

Appendix 8

Coastal Hazards Evidence - Bruce Gabites (Environment Canterbury)

**Before the Independent Hearing Panel appointed by
the Canterbury Regional Council**

IN THE MATTER OF The Resource Management Act
1991

AND

IN THE MATTER OF Application CRC242267 by the
Christchurch City Council to install a series of coastal
erosion and inundation protection works along the
estuary edge between South New Brighton and
Southshore.

Addendum to Section 42A Officer's Report

Report of Bruce Martin Gabites

Introduction

Background

1. This report forms part of the Canterbury Regional Council's (CRC) audit of the assessment of environmental effects (AEE) provided by the Christchurch City Council (the applicant) in support of resource consent applications for a series of coastal erosion and inundation protection works along the estuary edge between South New Brighton and Southshore.
2. This report will provide the decision-maker with information and advice related to:
 - a. the actual and potential effects of the proposed activities on nearshore coastal processes
3. While not required for a Council hearing for a resource consent application, I have read the Code of Conduct for Expert Witnesses in giving evidence to the Environment Court. I agree to comply with that code when giving evidence to the Hearing Panel in this matter. All my evidence is within my expertise and I have considered and stated all material facts known to me which might alter or qualify the opinions I express.

Qualifications

4. I have been employed by the Canterbury Regional Council (CRC) as a coastal hazard scientist since 2003 and have been responsible for monitoring rates of change along the Canterbury coast since this time. I hold a Master of Science degree in Marine Science from the University of Otago.

Scope of Report

5. This report is prepared under the provisions of section 42A of the Resource Management Act 1991 (RMA). This section allows a council officer or consultant to provide a report to the decision-maker(s) on a resource consent application made to the council and allows the decision-maker(s) to consider the report at the hearing. Section 41(4) of the RMA allows the decision-maker(s) to request and receive from any person

who makes a report under Section 42A *"any information or advice that is relevant and reasonably necessary to determine the application"*.

6. This report is supplementary to the Section 42A Report prepared by the CRC for the above resource consent applications. Full details of the consent applications are provided in that report. To carry out this audit of the consent applications I have considered the relevant sections of the assessment of effects on the environment (AEE) submitted by the applicant, including its technical appendices. I have also reviewed further information that was provided by the applicant on the 16th of February 2025. Finally, I have also taken into account relevant issues raised by submitters in relation to the effects I have considered in this report.

Assessment of Receiving Environment

7. The Christchurch City Council is proposing to construct and install a series of coastal protection structures along the Avon-Heathcote Estuary edge and adjoining land between South New Brighton and Southshore to lessen the impacts of coastal hazards on the local community.
8. A large part of the estuary side of Southshore and South New Brighton was purchased by Land Information New Zealand (LINZ) on behalf of the government following the Christchurch Earthquake Sequence (CES), and an inundation bund was constructed on this 'red-zoned' land as well as adjoining properties to provide protection to the surrounding areas from seawater inundation.
9. The local community is concerned about two coastal hazards, both of which will be addressed in this project. The first hazard is the loss of land along the estuary edge due to coastal erosion, while the second hazard is inundation of low-lying land around the South New Brighton and Southshore area by seawater, which is caused by high estuary water levels or a combination of high water levels and locally generated waves.
10. In order to address these two coastal hazards, the Council is proposing to construct a series of gabion baskets, rock revetments and cobble beaches to armour and protect the shoreline against further future coastal erosion.
11. The current estuary edge in this area predominantly contains a series of ad-hoc and informal protection structures that were presumably installed by the previous adjacent landowners at various times and to varying construction and engineering standards and with a wide variety of materials.
12. A large portion of these existing or remnant protection structures along this stretch of coastline are in a poor condition and many individual structures have failed during, and as a result of the Christchurch Earthquake Sequence.
13. In addition, and due to land subsidence that occurred during the Christchurch Earthquake Sequence, many of these protection structures are now at levels where they are overtopped by waves and this combination of factors has led to erosion of the land behind.
14. The initial application planned to encapsulate and/or reuse the remnant protection structures into the new erosion protection works, however recent amendments to the proposal will see the remnant protection structures removed altogether with the edge protection structures and the inundation bund shifted inland.
15. The second intention of this proposal is to replace the existing LINZ bund with an engineered bund along the approximate orientation of the existing bund to a level of 11.5 m CDD (Christchurch Drainage Datum). This height has been chosen to be consistent with similar bunds and to satisfy the CCC requirements of a minimum bund level of 11.4 m CDD. A height of 11.5 m CDD will provide 0.1 m of freeboard above the Council's

minimum bund level of 11.4 m CDD to allow for construction tolerance and general settlement.

16. The edge protection structures are planned to be seaward of the inundation bund to provide protection to the inundation bund during high water level and coastal storm events.
17. The works that are proposed to occur in this project have a design life of 20 years which are intended to provide sufficient time for the CCC to undertake appropriate consultation and planning with the local community so that a series of future adaptation measures and strategies can be implemented to ensure the resilience of the community is maintained into the future.

Assessment of Effects on the Environment

18. I have read the Southshore and South New Brighton Park Preliminary Design Report (Appendix D) of the consent application and make the following comments on the information contained within it.
19. The design basis for the inundation bund is given in section 3.1.2 (Pg 8) and the criteria for the bund include the following features:
 - Design level of protection to be able to be maintained for 20 years to allow time for decisions with communities on longer-term adaptative planning responses to climate change and sea level rise to be made and implemented. The expected physical lifetime of the structures will be longer than 20 years, however, increased maintenance and repairs may be required to maintain the structures after this timeframe.
 - Maximum storm scenario (waves and water level): Protection from erosion in a 50-year return period (2% AEP) extreme estuary water level combined with waves generated by a 50-year return period (2% AEP) south-west or westerly wind event blowing across the estuary.
 - No allowance for increased water levels due to sea level rise, or other climate change factors (e.g. increased wind climate, changed fluvial/pluvial flood frequency).
 - No allowance for further land subsidence along the shoreline.
 - Bund structures will be designed for standard static conditions but not be designed to withstand seismic load cases and will require inspection and maintenance following a seismic event.
20. One of the key pieces of information within the design report in my opinion is the estuary water levels provided in Section 2.3 and specifically within Table 2-1 (Pg 5) which is included below.

Table 2-1. Storm Tide Levels at Bridge St from Mulgor (2018) and GHD (2021)

Reference	Mean Sea Level (MSL)	Mean High Water Springs (MHWS)	Highest Astronomical Tide (HAT)	50-y RP	100-y RP	1000-y RP
Mulgor (2018)	9.21 m CDD	10.26 m CDD	10.43 m CDD	11.06 m CDD	11.14 m CDD	11.39 m CDD
GHD (2021)	-	-	-	11.12 m CDD	11.19 m CDD	11.43 m CDD

Note: CDD = Christchurch Drainage Datum

21. These values are the basis for the design level of the inundation bund and are also one of the key parameters in the design criteria for determining the amount of damage and the level of overtopping to the rock revetment. They therefore underpin the entire project and I consider it appropriate that they be examined.

22. Water levels within the Avon/Heathcote Ihutai Estuary have been measured by the Christchurch City Council at the Bridge St recorder site since 1997, and this data set has been synthetically extended back to 1960 (Jacobs 2019) to give a longer term record, and this longer record was used by Mulgor (2018) and GHD (2021) to calculate projected water levels of the estuary for a specified series of return period events. I have no reason to suspect that the values in this table are incorrect, and I therefore consider that these values are accurate and appropriate to use.
23. The highlighted values shown in Table 2-1 above are those that have been used in the design report and of particular note in this table is the height for a 50 year return period water level event which as calculated by GHD (2021) is 11.12 m CDD (Christchurch Drainage Datum).
24. The new inundation bund in Southshore and landward of the South New Brighton Park will be built to a level of 11.5 m CDD to be consistent with similar bunds and to satisfy the CCC requirements of a minimum bund level of 11.4 m CDD. It is expected that the build level of 11.5 m CDD will provide sufficient allowance for post construction settlement and variations in survey tolerances of up to 100 mm to occur so that the finished bund will still satisfy the CCC bund height requirements.
25. Based on the calculated water levels shown in Table 2-1, the inundation bund height of 11.5 m CDD will provide approximately 380 mm of freeboard above the 50 year ARI estuary water level event, approximately 310 mm of freeboard above the 100 year ARI water level, and approximately 230 mm of freeboard above the 200 year ARI estuary water level. The finished bund will provide approximately 470 mm of freeboard above the 20 year ARI estuary water level and is in my opinion, unlikely to be overtopped within the 20 year consenting timeframe.
26. The bund level of 11.5 m CDD effectively provides protection for estuary water level events with return periods of between 500 and 1000 years without taking into account changes in sea level due to climate change factors, or changes in ground levels.
27. A key requirement of the inundation bund is to provide protection against erosion in a 1-in-50 year estuary water level event in combination with a 1-in-50 year wave event.
28. An analysis of a 1-in-50 year return period wave event was not provided within the design report, however a slightly lower 1-in-20 year return period wave event had been calculated in an earlier study by Jacobs (2020). In this report, Jacobs (2020) found that waves with significant heights of approximately 0.7 m and periods of 3.1 s could be generated from winds blowing from the west or south-west across the estuary, and the resulting wave run-up elevations for these waves were calculated to reach 0.2 m above the extreme water levels in this event. Given this information, I would anticipate that a longer 1-in-50 year return period wave event would have slightly larger wave heights, longer periods and therefore higher run-up heights than those for a 1-in-20 year event.
29. If a combined wave and water level event were to occur at the same time within the estuary, and based on 0.2 m of wave run-up occurring in a 1-in-20 year return period wave event within the estuary, the proposed inundation bund built to a level of 11.5 m CDD is also likely to provide protection during combined events where the water level is at an ARI level of up to 1 in 200 years.
30. Assuming that a slightly larger amount of wave run-up were to occur in a 1-in-50 year wave event, the proposed inundation bund built to a level of 11.5 m CDD is also in my opinion, likely to provide protection during combined events where the water level is at an ARI level of up to 1 in 100 years.
31. A 1-in-50 year water level event on its own has an approximately 33% probability of occurring over the next 20 years (https://www.weather.gov/epz/wxcalc_floodperiod). Theoretically, a 1-in-50 year wave event has the same probability of occurring over the

same timeframe as the water level event, however I consider that there is a relatively high level of dependence between the estuary water level and the likelihood of a high wave event. In my opinion, high wave events are more likely to occur during high estuary water levels, however there also remains a level of independence between the two factors as a high estuary water level does not necessarily mean that a high wave event will also occur.

32. In my opinion, the probability of both events occurring concurrently will be less than the 33% probability of each event occurring on its own, however I also consider that the probability of both events occurring concurrently will also be noticeably higher than if the two events were treated as being completely independent of each other and simply multiplied together. If such a calculation were performed, the resulting event would be a 1-in-2500 year event (0.04% AEP event), which has a 0.8% probability of occurring within the next 20 years.
33. I therefore consider the use of a 1-in-50 year estuary water level event in combination with a 1-in-50 year wave event to be overly conservative considering that the design life timeframes for the proposed erosion protection structures are for 20 years. It is acknowledged in the design basis that the expected physical lifetime of the structures will be longer than 20 years, and that after this time, there may be a requirement for increased maintenance and repairs to occur and be undertaken in order to continue to provide a sufficient level of protection to the local community.
34. One of the key points of the design basis was that no allowance was made for climate change considerations such as increased water levels due to sea level rise, or other climate change factors (e.g. increased wind climate, changed fluvial/pluvial flood frequency). No allowance was also made for land subsidence along the shoreline.
35. The reason to not include climate change effects/SLR at the design stage was taken by the CCC after discussions with the local community that have been ongoing since the Christchurch Earthquake Sequence. What is being proposed in this application is therefore a relatively short-term solution that is being taken to deal with the impacts of the Christchurch earthquakes and to allow the CCC to consult further with the local community about future adaptation solutions to climate change.
36. If increases in sea level due to climate change effects and changes in local ground level are taken into account (such as from the NZ Searise project), this is likely to increase the likelihood of an event occurring and therefore decrease the return period over the design life of the structures. However, I do not believe that the changes in the level of the sea or changes in the ground levels in the wider area over the next 20 years will have any material impact on the protection afforded to the community in this area by the construction of the inundation bund to this height. I therefore consider that a bund height of 11.5 m CDD will provide protection against inundation for at least the next 20 years even with sea level and ground level changes.
37. The requirements for the inundation bund as specified by the CCC are shown in section 3.2.1 (Pg 9) of the Design report and these are:
 - Construct an engineered bund to RL 11.5 m beside the existing LINZ bund alignment in Southshore, and between the Jetty near Beatty Street and the southern end of the campground on Halsey Street in South New Brighton Park, the same as is provided along the lower reaches of the Ōtākaro Avon River
 - The new bund will be approximately 5 m set back from the erosion protection or behind the existing LINZ bund in Southshore, whichever is further from the edge. The South New Brighton Park bund has been set back from the edge by between 40 to 180 metres.

38. The proposed orientation of the inundation bund is generally along the alignment of the existing LINZ bund through the Residential Red Zone in Southshore to avoid overlooking adjoining properties and to allow the ongoing use of the land in its current state. For the South New Brighton Park area, the original alignment of the proposed inundation bund was through coastal forest and generally followed existing paths to minimise the impacts on trees. For both locations, the ends of the inundation bunds are proposed to tie into existing areas of high ground to provide a continuous level of 11.5 m CDD.
39. Early in the Design report (Pg 1), it is stated that: "The existing LINZ bund was constructed as a temporary and non-engineered measure after the demolition of the RRZ (Residential Red Zone) properties to replace some of the inundation protection previously provided by private property boundary structures. This was generally constructed of site-won topsoil and did not respond to a specific design level and some locations along the LINZ bund are lower than the projected 50 year return period tide level."
40. The height and position of the LINZ bund along Southshore was noted in the earlier Jacobs (2019) Estuary edge condition inventory report (Section 7.1.2 – Pg 47) and this section stated that: "Within cleared RRZ, LINZ as the post CES land owner, constructed a temporary bund (O1-A) to a general elevation of 11.2 m following the March 2014 storm tide event (10.90 m) to provide protection from estuary flooding. At the time of construction, the bund was not continuous; as did not include the road ends which were council land. However, following flooding in these location in extreme storm tides in July 2017 (10.96 m), these gaps were filled by council as emergency works, such that the bund now provides continuous protection over a 1.6 km length from Godwit Street to south of Tern Street. As reported by Ch2M Beca (2019) the bund comprises of grassed soil section (constructed by LINZ) and aggregate or quarry run sections (constructed by council)."
41. The proposed alignment of the inundation bund has therefore been chosen for reasons that appear to have little to do with fulfilling a specific inundation hazard requirement.
42. The protection structures for the inundation bund have been designed so that less than 5% damage occurs to the armour units during a coincident 50-year wave and estuary water level event (section 3.3.2.1 of the Preliminary design report). Table 3-1 specifies the criteria used in the assessment and design of the rock revetment.

Table 3-1. Damage and overtopping criteria for the rock revetment

Return Period (years)	Water level (m CDD)	Significant wave height, Hs (m)	Significant wave period, Ts (s)	Armour unit damage criteria	Overtopping damage criteria
50	11.12	0.8	3.2	No damage	< 20 l/s/m at the revetment (no significant erosion behind the structure)

43. These two considerations – the proposed alignment of the inundation bund and the requirement for less than 5% damage to occur to the erosion protection structures – along with the use of a concurrent 1-in-50 year estuary water level event and a 1-in-50 year wave event within the estuary has driven the design of the erosion protection structures and to a large degree, also determined the location of the erosion protection structures.
44. Three different structures have been proposed to provide protection against erosion for different sections of the coastline within the project area, with these structures being a series of gabion baskets, a rock revetment, and a cobble beach. All three protection structures are proposed to have a crest height of 11.3 m CDD and have been designed

so that wave run-up may overtop them during large storm events without causing significant damage to the structures.

45. The design of the erosion protection works is such that additional material can be added to the structure at some point into the future should future sea levels require this to happen.
46. At Southshore, a rock revetment is proposed for the majority of the shoreline in this area, with a 330 m section of cobble beach proposed for the area between 62b and 88 Rockinghorse Rd.
47. A series of gabion baskets have been proposed for the South New Brighton Park area from the boat ramp to 50 m north of Jellicoe Marsh to provide protection to a series of middens which have historic and cultural heritage values so that they can be protected and preserved. These baskets have also been chosen for their small footprint which minimises the impacts on the ecology of the estuary mudflats while still being able to provide adequate protection against erosion.
48. A cobble beach was originally proposed for the southern end of this section of coast, however another recent amendment to the project will see the cobble beach replaced with a more naturalised, yet still engineered 'soft edge' shoreline. A recent amendment to the proposal would effectively see this area becoming a trial area for 'softer' engineered protection structures, and at the time of writing, will comprise a series of imported rock 'headlands' placed at regular intervals, with locally available beach material and imported sand used to create a series of SW facing beaches between the 'headlands'. Appropriate planting would also take place towards the back of the created beaches.
49. The cobble beach would however remain as an option for this area if the amount of future shoreline erosion is deemed greater than what the community is willing to withstand. As part of the trial of these proposed 'soft' engineering solutions, a series of yet to be determined 'failure triggers' or points at which the trial is deemed to have been unsuccessful in protecting the shoreline against erosion are to be included, and if or when these trigger points are reached, it is envisaged that the originally proposed cobble beach would be installed in this area.
50. It is acknowledged in the design report (Section 3.3.3.1 Pg 16) that: "A minimum median cobble size of $D_{n50} = 130$ mm is required at South New Brighton Park. Smaller depth limited wave conditions are estimated at Southshore due to the higher estuary bed elevation, and therefore the minimum required median cobble size is slightly less ($D_{n50} = 100$ mm)."
51. As already mentioned, the cobble beach option at South New Brighton Park is proposed to now become a 'backstop' option if or when a more natural 'soft edge' trial is deemed unsuccessful in this area. However, it is my opinion that if a conservative combination of wave and water level factors has been used in the design process and has found that a cobble beach will provide sufficient protection against coastal erosion for the next 20 years in the South New Brighton Park area where the combination of water, wave and river channel processes are likely to be greatest within the estuary, I see no reason from a coastal process and hazard assessment perspective why a 'harder' engineered rock revetment is therefore required for the majority of the Southshore estuary shoreline.
52. The higher estuary bed elevations around Southshore will effectively have the impact of reducing the wave heights in this area, and as this area is also further from where the main channel of the Avon River enters the estuary, I consider it likely that the impacts from the river channel are also likely to be lower. The wind fetch across the estuary from southerly through to south westerly wind directions is also slightly lower for the Southshore area (refer to section 4.2.3.1 of the Coastal processes assessment) and I therefore believe that the Southshore area is likely to be subject to generally less

energetic wave, water and river channel processes when compared to those adjacent to the South New Brighton Park area.

53. It is my opinion that a slightly 'softer' engineered cobble beach along the Southshore estuary coastline would also provide sufficient protection against coastal erosion for this area, and the selection of the rock revetment along the majority of the Southshore estuary shoreline appears excessive given the wave and water conditions that are to be mitigated against.
54. I have also read through the Coastal Processes and Natural Hazards Assessment in support of Resource Consent Application report (Appendix I) of the consent application and make the following comments on the information contained within it.
55. In my opinion, the key parts of this report are located within Section 4. This section provides a thorough assessment of the coastal processes that are operating within the project area and wider estuary environment, and in my opinion, the author uses appropriate data and sources of information to assess the environment in sufficient detail. I consider that the information provided within this section is therefore appropriate for the scale and location of the proposed activities, accurate, relevant and sufficiently detailed for me to make an assessment of the potential effects that the proposed structures may have on the coastal environment.
56. The assessment is limited in directly assessing the impacts of climate change and SLR, however climate change effects were considered in the amounts of projected future coastal erosion around the estuary edge (section 4.2.6 – Pg 29), as well as in the effectiveness of the inundation bund at the end of the proposed consent duration (section 5.1.5 – Pg 38).
57. The extreme estuary water levels are shown in Section 4.2.3 of the report, and as these values are the same as those used in Section 2.3 of the Design report, I see no need to repeat my analysis of these here.
58. The estuary edge has been subject to a number of investigations and reports since the earthquakes, including the Avon-Heathcote Ihutai Estuary Edge Condition Inventory report which was carried out by Jacobs in 2019. This particular report provides a detailed investigation into the condition and height of the various edge structures from North of Bridge Street through to the South Brighton Spit Tip, and it also quantifies the amount of erosion that has occurred since the CES by using the August 2010 estuary edge position as the baseline against which the amount of erosion since has been measured against. Due to its comprehensiveness and relatively recent assessment, I consider that it contains relevant information that is pertinent to this application.
59. The August 2010 shoreline position for the majority of the Southshore estuary coastline is not the same as the historic unmodified and therefore "natural" estuary shoreline of the 1950's or earlier. Numerous reclamations and protective structures have clearly been installed and undertaken since the 1950's which have encroached into the estuary and subsequently pushed the estuary shoreline further seaward. The 2010 shoreline is therefore noticeably different to the 1950's shoreline and generally further seaward, so by choosing the 2010 shoreline position as the baseline against which shoreline change has been measured, in many locations land that has been reclaimed between the 1950's and 2010 will appear to have been 'lost' since 2010, even if the erosion of that land since 2010 means that the shoreline is now effectively in the same position as it could have been if the land was not reclaimed in the first place.
60. The Jacobs 2019 shoreline assessment report concluded that 40% of the 7.1 km shoreline between South New Brighton and south of Tern St had been stable (+/- 1 m) since 2010, with a further 34% having undergone erosion since February 2011. The majority of the erosion that had occurred in this area was less than 4 m, with only 330

m (5%) of the 7.1 km of shoreline between South New Brighton and south of Tern St experiencing erosion of greater than 4 meters.

61. For the Southshore area, 37% of the shoreline behind the existing structures along the Godwit Street to south of Tern Street shoreline has eroded since the CES, with the amount of erosion being generally less than 4 m as it was concluded that the remnant protection structures still provide some degree of erosion protection. Erosion of greater than 4 m was only observed for a 40 m stretch of coastline immediately south of Godwit Street. Erosion was found to be prominent around areas where there were gaps in the protective structures, and in some instances, these areas of localised erosion have been informally filled with loose rubble and other material to prevent any further erosion.
62. The Jacobs 2019 shoreline assessment noted 75% of the South New Brighton Park area had suffered erosion, with the areas of highest erosion corresponding to the locations where the elevations of the reno mattresses were at their lowest.
63. One of the key sections of the natural hazards assessment report is Section 4.2.6, which specifies the projected amounts of future coastal erosion that may occur at given dates in the future under various amounts of sea level rise. The information contained in this section primarily comes from a report carried out by Tonkin & Taylor in their 2021 coastal hazards assessment for the Christchurch City Council. I have reviewed the information in this report by Tonkin & Taylor and consider that the values they have used for calculating amounts of change within the Avon-Heathcote estuary to be appropriate. I therefore am comfortable with the values for the various parameters (shown in Table 4.24 of T&T 2021 Pg 81) that are used in the calculations of the Area Susceptible to Coastal Erosion around the Avon-Heathcote estuary (Table 5.4 on page 111 of T&T 2021) and which are also summarised in Table 4.2 (Pg 29) of the natural hazards assessment report shown below.

Table 4.2: Summary of projected future coastal erosion produced by Tonkin & Taylor (2021) for Southshore from the combination of SLR, short term storm cut and extrapolation of long-term rates. Greyed boxes are most relevant estimates for the design life of this project.

	2050 (66%) ⁽¹⁾		2080 (66%)		2130 (66%)		
	0.2 m SLR	0.4m SLR	0.4m SLR	0.8m SLR	0.4m SLR	1m SLR	1.5m SLR
Southshore (T&T Cell 16; Plover to Tern Street)	-5 m	-8 m	-6 m	-12 m	-4 m	-12 m	-13 m
Southshore (T&T Cell 17; Plover to Ebbtide Street)	-11 m	-14 m	-18 m	-24 m	-26 m	-34 m	-39 m

64. I do note that the T&T approach to future coastal erosion involves the use of a 'banks down' scenario where the existing protection structures are assumed to not be present. As the existing structures still have some protective function against coastal erosion, I consider the projected amounts of future erosion to be conservative if the structures remain as they presently are, however I also note that recent changes to the proposal now include the removal of these structures. In light of this change, I consider the use of the 'banks down' approach and therefore also the projected amounts of future coastal erosion to be appropriate.
65. I also note that the values for the storm cut distances within the T&T report (section 4.4.2 Pg 74 T&T (2021)) are considered to be conservative as these distances assume that an equilibrium beach profile is reached during a given storm. This approach therefore does not take into account the fact that an equilibrium profile may not be reached during the storm or alternatively assumes that an equilibrium profile is reached within the

storm's duration and without regard for whether it would be physically possible for the assumed changes to the beach profile to actually occur.

66. I also believe that the amount of future erosion is likely to be primarily driven by specific storm events rather than due to ongoing gradual erosion of the shoreline. As an example, the value of -5 m of erosion that is estimated to occur for Cell 16 through to 2050 with 0.2 m of SLR is composed of an estimated storm cut amount of 3 m coupled with additional erosion of 2 m due to SLR.
67. Overall, I consider that the information presented in this section of the report is accurate and I agree with the conclusion that erosion of between 5 to 11 m may potentially occur over the next 25 years through to 2050 if there is relative sea level rise of 0.2 m.
68. An important point to note about the amounts of future coastal erosion calculated within the T&T (2021) report and referenced here, is that the baseline against which the future erosion is measured from is the toe of the structure for Class 1 structures (significantly modified shorelines). This implies that the amount of erosion that could occur into the future is measured against the base of the existing structures along the Southshore coast, rather than from the current shoreline position. (section 3.2 pages 31-32 of T&T (2021). Any erosion that has subsequently occurred since the earthquakes could be considered to be expected to have occurred and therefore the amount of potential future erosion may be discounted by that which has already occurred.
69. The Jacobs 2019 estuary edge report found that: "The current LINZ inundation bund alignment is setback by 0 m to up to 20 m from the present-day edge." Further information on the distances between the LINZ bund and the estuary edge structures along Southshore are given in Section 7.3 of the Estuary edge condition inventory report (Jacobs 2019), and for the section of estuary coastline between Godwit and Heron St, section 7.3.1 (Pg 57) of the inventory report states: "The setback distance between the LINZ bund (O1) and the estuary edge varies between 0 – 15 m. The two areas where the bund is along the edge (44a Rockinghorse Rd and Heron St), it has been protected by council placed rock revetment."
70. Based on the projected amount of future coastal erosion between Plover and Ebbside St from the Tonkin & Taylor 2021 analysis shown in Table 4.2 through to 2050, I consider that the existing LINZ bund between Godwit and Heron St is unlikely to be subject to erosion within the next 20 years.
71. For the section of estuary shoreline between Heron St and Penguin Street, section 7.3.2 of the Estuary edge condition inventory report (Jacobs 2019) (Pg 57) states: "The setback distance between the LINZ bund and the edge structures varies between 10-20 m along this sub area."
72. I consider that an approximate 25 m length of the estuary shoreline seaward of #78 Rockinghorse Rd as well as a 20 m length of shoreline at the end of Penguin Street may be susceptible to erosion of the LINZ bund within the next 20 years if the projected amounts of future coastal erosion for the area between Plover and Ebbside Streets do occur.
73. For the section of estuary shoreline between Penguin Street and Plover St, section 7.3.3 of the Estuary edge condition inventory report (Jacobs 2019) (Pg 59) states: "The setback distance between the LINZ bund and the estuary edge structures is between 10-15 m along this sub area."
74. Using the projected amount of future coastal erosion between Plover and Ebbside St from the Tonkin & Taylor 2021 analysis shown in Table 4.2 through to 2050, I consider it unlikely that erosion of the existing LINZ bund will occur for the area between Penguin Street and Plover Street within the next 20 years.

75. For the section of estuary shoreline between Plover Street to Tern Street, section 7.3.4 of the Estuary edge condition inventory report (Jacobs 2019) (Pg 59) states: "The setback distance between the LINZ bund and the estuary edge structures in this sub-area is in the range of 8-15 m."
76. Using the projected amount of future coastal erosion between Plover and Tern St from the Tonkin & Taylor 2021 analysis shown in Table 4.2 through to 2050, I consider it unlikely that erosion of the existing LINZ bund will occur for the area between Plover Street and Tern Street within the next 20 years.
77. Lastly, for the area South of Tern Street, section 7.3.5 (Pg 59) of the Estuary edge condition inventory report (Jacobs 2019) stated: "The LINZ bund terminates approximately 150 m from the southern end of this area, being is (sic) setback from the estuary edge around 15 m at Tern Street and around 60 m at its southern end."
78. Using the projected amount of future coastal erosion between Plover and Tern St from the Tonkin & Taylor 2021 analysis shown in Table 4.2 through to 2050, I consider it unlikely that erosion of the existing LINZ bund will occur for the area south of Tern Street within the next 20 years.
79. Overall, apart from two areas of between 20 to 25 m each between Heron and Penguin Streets, it is my opinion that the current position of the LINZ bund along Southshore is located a sufficient distance landward of the existing estuary edge structures that the LINZ bund is unlikely to be subject to coastal erosion for the next 20 years, even with relative sea level rise of up to 0.2 m. Put another way, I do not consider that the projected amounts of estuary edge erosion along the Southshore estuary shoreline are likely to result in erosion of the existing LINZ inundation bund in this area within the next 20 years, and I therefore struggle to see why hard coastal erosion protection works are required.
80. Another way to consider the information presented is that if the proposed inundation bund along Southshore was located 5 m or more further landward of the existing LINZ bund wherever possible, it is my opinion that there would likely be sufficient space for a natural estuary edge to develop. In my opinion, there is time and space for natural coastal, estuarine and ecological processes, including sea level rise impacts associated with climate change and ground level changes to shape the natural estuary edge without impacting on the level of protection afforded to the local community from the proposed inundation bund and necessitating the need for erosion protection works for the next 20 years.
81. I am generally in agreement with the conclusions reached in Sections 5 and 6 of the Coastal Processes and Natural Hazards Assessment report (Appendix I) and from the information provided, I don't expect that there will be significant impacts on coastal processes from the proposed activities either during construction or once the works have been completed.
82. The estuary is a relatively low energy environment, and the estuary edge is away from the main channels from the Avon/Ōtākaro and Heathcote/Ōpāwaho and therefore generally unaffected by river flow. The estuary edge is generally only affected by coastal processes around high tide and during storm tide events, so there is only a relatively short window over which coastal processes can act upon the estuary edge.
83. In my opinion, this time element is likely to limit the scale of any impacts that do arise to being relatively small, and localised. The structures to be built along Southshore will form a continuous structure and will be tied into existing structures and higher ground at the southern end of Southshore. I therefore believe that the chance of 'end effects' occurring will be low and even if such effects do occur, I believe that they'll be relatively small and localised due to the low energy environment and the short window through which waves can impact upon the coast.

84. If consent were granted for the erosion protection structures, I also don't believe that there will be many issues during construction from a coastal hazard perspective unless there is a significant storm or other natural hazard event that occurs while construction is occurring. The erosion protection works will occur in a gradual and staged manner along the coast as tides and weather windows allow, and one of the requirements for construction is that the edge won't be left unprotected during construction. This requirement should therefore limit the amount of edge excavation and erosion protection that can get done, to that which can be achieved in a day.
85. As the erosion protection works progress along the coast, there is potential for scour of the 'softer' unprotected shoreline to occur where this butts against the 'harder' erosion protection works. This risk will exist for the duration of the construction of the erosion protection works and essentially move along the coast as the works progress, however given the generally low energy environment in which the works will be occurring and the relatively small window over which the coast could be impacted, I consider that this risk can be mitigated by the construction methods and earlier mentioned edge protection requirement.
86. Based on the proposed design plans, and assuming that the proposed works are carried out by a competent and experienced earthworks contractor to the specifications, depths and heights, and with the proposed materials shown in the design document and the accompanying design drawings, I consider that the proposed inundation and erosion protection works will provide sufficient protection for well in excess of the design life of 20 years.
87. I am generally supportive of the approach that has been proposed for dealing with the impacts of coastal erosion and coastal inundation for the South New Brighton Park area. The coastal erosion and inundation issues have been separated out for this area with the inundation bund located between 40 and 180 m landward of the estuary edge. At these distances from the estuary edge, I consider it highly unlikely that this bund will be subject to erosion from coastal processes within the next 20 years, and particularly so once the gabion baskets to protect the historic middens are installed.
88. The design plans show that the inundation bund in the South New Brighton Park area will tie into areas of natural high ground at both ends of the bund. It is therefore my opinion that the inundation bund will provide a sufficient level of protection from inundation to the South New Brighton Park area.
89. One of the key documents for works in the coastal area is the New Zealand Coastal Policy Statement (2010) which contains a series of objectives and policies to direct the types and locations of particular activities. An assessment of this application against the relevant NZCPS objectives and policies is given in Section 10.3.4 of the consent application document. In my opinion, the most relevant NZCPS policies to this application are policies 24 to 27 as these underpin Objective 5 which relates to coastal hazard risks and climate change.
90. In my opinion, the proposed erosion protection structures in this project run contrary to clause e of NZCPS Policy 25 which specifies that hard protection structures are to be discouraged in areas potentially affected by coastal hazards over the next 100 years. This section of the policy also promotes the use of natural defences which in my opinion is also not achieved by the proposed erosion protection structures. As there is space available along the majority of Southshore, it is my opinion that if sufficient time were given, natural processes are likely to eventually create a natural estuary shoreline which will offer its own level of protection to this area against coastal erosion. I consider the option of 'doing nothing' to be one way of promoting natural defences.
91. I also consider that the replacement of the proposed inundation bund along the orientation of the existing LINZ bund does not achieve the intended outcome of clauses

- a, c and d of Policy 25 which are to avoid increasing the risk of social, environmental and economic harm from coastal hazards; encourage redevelopment or change in land use where that would reduce the risk of adverse effects from coastal hazards, including managed retreat by relocation or removal of existing structures or their abandonment in extreme circumstances, and designing for relocatability or recoverability from hazard events; and encourage the location of infrastructure away from areas of hazard risk where practicable.
92. Policy 27 of the NZCPS provides a range of strategies for protecting significant existing development from coastal hazard risk. A range of options for reducing risk are to be assessed as part of this policy, and when evaluating those options, clause 2a focuses “on approaches to risk management that reduce the need for hard protection structures and similar engineering interventions”. Additionally, clause 3 states that: “Where hard protection structures are considered to be necessary, ensure that the form and location of any structures are designed to minimise adverse effects on the coastal environment.”
93. In my opinion, if the inundation bund was located further landward than what is proposed in this application and thereby satisfying the requirements of clause d of NZCPS Policy 25, this would likely reduce the requirement for the accompanying erosion protection structures and thereby also satisfy the requirements of clauses a, b, d and e of NZCPS Policy 25. I also consider that locating the inundation bund landward will be consistent with and also satisfy clauses 1, 2 and 3 of NZCPS Policy 27.
94. Lastly, if the inundation bund was located further landward to satisfy Policies 25 and 27, then this would in my opinion, also be consistent with NZCPS Policy 26.

Conclusions

95. I consider the data and information used in the Design and the Coastal Processes and hazards assessment reports to be appropriate and relevant, and I am satisfied that the reports have provided sufficient detail for assessments of the impacts of the proposed activities on coastal processes within the Avon-Heathcote estuary.
96. No allowance for increased water levels due to sea level rise or other climate change impacts or changes in ground elevations were included in the design process. The reason to not include climate change effects/SLR at the design stage was taken by the CCC after discussions with the local community that have been ongoing since the Christchurch Earthquake Sequence.
97. What is being proposed in this application is therefore a relatively short-term solution to deal with the impacts of the Christchurch earthquakes while the CCC consult further with the local community on long-term climate adaptation options.
98. I consider the use of a storm scenario of a 1-in-50 year estuary water level event occurring concurrently with a 1-in-50 year wave event as a design level for the inundation bund to be overly conservative for a design period of 20 years.
99. It is my opinion that the proposed height of the inundation bund of 11.5 m CDD for both South New Brighton Park and Southshore will provide protection from estuary water level events of between 500 and 1000 years without taking into account the impacts of climate change or local land changes. When built to this height, it is also likely to provide protection against inundation during a storm scenario of a 1-in-100 year estuary water level event occurring concurrently with a 1-in-50 year wave event.
100. I do not believe that the changes in the level of the sea or changes in the ground levels in the wider area over the next 20 years will have any material impact on the protection afforded to the community in this area by the construction of the inundation bund to this

height. I therefore consider that a bund height of 11.5 m CDD will provide protection against inundation for at least the next 20 years even with sea level and ground level changes.

101. The proposed orientation of the inundation bund is generally along the alignment of the existing LINZ bund through the Residential Red Zone in Southshore to avoid overlooking adjoining properties and to allow the ongoing use of the land in its current state. For the South New Brighton Park area, the original alignment of the proposed inundation bund was through coastal forest and generally followed existing paths to minimise the impacts on trees.
102. The proposed alignment of the inundation bund has therefore been chosen for reasons that appear to have little to do with fulfilling a specific inundation hazard requirement.
103. Three different structures have been proposed to provide protection to the inundation bund against erosion for different sections of the coastline within the project area, with these structures being a series of gabion baskets, a rock revetment, and a cobble beach. All three protection structures are proposed to have a crest height of 11.3 m CDD and have been designed so that wave run-up may overtop them during large storm events without causing significant damage to the structures.
104. The design of the erosion protection works is such that additional material can be added to the structure at some point into the future should future sea levels require this to happen.
105. A cobble beach has been found to provide an appropriate level of protection against coastal erosion to the South New Brighton Park area and parts of Southshore over the next 20 years. If this conclusion has been reached for a conservative storm scenario in a relatively energetic area of the Avon-Heathcote estuary, it is my opinion that a similar structure would also provide sufficient protection against coastal erosion in the generally less energetic area of Southshore.
106. It is my opinion that a slightly 'softer' engineered cobble beach along the Southshore estuary coastline would also provide sufficient protection against coastal erosion for this area, and the selection of the rock revetment along the majority of the Southshore estuary shoreline appears excessive given the conditions that are to be mitigated against.
107. I consider that the information contained within the Tonkin & Taylor (2021) report into coastal hazards for the Christchurch City Council to be accurate and appropriate and agree with the findings of this report that erosion of between 5 and 11 m could potentially occur along the Southshore and South New Brighton shorelines over the next 25 years if relative sea level rise of 0.2 m occurs over this time.
108. I consider that erosion of the estuary shoreline is most likely to occur during episodic storm events as opposed to occurring at a low gradual rate.
109. I also believe that the existing position of the LINZ bund along Southshore is located sufficiently landward of the existing coastal protection structures in this area that the bund is unlikely to be subject to erosion within the next 20 years, even considering the changes that may occur due to sea level and local land level changes over this time.
110. Another way to consider the information presented is that if the proposed inundation bund along Southshore was located 5 m further landward of the existing LINZ bund wherever possible, it is my opinion that there would likely be sufficient space and therefore time for natural coastal, estuarine and ecological processes, including sea level rise impacts associated with climate change and ground level changes to occur without impacting on the level of protection afforded to the local community from the proposed inundation bund and necessitating the need for erosion protection works for the next 20 years.

111. I therefore consider that there is sufficient time within the next 20 years for conversations with the local community on longer-term adaptation planning responses to be considered and implemented before any further inundation or erosion protection works are required.
112. If the proposed works proceed as designed, I believe that the level of protection that they will provide will far exceed either the design life or the consenting timeframe. I do not believe that they represent a short-term solution as given the design criteria that has been applied and the information that has been supplied, it is my opinion they will provide protection from inundation for in excess of 100 years, and protection against erosion for at least a similar timeframe. The design of the rock revetment also allows for additional material to be placed onto it in the future if required and has therefore been designed with a longer timeframe in mind. I consider that the proposed structures represent a significant upgrade to the pre-earthquake levels of protection from coastal erosion and inundation to the local community.
113. If the works proceed as proposed, I see that the requirement for future discussions around adaptation to changes caused by climate change effects and increased sea levels to essentially become redundant as the level of protection provided to the community from the proposed structures will ensure that future works would be unlikely to be required for the next approximately 100 years.
114. I am supportive of separating the coastal inundation hazard from the coastal erosion hazard as is proposed at South New Brighton Park and generally see no reason why a similar approach cannot be taken for Southshore. I see no justification from a coastal process or hazard perspective why these two hazards need to be linked together as they are along Southshore, particularly when there is in my opinion, land available on which the inundation bund could be constructed.
115. Assuming that the works will be carried out by a competent and experienced earthworks contractor to the proposed levels, widths and depths specified in the design report and drawings and using the specified materials and methods, I consider that the changes to the coastal processes within the estuary either during the construction phase, or once the works have been completed to be less than minor.
116. In my opinion, the proposed inundation and erosion protection structures run contrary to the New Zealand Coastal Policy Statement policies 25 and 27. Clause d of NZCPS Policy 25 encourages the location of infrastructure away from areas of hazard risk where practicable, while clause e specifies that hard protection structures are to be discouraged in areas potentially affected by coastal hazards over the next 100 years, while also promoting the use of natural defences.
117. I believe that if the inundation bund was located further landward than what is proposed in this application, the requirements of clause d of NZCPS Policy 25 would be satisfied, and this would in turn likely reduce the requirement for the accompanying erosion protection structures and thereby also satisfy the requirements of clauses a, b, d and e of NZCPS Policy 25. I also consider that locating the inundation bund landward would be consistent with and also satisfy clauses 1, 2 and 3 of NZCPS Policy 27, and by extension, also be consistent with NZCPS Policy 26.
118. My overall perception of the information that has been provided is that the coastal inundation and erosion protection works that have been proposed and requested by the local community and the location of these works along the Southshore coastline are predominantly done for reasons that are not to do with the current coastal processes or the potential future coastal hazards and impacts that may affect this area.

References

119. GHD (2021). LDRP097 Multi-Hazard Baseline Modelling Joint Risks of Pluvial and Tidal Flooding. Report prepared for Christchurch City Council.
 120. Jacobs (2019). Avon-Heathcote Ihutai Estuary Edge Condition Inventory. Report prepared for Christchurch City Council.
 121. Jacobs (2020). Erosion management option report, Southshore, Ihutai/Avon-Heathcote Estuary. Report prepared for Christchurch City Council.
 122. Mulgor (2018). Extreme sea levels at Christchurch Sites: EV1 Analysis. Report to Christchurch City Council. 16 pgs.
 123. Tonkin and Taylor (2021). Coastal hazard assessment for Christchurch District. Report prepared for Christchurch City Council.
 - 124.
- Jacobs (2023). Southshore and South New Brighton Park Preliminary Design Report. Report prepared for Christchurch City Council. Appendix D.
- Jacobs (2023). Coastal Processes and Natural Hazards Assessment in support of Recourse Consent Application. Report prepared for Christchurch City Council. Appendix I.

Appendix 9 – Draft Conditions

Draft Conditions (9/11/2025)

General

1. Except where varied by the conditions of this consent the development shall proceed in accordance with the information and plans submitted with the application, including the further information/amended plans submitted on +

List to be completed

2. The works authorised by this resource consent shall be located within the Project Footprint, Southshore and South New Brighton as shown on the Approved Consent Plans and are limited to the following works and associated ancillary activities, as set out in the Approved Consent Documents except where modified by any other condition of this consent:
 - a) Removal of an existing earth bund and existing structures;
 - b) Installation of an inundation bund;
 - c) Installation of cobble beach, rock revetment, gabion baskets and a soft edge beach area;
 - d) Installation of two stepped access points at Tern Street and Godwit Street;
 - e) Removal of trees and plants;
 - f) Associated earthworks and infrastructure;
 - g) Planting, footpaths, nature play and other landscape sundries as shown in the landscaping plans in the Approved Consent Plans;
 - h) Owles Terrace stockpile site; and
 - i) Maintenance of the structures provided for within in this condition.

Advice note re maintenance: For the purpose of this consent, maintenance means repairs required to repair damage and maintain the erosion protection works and inundation bund in good order.

3. The works authorised under this resource consent shall be completed in stages. The consent holder must notify the Head of Planning and Consents via email to rcmon@ccc.govt.nz when a new stage is proposed to commence or re-notify where works have ceased for a period of 8 weeks or longer.

The Consent Holder must, a minimum of 15 working days prior to the commencement or recommencement of works in any new or continuing stage, provide the Council with:

- a) A written notification detailing the proposed recommencement date and the specific stage(s) of work to be undertaken.
- b) An updated Construction Environmental Management Plan (CEMP) and any other relevant management plans required by the conditions of this consent highlighting any material changes to:
 - i. Construction methodology, sequencing or timing for the upcoming stage;
 - ii. Key personnel or contact details; and
 - iii. Any relevant environmental management practices pertinent to the upcoming stage (e.g., changes to erosion and sediment control measures).

No works are to commence/recommence on site until the updated plan/s are formally approved by the Council.

Pre-construction meeting

4. In the 15 working days prior to the commencement of construction and following the submission of all management plans required by the conditions of this consent, a pre-construction meeting must be held between the Canterbury Regional Council, the Christchurch City Council, the primary contractor, and the consent holder. At a minimum, the following shall be covered in the meeting:
 - a) Scheduling and staging of the works;
 - b) Responsibilities of all relevant parties;
 - c) Contact details for all relevant parties;
 - d) Expectations regarding communication between all relevant parties;
 - e) Procedures for implementing any amendments;
 - f) Site inspection; and
 - g) Confirmation that all relevant parties have copies of the contents of this consent document, all relevant management plans including the Construction Environmental Management Plan (CEMP).

Management Plans and Construction Methodology

5. The Consent Holder shall prepare a construction methodology for each stage of works which shall include, but is not limited to:
 - a) A description of how the relevant structures and activities components will be carried out;
 - b) the proposed timing of the works, including compliance with any seasonal or tidal restrictions;
 - c) the proposed timing of the works, including compliance with any restrictions around protected birdlife;
 - d) identifying specialist inputs required for the stage, such as a stand over ecologist, Suitably Qualified and Experienced Person (SQEP) or archaeologist.

The construction methodology will be submitted to Head of Planning and Consents via email to rcmon@ccc.govt.nz, Attention xxx, for certification that the methodology complies with the requirements of condition (x) a.-d. above, a minimum of 30 working days prior to the proposed commencement of works.

6. The consent holder shall submit to Head of Planning and Consents via email to rcmon@ccc.govt.nz, for certification, the following management plans:
 - j) A Construction Environmental Management Plan (CEMP);
 - k) A Construction Traffic Management Plan (CTMP);
 - l) An Erosion, Sediment and Dust Control Plan (ESDCP);
 - m) A Spill Response Plan;
 - n) A Heritage Management Plan (HMP);
 - o) A Seagrass and Saltmarsh Management Plan (SSMP);
 - p) A Saltmeadow Remediation Plan (SRP)
 - q) A Bird Management Plan;
 - r) (Soft Edge Beach Trial...)

Each management plan shall be submitted at least 10 working days prior to the proposed commencement of construction unless longer period for any management plan is required by another condition of this consent.

Where the consent holder amends a management plan it must be re-submitted to Head of Planning and Consents via email to rcmon@ccc.govt.nz for recertification.

Construction Environment Management Plan

7. The Consent Holder shall prepare a Construction Environmental Management Plan (CEMP) as required by condition x. The CEMP shall be submitted to Head of Planning and Consents via email to rcmon@ccc.govt.nz for approval at least **ten** working days prior to construction works commencing and shall be adhered to by the Consent Holder. The CEMP required by this condition shall clearly set out the measures to be undertaken to comply with the conditions of this consent.

The CEMP shall include, but is not limited to:

- a) A map showing the location of all works, including of the remote stockpile location at Owles Tce;
- b) Details of the construction methods proposed for the inundation bund, gabion baskets, rock revetment, cobble beach and **soft beach area**;
- c) Details of forecast monitoring frequency including methodology for providing temporary joining of the inundation bund where tidal and rainfall events are likely to pose an inundation risk;
- d) A programme of works including an indicative timeframe and sequence of works, consistent with any seasonal and tidal restrictions specified in Condition [x] and the Construction Methodology required by Condition [x];
- e) The methodology for stabilising the site if works are abandoned;
- f) Construction noise and vibration controls;
- g) Water quality management;
- h) Reference to the Spill Response Plan (required by Condition [x]), outlining how compliance with its procedures will be achieved;
- i) Archaeological and Cultural Discovery protocols (to be consistent with any Archaeological Authority granted for the project);
- j) Site notices to inform the public of the works and direct people safely to alternative routes;
- k) The monitoring and visual observations, required in accordance with condition (x) to (x).
- l) Details of site induction processes for all personnel, covering all relevant environmental, health and safety, and cultural protocols;
- m) Contact details for all key project personnel, including the designated Site Supervisor and specialist technical advisors (eg SQEP, archaeologist); and
- n) Waste management and recycling protocols for all construction-generated waste; and
- o) Relevant matters from the Bird Management Plan, including pre-work breeding surveys and accidental nest discovery protocols.

Erosion, Sediment and Dust Control Plan (ESDCP)

8. The Consent Holder shall prepare an Erosion, Sediment and Dust Control Plan (ESDCP) as required by condition x. The Erosion, Sediment and Dust Control Plan (ESDCP) shall

clearly set out the measures to be undertaken to comply with the conditions of this consent. The ESDCP shall be submitted to Head of Planning and Consents via email to rcmon@ccc.govt.nz Attention: xxx for approval, at least ten working days prior to construction works commencing and shall be adhered to by the Consent Holder. The ESDCP shall be based on the Erosion and Sediment Control Toolbox for Canterbury (<http://esc.canterbury.co.nz/>) and shall include but not be limited to:

- a) Detailed plans showing the location and design of all sediment control measures, on-site catchment boundaries and identification of all potential sources of run-off and sediment generation for all work sites, including Owles Terrace;
 - b) Methods to manage the discharge of contaminants, including the screening of material prior to placement and protocols for managing any imported fill material;
 - c) Methodologies for managing works within and adjacent to the Coastal Marine Area (CMA), including measures to prevent sediment discharges during tidal cycles;
 - d) An inspection and maintenance schedule for all sediment control measures;
 - e) The methodology for progressively stabilising the site and decommissioning erosion and sediment control measures after works have been completed or abandoned;
 - f) Dust control measures;
 - g) Water quality management protocols;
 - h) Controls on the disturbances adjacent to the CMA, including the placement of geotextiles or geofabrics in excavations.
 - i) Procedures for managing stormwater runoff from the site during construction, including the management of any dewatering activities (if required); and
 - j) Details of contingency measures to be implemented in the event of failure of erosion and sediment control measures or during extreme weather events.
9. Stockpiles at the Owles Tce site must be placed at least 50m from the eastern road boundary of the site and restricted in height to 5m.
10. If the consent holder permanently abandons work on any of the defined sites or ceases works for a period greater than one-week, adequate preventative and remedial measures shall be taken to control sediment discharged from exposed or unconsolidated surfaces.
11. Erosion and sediment control measures shall be inspected at least daily during active earthworks, and within 12 hours following any rainfall event exceeding 5mm in a 24 hour period, or upon receipt of a severe storm warning.
Any accumulated sediment shall be removed, and repairs made, as necessary, to ensure effective functioning of devices. Records of all inspections and any maintenance or repairs undertaken shall be kept and provided to the Christchurch City Council on request.
12. All earthworks and construction authorised by this consent shall be monitored by a suitably experienced person on behalf of the consent holder.
13. Erosion and sediment control measures shall not be decommissioned until the affected site/area is stabilised and the permanent stormwater system for the site is functioning. Decommissioning measures shall be undertaken in the following order:
- a) All disturbed areas shall be stabilised and/or re-vegetated as soon as practicable following completion of the works; and

- b) All temporary erosion and sediment control measures shall be removed from site, along with any accumulated sediment, visible debris, litter, and hydrocarbons associated with their operation.

Machinery and Material Storage

- 14. All machinery and equipment shall be stored securely and at least 20 metres away from the estuary edge overnight.
- 15. All material excavated from the land shall be managed in accordance with the certified ESDCP and CSMP. Where deemed suitable as cleanfill, material shall be reused on site or otherwise disposed of off-site at a facility authorised to receive such material in accordance with RMA/2021/2094.

Spills and Hazardous substances

- 16. All practicable measures shall be undertaken to prevent oil and fuel leaks from vehicles and machinery or spills of any other contaminant within the site. Refuelling of machinery, or the storage of fuels or hazardous substances, shall not take place within 20m of the Estuary edge.
- 17. The consent holder shall ensure that spill management measures and equipment, as necessary to contain, manage, and remove spilled hazardous substances and contaminated material, are retained on site at all times. These measures shall be implemented in accordance with the certified Spill Response Plan and include, but not be limited to:
 - a) Preparing and providing a written spill response plan to all persons undertaking activities authorised by this consent. A copy of this response plan shall be kept on site at all times;
 - b) Retaining a spill kit on-site that is capable of absorbing the quantity of oil and petroleum products that may be spilled on site at any one time; and
 - c) The spill response plan should include detail on how exposure by birds and other wildlife to hazardous substances such as fuels and chemicals will be managed.
- 18. In the event of a spill of fuel or any other hazardous substance with the potential to enter the Estuary, the consent holder shall:
 - a) Immediately implement the Spill Response Plan to contain and clean up the spill as soon as practicable, inspect and clean the spill area, and take measures to prevent a recurrence.
 - b) Inform ECAN, CCC, DoC and Fish & Game Council within 1 hour if any spill has already, or has potential to, reach birds and other wildlife.
 - c) Inform the Head of Planning and Consents via email to rcmon@ccc.govt.nz, Attention: xxx, within 24 hours of a spill event greater than 1 litre and provide the following information:
 - i. the date, time, location and estimated volume of the spill:
 - ii. the cause of the spill:
 - iii. the type of hazardous substance(s) spilled:
 - iv. clean up procedures undertaken:
 - v. details of the steps taken to control and remediate the effects of the spill on the receiving environment:
 - vi. an assessment of any potential effects of the spill: and
 - vii. measures to be taken to prevent a recurrence.

Contaminated Material

19. In the event that temporary stockpiling of suspected potential or contaminated material is required, then the stockpiles shall be managed as below:
- a) Controls shall be installed to prevent runoff leaving the area and stormwater from other areas entering the stockpile area: and
 - b) Stockpiled material shall be covered or dampened during dry and windy conditions to prevent the generation of dust: and
 - c) If significant rainfall is forecast, the stockpiled material shall be covered by a suitable material to prevent contaminated stormwater discharge or wind-blown dust generation.
20. In the event of unexpected discovery of contaminated material, the Consent Holder shall immediately notify a suitably qualified and experienced professional (SQEP) who will advise of the appropriate management protocols to be followed for disposal in accordance with RMA/2021/2094.

Biosecurity

21. The consent holder shall ensure that activities authorised by this consent are undertaken in accordance with the Biosecurity New Zealand's hygiene procedures and that machinery shall be free of plants and plant seeds prior to use.

The spread of weeds shall be minimised during the construction period by methods including but not limited to hosing down machinery upon completion of works to prevent tracking of seeds and continuing to control weeds through spraying or mechanical means as part of ongoing reserve maintenance.

ADVICE NOTE: You can access the most current version of these procedures from the Biosecurity New Zealand website <http://www.biosecurity.govt.nz>.

Construction Traffic Management Plan

22. The Consent Holder must prepare a Construction Traffic Management Plan (CTMP). The CTMP must clearly set out the measures to be undertaken to comply with the conditions of this consent and must be adhered to by the Consent Holder. The CTMP shall be submitted Council, Attention: Christchurch Transport Operation Centre (CTOC) by way of email to rcmon@ccc.govt.nz at least **ten** working days prior to works commencing. The CTMP shall include but not be limited to the following:
- a) Methods to manage the effects of temporary traffic management activities on vehicular, pedestrian, and cyclist traffic.
 - b) Measures to manage the safety of all transport users.
 - c) The estimated numbers, frequencies, routes and timing of construction traffic movements, including any specific non-working or non-movement hours to manage vehicular and pedestrian traffic near educational facilities and childcare facilities or to manage traffic congestion.
 - d) Details on temporary facilities for pedestrians to ensure connectivity if the existing facilities cannot be safely and reasonably maintained.
 - e) Details of wayfinding signage for cyclists and pedestrians.
 - f) Site access routes and access points for heavy vehicles, the size and location of parking areas for plant, construction vehicles and the vehicles of workers and visitors.

- g) Location of areas for the loading and unloading of trucks with excavation or fill material.
 - h) Methods to maintain vehicle access to property and/or private roads where practicable, or to provide alternative access arrangements when it will not be.
 - i) Methods to engage with residents and open space users.
 - j) The management approach to loads on heavy vehicles, including covering loads of fine material and the timely removal of any material deposited or spilled on public roads outside active construction areas.
23. The consent holder must ensure that the content of the CTMP is communicated to all transportation contractors, and a copy of the plan is provided to them to utilise for the duration of the consent.

Hours of operation

24. No construction work, other than maintenance of dust and erosion and sediment control measures, must be undertaken on Sundays, Public Holidays or outside the hours of 7.30am to 6.00pm Monday to Saturday, without the prior consent of the Head of Planning and Consents (or their nominee).

Site supervisor and contractors

25. Prior to the commencement of works the consent holder shall appoint a site supervisor with responsibility to ensure compliance with the conditions of this consent.

Contact details of the site supervisor shall be sent to all properties that immediately adjoin the proposed works area and to Head of Planning and Consents via email to rcmon@ccc.govt.nz Attention: xxx (compliance teams).

26. The consent holder shall be responsible for all contracted operations relating to the exercise of this consent and shall:
- a) undertake an induction briefing for all personnel, and
 - b) ensure that all personnel working on the site are made aware of the conditions of this consent and have access to the contents of the relevant consent documents and all associated management plans.

Seagrass, Saltmeadow and Saltmarsh areas

27. At least 30 days prior to the commencement of the works, the eastern boundary (closest to the estuary edge) of the seagrass, saltmeadow and saltmarsh habitat shall be re-mapped by a suitably qualified marine ecologist to:
- a) Confirm the extent of any overlap between seagrass and the project footprint at 44a Rocking Horse Road; and
 - b) Confirm that there is no further overlap between seagrass or saltmarsh and the project footprint.

The project design or construction methodology is to be revised to avoid affected areas if the updated mapping identifies new areas of seagrass and / or saltmarsh that overlaps with the footprint of the proposed structures.

Before work is undertaken in the proximity of seagrass and / or saltmarsh, a suitably qualified marine ecologist shall mark the eastern boundary of the main seagrass meadow, as well as the location of small, isolated seagrass patches (with flags / stakes or similar), and the eastern boundary of saltmarsh habitat, to ensure that the seagrass and saltmarsh areas to be avoided are clearly visible.

28. All works associated with the removal of existing structures where seagrass, saltmeadow or saltmarsh is within 10 m of the structure, will be undertaken in accordance with the following requirements:
- a) Development of a Seagrass and Saltmarsh Management Plan (SSMP) as per Condition x, prior to the commencement of works near seagrass and saltmarsh habitats.
 - b) Development of a Saltmeadow Remediation Plan (SRP) as per Condition x, prior to the commencement of works near saltmeadow habitats.
 - c) A detailed methodology for demolition of the structures shall be included in the SSMP, to ensure disturbance of seagrass during demolition and removal of the existing structures is avoided.
 - d) A suitably qualified and experienced ecologist shall be present during works, in a 'standover' capacity, for the works between CH1260-1270 and 1310-1370m where seagrass, saltmeadow and /or saltmarsh abuts the structures and any other areas identified by the pre-construction survey required by Condition (x).
 - e) Demolition works shall only occur from the landward side. Machinery is not permitted to enter the estuary for the purpose of removing structures.
 - f) Physical removal of the existing structures within the estuary edge is to be done manually, including the removal of footings where possible without disturbance to the seagrass. In areas where structure footings cannot be removed without disturbance of seagrass, footings may be cut off at a level 100mm above the estuary bed and left in situ.

29. The Seagrass and Saltmarsh Management Plan (SSMP), required by Condition x, shall be prepared by a suitably qualified and experienced marine ecologist to identify how risks on seagrass and saltmarsh adjacent to the construction corridor will be managed through the construction process. The SSMP shall outline measures for the management of physical works near mapped seagrass and saltmarsh areas.

The works required by the SSMP is to be-supervised by a suitably qualified marine ecologist who shall be present on site when work is undertaken in areas where impacts on seagrass and saltmarsh may occur.

30. The Saltmeadow Remediation Plan (SRP), required by Condition x shall set out the measures to be undertaken to remediate saltmeadow in the areas identified on Plan xx. The SRP shall be prepared by a suitably qualified and experienced ecologist with input from a suitably qualified and experienced engineer with groundwater expertise.
- The SRP shall include but not be limited to:
- a) Identifying areas of low-lying surface landward of the erosion protection revetment, which have suitably saline soils for the reestablishment of saltmeadow;
 - b) Confirming the areas are at least 0.2 ha to achieve an overall Net Gain
 - c) identification of species to be planted;
 - d) planting timeframes;

- e) pest and weed control measures;
 - f) maintenance measures; and
 - g) ongoing monitoring required.
31. Where mapping carried out in accordance with Condition 27 indicates there has been a loss of saltmarsh below MHWS that is attributed to the project during construction phase, remediation shall be required by planting of greater numbers of saltmarsh plants into sparsely vegetated areas of (or at the upper edge of) existing saltmarsh, to achieve a no net loss or a net gain in saltmarsh extent.
32. Saltmeadow, saltmarsh and sea grass restoration shall be monitored by the consent Holder for a minimum of 10 years to confirm that initial plantings survive and meet the requirement of replacing lost saltmarsh extent.
33. The consent holder shall monitor the migration of cobble beach material onto the mudflat habitat (both at South New Brighton Park and Southshore) and onto the saltmarsh habitat below MHWS at Penguin Street (Southshore) by undertaking the following:
- a) Monitor and map the position of the toe of the cobble beach structures yearly, commencing at the completion of construction and annually thereafter, to assess whether the structures are encroaching or moving closer to the mudflat and saltmarsh habitats;
 - b) Promptly inspect the cobble beach structures following large storm events;
 - c) Assess damage to the saltmarsh vegetation in case of cobble encroachment/inundation in the saltmarsh habitat.
34. If needed, based on the results of the yearly mapping and of any post-storm inspection:
- a) Reinstate the original position of the toe of the cobble beach structures.
 - b) Remove any material washed onto the mudflat and saltmarsh habitats.
 - c) Re-establish saltmarsh plants in areas where cobbles have caused damage to the saltmarsh vegetation.
 - d) Results of the yearly mapping and post-storm inspections and any activities associated with clauses a. – c. shall be documented and provided on request to Christchurch City Council.
 - e) Reinstatement works should be undertaken in accordance with the Bird Management Plan (BMP) to ensure works do not cause unacceptable levels of disturbance to protected birds, displace bird roosts, or disturb the breeding of protected species.

Bird Management Plan

35. A Bird Management Plan relating to birds protected or partially protected under the Wildlife Act 1953, must be submitted to the Christchurch City Council, Head of Planning and Consents for confirmation by Council's Ornithologist that it meets the requirements of condition x, (via email to rcmon@ccc.govt.nz) at any time up to xxx working days before works commence. No works are to commence on site until the confirmation is received, except that if confirmation is not received within 15 working days of submission it will be deemed to have been received. The Bird Management Plan required under this condition must be prepared by a suitably qualified and experienced professional.

Advice Note: For confirmation of which bird species are protected or partially protected under the Wildlife Act 1953 please see Sections 3 and 5 of the Wildlife Act 1953, respectively.

36. The Bird Management Plan must include but is not limited to:
 - a) A description of measures to be undertaken in order to limit bird occupation of breeding habitat within the works area prior to nesting;
 - b) The timings of works (based on season and tides) for the purpose of minimising disturbance to protected bird species that are feeding, loafing and roosting within a 100m wide disturbance zone of the works and associated activity footprint.
 - c) Avian monitoring that will take place to ensure that disturbance mitigation measures on birds is being complied with.
 - d) Mitigation and methods that will be applied if works are required within the bird breeding season (15 August to 15 February annually).
37. The Bird Management Plan must be implemented and provided to the contractor controlling this work and retained on site for the duration of works.
38. At least 8 working days prior to the commencement of any site works, the consent holder's appointed ornithologist must compile a list of birds protected by the Wildlife Act (1954) that are currently occurring (feeding, roosting, etc) within and near the site. The consent holder will then advise Council, by way of email to rcmon@ccc.govt.nz, Attention Council's Ornithologist, how disturbance to these birds will be mitigated. Works include earthworks and cutting/removal of vegetation.
39. Within eight calendar days prior to any works authorised by this consent being carried out in the period 15 August to 15 February, the consent holder's appointed ornithologist must undertake a breeding survey of birds protected by the Wildlife Act.
Note: This is only required between Bridge Street and Caspian Street as protected birds are not known to breed south of Caspian Street.
40. The ornithologist carrying out the inspection required by condition x shall prepare a written report that identifies all the located bird breeding or nesting sites and provide copies of that report to the consent holder and Head of Planning and Consents, Christchurch City Council, via email to rcmon@ccc.govt.nz for the Council's Ornithologists review.
41. If the inspection required by condition x indicates that birds protected under The Wildlife Act (1954) are nesting or rearing their young, the contractors carrying out the works shall be informed of this by the Consent Holder and works shall not be carried out within 100m of the locations of any occupied nests. If work ceases in any section for more than eight days, the site must be re-inspected for bird breeding and nesting sites by the consent holder's appointed ornithologist, and an addendum to the report required under condition 6 must be prepared and provided to rcmon@ccc.govt.nz to provide to the Council's Ornithologist, prior to any works re-commencing in accordance with this condition.
42. Any works (including tree removals) carried out within the bird breeding season (15 August to 15 February annually) must occur in accordance with the Bird Management Plan.
43. Inspections must be conducted for each section of works no more than 5 working days prior to their commencement (maximum of 8 calendar days). The person carrying out the

inspection must prepare a written report that identifies located breeding or nesting sites for any protected species under the Wildlife Act (1954). This report must be made available to the Head of Planning and Consents (via email to rcmon@ccc.govt.nz) for review by the Council's Ornithologist prior to any works commencing, and the Consent Holder, site supervisor, and any persons carrying out works on site along with the name, qualifications and contact information of the person preparing the report.

44. In the event that a nest is found when works are performed outside of bird breeding and nesting seasons, work within 20m of the nest must cease immediately and the consent holder must contact the Council's Ornithologist for advice. No works in these areas may occur until Council's Ornithologist has assessed the nest and associated birds and determined that appropriate steps are being taken to avoid adverse effects on birds. A buffer zone where works shall not be carried out within 100m of the locations of any occupied nests may be required. If the species involved is classified as 'at risk' or 'threatened' then the Council's ornithologist may need to consult with Department of Conservation staff to ensure the course of action is acceptable.
45. The consent holder shall not allow noise devices or dogs to be used as part of bird breeding deterrence actions.
46. The consent holder shall manage activities on the site to ensure no dogs are brought onto the site by persons exercising or working under this consent.

Landscaping

47. Landscaping activity shall be undertaken in general accordance with the Landscape Plan submitted with the application. As far as practicable, landscape planting should occur sequentially as erosion protection and inundation bund works in a common area are completed with planting to be planned so that as much implementation as possible occurs during the next available planting season.

The Landscape Plan (page x of the Approved Consent Plans) must be implemented subject to the following:

- i. Coastal vegetation planting within the Construction Footprint will be low-growing ecologically representative native species.
 - ii. Tree planting of at least two trees for every tree removed through clearance of the Construction Footprint.
 - iii. Planting on the landward face of the inundation bund shall be limited to grass only.
 - iv. No trees shall be planted within 6m of the bund core.
 - v. All existing trees, and their roots 100mm or larger in diameter must be removed where these are located within 6m of the core of the bund core.
48. All landscaping required for this consent shall be maintained for the first two years following the completion of all planting. During this period, any tree that dies, becomes diseased is vandalised / damaged or fails to thrive shall be replaced with a similar species as soon as practicable.
49. Any losses of saltmarsh ribbonwood, knobby clubrush or native celery in the saltmarsh ribbonwood / marram grass grassland area must be remedied by propagation and planting of those species in grassland areas adjacent to the inundation bund, following construction.

The specific methodology and target areas for this remediation must be detailed in the Seagrass and Saltmarsh Management Plan (SSMP) required by Condition [x].

Archaeological Authority

50. No works shall be undertaken until a copy of the Archaeological Authority is provided to Head of Planning and Consents via email to rcmon@ccc.govt.nz.

Inundation Bund

51. All double sumps used for stormwater pumping (Plover, Tern and Penguin Streets) must be relocated where the current location is shown to be underneath the proposed inundation bund footprint.

Public spaces

52. Roads to and from the site (except for stopped roads in the Specific Purpose Flat Land Recovery Zone) shall be regularly monitored and swept or vacuumed where soil or debris has been tracked into the road by construction equipment.
53. A pre-construction inspection of public roads, footpaths, landscaped areas or service structures shall be completed prior to the commencement of works and provided to the Head of Planning and Consents via email to rcmon@ccc.govt.nz.
54. Any public road, footpath, landscaped area or service structure that has been damaged by the consent holder, contractor(s), or persons involved with the implementation of this consent or vehicles and machinery used in relation to the implementation of this consent must be reinstated as specified in the Construction Standards Specifications (CSS) at the expense of the Consent Holder, and to the satisfaction of Christchurch City Council.

Any assets recorded as being damaged prior to the commencement of this consent are excluded from compliance with this condition.

55. The consent holder must:
- Minimise, where practicable open space closures during heavy periods of use, such as, but not limited to summer holidays and long weekends (i.e. 20 December to 31 January, public holidays and anniversary days).
 - Provide wayfinding information to direct open space users to facilities where access to the open space at the site is restricted.
 - Require, where practicable, the Project's Construction Traffic Management Plan (CTMP) and Construction Environment Management Plan (CEMP) to minimise road, car park and pedestrian access closures/disruptions.
 - Require, where practicable, the Project's CTMP to provide alternative pedestrian and cyclist access to the important linkage connecting SNBP to Southshore Spit Reserve where disruptions occur.
 - Undertake ongoing communication with residents, sports clubs (including the football, yacht and cricket clubs, organisers of the annual Sport Canterbury Tough Kid event), and local businesses and education facilities (eg South Brighton Holiday Park, South New Brighton Primary School and playcentre) to inform of temporary open space closures, access and drop-off zone disruptions.

Post construction

56. All structures authorised by this consent, including the inundation bund, cobble beach, rock revetment, gabion baskets, **soft edge beach area** and access points shall be maintained to a standard where they will continue to function as designed for the duration of the consent.
57. Upon the completion of all construction and landscaping works, the work site(s) shall be remediated, and all disturbed areas shall be stabilised.
58. All temporary erosion and sediment control measures shall be removed from the site, once the underlying disturbed areas are stabilised to 80% or more coverage in accordance with the Erosion and Sediment Control Toolbox for Canterbury (<http://esc.canterbury.co.nz/>).
59. Upon completion of works and prior to the reopening of the area for public access, the consent holder shall erect educational signs at public access points. Each sign shall clearly state:
 - a) Information on māhinga kai / shellfish gathering including current health or contamination advisories;
 - b) That dogs are prohibited from the Avon/Heathcote-Ihutai Estuary at all times; and
 - c) Information on ecological values of the Avon/Heathcote-Ihutai Estuary including sensitive habitats, protected species, restoration areas and how users can minimise their effects.
60. The Consent Holder shall maintain the educational signage in good condition for the duration of the consent and shall replace or update the signage if it becomes damaged, illegible or out of date.
61. Pursuant to s123(b) of the Resource Management Act, this consent will expire on [date].
62. A minimum of twelve months before the expiry date of this consent in condition X the consent holder must advise the Head of Planning and Consents (or their equivalent) at the Christchurch City Council via email to rcmon@ccc.govt.nz of the required course of action to either retain the structures, or remove them, and the timeframe for implementation of the chosen option, noting it is likely that consents will be required for either option.

Advice notes:

- i) This resource consent will **lapse five years from the date it is issued** unless it is given effect to (i.e. the activity is established) before then. Application may be made under Section 125 of the Resource Management Act 1991 to extend the period for giving effect to the resource consent, and this must be submitted prior to the consent lapsing.
- ii) **Monitoring** will be carried out to ensure the **conditions are complied with** and that the development proceeds in accordance with the plans and details which were submitted with the application.

The Council will require payment of its **administrative charges** in relation to monitoring, under section 36 of the Resource Management Act 1991. The monitoring programme administration fee and initial inspection fee will be charged to the applicant with the consent processing costs. If more than one inspection, or additional monitoring activities (including

those relating to non-compliance with conditions), are required, the additional time will be invoiced to the consent holder when the monitoring is carried out, at the applicable hourly rate. The current monitoring charges are outlined on the [Resource Management Fee Schedule](#).

- iii) **Engineering acceptance and inspection fees:** This consent requires post-issue acceptance of engineering plans/designs and may require on-site monitoring while the works are carried out. Time spent by the Council's Subdivisions Engineer and other specialist staff will be on-charged separately from the consent-processing costs, at the rates listed in the [RMA Fee Schedule](#).
- iv) Authority from Heritage New Zealand is required for any work that affects or may affect an archaeological site. **Please contact the Heritage New Zealand regional archaeologist on 03 363 1880 or archaeologistcw@heritage.org.nz before commencing work on the land.**