefore be produced each year at full production.

General Description of Effects

2. *Please provide an overview of the general impacts of the shellfish farming, including references and relevant supporting extracts;*

   Response: This information is considered to be well covered in both the Assessment of Environmental Effects (AEE) document and the NIWA report that supports it. The former includes references and supporting extracts, and the NIWA report lists seventeen references that it has relied on for some of the information provided.

   Some specific information that is in the application is as follows:

   - in the Baseline Benthic Survey report produced by NIWA for our application, there is a passage on page 7 in the introduction:

"*In this context, cultured mussels can contribute to benthic sedimentation and possible eutrophication. Mussels, feeding mainly on natural phytoplankton, detritus and to a lesser extent on small zooplankton (Zeldis et al. 2004), load the water column with organic waste in the form of faeces and pseudofaeces (mucus-laden, uneaten particles)*";

- in the AEE, starting on page 7, Part 4, Assessment of Environmental Effects, the potential effects of mussel farming as proposed are described and discussed, with a number of extracts and references throughout. The adverse effects that need to be considered are the potential impacts on landscape, water quality, seabed, interactions with marine mammals, noise, safety and navigation, high value areas, heritage and amenity values.

  These are addressed in the application and are dealt with one by one in the AEE. Also included are the positive impacts of shellfish farming especially with reference to the ability of mussels to "graze some of the phytoplankton produced by excess nutrients released from salmon farm feed inputs in Big Glory Bay" and the positive impacts on the Stewart Island community through employment and general well-being; and

- on page 8 of the application, there is noted a report by Cawthron, "Review of the Ecological Effects of Farming Shellfish and Other Non-finfish Species in New Zealand" published in 2009 for Ministry of Fisheries, referred to within the application as the Cawthron Report, and quoted on some of the above and below points, on potential impacts of shellfish farming. The adverse effects identified in that report, where relevant, are addressed in the application;

3. *Page 9 of the AEE outlines that monitoring has not detected adverse effects of marine farming that extend significantly beyond the boundaries of each site. Please include a reference from the relevant monitoring reports within BGB, including relevant supporting extracts, and restricting the commentary to shellfish sites;*

Response: This can be answered by reference to the report on bay-wide monitoring of the water column and seabed required by Environment Southland, supplied by NIWA until 2010, when the 13th annual report stated in the Executive summary:

"*As concluded in the previous surveys, at most farm sites, there is no evidence that the depositional effects from the mussel farming activity have caused significant changes to the epifaunal community apart from an increase in mussel densities*."

If there were any significant effects beyond the immediate farm boundaries, they would definitely show up directly beneath the sites, which is where the sampling is done, and so would feature in the report.

Post 2010, amendments to the consents for marine farming applied new monitoring conditions. The monitoring of mussel sites has been limited to only two sites per year with

the focus more on salmon sites. This change is the reason why the quoted passages from ADS's 2017 monitoring report, in Section - 4.4 Benthic Effects of the application, mainly refer to salmon sites, and the levels of copper and zinc found in the sediments under them (analysis for metals is not carried out on the benthic sampling sites under the mussel farms). Unfortunately, the references to the impacts on the mussel site benthos were inextricably bound up with those of the salmon sites leading to confusion for the reader.

Within Section 4 of the application, both water quality and benthic monitoring results are discussed based on the latest monitoring report for the 2016-17 year. This report references earlier monitoring reports and changes that were noted. A number of the most relevant references and extracts are included in Section 4.

Detailed analysis of historic reports has not been carried out because any matters of significance tend to be followed up on in subsequent reports (e.g. the finding of *Beggiatoa* mats found during the 2015-16 monitoring that were specifically looked for during the 2016-17 monitoring). In addition, any relevant trends are identified and reported on year-by-year.

Overall, the annual monitoring reports support the statement that mussel farming has not caused any significant changes to either water quality or the marine benthos in the bay outside of the boundary of each site.

4. *Please provide a brief summary of existing shellfish farm monitoring to date in BGB. The summary should take the form of a table outlining what monitoring has been conducted, where the monitoring has been conducted, and the overall finding for each instance of monitoring. This is requested to assist the reader to obtain an overall view of water quality and the benthic environment in BGB;*

Response: Table 2 below sets out the monitoring that has been carried out over the past 20 years. The monitoring sites are shown on the figures attached as Appendix 2. They are the sites monitored post 2010 but note that, apart from the control sites, the benthic sites change from year to year.

While the overall findings have been addressed in the application, the "… overall finding of each instance of monitoring …" is not included because there is no particular information, apart from the formation of the *Beggiatoa* mat, that stands out as being important to the consideration of this application. To address each instance of monitoring separately is therefore considered to be onerous and unnecessary.

Period	1997-2010	2012-2015	2016-2017
Benthic monitoring	Annual sampling of 7 mussel sites and 2 control sites for: • sediment analysis (mud, sand & gravel percentage); • volatile organic matter (VOC); and • particulate nitrogen and phosphorus and their ratio.	Annual sampling of 2 mussel sites and 2 control sites for: • sediment analysis and grain size, and sulphide odour; • total organic matter (TOM); • particulate organic carbon(POC); • copper; • zinc; • redox potential discontinuity layer (RPD); • depth of oxygenated layer below sediment surface; • *Beggiatoa*; and • epifauna and infauna.	Annual sampling of 2 mussel sites and 2 control sites for: • sediment analysis and grain size, and sulphide odour; • total organic matter (TOM); • particulate organic carbon(POC); • copper; • zinc; • redox potential discontinuity layer (RPD); • depth of oxygenated layer below sediment surface; • *Beggiatoa*; and • epifauna and infauna.
Water quality monitoring	Annual sampling at 7 sites within the bay, but not in a farmed site, for: • dissolved reactive phosphorus; • nitrate nitrogen; • ammoniacal nitrogen; • Urea; • chlorophyll-*a*; • particulate nitrogen and phosphorus and their ratio; and • black disc clarity. In addition, dissolved oxygen was monitored monthly at 3 of the sites	Monthly sampling at 6 sites within the bay, but not in a farmed site, for: • temperature; • dissolved oxygen; • dissolved reactive phosphorus; • nitrate nitrogen; • ammoniacal nitrogen; • suspended solids; • volatile suspended solids; • chlorophyll-*a*; • particulate nitrogen and carbon; and • black disc clarity.	Monthly sampling at 6 sites within the bay, but not in a farmed site, for: • temperature; • dissolved oxygen; • dissolved reactive phosphorus; • nitrate nitrogen; • ammoniacal nitrogen; • suspended solids; • volatile suspended solids; • chlorophyll-*a*; • particulate nitrogen and carbon; and • black disc clarity.
Other	Video transects of 20m were recorded at 13 sites, including 3 control sites.		

Table 2 – Summary of monitoring in Big Glory Bay since 1997.

Biosecurity

5. *page 4 of the assessment of environmental effects (AEE) states that new materials will be 'favoured' for biosecurity purposes. Please confirm that the Applicant will utilise entirely new materials in the installation and repair of marine farming structures;*

   Response: The applicants will use only new materials for the installation of the marine farming structures to prevent the possible transference of any marine invasive pests. The applicants will, however, use any structures and materials, such as mooring blocks, steel anchors, backbone ropes, floats and mussel rope, which have been used previously, but only in Big Glory Bay.

Carrying Capacity

6. *page 9 of the AEE states that the model used by the then-Ministry of Agriculture and Fisheries (MAF) as grounds not to permit Sites 2 and 3 has been disputed and shown to be flawed, and that additional carrying capacity is available within BGB. Please include: references from relevant studies/reports within BGB, including relevant supporting extracts, explicitly highlighting how the conclusions about the MAF model and the additional carrying capacity were reached. Please restrict your commentary to shellfish sites;*

   Response: In regard to this response, please note that NIWA's nitrogen model was developed primarily by Sanford Ltd and used by the regulatory agencies. The "flawed" part of the process related to the Ministry's application of it, which differed from Environment Southland's. The Ministry, when determining existing nitrogen allocation in the bay, included the nitrogen output from farms for both shellfish and finfish where they were authorised for both. However, in practice, only one or the other could be farmed so it would have been appropriate to take the worst case scenario, i.e. finfish only, which is what Environment Southland did. The Ministry's approach included nitrogen allocation that could not be farmed.

   To address the issue raised, in the early DSIR model, prepared by Dr Rick Pridmore[1], on carrying capacity in Big Glory Bay based on the nitrogen (N) budget for salmon and mussels grown, there was no allowance made for the amount of N removed from the ecosystem when mussels were harvested.

   It would be more correct to say that it is now known that the assumptions on which the model was based were incorrect rather than the model itself was flawed. The problem that was focused on related to the waste patch below each farm site, which was given a value of 0.52 t N contributed per hectare per year to the N budget, based on production of 100 tonnes of mussels/ha/year, with no deduction for N removed from the bay when harvest

[1] Dr Pridmore was involved in most of the early research work around marine farming in Big Glory Bay and is referred to at various points in this response.

occurred. It should also be noted that 100 t/ha/year of mussels is very high productivity. Currently, some sites in BGB struggle to produce 30 t/ha/yr.

The biggest anomaly though, when assessing how much N should be attributed to mussel production, was that production was estimated to be in the order of 4,900 to 6,200 tonnes of mussels per year from the 15.5 existing mussel sites that were available at that time. However, that required every backbone on every site to be harvested every year - 15.5 sites x 10 backbones/site x 32 - 40 tonnes per backbone, giving the figures above, 4,900 to 6,200 tonnes of mussels per year. This scenario is completely impossible for Stewart Island waters as even the most productive sites require about 3 years minimum for crop to grow to harvesting size.

The consequence of using these inputs to the model means the calculations for the N budget were always stacked against having more mussel production. The model assumed much more production than there actually was and therefore attributed much more N inputs from mussel waste patches to the budget, but did not balance that by making allowance for removal of some N during mussel harvest.

There are other studies available which explore N budgets/fluxes but the only one relevant to Big Glory Bay is the one done by DHI for Sanford Ltd in 2011 – "*Summary Carrying Capacity assessment of Big Glory Bay*".

Sanford Ltd has currently before Environment Southland an application to amend a number of its resource consents to "lift" the nitrogen cap for the bay, allowing the company to farm more salmon.

The monitoring work done for Sanford in the two most recent seasons (2015/16 and 2016/17) by Aquadynamic Solutions (ADS) reveals an amount of "missing" N in the system. It has been attributed to uptake by mussels during spring and summer, which is the period of time when most mussel growth occurs due to higher water temperatures.

The following extract is from Sanford's latest application document, "Big Glory Bay Carrying Capacity Update, Stewart Island, New Zealand" - Volume 1 - Summary of Findings October 2017 – page 8, Section 1.2 - Existing Environmental Conditions[2]:

> "*Overall, from both a nutrient and a chlorophyll-a (proxy for algae biomass) perspective, the environmental conditions appear to have remained similar if not identical for nearly 30 years, despite the significant increases in farmed fish biomass. A potential reason for this is apparent in the total N cycle presented in Fig.3 (appended). During summer, it appears that something is removing N from the system. Based on literature and a simple N budget, it seems quite likely that the difference is due to farmed mussels present in large quantities in Big Glory Bay.*

[2] The information from Sanford Ltd's application to increase the nitrogen limits for salmon feed input in Big Glory Bay that is currently with Environment Southland is reproduced with kind permission from Ali Undorf-Lay, Sanford Ltd (copy of email attached).

Missing nutrients correspond to the timing of the mussel's largest growth (when water temperatures are high)."

So there is increasing evidence that there is a large consumption of N from mussel farming, which has not been used in previous N budget models, for whatever reason. Locally, it is coupled with the situation that is now occurring in Big Glory Bay, whereby Sanford are retiring some of the farms that were previously growing mussels so they can be used for salmon production. If anything, more mussel growing sites will be needed to take up the N that was previously consumed on those farms.

The sites that will no longer have mussels are MF 249 (formerly a mussel site, now partial fallowing/retirement after salmon use for about 5 years); MF 246 (previously two mussel farms, LI 323 and MF 246 now combined into a salmon site); LI 339 (previously mussels, then salmon, now fallowed); LI 340, (previously mussels, now salmon smolt); and LI 321 (previously oysters, now empty). LI 320 is the only fallowed salmon site fully restocked with mussels at present.

Regardless of whether Sanford is successful in their bid to increase the nitrogen cap for Big Glory Bay salmon production, it is fallowing sites that used to grow mussels before they grew salmon, or using them with mussels removed to allow salmon farming. There is an obvious reduction in sites originally growing mussels, which this application for sites will restore to some extent. If however, Sanford are successful in their attempt to increase the production of salmon from the Bay, the presence of more mussel farms may be critical in helping remove the extra nutrients by consuming an increased level of phytoplankton.

On the basis of this information, particularly the more recent work carried out to support the Sanford application, the applicant is confident that there is proven spare capacity for more mussel farms in Big Glory Bay.

Water Column

7. *page 11 of the AEE discusses water column issues, including:*

   (a) nutrients;
   (b) restrictions on water movement; and
   (c) wave attenuation.

   The Cawthron report referred to provides an overview of the effects listed in 4(a) to (c) in a generic sense. In order that these effects can be adequately assessed in relation to BGB specifically, please include references from relevant studies/reports within BGB, including relevant supporting extracts, which address the effects of the release of nutrient levels (including effects on phytoplankton), restrictions on water movement, and wave attenuation arising from the proposed activities. If this information is not available, additional desktop commentary may be sought from a water column expert;

Response: In regard to nutrients, the most recent information is provided in a report[3] by various consultants that is part of the Sanford application referred to above (hereafter referred to as the Sanford AEE). Although the Cawthron report is generic in nature, it is specific to mussel farming and some physiological aspects are true under any circumstances. The report, although nearly 10 years old now, identifies gaps in our understanding of some of the processes that occur in and around farms, but filling those gaps is beyond the capacity of this one application, nor is it considered necessary to do so in order to understand the significance of the potential adverse effects

Notwithstanding that, the ADS report is a timely addition to the body of knowledge for aquaculture in Big Glory Bay. It provides the most recent information and, although it is written to support an increase in salmon farming, much of it is also relevant to mussel farming.

Restrictions on water movement simply recognises that structures in the water will exert a drag on water movement, particularly tidal currents. The amount of water coming in and out of the bay does not change but the marine farm structures will deflect water around them and create eddies in the tidal current. The ADS report includes a study of the hydrodynamics of the bay but it was beyond the capability of the two and three dimensional models that were used to assess the flow around individual sites (see Question 8 below for more comment on this aspect).

The study by Plew that is referenced below also looked at the impact on currents and found the reduction to be substantial (between 47% and 67%). At the site he investigated, water tended to flow around the site rather than under it, but there was increased mixing occurring as a result. The site in this case is very different to those in Big Glory Bay so, apart from the extent to which the current is reduced, it is difficult to make any conclusions in regard to Big Glory Bay.

The main point is that tidal current in Big Glory Bay is weak even without the marine farms present. The farms will have an effect on how the water flows around the bay but they will not impact on the overall flushing time. The generation of eddies may assist mixing within the water column but the overall impact is considered to be no more than minor.

In regard to wave attenuation, it is acknowledged that marine farms for both finfish and mussels will have an effect but it does not appear to have been studied in Big Glory Bay. The only science paper on the subject that could be found was a 2005 thesis by D R Plew[4], but it is limited to research on one site at Collingwood in Golden Bay, an area that is very

[3] "Assessment of ecological effects of expanding salmon farming in Big Glory Bay, Stewart Island – Aquatic Environmental Sciences (AES), ADS & Pisces Consulting Ltd – 26 April 2018. It includes Part 1 - Description of aquatic ecology, and Part 2 – Assessment of effects. A copy of this report is not included but it is available with the Sanford application. If necessary, a copy can be provided to support this application.

[4] "The Hydrodynamic Effects of Long-line Mussel Farms" – D R Plew, 2005. It is a thesis submitted for a Doctorate in Civil Engineering.

different to Big Glory Bay. At that site, the mussel lines reduced wave energy by about 10% but it varied with wave frequency.

Marine farms do cause a reduction in wave energy but no link to any environmental or ecological effects appears to have been observed or considered. Due to the enclosed nature of the bay, wave action is not as significant as open coastal areas but strong winds blowing up the bay towards the mouth can generate some significant wave action. The practice is to align the backbones parallel to that wind direction to minimise the drag on the lines, but what impact that has on wave energy is not known. The fetch distances for forming waves in other directions is relatively short. Wind toward the head of the bay (north easterly) is less common and generally not as strong (based on wind data for Bluff and Oban).

In conclusion, while current and water residence time in Big Glory Bay has been studied, specific effects from individual farm sites has not. There is also no study in the bay on the effect of farms on wave action. One of the reasons for the lack of specific data is that neither have been identified as significant issues that are in need of research. However, there is some effect on both, which is considered to be no more than minor, and possible less than minor in regard to wave attenuation.

8. *water movement and residence time is discussed on page 12 of the AEE. Please provide a reference that supports these comments, including any relevant extracts;*

Response: Information on this matter is also available from the Sanford AEE in Section 3.2 - Flushing modelling. The results of the model give a longer retention time than Pridmore's earlier estimate that was developed in July 1988 , i.e. a flushing time of 10 -14 days for extended periods of calm weather and 5 – 9 days depending on wind speed. ADS's model gives about twice this length of time to flush 85 – 90% of the bay. The report states as follows:

> ***From "Big Glory Bay Carrying Capacity Update, Stewart Island, New Zealand – Volume I – Summary of Findings" - Section 3.1 - Hydrodynamic modelling***
>
> *"Model results indicate that flow within the bay is weak and generally less than 5cm/sec. Flow is stronger towards the mouth of the bay, reaching speeds of up to 10 – 12cm/sec. The strongest flows in the bay appear to occur along the northern and southern shoreline with current speeds reaching up to 12cm/sec in some locations."*
>
> ***From "Big Glory Bay Carrying Capacity Update, Stewart Island, New Zealand – Volume II – Hydrodynamic Modelling and Flushing" – Section 5.2 - Seasonal Retention Time***
>
> *"After 28 days approximately 85 – 90% of water within Big Glory Bay has been flushed out. The remaining water is slowly transported out over the next 20 – 30 days*

or so. Results indicate that the initial exchange of the tracer is quite rapid and that the remaining 10 – 15% of the tracer take considerably longer."

Pridmore did some work with drogues and also used current meters in July 1988. In March 1991, he produced a diagram describing the net flushing pattern of BGB (attached as Appendix 3) that showed a general movement of deeper water inwards along the middle of the bay, rising to the surface and outwards along the shorelines. This pattern was occurring during the Heterosigma bloom of 1988 -89 when there was a considerable period of calm weather. It is understood there is a generally mouthwards movement of surface water under influence of the prevailing westerly wind.

A study by DHI in 2011 that was carried out for Sanford notes a similar effect to that noted by Pridmore above, namely "*The bottom current flow through the mouth of the bay, close to the location of site 1 (a water sample station) and control site CM, appears to be predominantly into BGB while the surface flow is strongly tidal*".

Benthic Effects

9. *page 13 of the application discusses benthic effects. Please provide an overview of the potential benthic impacts of shellfish farming, including references and relevant supporting extracts;*

The potential benthic effects of mussel farming are generally related to deposition on the seabed of the products of shellfish farming, and the effects it will have on the composition of the sediments, as well as the fauna and infauna associated with those sediments. The main products are the solid matter of shellfish and fouling organisms released at harvest time, and the constant gentle rain of faeces and pseudofaeces that is expelled during the feeding processes of the shell fish and many of the fouling organisms.

10. *page 13 discusses copper concentrations in benthic sediments under salmon farm lease sites LI338 and LI339. Please also discuss zinc concentrations in benthic sediments, including references from relevant studies/reports within BGB and relevant supporting extracts;*

For the proposed sites, there has been no investigation of zinc concentrations in benthic sediments. There has never been any monitoring of zinc or copper levels in mussel farm sediments in the bay. If it were monitored, it would not be expected to find any more than background levels, as the source of zinc is generally from salmon feed, while copper is associated with net anti-fouling products. There has never been any feeding of salmon within several hundred metres of any of the proposed sites.

For the record, the results of copper and sediment analysis from the two most recent monitoring reports for the control sites in the bay are set out in the following table:

Parameter	Site	Year	Concentration (mg/kg dry weight)
Copper	Con mouth	2016	7.3
	Con head		9.3
	Con mouth	2017	7.7
	Con head		9.3
Zinc	Con mouth	2016	37.0
	Con head		35.0
	Con mouth	2017	32.7
	Con head		31.7

11. *Sites 2 and 3 were formerly used to store salmon farming cages. Please comment, with reference to any available studies/reports within BGB, including relevant supporting extracts, on:*

    (a) the extent to which zinc and copper are enriched under this site; and

    (b) the likely effects on the Applicant's proposed activities which may result from any existing zinc and/or copper enrichment;

12. *please comment on the likelihood of, and extent to which, the proposed shellfish farms may give rise to zinc and copper enrichment in benthic sediments within the proposed sites, and the likely adverse effects of this enrichment on benthic ecology. Commentary around Sites 2 and 3 should also focus on the likelihood of cumulative enrichment due to the historical use of these sites for storing salmon cages. Please include references to relevant studies/reports, including relevant supporting extracts;*

    Response: Site 3 was used by Regal Salmon to store two empty salmon cages (steel painted pontoons) in about the mid to late 1990's. There were no nets on them so no fish were farmed on that site. Although not present on site anyway, it was known that Regal Salmon did not antifoul their nets. It would not be expected to find zinc or copper in the sediments at elevated levels under Site 3 (or Site 2) as a result of the temporary storage of empty cages on the site.

    In regard to the potential impact of shellfish farming on copper and zinc enrichment, including cumulative impact, the risk is virtually non-existent because neither metals are used in shellfish farming. They are used in products associated with finfish farming,

including in feed products in the case of zinc, but neither metal cages nor feed products are required in mussel farming.

If copper and/or zinc are present in elevated levels on Sites 2 or 3, the level will not increase as a result of mussel farming.

Discharges

13. *in order to clarify the nature and extent of the proposed activity, please describe the discharge to water outlined on page 3 of the AEE in more detail, including:*

    (a) a description of the nature, volume, contents and frequency or rate of the proposed discharge;

    (b) a description of the procedure for discharge;

    (c) a description of the presence of biological matter (for example pseudofaeces, shell fragments and other biological debris); and

    (d) a description of the procedure for preventing the discharge of inorganic materials (for example ties, fragments of mussel ropes, baskets, and trays);

Response: In regard to parts (a) and (c), the nature, volume, contents and frequency of the discharge will vary depending on what tasks are being performed. The mussel harvest will be done by a contractor and the rate of take, and hence discharge as there is no storage in the wash system, will depend on the pump on the vessel used. However, on the current small vessel used in the bay by the applicants, the discharge quantity will be limited to the size of the deck wash hose, which is 40mm in diameter, and is estimated to pump approximately 500 litres per minute.

The amount of the material that is described below, which is washed off and discharged back into the sea on any one day, will depend on the environment in which the mussels are growing and the amount of mussels harvested. It is all material that is either natural to that environment or the by-product of farming mussels, i.e. pseudofaeces, much of which falls to the sea floor but there is some settling on the mussels and lines under them.

The discharge could be as simple as a quick washdown of the deck after a day of tying on floats, to a full mussel harvest of about 20 tonnes over a period of three to four hours. This latter discharge would contain all the wash water required to wash the crop being harvested, all the faeces and pseudofaeces bound up among the mussels, many marine worms and fish species, such as triplefins, that live among the crop; camouflage crabs; millions of isopods or amphipods, or similar crustaceans; several types of bivalves such as blue mussels, nesting mussels, and ribbed mussels; sea tulips (kaeos); sea squirts; colonial ascidians; sponges; barnacles; anemones; and a variety of weeds.

The tasks that would cause the maximum discharge, using the applicants' current vessel that takes and discharges approximately 500 litres/minute, would be harvest of seed for intermediate re-seeding, and harvest of seed for final re-seed. The biomass is much less for these mussels as they have not been in the water for long, so the build-up of faeces, pseudofaeces and fouling is very much reduced compared to a mature crop. Most of the discharge will sink slowly towards the seafloor and not be seen to drift, however there would probably be a small plume of discoloured water drifting downwind, several metres at most.

There is not normally much in the way of shell fragments in the discharge. The shell that is seen on the seafloor is most likely to be from odd Greenshell mussels that have fallen off the droppers. On sites that have been subject to one or more harvests, most of the shell "hash" is from the effects of the harvest. The blue and ribbed mussels for example can be quite large, but they have nearly all been consumed, mainly starfish, but also by fish, crabs, and octopus, leaving just empty shells. These fouling species do not usually all occur together. Much of it is found as fouling on the backbone ropes and underside of the mussel floats, which is also removed and discharged.

The effect of the discharge is to create an area around the harvest vessel of increased turbidity that disipates reasonably quickly after harvesting ceases because all of the material, including the pseudofaeces, settles relatively quickly. The currents in the bay are low and there is no significant plume of discoloured water created by the harvesting activity.

In response to part (b), there is no procedure for the discharge. The vessel pumps water continuously during harvesting and all washwater is returned to the sea without any screening. The material that is washed out is either part of the marine ecology or accumulated sediment, both of which are best returned to that immediate environment rather than creating another waste product that would need to be disposed of elsewhere.

In response to part (d), there is always a bucket, fishtub or bag available to place any inorganic waste into, and a hook and scoop is always available to pick out any ties that might fall over the side. The applicants are well experienced and careful in their current operation and operate under best practise methods. These methods are detailed in the industry Code of Practice that the applicants will adhere to, as is noted in Section 4.12 of the application, and they expect to continue in that vein.

14. *with regard to discharges arising from the proposed activities, please provide comment on:*

    (a) the sensitivity of the receiving environment;

    (b) the nature of the contaminants to be discharged, the particular concentration of contaminants needed to achieve the required water quality in the receiving environment and the risks if that concentration of contaminants is exceeded; and

(c) the capacity of the receiving environment to assimilate the contaminants; and:

(d) avoiding significant adverse effects on ecosystems and habitats after reasonable mixing;

(e) using the smallest mixing zone necessary to achieve the required water quality in the receiving environment; and

(f) minimising adverse effects on the life-supporting capacity of water within a mixing zone.

This information is a requirement of Policy 23(1) of the NZCPS, and also feeds into our consideration of Section 105 and 107 of the RMA;

Response: The information provided in response to this item is to be to the level that is necessary to consider the potential adverse effects for this type of discharge. Policy 23(1) of the NZCPS applies to all types of discharges, including municipal and industrial wastewater, and stormwater, all of which originate on land. Applying all of its provisions to a discharge of this type is therefore difficult. The discharge associated with harvesting mussels is very different in nature, so options for mitigation, to the extent they may be considered necessary, are limited.

The responses below are based on the fact that, although the activity cannot be described as 'natural', all of the material that could be considered to be a contaminant in the discharge are either part of the marine ecology associated with the site or material that is produced as a result of natural processes. No component is toxic to the marine environment but it will alter the physical and biological nature of the water column and the benthic environment – the former are localised effects for a short duration, and the latter will endure as long as mussel farming occurs on the site but will be remediated by natural processes once it stops.

The responses to each of the parts of this item are therefore as follows:

(a) the sensitivity of the receiving environment is considered to be low for this proposed discharge. The marine environment is generally very robust and shellfish farming generally is at the low end of the impact scale in regard to effects on water quality and the benthic environment. The nature of the contaminants in the discharge are such that it is difficult to differentiate between the effects of the discharge and the effects of growing the mussels. The applicant relies on the monitoring carried out on shellfish farming to show that the effects are no more than minor and are not irreversible if farming were to cease.

In terms of the basic physical parameters, marine farming, including these three proposed sites, takes up less than 13% of the spatial area of the bay. The volume of the bay is estimated to be in the order of 0.2 km^3 or 200 million cubic metres, of which about 10% is cycled per tide on average (from Pridmore and Rutherford 1988, Physical characteristics of Big Glory Bay);

b) the nature of the contaminants is described in Question 13 above. The only contaminant to which a concentration level could be applied is the accumulated pseudofaeces and sediment that will temporarily elevate the level of suspended solids. In the type of situation where this discharge occurs, there is no control over suspended solids concentration except to control the pumping rate of the take. There is insufficient information to specify a particular concentration of contaminants but it is not considered to be necessary in this instance.

The waters in Big Glory Bay are classified as People & Aquatic Life. In regard to suspended solids, the relevant provision is that visual clarity must not be diminished by more than 20% beyond a reasonable mixing zone. As the currents are not strong within the bay, wind is often the main cause of a plume being formed but, based on experience on existing sites, such plumes are not significant and the suspended material settles within a short time;

(c) see 14(a) above. The capacity of the environment is very high for assimilating the effects of mussel farming, which relies on natural processes to grow mussels on artificial structures. The concentration of stock causes a concentration of faeces and pseudofaeces in one place but not to the extent it creates a toxic environment, either in and around the lines or on the seabed, that will not continue to support marine life.

The research on marine farm carrying capacity has focussed on the more significant effects of finfish farming. Research already quoted in the application has shown that shellfish and finfish farming can complement each other, and this finding has been supported by the ADS investigation and report for the Sanford application. However, the actual assimilative capacity of the bay is not known with any accuracy but the results of monitoring for the existing farms and the recent work by ADS indicate that it will not be exceeded by this proposal; and

(d)-(f) these matters have, for the most part, been addressed. The description of the effects is consistent with the benthic monitoring that is carried out and enables the applicants to be confident that they can operate without causing a significant impact on water quality. It is only an issue when harvesting or re-seeding activity is occurring at the outer ends of the lines, and outside of those times, water quality standards will be met across the whole site. The nature of the discharges is such that the life-supporting capacity of the water within the mixing zone is not significantly affected but the activity on the site at that time may deter some species from going into the area.

The water quality is near pristine. All of the discharge, apart from some shell and the marine species that inhabit the mussel lines as fouling, is organic matter, and has been assimilated into Big Glory Bay without negative impact for several decades now. The discharges are sporadic and of short duration - the worst case scenario would be mussel harvest time. For say Site 3, there are 10 backbones. After setting up and growing a crop of intermediate re-seeded mussels on one line for some months, about three backbones would have a final re-seed sown on them. After another 3 years these three lines will be harvested, requiring two harvests per backbone, six harvests in total, each one taking

between three and four hours, which is about 6 part days on site in 3 years. Then each year onwards there would be another three lines harvested.

To the applicants' knowledge, the seabed has never been tested immediately after a harvest but Mr Maass-Barrett has dived to the sea bed on several occasions soon after a mussel harvest (sometimes to retrieve an object). The only observation noted was that sometimes there was a cloudiness in the lower part of the water column, making for poorer visibility in an already dark place if it was a dull cloudy day. If the discharges from harvesting were causing a problem, it would be showing up in the annual monitoring.

Codes of Practice

15. *please confirm, that the Applicant intends to follow both the New Zealand Greenshell™ Mussel and the New Zealand Oyster Environmental Codes of Practice (2007) in carrying out the proposed marine farming activities. In your commentary, please provide evidence of how on-farm practices will comply with these Codes of Practice;*

Response: The applicants currently operate, and will continue to operate, under the codes of best practise put out by Aquaculture NZ , Marine Farmers Association for mussels and oysters, and Maritime New Zealand. They also aware that there is a proposal for National Environmental Standards for Marine Aquaculture(NESMA) and are awaiting the outcome of that process.

Wildlife and Habitats

16. *please provide additional commentary around wildlife interactions, focusing on the issues of (1) entanglement and (2) displacement, with reference to relevant scientific studies and reports, and providing supporting extracts. Please also discuss the findings of these studies in relation to measures taken by the Applicant to avoid, remedy or mitigate the effects of possible wildlife interactions;*

Response: The Cawthron report referred to in the original application that reviewed the ecological effects of farming shellfish is relied on to support the application. There does not appear to be any specific studies carried out in Big Glory Bay so the overview in the Cawthron report is the most rigorous assessment that is available to the applicants. Some anecdotal information is available and that is included below.

Key information from the Cawthron report is as follows:

a. fish – the mussel farms can create habitat for fouling organisms and fish species. They create a different sort of foraging habitat, food source, breeding habitat and refuge from predators. This increased growth of other species on the farm can potentially exacerbate benthic deposition and water quality effects but it is not an issue that is well understood.

   In regard to wild fish assemblages, the information is sparse, which "… *is probably consistent with a general lack of concern over the potential for adverse effects*" (from the

Cawthron report). It is likely that all marine farming within the bay has affected fish behaviour but the extent and nature of it has not been studied. There is no indication that any impact is significant or even negative overall;

b. seabirds – the potential effects can be both positive and negative but there have been few direct studies of note. There are a number of overseas studies but their relevance to this site is marginal. The report overview on the effects on seabirds states:

"Several New Zealand and overseas studies discuss the potential ecological effects of shellfish aquaculture on seabird populations, but only a few direct studies have been conducted (Roycroft et al. 2004; Zydelis et al. 2006; Kirk et al. 2007). Based on these studies, mussel aquaculture potentially affects seabirds by altering their food resources, causing physical disturbances (e.g. noise) and/or being a possible entanglement risk. The structures associated with aquaculture may also provide benefits including additional perching and feeding opportunities. As several of New Zealand's seabird species are endangered or threatened, it is important that the shellfish industry remains up-to-date on any possible influences shellfish farming may have on these populations (Dowding & Murphy 2001)."

c. marine mammals – direct interaction of marine mammals with shellfish aquaculture has been reasonably well studied and the Cawthron report found that "… *issues such as habitat exclusion, underwater noise and entanglement appear to be minor for New Zealand mussel farming, although the potential for adverse effects still exists with continued growth in both marine mammal populations and the industry. Potential risks are best identified and managed on a case-by-case basis; for example by selecting farm locations to minimise the likelihood of overlap with marine mammal migration routes and/or known habitats*."

Again, without any before and after studies available, it is not possible to know what impact the farms in the bay have had. However, based on the observations described below, marine mammals are not avoiding the area altogether. For seals, the shorelines where they may want to rest are unaffected and still available. For larger species like whales, there will be a restriction on the space available for them but to what extent they rely on Big Glory Bay as opposed to Paterson Inlet as a whole, is not known.

In regard to entanglement, there is apparently only one documented incident relating to mussel aquaculture in New Zealand and the circumstances of that are not clear. There are numerous incidents relating to other cases of entanglement involving lines but, in general, it appears that loose lines pose the biggest threat.

The following observations are from Jim Maass-Barrett:

"In my long experience of mussel and oyster farming in Big Glory Bay, spanning 23 years (and 16 years salmon farming within a 33 year period), we have never had a problem with any wildlife except for oystercatchers, gulls, shags and the odd white faced heron perching

on our mussel barge, necessitating considerable cleaning when it had not been used for a while. The structures and vessels appeared to enhance the habitat for these bird species rather than detract from it.

We are unaware of any entanglement issues from birds or marine mammals in our involvement with mussel farming. The birds, such as penguins and shags that dive, regard a marine farm as a place to find food. Shags and gulls, in particular, find good pickings at mussel harvest time, feeding on any morsel that floats within sight, such as the small triplefins (not unlike a cockabully) that pour out of the crop; or the insides of some types of sea squirts (ascidians) that get squeezed out during the declumping process. And of course the shags, gulls and oystercatchers all benefit from all the perching places provided by mussel floats.

We are privileged to work in an environment where Bottlenose dolphins are a reasonably frequent visitor; Hookers sealions are seen at times as are the odd fur seal; sightings of Southern right whales (5 times in 33 years in Big Glory) and a pair of Humpback whales once; an Elephant seal on two occasions; and, in Paterson Inlet, long finned pilot whales once. I have also seen in Big Glory Bay, a dead (stillborn?) baby pygmy sperm whale.

None of these animals has ever had an entanglement issue to my knowledge and we hope they will continue to navigate and feed safely in and around our structures in future. If there was ever an issue of any kind, we know the Department of Conservation is a phone call away for advice and assistance.

On page 15 of our application, there is an extract from the Cawthron report written by Dowding and Murphy in 2001 relating to potential ecological effects from shellfish aquaculture on seabird populations. Without quoting it here, it provides no great concerns at present that there is any problem with this issue."

17. *page 17 states that no specific habitat areas will be impacted by the proposed sites. Please provide a reference, including supporting extracts, that supports this;*

This particular statement was meant to be in relation to marine mammals and birds such as penguins. It simply noted that these species may traverse the proposed sites in the course of visiting the bay, but the sites held no particular significance in regard to feeding, breeding or simply resting. The coastline is unaffected and seals are known to use this area for resting but no breeding areas have been identified. No formal study or report on this aspect within Big Glory Bay is available.

The habitat values in regard to the benthic environment are based on the benthic survey of the sites that was carried out by NIWA, the report of which was included as part of the application. The survey identified those species for which the sites are considered to be their habitat and, for the most part, the species found are representative of what is found in the wider bay. Brachiopods were present and are regarded as sensitive to disturbance but they have also been found under mussel lines. Monitoring in the bay, as is stated in

Section 4.4 of the application, has shown that the mussel sites have retained "… a moderately high species richness and diversity". However, changes will occur whereby some species will move out and other opportunist species will move in to make use of conditions that are better suited for them.

The NIWA report and the recent monitoring reports are relied on for this information.

18. *in order to address the effects of the proposal on indigenous biological diversity, please provide an assessment of the adverse effects on the matters listed in Policy 11(a)(i)-(vi) of the New Zealand Coastal Policy Statement 2010 (NCPS), in particular whether these effects are 'avoided' as required by the policy;*

Response: to the extent possible, Policy 11(a) has been considered firstly, in regard to marine invertebrates, by carrying out a benthic survey of the proposed sites to see what is present; and secondly, by relying on the historical use of the bay for marine farming and the accumulated knowledge of the marine mammals that have been seen in the bay. In regard to each of the provisions, the following comments are provided:

(i) no indigenous taxa that are listed as threatened or at risk in the New Zealand Threat Classification System lists have been identified on any of the sites;

(ii) none identified. Bottle nose dolphins are known to visit the area but hectors dolphins have not been reported. Even if they were to visit the area, the risk of mussel farming causing any impact is very low;

(iii) none identified on the sites proposed;

(iv) none identified on the sites proposed;

(v) none identified on the sites proposed;

(vi) no such areas exist within the bay but there is a marine reserve in Paterson Inlet, just outside Big Glory Bay.

The benthic survey, and surveys carried out as part of the annual monitoring programme, have not identified any specific species that are listed as threatened or at risk. Brachiopods have been identified as a sensitive species, but the particular variety that is on the New Zealand Threat Classification list has not been identified in the bay. Tubeworm mounds are present towards the mouth of the bay but they are not close to these proposed sites (see Question 24 below).

A specific expert report on marine mammals in the bay has not been sought because the risk of any impact on threatened or at risk species is considered to be very low. Farmers have worked with the Department of Conservation on occasions and during resource consent processes, and at no time has any concern been raised about marine mammals.

Certain species, including at risk species, may visit the bay but it is not believed to be critical habitat for them.

19. *in order to address the effects of the proposal on indigenous biological diversity, please provide an assessment of the adverse effects on the matters listed in Policy 11(b)(i)-(vi) of the New Zealand Coastal Policy Statement 2010 (NCPS), in particular whether significant adverse effects are 'avoided'; and whether other adverse effects are avoided, remedied or mitigated; as required by the policy;*

Response: In regard to each of the provisions in Policy 11(b) of the NZCPS, the following assessment is provided:

(i) there are no areas of "predominantly indigenous vegetation" on the proposed sites. Photos taken at each site did not show any marine vegetation, only soft sediments and some detritus on the seabed. The NIWA report identified the epifauna present, none of which was unique to this site or the bay as a whole;

(ii) Big Glory Bay is a sheltered area that is part of Paterson Inlet. There is no indication it has particular benefit for any species during part of its life cycle. It is noted that by confining marine farming to Big Glory Bay and excluding it from others, enables the commercial and social benefits of this activity to occur while protecting larger areas that can provide similar benefits to indigenous marine species;

(iii) given the examples of habitats listed in this part, it is not particularly relevant to Big Glory Bay. While the bay has value as a habitat it is not unique or as sensitive as some of the other areas to use and development;

(iv) although appreciated for its scenic values and being part of an outstanding landscape, Big Glory Bay is predominantly used for commercial purposes. Some recreational activity occurs in and around the bay but it is not known to be particularly important for traditional or cultural purposes. However, those purposes are not necessarily excluded by the presence of marine farming given that fish are found in and around mussel farm lines. As previously stated, mussel farms provide an alternate habitat and feeding opportunities for some species;

(v) while no particular scientific reports are available to support it, it does appear that the inlet, and to a lesser extent, the bay, may provide a sheltered area for some marine mammals at certain times of year. The presence of marine farming does not seem to deter them but it is difficult to know whether farming has had any wider impact. Visits by some species vary from one season to the next so detecting a pattern or any changes is difficult; and

(vi) the bay does not form a corridor for marine species but it may do for some bird species. However, in regard to bird species, experience has shown that marine farms

tend to provide an alternative roosting site and, for some species, an alternate food source. While not able to provide any documented study, observations suggest that marine farming does not have a significant impact, if any, on ecological corridors for any marine or avian species.

For the most part, significant adverse effects on the matters relevant to this policy are avoided because they are not relevant to it. The potential for any significant impact is low, to the extent that these type of habitat issues do not appear to have attracted any scientific study. The work required to carry such studies is considered to be beyond the scope of an application of this scale and significance.

As mentioned above in answer to parts of questions 16, 17 and 18, the effects on indigenous biological diversity are considered to be minor or less than minor. The experience of mussel farmers, is described my r Maass-Barrett as follows:

> "*The presence of a fully stocked mussel farm gives a huge 3-D space for colonisation of (mostly) indigenous species. One mussel line can have 6 – 7 thousand metres of mussel filled rope, which is like a huge piece of hedge. Everything in the sea is trying to find a place to settle, grow and procreate. The presence of a mussel farm in deep water over a soft mud bottom provides this huge 3 dimensional "forest" for indigenous species to settle on and flourish, which would be not be available without the presence of a mussel farm in the middle of Big Glory Bay. So there is greatly enhanced biological diversity for many species, not displacement or exclusion*."

Hazardous Substances

20. *in order that we may assess the risk of unintentional, though possibly catastrophic, discharges to coastal waters, please describe any oil spill equipment, procedures and oil/chemical spill management plans that will be implemented and used by any vessels servicing the marine farm sites;*

Response: The current workbarge and other vessels, such as the Foveaux Freighter and contractors barge, all work under Maritime NZ's MOSS system and require a Maritime Transport Operators Plan for each vessel. These documents are very prescriptive and all will have their own specific hazardous substance register with methods to deal with any contingency.

In this case, the same methods to prevent spills would be used on any new sites for which consent is granted. Only small quantities of fuels and oils are carried, and the first line of defence is care when handling and storing in recommended containers. Petrol and diesel are kept in 20 litre tote containers and spare oil is in smaller approved containers. A large bag of cotton waste would be used for initially absorbing any spill, followed by mopping up any residue using a product called 'Simple Green' to dissolve and collect any oil based

product. The rags and mops would be taken off the vessel in a secured container and disposed of in an approved landfill.

Biosecurity

21. please describe, in more detail, biosecurity procedures to be followed on-farm, including:

(a) biosecurity procedures followed when introducing mussel, scallop, or oyster spat onto the site;

(b) a description of how biosecurity inspections of the marine farming structures are carried out, their frequency, and by whom they will be carried out; and

(c) a description of the procedure followed in the event a pest or unwanted organism is found during an inspection of the marine farming structures, including methods of removing pest or unwanted organisms, and disposal of pest or unwanted organisms;

Response: the responses to each part are as follows:

a. mussel spat for Big Glory Bay is only able to be sourced from Ninety Mile Beach due to biosecurity issues involved in transferring from other places, such as the Marlborough Sounds. At present, the applicants would be unable to grow any oyster spat in Big Glory Bay owing to MPI's Controlled Area Notice after the Bonamia ostreae outbreak in 2017. Only spat from Stewart Island sourced broodstock of scallops (and oysters possibly in the future) can be considered. Scallop spat can only be produced in a hatchery so, at present, growing it is not being considered;

b. spat can be inspected periodically by pulling up droppers, in the case of mussels, and during operations such as tying on flotation. Intermediate re-seeding and final seeding of the crop gives the farmer the opportunity to inspect the complete crop in a short window of time. As the applicants are hands on and have long experience with marine species, they would be the main eyes on the farm, and responsible for training up any staff they employ. They have reference material from Environment Southland about pest species, also from MPI and Aquaculture NZ among other agencies; and

c. if something unknown or suspicious is found, or a known unwanted species is found, the first approach would be to MPI/Biosecurity, as it has a hotline and assistance with identification. It is also able to advise on ways to handle and dispose of any problem species. Notifying Environment Southland is also possible if that is necessary. The actual actions taken will depend on what is found and what advice is given. The applicants are aware that taking the wrong steps could result in exacerbating the problem.

Maintenance

22. *please provide a maintenance schedule and procedures adhered to in order to maintain the marine farming structures in good repair, appearance, and condition;*

Response: The Marine Farming Association has codes of best practise for mussel farming that the applicants currently follow. There are several protocols , including an SOP for mussel farming; one for reducing waste taken to landfill; one for reducing pollution and emissions from marine farming activities; and various others. These are good common sense documents and all staff would be made familiar with them. Using these standards will ensure farms are kept tidy and well maintained, so that it is most unlikely that floats or other materialswill be lost.

As crops are being tended, the prudent marine farmer is always on the lookout for any issues such as float lashings chafing or coming loose, so they can be re-tied on the spot. Small farmers certainly cannot afford to lose floats as replacements are so expensive, without even considering the pollution factor. All lines, including the backbones are checked during harvesting and re-seeding operations but the materials used are durable and last for some time. However, anything that is damaged is replaced as soon as possible.

The greatest danger with mussel lines is that they break free and create a hazard but such an issue is rare if not unheard of. A backbone, for example has anchor points at each end, as well as connections to other lines in order to maintain the spacing. For a line to break free, it would require multiple breakages, which is extremely unlikely unless sabotaged.

Draft Conditions

23. *in order to gain a full assessment of: the extent of the activity; the measures proposed by the Applicant to avoid, remedy or mitigate the adverse effects of the proposal; and how adverse effects will be monitored, and responded to; please provide a proposed set of draft conditions, including (but not limited to):*

    (a) a description of the activities;

    (b) measures taken to avoid, remedy, or mitigate the effects of the activities;

    (c) a description and justification (with relevant references) of environmental benchmarks or standards for water quality and benthic sediment quality that will be adhered to;

    (d) proposed monitoring of the water quality effects and benthic effects of the three sites, with justification of the proposed monitoring programme; and

    (e) a description of any proposed measures to ensure compliance with the benchmarks or standards referred to in 23(c), in the event that they are exceeded.

Response: the draft conditions proposed are the same as those that have been agreed for all shellfish farm sites in Big Glory Bay. The attached set (Appendix 4) has only been amended to recognise that the conditions are for new sites rather than existing, hence an "as installed" survey is required afterwards.

The applicants want to ensure that the provisions of any new consent, particularly the monitoring, are consistent with other similar consents in the bay so that they can participate in the bay wide monitoring programme.

In regard to environmental benchmarks, various options were considered when the agreed conditions for shellfish and finfish farming were developed in about 2011-12. There was greater interest in environmental standards for finfish farming than shellfish farming at that time but there was considerable difficulty in setting practical and meaningful standards.

In regard to shellfish farming, the emphasis was on site selection, farming densities and "housekeeping" to control and limit potential adverse effects. The conditions as appended are what has been agreed for shellfish farms and nothing has changed since that time. The applicants' view is that if standards are to be applied, then they should be applied to all farms within the bay following consultation with all farmers.

Technical Review

24. *Rob Davidson of Davidson Environmental Ltd has carried out a review of the technical report supplied with the application. His comments on the technical report are appended to this letter. Please have your technical expert respond to Mr Davidson's comments.*

Response: Table 3 below provides a reference to the relevant part of the response to the information request for Mr Davidson's comments.

Reviewer comments (note – page references are to pages in the reviewers report)	**Responses** (the questions referred to are those in the request for further information (FRI) dated 5 June 2018)
Page 4 – first comment.	See response to Question 3 and, to a lesser extent, Question 4, which sets out the monitoring carried out from 1997.
Page 4 – second and third comments.	See response to Question 6. The Sanford information has been made available by that company to the applicants and has been referenced.
Page 4 – fourth comment.	See response to Question 4.

Page 4/5 – fifth comment.	See response to Question 7.
Page 5 – first comment.	See response to Question 8.
Page 5 – second comment.	See response to Question 15.
Page 5 – third comment.	See response to Question 9.
Page 5 – fourth comment.	Noted – typographical error..
Page 5/6 – fifth comment.	See response to Question 10, 11 & 12..
Page 6 – first comment.	See response to Question 16.
Page 6 – second comment.	See response to Question 17, 18 & 19.
Page 6-9 – third comment.	See below – the response was prepared by one of the applicants, Jim Maass-Barret. Mr Maass-Barrett has been involved in marine farming of shellfish in Big Glory Bay almost from the start as both an employee and a farmer in his own right. He has dived over a significant part of the bay and has been involved in collecting samples for various studies, including monitoring. Mr Maass-Barrett has also read many of the reports relating to marine farming in the bay and some reports on scientific studies on aspects of the marine ecology. Although not a qualified expert, he is certainly has the experience and knowledge to provide the information below.

Table 3 – summary of responses to matters raised in the Davidson review report.

The following additional information is provided by Jim Maass-Barrett:

> *"I have spoken with Rob Davidson and explained that the marine farmers, and those involved in doing work that supports their activities, are all familiar with the seabed in the area of the sites and know it is all soft uniform substratum, so we saw no reason to go into any detail or provide reference material.*
>
> *However, having dived on the seabed doing diving surveys on Site 2 (5 X 50m transects x 4m wide) and Site 3 (5 x 25m transects X 4m wide) in early 1996; dived several times on the eastern side of MF274, about 25m deep; and outside the southern side of LI 366 and LI 474, about 22m deep, retrieving and lifting lines and/or searching for lost mooring blocks, I can say with certainty that all the seabed out there was always found to be uniform soft mud*

bottom. There were no distinguishing features and the areas just described would be almost within the area of our Site 1.

I think the answers to Mr. Davidson's questions about representativeness of samples is answered by Jeanie Stenton-Dozey's analysis in the Executive Summary of the NIWA report and on pages 14 - 29 of her report in the way the results are referenced against the control sites within the bay. In regard to the two questions, the answer to question (A) is 'Yes', and (B) 'wider bay/ inner bay'.

I also note that the baseline survey was approved by Environment Southland's marine scientist, Nic Ward, as sufficient for the purposes of this application. After explaining the above, about our knowledge of the seabed at the proposed sites, to Mr. Davidson, his fears seemed to be somewhat allayed.

As above, Site 1 is more similar to Control Mouth in some features and sites 2 and 3 are more similar to Control Head (page 27 NIWA report).

I don't know why the reference to brachiopods in decline under the farms is made. It is not necessarily the case in BGB. In J S-D's report, page 21, the proposed sites had two examples of the Neothyris lenticularis *species, a single specimen in one grab sample and a clump of 7 in another sample. These would have found a small piece of hard surface, such as a shell, and grown on that, otherwise they cannot exist on the soft mud bottom. There were a few others in the Control station samples, including two shells of the* Terebratella sanguinea *species. While growing oysters, we would find hundreds of these shells settled onto our oyster crop, so much so, they were a real nuisance at times as they did not always get dislodged in the rumbler and had to be manually removed. I recall the same over-settlement years ago on mussel crops.*

The very few individuals that may be affected by farms out on the soft mud bottom will be seen as totally insignificant compared to the higher numbers encountered towards the entrance to the bay and in the scour channels there and out into Paterson Inlet where they can be quite numerous (pers. obs.)

*Application Sites 2 and 3 are at least 1.75 km from known tubeworm mounds (*Galeolaria hystrix*) on the south side of BGB entrance and Site 1 is about 900 m from the closest area where the mounds may be found on the north side, near the south end of Bravo Island.*"

Conclusion

The information above addresses the matters raised in the request for further information. It is considered to be consistent with Clause 2(3)(c) of the Fourth Schedule to the Resource Management Act, in that it "… corresponds with the scale and significance of the effects that the activity may have on the environment".

It is acknowledged that some of the information about the potential adverse effects on the environment that is relied upon is generic in nature, but it is applied where it is consistent with what has been observed in the bay. Some scientific research that would support the application with greater certainty is beyond the scope of an application of scale. Such research may have relevance to the bay as a whole, and the potential adverse effects associated with shellfish farming, including cumulative effects, do not justify the time and cost of getting that information.

However, the applicants have gone to to some lengths to address all of the matters raised in the information request and are able clarify any aspect of it if it is necessary.

Thank you for your consideration.

Yours faithfully,

John Engel
Manager, Bonisch Environmental