Before the Independent Hearing Panel
Appointed by the Southland Regional Council

Under	the Resource Management Act 1991 (**RMA**)
In the matter of	an application by **South Port NZ Limited** to dredge parts of the Bluff Harbour

Statement of evidence of Bryony Miller

29 March 2022

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Qualifications and experience

1 My name is **Bryony Miller**.

2 I am currently employed as the Technical Director of Marine and Freshwater Ecology and Principal Marine and Freshwater Ecologist at e3Scientific Ltd.

3 I am a professional marine and freshwater ecologist with over 12 years' experience working in the marine science industry in Australia and New Zealand. My experience includes providing ecological impact assessments in the marine and freshwater environments predominantly within the Otago, Southland (including Fiordland), Marlborough and Bay of Plenty Regions and providing technical input and review for Fisheries New Zealand (FNZ) and Regional Councils within Marlborough, Chatham Islands, Southland and Otago. Prior to working for e3Scientific I was employed by Fisheries New Zealand (FNZ) under The Ministry for Primary Industries (MPI), NZ Marine Science Centre, Antarctica NZ and the Institute of Geological and Nuclear Sciences (GNS Science).

4 I am on the executive committee for the New Zealand Coastal Society and a committee member of NZ Science Divers. I am also a member of the New Zealand Marine Sciences Society and the New Zealand Freshwater Science Society. I hold the following tertiary qualifications; a Bachelor of Applied Science in Environmental Science from AUT and a Diploma in Marine Science from Toi Ohomai Institute of Technology.

5 I have a strong understanding of benthic dynamics and habitat function based on numerous subtidal marine investigations, benthic marine assessments for capital dredging and blasting works in Bluff and Otago Harbours, compliance seabed and wharf surveys for ports, benthic infaunal and epifaunal investigations to support coastal activities within marine protected areas, the classification of cockle (Austrovenus stutchburyi) suspended sediment threshold levels with regard to dredging and shellfish stock assessments for FNZ. I have also provided ecological impact assessments for aquaculture facilities that include a range of marine and freshwater species, including salmon and oysters. Whilst employed by MPI I worked on special projects assessing national and international dredging and trawling methods, and the flatfish fisheries plan which included benthic habitat assessments. Technical audits completed on behalf of regional and central government include hydro dam coastal discharge applications, Marlborough Sounds scallop fishery (SCA7) benthic investigations and fishery issues, cockle stock assessments for Otago (COC3) and Marlborough and Nelson Bays (COC7A), port activities, water abstractions

and stormwater discharges. I have prepared ecological evidence for hearings and provided expert technical evidence at Environment Court.

6 I have read the Code of Conduct for Expert Witnesses in the Environment Court Practice Note 2014. This evidence has been prepared in accordance with it and I agree to comply with it. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

Scope of evidence

7 I have been asked to prepare evidence in relation to marine environmental effects and mitigation. e3Scientific prepared an assessment of marine effects (Miller & Davis, 2021)[1] and an adaptive marine management plan (AMMP) (Miller, 2021)[2]. I was the lead author of both these reports and adopt them as part of my evidence. My evidence includes:

(a) A brief overview of the proposed activity;

(b) Marine environmental effects of rock drilling, blasting, removal and deposition and avoidance/mitigation strategies;

(c) Marine environmental effects of sediment dredging and disposal and avoidance/mitigation strategies; and

(d) The adaptive marine management plan strategies.

8 I have also been involved in a pre-application workshop with Environment Southland and consultants (15/11/2021), and online pre-hearing meetings via MS Teams with submitters, the Department of Conservation (23/02/2022) and Forest and Bird (09/03/2022).

Executive summary

9 South Port NZ Ltd (South Port) are applying to complete a capital dredging programme which includes the removal of approximately 120,000 m^3 of soft sediment and 40,000 m^3 of rock from Bluff Harbour, and the deposition of this material at identified sites within Foveaux Strait. The removal of sediment is proposed to be completed via trailer suction hopper dredge (TSHD) and the rock mack material is proposed to be removed via rock breaking, drilling, blasting and dredging and is expected to take

[1] Miller, B & Davis, G. (2021). *South Port Capital Dredging Assessment of Marine Environmental Effects.* Invercargill: Prepared for South Port NZ Ltd. e3Scientific Report No. 20041.

[2] Miller, B. (2021). *South Port Capital Dredging Adaptive Marine Management Plan.* Prepared for South Port NZ Ltd. e3Scientific Report. Invercargill.

approximately 9 months to complete. South Ports' combined proposed dredge volume represent less than 1% of Lyttleton Port Company's capital dredging campaign and 5% of Napier Ports' capital dredging in 2018.

10 e3Scientific completed investigations into ecological habitat and sediment characteristics of the proposed sediment dredge zones via sediment cores on SCUBA and assessed ecological habitat of the proposed rock dredge zones on SCUBA. Subtidal investigations were also carried out at South Ports' existing dredge disposal site and a proposed rock disposal site both located in Foveaux Strait. Further details regarding the methodologies of these investigations are provided in the Assessment of Marine Effects[3]. The impact assessment completed within this report follows the Ecological Impact Assessment guidelines published by EIANZ in 2018[4]. This methodology assesses the known ecological values against the magnitude of effect to provide an overall assessment of impact or level of effect. Where impacts were assessed to be more than minor, an effects management hierarchical system was utilised whereby avoidance and mitigation management tools were then adapted, and a level of residual impact was generated.

11 A number of the identified effects were assessed as being Low based on the ecological values present and the magnitude of effect. Rationale and discussion regarding these assessments are provided in Section 7 of the Assessment of Marine Effects (Miller & Davis, 2021). Where the level of effect was greater than Low, the effects management hierarchy was utilised. The following potential effects required further management:

(a) Underwater noise and blasting effects on marine species;

(b) Marine biosecurity issues;

(c) Contamination /modification of inner harbour environments;

(d) Rock habitat sedimentation; and

(e) Reduction in water clarity during dredging.

[3] See [1].

[4] Roper-Lindsay, J., Fuller S.A., Hooson, S., Sanders, M.D., Ussher, G. (2018). *Ecological Impact Assessment (EcIA): EIANZ guidelines for use in New Zealand: terrestrial and freshwater ecosystems*. Melbourne: EIANZ.

12 Underwater noise and the effects on marine species (excluding marine mammals[5] and seabirds[6]) from rock breaking, drilling, blasting and dredging is proposed to be avoided by primarily avoiding peak seasons marine species utilise the harbour, namely the warmer summer months. For marine species that remain in the harbour year-round, impacts are avoided by limiting the works activities to avoid peak feeding times at dawn and dusk. Acoustic modelling was undertaken to delineate the extent of the area in which adverse effects were likely to occur. This conservative 'mortality' zone was found to extend 85 m from the blast during the highest energy blasting scenarios (which are likely to occur approximately 2% of the time). This relatively small areal extent means that the likelihood of adverse impacts on marine species are further reduced, particularly as this is in a swift flow channel environment which does not support general marine species habitat requirements and will primarily be used for foraging. However, to further reduce the chances of inadvertently causing adverse effects, mitigation strategies including a 'warning blast', soft starts and an acoustic harassment device (AHD) will be carried out prior to each blasting event to effectively startle away any foraging, benthic or cryptic species from the 85 m maximum radius without harming them.

13 Marine biosecurity protocols are standard practice amongst national and international dredging companies which provide documentation as to their in-house protocols before plant arrives at each port. Biosecurity NZ and Ministry of Primary Industries also require ballast water discharge regulations and South Port have biannual monitoring occurring on their port structures. Further to this a regional compliance and surveillance programme has been established by Otago University on behalf of Environment Southland to ensure the early detection of marine pests in the Southland Coastal Marine Area, which includes Bluff Harbour. Specific monitoring is proposed as part of the proposed activity to further assist these plans that are already in place in the vicinity of the works. Details of this monitoring is described in the AMMP (Miller, 2021).

14 Sediment, including silts and low level contaminants where present, will be mobilised into the water column during dredging, however the likelihood of these being transported to high ecological value habitats within the inner Bluff Harbour, such as Awarua Bay and nearby seagrass habitats, at concentrations that might be of ecological interest or concern is small and

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[5] Childerhouse, S. (2021). *South Port Capital Harbour Dredging Project Assessment Of Environmental Effects - Marine Mammals*. Nelson: Prepared for South Port Ltd. Cawthron Report.

[6] Stephenson, B. (2021). *Survey and Assessment of Avian Values: Bluff Harbour Capital Dredging Project.* Napier: Prepared for South Port NZ Ltd.

less than minor. However, to avoid the likelihood of this occurring further, tidal limitations are in place which restrict dredging activities in identified high silt zones, and the deposition of the high silt content spoil. These measures also avoid the likelihood of fine sediments settling onto rocky reef habitats and causing adverse effects on sensitive species as sediment mapping illustrates sediment pathways to flow predominantly into Foveaux Strait. Monitoring in the Motupōhue mātaitai is proposed to provide assurance to local kaitiaki and verify these assessments.

15 A reduction in water clarity is expected during soft sediment dredging, however, tidal restrictions on dredging fine silt zones will minimise any turbidity in the water column near sensitive habitats such as seagrass and rocky reef environments. Soft sediment dredging is further restricted to the months of April through July to avoid seagrass flowering and seabird breeding seasons. To provide real-time adaptive management of this an ecological receptor-based turbidity monitoring is proposed and an associated tiered trigger level has been adapted. This allows for a series of management responses, including halting dredging, if levels based on the most sensitive ecological habitat present are triggered.

16 South Port's proposed capital dredging project is a large-scale marine project which, left unchecked, has the potential to have adverse impacts on the receiving marine environment. However, South Port proposes a comprehensive management strategy and suite of tools to minimise the risk to the marine environment. All strategies have proven track records in the marine environment and are based on a sound understanding of the specific receiving environment. These are not exploratory nor unproven methods and therefore the proposed monitoring is solely to provide validation of these methods to satisfy resource users, kaitiaki and consenting authorities that the documented procedures are being followed.

17 Based on the impact assessment and the effects management hierarchy completed within the Assessment of Marine Effects (Miller & Davis, 2021) the proposed capital dredging programme addresses and avoids or mitigates to an appropriate level any potential effect on the marine environment from the proposed activity.

Overview

18 South Port NZ Ltd (South Port) are applying to complete a capital dredging programme which includes the removal of approximately 120,000 m^3 of soft sediment and 40,000 m^3 of rock from Bluff Harbour, and the deposition of this material at identified sites within Foveaux Strait.

19 The proposed changes to seabed levels across the different zones from this activity ranges from 0.4 m – 1 m.

20 Figure 1 illustrates the proposed zones to be dredged and Table 1 provides a breakdown of proposed volumes and depths. Total cut volumes of sediment and rock are estimated to be 103,040 m^3 and 29,612 m^3 respectively.

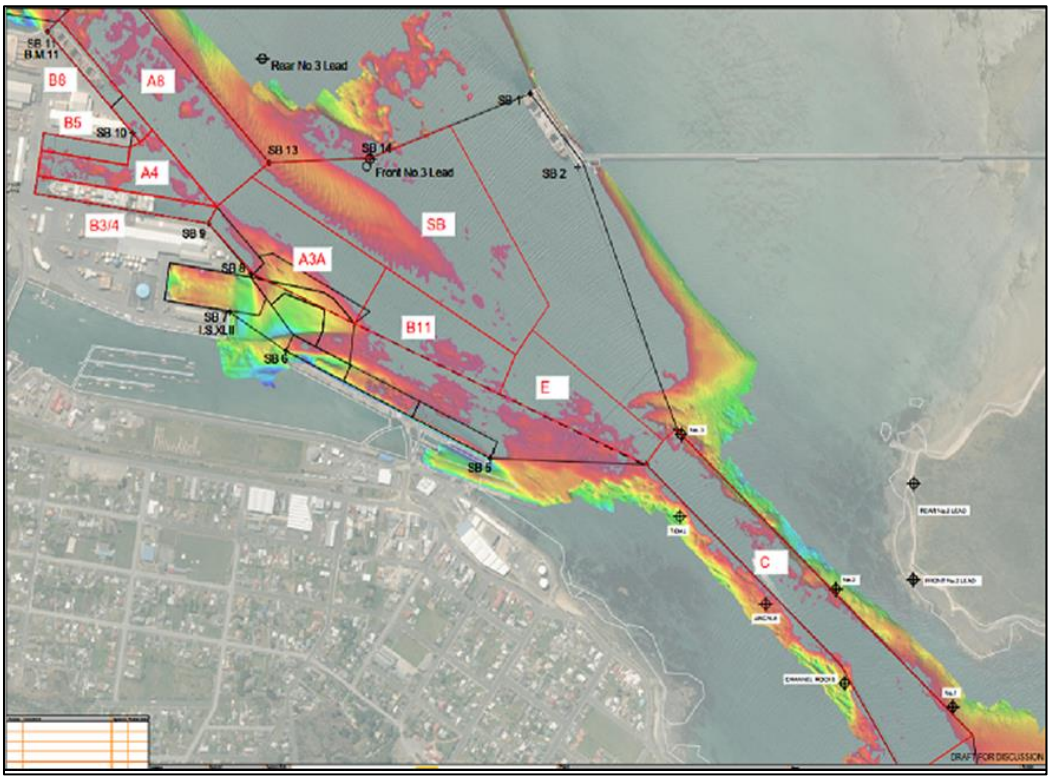

Figure 1: Dredge deepening zones. (Provided by South Port NZ Ltd.)

Table 1: South Port Deepening Volume Calculation (Provided by South Port NZ Ltd based on Post-dredge Q2 2020 Bathymetry).

Zone	Target Depth (m)	Cut Volume (m^3)	Overdepth Value (m)	Overdepth Cut Volume (m^3)	Total Cut Volume (m^3)	Area Above Target Depth (m^2)
A3A	9.45	18,210	0.2	4,961	23,171	23,033
A4	9.45	2,605	0.2	2,629	5,234	10,079
A8	9.45	6,210	0.2	7,629	13,839	26,976
SB	9.45 - 9.7	25,692	0.2	14,049	39,741	58,373
E	9.7	1,294	0.2	2,180	3,474	7,435
B11	9.7	1,923	0.2	3,469	5,392	12,677
B5	10.70	1,657	-	-	1,657	4,039
B7-B8	10.70	6,082	-	-	6,082	8,463
B3-B4	10.70	4,450	-	-	4,450	9,966
Total Sediment	**-**	68,122	-	34,917	**103,040**	**185,363**
C	9.45	20,502	0.2	9,110	29,612	38,014
Total Rock	**-**	20,502	-	9,110	**29,612**	**38,014**

21 Figure 2 illustrates the approximate cut volumes from each zone and target depths.

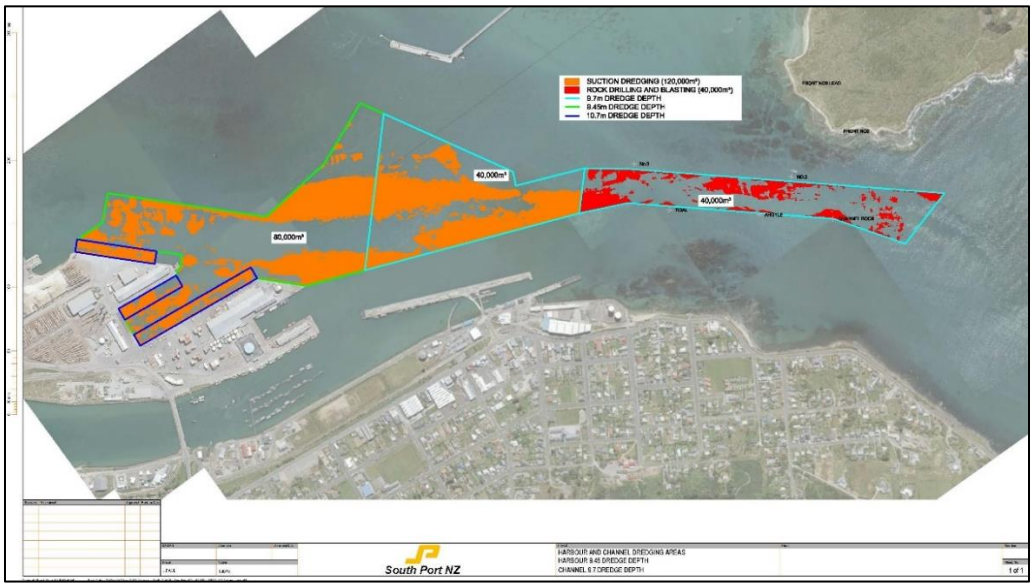

Figure 2: Approximate cut volumes to be removed, dredge method and target depths (Provided by South Port NZ Ltd).

22 The assessment of marine effects was based on the drill, blast and dredge methodologies outlined in Mr Teear's evidence and associated OCEL (2021) report, and the volumes and zones provided by South Port and illustrated in Figure 1, Figure 2 and Table 1 above.

23 e3Scientific completed investigations into ecological habitat and sediment characteristics of the proposed sediment dredge zones via sediment cores on SCUBA and assessed ecological habitat of the proposed rock dredge zones on SCUBA. Subtidal investigations were also carried out at South Ports' existing dredge disposal site and a proposed rock disposal site both located in Foveaux Strait. Further details regarding the methodologies of these investigations are provided in the marine assessment of effects report[7].

24 The impact assessment completed within the Assessment of Marine Effects (Miller & Davis, 2021) follows the Ecological Impact Assessment guidelines published by EIANZ in 2018[8]. Although these guidelines specifically exclude the coastal and marine environment, they provide an approach generally accepted by ecological professionals to support a nationally consistent approach to assessing ecological effects of development activities. These guidelines are further being adapted by at least one Regional Council[9] to provide an impact assessment framework for the marine environment.

Marine environmental effects of rock drilling, blasting, and removal and avoidance/mitigation strategies

Underwater noise and blasting effects on marine species

25 Underwater noise from the proposed drilling, blasting, rockbreaking and dredging was assessed against marine species present within the vicinity and their vulnerability to noise disturbance. Sharks have demonstrated the highest sensitivity to low frequency sound and increases in sound intensity (i.e., 10 times or more above a previous transmission) can result in immediate withdrawal by sharks from a source[10]. Fish that are hearing-specialists can experience temporary hearing loss when exposed to

[7] See [1].

[8] See [4].

[9] MDC. (2020). *Proposed Marlborough Environment Plan*. Prepared by Marlborough District Council. Appeals version. Nelson.

[10] Myrberg, A. (2001). *The acoustical biology of elasmobranchs*. Environmental Biology of Fishes, 60, 31-45.

increased background noise levels for 24 hours or more. Fish that are hearing-generalists do not necessarily show hearing loss.

26 Underwater blast charges may cause mortality or internal damage to marine species, such as fish, sharks, octopus, marine mammals, and seabirds if they are in the vicinity when blast charges are set off. This could affect species' air cavities, such as swim bladders, and pericardial or coelomic cavities, causing lethal or sublethal effects, depending on proximity to blasts. Drilling and blasting will be occurring in close time lapse proximity with each other therefore there is less risk that mobile species will return to the blasting area between drilling and the blasting, than if these activities were occurring apart. The use of in-rock blasting (charge holes are proposed to be drilled to a 5 m depth) also results in reduced pressures and lower aquatic organism mortality than the same explosive charge weight detonated in open water[11].

27 In order to reduce the potential effects on marine species from underwater noise and blasting effects a number of avoidance and mitigation strategies have been adopted by South Port.

28 Marine species are known to utilise Bluff Harbour more frequently during the summer months. This includes sharks, seabirds, shore birds, fish (i.e., blue cod and moki) and marine mammals. Some marine species emigrate from the coastal zone to offshore or northern waters during the autumn to winter months, including elasmobranch species (broadnose sevengill shark, oceanic blue shark, spiny dogfish, school shark and white shark), blue cod, flounder, kingfish and seabirds. Based on this and utilising an initial avoidance management strategy it was adopted that works primarily avoid the summer months. This strategy significantly reduces the impact underwater noise and blasting effects will have on a number of sensitive marine species with the vicinity. Dawn and dusk are known productive times of the day for a large number of marine species[12][13] and excessive noise from drilling and blasting during this time could lead to behavioural changes. However, as the drilling, rockbreaking and blasting is proposed to be completed sporadically during the daylight hours, avoiding dawn and dusk for most of the year, species will have respite from noise during these important times. This avoids peak feeding and breeding times in the

[11] Hempen, G. L., Keevin, T. M., & Jordan, T. L. (2007). *Underwater Blast Pressures from a Confined Rock Removal During the Miami Harbour Deepening Project*. Miami: International Society of Explosives Engineers.

[12] See [10].

[13] Francis, M. P., Duffy, C., & Lyon, W. (2015). *Spatial and temporal habitat use by white sharks (Carcharodon carcharias) at an aggregation site in southern New Zealand*. Marine and Freshwater Research. doi:http://dx.doi.org/10.1071/MF14186.

harbour vicinity due to seasonal offshore migrations and provides respite and feeding opportunities during the evenings when a number of marine species are more active.

29 Acoustic modelling completed by Styles Group (2020) assessed the radius size of the area likely to create permanent threshold shifts (PTS) and temporary threshold shifts (TTS) for hearing in cetaceans and mortality thresholds for fish with swim bladders (the most vulnerable group). The results and associated mitigation regarding cetaceans are covered in detail in Dr Childerhouses' evidence and associated report[14]. Modelling results by Styles Group[15] compared international thresholds and methods and found the maximum lethal zone extends to a distance of 85 m (based on a 25 kg charge, 5.0 m burial depth) and decreases to 77 m with a 10 kg charge (2.5 m burial depth)[16,17] (Figure 3). These are the most conservative ranges based on the lowest threshold of 100kPa/Lpk 220dB re 1 µPa and the more conservative sound pressure model[18]. Although these thresholds are not directly designed for sharks, these species are less likely to have adverse and lethal effects than fish with swim bladders but are still considered sensitive due to their ampullae of Lorenzini electroreceptors and would therefore be likely to depart the area rapidly before damage is incurred. During the periodic use of the rockbreaker, Styles Group (Consulting advice note; 27 August 2021) concluded that for fish with swim bladders that are used for hearing, the expected lethal zone is 10 m. For fish without swim bladders or those that do not use swim bladders for hearing, the percussive noise of the rockbreaker is not likely to cause mortality nor risk of injury and is comparable to underwater pile driving. The Marine Fauna Observers (MFO's) will complete a visual assessment of the blast predicted mortality zone (Figure 3) for shark species prior to blasting commencing.

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[14] See [5].

[15] Styles Group. (2020). *Physiological effects on marine mammals and fish confined rock blasting and drilling Bluff Harbour channel*. Report prepared for South Port NZ Ltd.

[16] Popper, A. N., Hawkins, A. D., & Fay, R. R. (2014). *Sound exposure guidelines for fishes and sea turtles.* A technical report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI. Report No. ASA S3/SC1.4.

[17] Wright, D. G., & Hopky, G. E. (1998). *Guidelines for the use of explosions in or near Canadian fisheries waters*. Canadian Technical Report of Fisheries and Aquatic Sciences.

[18] See [16].

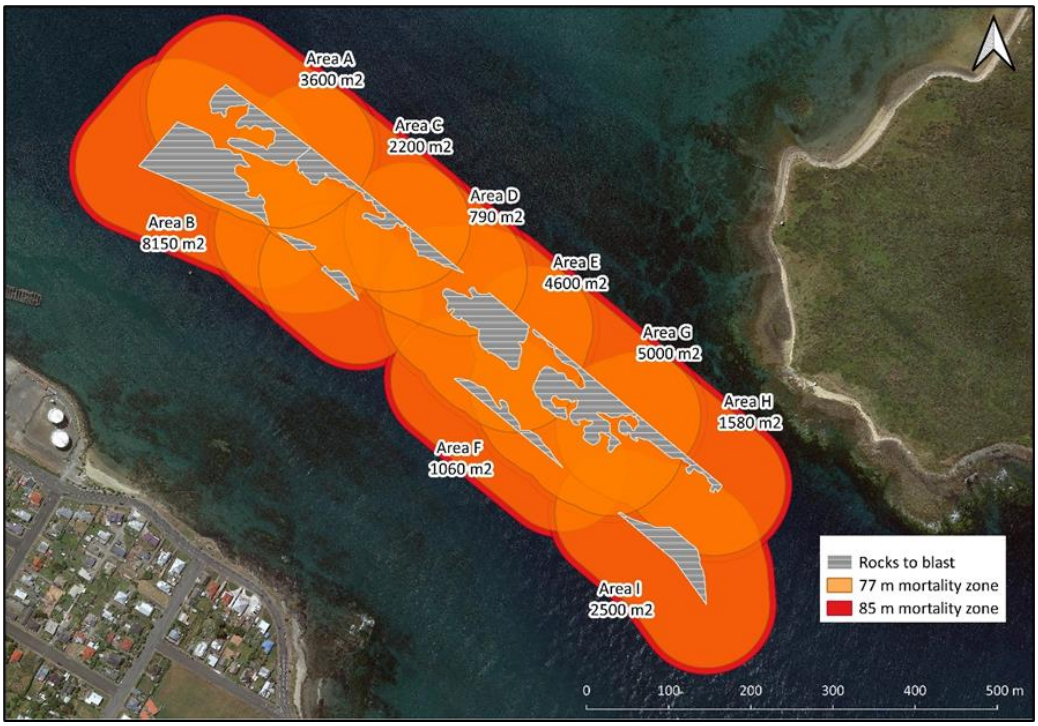

Figure 3: Conservative fish and shark mortality zones (based on species with swim bladders from Popper et al. (2014) for average 10 kg (77 m) and maximum 25 kg (85 m) blast charges.

30 A number of mitigation strategies have also been adopted to further reduce the predicted effects on marine species. These include a warning blast, soft starts, and an acoustic harassment device. The use of a 'warning blast' and 'soft start', would aim to effectively remove benthic and cryptic mobile marine species, likely predominantly fish and mobile molluscs but possibly including avifauna and marine mammals, from the projected mortality zone before damage is incurred. A 'warning blast' is effectively a 'warning' open water blast of low peak pressure set off to remove mobile species, largely benthic and cryptic species, from the area before blasting commences. A 'soft start' entails the subsequent blasting after the 'warning blast' to begin at its' lowest charge weight before gradually building to the maximum charge weight required for the specific site.

31 The use of an acoustic harassment device (AHD), which are largely used to deter marine mammals, is also considered beneficial in removing fish, bird and shark species from the immediate blast zone where damage could be incurred. Sharks have a similar response to fish and are known to be significantly less sensitive to underwater blasts than marine mammals. This is evidenced in Micronesia dynamite fishing where positive correlations between open water blasting, foodfish and shark populations have been observed[19]. However, where sharks do not accrue a feeding benefit from

[19] Houk, P., Deblieck, J., Benavente, D., Maxin, S., Yalon, A., McLean, M., Teresio, C., Graham, C., Kutta, S., Stephen, L., Cuetos-Bueno, J., Leberer, T. (2016). *Status and management of coral reefs and fisheries*

the effects of blasting and detonation on other species, they have been observed to immediately withdraw from the area[20]. The use of an AHD would aim to further remove mobile species outside of the fatal radii of the blast zone. Bubble nets were also initially considered as they reduce the predicted zone by two-thirds[21]. However, due to the swift current movement in the harbour channel entrance and the number of blasts to be detonated within each event, this option was not viable.

Marine Biosecurity Issues

32 An indirect impact of the removal of rock reef habitat is that invasive marine pest species may establish on the newly exposed rock substrate through inadvertent introduction from ballast water and biofouling. South Port has regular biannual marine pest surveys carried by the National Institute of Water and Atmospheric Research (NIWA) on behalf of the Ministry of Primary Industries (MPI) department, Biosecurity NZ (BNZ), with the most recent being carried out over the 15 – 19th February 2021. These BNZ surveys assess port structures for target species but also look for any and all new species that may survive in the localised conditions. The invasive algae, *Undaria pinnatifida*, is already present in the harbour and is classed as a 'containment' species within the Southland Regional Pest Management Plan (SRPMP)[22]. The Asian paddle crab (Charybdis japonica), sea squirts (Styela clava, Eudistoma elongatum, Pyura doppelgangera and Didemnum vexillum), and Mediterranean fanworm (Sabella spallanzanii) are listed as part of ES' active 'exclusion' programme.

33 To further reduce biosecurity issues within the Bluff Harbour, MPI governs ballast water discharge within their "Ballast Water from All Countries" Import Health Standard[23]. These provide regulations around ballast water and sediment from vessels to avoid the inadvertent introduction of further unwanted marine organisms.

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resources in Chuuk Lagoon and Kuop Atoll, Federated States of Micronesia: A synthesis of 2008 to 2016 data. Technical report prepared for The Nature Conservancy and the US Department of Interior.

[20] See [16].

[21] Popper, A. N. (2019). *An overview of fish bioacoustics and the impacts of anthropogenic sounds on fishes*. Journal of Fish Biology, 94, 692-713. doi: https://doi.org/10.1111/jfb.13948

[22] Environment Southland. (2019). *Southland Regional Pest Management Plan 2019-2029*. Invercargill: Environment Southland.

[23] MPI. (2016). *Ballast Water from All Countries*. Wellington: An Import Health Standard from Ministry of Primary Industries.

34 Given that Bluff Harbour is a commonly used port for vessels travelling on to the Fiordland National Park, marine biosecurity is further regulated, and a regional surveillance and compliance plan has been created by Otago University on behalf of ES to ensure the early detection of marine pests in the Southland Coastal Marine Area (CMA)[24].

35 To assist in the 'containment' of *Undaria pinnatifida* and exclusion of marine pest species identified in the SRPMP, biosecurity monitoring of the blasted rock sites will be carried out at approximately 3 months, 12 months, and 24 months post-works and should include the removal of any *Undaria pinnatifida*.

Channel Deepening Altering Coastal Processes

36 The coastal processes report[25] found that changes to the channel cross section from the removal of the rock outcrops will be minor, less than 5%, and the hydraulic resistance will not change, neither will the tidal prism. The wave energy environment in the harbour entrance is relatively low and wave energy penetration into the harbour is not high. Minor changes in wave refraction will occur, however, the difference is not anticipated to be noticeable. Therefore, the only change will be a very minor and hard to detect reduction in tidal current flow speeds[26]. The effect on tidal current velocities as a result of dredging in the swinging basin area will also be negligible. Based on these results no effects on marine species utilising the channel entrance is expected.

Marine environmental effects of rock deposition and avoidance/mitigation strategies

Alteration to Benthic Assemblages

37 The proposed rock deposition area is predominantly shell hash and has low diversity and abundance of infauna and epifauna. The size of the area, 130,000 m^2, allows for areas of soft benthic habitat and feeding ground to remain between deposited rock fragments. Although it is likely that the addition of rock fragments to this area may alter the few benthic

[24] Davis, J. P., & Hepburn, C. D. (2020). *Southland Regional Marine Invasive Species Surveillance and Compliance Plan*. Dunedin: Prepared for Environment Southland by the Department of Marine Science, Otago University.

[25] OCEL. (2021). *Bluff Harbour Entrance Dredging - Coastal Processes Assessment. Rev 2*. Christchurch: Prepared for South Port NZ Ltd

[26] See [25]

communities present, it is an area of low ecological value and few marine species were observed to currently utilise it as habitat.

38 The prediction of a low and probably negligible impact can be verified via a monitoring regime of this site. This monitoring is outlined in the AMMP[27] and briefly referred to in para 78.

Displacement/Destruction of Existing Benthos

39 The rock disposal seabed investigation as part of the assessment of marine effects report[28] found that the species observed within the proposed rock disposal site were predominantly adventive or mobile species and would have minimal impacts from the deposition of rock to the seabed. This effect is considered less than minor and no mitigation is proposed.

Alterations to the Shoreline

40 The rock disposal site was specifically chosen based on the similarity of the receiving shoreline (i.e., gravel fields), an appropriate depth characteristic (13 – 15 m), and absence of any identified or known significant habitats and breeding areas. The rock fragments are expected to settle under wave action into a stable matrix, the larger fragments sheltering smaller elements and being mutually supported by them, forming a permanent, low height rock reef structure. Wave calculations completed by OCEL[29] show nothing larger than 150 mm will be mobilised at these depths, and gravel smaller than 150 mm will be comparable to the shoreline substrate. No discernible effects on wave height and wave focussing on the adjacent beach is expected based on an average deposition depth of 0.3 m (rock volume of 40,000 m^3 over 13 ha). The deposition over the area will not be uniform to that extent but the projection of the dumped material above seabed level could be expected to be of the order of 1 m maximum after the levelling effects of wave action on isolated mounds have occurred. In 13 -15 m water depth, that amount of bottom variability will not cause any discernible effects on wave height and focussing and would not function as a surf reef [30]. Therefore, this impact is considered less than minor.

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[27] See [2].

[28] See [1].

[29] See [25].

[30] See [25].

Marine environmental effects of sediment dredging and avoidance/mitigation strategies.

Contamination/Modification of Inner Harbour Environments

41 The South Port berth pockets are predominantly natural deposition zones as they are deeper and there is limited tidal current flow. Consequently, the berth pockets tend to have higher proportions of silt and contaminants than the wider harbour. The exception to this is Berth 8 whereby the seabed is eroding as opposed to accreting due to high tidal flow and has lower silt content than inner berths.

42 Sediment, including silts and contaminants where present, will be mobilised into the water column during dredging, however the likelihood of these being transported to high ecological value habitats within the inner Bluff Harbour, such as Awarua Bay and nearby seagrass habitats, at concentrations that might be of ecological interest or concern is small and less than minor. Estimates from the coastal processes assessment[31] report that the tidal excursion distance is less than the distance to the Awarua Bay entrance. Tidal velocity and sediment size mapping completed as part of the assessment of marine effects[32] also illustrate that a large back eddy is present within the vicinity of the berths, although not necessarily encompassing the northernmost end of Berth 8, during the incoming tidal flow and only limited flow is present within the Berth 5 & 6 basin, where silt proportions and contaminants are highest. Therefore, even if the plume is transported out of the eddy and beyond the berths, it is unlikely to reach the bay before the current changes direction. In short, there are limited tidal mechanisms for transport of such silts or contaminants to other areas of the inner harbour. Further limiting of any risk is that dredging of the areas with highest silt proportion and contaminant load (i.e., Berth 5 & 6 basin and Berths 7 & 8) is expected to be completed in approximately 1 week.

43 In order to reduce adverse effects on high ecological value areas within the inner harbour, avoidance and mitigation strategies were adopted. Further avoidance of risks to the inner harbour environments is proposed to be achieved by restricting dredging of the Berth 5 & 6 basin (this includes Zones B3/4, B5 and A4) and Berths 7 & 8 (Zone B7-B8) to slack and outgoing (ebb) tides. Verification that this avoidance strategy works is proposed to be achieved via turbidity meters which will be placed near sensitive habitats (i.e., near seagrass habitat and at the eastern edge of

[31] See [25].

[32] See [1].

Motupōhue mātaitai) to verify that water quality conditions remain within the expected ambient range.

Removal of Soft Sediment Benthic Flora and Fauna

44 Dredging will remove benthic flora and fauna from the identified areas in the Bluff Harbour. Based on previous monitoring in 2019[33] and January 2021, fauna present in the proposed dredging sites are resilient, common and will readily recolonise the sites post-dredging, furthermore no flora is attached to benthic substrate within the proposed dredging sites. It is expected that mobile species will depart the works area due to noise vibrations from the vessel pre-dredging. Based on these findings, this effect is considered less than minor, and no mitigation is proposed.

Rock Habitat Sedimentation

45 Sedimentation and sediment plumes can cause adverse effects on rocky shore marine species, such as gill clogging, reduction in light availability and increased acidification[34]. However, typically plumes generated by trailer suction hopper dredge (TSHD) operations, or by backhoe dredger around confined areas like berth pockets, are localised and dissipate rapidly. Also restricting the dredging of areas with higher silt proportions to slack or ebb tides (see para 43), and the limited duration of this part of the dredging works, limits the risk to the high value marine habitats along the channel edge (and beyond the area that will be lost to blasting). Sediment mapping as part of the marine assessment of effects[35] indicates that during this tidal window sediment will either be flushed beyond both the Bluff Harbour entrance and Motupōhue mātaitai rock environments or resettle in the berths. The majority of sediment to be dredged (approximately 80%) will be similar to natural environments within the harbour and surrounds, therefore, during the remainder of the dredging in the Swinging Basin and outside of the berth pockets an overall less than minor impact is expected.

Reduced Water Clarity from Sediment Pluming

46 Suspended sediments in the water column near preferred seabird feeding habitats, such as Tiwai Point and Argyle Beach, can reduce visual feeding

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[33] Miller, B. (2019). *South Port Seabed and Wharf Monitoring:2019*. Prepared for South Port NZ, e3Scientific Report No. 19079. Invercargill.

[34] Law, C. S., Bell, J. J., Bostock, H. C., Cornwall, C. E., Cummings, V. J., Currie, K., Davy, S. K., Gammon, M., Hepburn, C., Tracey, D. M. (2018). Ocean acidification in New Zealand waters: trends and impacts. New Zealand Journal of Marine and Freshwater Research, 52(2), 155-195.

[35] See [1].

abilities. This can be particularly detrimental during breeding seasons as it forces breeding pairs with new chicks to search further afield for food, increasing the risks for the nesting parent. Reduced water clarity can also have a detrimental effect on sensitive ecological habitats such as seagrass (*Zostera muelleri*) if light availability is reduced over an extended time frame. The "preferred water clarity for seagrass" in Tool 2 of the New Zealand Estuary Trophic Index Toolbox is classified as "an average value of at least 20% of the sunlight that strikes the water's surface (incident light) should reach the estuary bed"[36]. The average minimal light requirement for seagrass was determined to be 10.8% by Duarte[37], however, there is a wide range of minimal light requirements amongst different seagrass species, from 4 to 29%[38]. The ANZG[39] guidelines for national water quality management acknowledge that turbidity may not be a particularly useful indicator, particularly regarding the protection of sensitive ecological habitats, such as seagrass: "Low turbidity values are normally found in offshore waters. Higher values may be found in estuaries or inshore coastal waters due to wind-induced resuspension, dredging or the input of turbid water from the catchment. Turbidity is not a very useful indicator in estuarine and marine waters. A move towards the measurement of light attenuation in preference to turbidity is recommended."

47 Tidal mapping as part of the marine assessment of effects[40] illustrates that high tidal flows and wave energy within seabird feeding areas such as Tiwai Point and Argyle Beach and nearby seagrass beds, should ensure water clarity is rapidly restored and maintained during the dredging process. Given the short period of approximately 1 week to 10 days required to dredge the fine sediments and the adaptation of a 'green valve' on the TSHD, sediment pluming is expected to be exceedingly short-lived / limited within the harbour and mātaitai, and not expected at all within Awarua Bay.

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[36] Robertson, B. M., Stevens, L., Robertson, B., Zeldis, J., Green, M. O., Madarasz-Smith, A., Plew, D., Story, R., Oliver, M. (2016). *NZ Estuary Trophic Index Screening Tool 2. Determining Monitoring Indicators and Assessing Estuary Trophic State*. Wellington: Prepared for Envirolink Tools Project: Estuarine Trophic Index, MBIE/NIWA.

[37] Duarte, C. M. (1991). *Seagrass depth limits.* Aquatic Botany, 40, 363-377.

[38] Turner, S., & Schwarz, A.-M. (2006). *Management and conservation of seagrass in New Zealand: an introduction.* Wellington: Department of Conservation, Science for Conservation 264.

[39] ANZG. (2018). *National water quality management strategy paper Number 4: Australian and New Zealand guidelines for fresh and marine water quality, Volume 1, The Guidelines*. Canberra: Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand.

[40] See [1].

48 To further mitigate any chance of suspended sediments causing an adverse effect on seabirds or seagrass, soft sediment dredging is proposed to occur outside of little penguin breeding months (September to March), and outside of the flowering and most productive season for seagrass (*Zostera muelleri*) (December to March) as both species are most vulnerable during this period.

49 To provide validity to these findings, turbidity meters will be deployed near sensitive ecosystems such as seagrass beds and at the eastern edge of the rocky reef mātaitai habitat during the soft sediment dredging works. Turbidity measures will be used as a proxy for light availability, a more relevant measure for ecological habitats, by utilising the data collected via local calibration which will then provide for ecological receptor-based turbidity monitoring. The ecological receptor-based turbidity monitoring and associated tiered trigger levels for adaptive dredge management is further discussed in paras 64 to 72.

50 Taking the above into account, any water clarity effects are expected to be relatively brief, localised and have a less than minor overall impact on seabirds and sensitive marine habitats such as seagrass beds.

Marine environmental effects of sediment disposal and avoidance/mitigation strategies

Reduction in Benthic Productivity

51 Increased levels of suspended sediments in the water column and ongoing sediment deposition at the site could lead to a reduction in photosensitive benthic productivity and potential smothering of species. However, based on the sediment mapping completed as part of the marine assessment of effects[41], wave action and tidal velocity within this area sediments will be rapidly dispersed and will not resettle in sensitive habitats (such as seagrass beds) back within the harbour. The areas where finer silts are expected to be mobilised (Berth 5 & 6 basin and Berths 7 & 8) will be dredged and disposed of over a timeframe of approximately 1 week. This week is proposed to occur during the winter months where natural turbidity levels are lower due to less wind and low phytoplankton production so as to not create cumulative effects within the water column. Furthermore, faunal assemblages in the spoil disposal site are modified due to historic spoil deposition at this site and species remaining are highly tolerant of suspended sediment and sedimentation due to the spoil deposition and

[41] See [1].

natural coastal processes. Based on these findings, the residual impact is considered less than minor.

Alterations to Benthic Compositions

52 The deposition of 120,000 m^3 of harbour-originated sediment over a proposed 6 week timeframe at the sediment disposal site will likely lead to changes in benthic composition and topography. This deposition rate roughly equates to two THSD loads a day or ~3,200 m^3/day but may be up to 4,000 m^3/day. Historic bathymetry information from OCEL (2021)[42] states that "the seabed levels at the disposal location have remained stable and have not changed significantly over time so the sediment dropped on the location has been completely dispersed in the period between hydrographic surveys and the seabed has returned to a state of equilibrium." This is also evidenced by the sediment mapping completed as part of the marine assessment of effects[43], the known high energy environment[44] and historic benthic investigations[45][46]. Sediment is readily redistributed from this site, either south westerly with the ebb-tide through the basin formed west of Dog's Tongue Reef and on into the predominant easterly flow of Foveaux Strait[47], or onshore via low height swell wave action to build up the beach and sand dunes[48]. Natural disturbance is known to be considerable in Foveaux Strait and it is the highest energy environment in mainland New Zealand, where oceanic swells and tidal currents shift sediments and shape habitats and their benthic communities[49].

53 Surveys conducted in January 2020 (pre-dredging spoil deposition) and 2021 (post-dredging spoil deposition) assessing infaunal communities at the disposal site found minor changes in diversity and species density after the deposition of 40,000 m^3 of berth spoil at the site. However, no

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[42] See [25].

[43] See [1].

[44] Michael, K. P. (2010). *Summary of information from Foveaux Strait oyster (Ostrea chilensis) OYU5 strategic research 2000-09*: *context for the 2010 strategic research plan*. Ministry of Fisheries, Wellington: New Zealand Fisheries Assessment Report 2010/20.

[45] Dunmore, R., & Barter, P. (2008). *Benthic Survey of Bluff Harbour Dredge Spoil Disposal*. Nelson: Prepared for South Port New Zealand Ltd.

[46] Miller, B. (2020). *South Port Dredge Spoil Disposal Benthic Survey*. Invercargill: Prepared for South Port NZ Ltd, e3Scientific Report 19096.

[47] Morris, R. W., & Associates. (1984). *Tiwai Offshore and Harbour Studies*. Invercargill: Southland Harbour Board.

[48] See [25].

[49] See [44].

statistically significant changes between pre- and post-dredge infaunal communities were observed. Although the capital dredging proposes to deposit three times as much sediment, the sediment type to be deposited at the spoil disposal site is predominantly sand (i.e., ≥ 2 mm grain size) which is similar in particle size to the receiving environment.

54 Therefore, although some changes are likely in the short term, given the altered state of the site from historic and current deposition, evident natural sediment redistribution, and evidence of readily recolonising infauna, this effect is considered less than minor and no mitigation is proposed. To validate this prediction, a faunal and sediment monitoring survey is proposed which would include the disposal site and the nearby control disposal site. This will be completed within 6 months and again at 12 months post-dredging disposal as an effects assessment.

Sedimentation in Rocky Habitats

55 Sediment mapping and tidal velocity data completed as part of the marine assessment of effects[50] illustrate that it is highly unlikely that suspended sediment generated during the disposal and subsequent transport from the disposal site will migrate to or settle near the Motupōhue mātaitai or the Tiwai Point/harbour entrance. Provided no wave action is occurring, suspended sediments (including fine silts) during ebb tides will be distributed to the west where they converge with the strong tidal flow exiting the harbour entrance and are distributed out past the mātaitai to Foveaux Strait. During flow tides, suspended silts will be distributed to the north and east along the Tiwai Peninsula, the same direction if wave action were occurring. Sediment deposition during slack spring tides poses the most risk to the mātaitai of all tidal windows, although tidal velocity mapping shows tidal velocities to be 0.3 to 0.6 m/s along the mātaitai coastline during this tidal window which would ensure silts remain in suspension and are distributed beyond the mātaitai's boundaries. However, it is acknowledged that owing to the high cultural value of mahinga kai within the mātaitai further assurance may be necessary.

56 The risk to high value rocky reef habitats is low and can be further reduced through the proposed mitigation that the finer sediments dredged from the Berth 5 & 6 basin and Berths 7 & 8, which is expected to take approximately 1 week, should not be deposited at the disposal site during slack tide during periods of little or no wave action whereby there is a slight chance that these could be settle within the mātaitai. The prediction of a low and probably

[50] See [1].

negligible impact can be verified by deployment of turbidity meters as discussed in para 49 and the inclusion of a subtidal impact assessment within the mātaitai both of which are contained within the AMMP[51] and are to be completed in consultation with Te Rūnanga o Awarua. Provided this mitigation and monitoring is carried out, the residual impact is considered less than minor.

Adaptive marine management plan (AMMP)[52] strategies

57 The AMMP briefly describes the proposed works, summarises the potential effects on the marine environment and outlines the management responses that will avoid or minimise the potential for adverse effects of the capital dredging activities on the marine environment. The AMMP is a working document that will be refined once contractors have been appointed, final specifications are set in place and baseline data becomes available. South Port is committed to collaborating with iwi to avoid or minimise effects on the marine environment, mauri and mahinga kai. Outcomes of collaboration with iwi will also be incorporated into this document as they become available.

58 Management controls outlined in the AMMP include restrictions around the timing of works (as also discussed in para 28); sediment control and dredge management (discussed in paras 43 and 56; protection measures for seabirds and marine species[53] (discussed in paras 28 through 31); and biosecurity (discussed in paras 32 through 35).

59 Monitoring and subsequent reporting to validate the above management controls include a seagrass monitoring programme; soft sediment assessments; rocky reef assessments at the rock disposal site and a monitoring programme within the Motupōhue mātaitai.

60 As the AMMP is a working document it will require reviewing and updating when baseline and calibration data become available. Procedures are provided within Section 5 of the AMMP which would also trigger reviews/updates of the plan. This is to ensure the plan remains current and can adapt to real-time data collection and observations. Any changes to the AMMP would be submitted in writing and certified by Environment Southland.

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[51] See [2].

[52] AMMP refers to [2].

[53] The protection measures for seabirds and marine species have since been further detailed in the Marine Fauna Operational Plan (Childerhouse, Miller & Stephenson, 2022).

Management Controls

61 Timing of works is proposed as follows:

(a) Drilling, blasting, dredging and deposition activities shall be limited annually to the period 1 February to 30 September to avoid the peak marine mammal migration season and peak seabird and fish breeding and coastal feeding seasons;

(b) Soft sediment dredging shall be limited to the period 1 April to 31 July to avoid the little penguin breeding and moulting season and seagrass (Zostera muelleri) flowering and growing season; and

(c) Drilling and blasting activities shall be limited to the hours between 7.30 am and 6 pm when marine species are less active.

62 Sediment control and dredge management uses two primary management methods throughout the operational soft sediment dredging phase of the project. These are:

(a) "Proactive Operational Management: utilises forecast and real time environmental information (i.e., tides, wind, waves, weather etc.) to guide operational management decisions during dredging. Undertaken as part of common dredging practice; and

(b) Adaptive Dredge Management: based on turbidity monitoring - implements an adaptive management precautionary approach in response to predetermined receptor-based trigger levels.

63 The Dredge Contractor is responsible for proactive operational management of the dredge and disposal activities. This will take into consideration the hydro-meteorological conditions, dredging restrictions within certain tidal ranges identified within the assessment of marine effects[54] and water quality information (turbidity, waves and currents). The purpose of proactive operational management is to constantly assess the daily planned dredge operations to minimise the risk of a dredge-induced adverse effect of surrounding environments and trigger exceedances. Proactive dredge restrictions to avoid adverse effects on the receiving environment are as follows and are expanded upon within the marine assessment of effects[55]:

[54] See [1].

[55] See [1].

(a) The use of a Green Valve which reduces turbidity caused by overflow;

(b) The consent holder shall ensure that the dredging of the Berth 5 and 6 basin (Zones B3/4, B5 and A4) and Berths 7 & 8 (Zone B7-B8) (Figure 1) occurs during slack or outgoing (ebb) tides to avoid the potential for suspended sediment to migrate into the upper harbour, or Awarua Bay; and

(c) Sediment dredged from the Berth 5 & 6 basin (Zones B3/4, B5 and A4) and Berths 7 & 8 (Zone B7-B8) (Figure 1) should not be deposited at the sediment spoil site during slack tide where little or no wave action is evident.

64 A sensitive ecological receptor-based approach is proposed as the adaptive dredge management to manage dredging in Bluff Harbour, utilising light availability thresholds for seagrass beds as the most sensitive receptor in the surrounding marine environment. Light availability can be measured by water clarity (m), which in turn can be assessed via local calibration from turbidity meters (NTU). This is proposed in conjunction with health status monitoring of the sensitive receptors which is referred to in para 76 and discussed within the AMMP.

65 A tiered trigger system for protection of the most vulnerable identified habitat within the vicinity, i.e., seagrass, is proposed and is adapted to respond to ecological receptors, rather than simply turbidity. This is an important detail as in a naturally highly variable harbour environment, such as Bluff Harbour, turbidity and low water clarity is common and will not cause adverse effects on the ecology of the area, short term. However, continuous reduced water clarity may start to cause adverse impacts and therefore should be managed.

66 During the dredging operations, the location of both dredging and disposal will be managed in response to results of daily and weekly turbidity monitoring. Monitoring of turbidity at 3 locations shown in Figure 4 near sensitive habitats will be undertaken as part of the Turbidity Baseline Monitoring Period and will continue during the dredging.

67 The adaptive receptor-based dredge management is to be implemented through a system of triggers which, when exceeded, require management responses. These trigger systems are based on conservative ecological receptor-based tiered (water clarity/duration (days)) combinations to ascertain management required. These are proposed as follows:

(a) Tier 1 trigger – Warning, reduced water clarity: commence management actions;

(i) Daily average is less than X m[56] water clarity (based on local calibration with continuous turbidity (NTU) metering);

(b) Tier 2 trigger – Water clarity reduced further and daily duration exceeded: increase management actions;

(i) Daily average is less than X m[57] water clarity for two consecutive days; and

(c) Tier 3 compliance level – Cease dredging in the vicinity of the monitoring station(s) showing the exceedance until water quality daily average returns to acceptable levels;

(i) Daily average less than X m[58] water clarity for three consecutive days.

68 It is important to note that the design of the trigger system means natural events will cause exceedances of the trigger and compliance levels above. Discrete turbidity data collected by Southern Waterways for Environment Southland found that natural turbidity in the Bluff Harbour ranged from 0.81 to 4.4 NTU over 13 recordings between May and August 2016. Local calibration of turbidity (NTU) and water clarity (secchi disc) will start in April 2022 and be completed prior to dredging commencing from baseline data collected by turbidity meters and associated turbidity and water clarity ranges will be updated into this management plan.

69 The objective of this turbidity and water clarity monitoring program is to provide daily averages of turbidity and water clarity when higher risk sites are being dredged and weekly when lower risk sites are being dredged, to inform the adaptive management of the dredging operations. The dredge operations will be managed daily or weekly by comparing the averaged turbidity data with the pre-established trigger levels defined in para 67.

70 Higher risk dredging zones are considered to be the zones adjacent to the South Port berths and the Berth 5 & 6 basin (Zones B3/4, B5, A4, B7&8, A3) (Figure 1). This criterion is based on sediment quality assessments from the marine assessment of effects[59] indicating ‘above natural’ silt and

[56] These values are to be confirmed following the baseline data collection period prior to dredging commencing. Based on a single round in April 2021 these values were 2, 1.5 and 1.5 m respectively, however these cannot be utilised until local calibration and baseline data has been validated.

[57] See [56].

[58] See [56].

[59] See [1].

contaminant levels at these sites. During dredging of these sites, data will be downloaded daily to allow for daily average calculation and tiered trigger assessment. Daily data will be provided to the ES Compliance Manager in a CSV format. The 'higher risk' zone volumes total approximately 40,000 m^3 and based on ~4,000 m^3 being removed daily, equates to 10 days of daily monitoring.

71 Lower risk dredging zones are considered to be the swinging basin, B11, C and E zones (Figure 1). This criterion is based on sediment quality assessments from the marine assessment of effects[60] finding naturally occurring levels of silt and contaminants at these sites. During dredging of these sites, turbidity data will be downloaded weekly and provided to the ES Compliance Manager in a CSV format. The 'lower risk' zone volumes total approximately 80,000 m^3 and based on ~4,000 m^3 being removed daily, equates to 3 weeks of weekly monitoring.

72 The turbidity data is to be converted to water clarity (m) and compared to pre-established triggers as part of the tiered management system approach. In determining the locations of the monitoring sites (Figure 4) the objectives were to:

(a) Provide monitoring near mahinga kai, mātaitai and sensitive ecological habitat locations; and

(b) Provide a reference (control) site in the harbour away from predicted increases in turbidity.

[60] See [1].

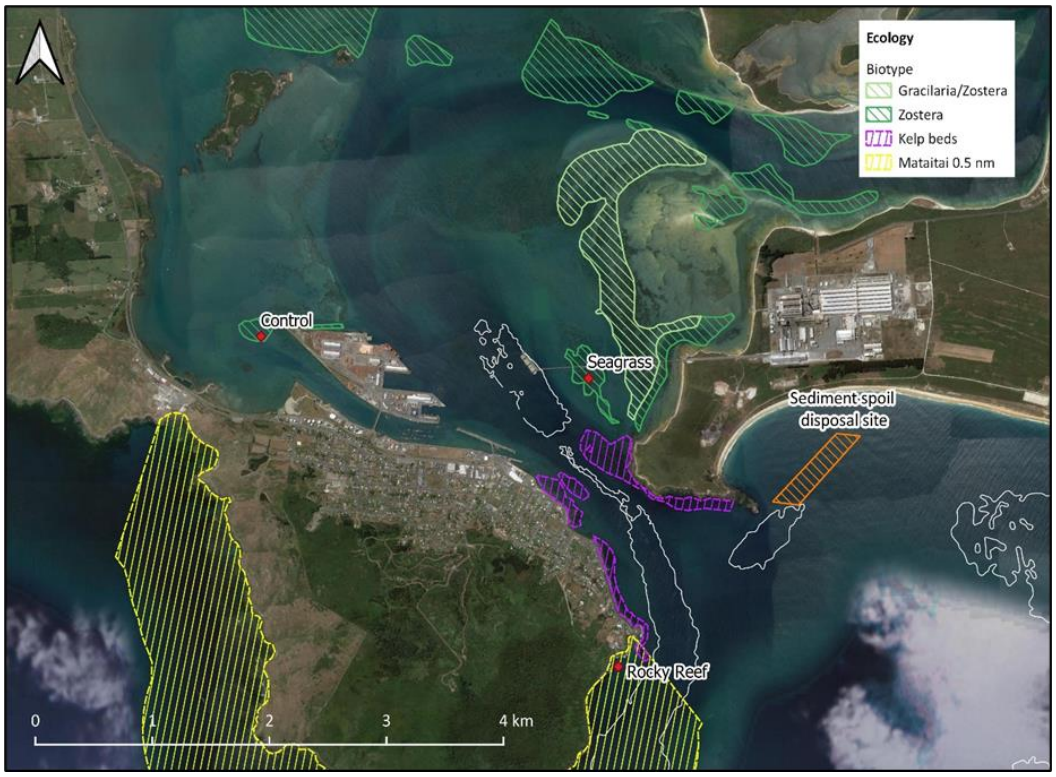

Figure 4: Proposed turbidity meter locations. Please note, finalised 'Rocky Reef' site pending approval from Te Rūnanga o Awarua.

73 Protection measures for seabirds and marine species are discussed in greater detail in Dr Childerhouses' evidence and are included in the Marine Fauna Observer (MFO) programme. Proactive operational management to avoid adverse effects on marine species also include:

(a) Open Water Blasts. This consists of an initial open water blast of low peak pressure to remove benthic and cryptic mobile species from the harbour entrance channel and surrounding waters. This open water blast will only occur once the MFO observers have assessed the temporary threshold shift (TTS) zone[61] and are satisfied that no marine mammal, seabird, and shark species are evident within their given threshold or mortality zone. A period of 90 seconds should pass before blasting commences to enable species, likely predominantly benthic fish and mobile mollusc species, to exit the identified zones. If it is noted by the MFOs that the open water blast is causing mortality to small marine fish species and thereby creating a feeding flock of gulls and terns prior to the main blasting this management control should be revised and potentially discarded;

[61] The definition and rationale of the TTS is provided in Dr Childerhouses' evidence and associated report (Childerhouse, 2021).

(b) Soft Starts. A soft start is when the lowest explosive charge is set off at the commencement of each blast event to further assist in deterring seabirds and fish from the harbour entrance channel and surrounding waters; and

(c) Acoustic Harassment Device. An acoustic harassment device will be operated at all times during drilling blasting operations to deter seabirds and fish from the harbour entrance channel and surrounding waters.

74 Biosecurity management consists of proactive operational management and monitoring responses. The proactive operational management includes inspections of all plant operating as part of the capital dredging programme for fouling organisms listed as 'exclusion' species within the Southland Regional Pest Management Plan (SRPMP)[62] and *Undaria pinnatifida*. An inspection report will be submitted to Council's Environmental Compliance Manager prior to the dredge equipment entering Bluff Harbour detailing the timing, method and findings of the inspection.

75 The biosecurity monitoring response provides an ongoing assessment of the successfulness of the proactive operational management by assessing for unwanted marine pest organisms within the blast zone where the likelihood of invasive species colonising quickly is highest.

Monitoring and Reporting

76 The purpose of the seagrass, soft sediment, rocky reef and mātaitai monitoring is to provide validation of the specific management controls that are in place to avoid or mitigate any adverse effects on the receiving marine environment.

77 Seagrass baseline monitoring is set to start in April 2022 with subsequent baseline monitoring surveys in July 2022 and March 2023. These baseline surveys will provide seasonal baseline data sets from which comparisons of the two surveys during the dredging operation can be assessed against.

78 Methodologies for all monitoring programmes proposed are provided within the AMMP and utilise widely accepted techniques contained within

[62] See [22].

Kingsford & Battershill (1998)[63], Wood & Lavery (2000)[64] and Schweikert *et al*. (2012)[65].

Response to section 42A report

79 Appendix B pg. 4 Section 3 of the s42A states "*In order to determine the effects of the proposed activities, the application proposes monitoring programmes*". I would like to reiterate that we have repeatedly stated that the monitoring is not proposed to **determine effects**, it is proposed to **validate** our findings from various subtidal and intertidal surveys (including sediment coring, dive transects, biota dredges, infauna sampling, video transects, bird surveys, and acoustic recordings), mapping and historical data.

80 Appendix B pg. 5 Section 4 para 2 of the s42A discusses perceived issues with the proposed turbidity triggers. Mr White states "*There is no clarity around what these trigger values will be or even what level of effect they will represent*". Mr White considers that "*It would be simpler to assume that a reduction of light transmission through the Harbour water of greater than, say, 20% would constitute an effect outside that reasonably expected to occur under natural conditions*". The turbidity triggers component has been discussed in pre-application meetings with Mr White in which no issues were raised and both DOC and Forest and Bird were satisfied with the approach taken. The 20% reduction in light transmission suggested by Mr White is unsubstantiated, and it is unclear as to what actual value of light transmission his suggestion would constitute. Further to this, as is stated in both the AMMP[66] and Assessment of Marine Effects[67], any adverse effects on seagrass will be due to the length of time light transmission is reduced, as well as the size of the sediment particles, as temperate seagrass species are known to tolerate periods of reduced light[68]. By avoiding lingering turbidity levels of finer silts utilising favourable tidal movements the majority

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[63] Kingsford, M., & Battershill, C. (1998). *Studying temperate marine environments: A handbook for ecologists.* Canterbury University Press. Christchurch.

[64] Wood, N., & Lavery, P. (2000). *Monitoring seagrass ecosystem health-The role of perception in defining health and indicators*. Ecosystem Health, 6(2), 134–148. https://doi.org/10.1046/j.1526-0992.2000.00015.x

[65] Schweikert, K., McCarthy, A., Akins, A., Scott, N., Moller, H., Hepburn, C., & Landesberger, F. (2012). *A Marine Cultural Health Index for the sustainable management of mahinga kai in Aotearoa – New Zealand*. A report for Te Rūnanga o Ngāi Tahu. February 2015, 112.

[66] See [2].

[67] See [1].

[68] Stoddart, J. (2011). *Browse LNG Development: Sediment Impact Thresholds Developed for James Price Point Nearshore Benthic Communities*. MScience Report No. MSA157R11. Prepared for Woodside Energy Ltd. Nedlands, Australia.

of any potential adverse effect on seagrass and rocky reef habitats is minimised. In addition to this avoidance strategy, the completion of local turbidity calibration within the same seasonal timeframe for which the dredging is proposed to occur, allows for accurate baseline conditions and subsequent meaningful adaptation of turbidity trigger and compliance levels. This method of collecting locally calibrated baselines is a standard approach and allows for greater accuracy in protecting area-specific identified vulnerable habitats. As the timeframe of the soft sediment dredging was not confirmed until the application was submitted on 9 December 2021; April to July 2022 is the first appropriate seasonal window for this calibration to occur. These "*complex array*" of triggers are relatively simple tools to provide real-time management responses and variations of which are widely used and accepted in soft sediment dredging management nationally and internationally[69] [70].

81 I therefore disagree with Mr Whites' assessment that a simple reduction in percentage of light transmission (i.e., 20% as stated in para 73) should be utilised from which to base an assessment of effects on seagrass against. This approach could potentially jeopardise the soft dredging sediment programme which currently poses a low risk to the receiving marine environment, particularly when considered in conjunction with tidal dredging limitations. Adverse effects on vulnerable habitats are more likely to occur if sediment dredging is prolonged as Mr White suggests, which is likely if work is halted.

82 Mr White considers that Consent Condition 11 be amended to require "*<u>all</u>* (my underline) *soft sediment dredging be undertaken on outgoing tides*". I disagree with this recommendation based on two unequivocal factors.

(a) Coarse sand (which is the predominant particle size outside of the finer silt zones) readily settles out of suspension and has no impact on seagrass nor rocky reef habitats within tidally influenced areas such as the channel and mātaitai.

(b) This recommendation would significantly increase the length of time over which soft sediment dredging would have to occur, which would have a larger impact on the identified vulnerable habitats.

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[69] Enviser Ltd. (2018). *Environmental Monitoring and Management Plan. LPC Channel Deepening Project: Stage 1 (Environment Canterbury Certified)*. Enviser Report Ref. 1006. Prepared for Lyttleton Port Company.

[70] CEDA. (2020). *Assessing and Evaluating Environmental Turbidity Limits for Dredging [online]*. Available at http://www.dredging.org/media/ceda/org/documents/resources/cedaonline/2020-05-AETL.pdf

83 I also disagree with Mr White's statement concerning the potential effects of rock breaking, drilling and blasting on fish fauna having had "*little consideration*" (Appendix B, pg. 5, Section 4) within the assessment of marine effects. Rock breaking, drilling and blasting activities are seasonally limited specifically to target the periods of the year when fish species move offshore to deeper waters (i.e. blue cod and shark species, see para 28) and to avoid fish fauna breeding times for species that remain in the harbour year-round (i.e. butterfish *Odax pullus,* which breed October to January in Southland). Furthermore, a conservative mortality zone specifically for the most vulnerable fish fauna present, fish with swim bladders or cartilaginous fish with oil-filled livers was modelled by Dr Pine[71] and is provided in Figure 3 and discussed in para 29. This modelled zone identified a maximum of 85 m within which the highest blast of 25 kg could potentially cause mortality to these fish species and Marine Fauna Observers (MFO's) will be assessing the area for shark species. Swim bladders are predominantly absent in demersal fish (both benthic and benthopelagic) which in the Bluff Harbour locality include blue cod, blue moki, and triplefin species which indicates that the mortality zone for predominant species in the area would be less than this modelled footprint. Further avoidance and mitigation strategies to reduce the impacts on these species are discussed in paras 25 to 31.

84 With regards to Mr White's perceived shortcomings in the biosecurity approach outlined within the application I would direct him to Section 7.5.2 of the Assessment of Marine Effects[72] and Section 3.4 of the AMMP[73] which are summarised in paras 32 to 35 of this evidence. During pre-hearing meetings both DOC and Forest and Bird were satisfied with the biosecurity approach outlined. No further clarity nor conditions were required for either party.

85 In response to Mr White's comments regarding Condition 44 (Appendix B, pg. 9 Section 5), abiotic indicators such as sediment quality and grain size are appropriate measurements to provide validation of the success of avoidance (dredging tidal limitations) and mitigation (turbidity tiered triggers and compliance level) strategies employed to manage the soft sediment dredging activity. They are based on assessing any changes within the harbour environment from the activity's discharge, which in this instance is sediment. Infaunal studies in this environment will add no benefit to the monitoring as low levels of sediment accumulation within the 3 month

[71] See [15].

[72] See [1].

[73] See [2].

timeframe (which Mr White was satisfied with during the section 92 workshop dated 15 November 2021) will result in no discernible change to species assemblages. Changes in sediment characteristics, however, will be apparent immediately.

86 Furthermore, a benthic survey assessing infauna, epifauna, particle size and chemistry within the Sediment Disposal Site, where the deposition activity is proposed, and the nearby Sediment Control Site will also occur within 3 months of the works being completed. Infauna and epifauna assessments at these locations have validity as the benthic habitat will be directly modified by the deposition activity.

Response to section 42A Proposed Consent Conditions (Section 7.4; Table 4)

87 I have been asked to respond to specific amended and new consent conditions provided in Table 4 (pages 46 to 72) of the section 42A report. The specific consent conditions are Condition 8, 11, 12, 13, 13A, 26, 28, 30, 44, 44B, 45A, and 46.

88 Amendments and new consent conditions for Conditions 13, 26, 45A, and 46 are agreed with and therefore not discussed further.

89 I strongly disagree with Conditions 8 and 11 as is discussed in paras 80 to 82 of my evidence.

90 I strongly disagree with Condition 12 and consider Mr Todd's findings to be inconsistent with all evidence presented in the Coastal Processes[74] and Assessment of Marine Effects[75] reports. From an ecological perspective there is no rationale nor ecological benefit for the proposed changes to this condition. As is stated in paras 80 to 82 of my evidence, it is more likely that adverse effects on the receiving environment will occur due to the significantly increased dredging timeframe this condition, and Conditions 8 and 11, represent. Regarding issues cited concerning coastal processes I will defer to Mr Teear's expertise on the matter.

91 Regarding Condition 13 it is further offered that no overflow and no benthic sediment 'jetting' will be used during the dredging of the identified zones with higher silt content. Namely, Zones B3/4, B5, A4, B7&8, and A3. These measures further reduce turbidity.

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[74] See [25].

[75] See [1].

92 Regarding clarification sought by the section 42A reporting officer for Condition 28; I would reiterate that the proposed open water blast is one of many mitigating factors employed to deter fish and birds from the blast zone. As is stated in paras 28 to 31, 61 and 73 of my evidence and in reports prepared[76] other deterrents include an acoustic harassment device (AHD), soft starts and the primary avoidance management strategies of timing of works.

93 Regarding clarification sought by the section 42A reporting officer for Condition 30; the AHD operating times are prior to blasting and limited to the works hours of 7.30am and 6pm.

94 The amendment to Condition 44 requiring rocky reef benthic monitoring to be undertaken 12 months prior to the works to establish a baseline has no ecological rationale nor benefit and would have been required to be completed last month based on capital dredging works potentially starting in 2023. There are minimal seasonal variations in subtidal rocky reef benthic habitats (unlike seagrass beds) and pre-works baseline monitoring can be effectively undertaken during any season. The amendment to Condition 44 requiring a 24 month monitoring survey alongside the 3, 12 and 36 month surveys is unnecessary in my opinion but agreed with.

95 It is unclear what Condition 44B requires. Is it requested that the rocky reef survey is also undertaken at the completion of the capital dredging and then at 3, 12, 24 and 36 months? Given that there will be clean rock surface at these sites directly following the completion of the Capital Dredging programme it is unclear what this additional consent is attempting to measure. I would therefore disagree that Condition 44B is required.

Response to matters raised in submissions

96 DOC's concerns regarding the Assessment of Marine Effects and associated AMMP within their submission were addressed in pre-hearing correspondence dated 22/02/2022 (see Appendix A) and a follow-up meeting on 23/02/2022. DOC were satisfied with the responses provided and no further information, actions or consent conditions were requested regarding this.

97 Forest and Bird concerns regarding the Assessment of Marine Effects and associated AMMP within their submission were addressed in pre-hearing correspondence dated 08/03/2022 (Appendix B) and a follow-up meeting

[76] See [1] and [2].

on 09/03/2022. Forest and Bird were satisfied with the responses provided and no further clarification was sought.

Conclusion

98 To conclude, South Port's proposed capital dredging project is a large-scale marine project which, left unchecked, has the potential to have adverse impacts on the receiving marine environment. However, South Port proposes a comprehensive management strategy and suite of tools to minimise the risk to the marine environment. All strategies have proven track records in the marine environment and are based on a sound understanding of the specific receiving environment. These are not exploratory nor unproven methods and therefore the proposed monitoring is solely to provide validation of these methods to satisfy resource users, kaitiaki and consenting authorities that the documented procedures are being followed.

99 As a professional principal marine ecologist, I am satisfied that the Assessment of Marine Effects and associated AMMP addresses and avoids or mitigates to an appropriate level any potential effect on the marine environment from the proposed activity.

Bryony Miller

29 March 2022

Appendix A – DOC Submission Response Table

South Port responses to DOC Submission

Confidential and without prejudice.

Item	Points Raised	South Port Response
1/2	The area of Bluff Harbour and Foveaux Strait in the vicinity of the works contains a number of conservation values. These are generally assessed in the application, but I note that particular priority values present include: • Hector's dolphin (nationally vulnerable) are resident in the Catlins Coast Marine Mammal sanctuary; • Southern Right Whale (recovering); • Pods of Bottlenose Dolphins (nationally endangered) venture into Awarua Bay on a regular basis; • Humpback whales travel through Foveaux Strait during summer months; • Orca (nationally critical); • Beaked whales; • Sea lions (nationally vulnerable) are present in harbour; • Yellow-eyed (nationally endangered) and fiordland crested (at risk-declining) penguins come ashore to moult; • Foveaux Shags (nationally vulnerable) roost at the mouth of the harbour, forage in the operational area and traverse the operational area to forage in the upper harbour wider Awarua Bay Area; • Eel-grass beds (at risk-declining).	The AEE for marine mammals (Childerhouse 2021) provides details of the potential occurrence and behaviour of a variety of marine mammals (including some threatened species) within the Bluff Port Area (BPA). The AEE also specifically notes that the species most likely to be affected by the proposal are Hector's dolphins, New Zealand fur seals, New Zealand sea lions, bottlenose dolphins, southern right whales, humpback whales and killer whales (orca). The BPA represents only a small fraction of general habitats available to support those marine mammal species around the larger coastal region and the BPA is not considered an important feeding, breeding or resting area for any of these species. Preliminary results from acoustic monitoring for marine mammals undertaken by South Port within the BPA are consistent with the overall assessment that marine mammals have a low occurrence in the area and, when present, are only present for short periods. The AEE assessed all potential effects as less than minor when considered in conjunction with recommended mitigation actions. The single exception to this is the potential impacts of habitat exclusion / displacement from underwater noise from blasting activities. However, when undertaken

	The disturbance and discharges associated with the works have the potential to adversely affect these and other conservation values.	in conjunction with the recommended mitigation, blasting has a residual risk assessed as minor. As per the report on Avian values of the Bluff Harbour, yellow-eyed and Fiordland crested penguins do not breed within the affected area, and only on very rare occasions have they been found ashore as moulting individuals. Therefore they are highly unlikely to be affected by these works in any form. If a bird of either species was to come into the works area, they would be under the same protocols as other avian species during the drilling and blasting program, and would be detected by the observer program. They are therefore not deemed to be species at risk from any of the proposed works. Foveaux shags are known to forage within the area in which works (drilling and blasting) will be undertaken, and roost nearby. The only breeding site for this species in the Bluff Harbour area is a significant distance from the area in which the works will be conducted, and this work will mostly occur outside of the breeding season for this species. These birds are used to foraging in and around the Port area, they are acclimated to shipping and noise, and therefore the increased traffic and noise associated with these works is unlikely to cause any negative impacts on this species indirectly.

		There are a number of roosting sites used by this species around the Harbour, and traversing the works area in flight will not impact this species. The area in which the drilling and blasting will occur is a very small part of the area in which this species forages within the Bluff Harbour, and therefore loss of foraging habitat during the works is unlikely to have any negative population effects. As with marine mammals, this species (as well as other shags/cormorants, gulls, terns, and penguins) will be monitored around the drilling and blasting sites, and a strict protocol will be followed during this time. If birds or marine mammals are within the specified distances from the blasting site prior to blasts, then works will be halted until they have departed, and soft-start procedures used to deter birds from the blast area prior to actual blasting. With all of these procedures in place, it is considered highly unlikely that there will be any indirect or direct impacts of the drilling and blasting program on Foveaux shags.
3	In addition, South Port is used by vessels travelling on to other locations, including environmentally sensitive locations such as Fiordland and the Sub-Antarctic Islands. Any failure in biosecurity measures could risk significant adverse effects through introduction of pest species.	Noted. The dredge operators Heron Construction and Dutch Dredging have provided biofouling management plans that form part of the application. These plans include a number of procedures designed to ensure no invasive species are accidently introduced into Bluff Harbour.

		The plans follow the IMO *Guidelines for the control and management of ship's biofouling to minimise the transfer of invasive aquatic species,* as adopted under Resolution MEPC.207(62) on 15 July 2011.
4	The applicable planning instruments require adverse effects to be avoided, remedied and mitigated.	Noted.
5	In particular, the New Zealand Coastal Policy Statement 2010 requires that any adverse effects on values listed in Policy 11(a) are avoided, and significant adverse effects on values listed in Policy 11(b) are avoided. The priority conservation values listed above include both 11(a) and 11(b) values. This sets a high standard that must be met before consents can be granted.	The capital dredging proposal by South Port is consistent with Policies 11(a) and 11(b) of the NZCPS. The proposal places a heavy emphasis on avoiding significant adverse effects and adverse effects on priority conservation values in the marine environment through a number of measures as documented in the marine effects assessment and marine mammals effects assessment as well as in the proposed consent conditions. These include: Timing of the works to avoid the peak marine mammal migration season and peak seabird and fish breeding seasons. Restricting the dredging of soft sediment to the period 1 April to 31 July to avoid the seagrass flowering and growing season.

		Restricting the deposition of soft sediment dredged from Berths 5 & 6 and 7 & 8 at the sediment deposition site outside of periods of slack tide or when there is little wave action to avoid adverse effects on the rocky shoreline habitats within the Motupōhue mātaitai. Restricting the deposition of soft sediment from Berths 5 & 6 and 7 & 8 to slack or outgoing tides to avoid depositing fine sediment in Awarua Bay and the upper harbour where sensitive benthic communities are located such as seagrass beds.
6	Although the information provided with the application states that the adverse effects on these conservation values are likely to be low, there remains risk and uncertainty which needs to be addressed if consents are granted.	Matter for discussion during the MS Team Mtg call.
7	The consent conditions proposed by the applicant would generally benefit from improvements to drafting to provide consistency and certainty, and to conform to Environment Southland requirements. However, there are also some more significant concerns, which are addressed in the following points.	Noted.
8	The marine mammal management plan is generally appropriate, subject to ensuring that it is adequately reflected in final consent conditions. However, the plan provides for different approaches depending on what	There are a wide variety of underwater noise levels produced by the different activities (see Styles Group (2021) report) and, therefore, it would be

	species are involved and different blasting scenarios - it would be more certain and effective if the approach was based on the worst-case circumstances.	inappropriate to set a single standard based on the worst case scenario as that could lead to shutdowns for quieter activities when there in fact was no risk to marine mammals. South Port notes that there is some complexity involved in implementing different sized shut down zones based on the specific type of blasting or rock breaking activity and the type of marine mammal present. However, it is important to ensure that mitigation is tailored to each activity to ensure appropriate protection to marine mammals on an activity by activity basis. South Port therefore agree with DOC that mitigation should be based on the worst case scenarios and will implement the largest estimated shut down zone modelled for each activity and scenario to provide the highest protection for marine mammals. Based on the preliminary results from South Port's 12 month acoustic monitoring programme, we are able to confirm that marine mammals are very rare visitors to the Bluff Port Area. Specifically, both Hector's dolphins and Southern right whales were detected for less than one hour each (i.e., less than 0.01% of the total time monitored) during nearly the first 9 months of monitoring (the final three months of data will be available shortly). The most commonly detected marine mammals were dolphins (excluding Hector's dolphins) which were detected on 7% of days but only comprising 0.2% of the total time monitored. T Given the very low levels of

		marine mammal being present within the Bluff Port Area, it is very unlikely that marine mammals will be exposed to any effects from the proposed activities. Notwithstanding this, South Port are proposing precautionary mitigation in the event that marine mammals do come into the area. This mitigation will avoid any risk of permanent hearing injury and significantly reduce or avoid any risk of temporary hearing injuries. South Port therefore proposes to implement Marine Mammal Observation Zones; MMOZ) for each activity based on avoiding any permanent hearing injuries (i.e., Permanent Threshold Shift) to marine mammals. If any marine mammals are seen within this area immediately prior to or during activities, then activities will cease until they are observed to move out of the zone, when activities will recommence. These MMOZs will be monitored by dedicated Marine Mammal Observers to ensure that there are no marine mammals within the zones. Based on the estimated sizes of the primary MMOZs, MMOs will be able to confidently detect all marine mammals with this zone and therefore avoid any permanent hearing effects.
9	There is inconsistency between the blasting scenarios proposed in the description of the activity, and what has been used as the basis for assessing effects and conditions. This is important to address, as it will	The worst case blasting scenario involving a charge of 25 kg has been used for assessing effects and determining the MMOZs for the various marine

	determine how blasting should be managed, and the approach required for wildlife observers. Specific limits and management requirements for blasting are required, and need to also cover the trial drilling and blasting programme referred to in the application.	mammal types (see above). This approach therefore builds in a high degree of conservatism to the effects assessment. This also applies to the trail drilling and blasting programme. The explosive expert has stated that a charge of 10 kg will be used on most occasions during the blasting of rock within the entrance channel.
10	Adequate controls are required for the disposal of rock and sediment.	As stated in Section 3.2 of the Adaptive Marine Management Plan (AMMP) (Miller, 2021) two primary management methods and controls will be employed throughout the operational soft sediment dredging phase of the project: • Proactive Operational Management: utilises forecast and real time environmental information (i.e. tides, wind, waves, weather etc.) to guide operational management decisions during dredging. Undertaken as part of common dredging practice. • Adaptive Dredge Management: based on turbidity monitoring - implements an adaptive management precautionary approach in response to predetermined receptor-based trigger levels. Each of these management controls are further elaborated on in the following sections of the plan (3.2.1 and 3.2.2). Two examples of the proposed controls are as follows: 1. Sediment dredged from the Berth 5 & 6 basin (Zones B3/4, B5 and A4) and Berths 7 & 8

		(Zone B7-B8) (Figure 1) should not be deposited at the sediment spoil site during slack tide where little or no wave action is evident. 2. The use of an adaptive receptor-based tiered trigger system during sediment deposition. This control provides meaningful measures for the health status of sensitive ecological areas nearby such as seagrass. The rock disposal site and disposal controls are discussed in Sections 4 and 7.6.2 of the South Port Capital Dredging Assessment of Marine Effects report (Miller & Davis, 2021). The controls around the disposal of rock to the seabed are predominantly to ensure no coastal processes are adversely affected (see OCEL, 2021) nor navigational issues arise by ensuring the rock is deposited no higher than 0.5 m (in a depth of ~13-15 m) and are of a size to not be resuspended. The ecological impacts are considered to be less than minor based on the initial surveys to locate a site whereby no infauna nor epifauna would be adversely affected or displaced by the addition of rock.
11	Conditions: That if consents are granted, they include conditions which adequately protect conservation values. This would include ensuring that: • the activity and effects are as described in the application;	South Port welcomes the opportunity to work with DOC in providing conditions that protect conservation values. It is noted that within the Adaptive Marine Management Plan (AMMP) (Miller, 2021) a range of

	• there are adequate controls on the disposal of rock and sediment; • there are adequate controls on blasting; • observer zones for marine mammals and avifauna are clearly defined; • management plans are effective; • there is adequate monitoring to detect and respond to any adverse effects which do arise; and • consent durations are appropriate for the activity and effects. Management Plans: That if management plans are included in consents, the conditions: • contain clear and effects-based objectives and performance standards, to ensure that environmental outcomes are understood from the outset, and that the management plans will lead to actions 'on the ground' to achieve those outcomes; • have ongoing effect, and require ongoing implementation; • set intervention thresholds to allow review and intervention if objectives are not being met; • require ongoing monitoring and reporting; • provide for adaptive management where appropriate; and • are enforceable throughout the duration of the consents.	conditions and controls are proposed which adopt the precautionary approach to avoid adverse effects on marine species. Avoidance controls include restrictions around the timing of works (both seasonally and daily), dredging sediment controls (see response 10 above), open water blasts, and biosecurity controls. Monitoring is then proposed, not to assess the effects, but to validate and provide certainty that the avoidance controls are working. The monitoring also provides the ability to respond in real-time to any unforeseen issues that may arise and further reduce risks to the marine environment. Set thresholds such as the proposed Tiered Trigger Levels for soft sediment dredging (Section 3.2.2 of the AMMP) allow for intervention if the criteria are not being met.

Appendix B – Forest and Bird Submission Response Table

South Port responses to Forest and Bird Submission

Confidential and without prejudice

Item	Points Raised	South Port Response
6	The applicant hasn't established the need for the capital dredging works in order to increase the usability of the port as described. They haven't considered how the impact of sea level rise may enable to increased target depths in the next decades without the need to undertake such destructive activities on the seabed and associated effects on the coastal environment and species.	Waiting for sea level rise is not a practical option. The ship sizes since the Island Harbour was built in 1960 have increased significantly but the entrance channel has remained the same (apart for a 0.5m deepening in 1980's). Refer to **Figure 1** below to see progression of ship sizes. Our channel is 107m wide but because of an outcrop of rock along north edge and an outcrop along south edge, the width reduces to approx. 84m in one location (refer to **Figure 2** below). When you consider the width of ships are, on average, 32m and lengths of up to 260m there is not a lot of room to navigate the channel. It must be also noted that ships rarely travel through the channel in a straight line due to various factors including wind, tide and water current, then this width is reduced further. This channel deepening (and some widening) therefore increases the safety limits of the port. It is important to note that the area of the entrance channel is approx. 12.5 Ha. The area which we will be drilling and blasting is 3.3 Ha which indicates the majority of the channel is already deep enough and we are only looking to remove high spots. Refer **Figure 3** for typical cross section of channel.

		In terms of the deepening proposed in the swinging basin and berth pockets, this is already a highly modified area where we undertake maintenance dredging annually. As recent as 2020 a Trailer Hopper Suction Dredge removed 40,000m^3 to ensure we maintained our existing navigational target depth. It is this same area we propose to deepen by a further 1m i.e. already a regularly modified environment. Refer to **Figure 4** to compare maintenance dredging areas to proposed capital dredging areas. It should be noted that 1m is the maximum to be removed, in some areas it is much less than that. Compared to other dredging campaigns carried out in New Zealand this proposed project is significantly smaller in volume and has the potential to create great benefits, through both increased safety limits and improved efficiencies.
7/8	The applicant hasn't demonstrated how the proposed benefits of the activity could be meet in other ways such as transporting the exports from the region by rail to an existing port in Dunedin which already has depths deeper than the target depths of the proposed activity. This would be one feasible way of avoiding the adverse effects on the coastal environment This is a vital first step in the application given the strong policy direction in the New Zealand Coastal Policy Statement to, amongst other things, safeguard the coastal environment, and protect indigenous biological diversity by avoiding inappropriate use and development.	In the current environment only a proportion of the container traffic could utilise rail as suggested by Forest & Bird. It must be noted 87% of cargo which South Port handles is 'bulk' cargo, such as stock food, fertiliser, logs, woodchip and ingredients to manufacture aluminium. If bulk cargo was not able to come to South Port (the nearest port), then it would need to be trucked to Dunedin. This would be equivalent to moving approximately 3,000,000 MT over an additional 200 km to Dunedin or 85,000 truck movements (160,000 including return trips) – for bulk cargo alone. This would increase the volume of heavy traffic on our roads, increasing risk to safety, increased road maintenance and also creating a bigger carbon footprint. Currently ships enter or leave South Port with capacity to take more cargo. The current depth of the channel prevents

		customers from loading the ships to their capacity. This means the ships have to steam to another port to 'top-up'. This comes at a cost to the customer financially but also has a negative impact on the environment due to ships having to travel longer distances and wait for berth vacancies to load / discharge their cargo. By deepening the channel by up to 1m will allow customers to fully load ships and therefore have only one port call in New Zealand before turning around and exporting their product to the rest of the world. This reduces the cost on the Southland exporter/importer making them more competitive in the market which has a wider benefit to the Southland/New Zealand economy. The environment benefits are also there with less ships steaming around the NZ coast. With current cargo mix and volumes, if we deepen the port, we are likely to see less ships calling to Bluff given they can import/export more cargo on existing vessels. A development of this nature would create much needed efficiencies in the supply chain that is currently heavily disrupted largely due to capacity issues. The proposed deepening aligns with our company purpose which is *to* ***facilitate the best logistic solutions for the region*****.** When the Harbour Board had a vision in the 1950's to build the Island Harbour they provided an international port which

		Southland has been benefitting from for almost 70 years. With this deepening, we are helping to keep Southland businesses competitive on a global scale for the next 70 years. Another potential benefit of deepening the port is making Southland (and therefore New Zealand) more attractive for green energy production whether it be more wind farms or green hydrogen. The current depth of the entrance channel restricts some of these opportunities being developed in the Southern Region of New Zealand. Potential consortiums have advised that due to the high cost of transportation larger ships are more desirable to make any project more commercially viable. They advised that a draft of 10.7m (9.7m CD) would make development in Southland a more realistic opportunity. With a deeper channel we increase the possibility of green energy being developed in New Zealand and this comes with significant environmental benefits. This has been highlighted also with the announced closure of the New Zealand Aluminium Smelter in 2024. The region is working with the Just Transition team from MBIE looking at future opportunities for new industry to be established in the south. The channel project will provide much needed additional capacity to help create efficiencies in the supply chain that new industry are currently looking for.

9	The application and associated documents has identified how the affected area provides habitats for several shark and other fish species, and marine mammals such as sea lions, dolphins (including Hector's) and Southern Right Whales.	Noted.
10/11	Forest & Bird is particularly concerned that the ecologist report notes 59 species have been identified in the area with a threat classification including three penguin species (Hoiho, Fiordland crested penguin, and Little Penguin). The application also notes the large numbers of shore and sea birds including the nationally threatened New Zealand Dotterel	The location does have a considerable list of bird species that have a threat classification, that at some stage of the year utilise the extended area for feeding or breeding. However, as per the report, there are very few species that are of legitimate concern with regards to the planned work, if the protocols designed for this work are adhered to. More importantly, the list of threatened species should not be taken out of the context of the planned works. The report outlines in full those species that are of concern with regards to these works, and this list is restricted to just a few species. Each of these species are addressed within the context of this report. The report considers most of these species to be at no risk with regards to this project. The inclusion of other threatened species within the submission (yellow-eyed and Fiordland crested penguins, and New Zealand dotterel) does not take into account the report findings, that these species are highly unlikely to even be present within the direct footprint of the works. The report also addresses the measures that will be put in place to prevent sediment impacting the upper estuary with regards to shorebirds.

		The report also highlights that the mentioned species are not going to be in the water, close to the drilling and blasting, so will not be directly impacted, nor have increased potential for mortality. Little penguins, shags/cormorants, and gulls/terns COULD potentially be directly impacted (be killed or injured) by the drilling and blasting regime. However, the observer scheme that is set up to monitor for the presence of marine mammals, will also be monitoring for the presence of these bird species. Any level of mortality is not acceptable, and South Port is aiming for a zero level of mortality of all of these species. The presence of any birds within the 'exclusion zone' will require a halt to blasting, and the soft start process should deter any birds not detected by observers, to move away from the blasting area.
12	The application takes minimal and inadequate steps to avoid the effects of the activities these species. For example, the application proposes a schedule of operations to avoid 'most' (but not all) of the breeding season of Little Penguins. It also notes that the activity will only occur in part of the foraging range of these birds yet provides no evidence of how the noise and other effects (increased turbidity etc.) of the activity will impact on whether or not foraging birds will return to their nests. This could result in nests being abandoned and chicks left to starve. The activities and one of the proposed mitigation methods proposed (warning blasts) would specifically disturb wildlife in order to deter them yet there is no evidence presented of requisite Wildlife Act permits being sought for these activities.	The works are planned to start during the late summer when little penguins will have already finished their breeding period, and are likely to be completing their post-breeding moult cycle. During the latter, they will not be entering the water, until they have finished their moult, at which time they will depart their land-based burrows and head out to sea for the winter. The drilling and blasting works will likely extend through to the start of the next breeding season for this species (Aug-mid-October). However, the daily timing of drilling and blasting works to be outside of the key crepuscular periods that penguins are coming and going from burrows, is a key limiting strategy. Drilling and blasting will be only conducted during daylight hours, which is outside of the main period that little penguins are traversing the area to and from their burrows (during dawn and dusk).

		Increased turbidity is outlined in the report, and although it may have an impact on foraging within the channel area where works are being conducted, as outlined this is but a small area of any little penguins foraging range. Moreover, increased turbidity is unlikely to have any effect on the navigation of adult penguins to and from their nests, as they frequently surface to breath, and are likely to use these times to navigate accurately to their breeding sites. The impacts of the drilling and blasting on the foraging of little penguins in the works is area is also discussed in the report, and again is considered to be within a relatively small part of the overall foraging zone of these birds (up to 10km per day). The period of drilling and blasting will also be maintained during the early part of the breeding season as little penguins come back to start breeding at the next breeding season. However, any increased disturbance from these works is likely to cause penguins to re-evaluate their breeding sites and possibly chose a new site away from the works location, rather than start breeding and then abandon partway through the egg or chick stage. Breeding penguins are much less likely to abandon a breeding burrow once an egg is laid, and even less likely once a chick is present. The daily works schedule will effectively remove any chance of these works causing this sort of abandonment.
13	The application presents little analysis or evidence of the impacts of the deposited materials on the shoreline and habitats of sea and shorebirds in that area. Forest & Bird is deeply concerned that the existing monitoring of the	The deposited materials are not expected to have an impact on the shoreline and habitats of sea and shorebirds. The distribution of the sediment deposits has been illustrated via the

	deposits shows high levels of arsenic and presence of other heavy metals and contaminates which are likely to be mobilised through the proposed activities. The effect of these contaminants on marine ecosystems is not properly addressed in the application.	sediment mapping report and the coastal processes report[1]. As stated in these reports the sediment is shown to be readily mobilised and redistributed into Foveaux Strait. Heavy metals and polycyclic aromatic carbons from the wharf and swinging basin sites to be dredged were all below the ANZG (2018) ecological effects threshold. The only exception to this is tributyltin which was found in discrete (as opposed to ambient) particles at two of the wharf sites. Arsenic concentrations were found to exceed ANZG (2018) ecological effects thresholds at the Control Site along the Tiwai Peninsula only. This concentration of arsenic was significantly higher than concentrations found within the berth, swinging basin and disposal sites and was concluded to not be originating from South Port's dredge material. As these contaminants are primarily below the threshold for a *possible* ecological effect the impacts of the contaminants are expected to be less than minor. However, further avoidance was recommended within the marine ecological impact assessment [2] which limits the dredging of berth pockets to outgoing tides as to avoid sediment deposition occurring in sensitive inner harbour habitats (such as seagrass) which sea and shorebirds utilise.
14	The application provides little evidence of how it has stepped through the effects management hierarchy of how the effects can first be avoided or remedied and instead proposes inadequate mitigation methods.	The marine ecological impact assessment[3] has utilised an adapted version of the Environmental Institute of Australia and New Zealand (EIANZ) effects management strategy for ecological impact assessments (EcIA) in freshwater and terrestrial environments. The marine environment currently has

[1] OCEL. (2021). Bluff Harbour Entrance Dredging – Coastal Processes Assessment. Rev 2. *Prepared for South Port NZ Ltd.* Christchurch, NZ.
[2] Miller, B. & Davis, G. (2021) South Port Capital Dredging Assessment of Marine Ecological Effects. *Prepared for South Port NZ Ltd, e3Scientific Ltd Report No. 20041.* Invercargill, NZ.
[3] As above.

		no widely accepted effects management strategy and the marine adapted EIANZ approach is being utilised by regional councils in recent coastal plans. Each proposed activity is assessed against this framework and avoided where possible and otherwise mitigated. The mitigation methods proposed are considered best practice in their respective fields and are tailored to provide the most robust and specific methods. If Forest & Bird have specific examples of where they believe the mitigation methods are inadequate this would assist our response. With respect to potential impacts on marine mammals, South Port are adopting an avoidance strategy. Specifically, all rock breaking and blasting activities will require dedicated Marine Mammal Observers (MMOs) to be on duty and confirm that no marine mammals are within the Marine Mammal Observation Zone (MMOZ) prior to any activity commencing. If any marine mammals are seen within the MMOZ, then the start of activities will be delayed until they are seen to move out. Similarly, MMOs will be on duty during these operations and, if any marine mammals are observed to move into the MMOZ, then activities will be immediately halted and will not resume until the marine mammals are seen to leave the area. This proactive approach will ensure that any potential impacts from underwater noise are avoided.
15	In Forest & Bird's view there is not enough evidence to demonstrate the effects on indigenous species and coastal processes will be minor or less than minor after the mitigations. A lot of the mitigations proposed rely on	The onsite monitoring is only proposed to validate the expected outcomes of minor or less than minor which are based on scientific peer reviewed literature, numerous site specific surveys and expert opinion. It is considered good practice to provide confirmation of the expected effects being minor or less

	future studies or onsite monitoring which is not contained specifically in the conditions proposed.	than minor given the sensitivity and value of the nearby marine species and habitats. The onsite monitoring is clearly outlined in the consent conditions and supporting management plans. It is unclear what the future studies are that Forest & Bird are referring to. If it is in regard to the proposed 'reef ball' project this is out of scope of the application (as is stated in the application) and has been initiated in conjunction with local SIT polytechnic students and South Port. If there are other future studies it would be appreciated if Forest & Bird could elaborate on this. South Port have recently completed 12 months of acoustic monitoring for marine mammals in the Bluff Port area. Preliminary results from South Port's 12 month acoustic monitoring programme have confirmed that marine mammals are very rare visitors to the Bluff Port Area. Specifically, both Hector's dolphins and Southern right whales were detected for less than one hour each (i.e., less than 0.01% of the total time monitored) during nearly the first 9 months of monitoring (the final three months of data will be available shortly). The most commonly detected marine mammals were dolphins (excluding Hector's dolphins) which were detected on 7% of days but only comprising 0.2% of the total time monitored. Given the very low levels of marine mammal being present within the Bluff Port Area, it is very unlikely that marine mammals will be exposed to any effects from the proposed activities. Notwithstanding this, South Port are proposing precautionary mitigation in the event that marine mammals do come into the area. This mitigation

		will avoid any risk of permanent hearing injury and significantly reduce or avoid any risk of temporary hearing injuries.
16	Forest & Bird is concerned that despite extensive requests for further information, the consents officer found that in their "evaluation of the application and specifically the above listed environmental effects have found that some of those effects are somewhat lacking in evidential basis (e.g. cultural effects with no official Written Approval), or reliant on previous studies, trials before commencing the works, or on mitigation factors where the effectiveness is partially outside the control of the applicant and its contractors." (emphasis added). Forest & Bird agrees with this analysis and notes that the NZCPS directs that a precautionary approach is adopted where effects are "uncertain, unknown, or little understood, but potentially significantly adverse."	South Port has undertaken a pro-active approach to the application such as in procuring up to date empirical data and by embarking on a comprehensive consultation programme. South Port has commissioned for example, a number of dive surveys and laboratory analyses, including characterisation of the chemistry and physical characteristics of the bed sediments, investigation of potential rock disposal sites, a preliminary diving exercise to simulate the drilling and blasting programme and undertaking a 12 acoustic marine mammal monitoring programme. South Port has a positive working relationship with the Rūnanga. South Port has in conjunction with the Rūnanga developed a MOU in relation to the project with the long term goal of enhancing the cultural values of Bluff Harbour. Written approval has been provided by Te Ao Marama on behalf of the Rūnanga.

17/18/19/20	Forest & Bird finds the application at odds with several parts of the Resource Management Act (RMA), the New Zealand Coastal Policy Statement 2010 (NZCPS), the Southland Regional Policy Statement (RPS), and Southland Coastal Plan. The application is inconsistent with Part 2 of the RMA especially s5(2)(a), s5(2)(b), s5(2)(c), s6(a), s7(d), and 7(f) as the applicant has failed to adequately demonstrate how they are going to first avoid adverse effects on the coastal environment and indigenous species or provide robust mitigation measures. Further the application fails to meet several provisions of the New Zealand Coastal Policy Statement 2010, namely Objectives 1, 2, and 4, Policies 3, 11, and 13 as the application does not adequately avoid effects on indigenous biodiversity nor protect natural features. The proposed activities do not support the objectives in the Southland Regional Policy Statement 2017 in particular Objectives; COAST.3, COAST.4, COAST.5, along with Policies; COAST.2, COAST.3, COAST.5, COAST.6, COAST.7 as the proposed activities fail to adequately avoid the adverse effects on the coastal environment and ecosystems.	The capital dredging proposal by South Port is consistent with the relevant provisions of the RMA and NZCPS. The application places a heavy emphasis on avoiding significant adverse effects and adverse effects on priority conservation values in the marine environment through a number of measures as documented in the marine effects assessment and marine mammals effects assessment as well as in the proposed consent conditions. These avoidance measures, as set out in the application include: Timing of the works to avoid the peak marine mammal migration season and peak seabird and fish breeding seasons. Restricting the dredging of soft sediment to the period 1 April to 31 July to avoid the seagrass flowering and growing season. Restricting the deposition of soft sediment dredged from Berths 5 & 6 and 7 & 8 at the sediment deposition site outside of periods of slack tide or when there is little wave action to avoid adverse effects on the rocky shoreline habitats within the Motupōhue mātaitai. Restricting the deposition of soft sediment from Berths 5 & 6 and 7 & 8 to slack or outgoing tides to avoid depositing fine sediment in Awarua Bay and the upper harbour where sensitive benthic communities are located such as seagrass beds.

		The employment of Marine Mammal Observation Zones (MMOZ) to avoid adverse effects on marine mammals that enter Bluff Harbour over the duration of the project. Implementing biofouling management measures to avoid the potential for the introduction of invasive organisms in Bluff Harbour.
21	For similar reasons, the application is at odds with significant parts of the Southland Coastal Plan 2013.	South Port seeks clarification from Forest and Bird as to provisions of the regional coastal plan that are at odds with the application.
22	In terms of provisions that recognise the importance of port related activities such as the RPS Policy COAST.4 or NZCPS Policy 9 of the NZCPS, Forest & Bird submits that the operational needs of a port at Bluff are already being met with the existing depths and these are able to be maintained through existing permits. These provisions do not explicitly allow for expansions as the application proposes.	The importance of the project from an operational and environmental perspective and constraints the current entrance channel poses to shipping are set out in the responses provided to Item 6 above. The project is consistent with RPS Policy COAST.4 as this recognises and makes provision for nationally significant port projects such as is proposed for Bluff Harbour based on functional and operational needs. The explanation to the policy states: "*In accordance with Policies 6(1)(a), 6(2)(a) and 8 of the NZCPS these types of activities need to be given recognition for the activities they facilitate, to enable appropriate development and diversification to occur to meet the changing needs of the region*."

		Policy 9 of the NZCPS specifically provides for an efficient and safe operation of ports which are two of the key drivers for this project.

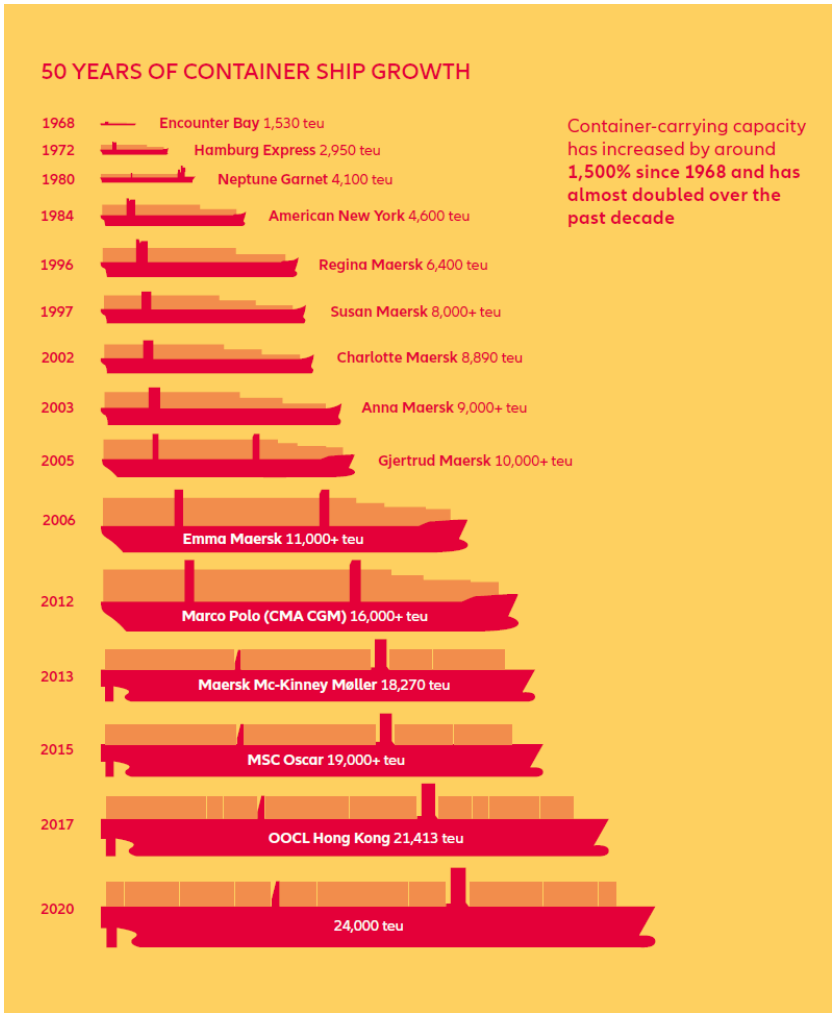

Figure 1 – Progression of ship sizes

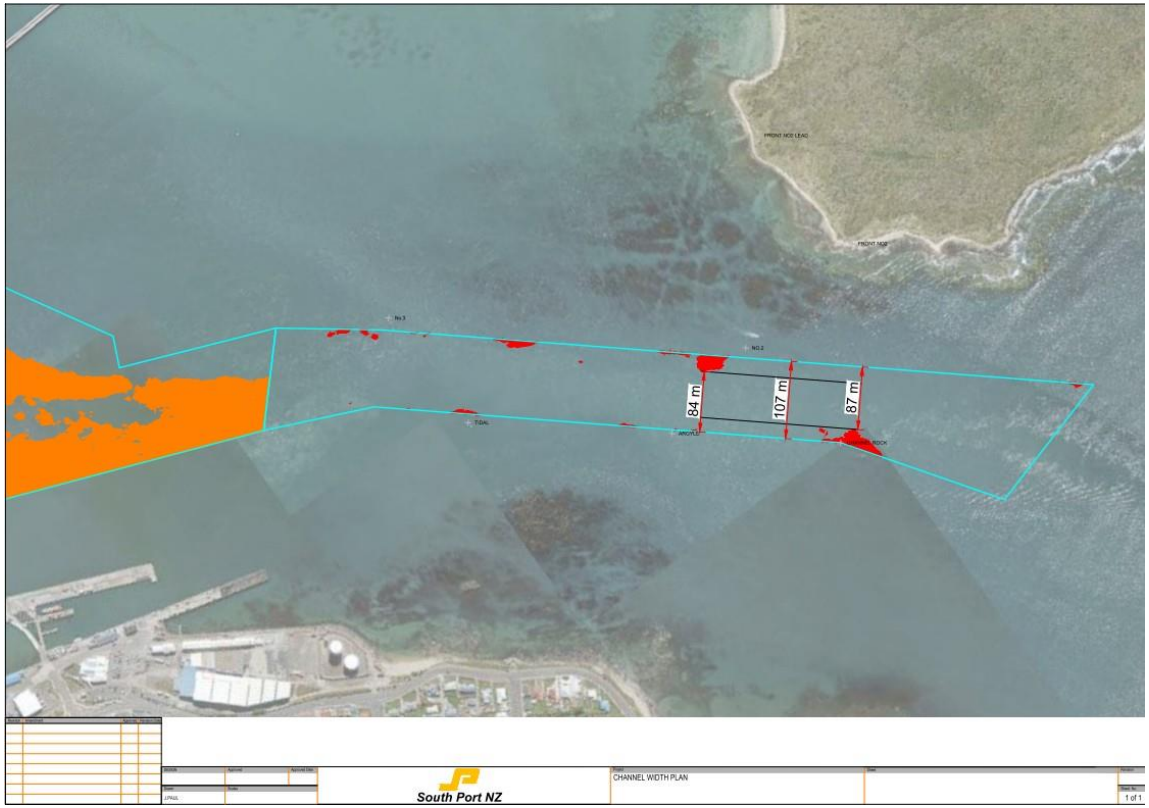

Figure 2 – Existing widths of entrance channel

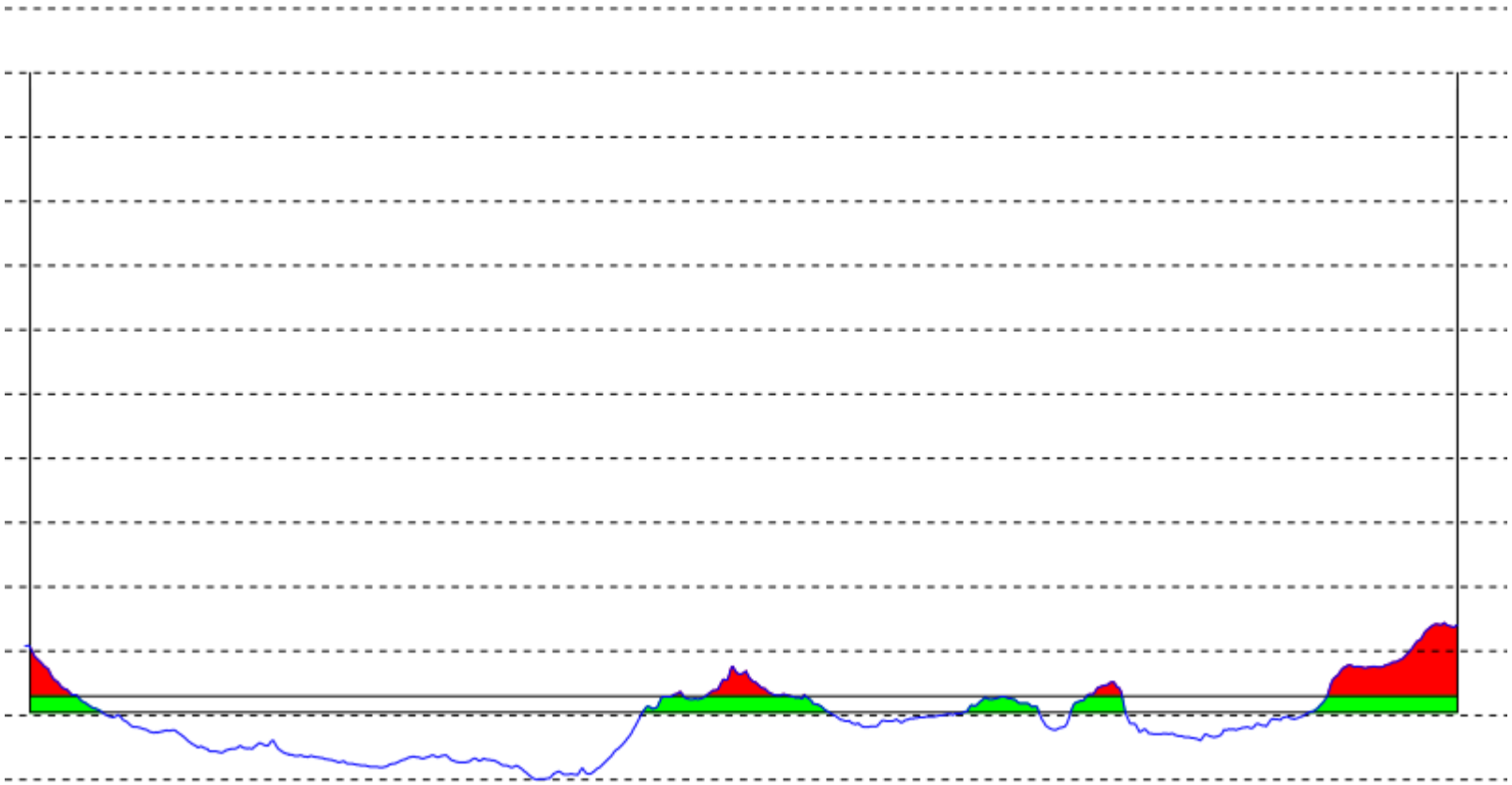

Figure 3 – Typical cross section of entrance channel (high spots)

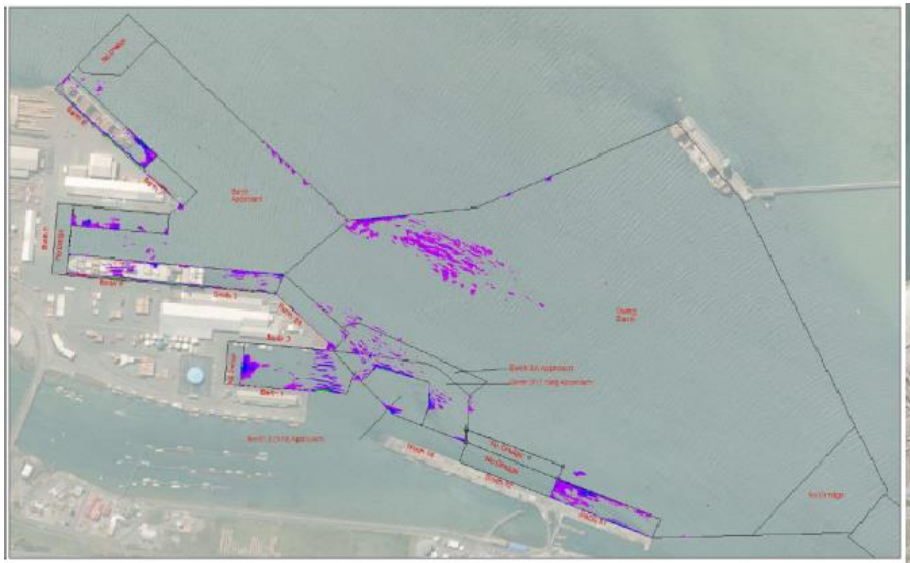

Figure 4 (a) – Areas dredged in 2020 (swinging basin & berth pockets) **Figure 4 (b)** – Proposed areas for capital dredging