ATTACHMENT FIFTEEN
Cup Corals and Schedule 7 of the Fast-Track Approvals Act (NIWA)

McCALLUM BROS LTD
Established 1904

Cup corals and Schedule 7 of the Fast-track Approvals Act 2024

Prepared for McCallum Bros Limited

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Climate, Freshwater & Ocean Science

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Executive summary

McCallum Brothers Limited (MBL) is seeking a resource consent to extract sand from a 15.4 km^2 area within Te Ākau Bream Bay, Northland. The proposed sand extraction area forms a rectangle extending approximately northwest to southeast, roughly parallel with the central Te Ākau Bream Bay shoreline, in water between approximately 20 and 30 m deep and approximately 4.7 km offshore. MBL have previously extracted sand from Mangawhai-Pākiri embayment (hereafter referred to as Pākiri), to the south of Te Ākau Bream Bay.

During environmental surveys MBL identified two species of scleractinian solitary cup coral (*Sphenotrochus ralphae* and *Kionotrochus suteri*) at Te Ākau Bream Bay. All Scleractinia are protected under the Wildlife Act 1953. A previous report for MBL summarised the known distribution and life histories of *Sphenotrochus ralphae* and *Kionotrochus suteri* (Beaumont et al. 2025).

MBL is seeking an authorisation (approval) under the Wildlife Act 1953 pursuant to the Fast-track Approvals Act 2024 (FTAA), with respect to cup corals. MBL has asked NIWA to compile information that will assist MBL with producing a report for Wildlife Act approval as defined in Schedule 7 FTAA.

This report specifically, and only, considers the cup coral taxa known to occur in Te Ākau Bream Bay and the proposed sand extraction area in relation to the items listed below and summarises a previous report (Beaumont et al. 2025) on the two species of cup corals known to be present within MBL's proposed extraction area.

We address points c, d, e, j and k within Schedule 7(2)(1) FTAA in relation to cup corals:

(c) Include an assessment of the activity and its impacts against the purpose of the Wildlife Act:

(d) List protected wildlife species known or predicted to be in the area and, where possible, the numbers of wildlife present and numbers likely to be impacted:

(e) Outline impacts on threatened, data deficient, and at-risk wildlife species (as defined in the New Zealand Threat Classification System):

(j) List all actual and potential wildlife effects (adverse or positive) of the proposed activity, including effects on the target species, other indigenous species, and the ecosystems at the site (Note that this is only in relation to cup corals):

(k) Where adverse effects are identified, state what methods will be used to avoid and minimise those effects, and any offsetting or compensation proposed to address unmitigated adverse effects (including steps taken before the project begins, such as surveying, salvaging, and relocating protected wildlife).

Sand extraction occurs using a trailing suction hopper dredge (TSHD) vessel. During the extraction process, sand is fluidised into a slurry at the draghead via suction pulling sand and water through the draghead at the seabed. The sand slurry then moves up the draghead pipe, through a pump and onto the vessel where it is discharged onto a screen deck that utilises a 2 mm screen mesh to prevent larger material going into the load of the hopper. Oversized material (> 2 mm) passes across the top of the screen and drops, via a pipe, into the forward port side moon pool where it drops through the vessel and exits, at keel height, under the vessel to return to the seabed.

The two species of cup coral known to be present within the proposed sand extraction area (*Kionotrochus suteri* and *Sphenotrochus ralphae*) are both expected to be returned to the seafloor as oversized material. However, passage through the TSHD and across the screens is not without some risk and there is the potential that organisms, including the protected cup corals, could be damaged or killed during this process. Any mortality or damage to corals would be incidental to the overall extraction activity. There is also the potential for disturbance on the seabed such as burial by deposited sediments or increased suspended sediments. The following actual or potential wildlife effects of the proposed activity have been identified:

- Physical damage or mortality from passage through the TSHD
- Burial by sediments
- Stress/mortality from elevated suspended sediments

Based on the available sample data, and noting the patchy distributions of both species, the overall live population of the two species of cup corals within the 15.4 km^2 proposed sand extraction area could be in the order of millions. It is expected that up to 5.6 km^2 of seabed will be subject to extraction per year. Available literature suggests that members of the Turbinoliidae family of cup corals are well adapted to infaunal life and the challenges faced with living in mobile sediments and are resilient to sediment burial and damage and/or fragmentation of both skeleton and soft tissues.

While the proportion of corals that will be damaged or killed as they pass through the TSHD cannot be specified with certainty, some corals are expected to survive the disturbance. In addition, the presence of live *Sphenotrochus* corals within the sand extraction area at MBL's Pākiri site is indicative that some cup corals are likely to survive the proposed disturbance at Te Ākau Bream Bay.

With respect to minimising any adverse effects, the salvaging and relocating of these cup corals is not possible due to their small size and difficulty in collecting them. However, the survival of damaged or fragmented corals returned to the seabed following sand extraction could be increased by not returning to previously disturbed areas for at least seven months. This would enable damaged/fragmented corals to regenerate between disturbance events, giving them the ability to move through sediments to escape burial. A longer timeframe between disturbance events would likely increase their resilience to repeated disturbance.

The proposed sand extraction area at Te Ākau Bream Bay is less than 0.2% and 0.1% of the identified potential suitable habitat for *Sphenotrochus ralphae* and *Kionotrochus suteri*, respectively (Beaumont et al. 2025). This, together with the expected resilience of these corals to disturbance, means it is considered likely that the proposed sand extraction activity within Te Ākau Bream Bay will have a minor to negligible impact on the populations of either *Sphenotrochus ralphae* or *Kionotrochus suteri* within the Aotearoa New Zealand region. In addition, recovery of coral populations within the proposed sand extraction area by adult immigration and/or larval settlement is expected over time once extraction activities cease, though connectivity between populations remains unknown.

Neither *Sphenotrochus ralphae* nor *Kionotrochus suteri* have been assessed by the New Zealand Threat Classification System (NZTCS) and, therefore, are not deemed to be 'Threatened', 'Data Deficient' or 'At Risk' wildlife (as defined in the NZTCS).

1 Background

McCallum Brothers Limited (MBL) is seeking resource consent to dredge sand from a 15.4 km^2 area within Te Ākau Bream Bay, Northland. The proposed sand extraction area forms a rectangle extending approximately northwest to southeast, roughly parallel with the central Te Ākau Bream Bay shoreline, in water between approximately 20 and 30 m deep and approximately 4.7 km offshore (Figure 1-1). MBL have previously extracted sand from Mangawhai-Pākiri embayment (hereafter referred to as Pākiri), to the south of Te Ākau Bream Bay.

During environmental surveys MBL identified two species of scleractinian solitary cup coral (*Sphenotrochus ralphae* and *Kionotrochus suteri*) at Te Ākau Bream Bay. All Scleractinia are protected under the Wildlife Act 1953. A previous report for MBL summarised the known distribution and life histories of *Sphenotrochus ralphae* and *Kionotrochus suteri* (Beaumont et al. 2025).

MBL is seeking an exemption to the Wildlife Act 1953, with respect to cup corals, and has asked NIWA to write a report to assist MBL with compiling a report for Wildlife Act approval as defined in Schedule 7 of the FTAA.

We will address points c, d, e, j and k within Schedule 7 FTAA in relation to cup corals:

(c) Include an assessment of the activity and its impacts against the purpose of the Wildlife Act:

(d) List protected wildlife species known or predicted to be in the area and, where possible, the numbers of wildlife present and numbers likely to be impacted:

(e) Outline impacts on threatened, data deficient, and at-risk wildlife species (as defined in the New Zealand Threat Classification System):

(j) List all actual and potential wildlife effects (adverse or positive) of the proposed activity, including effects on the target species, other indigenous species, and the ecosystems at the site (Note that this is only in relation to cup corals):

(k) Where adverse effects are identified, state what methods will be used to avoid and minimise those effects, and any offsetting or compensation proposed to address unmitigated adverse effects (including steps taken before the project begins, such as surveying, salvaging, and relocating protected wildlife).

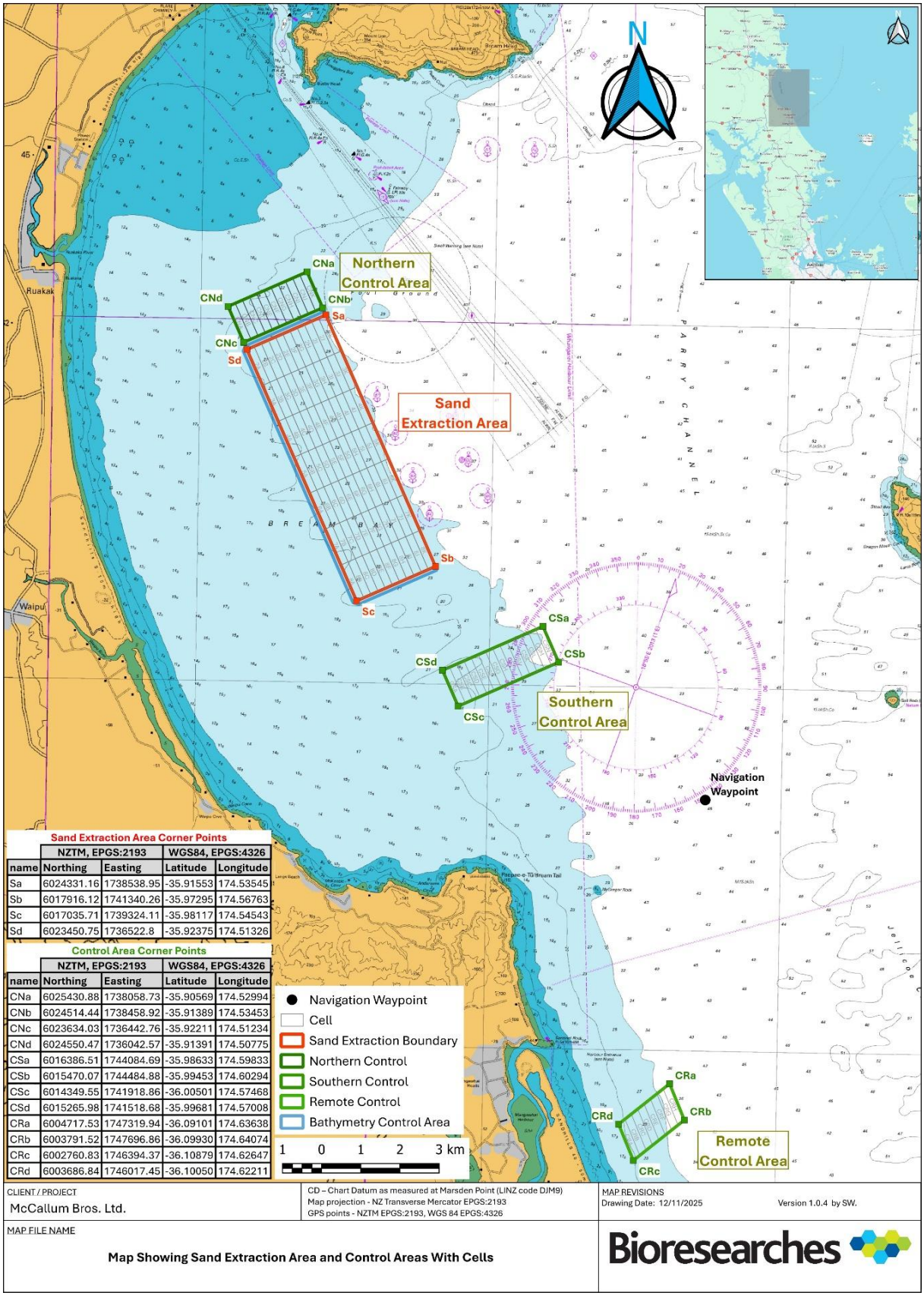

Figure 1-1: Map showing the location of the proposed sand extraction area within Te Ākau Bream Bay. Three proposed control areas are shown together with an inset box placing Te Ākau Bream Bay within a wider, regional, context.

2 Informing MBL's report to address Schedule 7 FTAA

This report specifically and only considers the cup coral taxa known to occur in Te Ākau Bream Bay and the proposed sand extraction area. We consider each of the points noted above (c, d, e, j and k within Schedule 7 FTAA) separately. Remaining relevant provisions of Schedule 7 are addressed by others and are not repeated here.

The Wildlife Act 1953 was amended as of 14 May 2025 through the insertion of section 53A, B and C. MBL's legal advice is that these amendments are relevant to authorities sought to kill wildlife incidentally under the FTAA and whether grant of such an authority is consistent with the protection of wildlife (and thus consistent with the purpose of the Wildlife Act). Accordingly, our assessment below takes account of those amended provisions in the context of assessing the activity and its impacts against the purpose of the Wildlife Act.

2.1 Schedule 7 (2)(1)(c) : include an assessment of the activity and its impacts against the purpose of the Wildlife Act

Sand extraction occurs using a TSHD vessel (the "*William Fraser*"), which was purpose built and includes technologies to improve performance and reduce environmental impact (McCallum 2022).

A comprehensive description of the purpose of the proposed activity (Schedule 7 (2)(1)(a)) and the actions MBL wishes to carry out involving protected wildlife and where they will be carried out (Schedule 7 (2)(1)(b)) is set out in Section 2.4 (Beaumont et al. 2025). We rely on those descriptions.

In brief, during the extraction process, sand is fluidised into a slurry at the draghead via suction pulling sand and water through the draghead at the seabed. The sand slurry then moves up the draghead pipe, through a pump and onto the vessel where it is discharged onto a screen deck that utilises a 2 mm screen mesh to prevent larger material going into the load of the hopper. Oversized material (> 2 mm) passes across the top of the screen and drops, via a pipe, into the forward port side moon pool where it drops through the vessel and exits, at keel height, under the vessel to return to the seabed (McCallum 2022).

Both *Kionotrochus suteri* and *Sphenotrochus ralphae* are expected to be returned to the seafloor as oversized material. They are returned to the water almost immediately after being extracted. However, passage through the sand dredge and across the screens is not without some risk and there is the potential that organisms, including the protected corals, could be damaged or destroyed during this process. There is also the potential for disturbance on the seabed such as burial by deposited sediments, increased predation, or increased suspended sediments.

Relevant to an assessment of impacts under this heading is the list of actual and potential wildlife effects under Schedule 7(1)(2)(j) below.

Our assessment of impacts against the purpose of the Wildlife Act takes into account the new legislation in s53A and 53B.

When any cup coral is entrained from the seabed during the extraction process and moved via suction up the drag head pipe it comes within the term "hunt" as defined in the Wildlife Act because that term encompasses taking, catching alive or capturing relevant wildlife. Our analysis pursuant to Schedule 7 of the Wildlife Act also identifies the potential for mortality of some cup coral specimens. Therefore an authorisation for taking or killing of wildlife under section 53 of the Wildlife Act is required.

With respect to section 53A, we record our understanding that the purpose of the proposed activity is sand extraction and any adverse effects on the cup corals (including killing) are incidental to carrying out that activity.

In terms of taking, catching alive or capturing relevant wildlife, the return to the environment is almost immediate. For dead coral skeletons, there is no effect. For those live corals which pass through and are returned to the water without damage, the impact is limited to landing in a slightly different position on the seafloor from where they were extracted and increased exposure to predation. As explained below in the context of Schedule 7 (2)(1)(j) other species in this coral family can move vertically through sediments to escape burial, can burrow into sediments and can return to an upright position after being overturned.

For those live corals which pass through and are returned to the water with some damage, as explained below in the context of Schedule 7 (2)(1)(j) cup corals within the Turbinoliidae family have the potential to regenerate both soft and skeletal tissues following damage and/or fragmentation. This is true even of relatively small fragments (approximately 10% of original coral). They need time to regenerate, and therefore survival of coral fragments following sand extraction would be increased by returning damaged corals and/or fragments to an area that will remain undisturbed by active sand extraction for at least seven months. We understand that the rotation methodology adopted for the extraction area will mean that extraction cells will be undisturbed for at least seven months after an extraction event.

The potential death of some individual cup corals cannot be ruled out. As already noted, any such death would be incidental.

We understand that with reference to section 53B an authority to kill wildlife incidentally must still be "consistent with the protection of wildlife". Our assessment under Schedule 7 of the FTAA illustrates with respect to s53B:

(a) In the context of s53B (3):

  (i) The authority sought relating to cup corals is unlikely to result in any material adverse effects on the populations of cup corals, or the viability of the cup coral species (refer below to our assessment under Schedule 7 (2)(1)(d)).

  (ii) The extraction process and methodology offered (secured as necessary by conditions on the authority) described in the application material and our assessment of Schedule 7 (2)(1)(c) mitigates to the extent possible (while enabling the extraction activity) potential adverse effects.

(b) Having regard to those matters above identified in s53B (3), then by reference to s53B (2) in our opinion the decision-maker may be satisfied that the overall effect of the authority is likely consistent with the protection of populations of wildlife and individual wildlife. That is because:

  (i) Populations of wildlife are unlikely to be threatened or materially affected by the activities enabled by the authority.

  (ii) Any threat to individual wildlife is incidental, has been avoided, minimised and mitigated to the extent possible through the reasonable steps adopted by the applicant (s53B (4)), and any individual incidental act of killing viewed in isolation does not need to be consistent with the protection of wildlife (s53B (5)).

2.2 Schedule 7 (2)(1)(d): list protected wildlife species known or predicted to be in the area and, where possible, the numbers of wildlife present and numbers likely to be impacted

The protected scleractinian cup corals *Sphenotrochus ralphae* and *Kionotrochus suteri* have been identified within the proposed sand extraction area at Te Ākau Bream Bay.

Sphenotrochus ralphae and *Kionotrochus suteri* are both members of the family Turbinoliidae (Cnidaria, Scleractinia). This family is composed exclusively of free-living, solitary corals that only inhabit soft-bottom substrates (e.g., sand and mud) at depths beyond the reach of vigorous wave motion (Vaughan and Wells 1943; Cairns 1997).

Turbinoliidae are azooxanthellate, non-constructional and ahermatypic (not reef building) and occur mostly in moderately deep water in temperate and tropical seas (Vaughan and Wells 1943; Cairns 1997). The corallum (skeletal "cup") of Turbinoliidae are small, usually less than 10 mm in calicular diameter (CD). Their small size and apparent interstitial habit within sandy substrates at lower shelf to upper slope depths have resulted in the collection of relatively few turbinoliid specimens, and little is known about their modes of life and life history traits (Cairns 1997).

Sphenotrochus ralphae (Squires 1964) is endemic to Aotearoa New Zealand, with a distribution ranging from Cape Egmont (Taranaki) to Te Moana-a-Toitehuatahi Bay of Plenty, including off Manawatāwhi Three Kings Islands (Cairns 1995). This species has a small triangular corallum with flat faces and rounded edges. The corallum is white or sometimes porcellanous and measures up to 9 mm in height (Figure 2-1).

Figure 2-1: Images of *Sphenotrochus ralphae*. Specimens collected during the 2024 Te Ākau Bream Bay survey and photographed alongside a ruler for scale with each black line 1 mm apart. Left: top view; Right: side view. Photo credit: Simon West.

Kionotrochus suteri is also endemic to Aotearoa New Zealand with a known distribution from off Tairāwhiti East Cape to just north of Kaipara Harbour, including Manawatāwhi Three Kings Islands (Cairns 1995, 1997). The reported depth range for this species is 31-622 m (with most records between 100-200 m) (Brook 1982; Cairns 1995). Note that the MBL survey sites were in depths of 18 to 32 m so at the very shallowest extent of the reported depth range for this species.

This species is up to 6.8 mm in CD and 6.5 mm in height (Cairns 1995, Figure 2-2). The corallum is white and often attached to a bivalve shell. Mature specimens have a conical corallum with a rounded base. It is a commonly collected coral that can be found in relatively shallow water in the Aotearoa New Zealand region and has been studied and redescribed several times (Cairns 1995 and referernces therein).

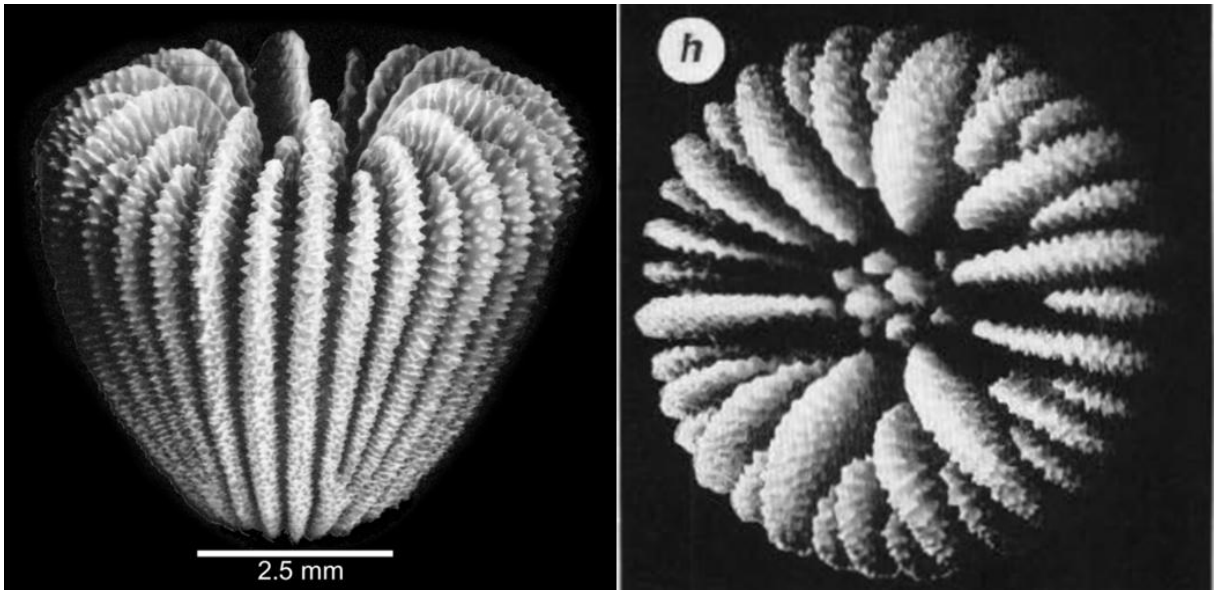

Figure 2-2: Images of *Kionotrochus suteri*. Images taken from Cairns (1995; 1997, plates 25 and 3 respectively).

Kionotrochus suteri, the smaller of the two cup coral species present within MBL's proposed sand extraction area, is known to reproduce by transverse division (see Beaumont et al. 2025 and references therein). In summary, the planula larvae of *Kionotrochus suteri* settle and attach to hard substrates, such as shell hash, where they develop into a coral polyp (an anthocaulus, Figure 2-3). This anthocaulus reproduces asexually and produces an anthocyathus (e.g., Figure 2-4), a free-living coral inhabiting mobile sediments as observed within the proposed sand extraction area. As such, small, juvenile individuals are attached to shells or other hard substrates (e.g., Stage A in Figure 2-3) and would be returned to the seafloor with the oversize material as described in section 2.1. All life stages of coral, with the exception of the planktonic larval phase, from newly settled individuals to mature anthocaulus or anthocyathus are, therefore, expected to be retained with oversize material and returned to the seafloor.

The reproductive mode of *Sphenotrochus ralphae* is yet unknown. However, records of this species attached to blades of kelp (see Beaumont et al. 2025) suggest that this species may also reproduce by transverse division.

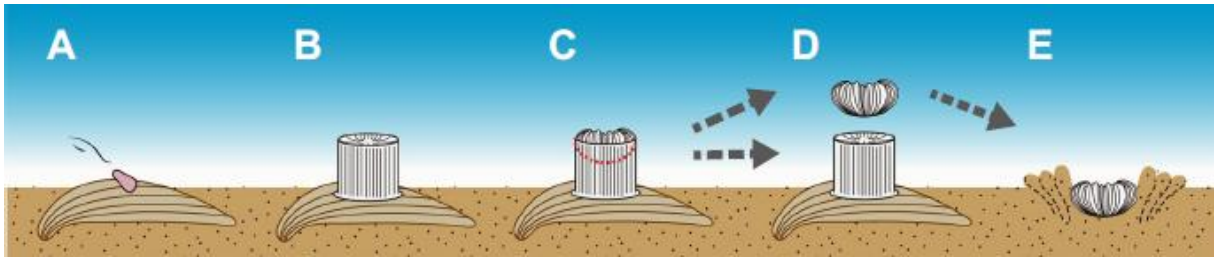

Figure 2-3: Schematic of reproduction by transverse division. Image taken from Figure 7 in Sentoku et al. (2022) showing the dimorphic life cycle of the azooxanthellate scleractinian coral *Deltocyathoides orientalis* A) Coral planula attaching to shell fragment on soft substrate. B) Anthocaulus. C) Anthocyathus occurring at the upper interior of the anthocaulus. D) Division of the anthocyathus from anthocaulus. E) Anthocyathus burrowing into a soft bottom substrate immediately after division.

Figure 2-4: Example of an apparently recently budded anthocyathus of *Kionotrochus suteri* collected during MBL survey work. Photographed alongside a ruler for scale with each black line 1 mm apart. Left: side view; Right: top view. The age of this individual, or time since budding occurred, is unknown.

Survey work conducted in 2024 for MBL recorded 225 coral specimens from 264 grab samples within the proposed sand extraction area at Te Ākau Bream Bay. Of these, nine were live specimens (seven *Sphenotrochus ralphae* and two *Kionotrochus suteri*) and 216 were dead skeletons (209 *Sphenotrochus ralphae* and seven *Kionotrochus suteri*).

The ponar grab used in the 2024 Te Ākau Bream Bay survey sampled an area of 250 x 285 mm (or 0.07 m^2) of seabed per deployment. The population of corals within this area is patchily distributed

and specimens recorded per grab ranged from zero to 29 individuals. The maximum recorded number of live specimens in any grab sample was one specimen for *Kionotrochus suteri* and two specimens for *Sphenotrochus ralphae*. Average densities of corals, standardised to individuals per m^2, within the proposed sand extraction area are given in Table 2-1.

Table 2-1: Average densities and estimated population of coral specimens recorded in grab samples across the proposed sand extraction area at Bream Bay (15.4 km^2).

Taxon	Status	Average density (inds./m^2) ± SE	Estimated population (± SE)
Kionotrochus suteri	Alive	0.11 ± 0.08	1.6 million (± 1.2 m)
Kionotrochus suteri	Dead	0.37 ± 0.23	5.7 million (± 3.6 m)
Sphenotrochus ralphae	Alive	0.37 ± 0.16	5.7 million (± 2.4 m)
Sphenotrochus ralphae	Dead	11.11 ± 2.52	171.1 million (± 38.9 m)

Both live and dead specimens have been included here for completeness as both are protected by the Wildlife Act but note that all material greater than 2 mm (which would include both live and dead corals and most fragments) will be returned to the seafloor during the sand extraction process. As dead coral skeletons will be returned to the seafloor, and they are already dead, we have focussed on the effects of the proposed operation on live cup corals.

Based on the available sample data, and noting the patchy distributions of both species, the overall live population of the two species of cup corals within the 15.4 km^2 proposed sand extraction area could be in the order of millions. It is expected that up to 5.6 km^2 of seabed will be extracted per year. While the proportion of corals that will be damaged or killed as they pass through the TSHD is unknown, some corals are expected to survive the disturbance.

In addition, it is estimated that environmental monitoring conducted by MBL as part of the consent conditions, using grab sampling, camera surveys and dredge surveys, could disturb approximately 2, 3 and 937 live *Kionotrochus suteri* corals respectively, and approximately 7, 10 and 3152 live *Sphenotrochus ralphae* respectively (Table 2-2 and see Beaumont et al. (2025) for details)

Table 2-2: Average densities of corals within Te Ākau Bream Bay and estimated population of corals for each monitoring gear type. Average density of corals was determined from pre-consent monitoring within Te Ākau Bream Bay. The area provided is the estimated contact area of the seabed for each gear type. The estimated abundance of corals does not allow for the expected patchiness in the distribution of the corals within Te Ākau Bream Bay but is the best estimate available.

			Estimated abundance of corals (inds./m^2 ± SE)		
Taxon	Status	Average density (inds./m^2 ± SE)	Drop camera (19.8 m^2)	Grab sampling (28.1 m^2)	Epibenthic dredge (8,250 m^2)
Kionotrochus suteri	Alive	0.11 ± 0.08	2.2 ± 1.6	3.1 ± 2.2	937.2 ± 681.6
Kionotrochus suteri	Dead	0.37 ± 0.23	7.3 ± 4.5	10.4 ± 6.5	3,152.4 ± 1,363.2
Sphenotrochus ralphae	Alive	0.37 ± 0.16	7.3 ± 3.2	10.4 ± 4.5	3,152.4 ± 1,959.6
Sphenotrochus ralphae	Dead	11.11 ± 2.52	220.0 ± 50.0	312.4 ± 70.9	94,657.2 ± 21,470.4

2.3 Schedule 7 (2)(1)(e): outline impacts on threatened, data deficient, and at-risk wildlife species (as defined in the New Zealand Threat Classification System)

The two cup coral species known to be present within the proposed extraction area (*Sphenotrochus ralphae* and *Kionotrochus suteri*) have not been assessed by the New Zealand Threat Classification System (NZTCS) and, therefore, are not deemed to be 'Threatened', 'Data Deficient' or 'At Risk' wildlife (as defined in the NZTCS). Note that *Sphenotrochus squiresi* is listed as 'At Risk - Naturally Uncommon'[1] but this species is not known to be present within the proposed sand extraction area.

2.4 Schedule 7 (2)(1)(j): list all actual and potential wildlife effects (adverse or positive) of the proposed activity, including effects on the target species, other indigenous species, and the ecosystems at the site.

The following actual or potential wildlife effects of the proposed activity have been identified:

- Physical damage or mortality from passage through the TSHD
- Burial by sediments
- Stress/mortality from elevated suspended sediments

In terms of taking, catching alive or capturing relevant wildlife, the return to the environment is almost immediate. Although both species of coral are expected to be returned to the seafloor as oversized material, MBL's sand extraction process has the potential to cause mortality and/or damage to benthic faunal species as they pass through the draghead and screening deck. In addition, the proposed sand extraction activities at Te Ākau Bream Bay will necessarily cause periods of elevated suspended sediments and sediment movement/deposition to at least the immediate area of extraction which may have the potential to bury or smother these small corals.

While there is little available information on the behaviour or life histories of *Sphenotrochus ralphae* or *Kionotrochus suteri*, evidence in the literature (see Beaumont et al. 2025) suggests that members of the Turbinoliidae family of cup corals are well adapted to infaunal life and the challenges faced with living in mobile sediments. For example, these corals can move vertically through sediments to escape burial (at least up to 1 cm), can burrow into sediments (perhaps as a predator avoidance strategy) and can return to an upright position after being overturned (Sentoku et al. 2016). In addition, many species of solitary cup coral, including those within the Turbinoliidae family, can regenerate both soft and skeletal tissues following damage and/or fragmentation (Sentoku et al. 2017). This is true even of relatively small fragments (approximately 10% of original coral).

West (2022) concluded that many benthic faunal species, particularly those smaller than approximately 20 mm, are able to survive MBL's extraction process, at least as far as being returned to the seafloor. Although cup corals were not included in these survivability studies, the presence of live *Sphenotrochus* corals within the sand extraction area at MBL's Pākiri site (see Beaumont et al. 2025) is indicative that cup corals may survive the proposed disturbance at Te Ākau Bream Bay. This

[1] See https://nztcs.org.nz/ and Funnell, G., Gordon, D., Leduc, D., Makan, T., Marshall, B.A., Mills, S., Michel, P., Read, G., Schnabel, K., Tracey, D., Wing, S. (2023) Conservation status of indigenous marine invertebrates in Aotearoa New Zealand, 2021. . *New Zealand Threat Classification Series: 42*.

is perhaps not surprising given the known ability of Turbinoliidae cup corals to move within sediments and regenerate tissues if damaged.

It should be noted, however, that fragmented parts of corals would be unlikely to have the ability to escape sediment burial and may also be prone to predation on the seabed. As such, some mortality of fragments would be expected but the extent of such mortality is unknown. Sentoku et al. (2017) noted that fragmented corals were able to burrow into sediments 188 days (a little over six months) following fragmentation. Survival of coral fragments following sand extraction would, therefore, be increased by returning damaged corals and/or fragments to an area that will remain undisturbed by active sand extraction for at least seven months. It is, however, considered likely that repeated disturbance could reduce the resilience or survivability of cup corals following damage or fragmentation.

The proposed sand extraction area at Te Ākau Bream Bay is less than 0.2% and 0.1% of the identified potential suitable habitat for *Sphenotrochus ralphae* and *Kionotrochus suteri*, respectively (Beaumont et al. 2025). This, together with the expected resilience of these corals to disturbance, means it is considered likely that the proposed sand extraction activity within Te Ākau Bream Bay will have a minor to negligible impact on the populations of either *Sphenotrochus ralphae* or *Kionotrochus suteri* within the Aotearoa New Zealand region. In addition, recovery of coral populations within the proposed sand extraction area by adult immigration and/or larval settlement is expected over time once extraction activities cease, though connectivity between populations remains unknown.

Summarising potential effects, as recorded above under our assessment of Schedule 7 (2)(1)(c),

(a) the purpose of the proposed activity is sand extraction and any adverse effects on the cup corals (including killing) are incidental to carrying out that activity.

(b) In terms of taking, catching alive or capturing relevant wildlife, the return to the environment is almost immediate.

(c) For dead coral skeletons, there is no effect.

(d) For those live corals which pass through and are returned to the water without damage, the impact is limited to landing in a slightly different position on the seafloor from where they were extracted and increased exposure to predation. Other species of this coral family can move vertically through sediments to escape burial, can burrow into sediments and can return to an upright position after being overturned.

(e) For those live corals which pass through and are returned to the water with some damage, based on observations on other species of the same coral family, they may have the potential to regenerate both soft and skeletal tissues following damage and/or fragmentation. We understand that the rotation methodology adopted for the extraction area will mean that extraction cells will be undisturbed for at least seven months after an extraction event, giving time for regeneration to occur.

(f) The potential death of some individual cup corals cannot be ruled out. As already noted, any such death would be incidental.

(g) The authority sought relating to cup corals is unlikely to result in any material adverse effects on the populations of cup corals, or the viability of the cup coral species.

(h) The extraction process and methodology offered (secured as necessary by conditions on the authority) described in the application material and our assessment of Schedule 7 mitigates to the extent possible (while enabling the extraction activity) potential adverse effects.

(i) Populations of cup corals are not likely to be threatened or materially affected by the activities enabled by the authority.

2.5 Schedule 7 (2)(1)(k): where adverse effects are identified, state what methods will be used to avoid and minimise those effects, and any offsetting or compensation proposed to address unmitigated adverse effects (including steps taken before the project begins, such as surveying, salvaging, and relocating protected wildlife).

As described above, should adverse effects be considered on the Aotearoa New Zealand population scale, it is considered likely that any adverse effects of the proposed sand extraction activity within Te Ākau Bream Bay with have a minor to negligible impact on the populations of either *Sphenotrochus ralphae* or *Kionotrochus suteri* within the Aotearoa New Zealand region.

With respect to minimising any adverse effects, the salvaging and relocating of these cup corals is not possible due to their small size and difficulty in collecting them. However, the sand extraction vessel *William Fraser* incorporates technologies to improve performance and reduce environmental impact (McCallum 2022). These include:

- A Dutch-designed screening deck, rather than flume pipes, which reduces damage to live animals passing through the drag head and increases the screening efficiency.
- Moon pools to deliver the over-size [material] and sediment discharge below the water line to minimise turbidity.
- The moon pool system also reduces the aeration of the sediment and/or biota, which decreases their settling time, and therefore the time they may be vulnerable to predation, compared to the flume pipe and discharge over the side of the boat method.

In addition, survival of damaged or fragmented corals returned to the seabed following sand extraction could be increased by not returning to previously disturbed areas for at least seven months. A longer timeframe between disturbance events would likely increase their resilience to repeated disturbance. The sand extraction rotation methodology, as outlined in the Sand Extraction Operation Plan, will result in the same extraction tracks not being reused for up to 1 year. This would enable damaged/fragmented corals to regenerate between disturbance events, giving them the ability to move through sediments to escape burial.

3 Acknowledgements

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4 Glossary of abbreviations and terms

Anthocaulus	The attached form of the coral which reproduces asexually. A stalk-like basal portion of a zooid in some solitary corals, from which the oral portion is pinched of to form a new zooid (anthocyathus).
Anthocyathus	The free-living form of the coral which reproduces sexually. The oral disk that is pinched off from the basal portion (anthocaulus) in some solitary corals. This enlarges to become a new zooid.
CD	Calicular Diameter
Corallum	The skeletal "cup" of the cup coral
MBL	McCallum Brothers Limited
NZTCS	New Zealand Threat Classification System
TSHD	Trailing Suction Hopper Dredge

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