

To Christin Atchinson, Waikato Regional Council

From Dr Hilke Giles, Pisces Consulting

Date 16 August 2023

Subject Technical review of general ecological matters (benthic, water quality, and biosecurity) of an application by North Western Mussels Limited for a mussel spat/nursery marine farm off the Waikato Region West Coast

WRC Reference APP145770

1 Background and structure of this review

This memo provides a review of an application by North Western Mussels Ltd (**NWML** or **applicant**), for a mussel spat/nursery marine farm, focusing on the aspects related to benthic and water quality effects, and biosecurity risk.

You specifically asked me to answer the following questions:

- Has a robust baseline survey in accordance with Appendix 1A of the Coastal Plan been undertaken? If not, what are the differences. Do you consider the deviation from Appendix 1A appropriate and if so, why?
- Have benthic reef communities been identified within the impact zone?
- Is the ecological assessment scientifically robust? Do you agree with the conclusions and identified level of effect? Please provide reasoning.
- Is the biosecurity assessment scientifically robust and can WRC rely on the conclusions? Please provide reasoning.
- Do you consider that any other effects require further consideration?
- Is further information required to ensure a robust assessment in respect to effect on benthic communities, water quality, and biosecurity risk. If so, please detail the information required and provide reasoning.
- Have mitigation measures been proposed and do you consider them appropriate to minimise and/or mitigate effects/risks?
- Has monitoring been proposed? If so, do you consider the proposed monitoring appropriate? Please provide reasoning.
- Do you have any further comments?

To inform my review, I have reviewed the following documents:

1. AEE by Aquaculture Direct (**AEE**)
2. Baseline Survey by NIWA, Schedule B (**NIWA report**, also referred to as **benthic baseline survey** and **water column sampling**)¹
3. Ecological Assessment by Coast and Catchment, Schedule C (**ecological assessment**)
4. Biosecurity Assessment by Coast and Catchment, Schedule F (**biosecurity assessment**)

¹ For water column surveys to be considered baseline surveys repeat sampling is required. As NIWA only carried out a single water column sampling event, I refer to the water column component of the NIWA report as water column sampling.

My review is structured as follows:

- Overview of the proposal (section 2)
- General comments (section 3)
- Benthic environment (section 4)
- Water column (section 5)
- Biosecurity (section 6)

Sections 4-6 commence with a summary of the effects assessment provided, followed by responses to your questions. Throughout this memo I identify information and action requirements and make recommendations. I suggest you provide the applicant with my full memo so that they can review the relevant context of each requirement and recommendation.

2 Overview of the proposal

The application is for a 700 ha spat catching and holding farm in four blocks (sites) north and south of Raglan/Whāingaroa on the Waikato west coast in 20-40 m deep water (Figure 1). The minimum distance between the farm sites and the coastline is 3.1-4.0 km. The application is to catch and seed Greenshell mussel spat (*Perna canaliculus*), and to grow and harvest Greenshell mussel seed (maximum size of 90 mm). The operational stages are described as follows:

1. Spat Catching/Collection Operations - Microscopic spat will attach themselves to the dropper lines during the free-swimming larval stage (which lasts approx. 3-5 weeks each cycle). There are three spat settlements per year namely autumn, winter and spring.
2. Spat Nursery Operations - Depending on a range of factors, operational options are:
 - Remove the dropper lines from the farm when the spat is still at 'spat stage' then relocate those dropper lines to existing mussel growing areas, including in the Coromandel/Hauraki Gulf;
 - Let the spat grow to a juvenile 'seed' stage prior to transfer; or
 - Introduce spat from an alternative source, such as a hatchery, in accordance with the proposed Biosecurity Management Plan, by introducing it onto mussel spat 'stocking' hung from the lines, then allow it to grow to juvenile 'seed' stage prior to transfer.

Spat nursery options enable spat to be grown to 'seed' to an average of 70 mm. This mussel seed will then be transferred to the Hauraki Gulf for on growing to harvest size

3. Harvesting and Maintenance - The spat catching/nursery activity will be carried out year round.

The applicant also seeks consent to install and maintain structures (and replace them as required), to seed, grow and harvest marine farming product from the marine farm (including the discharging of coastal seawater and discharge of biodegradable and organic waste matter), and all other activities that are ancillary to the operation of the farm.

Table 1. Proposed development stages. Source: AEE.

	Site A	Site B	Site C	Site D	Total
Stage 1	90ha	90ha	90ha	N/A	270ha
Stage 2	180ha	180ha	180ha	60ha	600ha
Stage 3	180ha	180ha	180ha	160ha	700ha

The applicant proposes developing the farm sites in three stages to ensure that actual effects on marine mammals and surf breaks are no greater than predicted, i.e., no greater than 'no more than minor'. Staged development generally comprises 50% development of each row in the first stage with farm site D being developed last with 27% development in Stage 2 (Table 1). The applicant proposes providing a staging development plan (SDP) for certification at a later stage. The SDP will include methods for appropriate monitoring of development stages to inform development of further stages.

The applicant describes that the activity will be operated in accordance with management plans, which will be developed in consultation with relevant experts and Iwi as appropriate and submitted to the Waikato Regional Council (WRC) for certification. Management plans will include the following:

- Staging Development Plan
- Operational Management Plan
- Marine Mammal Management Plan
- Biosecurity Management Plan

Furthermore, the marine farms will operate in accordance with all industry best management practices, including the A+ Sustainable Management Framework for Greenshell Mussels.

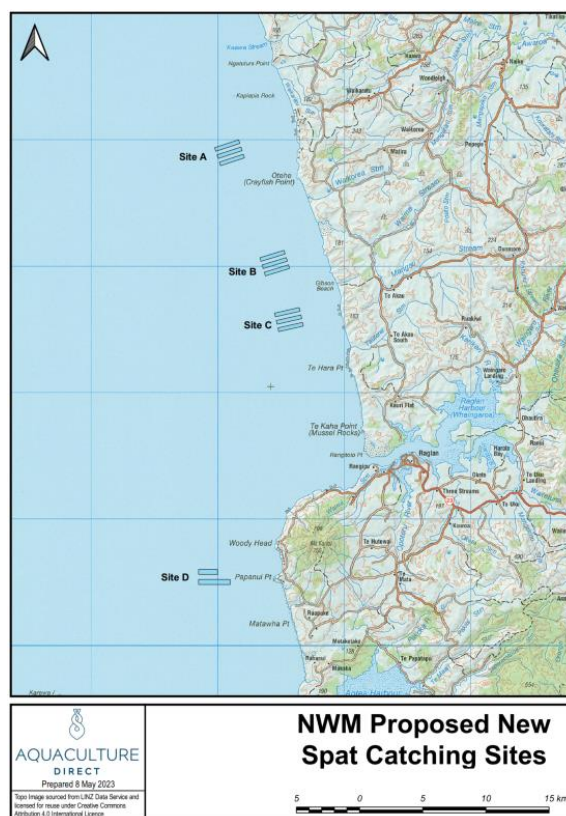


Figure 1. Locations of proposed marine farm sites A to D.

3 General comments

Suitability of the site for full scale mussel farming

The AEE describes that:²

“The site is unique and valuable for its spat catching/nursery characteristics and not suitable for full scale mussel farming” (emphasis added).

No further information is provided about the reasons for the determination that the site is unsuitable for full scale marine farming. The application is for growing spat/mussels up to 90 mm, which is relatively close to the mussel harvest size in grow-out farms (around 105 mm)³.

Furthermore, the AEE describes that, while spat catching and spat nursery activities included in the proposal are different to growing out the mussels to production size, they likely have a similar range of effects.⁴

No specific information was provided in the information I reviewed on why the respective environmental characteristics or effects would render the site not suitable for full scale mussel farming. I therefore assume that the statement on page 29 of the AEE quoted above does not relate to water column, benthic, seabird, or biosecurity effects. To ensure my review is complete, clarification is required on this aspect.

Information requirement 1:

- Please clarify whether the determination that the proposed farm sites are not deemed suitable for full scale marine mussel farming is based on (fully or partially) water column, benthic, seabird, or biosecurity effects.

Scope of effects to be considered in relation to staged development

It is my understanding that the reason for staging is to ensure appropriate management of effects on marine mammals and surf breaks only. For this reason:

- I based my review on the assumption that monitoring of water column, benthic, seabird, or biosecurity effects is not required to inform the progression through development stages; and
- I am not commenting on the need for or appropriateness of proposed staged development.

To ensure my review is complete, clarification is required on this aspect.

Information requirement 2:

- Please clarify the objectives of staged development, specifically whether staged development is intended to play a role in the management and/or monitoring of water column, benthic, seabird, or biosecurity effects.

² AEE, p.29.

³ AEE, p.14.

⁴ AEE, p.53.

4 Benthic environment

4.1 Summary of effects assessment by the applicant

The assessment of benthic effects is based on scientific literature (including research studies, outcomes of benthic monitoring of New Zealand mussel farms, and literature reviews) and a benthic baseline survey of the proposed four farm sites conducted in February 2017.

The benthic baseline survey included side-scan sonar, underwater video, drop camera photography, and sediment sampling for analysis of grain size, total organic content, and macrofauna. The survey design was based on the requirements for a baseline survey for non-fed new marine farms in WRCP Appendix 1A with some modifications.

As summarised by Coast and Catchment, the benthic baseline survey:⁵

"found that the substrate in Blocks A–C was predominantly sand, with a small percentage of mud (~10%). Block D contained a larger percentage of mud (~20–30%). Total organic content at all sites was very low (<0.14%). Epifauna was very sparse, and no sensitive habitats such as rocky reef or biogenic habitats were observed at the site. Macrofaunal communities had moderately low richness (mean = 12–16 taxa/grab) and moderate abundance (mean = 36–68 ind./grab). The community was dominated by small, common mobile taxa e.g., polychaetes, amphipods, cumaceans, the decapod *Ogyrides delli*, and the bivalves *Dosinia* sp. and *Mactra ordinaria*, which are widespread around the New Zealand coast in exposed, sandy areas".

In addition, the AEE describes rocky reefs near the proposed farming sites:⁶

"There are some sections of reef, notably Jacksons' Reef in the south (located some 3 km from the shoreline and nearest to Site D). In saying that, all four sites avoid placement over or in close proximity to reefs."

The assessment of effects considers benthic enrichment effects as well as effects from the drop-off of shell and live mussels. The ecological assessment concludes:⁷

"Given the lack of sensitive habitats at the site, the common macrofaunal species present, and the highly dispersive environment, the potential benthic effects of the proposed nursery farm are likely to be less than minor. However, given the lack of data available on the impacts of offshore mussel farming in New Zealand, it is recommended that benthic monitoring is conducted to provide further information on the benthic impacts of offshore mussel farms.

The NIWA report further states:⁸

"Each proposed farm location is similar in terms of sediment composition, water depth, organic content of the sediments, and infaunal abundance and composition. As such, there are unlikely to be any differences in how each site is likely to support and respond to mussel spat catching"; and

"The seasonal use of the sites to catch and hold mussel spat will not, in our opinion, result in any more than very minor alteration to the marine environment at the sites."

⁵ Ecological assessment, p.1.

⁶ AEE, p.36.

⁷ Ecological assessment, p.2.

⁸ NIWA report, p.18.

Overall, the applicant concludes that:⁹

“the benthic effects of mussel farms are well understood, and offshore farms are likely to have an even lesser and potentially negligible effect. The proposal is over a suitable habitat. NWML propose to carry out benthic monitoring as part of the staged development plan. Overall, the effects on the benthic environment are likely to be less than minor.”

The applicant also describes positive ecosystem effects of mussel farming, including the creation of benthic habitat through shell and crop drop-off and highlight that it is possible that the proposed spat nursery will provide some level of positive ecosystem effects in a similar manner to production mussel farms.

4.2 Response to your questions

In this section I provide responses to your questions relevant to benthic effects.

4.2.1 *Has a robust baseline survey in accordance with Appendix 1A of the Coastal Plan been undertaken? If not, what are the differences. Do you consider the deviation from Appendix 1A appropriate and if so, why?*

Baseline survey requirements stipulated in Appendix 1A include the following parameters:

- Sediment chemistry
 - Organic carbon
 - Nitrogen
 - Phosphorus
- Benthic fauna and flora
 - Macroinfauna species
 - Macroinfauna community parameters (abundance, richness, diversity)
 - Epifauna species
 - Epiflora
- Seafloor
 - Sediment grain size
 - Substrate (e.g., mud, sand, rock, shell, boulder)

The benthic baseline survey included all parameters listed under headings ‘Benthic fauna and flora’ and ‘Seafloor’. Instead of analysing organic carbon, nitrogen, and phosphorus, NIWA analysed sediments for total organic content. I consider that an appropriate substitution, which meets the intent of this baseline survey component.

The benthic baseline survey was carried out in 2017 and it is possible that some environmental change has occurred in the areas since then. However, considering the lack of sensitive habitats and the common macrofaunal species present at the sites, I do not have any concerns about the timing of the benthic baseline survey.

It is not clear from the NIWA report, how far beyond the proposed farming sites sonar swaths reached and whether they covered the spatial extent of potential shell/crop drop off, i.e., the area of

⁹ AEE, p.50.

approximately 100 m from the proposed farm boundaries. Appendix 1A requires sampling sites to be located 'adjoining the marine farm site, along a transect (or transects) of decreasing effect intensity in the direction of the prevailing current'. It appears that this requirement has not been met, especially with the prevailing current flowing north and south and the sonar swaths not extending along or beyond the northern and southern farming site boundaries.

As described below (in my response to your question on benthic reef communities), there is no indication of reefs being present in the vicinity of the proposed farming sites. Considering the relatively small expected spatial extent of drop off, I have no concerns about potential effects on potential reefs located north or south of the proposed farming sites. However, I recommend that confirming whether reefs are present within 200 m of the proposed farming sites will be a specific objective of the benthic monitoring proposed by the applicant (see my response to your question on monitoring below).

In conclusion, in my opinion, the benthic baseline survey is an appropriate baseline survey as required under Appendix 1A.

4.2.2 Have benthic reef communities been identified within the impact zone?

Rocky reef or biogenic habitats have not been identified in the four farming sites. However, as described in my response above, the benthic baseline survey did not include the full expected impact zone. Furthermore, the applicant did not provide robust information on where reefs are or may be located in the general area of interest, beyond one sentence referring to Jacksons Reef as "nearest to Site D".¹⁰

Waikato Regional Council provides a spatial data set titled 'Bathymetry - CMA habitat maps - bathymetry and substrate type (TR2017/34)' in their data catalogue, which contains a spatial layer 'East and west rocky reefs'. This spatial layer is described in Gardiner and Jones (2020) who summarised the state of knowledge of the extent of seabed habitats in the Hauraki Gulf and the Waikato west coast and created a range of spatial layers from the reviewed data.

In addition to mapping areas identified as potential rocky reefs, confidence scores for the identification were assigned, ranging from 1 (sites identified by a local fisherman but no other supporting evidence) to 5 (sites supported by three types of evidence). The methods used to identify rocky reefs and assign confidence scores is described in detail in Gardiner and Jones (2020). Gardiner and Jones (2020) stated that, where confidence levels are low, further survey work would be required to verify the mapped reefs.

Rocky reef areas mapped by Gardiner and Jones (2020) are shown in Figure 2. Of relevance to the proposed farming sites are:

- Jacksons Reef, located ~1.5 km north-east of Site D. This reef has been verified by several sources and has a confidence score of 5. This reef is referred to in the AEE.¹¹
- A reef mapped ~1.4 km north of Site A (confidence score 5).
- Two small areas of likely rocky reef ~600-800 m north of Site D (confidence score 1).

These reefs are outside the typical spatial extent of benthic effects (both in terms of benthic enrichment and drop-off) from mussel farms. Due to the exposed nature of these sites, shell drop-off

¹⁰ AEE, p.36.

¹¹ AEE, p.36.

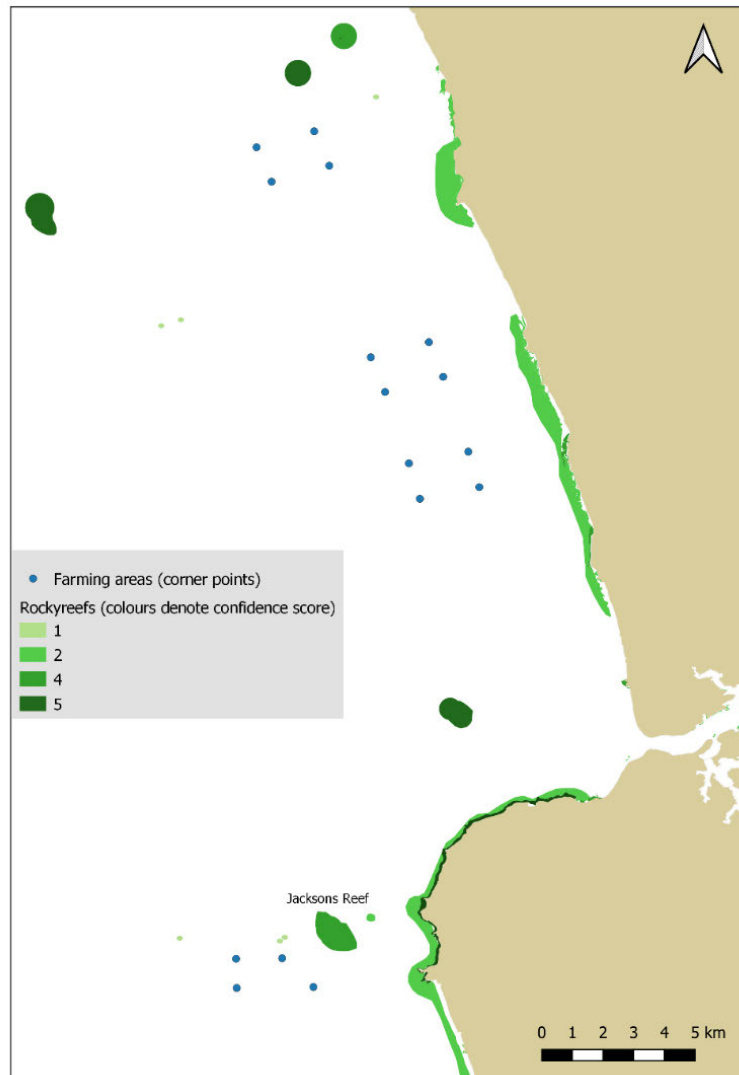


Figure 2. Rocky reefs identified in WRC spatial layer 'East and west rocky reefs', including confidence scores (higher scores denote greater confidence). The spatial layer is described in Gardiner and Jones (2020). Source: WRC Data Catalogue, spatial data set 'Bathymetry - CMA habitat maps - bathymetry and substrate type (TR2017/34)'.

may occur beyond the typical ~100 m distance from mussel farm boundaries; however, it is highly unlikely that it will reach any of the identified rocky reef areas.

Based on the information presented in Figure 2, Gardiner and Jones (2020) and the reasoning above, I have no concerns about adverse effects of the proposed farms on rocky reefs but refer to my recommendations on benthic monitoring in my response to your question on monitoring below.

4.2.3 *Is the ecological assessment scientifically robust? Do you agree with the conclusions and identified level of effect? Please provide reasoning.*

The assessment of benthic effects contained in the ecological assessment is concise but sufficiently robust. I agree that the benthic effects of mussel farms are well understood and that the effects of the proposed farms will be similar and likely less intense than the effects of grow-out farms. I also agree that the benthic habitat in the proposed farm sites is suitable for the proposed activities, especially in light of the mapped rocky reefs shown in Figure 2. The applicant proposes to carry out benthic

monitoring, which will address the limited information on reefs in the impact zone outside the proposed farming sites and the associated uncertainties.

If patches of reef are found in the immediate vicinity of the proposed farm sites, I consider it likely that the adverse effects of the respective farm(s) will be very small and not of ecological concern for the benthic ecosystem in the surrounding area. However, as recommended in my response to your question on monitoring below, this requires confirmation through monitoring.

Overall, I consider it likely that benthic effects will be positive (or at least neutral) due to the enhanced biogenic structure and associated biodiversity created on the seabed by shell material and live mussels dropping off the farm structure.

4.2.4 Do you consider that any other effects require further consideration?

No

4.2.5 Is further information required to ensure a robust assessment in respect to effect on benthic communities? If so, please detail the information required and provide reasoning.

No

4.2.6 Have mitigation measures been proposed and do you consider them appropriate to minimise and/or mitigate effects/risks?

The applicant describes benthic monitoring as forming 'part of the staged development plan'.¹² It is my understanding that staged development is proposed for the purpose of managing effects on marine mammals and surf breaks, not benthic effects.¹³ I agree that there is no need to include benthic monitoring in any staged development consent conditions and monitoring. This is because, in my opinion, there are no potential or expected adverse benthic effects that would preclude progression through development stages in an adaptive management sense. To avoid confusion and misunderstanding of the applicant's intentions, I recommend the applicant either (1) removes reference to benthic monitoring from page 50 of the AEE; or (2) adds benthic effects to the matters to be considered in the design of the staged development approach and SDP.

Recommendation:

To remove the current inconsistencies in the application regarding the purpose of staged development for managing benthic effects, I recommend the applicant either: (1) removes reference to benthic monitoring from page 50 of the AEE; or (2) adds benthic effects to the matters to be considered in the design of the staged development approach and SDP.

The applicant proposes to operate the marine farms in accordance with all industry best management practices, including the A+ Sustainable Management Framework for Greenshell Mussels. I consider that appropriate and sufficient to minimise and/or mitigate benthic effects.

4.2.7 Has monitoring been proposed? If so, do you consider the proposed monitoring appropriate? Please provide reasoning.

The applicant proposes benthic monitoring, presumably based on the recommendation by Coast and Catchment that "benthic monitoring is conducted to provide further information on the benthic impacts of offshore mussel farms".¹⁴

¹² AEE, p.50.

¹³ See my comment and request for information on this aspect in section 3.

¹⁴ Ecological assessment, p.2.

In my opinion, only two objectives are required for benthic monitoring:

1. to determine the level (intensity) and spatial extent of shell/crop drop-off from the farms; and
2. to assess whether any reefs are present within the area around the proposed farming sites in which shell/crop drop-off may occur.

For the avoidance of doubt, I do not consider it necessary to conduct any monitoring to ascertain benthic enrichment effects because of the strong currents at the proposed sites and the expected low level of benthic deposition. In my opinion, once the two objectives above have been met and if monitoring can confirm an absence of reefs in the area affected by the farms, benthic monitoring could be discontinued. If reefs are found in the area affected by drop-off, it may still be appropriate to continue monitoring at reduced frequencies (~5-10 yearly). The decision on whether benthic monitoring can be reduced or discontinued will need to take into consideration the level of development of each farming site. A reduction in monitoring frequency may be appropriate at a relatively low level of development, especially if the risk of adversely affecting ecologically valuable reefs is low. A decision to discontinue monitoring may require a level of development that is close to maximum development (~80%); however, expert judgement based on available information at the time may conclude otherwise and support an earlier discontinuation.

The applicant describes potential positive benthic effects of the proposed farms but does not refer to those in their conclusion, AEE summary table, or in the context of monitoring. In my opinion, it is likely that benthic effects will be largely positive, and, while not a compliance requirement, I recommend that benthic monitoring results are interpreted in terms of both, potential adverse and positive effects, as that would assist in progressing our scientific knowledge of benthic effects of this type of marine farming and inform decision-making on the need for additional monitoring.

4.2.8 *Do you have any further comments?*

No

5 Water column

5.1 Summary of effects assessment by the applicant

The assessment of water column effects is based on scientific literature (including research studies, outcomes of water quality monitoring of New Zealand mussel farms, and literature reviews) and a one-off baseline water column sampling event in February 2017.

The 2017 water column survey of 13 sampling stations in and around the four proposed farming sites revealed depth-integrated (0-8 m) chlorophyll a concentrations of 0.14-0.63 µg/L, with highest concentrations at site A and lowest at site D.

The applicant, referring to the water column components of the ecological assessment and the NIWA report, concluded that:¹⁵

"The effects of mussel farming on the water column are well understood, and include potential for localised phytoplankton depletion and changes to water column nutrients. Despite lengthy studies of existing mussel farms, little if any effects have been detected beyond the boundaries of the farm if the farms are well sited. This proposal is for sites in a well-flushed environment and overall, the effects on the water column will be negligible".

¹⁵ AEE, p.49.

The NIWA report also states that “phytoplankton depletion by the small spat will be undetectable against the background of open coastal water movement that will constantly replenish phytoplankton”.¹⁶

The applicant also describes positive ecosystem effects of mussel farming, including mitigation of nutrient enrichment through mussel filtration and highlight that it is possible that the proposed spat nursery will provide some level of positive ecosystem effects in a similar manner to production mussel farms.

5.2 Response to your questions

In this section I provide responses to your questions relevant to water column effects.

5.2.1 *Has a robust baseline survey in accordance with Appendix 1A of the Coastal Plan been undertaken? If not, what are the differences. Do you consider the deviation from Appendix 1A appropriate and if so, why?*

Baseline survey requirements stipulated in Appendix 1A include the following parameters:

- Temperature
- Salinity
- Water clarity
- Ammonium (NH₄-N)
- Ammonia (NH₃-N)
- Oxides of nitrogen (NO_x-N)
- Total N (TN)
- Dissolved reactive phosphorus (DRP)
- Total phosphorus (TP)
- Chlorophyll a (phytoplankton biomass)

In addition, a water quality baseline survey needs to provide information on spatial and temporal variability, which typically requires data gathering over at least one year.

The applicant provided very limited water column data, which technically does not meet the requirements of Appendix 1A. They only measured chlorophyll a and only during a one-off water column sampling event in February 2017. However, for the reasons outlined below I consider this appropriate.

Firstly, I agree that chlorophyll a is the only parameter of relevance for the assessment. Our knowledge of the water column effects of mussel farming has improved since Appendix 1A was created and there is now a general understanding that, unless water bodies are poorly flushed and/or oligotrophic, mussel filtration has largely positive ecosystem effects.

Another consideration for water column baseline surveys is the high temporal variability in water column parameters, including chlorophyll a. This means that, to be representative, water column surveys must be conducted over a relatively long period of time. It is therefore critical to evaluate the need for and usefulness of a water column baseline survey for each consent application.

¹⁶ NIWA report, p.18.

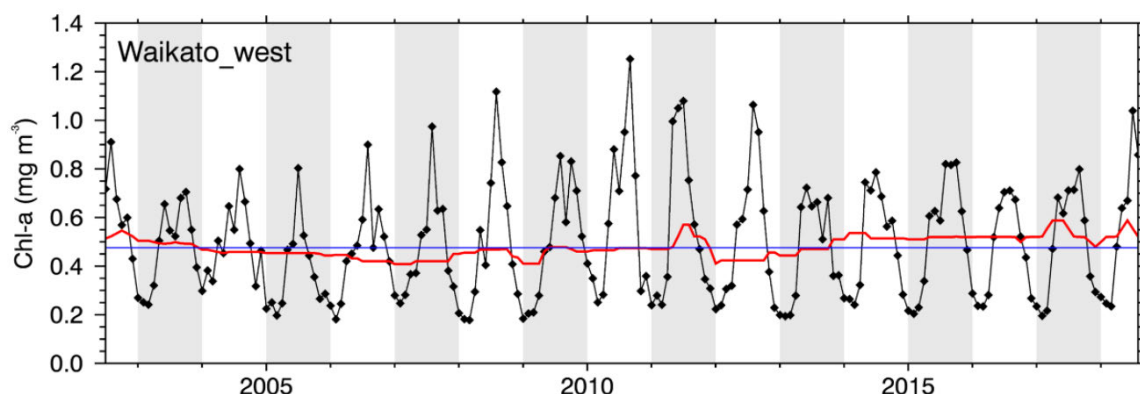


Figure 3. Coastal mean chlorophyll-a (Chl-a) by month for the western Waikato Coastal Marine Area. The 4-year smoothed trend is shown red, and the long-term median value is shown blue. Source: Pinkerton et al. (2019).

Valuable information on water column characteristics can be obtained from other sources. For example, it is useful to consider chlorophyll a concentrations derived from satellite information, such as data presented in Pinkerton et al. (2019), presented in Figure 3. Figure 3 shows the chlorophyll a concentration over the western Waikato Coastal Marine Area (CMA) between 2002 and 2018. The median concentration over this time period was 0.48 mg/m³ (=µg/L, Pinkerton et al., 2019).

While water column sampling results cannot be directly compared to satellite-derived concentrations, the information in Pinkerton et al. (2019) demonstrates that the chlorophyll a concentrations measured during the one-off water column sampling in 2017 (0.14-0.63 µg/L) reflect 'typical' concentrations within the expected variability of the wider Waikato west coast environment. Considering the temporal variability in chlorophyll a illustrated in Figure 3 and the likely even greater natural variability occurring at local scales, I doubt that a water column survey over a period of one or even multiple years would have provided more insights into site-specific chlorophyll a dynamics. Considering the well understood effects and the low risk of adverse effects of the proposed activity on phytoplankton stocks, food webs, and associated ecosystem functions, I do not have any concerns about the limited baseline data gathered by the applicant.

5.2.2 *Is the ecological assessment scientifically robust? Do you agree with the conclusions and identified level of effect? Please provide reasoning.*

The water column effects assessments in the ecological assessment and the NIWA report are succinct but appropriate. I agree that the water column effects of mussel farming are well understood, that the environmental conditions at the proposed sites create a low risk of adverse effects, and that the proposed spat catching and holding activities will result in smaller effects than mussel on-growing. I also agree with the overall conclusion of the assessment that water column effects will be negligible.

I consider it highly unlikely that the proposed farming activities will result in detectable change in chlorophyll a in the water column in and surrounding the proposed farm sites. If effects were detectable at the farm sites, they would most likely not be adverse. I note that I would have drawn the same conclusion if the applicant had proposed on-growing of mussels.

Furthermore, Pinkerton et al. (2019) demonstrates that there have not been any long-term trends in chlorophyll a in the western Waikato CMA (no statistically significant trends in chlorophyll a concentration between 2002 and 2018). As a consequence, it is unlikely that chlorophyll a levels will

decrease over the duration of consent. I therefore have no concerns about potential future (over the proposed duration of consent) adverse water column effects.

5.2.3 Do you consider that any other effects require further consideration?

No

5.2.4 Is further information required to ensure a robust assessment in respect to effect on water quality? If so, please detail the information required and provide reasoning.

No

5.2.5 Have mitigation measures been proposed and do you consider them appropriate to minimise and/or mitigate effects/risks?

No mitigation measures have been proposed. Considering the expected negligible effects, I consider that appropriate.

5.2.6 Has monitoring been proposed? If so, do you consider the proposed monitoring appropriate? Please provide reasoning.

No monitoring has been proposed. I consider this decision appropriate due to the very low likelihood that the proposed farming activities will result in detectable changes in chlorophyll a (the only potentially relevant monitoring parameter) and because a small reduction in chlorophyll a in or surrounding the proposed farm sites would not constitute an adverse effect.

5.2.7 Do you have any further comments?

In the water column section of the AEE, the activity is described as follows: ¹⁷

"For this project, the organisms will only be collected and harvested when they are at a microscopic spat stage, or at juvenile stage (30 to 50mm) after which they will be removed from the site and transported elsewhere. The rotational nature of the operation will mean that the biomass in the water column at any one time will be far lower than that on a mussel grow-out farm therefore the accompanying water column effects will also be far lower."

I have two comments on this description:

1. The maximum size description of mussels (50 mm) here is inconsistent with the remainder of the application (up to 90 mm). I assumed in my assessment that mussels may be up to 90 mm.
2. Based on my understanding a certain level of 'rotation' also applies to mussel grow-out farms. I did not consider this as a unique effects-mitigating feature for the proposed farms.

Consequently, the descriptions of maximum mussel size and rotational nature of the operation did not influence my assessment. The fact that they may not be accurate or unique to the proposal does not influence the outcome of my review.

6 Biosecurity

6.1 Summary of biosecurity assessment provided by the applicant

Coast and Catchment conducted a desktop review, including academic scientific publications, WRC reports, and targeted biosecurity survey findings to describe marine pests and diseases in the area of the proposed farms.

¹⁷ AEE, p.48.

The biosecurity assessment by Coast and Catchment identified four main sources of biosecurity risk associated with the proposed farm. Their assessment is summarised below, grouped by risk source, and largely citing from the Coast and Catchment report:

1. Farm placement and its structures

Farm structure surfaces for colonisation, coupled with good water flow in highly productive, surface waters means that many pests flourish on marine farms. Routine cleaning of biofouling organisms on floats and dropper ropes can reduce the abundance of pests on the farm, but fouling material is typically discarded on the seabed beneath the farm where pests may continue to live. Furthermore, fouling organisms are not easily removed from fixed farm equipment such as anchors and warps. The continual presence of mussels on the farm also means that there is a continuous host for mussel pathogens or parasites, meaning that mussel farms may act as reservoirs for pests and diseases. Currently, there is very little coastal development off the Raglan coast, with only two marine farms present along Waikato's west coast: a mussel spat catching farm in Aotea Harbour, and an oyster farm in Kawhia Harbour. No marine pests are known to occur in the coastal area offshore of Raglan, and therefore, there is unlikely to be a natural source of pests to the area. The proposed location of the farm 3 km offshore in an exposed environment is likely to greatly reduce the biofouling community that can grow on farm structures or on the seabed beneath the farm.

The biosecurity risk of the proposed farm acting as a reservoir for pests and diseases is assessed as less than minor, as long as no new pests or diseases are introduced into the area that are able to survive on the farm. Changes in the occurrence of harmful organisms near the proposed farm may require changes in farm biosecurity management, which should be addressed in a Biosecurity Management Plan that is regularly reviewed and updated as necessary.

2. Transfer of stock

The translocation of aquaculture stock has been associated with the introduction of harmful organisms at new locations and is considered to be one of the most important transmission pathways for harmful organisms.

The biosecurity risks of the proposed farm associated with the transfer of aquaculture stock depends on whether the farm is used for a nursery farm only, or as a grow-out farm.

If the proposed farm is used for spat catching and holding only, then there is no chance of introducing harmful organisms to the Raglan area via stock movements as no stock will be moved onto the farm.

If the proposed farm is used for on-growing hatchery spat, then the biosecurity risk is expected to be less than minor due to hatchery spat being produced in a controlled environment with appropriate water treatment and biosecurity procedures in place.

-> in application: "Introduce spat from an alternative source, such as a hatchery" – are there any other sources that may not have been considered in biosecurity assessment?

3. Transfer of equipment

Submerged aquaculture equipment (ropes, floats, anchors etc.) can become fouled with pest species and/or contaminated with pathogens. Equipment that is transported and redeployed in another location without cleaning and disinfection may facilitate the introduction and spread of pests and diseases. In particular, untreated used spat rope that is redeployed on the spat farm poses a high risk of introducing harmful organisms to the site.

The likelihood of introducing new pests or diseases to the area via submerged equipment can be minimised by:

- a. using new equipment;
- b. cleaning and disinfecting used impermeable equipment such as floats prior to use on the spat farm; and
- c. cleaning used rope and storing on land for at least 12 weeks before use on the spat farm.

Coast and Catchment also described two additional potential transmission pathways: marine litter and people:

- Marine litter generated by aquaculture activities are a potential transmission pathway. Marine litter has frequently been observed fouled with a range of organisms, including Mediterranean fan worms. However, the current biosecurity risk of litter from the proposed farm from is likely to be negligible as no marine pests are known to occur around the farm.
- People may inadvertently transfer harmful organisms that are attached to their clothing/personal protection gear if they move between sites. Personnel that enter the water at multiple sites per day, e.g., divers, pose the greatest personnel biosecurity risk. However, given the scarcity of other marine farms in the region, and the infrequent occurrence of such activity, this risk is likely to be negligible for the proposed farm.

Provided that used equipment is treated as recommended above, the risk of introducing pests to the Raglan area via farm equipment is assessed as minor.

4. The movement of farm vessels

Vessel movements, both recreational and commercial, are recognised as the most significant biosecurity risk for moving pests and diseases to, and around, the Waikato Region. These vessels may transport pests to the area via biofouling of hulls or equipment aboard the vessels, or the discharge of pest fragments, water or sediment that contains microscopic pest life stages.

The biosecurity risks associated vessel and vehicle movements can be mitigated by:

- a. regular cleaning and antifouling of the vessel's hull and niche areas;
- b. washing down decks and equipment, and flushing or emptying contained water once the vessel has left a farm and prior to arriving at its destination, and vice versa; and
- c. washing down trailer vessels and vehicles, and emptying any contained water before moving between operational zones, management areas or distant locations.

Given the lack of pests in the Raglan area and the limited normal movements of the farm vessels, the biosecurity risks associated with farm vessel movements are assessed as minor, provided the recommended mitigation methods are implemented.

NWML originally hoped to bring spat from Te Oneroa a Tōhe (Kaitaia spat) onto the farm. However, in response to Coast and Catchment's findings that the associated biosecurity risk may be more than minor¹⁸, this activity is no longer part of this proposal.

In summary, the overall biosecurity risk of the proposed farm is no more than minor as long as the farm is only used for spat catching and holding or for on-growing hatchery spat, and the

¹⁸ Because the applicant chose not to include this activity in their application I have not reviewed the associated biosecurity risk assessment.

recommended mitigation methods (listed in section 6.2.5 below) are implemented, including a 12 week drying time for used rope.

6.2 Response to your questions

In this section I provide responses to your questions relevant to biosecurity risks.

6.2.1 Has a robust baseline survey in accordance with Appendix 1A of the Coastal Plan been undertaken? If not, what are the differences. Do you consider the deviation from Appendix 1C appropriate and if so, why?

Appendix 1A does not provide specific requirements for baseline surveys for biosecurity assessments. I therefore provide general comments on the information provided on marine pests and diseases for the area of interest.

Coast and Catchment conducted a thorough desktop review, including academic scientific publications, WRC reports, and targeted biosecurity survey findings. The baseline information collated is robust and appropriate for informing the biosecurity assessment.

6.2.2 Is the biosecurity assessment scientifically robust and can WRC rely on the conclusions? Please provide reasoning.

The biosecurity assessment is scientifically robust and comprehensive. It demonstrates the deep understanding of and experience with biosecurity risks and marine farming operations by Coast and Catchment.

I agree that the biosecurity risk associated with the four main sources described in section 6.1 above is generally low providing the mitigation measures recommended by Coast and Catchment are implemented effectively (see my response to your question on mitigation in section below).

Coast and Catchment describe the outcomes of their assessment in RMA terminology:

1. Farm placement and its structures - less than minor
2. Transfer of stock - less than minor
3. Transfer of equipment - minor
4. The movement of farm vessels - minor

They conclude that the overall biosecurity risk of the proposed farm is no more than minor as long as the recommended mitigation methods are implemented, including a 12-week drying time for used rope.

In my opinion, the use of RMA terminology in scientific assessments can be problematic due to the lack of agreed scientific definitions of the RMA thresholds. No definition was provided by Coast and Catchment for their assessment, so there is some uncertainty about the alignment between the scientific risk assessment and the application of RMA effects terminology.

However, from experience I do agree that the assessment has demonstrated that adverse effects arising from biosecurity risks associated with the proposed marine farms are no more than minor for all four sources individually and combined. Without a definition of the use of RMA terminology in the assessment, I am not able to comment on the individual conclusions, specifically the differentiation between less than minor and minor. If 'no more than minor' is the relevant effects threshold for the assessment, no response action should be required.

6.2.3 *Do you consider that any other effects require further consideration?*

No

6.2.4 *Is further information required to ensure a robust assessment in respect to biosecurity risk? If so, please detail the information required and provide reasoning.*

No

6.2.5 *Have mitigation measures been proposed and do you consider them appropriate to minimise and/or mitigate effects/risks?*

Coast and Catchment recommend that a farm biosecurity management plan (BMP) is prepared and that it includes requirements for:

- regular surveillance and recording of the abundance of pest species, new species to the area, or any unusual mortality on the farm;
- reporting the occurrence of unwanted organisms or suspected disease to the Ministry for Primary Industries (MPI);
- providing appropriate training for farm staff in pest surveillance and biosecurity management;
- cleaning and decontaminating all removable farm equipment prior to redeployment in distant areas;
- cleaning fouling organisms off floats and ropes during harvest, and rotating floats to expose fouled surfaces to the sun;
- antifouling all farm vessels according to the manufacturer's recommendations;
- cleaning and decontaminating farm vessels and vehicles before travel between management areas or operational zones;
- washing down vessel decks and emptying or flushing bilges and any other contained spaces before leaving the farm or arriving at the farm;
- keeping accurate records of all stock transfers (i.e., date, origin and destination locations, quantity transferred, and health and performance of stock);
- regular review of the plan periodically, or in response to a new biosecurity incursion.

In addition, Coast and Catchment recommends that used rope should be dried for 12 weeks.¹⁹ The conclusion of the biosecurity assessment that the overall biosecurity risk of the proposed farm is no more than minor is conditional on this drying time.

The applicant proposes to follow the recommendations in the Coast and Catchment assessment. The list of proposed mitigation measures to be included in the BMP in the AEE²⁰ does not include the 12-week drying time for used rope, which is a gap. I assume this is not because the applicant rejects that recommendation but because it was not included in the list of recommendations in the biosecurity assessment and therefore missed. However, for clarity, this important mitigation measure should be included in the list of mitigation measures to be included in the BMP.

¹⁹ Biosecurity assessment, p.27.

²⁰ AEE, p.58.

Action required:

To capture all mitigation measures recommended in the biosecurity assessment, the following requirement needs to be added to the list of BMP requirements proposed by the applicant:

- drying used rope for at least 12 weeks.

The applicant also confirms they intend to operate the farm in accordance with A+ including its 'Greenshell Mussel Biosecurity Standards'. Overall, it is apparent that the applicant has made a strong effort in minimising biosecurity risk, including by making the decision not to bring spat from Te Oneroa a Tōhe (Kaitia spat) onto the farm.

6.2.6 Has monitoring been proposed? If so, do you consider the proposed monitoring appropriate? Please provide reasoning.

Mitigation measures listed in the previous section include surveillance and reporting, which is appropriate for managing biosecurity risk. No monitoring is required.

6.2.7 Do you have any further comments?

No

7 References

Gardiner, S., Jones, H., 2020. Habitat mapping for the Waikato region coastal marine area: Bathymetry and substrate type. Waikato Regional Council Technical Report 2017/34. Waikato Regional Council, Hamilton, New Zealand.

Pinkerton, M., Sutton, P., Wood, S., 2019. Satellite indicators of phytoplankton and ocean surface temperature for New Zealand. NIWA Client Report No. 2018180WN. Prepared for the Ministry for the Environment.

To Christin Atchinson, Waikato Regional Council

From Dr Hilke Giles, Pisces Consulting

Date 7 May 2024

Subject Review of 2024 benthic survey supporting application by North Western Mussels Limited for a mussel spat/nursery marine farm off the Waikato Region West Coast and advice whether my assessment and conclusions in respect to the benthic environment (section 4 of my memo dated 16 August 2023) have changed upon receipt of the further information

WRC Reference APP145770

You asked me to review the benthic survey report prepared by Carina Sim-Smith (2024)¹ in support of an application by North Western Mussels Limited for a mussel spat/nursery marine farm off the Waikato Region West Coast and advice whether my assessment and conclusions in respect to the benthic environment (section 4 of my memo dated 16 August 2023) have changed upon receipt of the further information.

The initial (2017) benthic baseline survey only partially covers the area applied for in the consent application. The new (2024) benthic survey was conducted to cover the remainder of proposed marine farming blocks (**Figure 1**).

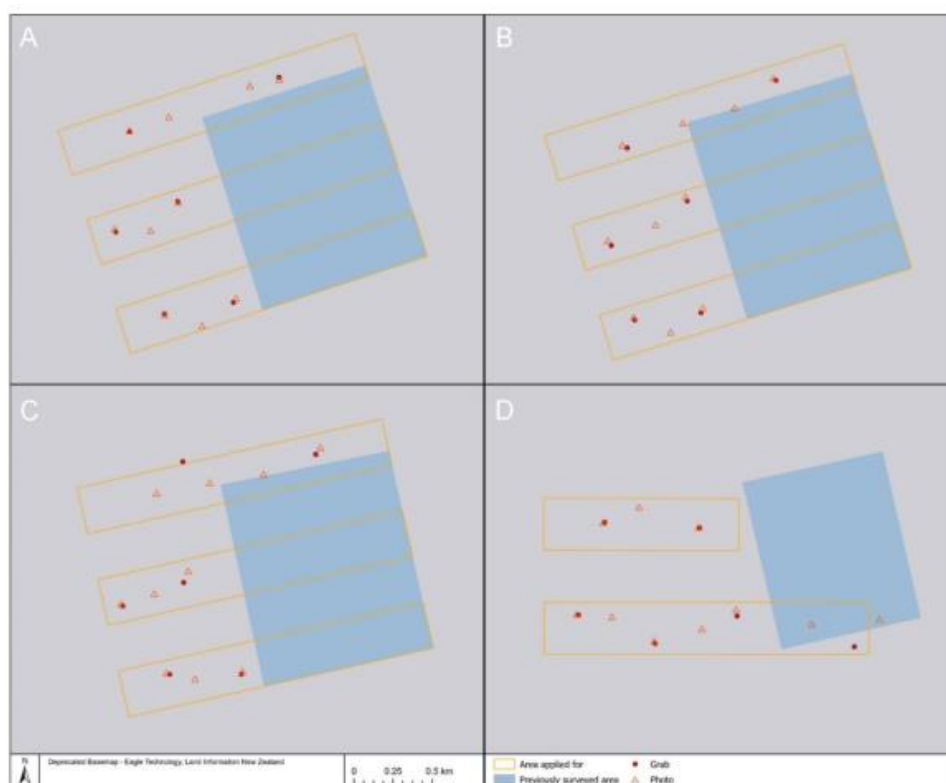


Figure 1. Location of grab samples and drop camera photos of the new benthic survey report.

¹ Sim-Smith, C (2024) Northwestern Mussels Ltd additional benthic survey of west Waikato mussel nursery. Prepared by Coast and Catchment for Northwestern Mussels Ltd.

The new survey was designed to complement the initial survey and involved grab sampling and underwater photography. A total of 24 sediment grab samples were collected (at six random stations per block) and analysed for macrofaunal community characteristics, grain size, and total organic carbon (TOC) analysis. Ten drop camera photos were taken in each block to detect if any biogenic habitat or large, emergent epibiota were present. Underwater video tows were also trialled, but the poor water clarity, depth and exposed sea conditions prevented the collection of usable footage.

Sim-Smith (2024) describes that the results from the 2024 survey of the previously unsurveyed areas within Blocks A–D concur with those of the initial survey and describes the results as follows:²

- “The substrate throughout the blocks was predominantly sand, with a minor proportion of mud. Visible sand ripples on the seabed indicate that the seabed is subjected to strong wave/current action and thus, is likely to be mobile.
- Concentrations of TOC were very low in all blocks, though they were slightly higher in Block D.
- No large emergent epifauna, biogenic habitat or rocky reef were observed in the benthic survey.
- The benthic macrofaunal community was diverse, but most species were present at very low abundances, which is typical of exposed sandy, subtidal habitats. No marine invertebrates are specified to be nationally threatened or regionally uncommon for the Waikato Region.”

I agree with Sim-Smith (2024) that the results of the two surveys are comparable. I also agree with the effects assessment provided by Sim-Smith (2024), which concluded that “overall, given macrofaunal and epibenthic community present, and the physical conditions at the site, the benthic impacts of the proposed mussel nursery are assessed as being less than minor”³.

Based on the outcome of my review of Sim-Smith (2024) I can confirm that the assessment and conclusions in respect to the benthic environment (section 4 of my memo dated 16 August 2023) are still valid and do not require any changes.

² At p.15.

³ At p.16.