

MCFS differentiation from OIF

Authors: Tonkin and Taylor, Earth Sciences NZ

Notes:

- Uses Puro.earth 2025 methodology to compare design of activities – feels circular. GB gets Puro.earth to write methodology based on what they would like to do, then refers to Puro.earth methodology as best practice?
- Paper considers the stimulation of primary productivity as principal intent of OIF, MCFS intent is biomass sinking 9(2)(h) .
- Assumption that the type of iron used and application method is the main determinant of whether an activity is OIF. There is no singular method of OIF – are they extrapolating a method from previous research experiments?
- Same argument as previous with second part of definition (“potential to result in deleterious effects...”) but no information on effects of MCFS.
- “...to allow plankton to self-import...” why would they self-import if not drawn towards something e.g. food?
- P4 - “...supported through controlled nutrient availability” aka fertilisation.
- Comment on p6 “there is no direct stimulation of ocean primary productivity”. Why include iron and manganese if not stimulating productivity?
- Table 2 does not provide any tangible evidence that the concerns raised are not valid for MCFS, only that they were considered in the design of particle and method.
- Exploration of LC/LP definition adds in ancillary characteristics which aren’t part of the definition. Unsure where “sustaining the food web” and “free ocean blooms” came from?
- Quite interesting ESNZ and T+T disclaimer at the bottom: very specific. What are the implications for our work?
- *My initial view: I think this doesn’t disprove anything from 9(2)(h) our read of the activity as OIF. The methodology is still stimulation of primary productivity with an ancillary sinking mechanism. Could be worth looking at how we consider hybrid mCDR activities – e.g. OIF with biomass sinking, macroalgae cultivation with biomass sinking, OIF and macroalgae cultivation.*

Environmental Impact Assessment

Authors: Tonkin and Taylor

Notes:

- This is different from the one provided to the Ministry in 2025 – this one relates to GIGPA04 (1000t of particles in 200t lots).

- Good to see this impact assessment has been developed based on feedback from EPA and requirements of EEZ Act. It is a lot more useful than the previous one provided for GIGPA05 and goes into more detail.
- This experiment doesn't appear to be researching the ability of the particles to grow phytoplankton, but this will happen as a result of the experiment and could be inferred from trawl data.
- Notes limitation of assessment due to lack of specific information on behavioural and physiological responses of marine organisms to the particles, limited information due to scale of area of interest.
- Refers to models used by GB to determine effects, but very little assessment of the limitations or inputs for these.
- Notes that the area of interest has been chosen to avoid sensitive environments, but limited info on whether the particles will end up in sensitive environment during drifting.
- The list of potential effects on p30 is useful but does not consider some of the more farfield effects, like nutrient robbing. It also does not provide potential magnitudes or likelihoods – possibly related to the lack of info?
- *My initial view: This is a much better EIA than the previous one, possibly because T&T had more time to work on it and EPA provided more direction. We should encourage them to continue working on these.*

In Situ MRV design and protocol

Author: Gigablue

Notes:

- “The project achieves carbon dioxide removal (CDR) under the Marine Carbon Fixation and Storage (MCFS) methodology by deploying a prepared substrate into a defined marine area to promote photosynthetic biomass growth in the substrates while floating in the surface water” – So the principal intent is still primary productivity??? Contradicts ‘MCFS differentiation from OIF’ document
- ‘...based on the first scheduled deployment in January 2026” of “100 - 200 tonnes” in “NZ open water HNLC”. Has this happened?
- This document refers to a free-floating plume, but I understand they have only been given permission to undertake activities in floating pens? Is this document correct? Or is this for commercial activity that hasn't happened yet?
- Risk management is based on avoidance before experiment, no methods to mitigate harm once observed. When is the trigger for the activity to stop, or for a notification to EPA? How do they plan to communicate about effects, should it occur?
- “If accumulation of Fe/Mn were to occur, it could be potentially beneficial given that iron and manganese deficiencies have been reported in lower trophic levels

in the region” – 9(2)(g)(i)

- *My initial thoughts: This document is very technical and could benefit from being reviewed by someone with more scientific experiment knowledge. It appears to contradict the statements in ‘MCFS differentiation from OIF’ and refers to activities that we are unsure have taken place. Would like to see more on how effects are managed once the activity begins.*

Microalgae Carbon Fixation and Sinking Methodology: Puro Standard

Author: Puro.Earth

This document is publicly available and was reviewed by the Marine Policy team in October.

Memo: Innovation and data for climate change solution

Author: Kauati – strategy and research consultancy

Notes:

- General outline of Ngāi Tahu climate change strategy.
- Notes discussions with Ngāi Tahu 9(2)(ba)(i), but still no actual confirmation from Ngāi Tahu that they are comfortable with activity or have any further interest.
- *My initial thoughts: We still don’t have any documentation on cultural effects, or any confirmation from Ngāi Tahu themselves that discussions are ongoing. Still no info on engagement with Ngāti Mutunga o Wharekauri or Moriori.*

GIGPA04 and 05

Author: Gigablue

Notes:

- Would be interested in what the result of GIGPA04 is, I understand GIGPA05 has been approved with conditions.
 - UPDATE: EPA unaware of GIGPA04, noted numbering may not represent order of pre-activity notice submission.
- GIGPA04 intends to release 1,000 tonnes of particles released at 200 tonne intervals.
- Applications have become very clear that they are not studying the ability of the particle to grow phytoplankton. Would be interested to know how this links in with MRV or the purpose of the activity.
- *My initial thoughts: How does GIGPA04 align with the letter sent by the EPA to GB with strict conditions for GIGPA05?*

Economic Assessment of Marine Carbon Dioxide Removal Activity in New Zealand's EEZ

Author: Insight Economics

Notes:

- Prepared under assumption that NZ legislation and regulatory settings from 2026 will permit Gigablue's activities. Assessment is to 2030.
- 'Information provided by the applicant has not been independently verified' would be interested to see how inputs have been developed.
- Assumes that they will be applying for a deposit of the seabed under EEZ Act – timeframes for this?
- Assumes deployment by existing shipping partners on established routes – but area of interest has incredibly low levels of maritime traffic?
- 'Gigablue estimates MCFS operation could remove up to 7MtCO₂-e around 2030" based on repeated seasonal deployments to sequestration fields. Based on ???
- 9(2)(b)(ii) [REDACTED]
- 9(2)(b)(ii) [REDACTED]
- Quite massive numbers for 9(2)(b)(ii) [REDACTED], 9(2)(b)(ii) [REDACTED] and contribution to GDP (\$585m)– but these are based on GB inputs, which have had no independent assessment.
- Assumes national and international objective to include marine CDR in national level accounting for climate goals.
- 9(2)(b)(ii) [REDACTED]
- Does not consider potential negative risks for fisheries, tourism or infrastructure. Does note potential conflict with other marine users.
- *My initial thoughts: This is the kind of analysis which could be helpful, but we need to understand where they have gotten the input data from in order to determine how realistic the projections are.* 9(2)(g)(i) [REDACTED]

Dissolved oxygen (DO) consumption on sediments and the overlaying water interface by substrates decomposition and remineralisation

Author: Gigablue

Notes:

- Provides information on a model for substrate deposition and dissolved oxygen.

- No discussion of limitations or potential to calibrate using data collected during experiments.
- *My thoughts: This model is difficult to assess without understanding the limitations of the model.* 9(2)(g)(i)

200-year durability assessment

Author: Gigablue

Notes:

- Understanding the re-exposure of deepwater is important for understanding effects, length of sequestration, transboundary effects for the activity. Good to see there is some initial thought going into this area.
- Good to see modelling summary describes some limitations. This model is quite limited so would be interested to see further work done.
- “enhanced biological activity results in local depletion of essential macronutrients in the surface mixed layer...” aka nutrient robbing and ocean fertilisation
- This model shows where the particles are after 10/20 years, but previous info said they were likely to disintegrate after 5? Is the model tracking the movement of fragments or of the CO₂ sequestered?
- *My initial thoughts: Would be interested in getting this peer reviewed by ESNZ or the LC/LP Scientific Working Group.* 9(2)(g)(i)

Benthic data summary for Gigablue’s area of interest with respect to marine carbon dioxide removal

Author: Earth Sciences NZ

Notes:

- Desktop review of benthic data and potential distribution across the area of interest. Meant to be read in conjunction with “Review of benthic thresholds for dissolved oxygen and particle deposition”.
- 9(2)(b)(ii)
- This report is actually helpful and is something we should expect to see from other potential operators.
- Potential distributions based on very limited data, as noted in the report. An example of this – area of interest is 130,500km² but only 55% of the seafloor has been mapped, dissolved oxygen info is based on 21 CTD casts across the whole area

- Looks like a few areas in the area of interest meet the threshold for sensitive environments under EEZ Act: stony coral thickets/reefs, xenophyophore beds, and brachiopod beds, but limited info on these (including extent). Potential for sensitive environments to be present for bryozoan thickets, sea pen fields, sponge gardens, bivalve mollusc beds, and worm fields – but no data.
 - o 9(2)(g)(i)
- Noted species vulnerable to smothering found in area of interest, but more info needed to confirm effects.
- *My initial thoughts: Info for any future research should build and expand on this report and the distribution model discussed from p91, would prefer this to be actively planned for by GB. This study has good info on limited knowledge of area.* 9(2)(g)(i)

Review study of benthic thresholds for dissolved oxygen and particle deposition

Author: Earth Sciences NZ

Notes:

- Again, this document is quite helpful but based on limited data. In this instance, it appears to be based on data from overseas assemblages due to a lack of NZ data.
- Report notes that a monitoring programme is likely needed to detect signs of ecological stress, more data on the presence of sensitive taxa and environments is needed, more experiments on benthic community responses to sedimentation and organic mineral remineralisation needed. Would be interested to see how this is planned for by GB.
- Sedimentation in the area of interest is generally below 1mm/year, with occasional pulses. How would additional sedimentation impact communities? Report recommends deposition threshold of <0.5mm/year - how to determine when this is reached?
- “The induced increase of photosynthetic carbon fixation in the photic zone” aka fertilisation.
- Report notes GB threshold of a 30% reduction in dissolved oxygen doesn’t appear to be linked to anything.
- “There are still uncertainties about where the release of particles will occur and how the particles may be dispersed, and what the range of the dispersal activity will be”

It is unclear at the time of writing this report what the growth potential or realized growth of these particles are when they are deployed in the HNLC waters found in the AOI. We understand that growth of phytoplankton (and associated micro-organisms) attached or associated with the particles has been demonstrated and indeed forms one of the critical premises of the MCFS method (Puro.Earth, 2025). We currently, however, lack scientific data on the rate or magnitude of the organic matter growth, the composition of the particle's phyto-microbial communities, and remineralisation (of the organic matter) and degradation (of the cellulose/viscose) potential and realized rates, either *in vitro* or *in situ*, although it is expected that the activities may result in a deposition of up to ~25 g of organic matter m⁻² (Gigablue pers. comm.). Other caveats in our understanding concern the specific particle volumes, and the area of expected release and dispersal. These uncertainties have shaped our methodology and have helped define how we addressed the objectives in the present report as described below.

- The matters raised in the screenshot above are vital for understanding how the activity sequesters carbon and potential effects.
- "The absence of certain types of information has limited our ability to constrain our findings, leaving several caveats in our ability to interpret potential impacts, including their magnitude, frequency and extent" 9(2)(g)(i)
- "The current empirical knowledge required to develop suitable thresholds for sensitive environments, representative species, groups of taxa, habitats or ecosystems within the area of interest is insufficient to support reliable application into practical or regulatory consent development"
- "Note that this exercise is limited by the fact that we did not have details on the biogeochemical characteristics of the particles, particle behaviour in-situ during the proposed MCFS activity (eg growth, flotation, sinking, remineralisation and degradation), particle accumulation rates, and definitive information on particle settling worst-case scenario."
- Again, useful breakdown of sensitive environments/species and how they might respond.

MCFS Technical Report

Author: Gigablue

Notes:

- This document is meant to respond to MfE questions from May 2025.
- This information does not really answer our questions, rather provides an overview of each topic and potential research planned.
- *My initial thoughts: While knowing they plan to consider some of these issues is helpful, this does not really provide us with any of the information* 9(2)(g)(i)