Prepared for
Waitaki District Council
Co No.: N/A

Beach Road Landfills Remediation

Assessment of Environmental Effects

29-Jun-2023
WDC Landfill Remediation

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Prepared by

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29-Jun-2023

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Quality Information

Document	Beach Road Landfills Remediation
Ref	https://aecomaus-my.sharepoint.com/personal/helen_lawrence_aecom_com/documents/desktop/beach road landfills remediation aee - june 2023.docx
Date	29-Jun-2023
Originator	Annabelle Osborne, Helen Lawrence
Checker/s	Andrew Hammond
Verifier/s	Jarrod Snowsill

Revision History

Rev	Revision Date	Details	Approved	
			Name/Position	Signature
1	17-Mar-2023	Draft for client review	Helen Lawrence Principal Environmental Planer	
2	27-Mar-2023	Draft for Verification	Helen Lawrence Principal Environmental Planer	
3	29-June-2023	Final for Lodgement	Helen Lawrence Principal Environmental Planer	

Table of Contents

Abbreviations

Abbreviation	Description
AEE	Assessment of Environmental Effects
CMA	Coastal Marine Area
DSI	Detailed Site Investigation
EcIA	Ecological Impact Assessment
ESCP	Erosion and Sediment Control Plan
HAIL	Hazardous Activities and Industries List
HNZPTA	Heritage New Zealand Pouhere Taonga Act 2014
NES-CS	National Environmental Standards for Assessing and Managing Contaminants in Soil to Protect Human Health Regulations 2011
NES-FW	National Environmental Standards for Freshwater 2020
NPS-FM	National Policy Statement for Freshwater Management 2020
NPS-HPL	National Policy Statement for Highly Productive Land 2022
NZHP	New Zealand Heritage Properties
ORC	Otago Regional Council
RMA	Resource Management Act 1991
The Project	Remediation of two historical landfills
The sites	Landfill 1 and Landfill 2.
WDC	Waitaki District Council
WDP	Waitaki District Plan

1.0 Introduction

1.1 Purpose of this report

This Assessment of Environmental Effects (AEE) has been prepared by AECOM NZ Limited (AECOM) for GHC Consulting on behalf of Waitaki District Council (WDC) in support of an application for resource consent for the remediation of two historical landfills (the 'Project') located along the coastal cliffs on Beach Road, Oamaru.

Resource consent is required from WDC under the Waitaki District Plan (WDP) for the following:

- Earthworks classified as a discretionary activity pursuant to Rule 4.3.3.12 for an activity that complies with the Critical Zone Standards but does not meet the relevant Site Development Standards.

Resource consent is also required under the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health Regulations 2011 (NES-CS), for the following:

- Disturbance of contaminated land.

Resource consent is required from Otago Regional Council (ORC) under the Regional Plan: Waste for Otago and Regional Plan: Coast for Otago, for the following:

- The disturbance of land at contaminated sites and the discharge of hazardous waste into air at or from the contaminated site is classified as a discretionary activity pursuant to Rule 5.6.1
- Occupation and disturbance of the foreshore or seabed for the purpose of removing contaminated materials under Rules 7.5.1.5 and 9.5.3.

This report contains an application for a **discretionary** activities resource consent to the WDC, under the WDP and the NES-CS, and a **discretionary** activities resource consent to the ORC under the Otago Regional Plans. Initial pre-application discussions to confirm consent requirements were held with ORC and WDC in January and February 2023.

This AEE accompanies applications for a resource consent made under Section 88 of the Resource Management Act 1991 (RMA). It has been prepared in accordance with the Fourth Schedule of the RMA, in such detail that corresponds with the scale and significance of the effects that the activity may have on the environment.

1.2 Project Overview

WDC have identified two historic unofficial landfills (Landfill 1 and Landfill 2 - the 'sites') located along the coastal cliffs on Beach Road, Oamaru, which are at risk of coastal erosion and consequently the uncontrolled release of contaminated material.

AECOM understands that the two landfills were never explicitly opened or approved by the council and are therefore described as unofficial landfills. It is understood that the landfills were in "operation" between the 1950's to 1970's.

The unofficial landfill areas were investigated and partially remediated in 2017 after a complaint by locals regarding rubbish washing out off the cliff face onto the beach. Following the complaints in 2017, approximately 60 tonnes of waste material was removed to Oamaru and the areas were closed.

Remediation works are proposed to remove all waste from the two landfills and dispose of the waste at the Palmerston Landfill, located approximately 55km south. Full removal of the waste is required to prevent waste being exposed during storm events and coastal erosion processes from washing into the ocean and being deposited along the foreshore. This will improve the amenity of the coastal environment, improve coastal water quality, restore coastal landforms and restore natural coastal processes.

On completion of the waste removal, the sites will be re-established to pre-landfill ground levels to allow for natural coastal erosion to occur in line with the surrounding coastline.

1.3 Structure of this report

The remainder of this report is set out in the following sections:

- Section 2: Description of the Environment
- Section 3: Description of Proposed Activities
- Section 4: Resource Consent Requirements
- Section 5: Consultation
- Section 6: Assessment of Environmental Effects
- Section 7: Statutory Assessment
- Section 8: Notification
- Section 9: Conclusion

The following information is appended to this report:

- Appendix A – Design Drawings
- Appendix B – Geotechnical Assessment
- Appendix C - Draft Erosion and Sediment Control Plan
- Appendix D – Contaminated Site Management Plan
- Appendix E – Draft Consent Conditions
- Appendix F - Ecological Impact Assessment
- Appendix G - Coastal Processes Effects Assessment
- Appendix H - Archaeological Assessment
- Appendix I – Detailed Site Investigation
- Appendix J – Consultation Details

2.0 Description of the Environment

2.1 Site Location

The Project area is situated in the coastal environment with farms located to the west approximately 3km south of Oamaru. The two landfill sites are located along the coastal cliffs on Beach Road as identified in Figure 1 below. The landfills are located within gullies along a steep, eroding coastal cliff between Beach Road and the Pacific Ocean.

Landfill 1 is located approximately 220m north east from the intersection with Awamoa Road and Beach Road and has an approximate total site area of 677m². Landfill 2 is approximately 10m south west of the intersection and has an approximate total site area of 722m². Beach Road traverses Landfill 1 and adjoins to the west of Landfill 2.

Figure 1 Location of landfill sites

2.2 Existing Land Use and Zoning

Both the landfill sites are zoned Rural General under the WDP and are located within a Significant Coastal Landscape overlay (shown in Figure 2 below). This Significant Coastal Landscape stretches from Oamaru in the north to Moeraki in the south.

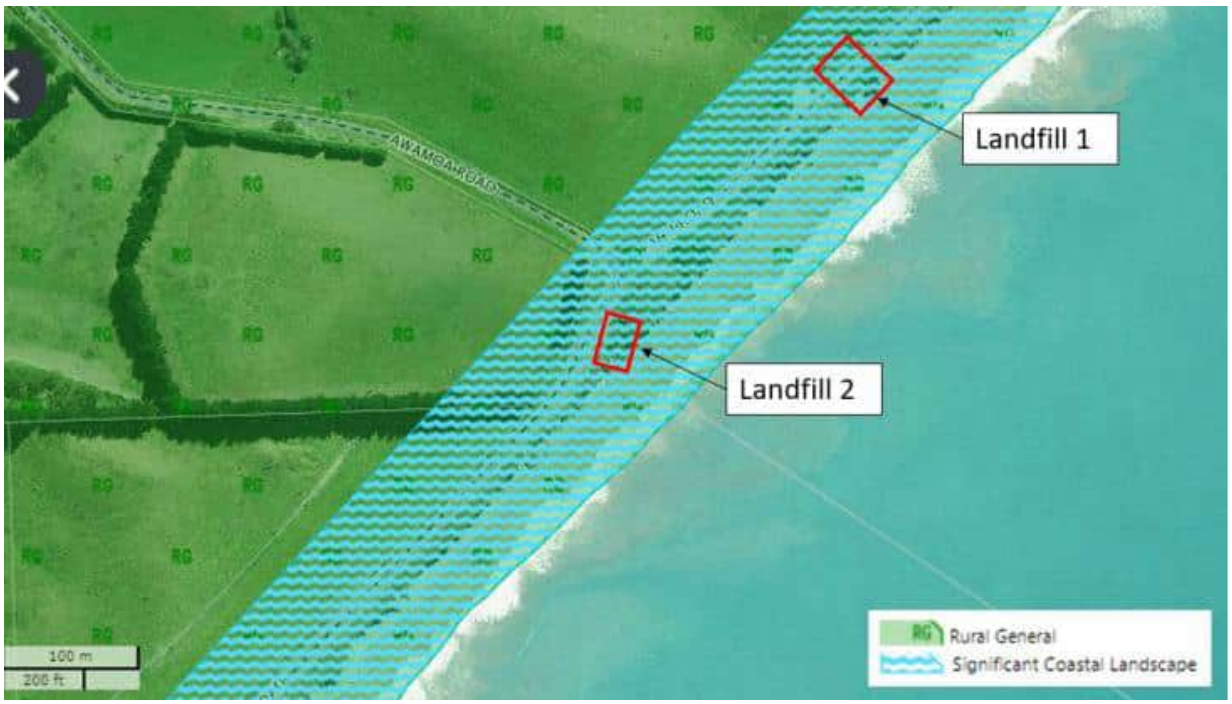

Figure 2 WDP zone and overlay

A site inspection of the landfill sites was completed by an AECOM engineering geologist and civil engineer, accompanied by Dave Hanan from GHC Consulting on 25 January 2023. The observations from both landfill sites are described in detail in section 5.0 of the Geotechnical Assessment (Appendix B).

3.0 Description of Proposed Activities

3.1 Overview

A summary of the Project is set out in section 1.2. Remediation works are proposed to remove all waste from the two landfill sites and dispose of the waste at the Palmerston Landfill. Design drawings of the proposed works are provided in Appendix A.

During the works Beach Road will be closed. Tt is desirable to keep Beach Road operational in the short to medium term until coastal erosion impacts road stability, however the future of Beach Road is undecided at this point and the works are not a determinant in that process.

3.2 Earthworks and Erosion and Sediment Controls

Earthworks are required for the remediation of the landfill sites. The remediation method for landfills includes excavation of all waste material and the re-shaping of the natural ground level below the landfill material. The total area required for earthworks at each landfill, including the total area and cut and fill volumes are provided in Table 1 below. The fill is likely gravel required for the access tracks.

Table 1 Approximate earthworks area and cut and fill volumes

TYPE	LANDFILL 1		LANDFILL 2	
	Cut (m^3)	Fill (m^3)	Cut (m^3)	Fill (m^3)
ACCESS TRACKS	800	250	2,030	180
REFUSE	3,820		5,960	
DESIGN PROFILE	7,500		7,460	
TOTAL	11,320	250	13,420	180

Excavations will be below existing ground surface and therefore runoff from cut areas will remain within the construction site. Where required to stabilize entry/exit and temporary site access gravel fill will be imported to the sites. A Draft Erosion and Sediment Control Plan (ESCP) has been prepared for the Project as attached at Appendix C. The ESCP describes erosion and sediment control measures to reduce and mitigate potential environmental effects that the proposed construction works could have on the adjacent receiving environment.

The measures proposed for the Project include construction of cut off channels to divert clean water from the upgradient catchment around the works areas and construction of impermeable liner fence or bund at the toe of the landfill to prevent the release of landfill materials from the site.

3.3 Construction Methodology

The final construction methodology will be confirmed when a remediation contractor is confirmed, however the following overview provides a high-level overview of the remediation process:

- Site access – two potential options may be utilised and would be adapted based on ground conditions at each landfill site:
  - Excavation of material from road areas and then bench sides of the excavated areas to create access down into lower areas of each landfill site.
  - Construction of temporary access tracks from the side of the landfills up to the existing road as identified in the Design Plans in Appendix A.
- Removal of material – landfill material and soils will be loaded directly into trucks, with the following considerations:
  - no stockpiles of material on the foreshore.
  - excavation is to be completed from the landward side of the landfill at each site.

- off road trucks may be required to access the base of the landfill material and transport up to roadside laydown areas before being transferred to trucks for disposal.
- the sides of each site will be benched in accordance with the recommendations in the geotechnical assessment. A Geotechnical engineer would be consulted during excavation to confirm final landform cut slopes.
- a bund or sediment control fencing would be maintained at the toe of each landfill to retain all waste material within the site. This would be checked regularly and inspected then strengthened as necessary prior to any large rainfall or storm surge events.

- Site stabilisation –
  - Visual inspections to be undertaken to confirm all landfill material has been removed, the site will then be stabilised.
  - It is not proposed to have a planting or landscaping plan for the sites other than hydroseeding to stabilise cut slopes. This is due to the likely ongoing coastal erosion that will impact the sites in the short to medium term.

Laydown areas adjacent to the landfill sites will be required for the storage of materials and equipment. It is expected works can be completed from the landward side of the landfills, however consent is also sought to cover potential occupation and disturbance of the CMA in case the removal of contaminated material requires vehicles to access the site from the seaward toe of the landfill.

4.0 Resource Consent Requirements

The proposed works are subject to both the ORC and WDC. An assessment of the proposed activities against the relevant regional and district plan rules and National Environmental Standards is provided below.

4.1 Consents Held

It is noted that WDC holds resource consents to occupy, disturb and place rock rip rap material within the CMA between Kakanui and Cape Wanbrow (refer to Figure 3), which the sites are located within.

These consents include:

- RM11.079.01: To temporarily occupy the CMA with rock rip rap material and any equipment used in its placement, for the purpose of erosion protection.
- RM11.079.02: To disturb the CMA by placing rock rip rap material for the purpose of erosion protection.
- RM11.079.03: To place rock rip-rap structures within the CMA for the purpose of providing erosion protection.

These consents may be applicable to works within the CMA to access the landfill sites and provide temporary erosion protection during construction. ORC confirmed at the pre-application meeting that these consents could be used where erosion protection within the CMA is proposed to be improved to mitigate the effects of the remediation activities. It is noted that further discussion with ORC confirmed that additional consent is required for works in the CMA to remove material if unrelated to the placement of erosion protection. The relevant rules are addressed in Section 4.3 below.

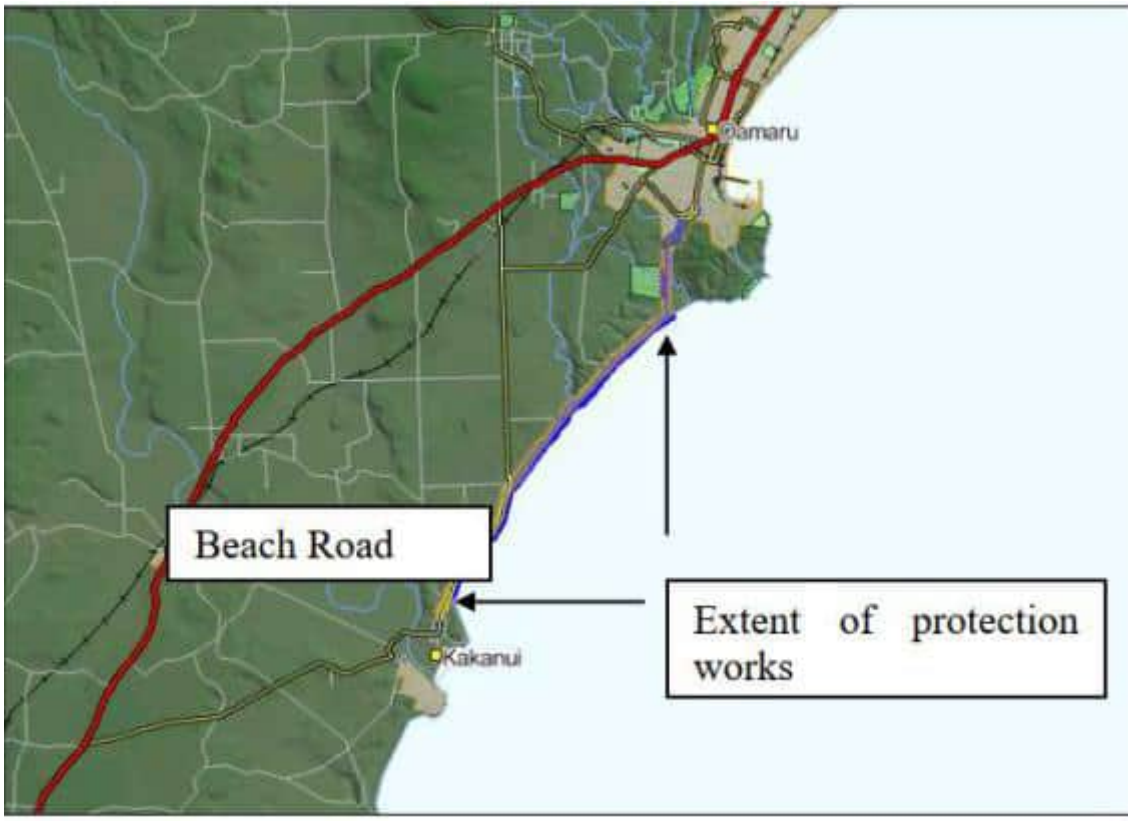

Figure 3 Consented area for coastal protection works (identified by blue line)

4.2 Waitaki District Council

4.2.1 Waitaki District Plan

The Waitaki District Plan (WDP) was made fully operative on 31 May 2010. Whilst a draft District Plan has been prepared this Plan does not have legal effect until notified as a proposed District Plan. The WDP Rural General zone and Significant Coastal Landscape overlay (Figure 2) are relevant to the sites.

The proposed works have been assessed against the provisions of the WDP. The identified reasons for consent are outlined in Table 2 below.

Table 2 Consents Required under the WDP

Rule	Activity	Status
Rule 4.3.1.14 (B) – Permitted Activity	Earthworks associated with all other activities on any site provided that the earthworks do not exceed 100 m^3 in volume over a continuous five year period or 50 m^2 in area.	Earthworks required for the remediation and potential temporary access tracks will exceed both the volume and area permitted volumes, therefore are not classified as a permitted activity.
Rule 4.3.2.1 (a) – Controlled Activity	On any site earthworks which exceed 100m^3 in volume over a continuous five year period or exceed 50 m^2 in area; and comply with the Site Development Standards 4.4.7 and 4.4.8.	The earthworks are located with a *Significant Coastal Landscape*, therefore Site Development Standard 4.4.7.2 cannot be met and the works are not classified as a controlled activity.
Rule 4.3.3.12 Any Activity which is listed as a Permitted Activity or a Controlled Activity or a Restricted Discretionary Activity under rules 4.3.3 (9), (10) or (11) and which complies with all of the relevant Critical Zone Standards (Rule 4.5), but does not comply with any one or more of the relevant Site Development Standards (Rule 4.4).	Earthworks required for the removal of waste at the sites that complies with the Critical Zone Standards but does not meet the relevant Site Development Standards.	**Discretionary activity**

4.2.2 National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health Regulations 2011 (NES-CS)

The NES-CS manages soil disturbance on land where an activity on the Hazardous Activities and Industries List (HAIL) is being carried out or is more than likely than not to have been carried out.

Given the sites are historic landfills, the sites are on the ORC HAIL list as verified G3: Landfill sites (HAIL.01508.01 and HAIL.01508.02) and are therefore, considered a piece of land under the NES-CS. A Detailed Site Investigation (DSI) was completed and states that concentrations of contaminants at the site exceed both background concentrations and human health guidelines (Appendix I).

Soil disturbance (including stripping grass and topsoil) is provided for as a permitted activity under the NES-CS where the requirements of Regulation 8(3) are met. Where soil disturbance is proposed to remove the waste material and re-contour the site it is expected all the requirements can be met, and that the main restrictions are in relation to the volume of soil disturbance over the site and the volume of soil that may be removed from the site.

Across the site's area of approximately 1,600m², the permitted volume of soil disturbance under the NES-CS is 80m³ and the permitted volume of soil removal is 16m³. The figures in Table 1 confirm this limit cannot be met; therefore, resource consent is required for a restricted discretionary activity under Regulation 10 of the NES-CS as a DSI has been completed for the site.

4.3 Otago Regional Council

The following regional plans were reviewed:

- Regional Plan: Waste for Otago
- Regional Plan: Water for Otago
- Regional Plan: Coast for Otago
- Regional Plan: Air for Otago

Upon review of the plans and discussions with ORC it was confirmed that consent is required under the Regional Plan: Waste for Otago and the Regional Plan: Coast for Otago under the rules set out in Table 3. The Waste for Otago Plan sets out the direction for waste minimisation, and management of landfills, contaminated sites, hazardous substances and wastes in the Otago Region.

Table 3 Reason for consent – Reginal Plan

Rule	Activity	Status
Regional Plan: Waste for Otago		
Rule 5.6.1	The disturbance of land at contaminated sites and also the discharge of hazardous waste into air at or from the contaminated site.	**Discretionary activity**
Regional Plan: Coast for Otago		
Rule 7.5.1.5	The occupation of land within the CMA, including for the use of vehicles, for the purpose of removing contaminated material.	**Discretionary activity**
Rule 9.5.3.6	The disturbance of foreshore or seabed or the purpose of removing contaminated material.	**Discretionary activity**

5.0 Consultation

5.1 Waitaki District Council

Email communication with WDC Planner, Marian Weaver, on 20 January 2023 confirmed the approach for applying for resource consent under Rule 4.3.3.12 and provided the following pre-application advice:

- It is useful to have a Contaminated Materials Management Plan (CMMP) for each site upfront with the applications, as producing such plans and doing the work in compliance with them will be a condition of consent.
- Information about coastal processes and historic/predicted erosion rates should be provided for the long-term future of the sites.
- A suggestion was to consult with adjacent landowners to inform them of what is planned.

5.2 Otago Regional Council

A pre-application meeting was held on 3 February 2023 and attended by Helen Lawrence and Annabelle Osborne from AECOM and Isabella Smith and Rebecca Jackson from ORC The key issues discussed were options for the proposed construction methodology, relevant regional plan rules and the final landforms proposed for the sites.

Additional email discussions occurred in April 2023 following the provision of a draft AEE, as included in Appendix J. This AEE revision has addressed the recommendations.

5.3 Te Runanga Moeraki

The project team have engaged with Aukaha to understand cultural values associated with sites, explain the proposed construction methodology and to seek feedback on the proposal. A meeting was held was held with Aukaha representatives 27 April 2023 and a site visit with the representatives and project manager Dave Hanan on 1 June 2023. The project team are continuing to follow up with Aukaha and any feedback or outcomes will be forwarded to ORC.

5.4 Department of Conservation (DoC)

A request for approval as an affected person under s95E of the RMA was sought from DoC and this approval was granted on 18 May 2023 (Appendix J).

5.5 Adjacent landowners and wider community

The WDC have undertaken a wide range of consultation and engagement in relation to the landfill remediation project, including but not limited to:

- As part of the WDC annual plan process
- Community board updates
- Adjacent residents and landowners to update on process and the proposed construction methodology

Key stakeholders will continue to be updated as the project and physical works proceed and a Communications Engagement Plan has been prepared.

6.0 Assessment of Effects on the Environment

6.1 Introduction

The Project will generate a range of potential effects on the environment, both positive and adverse.

Section 104 of the RMA requires the consent authority, when making a decision on a resource consent application, to have regard to the actual and potential effects on the environment of allowing an activity. The environmental effects of the proposal are assessed in this section of the report.

The conditions proposed for this consent are attached in Appendix E.

6.2 Positive Effects

The landfill remediation works will provide a number of positive effects including preventing waste being exposed during storm events and coastal erosion processes from washing into the ocean and being deposited along the foreshore. This will improve the amenity of the coastal environment, improve coastal water quality, restore coastal landforms and restore natural coastal processes.

6.3 Ecological Effects

The proposed works have the potential to have both direct and indirect impacts on ecological features present within the Project area. An Ecological Impact Assessment (EcIA) was carried out by AECOM and has been provided with this application in Appendix F. The assessment provides a detailed description of the terrestrial ecology within the Project area. There are no wetland features or streams close by to the Project area.

The EcIA determined that after the reinstatement of the sites following the removal of all waste, that the level of effect during the operational phase is considered to be positive. The potential impacts during the construction phase that were identified in the EcIA are discussed below. The level of effect after providing mitigation is considered to be minor.

6.3.1 Vegetation removal

The vegetation identified within the Project area includes:

- Exotic grassland (EG) (both rank unmanaged grass and mown / managed)
- Exotic shrub (ES) with > 50% cover/biomass of exotic secondary scrub or shrubland

Landfill 1 comprises entirely of exotic grassland, with 250m² of this proposed to be lost during the works. Approximately 90 percent of Landfill 2 is exotic grassland with 650m² of this expected to be lost as a result of the works. The remaining 10 percent of landfill 2 is exotic shrub, with 70m² of this expected to be lost.

The EcIA found this vegetation within the Project area to be of negligible value. Due to the value of the vegetation and the isolated impacts, no mitigation will be required.

6.3.2 Penguins

During the remediation works there is the potential for a direct localised impact on the national endangered, yellow-eyed penguins and little blue penguins, resulting in the disturbance and displacement of roosts and individuals. For this species the Project works results in moderate level of effects in relation to construction disturbance, prior to mitigation. As such mitigation is proposed including penguin management.

To mitigate possible disturbance of the nesting sites, any works should be avoided between mid-August to early February. Should there be a need to undertake work during the breeding and nesting period (August – February) a site inspection needs to be carried out prior to any work starting for the day. If any penguins are observed during this site inspection, works should stop immediately and consultation with DOC and Penguin Rescue should be undertaken in order to minimise any adverse effects on the yellow-eyed and little blue penguins in the area. The EcIA determined the level of effect will be reduced to low if this mitigation is implemented appropriately.

6.3.3 Lizards

The EcIA concluded the not threatened McCann's skink is likely to be present throughout the sites. The clearance of vegetation and associated earthworks required for the remediation works has the potential to result in direct injury or mortality to the Mc Cann's skink. These works result in moderate level of effects prior to mitigation being provided.

Due to the small area of vegetation removal and the fact that the vegetation will be reinstated, there is a low risk for lizard injury or mortality and therefore, a Lizard Management Plan will not be required. It is recommended that a vegetation manipulation approach is followed and/or a lizard salvage is completed by a DOC permitted herpetologist.

Typically, vegetation manipulation will include the mowing of the vegetation on site, prior to commencement of the vegetation removal. Mowing should occur over a period of 4 weeks where vegetation height is reduced to 500mm in the first week. At the end of the second week, vegetation height is reduced to 300mm. At the end of the 3rd week vegetation is reduced to 50mm. At the end of the 4th week vegetation will be reduced to ground level. It is considered that if these measures are implemented appropriately then the level of effect will be reduced to very low.

6.3.4 Summary

Prior to the mitigation and enhancement measures identified above, the Project has the potential to impact lizards and penguins that inhabit the surrounding environment. In accordance with EIANZ guidelines, the EcIA determined the magnitude of impacts on lizards and penguins was negligible once the above mitigation and enhancements are implemented. Therefore, the residual level is considered to be low after the mitigation proposed above has been implemented.

Given the opportunity to provide mitigation within the Project and the conclusions made by the EcIA, the effects on ecological values within the Project area are considered to be less than minor.

6.4 Earthworks

The overall affected area and cut and fill volumes for each site are identified in section 3.1. The combined excavation volume for each of the sites will be approximately 24,740m^3. Excavated waste material forms part of this material and approximately 9,780m^3 will be transported to the Palmerston Landfill. It is noted that these values are approximate and will be determined once the landfill extent below ground is confirmed at each site.

Construction activities that expose earth surface significantly increase the potential for erosion as well as sediment generation and contaminant deposition into the receiving environment. A draft ESCP has been prepared for the Project as attached at Appendix C.

The ESCP describes erosion and sediment control measures to reduce and mitigate potential environmental effects that the proposed construction works could have on the adjacent receiving environment. The ESCP has been prepared in accordance with the Auckland Council (2016) Erosion and Sediment Control Guidelines for Land Disturbing Activities as it is incorporated with ORC -ESCP guidelines. The contractor is responsible for updating and preparing the final ESCP which will be based on the final detailed designs and construction methodology. Once completed, the final ESCP will be submitted to ORC for approval prior to any works commencing.

It is considered that with the provision of suitable erosion and sediment control measures, that the effects generated by land disturbance activities will be appropriately controlled to ensure any effects will be less than minor.

6.5 Contaminated Soils and Human Health

There are potential risks to construction workers and public passing through the vicinity of the sites due to the contaminants present at the sites. The DSI included in Appendix I states that concentrations of contaminants at the site exceed both background concentrations and human health guidelines. A draft Contaminated Site Management Plan (CSMP) has been prepared and will be updated by the construction contractor prior to commencing Project works (refer Appendix D). The main pathways for

human exposure to contaminants are inhalation of fibers or dust, accidental ingestion of soil and skin contact. Environmental exposure mechanisms are identified as the discharge of stormwater runoff to the beach and tidal zone. Site management procedures are set out in the CSMP and will include securing the works site to prevent unauthorised access, staging excavation, avoiding the stockpiling of material and covering material in trucks prior to leaving site.

Where the mitigation measures set out in the CSMP, ESCP and Contractors Health and Safety Plan are implemented on site and updated as set out in the proposed consent conditions in Appendix E, the potential effects on human health will be no more than minor.

6.6 Archaeology

Earthworks have the potential to uncover archaeological artefacts and artefacts of Māori origin. No known archaeological sites or sites of significance to mana whenua are identified within the Project area. An Archaeological Assessment is provided in Appendix H.

New Zealand Heritage Properties (NZHP) recommends that all project managers and contractors (including site managers and those contractors on the ground) undergo an archaeological briefing outlining their requirements under the Heritage New Zealand Pouhere Taonga Act 2014 (HNZPTA) prior to any works commencing. The briefing will outline the likelihood of encountering archaeological evidence, how to identify possible archaeological sites during works, the archaeological work required under the conditions of the authority, and contractors' responsibilities with regard to notification of the discovery of archaeological evidence to ensure compliance with the authority conditions.

However, NZHP considers that the potential for encountering archaeological remains is considered to be low. Therefore, NZHP recommends that an archaeological authority is not required. Works must operate under an accidental discovery protocol (Appendix A of the Archaeological Assessment), which should be supplied to all contractors involved in earthworks. An accidental discovery protocol will be adopted to appropriately manage and avoid, remedy or mitigate any potential effects on unknown archaeological artefacts or artefacts of Māori origin that may be found during construction.

6.7 Coastal Effects

The sites are located within a Significant Coastal Landscape overlay. The proposed earthworks will not result in loss of key views or accesses or the loss of openness or naturalness of the landscape. Consideration of the effects on the natural landscape and coastal process of the site are addressed below.

6.7.1 Potential effects on the geomorphic landforms

A Coastal Processes and Effects Assessment (CPEA) was prepared by AECOM (provided in Appendix G). The proposed works will remove landfill material, modifying the current landforms and affecting the erosion potential of the local environment. The small spatial footprint of the landfill sites will limit these effects.

Removal of the fill will expose underlying sediment to the elements, with rainfall, wind and wave action having the potential to cause erosion. As the sites have been built up artificially rather than by natural processes, the removal of the landfill material will return the sites to a condition similar to that existing before the gullies were filled. It is likely that the gullies were somewhat vegetated before the landfills which would have helped to stabilise the loess in the gullies.

Following landfill material removal, bare exposed loess will be more susceptible to erosion until vegetation is re-established. The steep batters and narrow benches in the remediation design will help to limit erosion effects, but there remains the likelihood for accelerated erosion post construction, prior to the re-establishment of vegetation on the site. The erosion of bare soils will also be a potential impact during construction, should moderate to heavy rainfall occur.

However, sediment runoff can be controlled during construction through the use of erosion control measures. The implementation of the ESCP will result in any erosion effects being less than minor.

6.7.2 Potential effects on coastal processes

The effects of landfill removal on the beach environment are anticipated to be negligible. The toe of the landfills is located around the high tide line and are (currently) protected by rock armouring. Loess eroded from the remediated landfill site will be deposited onto the beach, where it will subsequently be removed by wave action. This is consistent with the existing natural processes. Once vegetation is established, a return to pre-landfill conditions will be established.

Rock armouring would have a much greater effect on the beach processes than removal of landfill material. In storm surge events this rock armouring acts to dissipate wave energy and slow erosion. While the area immediately behind the armouring is protected, the presence of this armouring does have the capacity to result in accelerated erosion adjacent to the armouring. Removal of the armouring would return the beach to a more natural environment, resulting in more equal rates of natural erosion along the cliff.

The removal of landfill material will prevent that material entering the ocean, however, its removal is not anticipated to have a material effect on the coast itself. Therefore, any effects on the beach environment are considered to be less than minor.

6.7.3 Natural character and amenity

The existing environment at both sites has been modified by the previous landfilling and road construction, although overall the area retains a level of natural appearance. Views of the sites during remediation will be limited due to the surrounding rural area and the cliff landforms on either side of the sites. The character of the site during and for the medium term following construction will potential look less natural due to the earthworks required to remove contaminated material and to stabilise the completed site as far as practical. Over time natural revegetation and the coastal processes described in the previous two sections will be allowed to take place and over the longer term will restore the natural character and amenity of the sites.

6.8 Air Quality

During the works there is potential for localised impacts on air quality due to the disturbance of soil and contaminated materials, and the movement of materials from the site. Given the relatively small volumes of waste, the likely small percentage of organic waste and the age of the waste (at least 40 years), landfill gas generation is unlikely to be significant and unlikely to impact surrounding air quality. It is noted asbestos has been identified within the landfills and controls are proposed in the CSMP to mitigate potential health effects on workers and dust suppression to avoid effects on the wider environment.

Dust will be minimised through implementing the erosion and sediment control and CSMP measures such as limiting the extent of exposed soil and limiting the heights of any stockpiles. Given the rural nature of the surrounding areas and that there are no dwellings immediately adjacent to the site, the potential effects on air quality will be less than minor.

6.9 Construction Effects on Amenity Values

The remediation works proposed have potential to impact on amenity due to the scale of earthworks required, particularly due to dust, visual impacts, use of heavy vehicles and construction noise. Effects on amenity will be limited to the construction period as all disturbed areas will be stabilised at the completion of the works.

As the sites are located within a rural area and the closest dwelling is approximately 500m northwest of the Project, potential noise effects will be limited. Construction activities would be limited to between 7am and 6pm daily and construction noise will be managed in accordance with the relevant noise limits in Tables 2 and 3 of NZS 6803:1999 Acoustics - Construction Noise. A Traffic Management Plan will be prepared by the Contractor and will document heavy vehicle routes between the sites and Palmerston Landfill, and also mitigation measures to avoid impacts on the transport network. Overall, although the remediation works will have temporary construction effects these can be adequately mitigated.

6.10 Tangata Whenua Values

Potential effects on archaeology sites have been considered through the archaeology assessment and all land disturbance activities will be managed in accordance with an accidental discovery protocol. The Kāi Tahu ki Otago Natural Resource Management Plan 2005 is the principal planning document for Kāi Tahu Ki Otago and was developed though consultation with the four Papatipu Rūnaka of Otago. The following objectives and policies set out in this plan are relevant to the Project and are summarised below:

- Objective 5.2.ii - Ki Uta Ki Tai management of natural resources is adopted within the Otago region.
- Objective 5.2.iii - The mana of Käi Tahu ki Otago is upheld through the management of natural, physical and historic resources in the Otago Region.
- Objective 5.2.iv - Käi Tahu ki Otago have effective participation in all resource management activities within the Otago Region.
- Policy 5.3.4.14 - To encourage Management Plans for all discharge activities that detail the procedure for containing spills and including plans for extraordinary events.
- Policy 5.4.4.5 - To promote the use of Accidental Discovery Protocols for any earth disturbance work
- Policy 5.6.4.22 - To require site rehabilitation plans for land contaminated by landfills, tip sites, treatment plants, industrial waste, and agricultural waste.

The Project seeks to remediate the ongoing impact of the landfills on the environment by removing the existing waste and stabilising the area to as far as possible reflect natural landforms. The remediation will be managed to mitigate potential effects of the temporary construction works required to remove the waste. Given the long-term benefits to the environment and the mitigation of construction effects it is considered the Project activities will be in accordance with the objectives and policies of the Kāi Tahu ki Otago Natural Resource Management Plan 2005.

Any recommendations from or outcomes of consultation with Te Rūnanga o Moeraki via Aukaha will be provided once received.

6.11 Summary of Effects

The Project could result in potential adverse environmental effects if not managed appropriately, on the coastal environment and terrestrial habitats. These potential effects will be managed through the appropriate plans and mitigation as discussed throughout this section.

The Project will also have significant positive effects through remediating the landfill sites and ensuring no more waste pollutes the coastal environment and the restoration of the coastal environment.

Overall, the resulting adverse effects on the environment can be appropriately avoided, remedied or mitigated. The appropriate management controls will be in place throughout the Project and on this basis, it is considered the potential effects on the environment will be less than minor.

7.0 Statutory Assessment

7.1 Resource Management Act 1991

7.1.1 Section 104

Section 104 of the Resource Management Act 1991 (RMA) sets out the matters to which a consent authority must, subject to Part 2 of the RMA, have regard to when considering an application for resource consent. These are:

- Any actual and potential effects on the environment of allowing the activity.
- Any relevant provisions of a national environmental standard, other regulations, national policy statements, the coastal policy statement, regional policy statements and plans, and the district plan.
- Any other matter the consent authority considers relevant and reasonably necessary to determine the application.

The actual and potential effects on the environment are set out is section 6.0 of this report.

Section 104B also applies as this is an application for a discretionary activity. Section 104B states:

104B Determination of applications for discretionary or non-complying activities

After considering an application for a resource consent for a discretionary activity or non-complying activity, a consent authority

(a) May grant or refuse the application; and

(b) If it grants the application, may impose conditions under section 108.

The following addresses the relevant statutory instruments under section 104(1) of the RMA relevant to this proposal.

7.2 National Policy Statements

7.2.1 New Zealand Coastal Policy Statement 2010 (NZCPS)

The NZCPS came into effect on 3 December 2010 and provides guidance for councils in their day-to-day management of the coastal environment. The purpose of the NZCPS is to state policies in order to achieve the purpose of the RMA in relation to the coastal environment of New Zealand.

The key Objectives of the NZCPS relevant to the Project include;

- *Objective 1: to safeguard the integrity, form, functioning and resilience of the coastal environment and sustain its ecosystems, including marine and intertidal areas, estuaries, dunes and land, by:*
    - *maintaining or enhancing natural biological and physical processes in the coastal environment and recognising their dynamic, complex and interdependent nature;*
    - *protecting representative or significant natural ecosystems and sites of biological importance and maintaining the diversity of New Zealand's indigenous coastal flora and fauna; and*
    - *maintaining coastal water quality, and enhancing it where it has deteriorated from what would otherwise be its natural condition, with significant adverse effects on ecology and habitat, because of discharges associated with human activity.*
- *Objective 2: To preserve the natural character of the coastal environment and protect natural features and landscape values through:*
    - *recognising the characteristics and qualities that contribute to natural character, natural features and landscape values and their location and distribution;*

- *identifying those areas where various forms of subdivision, use, and development would be inappropriate and protecting them from such activities; and*
- *encouraging restoration of the coastal environment.*

The key Policies of the NZCPS relevant to the Project include;

- *Policy 1: Extent and characteristics of the coastal environment*
- *Policy 13: Preservation of natural character*
- *Policy 14: Restoration of natural character*
- *Policy 15: Natural features and natural landscapes*
- *Policy 23: Discharge of contaminants*

As far as practical works will not occur within the CMA, however, erosion protection within the CMA may be proposed to mitigate the effects of the remediation activities and short duration works to remove contaminated material from the seaward side of the landfill may be required. The Project is consistent with the provisions of the NZCPS as the works will avoid adverse effects on the coastal environment including the coastal marine area, prevent the coastal water quality from degrading due to discharges from the sites, and enable the restoration of the coastal environment.

7.2.2 National Policy Statement for Freshwater Management 2020 (NPS-FM)

The NPS-FM provides a national framework for how councils are to go about setting objectives, policies and rules about fresh water in their regional plans.

The NPS-FM applies to all freshwater (including groundwater) and, to the extent they are affected by freshwater, to receiving environments (which may include estuaries and the wider coastal marine area). Councils are required to maintain or improve water quality, in accordance with the core values of the NPS-FM, “Ecosystem health”, “human health for recreation”, “threatened species” and “mahinga kai”. The objective of the NPS-FM is:

…to ensure that natural and physical resources are managed in a way that prioritises:

a. first, the health and well-being of water bodies and freshwater ecosystems

b. second, the health needs of people (such as drinking water)

c. third, the ability of people and communities to provide for their social, economic, and cultural well-being, now and in the future.

The key Policies of the NPS FM relevant to the Project include;

- Policy 1: Freshwater is managed in a way that gives effect to Te Mana o te Wai
- Policy 15 Communities are enabled to provide for their social, economic, and cultural wellbeing in a way that is consistent with this National Policy Statement.

In relation to the Project, the NPS-FM there are no freshwater bodies within the Project area, only areas of overland flow. The actual and potential impacts of these activities have been addressed throughout this report with it being demonstrated that the construction works will not adversely impact on the health of freshwater or the health and well-being of the wider environment, with consideration given to the roles and responsibilities of tangata whenua in achieving this. Overall, the Project is considered consistent with the objectives and policies of the NPS FM.

7.2.3 National Policy Statement for Highly Productive Land 2022 (NPS-HPL)

The main purpose of the NPS-HPL is to protect highly productive land from inappropriate subdivision, use and development. The intention is that these land areas (in particular the soil) should be available for primary production, including growing fruit and vegetables. The NPS HPL aims to direct new developments and other land activities that do not require the use of high quality soils, away from highly productive land. The NPS-HPL came into effect on 17 October 2022.

Highly productive land is defined in the NPS HPL as any land that is in a general rural zone or rural productive zone and is predominantly land use capability (LUC) class 1, 2 or 3 land and that forms a

large geographically cohesive area. There are no class 1, 2 or 3 land on or adjacent to Beach Road at the site location. Therefore, the NPS-HPL is not applicable to the Project.

7.3 Otago Regional Policy Statement (ORPS)

The following objectives and policies of the partially operative ORPS 2019 are relevant to the proposed works:

- *Objective 3.1 The values (including intrinsic values) of ecosystems and natural resources are recognised and maintained or enhanced where degraded.*
- *Policy 3.1.5 Maintain coastal water quality or enhance it where it has been degraded*
- *Policy 3.1.10 Biodiversity in the coastal environment*
- *Policy 3.1.12 Natural character in the coastal environment*
- *Objective 4.6 Hazardous substances, contaminated land and waste materials do not harm human health or the quality of the environment in Otago*
- *Policy 4.6.5 Managing contaminated land*

The remediation works will be managed in such a way that any adverse effects on habitats, water or natural resources within the coastal environment are avoided, remedied or mitigated. Contaminated waste removed from the sites will be appropriately transferred to the Palmerston Landfill. Upon completion of the works, the natural character of the landfill sites will be reinstated to enable natural coastal erosion to occur in line with the rest of the coastal cliff.

It is considered that the proposed activities are consistent with the intent of the objectives and policies of the ORPS 2019.

7.4 Regional Plan: Waste for Otago

The following provisions of the Regional Plan: Waste for Otago are those most relevant to the works:

- *Objective 7.3.1 To avoid, remedy or mitigate the adverse environmental effects arising from the discharge of contaminants at and from landfills.*
- *Objective 7.3.2 To eliminate illegal, uncontrolled, unmanaged, poorly managed and poorly located landfill sites.*
- *Policy 7.4.1 To recognise and provide for the relationship Kai Tahu have with Otago's natural and physical resources through:*
    - *a) Providing for the management and disposal of Otago's wastes in a manner that takes into account Kai Tahu cultural values; and*
    - *b) Supporting waste disposal methods which avoid, remedy or mitigate adverse effects on the environment and the mauri of its natural and physical resources; and*
    - *c) Protecting waahi tapu and waahi taoka from waste management practices; and*
    - *d) Ensuring that Kai Tahu access to waahi tapu and waahi taoka is not compromised by waste management practices; and*
    - *e) Acknowledging that future generations will inherit the results of good and bad waste management practices; and*
    - *f) Maintaining consultation with Kai Tahu on issues relating to landfill management.*
- *Policy 7.4.4 To monitor discharges to land, water, and air from new, operating and closed landfills, and from silage production and composting.*

As all practical mitigation measures will be taken during the remediation of the landfill sites; the quality of the surrounding environment will be enhanced. Upon completion of the works, the adverse environmental effects arising from the discharge of contaminants at the landfills will be remedied.

It is expected that where erosion and sediment control measures are implemented during the excavation of the landfill sites, the proposed activity will be consistent with the objectives and policies of the Regional Plan: Waste for Otago.

7.5 Regional Plan: Coast for Otago

The following provisions of the Regional Plan: Coast for Otago are those most relevant to the works:

- *Objective 5.3.1 - To provide for the use and development of Otago's coastal marine area while maintaining or enhancing its natural character, outstanding natural features and landscapes, and its ecosystem, amenity, cultural and historical values.*
- *Objective 7.3.2 - To provide for activities requiring the occupation of the coastal marine area.*
- *Policy 7.4.2 - For activities seeking the right to occupy land of the Crown, consideration will be given to the reasons for seeking that occupation, whether or not a coastal location is required, and to any other available practicable alternatives.*
- *Objective 9.3.2 - To preserve the natural character of Otago's coastal marine area as far as practicable from the adverse effects associated with any alteration of the foreshore or seabed.*
- *Objective 9.3.3 - To take into account the effects of natural physical coastal processes when considering activities which alter the foreshore or seabed in the coastal marine area.*
- *Policy 9.4.5 - The area to be disturbed during any operation altering the foreshore or seabed will be limited as far as practicable to the area necessary to carry out that operation.*
- *Policy 9.4.10 - Alterations of the foreshore and seabed should blend as far as is practicable with the adjoining landscape to minimise the visual impact of the alteration on the character of the area.*

The provisions recognise that some activities require occupation of the CMA to be able to carry out eth activity and in this instance the CMA will only be occupied where required to complete the landfill remediation. As far as practical and safe the remediation will take place from the landward side of the landfills. Public access along the wiser coastal area will not be restricted during the works. Overall, the works are necessary to remove the risk of potential contaminated material being discharged to the coastal marine area and will be managed to avoid, minimise and mitigate potential effects during construction and rehabilitation as far as possible.

7.6 Waitaki District Plan

The following assesses the proposed activities against the relevant objectives and policies of the WDP. The following objectives and policies are relevant to the Project:

- *Objective 16.8.2 - Subdivision, use and development are managed so that:*
    - *The values identified for the outstanding or significant natural features, the outstanding landscapes, and the significant coastal landscapes are protected from inappropriate use and development; and*
    - *The overall landscape qualities of the Rural Scenic Zone are retained.*
- *Policy 4 - To manage the effects of use and development within the significant coastal landscapes so that:*

    a) the natural character of the coastal environment is preserved and protected from inappropriate use and development; and

    b) the visual amenity associated with these landscapes is maintained.
- *Objective 16.9.2(2) - The maintenance or enhancement of the quality of water and the coastal environment, wetlands, lakes, rivers and their margins and the protection of these environments from inappropriate subdivision, use and development.*
- *Policy 2 - To manage the effects of land use activities so that they avoid, remedy or mitigate adverse effects on:*

i. freshwater fish habitat, fish passage and aquatic ecosystems generally, and

ii. water quality and quantity and/or

iii. important ecological functions such as connectivity and hydrology.

The actual and potential impacts of the proposed works have been addressed in section 6.0 of this report with it being demonstrated that the proposed remediation of two historical landfills will not adversely impact the site area, as mitigation measures will be in place. It is considered that where erosion and sediment control measures are implemented during the works, the Project is considered to be consistent with the objectives and policies of the WDP.

7.7 Part 2 Assessment

Part 2 of the RMA sets out the purpose and principles of the Act. The purpose of the RMA, as stated in section 5 of the Act, is to promote the sustainable management of natural and physical resources. The purpose is supported by the principles contained in sections 6-8 of the Act.

This application is consistent with sections 5 to 8 of the RMA and can be described as a sustainable use of natural and physical resources. The proposal will ensure that no more waste from the landfill sites will be released, with adverse effects upon the environment being avoided or mitigated.

7.8 Summary

The proposal aligns with the relevant objectives and policies of the NZCPS, the ORPS, the Regional Plan: Waste for Otago and the WDP. The proposed works are to be undertaken in a manner that aims to protect the surrounding coastal environment. Suitable environmental controls and mitigation will be implemented during construction to avoid any adverse effects. The works proposed are required to safeguard the coastal environment. Without the works being undertaken, there is the potential for more waste to enter the ocean and foreshore as further erosion occurs.

8.0 Notification

8.1 Section 95A

Section 95A of the Act sets out the provisions in relation to the public notification of applications.

Public notification is not mandatory as per step 1 (sections 95A (2) and (3)), for the following reasons:

a. The applicant does not request public notification,

b. Public notification is not required under section 95C, and

c. The application is not made jointly with an application to exchange recreation reserve land under section 15AA of the Reserves Act 1977.

As per step 2 (sections 95A (4) – (6)), public notification is not precluded by all the applicable rules or national environmental standards, and the activity is not a subdivision, a residential activity, a boundary activity or a prescribed activity.

Public notification is not required as per step 3 (sections 95A (7) and (8)) by any applicable rules or national environmental standards. Further, the assessment undertaken in section 6.0 of this report concludes that the adverse effects will be no more than minor.

As per step 4 (section 95A (9)), public notification is not required as there are no special circumstances.

8.2 Section 95B

Section 95B sets out the provisions in relation to the limited notification of applications.

As per step 1 (sections 95B(2) – (4)), limited notification is not required as there are no affected customary rights groups, affected customary marine title groups, and the proposed activity is not on, adjacent to, or may affect land, that is the subject of a statutory acknowledgment.

As per step 2 (sections 95B(5) and (6)), limited notification is not precluded by all the applicable rules or national environmental standards, and the activity is not a controlled activity or prescribed activity.

Limited notification is not required as per step 3 (sections 95B(7) – (9)). As noted above, the proposal is not for a boundary activity or a prescribed activity.

The assessment undertaken in section 6.0 of this report concludes that no parties are considered to be affected in accordance with section 95E. Therefore, there are no parties to be notified.

As per step 4 (section 95B(10)), limited notification to specific parties is not required as there are no special circumstances.

8.3 Section 95D

Section 95D(a) identifies that the effects of the owner and occupier of the subject site and any adjacent sites must be disregarded for the purposes of determining whether an activity will have more than minor adverse effects.

With regard to section 95D(b), there are no applicable national environmental standards or rules that permit this activity.

Section 95D(c) identifies that only the effects in terms of the matters of discretion are relevant for determining whether the effects are more than minor as the activity is a restricted discretionary activity.

Section 95D (d) notes that the effects of trade completion must be disregarded. No such trade competition matters are of relevance to this proposal.

Written approval has been provided by the Department of Conservation, which means potential adverse effects in relation to DoC cannot be considered in accordance with Section 95D(e). A full assessment of effects is provided in section 6.0 of this report, and it is concluded that the effects will be no more than minor.

8.4 Section 95E

Section 95E provides criteria for how a consent authority determines if a person is affected. Council must decide that a person is an affected person if the activity's adverse effects on the person are minor or more than minor (but not less than minor). No written approvals are provided in relation to this resource application. As per subsection (2), only the adverse effects as per the matters of discretion set out in the relevant plans may be considered.

It is considered that the proposal will not generate any effect to external parties that could be considered minor, or more than minor given the assessment provided in section 6.0 of this report

Therefore, in this case no persons are considered to be potentially affected and limited notification in accordance with section 95B(9) is unnecessary.

With consideration to the above, the application can therefore be processed on a non-notified basis

8.5 Summary

No persons are likely to be adversely affected by the proposal, therefore, it is considered that the application can be processed on a non-notified basis.

9.0 Conclusion

Waitaki District Council are seeking land resource consent for the remediation of two landfills at Beach Road, Oamaru.

Overall, resource consent is sought as a **discretionary activity** under the WDP and NES-CS, and for a **discretionary** activity under the Regional Plan: Waste for Otago and Regional Plan: Coast for Otago.

It is considered that, on the basis of the assessment of potential effects of the activity and relevant plan provisions, that the application can be approved on a non-notified basis.

The key findings of this report are that the potential adverse effects on the environment are less than minor and that there are no adversely affected persons as a result of the proposed landfill remediation.

It is considered that resource consent can be granted for the proposal due to the following reasons:

- The Project will prevent any more waste from entering the foreshore and ocean.
- There will be no adversely affected persons.
- The proposal is consistent with the purpose and principles of the RMA.
- The proposal is consistent with the relevant objectives and policies of the NZCPS, the NPSFM the ORPS, the Regional Plans and the WDP.

Overall, subject to section 104B of the RMA, it is recommended that consent be granted for the proposed development (subject to appropriate conditions). It is also considered that the application can be determined on a non-notified basis pursuant to sections 95a and 95b of the RMA.

Appendix A

Design Drawings

LOCATION PLAN

N.T.S.

DRAWING INDEX	
DRAWING NUMBER	TITLE
60668637-SHT-CV-0001	BEACH ROAD LANDFILL REMEDIATION COVER SHEET & DRAWING LIST
60668637-SHT-CV-0002	BEACH ROAD LANDFILL REMEDIATION EXISTING SITE PLAN
60668637-SHT-CV-0003	BEACH ROAD LANDFILL REMEDIATION LANDFILL 1 GENERAL ARRANGEMENT-PLAN
60668637-SHT-CV-0004	BEACH ROAD LANDFILL REMEDIATION LANDFILL 1 TYPICAL SECTIONS
60668637-SHT-CV-0005	BEACH ROAD LANDFILL REMEDIATION LANDFILL 2 GENERAL ARRANGEMENT-PLAN
60668637-SHT-CV-0006	BEACH ROAD LANDFILL REMEDIATION LANDFILL 2 TYPICAL SECTIONS

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PROJECT

BEACH ROAD LANDFILL REMEDIATION

Beach Road,
Oamaru,
New Zealand

Waitaki DISTRICT COUNCIL
TE KAUNIHERA Ā ROHE O WAITAKI

PROJECT DATA

DATUM		SURVEY	

PROJECT MANAGEMENT INITIALS

PK	KP	KP
DESIGNER	CHECKED	APPROVED

ISSUE/REVISION

1	X/XX/2023	FOR REVIEW
I/R	DATE	DESCRIPTION

PROJECT NUMBER

60697520

SHEET TITLE

BEACH RD LANDFILL REMEDIATION COVER SHEET & DRAWING LIST

SHEET NUMBER

60697520-SHT-CV-0001

ISO A1 594mm x 841mm

NOTES:

1. EXTENT OF LANDFILL IS INDICATIVE ONLY AND EXTRAPOLATED FROM BEACH ROAD CLOSED LANDFILLS DETAILED SITE INVESTIGATION, 16 FEB 2021.
2. BOREHOLE LOCATIONS ASSUMED FROM DETAILED SITE INVESTIGATION, 16 FEB 2021.
3. SURVEY PROVIDED BY SURVEY WAITAKI.
4. SURVEY DATA IN TERMS OF NZGD OBSERVATION POINT COORDINATE SYSTEM. VERTICAL DATA IN TERMS OF NZVD16 VERTICAL DATUM.
5. PROPERTY PARCEL BOUNDARY DATA SOURCED FROM LINZ.

LEGEND:

- PARCEL BOUNDARIES
- FENCES
- SUR SWALE
- BOREHOLES

Last saved by: GALINA KOULIKOVA (2023-03-07) Last Plotted: 2023-03-07
Filename: \\NA.AECOMNET.COM\LFS\APAC\CHRISTCHURCH-NZCHC-1\LEGACY\PROJECTS\606X\60697520\900_CAD_GIS\910_CAD\20_SHEETS\60697520-SHT-CV-0002.DWG

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PROJECT

BEACH ROAD LANDFILL REMEDIATION

Beach Road,
Oamaru,
New Zealand

Waitaki DISTRICT COUNCIL
TE KAUNIHERA Ā ROHE O WAITAKI

0 12.5 25 m
1:500

PROJECT DATA

DATUM		SURVEY	

PROJECT MANAGEMENT INITIALS

PK	KP	KP
DESIGNER	CHECKED	APPROVED

ISSUE/REVISION

1	X/XX/2023	FOR REVIEW
I/R	DATE	DESCRIPTION

PROJECT NUMBER

60697520

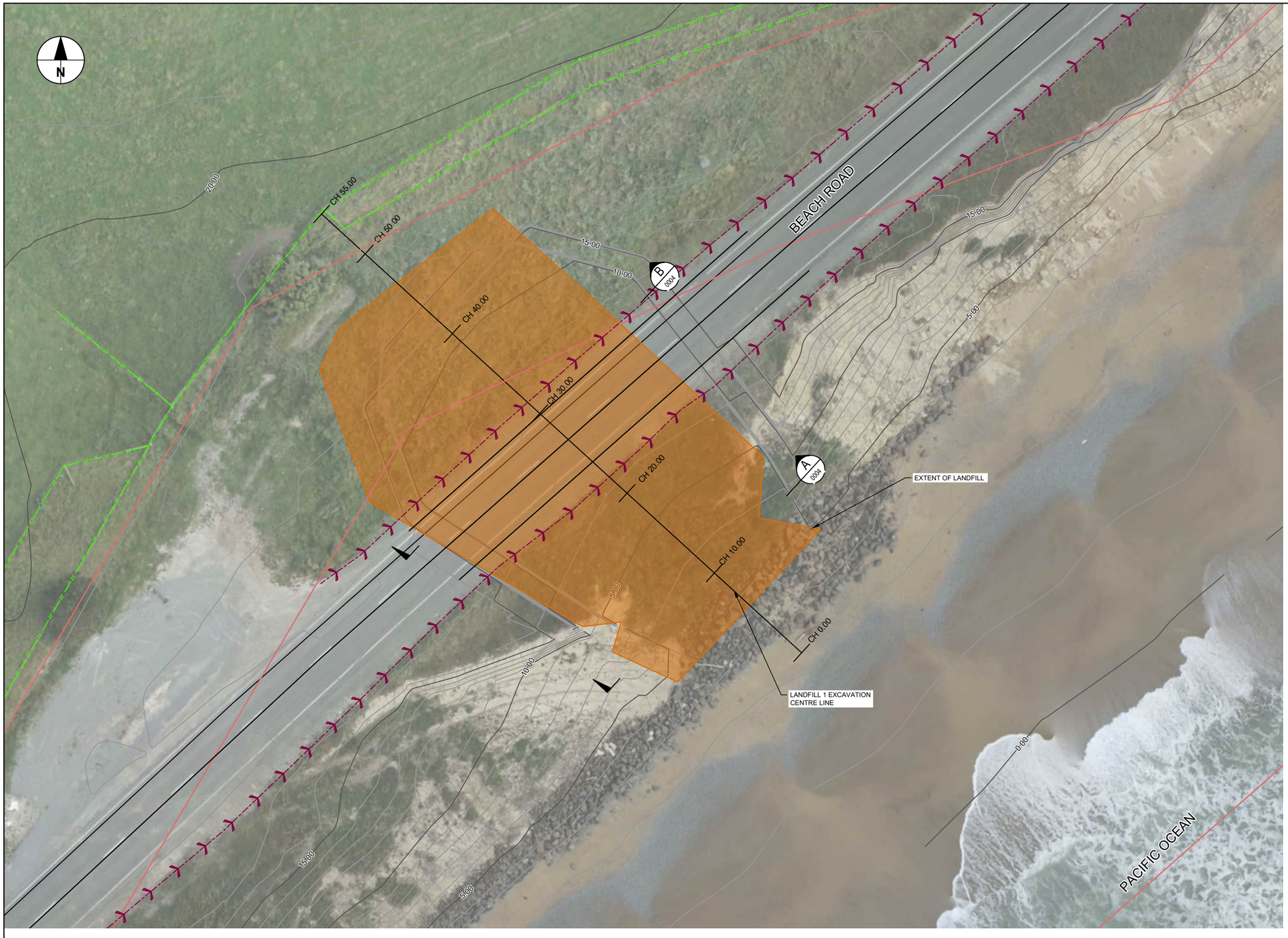
SHEET TITLE

BEACH RD LANDFILL REMEDIATION EXISTING SITE PLAN

SHEET NUMBER

60697520-SHT-CV-0002

ISO A1 594mm x 841mm



NOTES:

1. EXTENT OF LANDFILL IS INDICATIVE ONLY AND EXTRAPOLATED FROM BEACH ROAD CLOSED LANDFILLS DETAILED SITE INVESTIGATION, 16 FEB 2021.
2. DEPTH OF REFUSE IS INDICATIVE ONLY AND EXTRAPOLATED FROM BOREHOLES SOURCED FROM DSI- 16 FEB 2021.

LEGEND:

- PARCEL BOUNDARIES
- FENCES
- SUR SWALE

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PROJECT

BEACH ROAD LANDFILL REMEDIATION
Beach Road,
Oamaru,
New Zealand

Waitaki DISTRICT COUNCIL
TE KAUNIHERA Ā ROHE O WAITAKI

0 5 10 m
1:200

PROJECT DATA

DATUM		SURVEY	

PROJECT MANAGEMENT INITIALS

PK	KP	KP
DESIGNER	CHECKED	APPROVED

ISSUE/REVISION

1	X/XX/2023	FOR REVIEW
I/R	DATE	DESCRIPTION

PROJECT NUMBER

60697520

SHEET TITLE

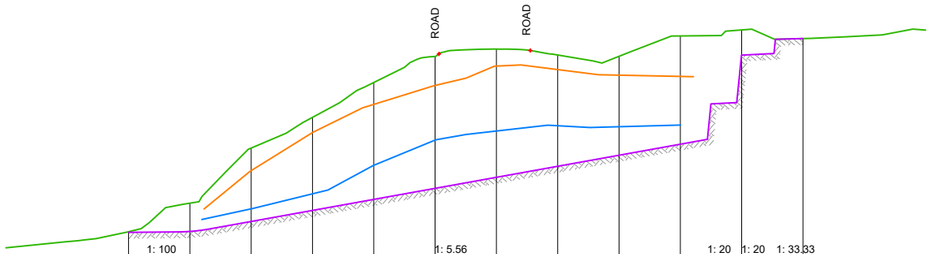
BEACH RD LANDFILL REMEDIATION
LANDFILL 1
GENERAL ARRANGEMENT-PLAN

SHEET NUMBER

60697520-SHT-CV-0003

NOTES:

1. EXTENT OF LANDFILL IS INDICATIVE ONLY AND EXTRAPOLATED FROM BEACH ROAD CLOSED LANDFILLS DETAILED SITE INVESTIGATION, 16 FEB 2021.
2. DEPTH OF REFUSE IS INDICATIVE ONLY AND EXTRAPOLATED FROM BOREHOLES SOURCED FROM DSI- 16 FEB 2021.
3. EXTENT OF REFUSE LAYER MAY VARY. EXTENT TO BE CONFIRMED ON SITE AT CONSTRUCTION STAGE.
4. VERTICAL DATA IN TERMS OF NZVD16 VERTICAL DATUM.



RL = -3.000

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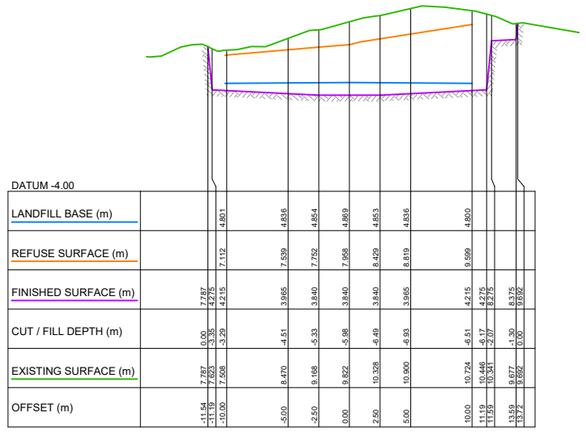
EXISTING SURFACE (m)	2.999	5.330	9.822	12.326	15.165	17.288	17.894	17.409	17.302	18.959	19.450	18.747
CUT / FILL DEPTH	-0.049	-2.302	-5.982	-7.586	-9.525	-10.748	-10.454	-9.069	-8.062	-8.819	-2.050	0.003

LONGITUDINAL SECTION MC LF1 EXCAVATION CENTRE LINE



DATUM -4.00

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EXISTING SURFACE (m)	7.787	7.653	7.508	8.470	9.166	9.822	10.328	10.900	10.724	10.446	10.341	9.677	9.992
CUT / FILL DEPTH (m)	0.00	-3.55	-3.29	-4.51	-5.33	-5.98	-6.49	-6.93	-6.51	-6.17	-2.07	-1.30	0.00
FINISHED SURFACE (m)	7.787	4.275	4.215	3.965	3.840	3.840	3.840	3.965	4.215	4.275	8.275	8.375	9.992
REFUSE SURFACE (m)		7.112		7.539	7.752	7.958	8.429	8.819	9.999				
LANDFILL BASE (m)		4.801		4.836	4.854	4.869	4.853	4.836	4.800				

SECTION A
SCALE 1:250
0004

CHAINAGE 10.000

DATUM 0.00

OFFSET (m)	-20.20	-20.00	-18.00	-16.00	-15.62	-15.00	-10.00	-5.00	-2.50	0.00	2.50	5.00	10.00	15.00	15.62	17.62	18.02	20.00	20.02	20.17
EXISTING SURFACE (m)	18.005	18.005	18.005	17.895	17.881	17.877	17.941	17.914	17.908	17.894	17.882	17.877	17.632	17.830	17.825	17.799	17.793	17.765	17.765	17.765
CUT / FILL DEPTH (m)	0.00	-1.73	-3.82	-1.82	-5.91	-8.90	-10.13	-10.35	-10.47	-10.45	-10.44	-10.31	-10.02	-9.76	-9.75	-5.62	-1.62	-1.49	-1.49	0.05
FINISHED SURFACE (m)	18.005	16.275	14.176	16.076	12.076	8.965	7.815	7.565	7.440	7.440	7.440	7.565	7.815	8.065	8.076	12.176	16.176	16.275	16.275	17.765
REFUSE SURFACE (m)							16.240	16.325	16.305	16.153	16.174	16.196	16.238							
LANDFILL BASE (m)							11.387	11.393	11.340	11.212	11.243	11.275	11.338							

SECTION B
SCALE 1:250
0004

CHAINAGE 30.000

0 6.25 12.5 m
1:250

CONSULTANT
AECOM New Zealand Ltd
NZ.B.N 942 903 209 1335
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PROJECT
BEACH ROAD LANDFILL REMEDIATION
Beach Road,
Oamaru,
New Zealand

Waitaki DISTRICT COUNCIL
TE KAUNIHERA Ā ROHE O WAITAKI

PROJECT DATA

DATUM		SURVEY	

PROJECT MANAGEMENT INITIALS

PK	KP	KP
DESIGNER	CHECKED	APPROVED

ISSUE/REVISION

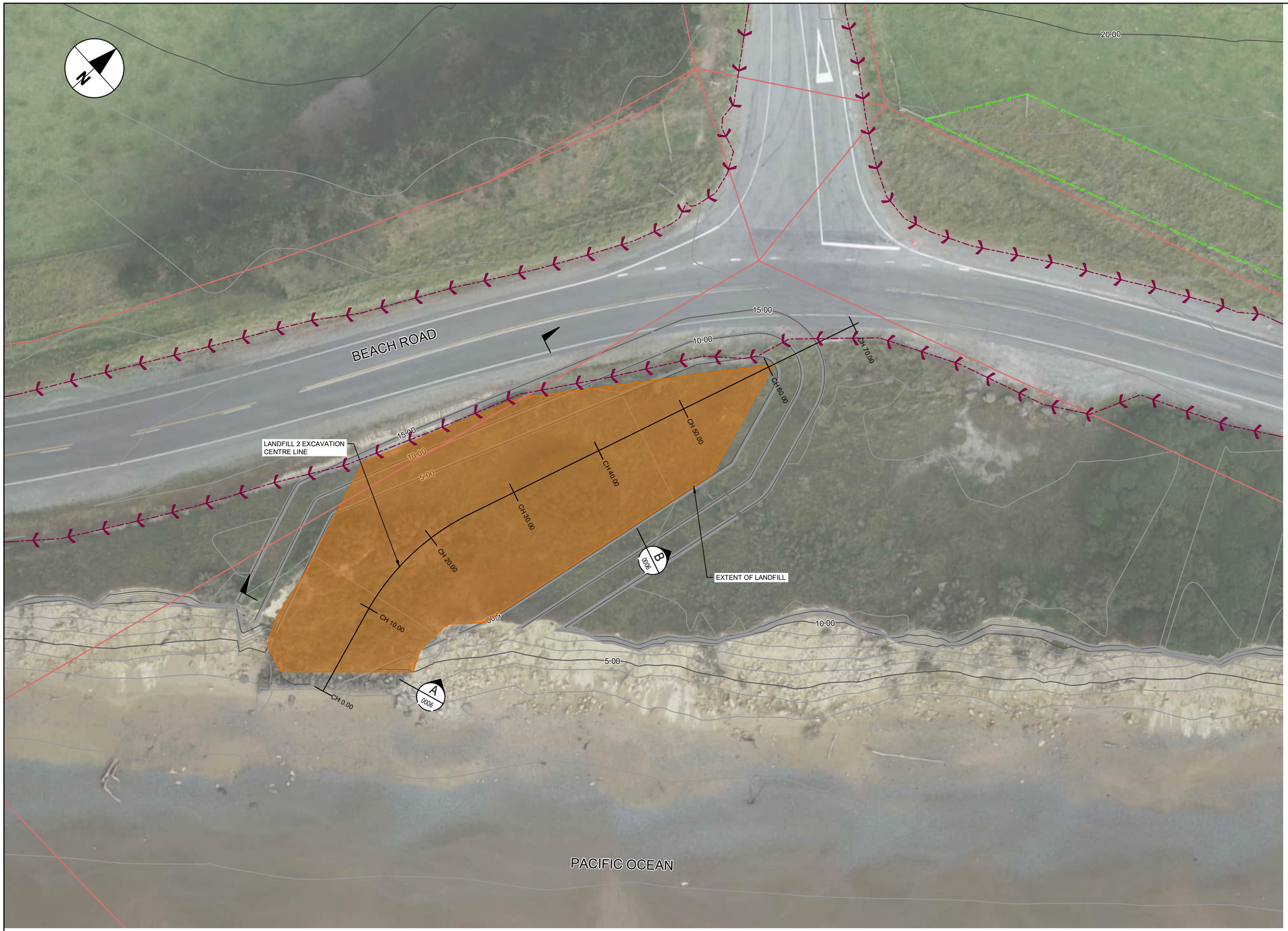
I/R	DATE	DESCRIPTION
1	X/XX/2023	FOR REVIEW

PROJECT NUMBER
60697520

SHEET TITLE
BEACH RD LANDFILL REMEDIATION
LANDFILL 1
TYPICAL SECTIONS

SHEET NUMBER
60697520-SHT-CV-0004

ISO A1 594mm x 841mm



NOTES:

1. EXTENT OF LANDFILL IS INDICATIVE ONLY AND EXTRAPOLATED FROM BEACH ROAD CLOSED LANDFILLS DETAILED SITE INVESTIGATION, 16 FEB 2021.
2. DEPTH OF REFUSE IS INDICATIVE ONLY AND EXTRAPOLATED FROM BOREHOLES SOURCED FROM DSI- 16 FEB 2021.

LEGEND:

- PARCEL BOUNDARIES
- FENCES
- SUR SWALE

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PROJECT

BEACH ROAD LANDFILL REMEDIATION
Beach Road,
Oamaru,
New Zealand

Waitaki DISTRICT COUNCIL
TE KAUNIHERA Ā ROHE O WAITAKI

0 5 10 m
1:200

PROJECT DATA

DATUM		SURVEY	

PROJECT MANAGEMENT INITIALS

PK	KP	KP
DESIGNER	CHECKED	APPROVED

ISSUE/REVISION

1	X/XX/2023	FOR REVIEW
I/R	DATE	DESCRIPTION

PROJECT NUMBER

60697520

SHEET TITLE

BEACH RD LANDFILL REMEDIATION
LANDFILL 2
GENERAL ARRANGEMENT-PLAN

SHEET NUMBER

60697520-SHT-CV-0005

ISO A1 594mm x 841mm

NOTES:

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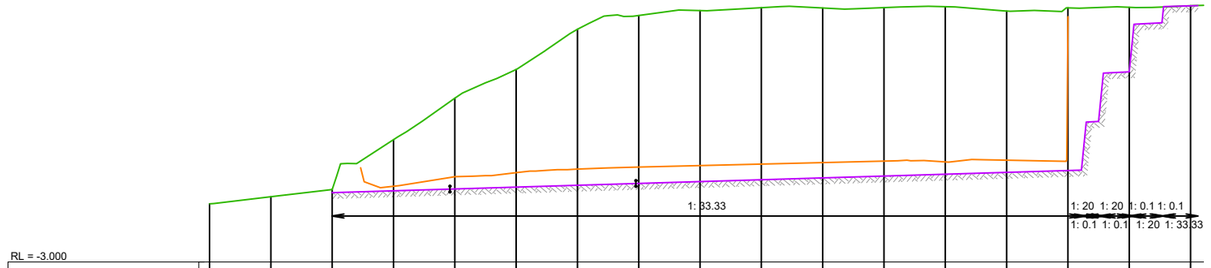
2. DEPTH OF REFUSE IS INDICATIVE ONLY AND EXTRAPOLATED FROM BOREHOLES SOURCED FROM DSI- 16 FEB 2021.
3. EXTENT OF REFUSE LAYER MAY VARY. EXTENT TO BE CONFIRMED ON SITE AT CONSTRUCTION STAGE.
4. VERTICAL DATA IN TERMS OF NZVD16 VERTICAL DATUM.



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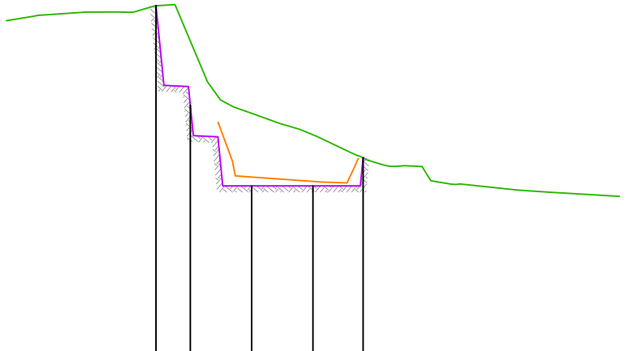
FINISHED SURFACE (m)				2.655	2.805	2.955	3.105	3.255	3.405	3.555	3.705	3.855	4.005	4.155	4.305	4.455	12.500	17.882
REFUSE SURFACE (m)				3.171	3.952	4.280	4.572	4.740	4.861	4.982	5.103	5.224	5.159	5.300				
EXISTING SURFACE (m)	1.743	2.320	2.904	6.973	10.351	12.691	15.971	17.000	17.494	17.720	17.704	17.735	17.811	17.455	17.715	17.761	17.892	
CUT / FILL DEPTH			-0.249	-4.168	-7.396	-9.586	-12.716	-13.688	-13.939	-14.025	-13.949	-13.730	-13.658	-13.150	-13.260	-5.261	-0.010	
CONTROL LINE CHAINAGE	-10	-5	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70	

LONGITUDINAL SECTION MC LF2



DATUM -11.00

FINISHED SURFACE (m)				17.493	9.389	2.805	2.805	5.094							
REFUSE SURFACE (m)						3.527	3.171		3.707	3.506	4.000				
CUT / FILL DEPTH (m)				0.000	-5.224	-5.921	-4.168	0.000							
EXISTING SURFACE (m)	16.346	16.938	16.985	17.493	14.614	8.726	6.973	5.094	5.649	8.841	12.174	17.152	16.941		
OFFSETS (m)	-25.000	-20.000	-15.000	-12.800	-10.000	-5.000	0.000	4.095	5.000	10.000	15.000	20.000	25.000		

SECTION A
SCALE 1:250
0006

CHAINAGE 5.000

DATUM -9.00

FINISHED SURFACE (m)					17.348	7.866	3.855	3.855	7.900	18.659					
REFUSE SURFACE (m)						10.293	5.103	4.669				10.372	4.634		
CUT / FILL DEPTH (m)					0.000	-9.170	-13.849	-14.552	-10.874	0.000					
EXISTING SURFACE (m)	18.113	17.563	17.672	17.426	17.348	17.038	17.704	18.407	18.774	18.659	18.760	18.726	18.246		
OFFSETS (m)	-25.000	-20.000	-15.000	-10.000	-9.772	-5.000	0.000	5.000	10.000	14.160	15.000	20.000	25.000		

SECTION B
SCALE 1:250
0006

CHAINAGE 40.000

CONSULTANT
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PROJECT
BEACH ROAD LANDFILL REMEDIATION
Beach Road,
Oamaru,
New Zealand

Waitaki DISTRICT COUNCIL
TE KAUNIHERA Ā ROHE O WAITAKI

0 6.25 12.5 m
1:250

PROJECT DATA

DATUM		SURVEY	

PROJECT MANAGEMENT INITIALS

PK	KP	KP
DESIGNER	CHECKED	APPROVED

ISSUE/REVISION

1	X/XX/2023	FOR REVIEW
I/R	DATE	DESCRIPTION

PROJECT NUMBER
60697520

SHEET TITLE
BEACH RD LANDFILL REMEDIATION
LANDFILL 2
TYPICAL SECTIONS

SHEET NUMBER
60697520-SHT-CV-0006

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CH 70.00
CH 60.00
CH 50.00
CH 40.00
CH 30.00
CH 20.00
CH 10.00
CH 0.00
10.00
5.00
0.00

Appendix B

Geotechnical Assessment

Prepared for
Waitaki District Council
Co No.: 9429041922798

Beach Road Landfills Remediation

Geotechnical desktop and assessment

15-Feb-2023

aecom.com

Delivering a better world

Beach Road Landfills Remediation

Geotechnical desktop and assessment

Client: Waitaki District Council

Co No.: 9429041922798

Prepared by

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15-Feb-2023

Job No.: 60697520

AECOM in Australia and New Zealand is certified to ISO9001, ISO14001 and ISO45001.

Quality Information

Document	Beach Road Landfills Remediation
Ref	60697520
Date	15-Feb-2023
Originator	Charlotte Parker & Dhugal McQuistan
Checker/s	Jordan Craig
Verifier/s	Russell Allison

Revision History

Rev	Revision Date	Details	Approved	
			Name/Position	Signature
1	15-Feb-2023	For issue	Russell Allison Associate Director - Ground Engineering & Tunnelling	

Table of Contents

1.0 Introduction

AECOM New Zealand Limited (AECOM) have been engaged by GHC Consulting on behalf of Waitaki District Council (WDC) to provide planning and technical services to prepare resource consent applications and assessment of environmental effects (AEE) for the remediation of two historical landfills (Landfill 1 and Landfill 2) located along the coastal cliffs on Beach Road, Oamaru.

This report summarises the geotechnical component that is intended to inform the concept design of the landfill remediation.

2.0 Scope of work

The following geotechnical work was undertaken:

- A desktop review of existing information,
- Site visit to assess site geology and inspect natural slope formations in the area,
- Review of local material sources for engineered fill,
- Static and seismic slope stability analysis to inform cut and fill slopes,
- Recommendations for post removal landform for concept design.

3.0 Background

AECOM understands that the two landfills were never explicitly opened or approved by the council. The sites have been investigated and partially remediated in 2017. A detailed site investigation was undertaken by WSP in 2021 to characterise the contamination risk at each site.

The previous investigations are reported in the following documents:

- Preliminary Site Investigation: Beach Road Landfills, Oamaru (Otago Regional Council, 2018)
- Beach Road closed landfills. Detailed site investigation (WSP, 2021)

4.0 Site description

The two landfill sites, referred to as Landfill 1 and Landfill 2, are located along Beach Road, approximately 3 km south of Oamaru (Figure 1). The landfills are located within existing gullies along a steep, eroding, coastal cliff between Beach Road and the Pacific Ocean.

Landfill 1 is located approximately 220 m northeast from the intersection with Awamoa Road and Beach Road and has an approximate total site area of 677 m^2. Landfill 2 is approximately 10 m southwest of the intersection and has an approximate total site area of 722 m^2. Beach Road traverses' Landfill 1 and passes inland of Landfill 2.

Figure 1 Site location of landfill sites (Google Earth imagery)

5.0 Site walkover observations

A visual inspection of the landfill sites was completed by an AECOM engineering geologist and civil engineer, accompanied by Dave Hanan, a principal environmental engineer from GHC Consulting, on 25th January 2023. The observations from each site are summarised below. Specific geological information is summarised in section 9.0.

5.1 Landfill 1

- The landfill area is dominantly vegetated with grass and small shrubs.
- Gabions are present at road level at the top of the cliff, retaining the road, approximately 8 m in length and at least 0.5 m high.
- Rock armouring is present at the base of the landfill, with a varying width from base of the landfill (5 to 8 m). The rock armour varies in size from approx. 0.3 m diameter, up to 1.5 m diameter.
- A steep access track from the road down to the beach has been established at the southern extent of the landfill.
- Sub vertical cliffs (dominantly loess overlaying marine sands) are adjacent to the landfill site. The contact between the loess and marine sand was obscured by collapsed cliff material.
- The contact between the landfill and natural ground is visible at the northern extent as shown in Figure 2. The approximate angle of this contact is 35 to 45 degrees.

Figure 2 Northern extent of Landfill 1 illustrating contact between the landfill and natural ground

5.2 Landfill 2

- The landfill area is dominantly vegetated with grass and small shrubs with some established trees.
- Surface drainage is present at road level, at the head of the landfill, parallel to the road. The unlined swale is approx. 0.8 m deep and 0.5 m wide at the base.
- Rock armouring is stacked vertically at the base of the landfill, approx. 1.5 to 2 m in height. The rock armour is typically larger rocks approx. 1 m diameter.
- Sub vertical cliffs (dominantly loess overlaying marine sands) are adjacent to the landfill site. The contact between the loess and marine sand was obscured by collapsed cliff material.
- The natural gully slope angles are estimated at approx. 35 to 40 degrees at the southern end and slightly steeper, 45 degrees, at the northern end shown in Figure 3.

Figure 3 Landfill 2 illustrating contact between the landfill and natural ground

6.0 Historical aerial imagery

WSP (2020) completed a historical aerial imagery assessment using MapsPast, Retrolens and Google Earth dated from 1866 to 2020, based on the review completed by Otago Regional Council (2018). The assessments have been reviewed and are summarised in Table 1 below.

Table 1 Reviewed summary of historical aerial imagery by ORC (2018) and WSP (2020)

Date/Source	Landfill 1 observations	Landfill 2 observations	Surrounding area
1866 (MapsPast)	Coastal profile visible as a slightly incised/eroded gully	Coastal profile visible as a slightly incised/eroded gully	Awamoa Road is partially completed
1955 (Retrolens)	Moderate sized gully (~20m x 40 m) clearly visible with Beach Road curving around the western extent of the gully.	Smaller gully (~20m x 20m) just south of the intersection between Beach Road and Awamoa Road.	Both Awamoa and Beach Road are well formed gravel roads
1966 (Retrolens)	Low quality imagery, difficult to distinguish any differences.	Low quality imagery, difficult to distinguish any differences.	Slight coastal retreat is visible.
1972 (Retrolens)	Beach road has been realigned directly across Landfill 1. There is surface scarring visible. Sides of gully show significant increase in vegetation growth. The existing road is visible to the northwest.	Small trail or drainage feature visible leading to the edge of the gully from Beach Road. Vegetation growth.	Coastal erosion continued
1978 (Retrolens)	Low quality imagery, difficult to distinguish any differences.	Low quality imagery, difficult to distinguish any differences.	Slight coastal retreat is visible
1982 (Retrolens)	Less visible scarring but the alignment is still visible.	Low quality imagery. The gully is less visible since 1972, likely due to image quality and camera angle.	Coastal erosion continued
2002 (Retrolens)	Low quality imagery, difficult to distinguish any differences.	Low quality imagery, difficult to distinguish any differences.	Coastal erosion continued
2006 (Google Earth)	Coastal erosion apparent	Coastal erosion apparent. Visible refuse on cliff face	
2020 (Google Earth)	Gully visible but in shadow. Rip rap at cliff toe visible.	Gully visible but in shadow. Rip rap at cliff toe visible.	Continued costal erosion

7.0 Geological setting

7.1 Published geological information

The published 1:250,000 scale geological map of the Waitaki area (Forsyth et al., 2001) indicates that both landfill sites are located on late Pleistocene aged ocean beach deposits composed of slightly weathered sand with pebbles and shells, overlain by loess.

An excerpt from the geological map is shown in (Figure 4).

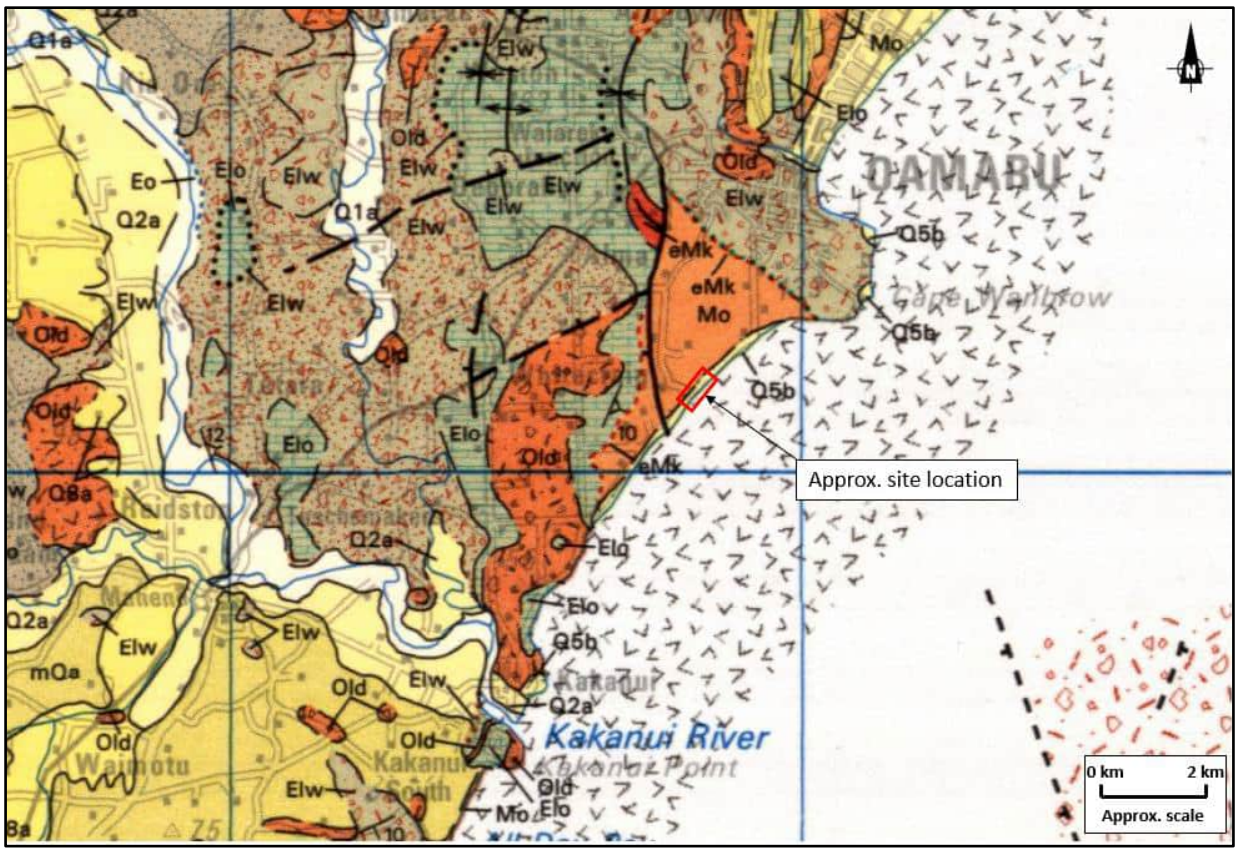

Figure 4 Geological map extract (Forsyth et al., 2001)

7.2 Active Faults

The NZ Active Faults Database indicates that the closest active fault to the site is >30 km to the northwest. Stonewall fault is a reverse fault located subparallel to the Waitaki River on the northern side. No further information on the fault is available on the database.

8.0 Geotechnical investigations

8.1 Existing on site data

Previous investigations were undertaken by WSP in November 2020, comprising 11 borehole investigations, six at Landfill 1 (BH01, BH02, BH03, BH09, BH10, BH11) and five at Landfill 2 (BH04, BH05, BH06, BH07, BH08). This information is summarised in Table 2, locations are illustrated in Figure 5 and Figure 6 and related records are presented in Appendix A.

Table 2 Summary of existing on site geotechnical data

Investigation reference	Source	Investigation type	Depth (m bgl)	Date
BH01	Geotechnics	Borehole	8.0	11/11/2020
BH02			3.0	11/11/2020
BH03			8.0	11/11/2020
BH04			3.0	11/11/2020
BH05			3.0	11/11/2020
BH06			5.0	11/11/2020
BH07			8.0	11/11/2020
BH08			3.0	11/11/2020
BH09			4.0	11/11/2020
BH10			2.0	11/11/2020
BH11			3.0	11/11/2020

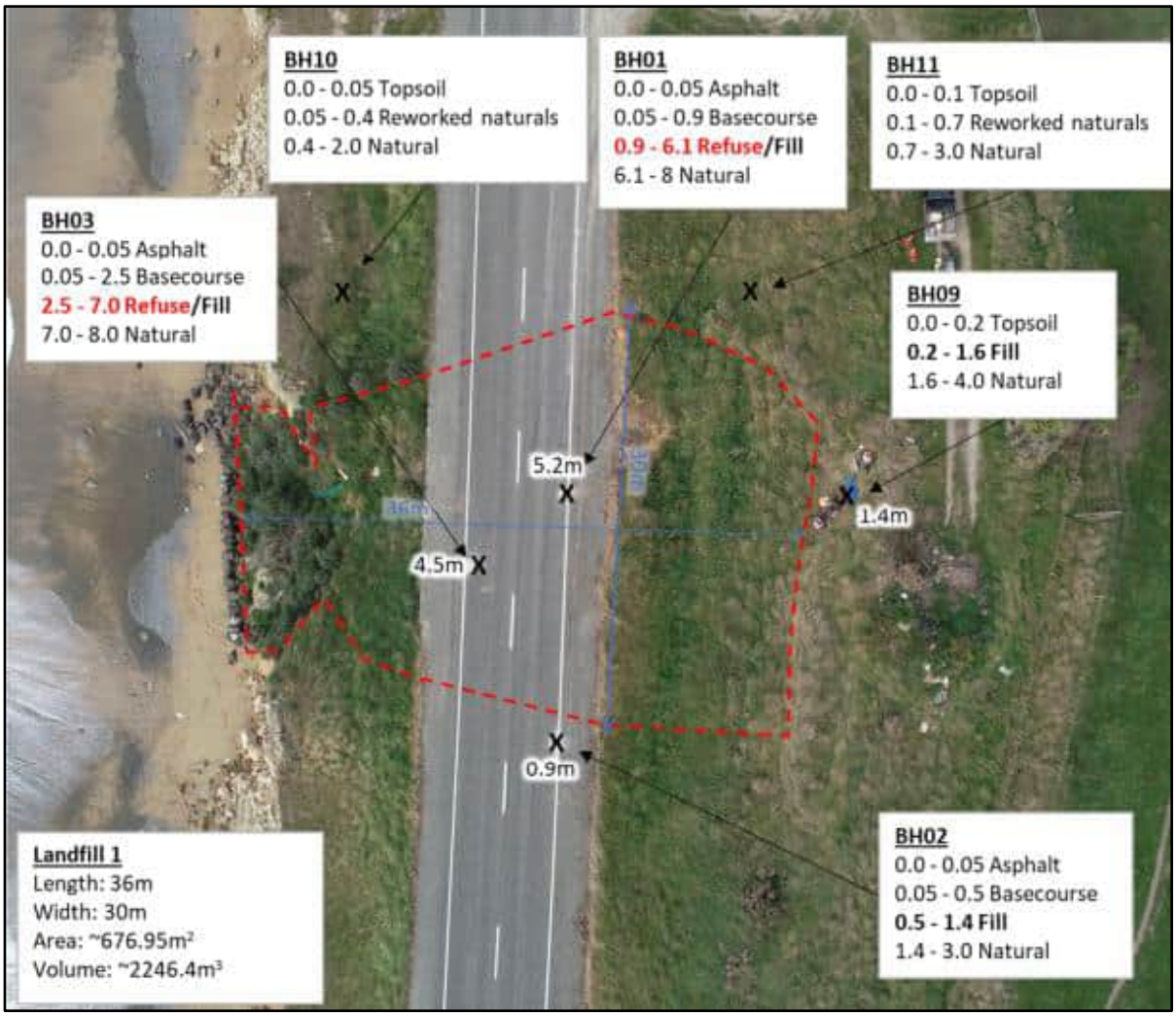

Figure 5 Location of WSP (2021) borehole investigations at Landfill 1 (extracted from WSP 2021 report)

Figure 6 Location of WSP (2021) borehole investigations at Landfill 2 (extracted from WSP 2021 report).

8.2 Existing nearby data

The New Zealand Geotechnical Database (NZGD) has been reviewed for geotechnical and geological information in the vicinity of the site. The nearest data is approximately 3 km to the northeast of the sites in Oamaru township, therefore has not been used in this report.

9.0 Ground conditions

9.1 Site geology

Based on the site history, geological map, the site walkover and the available geotechnical investigation data, the likely ground conditions at each landfill site are typically loess overlying bedded marine sands. Fill/refuse of varying thickness has been disposed of within natural gullies along the coastal cliffs.

Table 3 and Table 4 below summaries the interpreted geological profile at each landfill site including the refuse thickness.

Table 3 Geological profile at Landfill 1

Geological unit	Description	Thickness (m)
Topsoil or Asphalt	Topsoil – organic SILT	0.05 to 0.1
Fill/Refuse	Mixture of clay, silt, sand and gravel with refuse consisting of glass bottles, plastic wrapping, hard plastics, porcelain, tin, wire, concrete, shell, bricks, smelter waste and ash.	4.5 to 5.2
Loess	Clayey SILT, very stiff to hard, slightly plastic	Up to approx. 15 (based on cliff exposure adjacent to landfill site)
Ocean Beach deposits	Fine to medium SAND with beds of rounded fine to coarse gravel and shell fragments	>1.5

Table 4 Geological profile at Landfill 2

Geological unit	Description	Thickness (m)
Topsoil	Organic SILT	0.05 to 0.30
Fill/Refuse	Mixture of clayey SILT and SILT with refuse consisting of glass bottles, plastic wrapping, hard plastics, porcelain, tin, wire, concrete, shell, bricks, smelter waste, ash and coal tar.	0.9 to >7.95
Loess	Clayey SILT, very stiff to hard, slightly plastic	Up to approx. 15 (based on cliff exposure adjacent to landfill site)
Ocean Beach deposits	Fine to medium SAND with beds of rounded fine to coarse gravel and shell fragments	>2.0

9.2 Groundwater

Groundwater was not encountered in any of the boreholes previously undertaken on site, completed to a maximum depth of 8 m bgl.

During the AECOM site walkover, no seepage in the cliff faces from either landfill was observed.

The Otago Regional Council online GIS portal shows the nearest bore >500 m inland of the landfills.

The Otago Regional Council Report (2018) states that the landfill sites are located within the boundaries of the North Otago Volcanic Aquifer but is confined at the landfill sites and groundwater discharge to the coast is through marine springs and sea bed seepage.

10.0 Geotechnical assessment

10.1 Soil parameters

The ground profile and geotechnical properties have been derived for the soils directly adjacent to the landfill that will comprise the cut slopes.

Based on the geotechnical investigation data, local experience, first principals of soil mechanics, presumptive values in Bowles (1997) and Look (2007) and local studies (Russell (2022)), parameters have been adopted for the slope stability analysis assuming that all contaminated or disturbed materials have been removed until in-situ soil is encountered.

As no seepage has been observed in the cliff faces, a groundwater level of >15 m bgl has been assumed for the stability analysis.

A summary of the interpreted subsurface soil conditions, together with the adopted geotechnical parameters for the subsoil profile, are provided in Table 5 below.

Table 5 Geotechnical Soil Parameters

Geological unit	Soil / Rock type	Depth to base	Unit weight (kN/m^3)	Effective friction angle Φ' (°)	Effective cohesion C' (kPa)
Loess	Clayey SILT, very stiff to hard, slightly plastic	15 m	17	34	15
Ocean Beach deposits	Fine to medium SAND with beds of rounded fine to coarse gravel and shell fragments	Unknown	18	34	-

10.2 Design peak ground acceleration

The seismic loadings have been derived based on the methodology outlined in Module 1 of the Earthquake Geotechnical Engineering Practice (2021). Peak Ground Acceleration (PGA) and Earthquake Magnitude (M) have been selected from Table A.1 in Appendix A of the document corresponding to a selected return period. The return period has been determined using the following methodology:

- Identification of road type on One Network Road Classification (ONRC),
- Determination of Road Importance Level (IL) based on Tables 2.1 to 2.3 in the Bridge Manual 3rd Edition (2022).

The following seismic design criteria have been determined for slope stability analysis:

Table 6 Determination of seismic loading

Parameter	Input
Road classification (ONRC)	Secondary Collector
Importance level (Table 2.3 of BM)	3
Slope height	> 6 m
SLS return period	1/25
ULS/DCLS return period (Table 2.3 of BM)	1/1000

Table 7 Design seismic loadings

Load case	Return period	Peak ground acceleration (PGA), g	Earthquake magnitude (M)
SLS	1/25	0.06	6
ULS/DCLS	1/1000	0.29	6

10.3 Slope stability analysis

A quantitative slope stability assessment has been undertaken using Geostudio Slope/W software to assess the risk of slope failure affecting Beach Road at the two landfill locations. The analysis undertaken used geotechnical parameters outlined in Table 5 above. A back analysis model was run on a 13.5 m vertical loess cliff face to confirm the parameters outlined in Table 5.

Two representative slope models have been developed, one for each landfill to determine suitable cut slope angles. The cross-section locations are shown in Figure 7 and Figure 8.

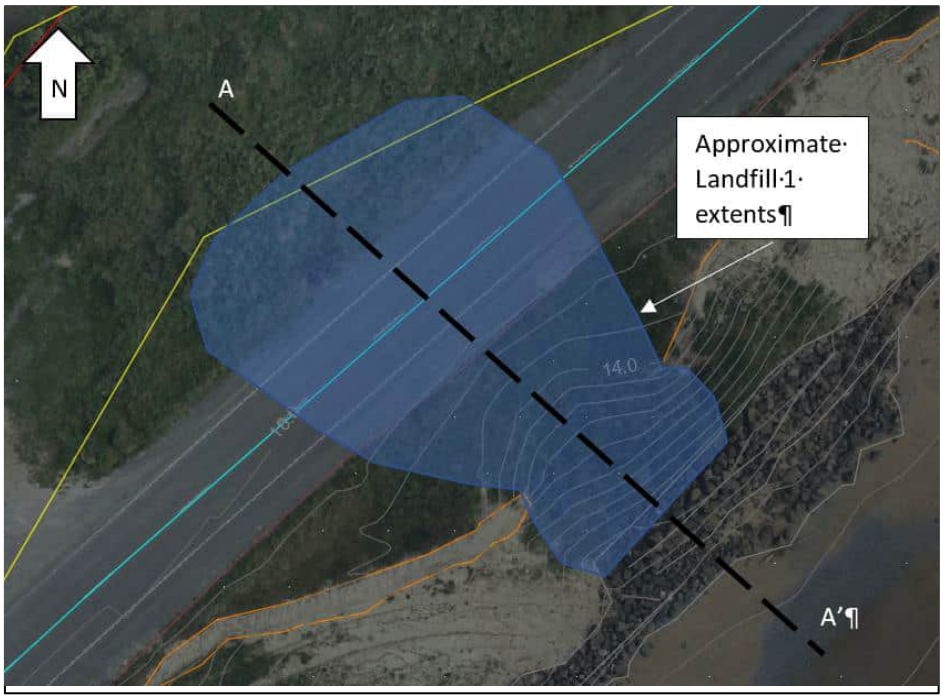

Figure 7 Location of Landfill 1 with cross-section location shown

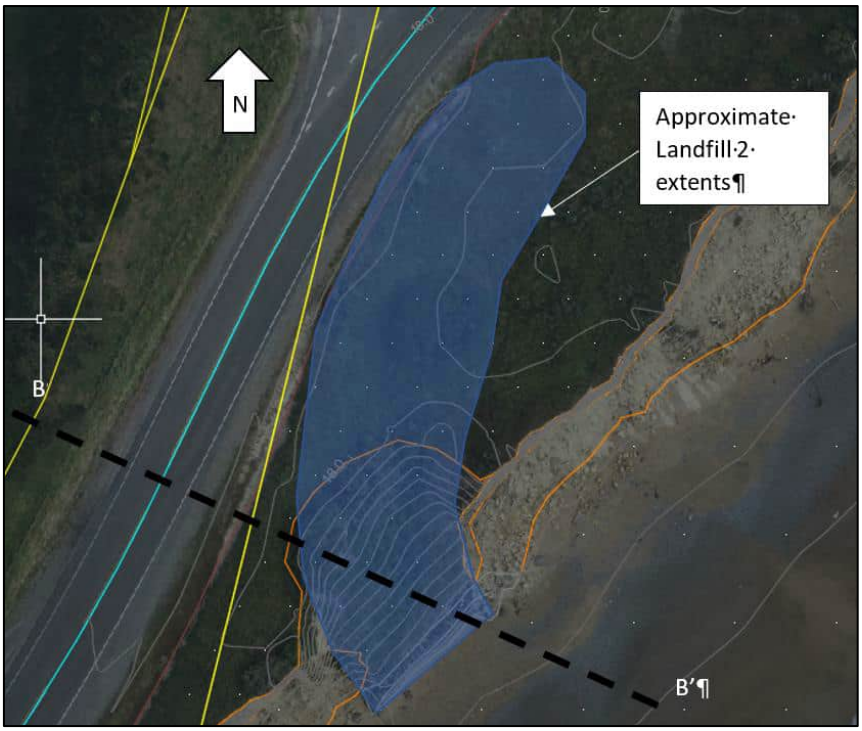

Figure 8 Location of Landfill 2 with cross-section location shown

The following cut slopes have been modelled in Slope/W shown in the figures in Appendix B:

- Max. bench height = 4 m
- Max. bench slope angle = 80°
- Bench width = 1.5 – 2.0 m
- Overall slope max height = 15 m
- Overall slope angle = 60°

The following scenarios have been analysed for the proposed cut slopes:

- Static global long-term stability
- Static local bench long-term stability
- Seismic SLS, where the serviceability level PGA is applied in a pseudo-static analysis
- Seismic ULS, where the ultimate maximum PGA is applied in a pseudo-static analysis
- Seismic ULS Local bench stability, where the ultimate maximum PGA is applied in a pseudo-static analysis
- Seismic Yield, where the PGA applied to the scenario results in a stability factor of safety of 1

The following assumptions were made for the slope stability assessment:

- Groundwater is anticipated to be > 15 mbgl
- Drained geotechnical parameters have been assumed
- A traffic surcharge of 12 kN/m^2 was assumed.

The results of the slope stability analyses are summarised in Table 8, outputs from the Slope/W software are included in Appendix B.

Table 8 Slope stability analyses results

Design scenario	Landfill 1	Landfill 2	
	Factor of Safety (FoS)	Factor of Safety (FoS)	Newmark deflection (mm)
Static global	1.52	1.49	N/A
Static local bench	-	1.35	N/A
Seismic SLS	1.38	1.36	N/A
Seismic ULS	1.02	0.96	N/A
Seismic ULS bench	-	0.88	N/A
Seismic ULS bench with yield PGA	-	1.00	10-20

10.3.1 Discussion of results

It is anticipated that the cut slopes will be excavated within loess material. Loess is known to have a low permeability and remain stable at steep slope angles when kept dry, however is easily erodible when exposed to surface water. Based on the nature of the loess, slopes have been designed to direct surface water runoff away from the slopes to prevent ponding on exposed surfaces.

It is anticipated that over the short to medium term the proposed slopes will remain stable, however small local failures and erosion may occur on benches as the slopes are exposed to weather.

Landfill 1

The removal of Landfill 1 results in the removal of Beach Road at this location. It is understood that the road is not to be realigned resulting in closure of the road from this location.

Based on the existing borehole data, it is assumed that an excavation height of maximum 8 m is required to remove all landfill material. To achieve a suitable factor of safety for the cut slopes, the following is proposed:

- Overall maximum slope height = 8 m
- Overall slope angle = 60°
- Bench slope max. height = 4 m
- Bench slope angle = 80°
- Bench width = 2 m
- Bench grade = 5%

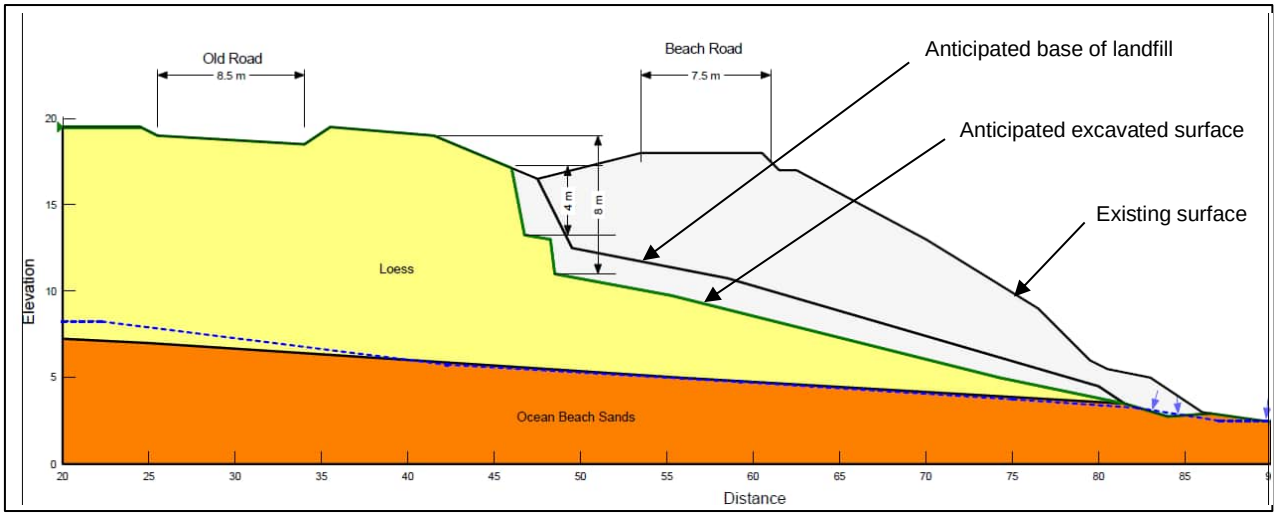

Figure 9 Landfill 1 proposed slopes (extract from slope stability results)

Landfill 2

The removal of Landfill 2 results in a potentially 15 m high cut slope, with the slope crest potentially at 6 m lateral distance from beach road. It is understood that at this location it is desirable to keep Beach Road operational in the short to medium term until coastal erosion impacts road stability.

To maximise the global stability of the slope, it is proposed that existing site rock armour be gathered and placed at the slope toe. If insufficient rock armour material can be gathered, imported material may be required.

To achieve a suitable factor of safety for the cut slopes, the following is proposed:

- Overall maximum slope height = 15 m
- Overall slope angle = 60°
- Bench slope max. height = 4 m
- Bench slope angle = 80°
- Bench width = 2 m
- Bench grade = 5%
- Site-gathered rock armour to be placed at slope toe approximately 3 m high and 5.5 m laterally.

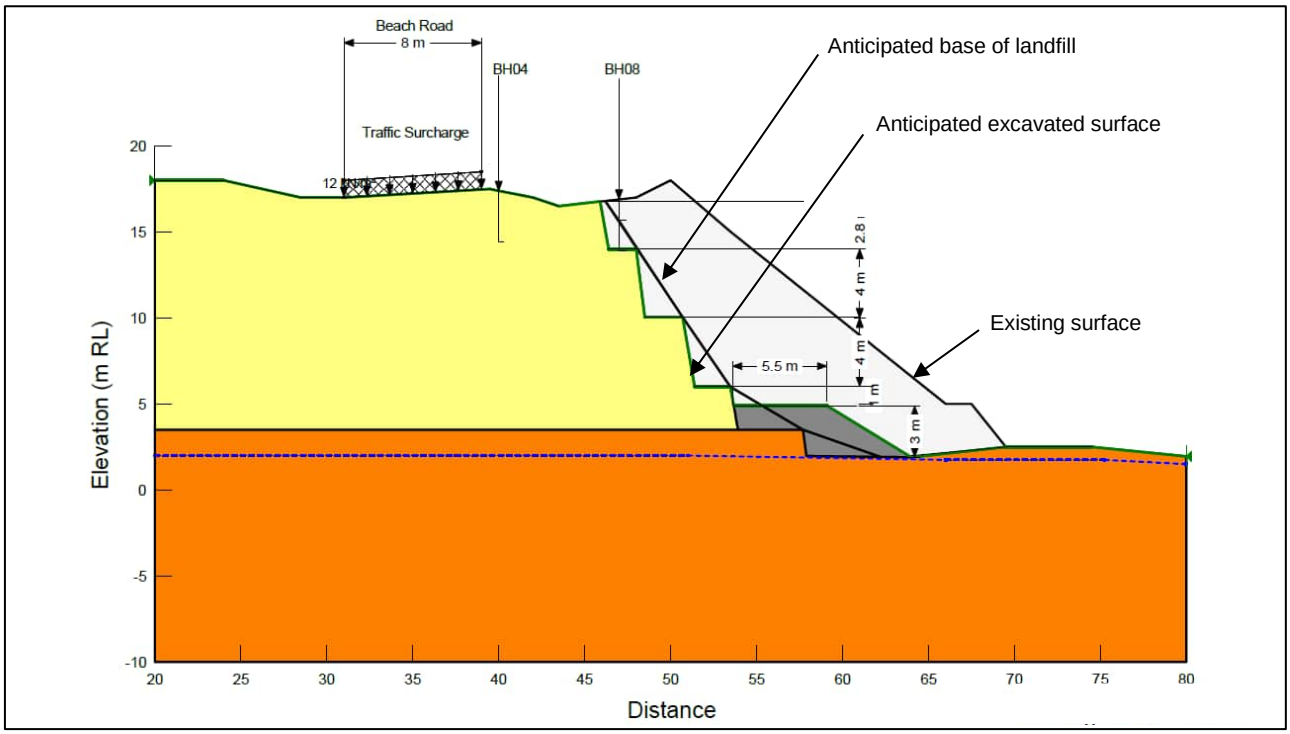

Figure 10 Landfill 2 proposed slopes (extract from slope stability results)

11.0 Local material sources for engineered fill

11.1 Loess

Loess material when disturbed has poor residual strength and is easily erodible unless stabilised (e.g. lime or cement stabilised). As such, loess material is unlikely to be suitable for reuse on site.

11.2 Rock armour

Rock armour present on the beach to be placed at toe of slope for Landfill 2. Based on the site inspection, the rock armour consists of basalt, ranging from 0.3 to 1.5 m in diameter. The extents of the rock armour at the toe of the cut slope at Landfill 2 should be a minimum of 3 m high and 5.5 m in length with a 45° face angle.

12.0 Recommendations

- All landfill material should be removed, including contaminated loess and sand material.
- Reworked loess is not suitable as fill material.
- Rock armour should be gathered and placed at the toe of Landfill 2.
- Based on the slope stability analysis, we provide the following landform details for concept design of Landfill 1 and Landfill 2:
  - Overall maximum slope height = 15 m
  - Overall slope angle = 60°
  - Bench slope max. height = 4 m
  - Bench slope angle = 80°
  - Bench width = 2 m
  - Bench grade = 5%
- A Geotechnical engineer should be consulted during excavation to confirm final landform cut slopes.

13.0 References

Forsyth, P.J. (compiler) 2001. Geology of the Waitaki area. Institute of Geological and Nuclear Sciences 1:250 000 geological map 19. 1 sheet and 64 p. Lower Hutt, New Zealand: Institute of Geological and Nuclear Sciences Limited.

Google, Inc. 2023, Google Maps, viewed January 2023, https://www.google.co.nz/maps/preview

GNS Science. 2022. New Zealand Active Fault Database. Retrieved January, 2023, from Active Faults 250K: https://data.gns.cri.nz/af/

Historical Imagery Resource, Retrolens aerial photograph database, 2022: http://retrolens.nz

New Zealand Geotechnical Database, 2022. Accessed via Google Earth from https://www.nzgd.org.nz/

Otago Regional Council, 2020. *Preliminary site investigation: Beach Road Landfills, Oamaru*. Reference A1097455

Otago Regional Council Bores, Accessed January 2023: https://orcportal.orc.govt.nz/portal/home/webmap/viewer

Russell, A. (2022). The unsaturated characteristics of natural loess in slopes, New Zealand. *Geotechnique*

WSP, 2021. *Beach Road closed landfills detailed site investigation*. Report prepared for Waitaki District Council

14.0 Limitations

The information, interpretation, recommendations and opinions contained in this report are based on a desk study and site walkover as described in this report. Inferences about ground conditions over the site are made using geological principles and engineering judgement. However, it is possible that conditions over the site may vary and it is therefore not possible to guarantee the continuity of ground conditions away from the existing investigation locations.

This report has been prepared for the particular project and purpose described in the brief and in this report, and no responsibility is accepted for the use of any part of this report in any other context or for any other purposes.

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Appendix A

Existing onsite geotechnical data

Project:	Beach Road Landfills Detailed Site Investigation	*Coordinates:*	Not established		
Client:	Waitaki District Council	*Ref. Grid:*	n/a	*Depth:*	8 m
Project No.:	6-TWT51.00	*R.L.:*	Not established	*Inclination:*	Vertical
Location:	Beach Road, Oamaru Beach Road, Oamaru	*Datum:*			

BH01

DRAFT

GEOLOGY	MAIN DESCRIPTION / DETAIL DESCRIPTION	R.L. (m)	DEPTH (m)	GRAPHIC LOG	TESTS: SPT 'N' VALUE	TESTS: SPT BLOW COUNTS OR SHEAR VALUE	CORE: CORE TYPE	CORE: TOTAL CORE RECOVERY (%)	DRILLING: DRILLING METHOD	DRILLING: CASING	DRILLING: BASE OF HOLE & WATER LEVEL	NOTES / OTHER TESTS	INSTALLATION DETAILS
Asphalt	Asphalt		0										
Fill	Silty Sandy GRAVELS; light brown. Loose; moist; sand, fine to coarse; subangular to rounded, fine to coarse gravel. (FILL)											Lab: BRL001	
	Silty CLAY and clayey SILT with minor to trace sand; light greyish brown. Firm; moist; Low plasticity; sand, fine to coarse. (FILL)		1									Lab: BRL002	
	Angular to rounded, fine to coarse GRAVEL with some sand; light gray with light green to black gravel. Loose; dry to moist; Sand, fine to coarse. (FILL)												
	Gravelly SAND with minor silt and clay; orangish brown. Loose; moist to wet; sand is coarse; angular to rounded, fine to coarse gravel. (FILL)											Lab: BRL003	
	Silty CLAY and clayey SILT; light orangish brown with minor grey mottling. Firm to stiff; moist; low plasticity. (FILL)		2									Lab: BRL004	
	SILT with some clay; dark brown. Dry to moist. Slight organic odour. (FILL)		3									Lab: BRL005	
	Sandy SILT with minor gravel; dark grey mottled orangish brown and brownish grey. Loose; moist; gravel, angular to rounded, fine to coarse including broken glass, concrete pieces, shell and ash.								Windowless Sampler			Lab: BRL006	
	Gravelly SAND with pockets of silt and clay; dark orange. Loose; dry to moist; sand is fine to coarse; gravel, angular to rounded, fine to coarse, including glass, shell, ash and refuse.		4									Lab: BRL007	
	ASH; light creamy brown. Consolidated but easy to indent. (FILL)											Lab: BRL008	
	Burnt silty CLAY with burnt organics; dark brown. Soft; including melted glass and steel. (FILL) 5.00-5.30m - Dark Orange		5									Lab: BRL009	
	Silty CLAY with fiberous organics; dark brown mottled light brown. Soft; moist; high plasticity. (FILL)		6									Lab: BRL010	
Ocean Beach Deposits	Sandy SILT; orangish grey mottled grey and dark orange. Stiff to very stiff; moist; non plastic; sand is fine. (OCEAN BEACH DEPOSITS)											Lab: BRL011	
	END OF BOREHOLE AT 8m - Target Criteria Achieved		7										
			8										
			9										

Notes:

1. Borehole completed at a depth of 8.00m begl.
2. Borehole dry during and on completion.
3. Borehole backfilled with arisings and bentonite cap upon completion.

Started:	11/10/2020	*Finished:*	11/10/2020
Drilling Co.:	Geotechnics	*Drilling Rig:*	Tracked Window Sampling Rig
Logged by:	MB	*Checked by:*	EDH

Logged in accordance with NZ Geotechnical Society Guidelines (2005). See attached key sheet for explanation of symbols.

Scale 1:50 @ A4

Project:	Beach Road Landfills Detailed Site Investigation		*Coordinates:*	Not established	
Client:	Waitaki District Council		*Ref. Grid:*	n/a	*Depth:* 3 m
Project No.:	6-TWT51.00	BH02	*R.L.:*	Not established	*Inclination:* Vertical
Location:	Beach Road, Oamaru Beach Road, Oamaru		*Datum:*		

DRAFT

GEOLOGY	MAIN DESCRIPTION / DETAIL DESCRIPTION	R.L. (m) / DEPTH (m)	GRAPHIC LOG	TESTS: SPT 'N' VALUE	TESTS: SPT BLOW COUNTS OR SHEAR VALUE	CORE: CORE TYPE	CORE: TOTAL CORE RECOVERY (%)	DRILLING: DRILLING METHOD	DRILLING: CASING	DRILLING: BASE OF HOLE & WATER LEVEL	NOTES / OTHER TESTS	INSTALLATION DETAILS
Asphalt	Asphalt	0										
Fill	Silty Sandy GRAVELS; light brown. Loose; moist; sand, fine to coarse; subangular to rounded, fine to coarse gravel. (FILL)											
	Sandy Silty CLAY with gravel; orangish brown. Moist; sand is fine to coarse; angular to subrounded, fine to coarse gravel. (FILL)										Lab: BRL012	
	0.90-1.40m - Becoming dark brown	1						Windowless Sampler			Lab: BRL013	
Ocean Beach Deposits	Silty SAND; light orangish brown. Firm; moist. (OCEAN BEACH DEPOSITS)	2									Lab: BRL014	
	END OF BOREHOLE AT 3m - Target Criteria Achieved	3										
		4										
		5										
		6										
		7										
		8										
		9										

BOREHOLE SOIL LOG A4 BEACH ROAD.GPJ WSP-OPUS2018_TEM.GDT 18/12/20

Notes:

1. Borehole completed at a depth of 3.00m begl.
2. Borehole dry during and on completion.
3. Borehole backfilled with arisings and bentonite cap upon completion.

Started:	11/10/2020	*Finished:*	11/10/2020
Drilling Co.:	Geotechnics	*Drilling Rig:*	Tracked Window Sampling Rig
Logged by:	MB	*Checked by:*	EDH

Logged in accordance with NZ Geotechnical Society Guidelines (2005). See attached key sheet for explanation of symbols.

Scale 1:50 @ A4

Project:	Beach Road Landfills Detailed Site Investigation	*Coordinates:*	Not established		
Client:	Waitaki District Council	*Ref. Grid:*	n/a	*Depth:*	8 m
Project No.:	6-TWT51.00	*R.L.:*	Not established	*Inclination:*	Vertical
Location:	Beach Road, Oamaru Beach Road, Oamaru	*Datum:*			

BH03

DRAFT

GEOLOGY	MAIN DESCRIPTION / DETAIL DESCRIPTION	R.L. (m)	DEPTH (m)	GRAPHIC LOG	TESTS: SPT 'N' VALUE	TESTS: SPT BLOW COUNTS OR SHEAR VALUE	CORE: CORE TYPE	CORE: TOTAL CORE RECOVERY (%)	DRILLING: DRILLING METHOD	DRILLING: CASING	DRILLING: BASE OF HOLE & WATER LEVEL	NOTES / OTHER TESTS	INSTALLATION DETAILS
Asphalt	Asphalt												
Fill	Sandy GRAVEL occasional cobble; light brownish cream. Sand is fine to coarse; subangular to rounded, fine to coarse gravel.											Lab: BRL015	
	0.70-0.90m - Black with mixed up asphalt		1										
			2										
	Silty CLAY and clayey SILT with quartz clasts; light greensish grey. Soft; wet. (FILL)												
	Rounded GRAVEL with cobbles. Loose.												
	Sandy SILT with some clay, trace gravel and fiberous organics; dark greenish grey with minor black mottling. Firm; moist. (FILL)		3									Lab: BRL016 Lab: BRL017	
	Silty CLAY; light orangish brown; very stiff; dry to moist. (FILL)												
	Burnt ground with SILT and CLAY ; very stiff; dry to moist; including glass, shell peices, layered charcoal and ash. (FILL)		4						Windowless Sampler				
			5									Lab: BRL018_Asb Lab: BRL018	
			6										
Ocean Beach Deposits	Silty SAND; light orangish brown. Firm; moist. (OCEAN BEACH DEPOSITS)		7									Lab: BRL019	
	END OF BOREHOLE AT 8m - Target Criteria Achieved		8										
			9										

Notes:

1. Borehole completed at a depth of 8.00m begl.
2. Borehole dry during and on completion.
3. Borehole backfilled with arisings and bentonite cap upon completion.

Started:	11/10/2020	*Finished:*	11/10/2020
Drilling Co.:	Geotechnics	*Drilling Rig:*	Tracked Window Sampling Rig
Logged by:	MB	*Checked by:*	EDH

Logged in accordance with NZ Geotechnical Society Guidelines (2005). See attached key sheet for explanation of symbols.

Scale 1:50 @ A4

Project:	Beach Road Landfills Detailed Site Investigation		*Coordinates:*	Not established	
Client:	Waitaki District Council		*Ref. Grid:*	n/a	*Depth:* 3 m
Project No.:	6-TWT51.00		*R.L.:*	Not established	*Inclination:* Vertical
Location:	Beach Road, Oamaru Beach Road, Oamaru	BH04	*Datum:*		

DRAFT

GEOLOGY	MAIN DESCRIPTION / DETAIL DESCRIPTION	R.L. (m)	DEPTH (m)	GRAPHIC LOG	TESTS: SPT 'N' VALUE	TESTS: SPT BLOW COUNTS OR SHEAR VALUE	CORE: CORE TYPE	CORE: TOTAL CORE RECOVERY (%)	DRILLING: DRILLING METHOD	DRILLING: CASING	DRILLING: BASE OF HOLE & WATER LEVEL	NOTES / OTHER TESTS	INSTALLATION DETAILS
Asphalt	Asphalt		0										
Asphalt	Silty Sandy GRAVELS; light brown. Loose; moist; sand, fine to coarse; subangular to rounded, fine to coarse gravel. (FILL)												
Asphalt	COAL TAR; black. (FILL)												
Ocean Beach Deposits	Gravelly SAND with cobbles and a slight hydrocarbon odour; dark orange. Sand is fine to coarse; subangular, coarse gravel. (FILL)											Lab: BRL020	
Ocean Beach Deposits	Clayey SILT; light orangish brown. Stiff; moist; low plasticity; liquid limit dilatant. (OCEAN BEACH DEPOSITS)		1						Windowless Sampler			Lab: BRL021 Lab: BRL022	
			2									Lab: BRL023 Lab: BRL024	
	END OF BOREHOLE AT 3m - Target Criteria Achieved		3									Lab: BRL025	
			4										
			5										
			6										
			7										
			8										
			9										

Notes:

1. Borehole completed at a depth of 3.00m begl.
2. Borehole dry during and on completion.
3. Borehole backfilled with arisings and bentonite cap upon completion.

Started:	11/11/2020	*Finished:*	11/11/2020
Drilling Co.:	Geotechnics	*Drilling Rig:*	Tracked Window Sampling Rig
Logged by:	MB	*Checked by:*	EDH

Logged in accordance with NZ Geotechnical Society Guidelines (2005). See attached key sheet for explanation of symbols.

Scale 1:50 @ A4

Project:	Beach Road Landfills Detailed Site Investigation	*Coordinates:*	Not established		
Client:	Waitaki District Council	*Ref. Grid:*	n/a	*Depth:*	3 m
Project No.:	6-TWT51.00	*R.L.:*	Not established	*Inclination:*	Vertical
Location:	Beach Road, Oamaru Beach Road, Oamaru	*Datum:*			

BH05

DRAFT

GEOLOGY	MAIN DESCRIPTION / DETAIL DESCRIPTION	R.L. (m)	DEPTH (m)	GRAPHIC LOG	TESTS: SPT 'N' VALUE	TESTS: SPT BLOW COUNTS OR SHEAR VALUE	CORE: CORE TYPE	CORE: TOTAL CORE RECOVERY (%)	DRILLING: DRILLING METHOD	DRILLING: CASING	DRILLING: BASE OF HOLE & WATER LEVEL	NOTES / OTHER TESTS	INSTALLATION DETAILS
Fill	Silty Sandy GRAVELS; light brown. Loose; moist; sand, fine to coarse; subangular to rounded, fine to coarse gravel. (FILL)		0										
Ocean Beach Deposits	Clayey SILT; light orangish brown. Stiff; moist; low plasticity; liquid limit dilatant. (OCEAN BEACH DEPOSITS)		1						Windowless Sampler			Lab: BRL026 Lab: BRL027 Lab: BRL028 Lab: BRL029	
	END OF BOREHOLE AT 3m - Target Criteria Achieved		3									Lab: BRL030	
			4										
			5										
			6										
			7										
			8										
			9										

BOREHOLE SOIL LOG A4 BEACH ROAD.GPJ WSP-OPUS2018_TEM.GDT 18/12/20

Notes:

1. Borehole completed at a depth of 3.00m begl.
2. Borehole dry during and on completion.
3. Borehole backfilled with arisings and bentonite cap upon completion.

Started:	11/11/2020	*Finished:*	11/11/2020
Drilling Co.:	Geotechnics	*Drilling Rig:*	Tracked Window Sampling Rig
Logged by:	MB	*Checked by:*	EDH

Logged in accordance with NZ Geotechnical Society Guidelines (2005). See attached key sheet for explanation of symbols.

Scale 1:50 @ A4

Project:	Beach Road Landfills Detailed Site Investigation	*Coordinates:*	Not established
Client:	Waitaki District Council	*Ref. Grid:*	n/a
Project No.:	6-TWT51.00	*R.L.:*	Not established
Location:	Beach Road, Oamaru Beach Road, Oamaru	*Datum:*	

BH06

Depth: 5 m
Inclination: Vertical

DRAFT

GEOLOGY	MAIN DESCRIPTION / DETAIL DESCRIPTION	R.L. (m)	DEPTH (m)	GRAPHIC LOG	TESTS: SPT 'N' VALUE	TESTS: SPT BLOW COUNTS OR SHEAR VALUE	CORE: CORE TYPE	CORE: TOTAL CORE RECOVERY (%)	DRILLING: DRILLING METHOD	DRILLING: CASING	DRILLING: BASE OF HOLE & WATER LEVEL	NOTES / OTHER TESTS	INSTALLATION DETAILS
Topsoil	TOPSOIL with grass and organics		0										
Reworked Naturals	SILT; light greyish brown. Dry. (REWORKED NATURALS)											Lab: BRL031	
Ocean Beach Deposits	SILT; light greyish brown. Dry grading to moist. (OCEAN BEACH DEPOSITS)		1						Windowless Sampler			Lab: BRL032	
			2									Lab: BRL033	
			3									Lab: BRL034	
			4									Lab: BRL035	
	END OF BOREHOLE AT 5m - Target Criteria Achieved		5									Lab: BRL036	
			6										
			7										
			8										
			9										

BOREHOLE SOIL LOG A4 BEACH ROAD.GPJ WSP-OPUS2018_TEM.GDT 18/12/20

Notes:
1. Borehole completed at a depth of 5.00m begl.
2. Borehole dry during and on completion.
3. Borehole backfilled with arisings upon completion.

Started:	11/11/2020	*Finished:*	11/11/2020
Drilling Co.:	Geotechnics	*Drilling Rig:*	Tracked Window Sampling Rig
Logged by:	MB	*Checked by:*	EDH

Logged in accordance with NZ Geotechnical Society Guidelines (2005). See attached key sheet for explanation of symbols.

Scale 1:50 @ A4

Project:	Beach Road Landfills Detailed Site Investigation		*Coordinates:*	Not established	
Client:	Waitaki District Council		*Ref. Grid:*	n/a	*Depth:* 8 m
Project No.:	6-TWT51.00		*R.L.:*	Not established	*Inclination:* Vertical
Location:	Beach Road, Oamaru Beach Road, Oamaru	BH07	*Datum:*		

DRAFT

GEOLOGY	MAIN DESCRIPTION / DETAIL DESCRIPTION	R.L. (m) / DEPTH (m)	GRAPHIC LOG	TESTS: SPT 'N' VALUE	TESTS: SPT BLOW COUNTS OR SHEAR VALUE	CORE: CORE TYPE	CORE: TOTAL CORE RECOVERY (%)	DRILLING: DRILLING METHOD	DRILLING: CASING	DRILLING: BASE OF HOLE & WATER LEVEL	NOTES / OTHER TESTS	INSTALLATION DETAILS
Topsoil	TOPSOIL with grass and organics	0										
Fill	Clayey SILT; layered dark brown, dark orange and dark grey. Thinly bedded: including glass bricks, wiring, china and smelter waste. Layers are no thicker than 0.30m. (FILL)							Windowless Sampler			Lab: BRL037_Asb Lab: BRL037	
		1									Lab: BRL038_Asb Lab: BRL038	
		2									Lab: BRL039	
	2.50m - Coal Tar inclusion										Lab: BRL040	
		3									Lab: BRL041	
		4									Lab: BRL042_Asb Lab: BRL042	
		5									Lab: BRL043	
		6									Lab: BRL044	
		7									Lab: BRL045	
	END OF BOREHOLE AT 8m - Target Criteria Achieved	8									Lab: BRL046	
		9										

Notes:

1. Borehole completed at a depth of 8.00m begl.
2. Borehole dry during and on completion.
3. Borehole backfilled with arisings and bentonite cap upon completion.

Started:	11/11/2020	*Finished:*	11/11/2020
Drilling Co.:	Geotechnics	*Drilling Rig:*	Tracked Window Sampling Rig
Logged by:	MB	*Checked by:*	EDH

Logged in accordance with NZ Geotechnical Society Guidelines (2005). See attached key sheet for explanation of symbols.

Scale 1:50 @ A4

Project:	Beach Road Landfills Detailed Site Investigation	*Coordinates:*	Not established
Client:	Waitaki District Council	*Ref. Grid:*	n/a
Project No.:	6-TWT51.00	*R.L.:*	Not established
Location:	Beach Road, Oamaru Beach Road, Oamaru	*Datum:*	

BH08

Depth: 3 m

Inclination: Vertical

DRAFT

GEOLOGY	MAIN DESCRIPTION / DETAIL DESCRIPTION	R.L. (m)	DEPTH (m)	GRAPHIC LOG	TESTS: SPT 'N' VALUE	TESTS: SPT BLOW COUNTS OR SHEAR VALUE	CORE: CORE TYPE	CORE: TOTAL CORE RECOVERY (%)	DRILLING: DRILLING METHOD	DRILLING: CASING	DRILLING: BASE OF HOLE & WATER LEVEL	NOTES / OTHER TESTS	INSTALLATION DETAILS
Topsoil	SILT with trace organics; greyish brown. Dry. (TOPSOIL)		0										
Fill	SILT; dark greyish brown to orangish white and dark brown. Loose; dry; smelter waste, fine gravel to cobble sized. (FILL)		1						Windowless Sampler			Lab: BRL047 Lab: BRL048 Lab: BRL048_Asb	
Ocean Beach Deposits	SILT; light greyish brown. Dry. (OCEAN BEACH DEPOSITS)		2									Lab: BRL049 Lab: BRL050	
	END OF BOREHOLE AT 3m - Target Criteria Achieved		3									Lab: BRL051	
			4										
			5										
			6										
			7										
			8										
			9										

BOREHOLE SOIL LOG A4 BEACH ROAD.GPJ WSP-OPUS2018_TEM.GDT 18/12/20

Notes:

1. Borehole completed at a depth of 3.00m begl.
2. Borehole dry during and on completion.
3. Borehole backfilled with arisings and bentonite cap upon completion.

Started:	11/11/2020	*Finished:*	11/11/2020
Drilling Co.:	Geotechnics	*Drilling Rig:*	Tracked Window Sampling Rig
Logged by:	MB	*Checked by:*	EDH

Logged in accordance with NZ Geotechnical Society Guidelines (2005). See attached key sheet for explanation of symbols.

Scale 1:50 @ A4

Project:	Beach Road Landfills Detailed Site Investigation	*Coordinates:*	Not established
Client:	Waitaki District Council	*Ref. Grid:*	n/a
Project No.:	6-TWT51.00	*R.L.:*	Not established
Location:	Beach Road, Oamaru Beach Road, Oamaru	*Datum:*	

BH09

Depth: 4 m
Inclination: Vertical

DRAFT

GEOLOGY	MAIN DESCRIPTION / DETAIL DESCRIPTION	R.L. (m)	DEPTH (m)	GRAPHIC LOG	TESTS: SPT 'N' VALUE	TESTS: SPT BLOW COUNTS OR SHEAR VALUE	CORE: CORE TYPE	CORE: TOTAL CORE RECOVERY (%)	DRILLING: DRILLING METHOD	DRILLING: CASING	DRILLING: BASE OF HOLE & WATER LEVEL	NOTES / OTHER TESTS	INSTALLATION DETAILS
Topsoil	SILT with organics; dark greyish brown . Dry. (TOPSOIL)		0										
Fill	SILT with some gravel; light brown. Soft; dry; rounded, coarse gravel.											Lab: BRL052 Lab: BRL053_Asb Lab: BRL053	
	0.90m - Becomes dark brownish grey. Firm.		1										
Ocean Beach Deposits	SILT; light greyish brown. Dry grading to moist. (OCEAN BEACH DEPOSITS)		2						Windowless Sampler			Lab: BRL054 Lab: BRL055	
			3									Lab: BRL056	
	END OF BOREHOLE AT 4m - Target Criteria Achieved		4									Lab: BRL057	
			5										
			6										
			7										
			8										
			9										

Notes:

1. Borehole completed at a depth of 4.00m begl.
2. Borehole dry during and on completion.
3. Borehole backfilled with arisings and bentonite cap upon completion.

Started:	11/11/2020	*Finished:*	11/11/2020
Drilling Co.:	Geotechnics	*Drilling Rig:*	Tracked Window Sampling Rig
Logged by:	MB	*Checked by:*	EDH

Logged in accordance with NZ Geotechnical Society Guidelines (2005). See attached key sheet for explanation of symbols.

Scale 1:50 @ A4

Project:	Beach Road Landfills Detailed Site Investigation	*Coordinates:*	Not established
Client:	Waitaki District Council	*Ref. Grid:*	n/a
Project No.:	6-TWT51.00	*R.L.:*	Not established
Location:	Beach Road, Oamaru Beach Road, Oamaru	*Datum:*	

BH10

Depth: 2 m

Inclination: Vertical

DRAFT

GEOLOGY	MAIN DESCRIPTION / DETAIL DESCRIPTION	R.L. (m)	DEPTH (m)	GRAPHIC LOG	TESTS: SPT 'N' VALUE	TESTS: SPT BLOW COUNTS OR SHEAR VALUE	CORE: CORE TYPE	CORE: TOTAL CORE RECOVERY (%)	DRILLING: DRILLING METHOD	DRILLING: CASING	DRILLING: BASE OF HOLE & WATER LEVEL	NOTES / OTHER TESTS	INSTALLATION DETAILS
Topsoil	TOPSOIL		0										
Ocean Beach Deposits	SILT with some gravel; greyish brown mottled cream with orange. Dry; angular to rounded; fine to coarse gravel. (FILL/REWORKED NATURAL)											Lab: BRL058_Asb Lab: BRL058	
	SILT; light greyish brown. Dry grading to moist. (OCEAN BEACH DEPOSITS)		1						Windowless Sampler			Lab: BRL059	
	END OF BOREHOLE AT 2m - Target Criteria Achieved		2										
			3										
			4										
			5										
			6										
			7										
			8										
			9										

BOREHOLE SOIL LOG A4 BEACH ROAD.GPJ WSP-OPUS2018_TEM.GDT 18/12/20

Notes:

1. Borehole completed at a depth of 2.00m begl.
2. Borehole dry during and on completion.
3. Borehole backfilled with arisings and bentonite cap upon completion.

Started:	11/11/2020	*Finished:*	11/11/2020
Drilling Co.:	Geotechnics	*Drilling Rig:*	Tracked Window Sampling Rig
Logged by:	MB	*Checked by:*	EDH

Logged in accordance with NZ Geotechnical Society Guidelines (2005). See attached key sheet for explanation of symbols.

Scale 1:50 @ A4

Project:	Beach Road Landfills Detailed Site Investigation	*Coordinates:*	Not established
Client:	Waitaki District Council	*Ref. Grid:*	n/a
Project No.:	6-TWT51.00	*R.L.:*	Not established
Location:	Beach Road, Oamaru Beach Road, Oamaru	*Datum:*	

BH11

Depth: 3 m

Inclination: Vertical

DRAFT

GEOLOGY	MAIN DESCRIPTION / DETAIL DESCRIPTION	R.L. (m)	DEPTH (m)	GRAPHIC LOG	TESTS: SPT 'N' VALUE	TESTS: SPT BLOW COUNTS OR SHEAR VALUE	CORE: CORE TYPE	CORE: TOTAL CORE RECOVERY (%)	DRILLING: DRILLING METHOD	DRILLING: CASING	DRILLING: BASE OF HOLE & WATER LEVEL	NOTES / OTHER TESTS	INSTALLATION DETAILS
Topsoil	TOPSOIL with grass and organics		0										
Fill	SILT with trace gravels; dark greyish brown; dry. (FILL/REWORKED NATURALS)											Lab: BRL060	
Ocean Beach Deposits	SILT; light greyish brown. Dry grading to moist. (OCEAN BEACH DEPOSITS)		1						Windowless Sampler			Lab: BRL061_Asb Lab: BRL061	
			2									Lab: BRL062	
												Lab: BRL063	
	END OF BOREHOLE AT 3m - Target Criteria Achieved		3									Lab: BRL064	
			4										
			5										
			6										
			7										
			8										
			9										

BOREHOLE SOIL LOG A4 BEACH ROAD.GPJ WSP-OPUS2018_TEM.GDT 18/12/20

Notes:

1. Borehole completed at a depth of 3.00m begl.
2. Borehole dry during and on completion.
3. Borehole backfilled with arisings and bentonite cap upon completion.

Started:	11/11/2020	*Finished:*	11/11/2020
Drilling Co.:	Geotechnics	*Drilling Rig:*	Tracked Window Sampling Rig
Logged by:	MB	*Checked by:*	EDH

Logged in accordance with NZ Geotechnical Society Guidelines (2005). See attached key sheet for explanation of symbols.

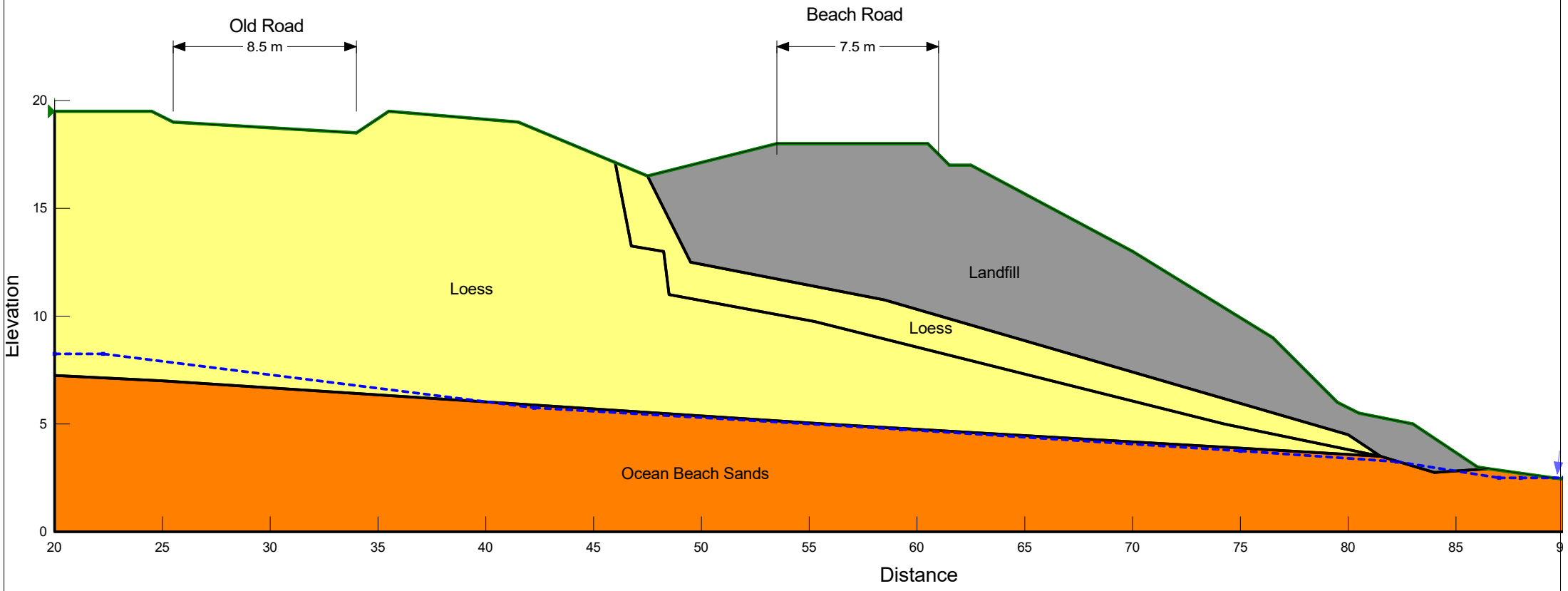
Scale 1:50 @ A4

Appendix B

Slope stability modelling results

Model Name: 00 Ground Model - Existing
Model Descrption:
Analysis Method: Morgenstern-Price

Color	Name	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Line
	Landfill	16			1
	Loess	17	15	34	1
	Ocean Beach Sands	18	0	34	1



Drawing Status For Issue

Client		Name	Date	Consultant	Project Title	Drawing Title	Project Number	Scales
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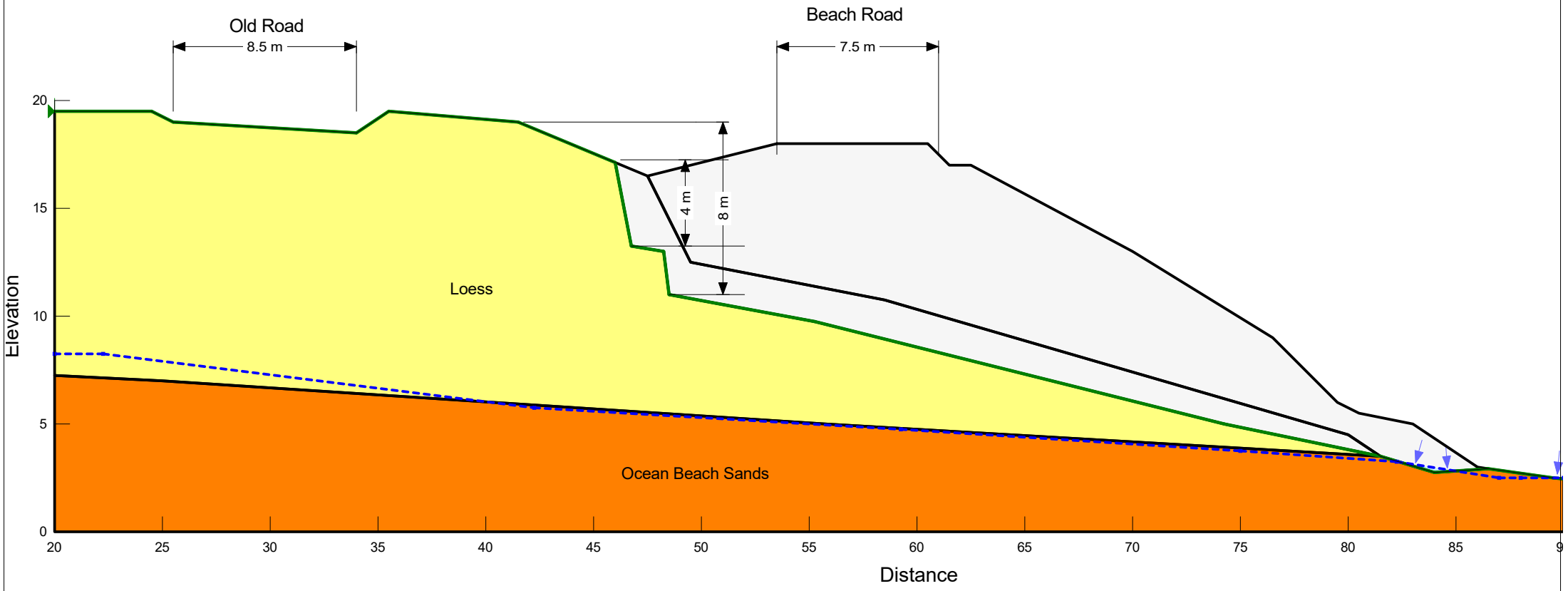
	Reviewed	Craig, Jordan						Sheet 1 of 1

Directory: \\na.aecomnet.com\LFS\APAC\Christchurch-NZCHC1\Legacy\Projects\606X\60697520\400_Technical\431_TechnicalArea_Geomorph & Geotech\Geotech\Slope Stability\

Geostudio Version 11.2.0.22838

Model Name: 00 Ground Model - Proposed
Model Descrption:
Analysis Method: Morgenstern-Price

Color	Name	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Line
	Loess	17	15	34	1
	Ocean Beach Sands	18	0	34	1



Drawing Status For Issue

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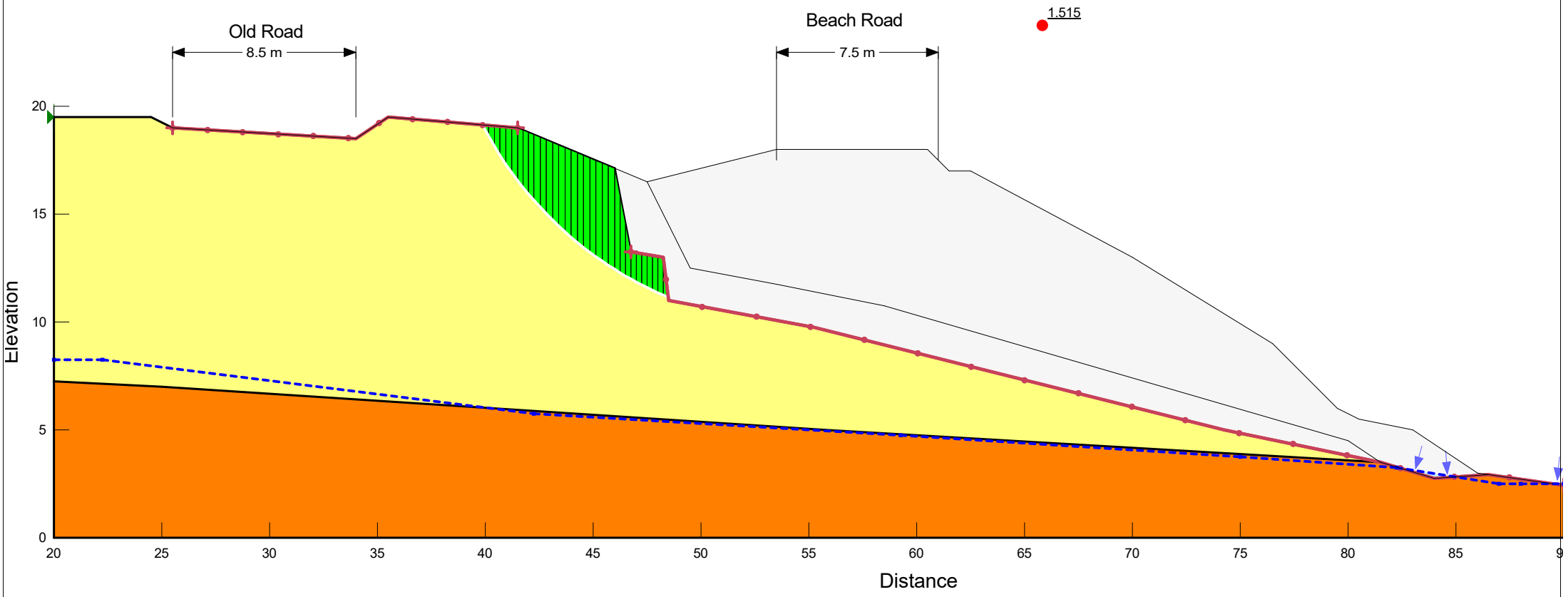
	Reviewed	Craig, Jordan						Sheet 1 of 1

Directory: \\na.aecomnet.com\LFS\APAC\Christchurch-NZCHC1\Legacy\Projects\606X\60697520\400_Technical\431_TechnicalArea_Geomorph & Geotech\Geotech\Slope Stability\

Geostudio Version 11.2.0.22838

Model Name: 01 Static Analysis
Model Descrption:
Analysis Method: Morgenstern-Price

Color	Name	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Line
	Loess	17	15	34	1
	Ocean Beach Sands	18	0	34	1



Drawing Status For Issue

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	Reviewed	Craig, Jordan						Sheet 1 of 1

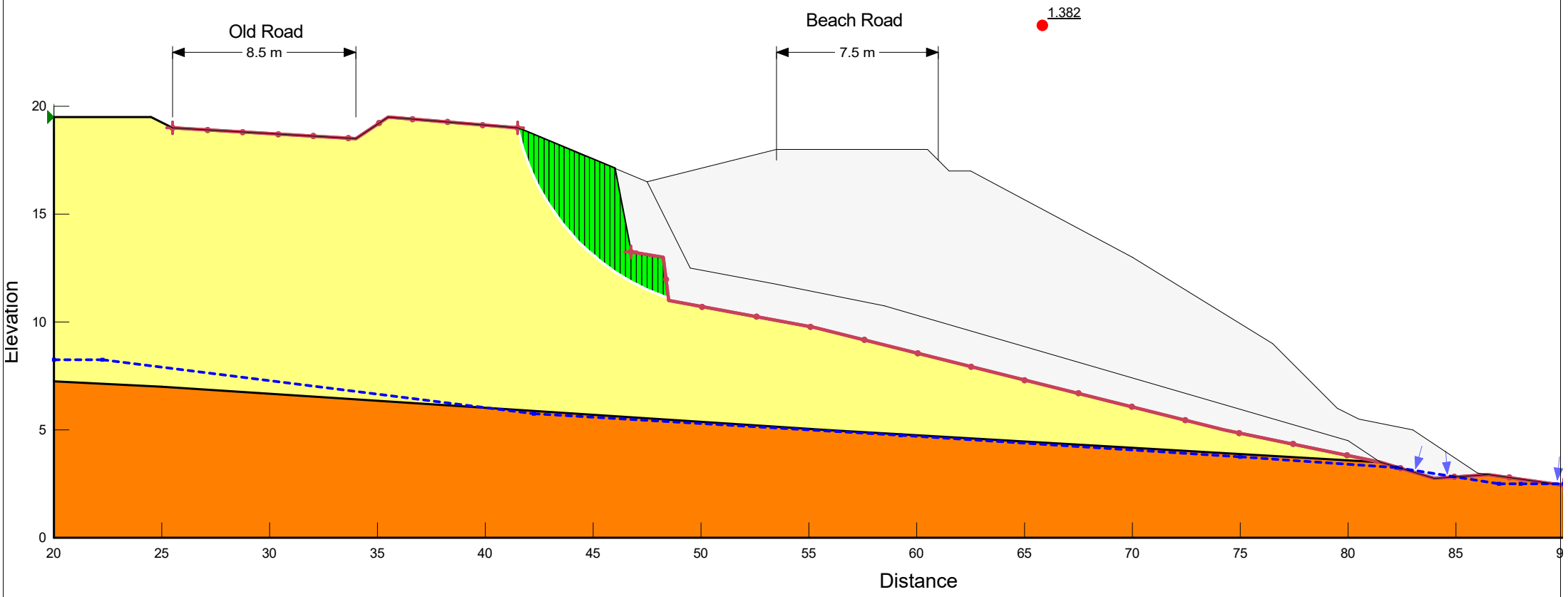
Directory: \\na.aecomnet.com\LFS\APAC\Christchurch-NZCHC1\Legacy\Projects\606X\60697520\400_Technical\431_TechnicalArea_Geomorph & Geotech\Geotech\Slope Stability\

Geostudio Version 11.2.0.22838

Model Name: 02 SLS
Model Descrption:
Analysis Method: Morgenstern-Price

Color	Name	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Line
	Loess	17	15	34	1
	Ocean Beach Sands	18	0	34	1

Horz Seismic Coef.: 0.06



Drawing Status For Issue

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	Reviewed	Craig, Jordan						Sheet 1 of 1

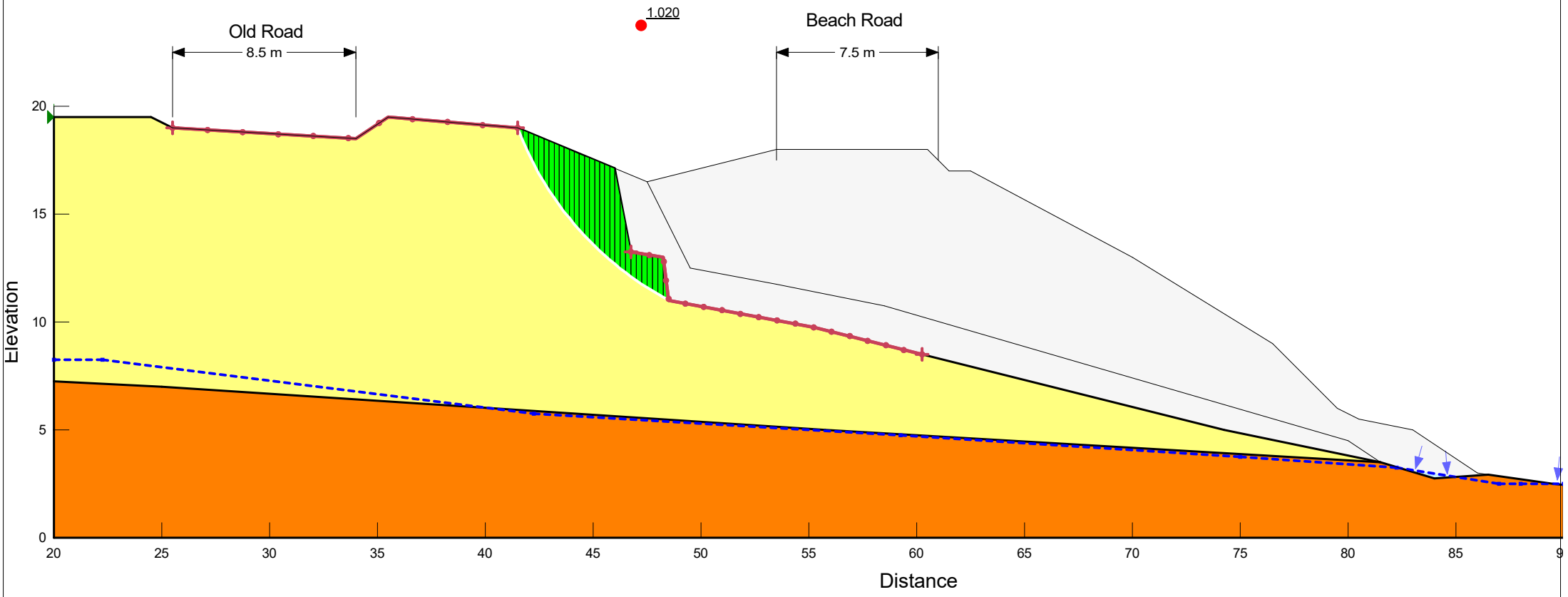
Directory: \\na.aecomnet.com\LFS\APAC\Christchurch-NZCHC1\Legacy\Projects\606X\60697520\400_Technical\431_TechnicalArea_Geomorph & Geotech\Geotech\Slope Stability\

Geostudio Version 11.2.0.22838

Model Name: 03 ULS
Model Descrption:
Analysis Method: Morgenstern-Price

Color	Name	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Line
	Loess	17	15	34	1
	Ocean Beach Sands	18	0	34	1

Horz Seismic Coef.: 0.29



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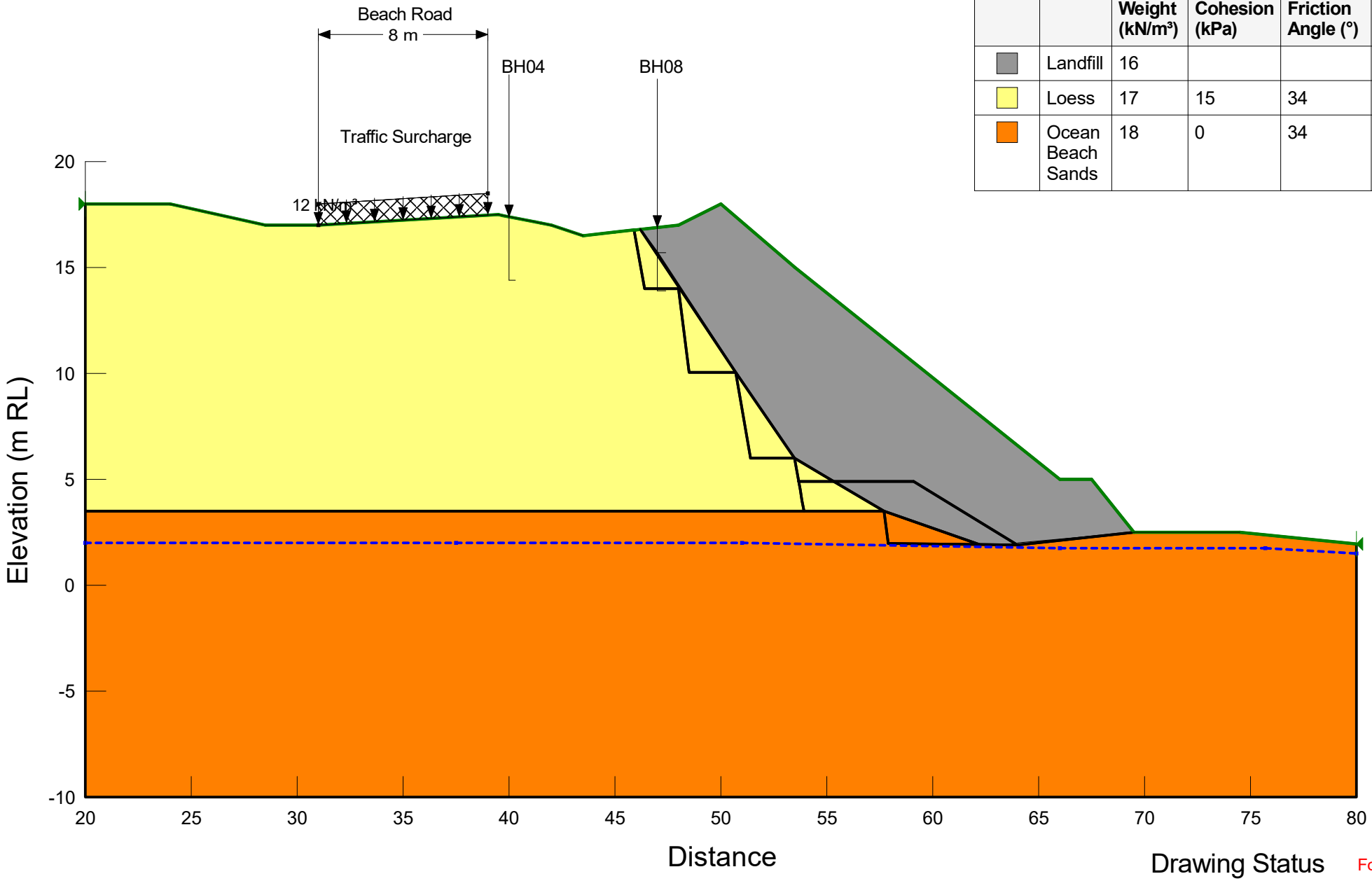
Directory: \\na.aecomnet.com\LFS\APAC\Christchurch-NZCHC1\Legacy\Projects\606X\60697520\400_Technical\431_TechnicalArea_Geomorph & Geotech\Geotech\Slope Stability\

Geostudio Version 11.2.0.22838

Model Name: 00 Ground Model - Existing
Model Descrption:
Analysis Method: Morgenstern-Price

Color	Name	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Line
	Landfill	16			1
	Loess	17	15	34	1
	Ocean Beach Sands	18	0	34	1



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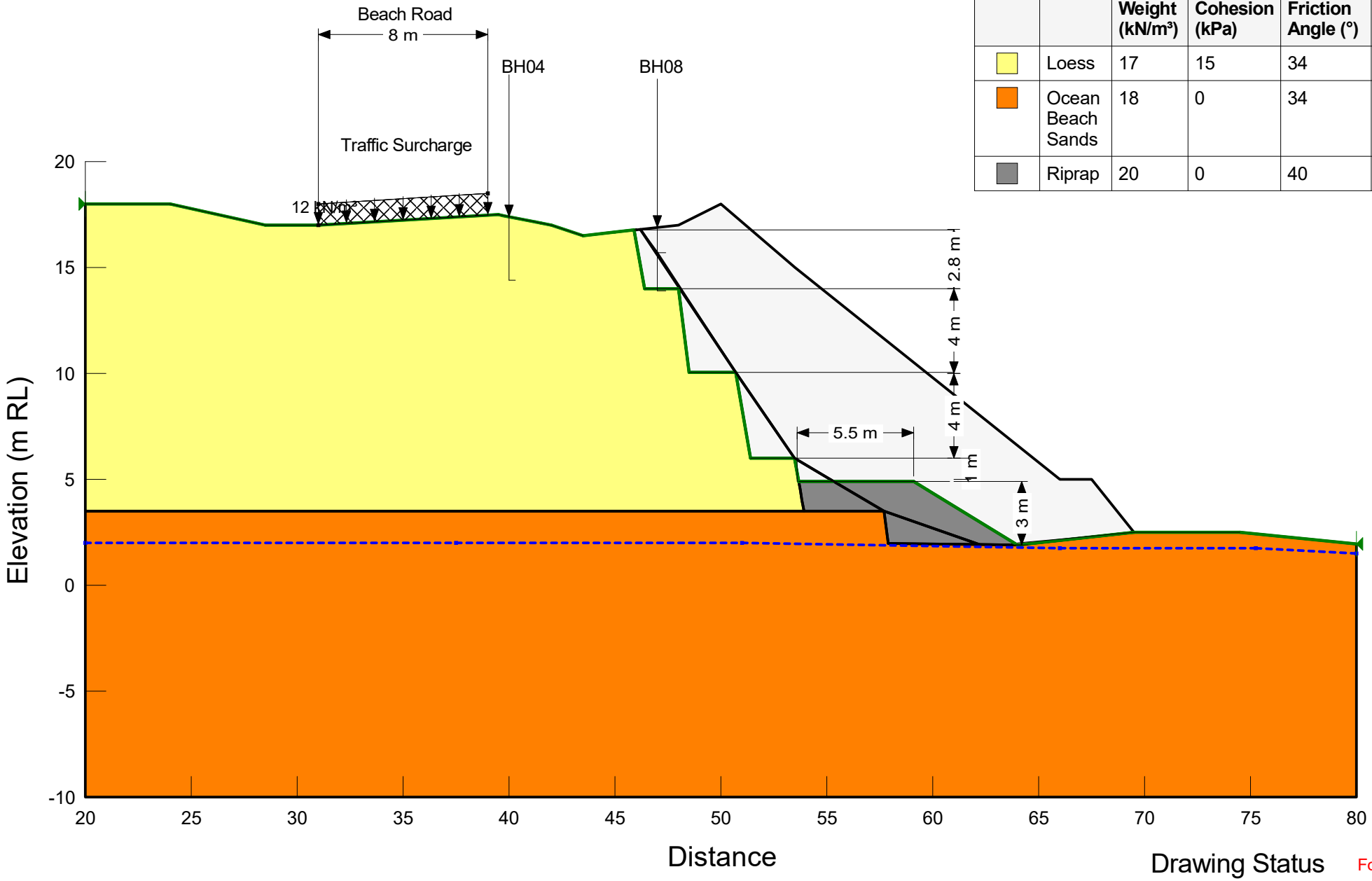
	Reviewed	Craig, Jordan	09/02/					Sheet 1 of 1

Directory: \\na.aecomnet.com\LFS\APAC\Christchurch-NZCHC1\Legacy\Projects\606X\60697520\400_Technical\431_TechnicalArea_Geomorph & Geotech\Geotech\Slope Stability\

Geostudio Version 11.2.0.22838

Model Name: 00 Ground Model - Proposed
Model Descrption:
Analysis Method: Morgenstern-Price

Color	Name	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Line
	Loess	17	15	34	1
	Ocean Beach Sands	18	0	34	1
	Riprap	20	0	40	1



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	Reviewed	Craig, Jordan	09/0				Geostudio Version 11.2.0.22838	Sheet 1 of 1

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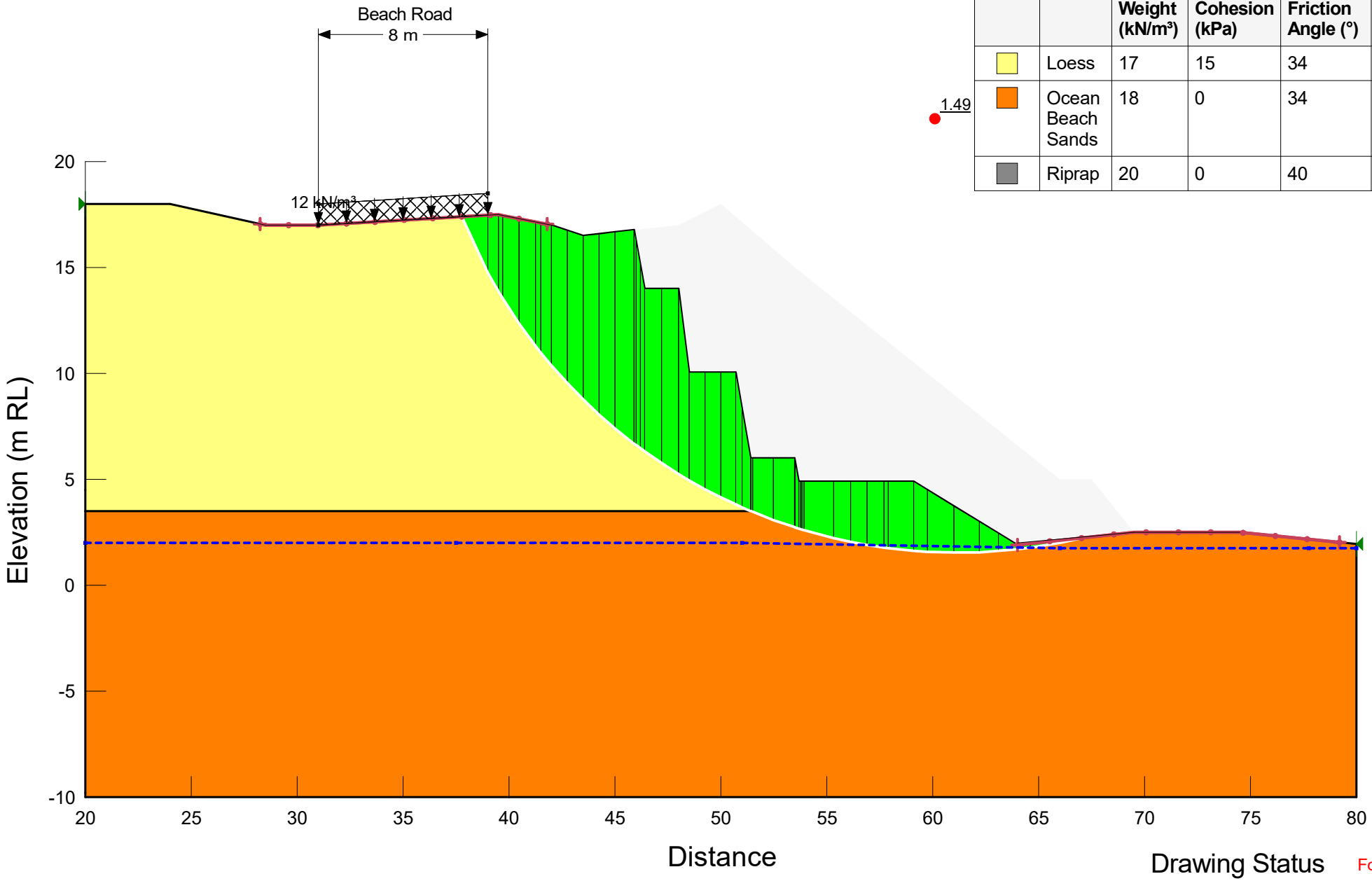
Model Name: 01 Static Analysis
Model Descrption:
Analysis Method: Morgenstern-Price

Color	Name	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Line
	Loess	17	15	34	1
	Ocean Beach Sands	18	0	34	1
	Riprap	20	0	40	1



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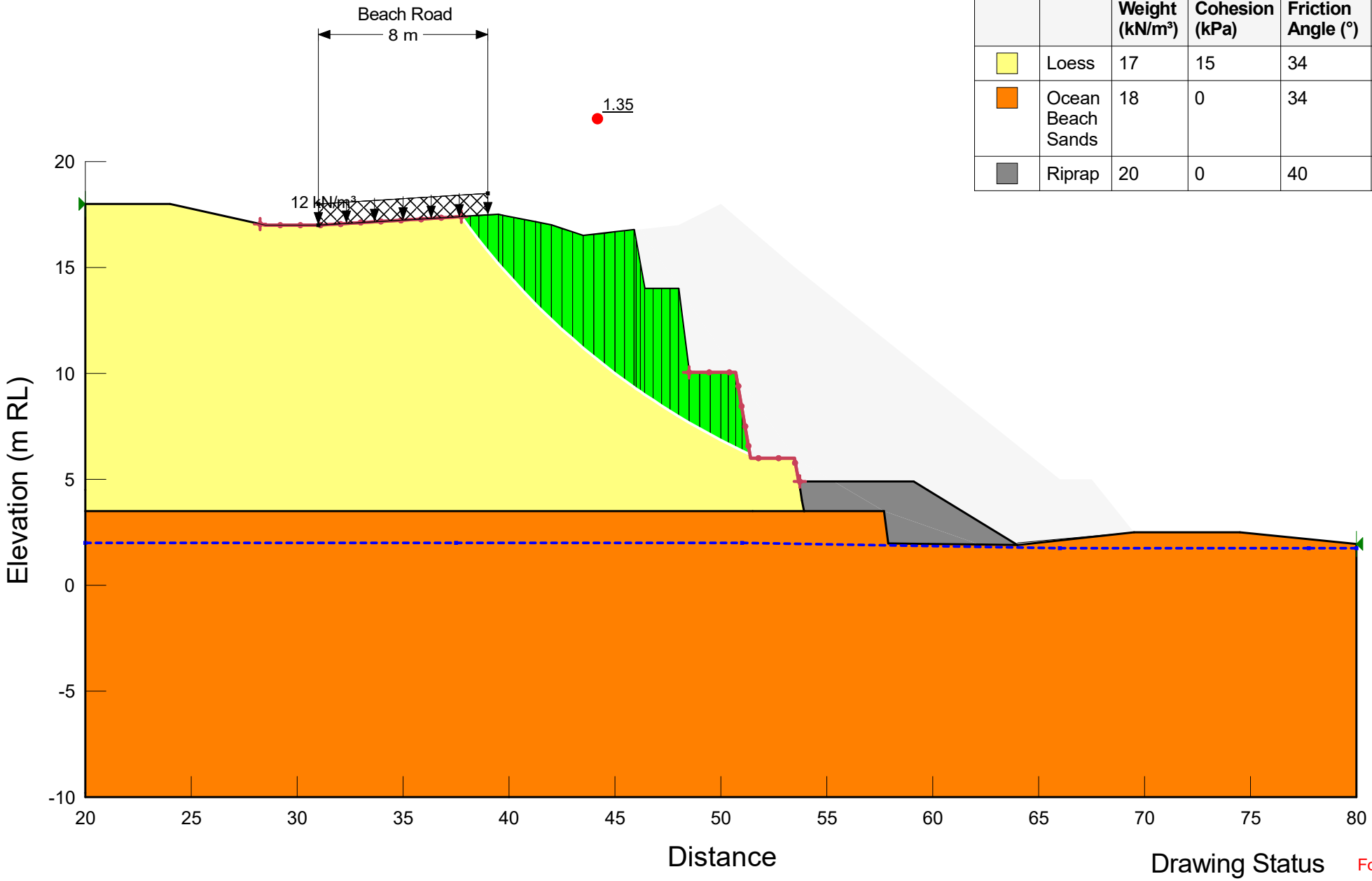
Geostudio Version 11.2.0.22838

Model Name: 02 Local
Model Descrption:
Analysis Method: Morgenstern-Price

Color	Name	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Line
	Loess	17	15	34	1
	Ocean Beach Sands	18	0	34	1
	Riprap	20	0	40	1



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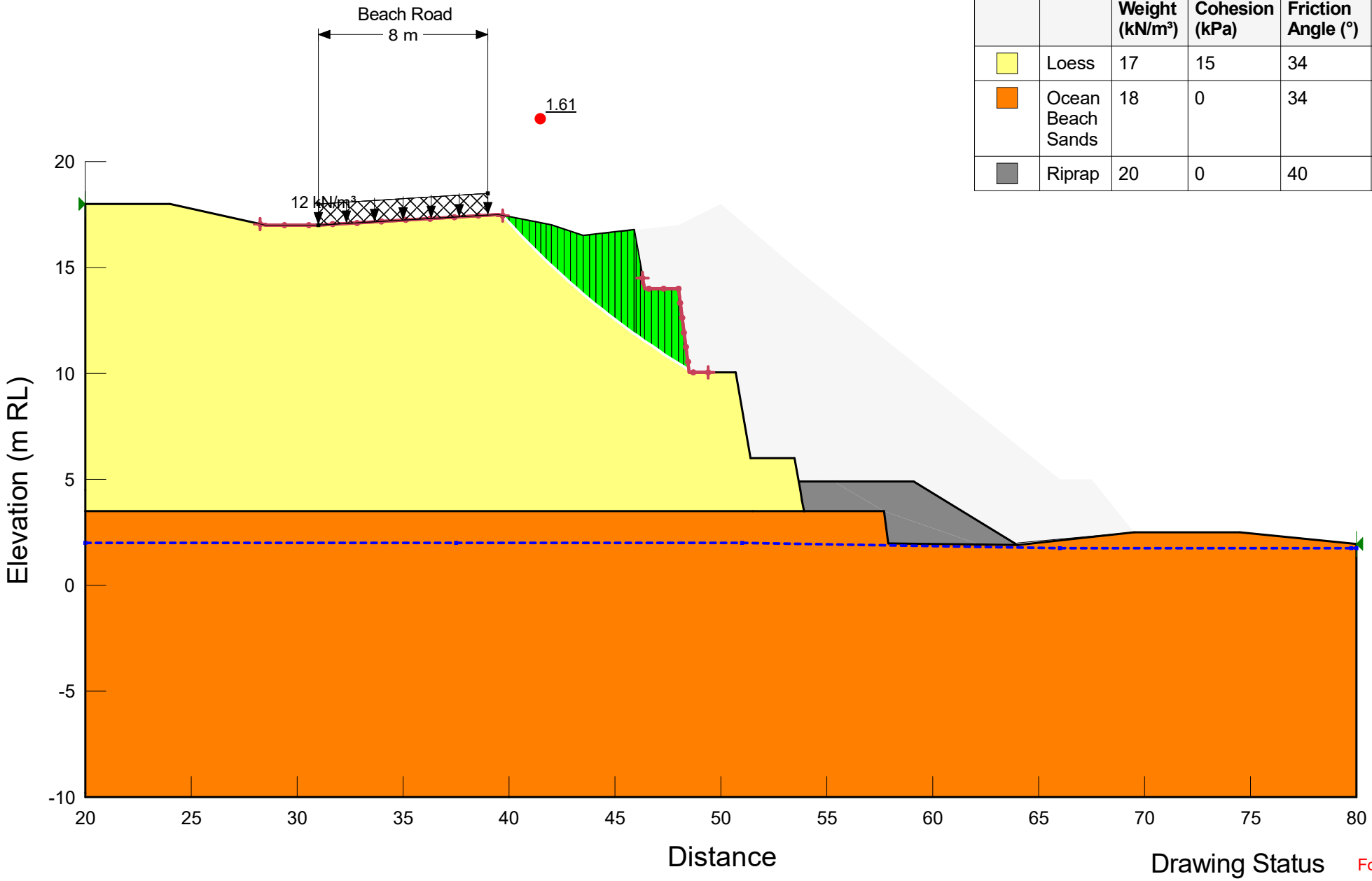
Geostudio Version 11.2.0.22838

Model Name: 03 Local
Model Descrption:
Analysis Method: Morgenstern-Price

Color	Name	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Line
	Loess	17	15	34	1
	Ocean Beach Sands	18	0	34	1
	Riprap	20	0	40	1



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Directory: \\na.aecomnet.com\LFS\APAC\Christchurch-NZCHC1\Legacy\Projects\606X\60697520\400_Technical\431_TechnicalArea_Geomorph & Geotech\Geotech\Slope Stability\

Geostudio Version 11.2.0.22838

Model Name: 04 SLS
Model Descrption:
Analysis Method: Morgenstern-Price

Color	Name	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Line
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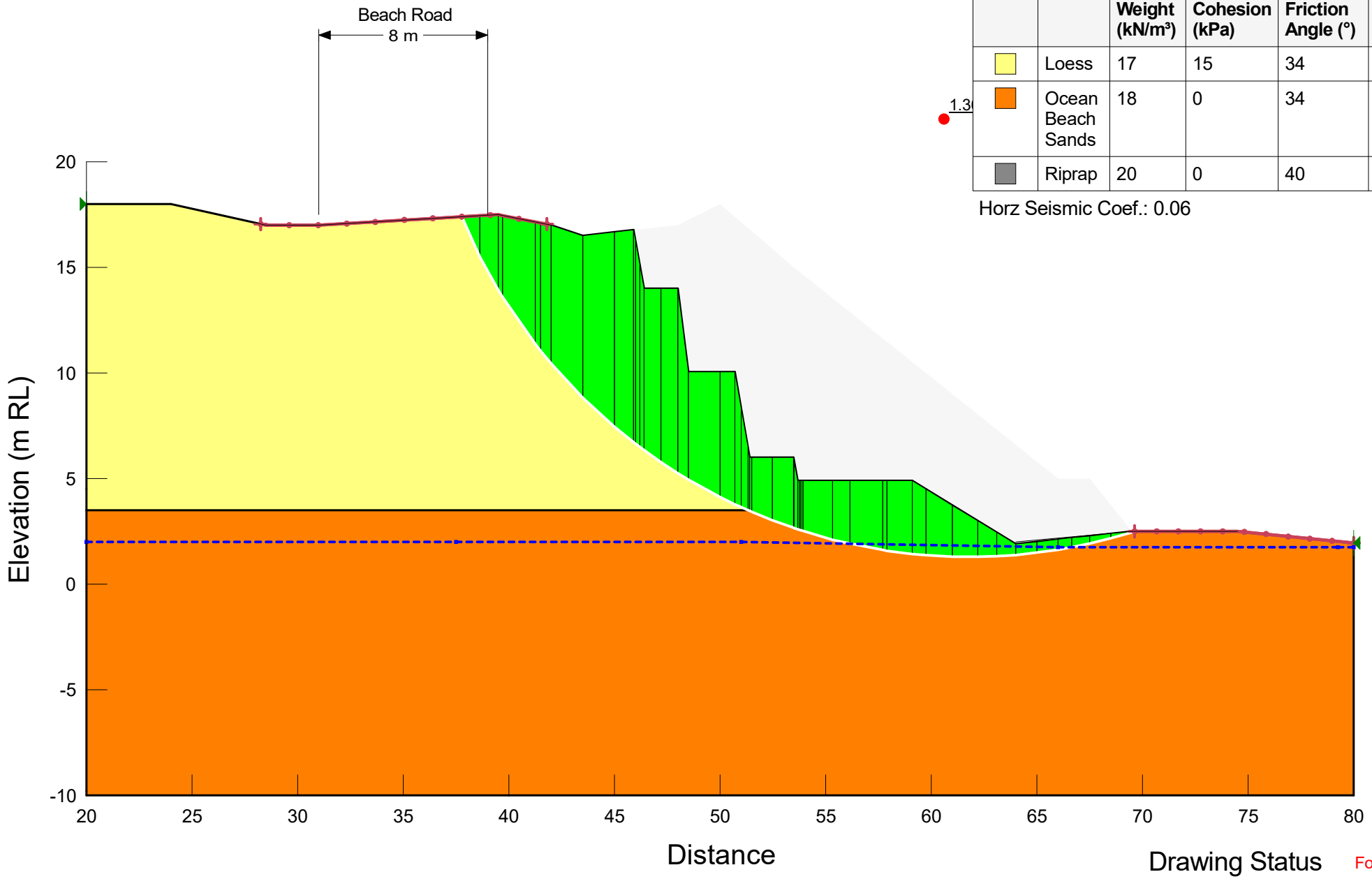
	Ocean Beach Sands	18	0	34	1
	Riprap	20	0	40	1

Horz Seismic Coef.: 0.06



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	Reviewed	Craig, Jordan	09/02					Sheet 1 of 1

Directory: \\na.aecomnet.com\LFS\APAC\Christchurch-NZCHC1\Legacy\Projects\606X\60697520\400_Technical\431_TechnicalArea_Geomorph & Geotech\Geotech\Slope Stability\

Geostudio Version 11.2.0.22838

Model Name: 05 ULS
Model Descrption:
Analysis Method: Morgenstern-Price

Color	Name	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Line
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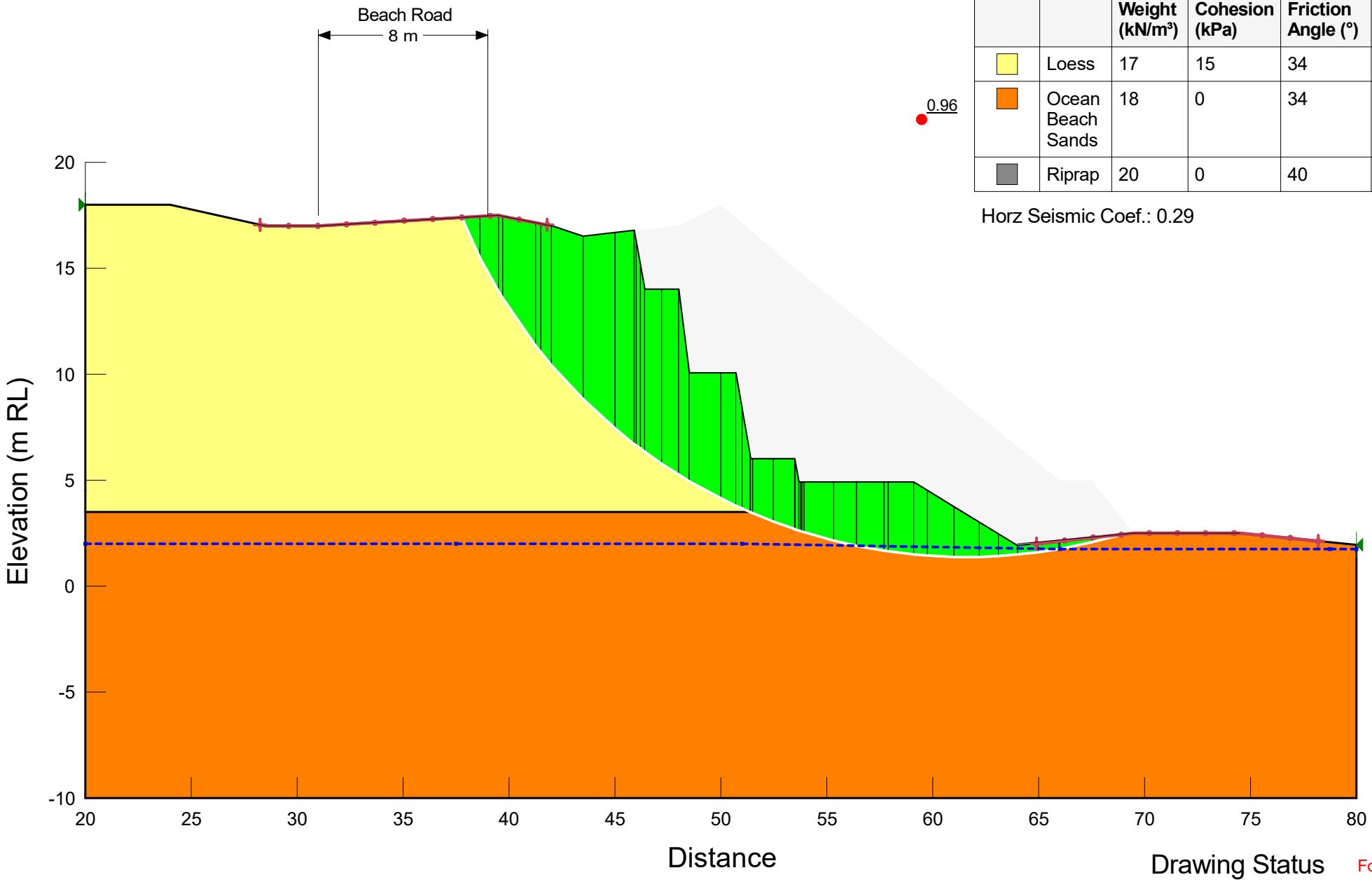
	Ocean Beach Sands	18	0	34	1
	Riprap	20	0	40	1

Horz Seismic Coef.: 0.29



Drawing Status For Issue

Client: Waitaki District Council

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Designed	McQuistan, Dhugal	08/02/2023
Reviewed	Craig, Jordan	09/02

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Consultant: AECOM

Project Title: Beach Road Landfills Remediation Geotechnical Desktop and Assessment

Drawing Title: Landfill 2 ULS Global Analysis

Project Number: 60697520

Scales: 1:250 (A4)

Sheet: 1 of 1

Geostudio Version 11.2.0.22838

Model Name: 06 ULS Local
Model Descrption:
Analysis Method: Morgenstern-Price

Color	Name	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Line
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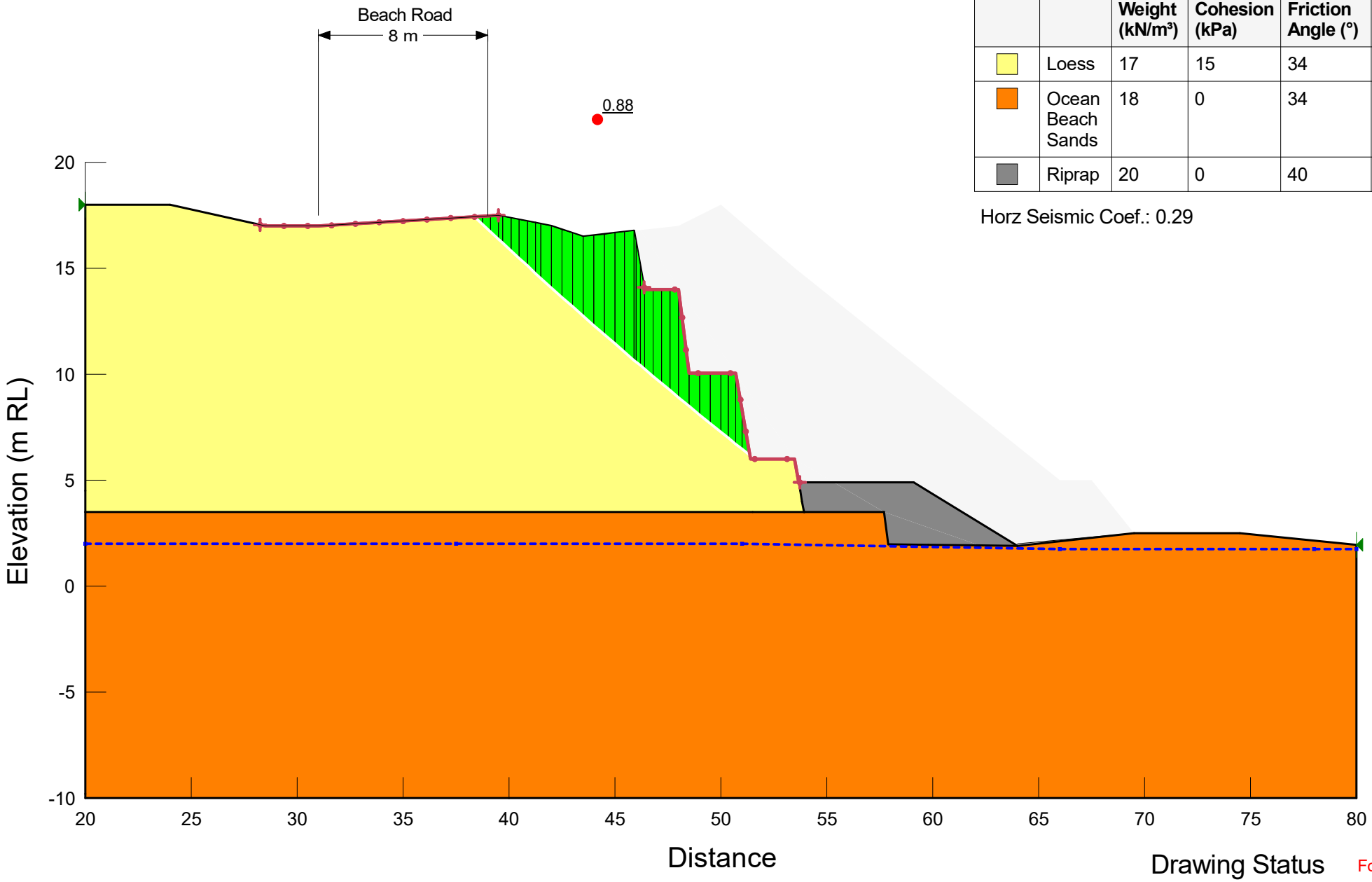
	Ocean Beach Sands	18	0	34	1
	Riprap	20	0	40	1

Horz Seismic Coef.: 0.29



Drawing Status For Issue

Client: Waitaki District Council

	Name	Date
Designed	McQuistan, Dhugal	08/02/2023
Reviewed	Craig, Jordan	09/02

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Consultant: AECOM

Project Title: Beach Road Landfills Remediation Geotechnical Desktop and Assessment

Drawing Title: Landfill 2 ULS Local Analysis

Project Number: 60697520

Scales: 1:250 (A4)

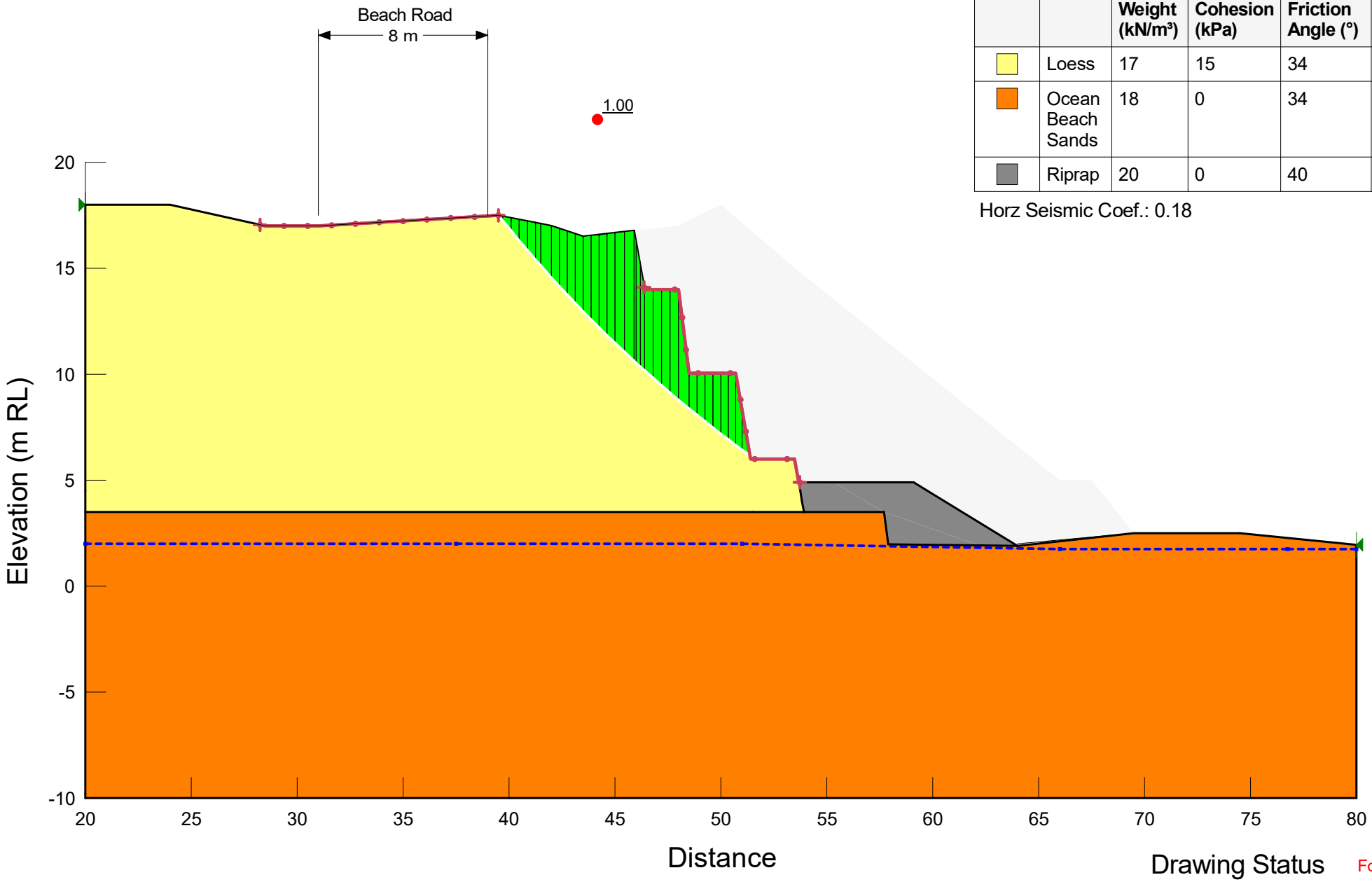
Sheet: 1 of 1

Geostudio Version 11.2.0.22838

Model Name: 06.1 ULS Local (Yield)
Model Descrption:
Analysis Method: Morgenstern-Price

Color	Name	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Piezometric Line
	Loess	17	15	34	1
	Ocean Beach Sands	18	0	34	1
	Riprap	20	0	40	1

Horz Seismic Coef.: 0.18



Drawing Status For Issue

Client: Waitaki District Council

	Name	Date
Designed	McQuistan, Dhugal	08/02/2023
Reviewed	Craig, Jordan	09/02

Directory: \\na.aecomnet.com\LFS\APAC\Christchurch-NZCHC1\Legacy\Projects\606X\60697520\400_Technical\431_TechnicalArea_Geomorph & Geotech\Geotech\Slope Stability\

Consultant: AECOM

Project Title: Beach Road Landfills Remediation Geotechnical Desktop and Assessment

Drawing Title: Landfill 2 ULS Local Analysis - Yield PGA

Project Number: 60697520

Scales: 1:250 (A4)

Sheet: 1 of 1

Geostudio Version 11.2.0.22838

Appendix C

Draft Erosion and Sediment Control Plan

Prepared for
Waitaki District Council
ABN: N/A

DRAFT

Beach Road Landfills Remediation

Draft Erosion and Sediment Control Plan

17-Mar-23

aecom.com

Delivering a better world

D R A F T

Beach Road Landfills Remediation

Draft Erosion and Sediment Control Plan

Client: Waitaki District Council

ABN: N/A

Prepared by

AECOM New Zealand Limited
Level 2, 88 Cashel Street, Ōtautahi|Christchurch 8024, P O Box 710, Christchurch MC, Ōtautahi|Christchurch 8140, New Zealand
T +64 3 966 6000 F +64 3 966 6001 www.aecom.com

17-Mar-23

Job No.: 60697520

AECOM in Australia and New Zealand is certified to ISO9001, ISO14001 and ISO45001.

D R A F T

Quality Information

Document	Beach Road Landfills Remediation
Ref	60697520
Date	17-Mar-23
Originator	Amarpreet Hura
Checker/s	Kiran Patel
Verifier/s	

Revision History

Rev	Revision Date	Details	Approved	
			Name/Position	Signature
1	17-March-2023	For Resource Consent	Helen Lawrence Principal Environmental Planner	

D R A F T

Table of Contents

D R A F T

1.0 Introduction

1.1 Background

The Beach Road Landfills are two historical landfills located along the coastal cliffs on Beach Road, Oamaru. AECOM understands that the two landfills were never explicitly opened or approved by the council. It is thought that the landfills were in “operation” between the 1950’s to 1970’s.

The unofficial landfill areas were investigated and partially remediated in 2017 after a complaint by locals regarding rubbish washing out off the cliff face onto the beach. Following the complaints in 2017, approximately 60 tonnes of waste material was removed to Oamaru and the areas were closed. A detailed site investigation was undertaken by WSP in 2021 to characterise the contamination risk at each site.

The previous investigations are reported in the following documents:

- Preliminary Site Investigation: Beach Road Landfills, Oamaru (Otago Regional Council, 2018)
- Beach Road closed landfills. Detailed site investigation (WSP, 2021)

It is now proposed to remove all waste from the landfill site and remediate ground levels of two historical landfills (1 and 2).

1.2 Purpose

This draft Erosion Sediment Control Plan (ESCP) is intended to support Resource Consent application for the excavation and construction works required to remediate the historic landfill sites. The draft ESCP is intended to be read in conjunction with the Contaminated Site Management Plan (CSMP), to mitigate sediment and/or contaminated runoff to the receiving environment.

1.3 Scope

AECOM has been engaged by Waitaki District Council, to prepare a draft ESCP for the excavation and construction works associated with remediation of the two historic landfills. The Otago Regional Council (ORC)-ESCP guidelines rely on the Auckland Council (2016) Erosion and Sediment Control Guidelines for Land Disturbing Activities, hence this ESCP has been prepared in accordance with the Auckland Erosion and Sediment Control Guidelines.

This ESCP describes the erosion and sediment control techniques and practices that will be required, to avoid or minimise the effects of any erosion or sediment run-off from the construction activities.

A final ESCP is to be submitted by the Construction Contractor to suit the construction methodology. Some control methods may need to be modified to suit the final actual site conditions encountered during construction and/or operation. This ESCP is intended to be a living document that can be updated as necessary during the course of its implementation.

1.4 Plan Aim and Objectives

The main aim of the measures outlined in this draft ESCP plan is to prevent the discharge of sediment and other contaminants to the ocean, during construction works to decommission the two landfills. This will be achieved by meeting the following objectives:

1. Controlling access to the construction site with site fencing

2. Prevention of materials being tracked off site by vehicles

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3. Direct removal of landfill/refuse material from site with no stockpiles of contaminated materials to be kept on site.
4. Construction of a clean fill toe for each landfill site
5. Construction of an impermeable liner under the upstream bank of the clean fill toe
6. Gravel pad access track to the construction site
7. Installation of silt fences along the length of the access road
8. Maintaining existing vegetation where possible
9. Re-directing road side swale runoff as sheet flow across the vegetated terrace
10. Constructing cut off channel to prevent clean water runoff to the active construction site
11. Regular inspection and maintenance of erosion and sediment control devices
12. Stabilise disturbed/exposed areas as soon as practicable

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2.0 Site Description

2.1 Site Location

The two landfill sites referred to as Landfill 1 and Landfill 2, are located along Beach Road approximately 3 km south of Oamaru (Figure 1). The site is legally described as Section 70 Block IV Oamaru SD. The landfills are located within existing gullies along a steep, eroding, coastal cliff between Beach Road and the Pacific Ocean.

Landfill 1 is located approximately 220 m northeast from the intersection with Awamoa Road and Beach Road and has an approximate total site area of 1000 m^2. Landfill 2 is approximately 10 m southwest of the intersection and has an approximate total site area of 800 m^2.

Figure 1 Site location of landfill sites (google earth imagery)

2.2 Site Surroundings

Both sites are situated in a coastal setting and in a rural farm area just south of Oamaru. A visual inspection of the landfill sites was completed by AECOM on 25th January, 2023. The observations from both landfill site is described below:

2.2.1 Landfill-1

- The landfill area is dominantly vegetated with grass and small shrubs.
- Gabions are present at road level at the top of the cliff, retaining the road, approximately 8 m in length and at least 0.5 m high.
- Rock armouring is present at the base of the landfill, with a varying width from base of the landfill (5 to 8 m). Rip rap varies in size from approx. 0.3 m diameter, up to 1.5 m diameter.
- A steep access track from the road down to the beach has been established at the southern extent of the landfill.
- Sub vertical cliffs (dominantly loess overlaying marine sands) are adjacent to the landfill site. The contact (interface) between the loess and marine sand was obscured by collapsed cliff material.

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- The contact (interface) between the landfill and refuse is visible at the northern extent. The approximate angle of this contact is 30 to 35 degrees.

2.2.2 Landfill-2

- The landfill area is dominantly vegetated with grass and small shrubs with some established trees.
- Surface drainage is present at road level, at the head of the landfill, parallel to the road. The unlined swale is approx. 0.8 m deep and 0.5 m wide at the base.
- Rock armouring is stacked vertically at the base of the landfill, approx. 1.5 to 2 m in height. Rip rap is typically larger rocks approx. 1 m diameter.
- Sub vertical cliffs (dominantly loess overlaying marine sands) are adjacent to the landfill site. The contact between the loess and marine sand was obscured by collapsed cliff material.
- The natural gully slope angles are estimated at approx. 35 to 40 degrees at the southern end and slightly steeper, 45 degrees, at the northern end.

2.3 Existing Site Contamination

The landfill sites received a wide range of material from household goods including glass, plastics and porcelain to industrial waste such as coal tar and soils. As the sites were never official landfills there was no order to deposition and loads were just fly tipped into the receiving environment. Detailed site investigation for both landfills has been done by the WSP and the report was submitted in February, 2021. During the investigation, soil samples were collected from various locations and results were compared against outdoor/maintenance worker soil guideline values for human health assessment purposes. In addition, soil results were compared against background concentrations and waste disposal acceptance criteria.

A summary of the results suggested that lead, few heavy metals and PAH (polycyclic aromatic hydrocarbons) and/or TPH (total petroleum hydrocarbons) exceeded the acceptance criteria. Due to the historical use of the sites and the elevated concentrations of identified contaminants of concern the NESCS (National Environment Standards for Managing and Assessing the Contaminants in Soil) does apply to the site and consent will need to be sought for any soil disturbance above permitted activity criteria.

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3.0 Proposed Works

Earthworks would be required to remove landfill material and to stabilise the historical landfills site. The removal of historic landfill material will be undertaken by construction machinery including excavators, and dump trucks to remove waste to the Palmerston Landfill approximately 60km south.

Estimated earthwork volumes for the two landfill sites are presented in Table 1. The earthworks volume include:

- the volume of waste to be removed
- temporary vehicle accessways to the landfill sites
- and the additional earthworks required to form the finished design profile.

Table 1: Earthworks Quantities

TYPE	LANDFILL 1		LANDFILL 2	
	Cut (m^3)	Fill (m^3)	Cut (m^3)	Fill (m^3)
ACCESS ROAD	800	250	2,030	180
REFUSE	3,820		5,960	
DESIGN PROFILE	7,500		7,460	
TOTAL	11,320	250	13.420	180

Excavations will be below existing ground surface and therefore runoff from cut areas will remain within the construction site. Fill for the temporary access way will be imported to site and will consist of engineered hardfill materials.

3.1 Site Work

The remediation of the two landfill sites will require the following activities:

- Site establishment including moving plant, equipment to site
- Site clearance of vegetation and scrub to form temporary access road to landfill toe
- Earthworks to form temporary access road
- Excavation of refuse material and loading of excavated refuse to dump trucks
- Haulage of refuse material from site to the Palmerston Landfill
- Earthworks to form the final design profile at the remediated landfill site
- Site reinstatement and hydroseeding
- Site demobilisation.

3.2 Potential Effects and Mitigation Measures

The construction activities required for the remediation of the two landfill sites have the potential to generate sediment. These activities are:

1. Movements of vehicles to and from site.
2. Excavation and removal of soils and/or waste.
3. Temporary stock piling of soils for construction.
4. Stored chemicals, oils and fuels.

Presented below are the potential effects associated with each of these groupings, along with proposed mitigation actions.

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3.2.1 Potential effects of vehicle movements to and from site

Construction equipment will be brought to and from site as required by the contractor. As the works progress the contractor will remove soils and/or waste and materials from site to the approved disposal location at the Palmerston Landfill approximately 60km south of the site. These vehicle movements, along, create the risk of sediment and contaminated material being tracked on to the road where it may be washed into the roadside swales and ultimately to waterway outlets to the ocean.

General mitigation proposed to manage this risk is the formation of a gravel pad over the extent of the access roads down to the landfill toe. Additionally vehicles will exit the site over a waterless wheel shaker to reduce the risk of sediment/contaminated materials leaving the site on the exterior of vehicles. The waterless wheel shaker will be inspected daily, and debris removed once half of the catch basin has been filled with debris.

The key controls are as follows:

Erosion Controls:

- Use of clean water diversions where possible, to direct clean water around the works areas.
- Undertaking the works progressively to minimise the open areas.
- Control/limit vehicle pathways

Sediment Controls:

- Formation of a gravel pad access road to the landfill toe
- Use of a waterless wheel shaker

3.2.2 Excavation of refuse materials

The main risk once excavation of the landfill material commences is refuse and contaminants being washed out to the beach and ultimately into the ocean. Rainfall on disturbed areas will be the primary source of water that has the potential to mobilise sediment and/or contamination.

The existing landfill toe will be excavated and removed, and a new temporary clan fill toe will be formed from engineered hardfill to prevent sediment/contaminant runoff to the beach. In addition, the upstream bank will be lined with an impermeable liner. The liner will ensure potential sediment/contaminant runoff will be retained within the existing landfill footprint during the construction works.

Excavations may also release dust into the environment. General mitigation includes Dust Management Plan, which will be produced by the Contractor and submitted for approval separately prior to commencement of any works. Measures to control and mitigate dust generated from the proposed works will include

- Having water-cart(s) available onsite during the excavation works;
- Ensuring no refuse stockpiles are kept on site;
- Keeping size and height of clean fill stockpiles to a minimum; and for a maximum of two days only.
- Carting refuse material from site to Palmerston Landfill within covered trucks to ensure no refuse material is lost during cartage.

The key control are as follows:

Erosion Controls:

- Use of clean water diversions where possible, to direct clean water around the works areas.
- Undertaking the works progressively to minimise the open areas.

Sediment Controls:

- Use of silt fences along length of access road
- New clean fill toe at existing landfill toe to act as bund and access way.

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- Use of an impermeable liner under upstream bank of clean fill toe
- Implementing an approved dust management plan

3.2.3 Temporary stockpiling of excavation materials

Temporary stockpiling of materials including contaminated soil and other material presents a risk of stockpiled material being mobilised by rainfall and washed into the ocean. Therefore, no stockpiles consisting of refuse/contaminated materials are to be kept on site. Refuse material is to be excavated and loaded immediately onto dump trucks for cartage to Palmerston Landfill.

Any clean fill stockpiles will be located away from surface water channels. Stockpile volumes will be kept to a minimum due to compactness of the site. Stockpiles will be kept below 1 m height and not cover more than 100 m^2. In addition, temporary clan fill stockpiles shall not be kept for more than 48 hours on site.

There were no practicable alternatives which could be implemented for this activity. Some imported material may be required to be stored prior to placement.

3.2.4 Spills of stored oils and fuels

Storage of oils and fuels present a risk of accidental spills which find their way to the surface water as overland flow from rainfall.

Any fuels required for the works will be stored away from the surface water channels at a minimum setback of 10m. Fuels will not be stored on the beach. Storage containers for any fuel will be protected with localised bunding, and emergency spill response kits will be kept available at all times.

There were no practicable alternatives which could be implemented for this activity, as small quantities of these are required for the proposed activities to occur.

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4.0 Erosion and Sediment Control Measures

4.1 Key Strategies

The erosion sediment control measures proposed are to prevent mobilisation of sediment and restrict it from leaving the site. The ESCP for the site has been prepared according to the following key principles of Auckland Council (2016) Erosion and Sediment Control Guidelines for Land Disturbing Activities as it is incorporated with ORC-ESCP guidelines.

The general concept for erosion and sediment control on site are:

- Minimise disturbance
- Separate clean and dirty water
- Undertake construction in stages
- Protect slopes and water courses
- Stabilise exposed areas quickly
- Consider the timing of earthworks
- Use sediment control tools.

The ESC measures outlined will be installed before any excavation activities commence and will remain in place for the entire period of works at that location. ESCs will shift as earthworks relocate and all ESC devices will remain in place until stabilisation is provided.

This section of the draft ESCP details the main controls and practises that will be implemented, maintained, and upgraded when needed and/or during the earthworks/construction phase by the contractor.

4.2 Erosion and Sediment Control Measures

4.2.1 Erosion Controls

The measures proposed are based on the controls and principles outlined in GD05 and are summarised in Table 2 below. The erosion and sediment control measures are detailed in Appendix A: Erosion & Sediment Control Plan.

Table 2 Erosion Control Measures

Typical control	Comments	Key design criteria
Clean water diversion	Cut off drain is to be constructed upstream of the Landfill 1 site and directed to the existing grassed swale. The grassed swales are to be realigned away from the active construction site.	• Prevent clean surface water and stormwater from the surrounding area entering the work site. • Where required use a bund constructed of stabilised material (e.g. hotmix or compacted • soil/hardfill wrapped in geotextile cloth) around the perimeter of the site to divert clean surface or stormwater run-off. • Bund height should be a minimum of 200 mm high. • Where possible use bunds in conjunction with retaining existing stormwater reticulation systems (e.g. kerb and channels).

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Typical control	Comments	Key design criteria
Establish Sheet flow	Sections of the existing swales are to be filled to create a bunded basin. The bunds will reduce runoff to the landfill sites. Once the storage capacity of the swale basin is exceeded in a rain event sheet flow will develop over the grassed terrace to the beach. The "bund" surface is to be graded and established with grass to promote sheet flow across the grassed terrace.	• Cut of concentrated flow to active construction site. • Use clean fill soil from site where possible • Establish grass over bund surface as soon as possible.
Stabilised access ways	The main access to the landfill toe will be stabilised, to minimise tracking and movement of sediment off-site. The temporary access road will have a gravel pad surface composed of pit run over a geotextile layer. The gravel pad is to be a minimum of 4m width and extend from the Beach Road interface to the landfill toe. The stabilised access road will also assist vehicle movement down the steep cut access road.	• Minimise tracking of material off-site from vehicle movements. • Each individual site should have defined entrance and/or exits to the work area. • Use a 50-150 mm aggregate laid 200 mm thick on geotextile to create a stabilised access way.
Maintain existing vegetation	The existing vegetation across the terrace is to be maintained where possible, to reduce risk of erosion.	• Limit construction vehicle movement and working area.
Stabilisation of exposed areas	The finished profile of the cleared landfill site is to be re-established with grass as soon as practicable following removal of the landfill material.	• Establish grass/vegetation as soon as practicable
Minimise open areas and use of staging of works	Contractor to provide construction methodology for approval prior to construction works. The methodology shall include staging of the works to minimise disturbed areas at any point of time. This can be used in conjunction with progressive stabilisation and ensuring only those areas which require earthworks being opened.	• Ensure the extent of works is clearly identified prior to commencing work including identification of areas which can be protected or stabilised without undertaking earthworks. • Where possible, the maximum extent of works at any point in time shall be minimised and areas stabilised prior to opening new areas.

4.2.2 Sediment Control

The measures proposed are mostly based on the controls and principles outlined in GD05 and are summarised in Table 3 below.

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Table 3 Sediment Control

Typical control	Comments	Key design criteria
Clean Fill Toe Bund	A temporary clean fill toe bund is to be constructed at the existing landfill toe. The intention of the clean fill toe is to prevent sediment/contaminant runoff from within the landfill footprint to the beach area. The clean fill toe is to be used in conjunction with an impermeable liner under the upstream bank to retain any sediment/contaminant laden runoff within the landfill footprint during construction. The clean fill toe bund will also provide a bench for vehicle use.	• Use a 50-150 mm pit run hardfill to create 1.0m high bund. • Top of bund to act as temporary access track • Install an impermeable liner under the upstream bank of the clean fill toe bund.
Silt fence	Silt fences to be installed along length of access road.	• To be installed along the perimeter of the work area where 'dirty water' run-off from the work area will discharge. • Silt fence must be supported by a top-wire to be run between wooden battens/waratahs placed at 2 to 4 m centres and embedded a minimum of 400 mm into the ground. • Silt fence fabric is to be installed 600 mm above ground level and trenched in 200 mm below ground. The site side of the trench is to be backfilled and well compacted to secure the silt fence. • Joins in lengths of silt fence fabric are to be done by doubling fabric or stapling each fabric end to a batten and butting together.
Impermeable liner	An impermeable liner is to be installed under the upstream bank of the temporary clean toe bund to prevent sediment/containment runoff o the beach area. Any sediment/contaminant runoff to be removed from within landfill footprint following rain event.	• Liner to extend past landfill extent at toe • Liner to be installed in accordance with manufacturer's instructions.

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5.0 Monitoring and Maintenance

On-going monitoring and maintenance schedule of the sediment control measures is to be implemented as a part of the erosion sediment control plan. This will include the following:

- Daily inspections of the site control measures prior to commencement of work. Inspections will include the following checks:
  - silt fence is intact and there is no significant build-up of sediment; and
  - swales and cut off drains are clear of debris
  - Gravel pad is intact.
- Additional site inspections immediately before end after heavy rainfall events.
- Clearing of sediment retention structures when they become 20% full.
- Maintenance of control measures immediately should monitoring identify remedial action.

The sediment control measures will remain in place until the site has become stabilised.

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6.0 Summary

The Erosion and Sediment Control assessment has been prepared to support an application of resource consent for remediation of historical landfills located along Beach Road.

The sensitivity of the receiving environment in sediment loads as well in other waste material is high for the immediate receiving environment in particular the beach area. Due to the sensitivity of the receiving environment, the use of best practice erosion and sediment control methods along with an adaptive approach to sediment control including monitoring and maintenance within the receiving environment are proposed. The erosion and sediment control measures proposed for the construction works are intended to prevent the mobilisation of sediments, landfill containments, and fuels, and restrict them from leaving the site.

This will be achieved by:

- Diverting clean water runoff the construction site with cut-off drains
- Providing silt fences along access roads
- Preventing sediment from entering the existing stormwater system
- Retaining the existing vegetation
- Providing emergency spill and clean up kits for fuel spills
- Ensuring no temporary stockpiles of landfill material
- Implementation of a dust management plan
- Monitoring of the erosion and sediment control measures through a maintenance plan until the site has been stabilised.

These controls and measures will ensure the discharge of sediment and/or contaminated waste during works is minimised.

Therefore, the effects from sediment discharges during construction works should able to be appropriately controlled to ensure effects are no more than minor.

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7.0 References

Erosion and Sediment Control Guide for Land Disturbing Activities in the Auckland Region, June 2016. Guideline Document 2016/005 (GD05). Incorporating Amendment 2

Otago Regional Council, 2020. *Preliminary site investigation: Beach Road Landfills, Oamaru*. Reference A1097455

Otago Regional Council Bores, Accessed January 2023: https://orcportal.orc.govt.nz/portal/home/webmap/viewer

WSP, 2021. *Beach Road closed landfills detailed site investigation*. Report prepared for Waitaki District Council

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8.0 Standard Limitation

AECOM (NZ) Limited (AECOM) has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of University of Canterbury and only those third parties who have been authorised in writing by AECOM to rely on this Report.

It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this Report.

It is prepared in accordance with the scope of work agreed between AECOM and the Waitaki District Council.

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Any estimates of potential costs which have been provided are presented as estimates only as at the date of the Report. Any cost estimates that have been provided may therefore vary from actual costs at the time of expenditure.

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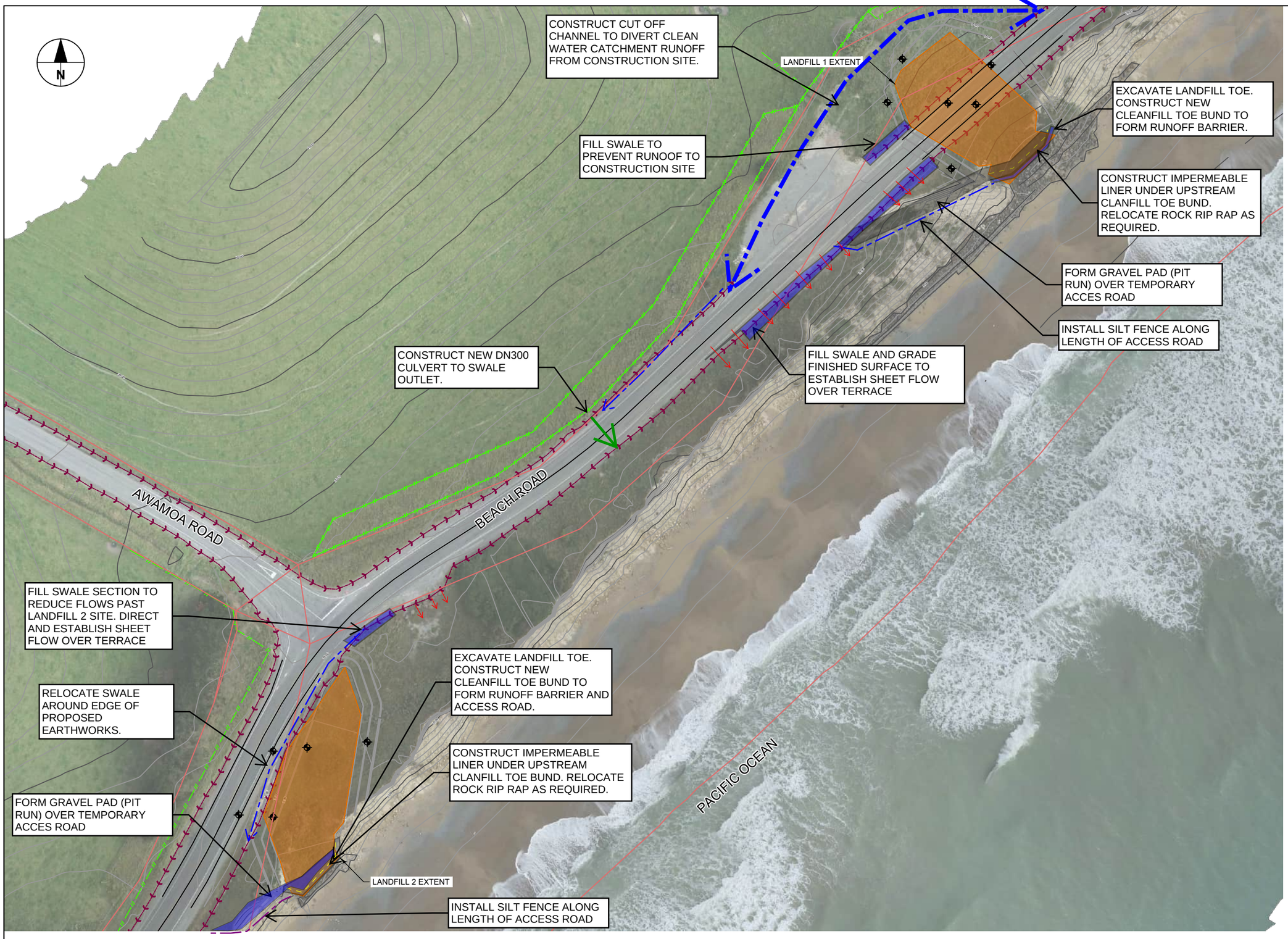
Appendix A

EROSION & SEDIMENT CONTROL PLAN

ISO A1 594mm x 841mm



NOTES:

1. EXTENT OF LANDFILL IS INDICATIVE ONLY AND EXTRAPOLATED FROM BEACH ROAD CLOSED LANDFILLS DETAILED SITE INVESTIGATION, 16 FEB 2021.
2. BOREHOLE LOCATIONS ASSUMED FROM DETAILED SITE INVESTIGATION, 16 FEB 2021.
3. SURVEY PROVIDED BY SURVEY WAITAKI.
4. SURVEY DATA IN TERMS OF NZGD OBSERVATION POINT COORDINATE SYSTEM. VERTICAL DATA IN TERMS OF NZVD16 VERTICAL DATUM.
5. PROPERTY PARCEL BOUNDARY DATA SOURCED FROM LINZ.

LEGEND:

- PARCEL BOUNDARIES
- FENCES
- SUR SWALE
- BOREHOLES

Last saved by: GALINA KOULIKOVA(2023-03-07) Last Plotted: 2023-03-07
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PROJECT

BEACH ROAD LANDFILL REMEDIATION

Beach Road,
Oamaru,
New Zealand

Waitaki DISTRICT COUNCIL
TE KAUNIHERA Ā ROHE O WAITAKI

0 12.5 25 m
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PROJECT DATA

DATUM		SURVEY	

PROJECT MANAGEMENT INITIALS

PK	KP	KP
DESIGNER	CHECKED	APPROVED

ISSUE/REVISION

1	X/XX/2023	FOR REVIEW
I/R	DATE	DESCRIPTION

PROJECT NUMBER

60697520

SHEET TITLE

BEACH RD LANDFILL REMEDIATION EROSION AND SEDIMENT CONTROL PLAN

SHEET NUMBER

60697520-SHT-CV-0000

Appendix D

Draft Contaminated Site Management Plan

Prepared for
Waitaki District Council
ABN: N/A

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Contaminated Site Management Plan

Beach Road Closed Landfill

17-Mar-2023
Beach Road Closed Landfill CSMP

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Contaminated Site Management Plan

Beach Road Closed Landfill

Client: Waitaki District Council

ABN: N/A

Prepared by

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17-Mar-2023

Job No.: 60697520

AECOM in Australia and New Zealand is certified to ISO9001, ISO14001 and ISO45001.

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Quality Information

Document	Contaminated Site Management Plan
Ref	60697520
	I:\legacy\projects\606x\60697520\400_technical\432_technicalarea_planning\beach road landfill\aee\appendices\appendix x - draft csmp.docx
Date	17-Mar-2023
Originator	Eli Reisman
Checker/s	Terry Widdowson
Verifier/s	

Revision History

Rev	Revision Date	Details	Approved	
			Name/Position	Signature
1	17-March-2023	For Resource Consent	Helen Lawrence Principal Environmental Planner	

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Table of Contents

D R A F T

1.0 Introduction

AECOM New Zealand Limited (AECOM) was engaged by Waitaki District Council (WDC) to prepare a Contaminated Site Management Plan (CSMP) for two former landfills (Landfills 1 and 2) on Beach Road, Awamoa, 9495.

The landfills are at risk from increasing rates of coastal erosion due to the effects of climate change on storm frequency and intensity. To mitigate the risk, WDC proposes to excavate and remove the waste from Landfills 1 and 2. The excavated waste will be transported to a licensed landfill in Palmerston.

1.1 Purpose

The purpose of this CSMP is to document procedures for managing risks to human health and the environment during the excavation and removal of waste materials from Landfills 1 and 2.

This draft CSMP is intended to support Resource Consent application for the excavation and construction works required to remediate the historic landfill sites. The draft CSMP is intended to be read in conjunction with the Erosion and Sediment Control Plan (ESCP), to mitigate sediment and/or contaminated runoff to the receiving environment.

A final CSMP is to be submitted by the Construction Contractor to suit the construction methodology. Some control methods may need to be modified to suit the final actual site conditions encountered during construction and/or operation. These aspects are highlighted in this version of the plan. This CSMP is intended to be a living document that can be updated as necessary during the course of its implementation.

1.2 Activities Relevant to this Plan

This CSMP is applicable to the remediation of Beach Road Landfills 1 and 2. The activities which trigger the implementation of this CSMP are:

- Disturbance of the landfill cover/surface.
- Ground disturbance adjacent to the known boundary of the landfills.
- Disturbance of the beach or cliff face below the landfills.
- Excavation of waste materials.

WDC shall be consulted prior to any ground disturbance on or in proximity to the landfills.

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2.0 Landfill Description

The landfills are located near the junction of Beach Road and Awamoa Road, Oamaru (**Figure 1, Appendix A)**. Landfill 1 is located to the northeast (along the beach) of Landfill 2. Both landfills are gully infills at the top of coastal cliffs which are some 15 to 20 metres high and have a steep gradient down to the beach.

There is little information on the operation of the landfills and it appears that there was no formal record keeping of the landfilling activities. The limited background information and the findings of intrusive investigations of the landfills are documented in the following reports:

- Otago Regional Council (2018). *Preliminary Site Investigation: Beach Road Landfills, Oamaru*.
- WSP (2021). *Beach Road Closed Landfills Detailed Site Investigation*.

A summary of the key findings from the reports is provided below.

The landfills operated as waste disposal sites from approximately the 1950's until the 1970's, and casual fly tipping is still occurring.

Landfill 1 (see **Figure 2, Appendix A**) covers an area of approximately 676.95 m^2, with an estimated waste volume of 2,246 m^3. It extends beneath Beach Road. Landfill 2 (see **Figure 3, Appendix A**) covers an area of approximately 721.79 m^2, with an estimated volume of 4,266.6 m^3.

The approximate boundaries of the landfills have been delineated, but there remains some uncertainty on the exact extents of the waste.

The landfills are not capped with impermeable material and therefore rainfall and surface water runoff are able to drain freely through the landfills. Groundwater was not encountered during the investigations and there were no seepages from the cliff faces. It is expected that the landfills will not contain a permanent water table due to their elevation above the beach and the proximity to the ocean.

The landfills appear to comprise a mixture of natural soils and waste materials, with waste encountered to a maximum depth of 8 m below ground level. Waste materials observed at the landfills included:

- Ceramics, including crockery and insulators.
- Glass bottles and broken glass.
- Metal pieces, including wire, cable.
- Bricks and concrete.
- Hard plastic and polythene wrapping.
- Suspected asbestos containing material.
- Weathered tar/bitumen.
- Ash and slag.

Laboratory analysis of samples collected from the landfills identified the following contaminants above guideline values:

- Landfill 1 – arsenic and lead (human health – maintenance excavation workers), various metals (ecological).
- Landfill 2 – various metals (ecological).

Petroleum hydrocarbons were identified within samples from both landfills, though not above human health guideline values. Asbestos was identified in samples of fibrous material from both landfills.

Landfill gas monitoring has not been undertaken at the landfills. However, given the relatively small volumes of waste, the likely small percentage of organic waste and the age of the waste (at least 40 years), landfill gas generation is unlikely to be significant.

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3.0 Roles and Responsibilities

3.1 Implementation

The responsible parties for implementing this CSMP are listed in **Table 1**. In addition, all persons working on or visiting the works sites must be made aware of the risks and hazards associated with the landfill remediation, as documented in this CSMP.

This CSMP is a 'live' document and it must be updated to reflect any changes in site conditions or works methodology.

Table 1 Summary of Responsibilities

Item	Responsible Party
Distributing this CSMP to relevant parties during and following award of the remediation contract	WDC
Maintaining this CSMP and keeping a 'hard copy' at the works site	Principal Contractor
Appointing a suitably qualified and experienced practitioner (SQEP)	Principal Contractor
Preparation of Health and Safety Plan	Principal Contractor with inputs from SQEP and WDC
Implementing works controls and risk mitigation procedures	Principal Contractor and relevant subcontractor (depending on nature of controls)
Monitoring of works controls	Principal Contractor and SQEP
Human health and environmental effects advice during works	SQEP
Provision of personnel protective equipment	All parties requiring staff at the work sites
Unexpected contamination discovery protocol	Principal Contractor and SQEP
Remediation validation	Principal Contractor and SQEP

3.2 Suitably Qualified and Experienced Practitioner

A SQEP (contaminated land advisor) will be required to provide oversight and guidance during the remediation works. The role of the SQEP includes, but is not limited to:

- Assisting with preparation and implementation of the Project Health and Safety Plan.
- Providing advice for the management of waste during excavation and removal activities.
- Providing advice on risk mitigation for contamination hazards.
- Undertaking site environmental monitoring and sampling during remediation works, if required.
- Responding to unexpected contamination discoveries.

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3.3 Contact Information

Contact details for key project personnel are included in Table 2.

To be populated when details are known. Additional contacts can be added as required.

Table 2 Contact Details

Role	Contact Details
WDC - Name	
Principal Contractor - Name	
Site Manager - Name	
SQEP - Name	

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4.0 Risks to Human Health and the Environment

4.1 Contaminants of Concern

The following contaminants have been identified within the landfills:

- Asbestos (Chrysotile)
- Metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc)
- Organochlorine Pesticides (OCP)
- Petroleum hydrocarbons
- Polycyclic aromatic hydrocarbons (PAH)

Arsenic and lead were identified at concentrations that present a risk to human health.

Arsenic, copper, lead, nickel and zinc were identified at concentrations which present a potential ecological risk to the marine environment.

It is possible that other identified contaminants could be present at concentrations that pose a risk to human health. It is also possible that contaminants not identified during the previous investigations could be present within the waste.

In addition to chemical contaminants, the waste itself presents a health and safety hazard (cuts and abrasions) due to broken glass and sharp metal fragments. There is also the possibility of pathogens from vermin (primarily rats).

4.2 Contaminant Exposure Pathways

The exposure pathways related to the known contaminants of concern are listed in **Table 3**.

Table 3 Identified Contaminants and Exposure Pathway/Mechanism

Contaminant	Human Health Exposure Mechanism	Environment Exposure Mechanism
Asbestos	Inhalation of fibres	None
Metals	• Inhalation and ingestion of dust • Accidental ingestion of soil	Discharge (stormwater runoff) of particulates to beach and tidal zone
OCP	• Inhalation and ingestion of dust • Accidental ingestion of soil	Discharge (stormwater runoff) of particulates to beach and tidal zone
Petroleum Hydrocarbons	• Skin contact • Vapour inhalation • Inhalation and ingestion of dust • Accidental ingestion of soil	• Discharge (stormwater runoff) of particulates to beach and tidal zone • Discharge of NAPL (if present) to beach and tidal zone
PAH	• Inhalation and ingestion of dust • Accidental ingestion of soil	Discharge (stormwater runoff) of particulates to beach and tidal zone
Notes: NAPL (non-aqueous phase liquids) are liquid hydrocarbons (e.g. diesel, oils, etc.)		

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5.0 Remediation Methodology

To be populated by the remediation contractor

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6.0 Site Management Procedures

6.1 Overview

This section describes the procedures (controls) to mitigate risks to human health and the environment from contaminated waste and soil during landfill remediation activities. Specialist advice from a SQEP may be required to implement some of the controls.

Use of the term “waste materials’ includes natural soil that is also present within the landfills.

When the remediation methodology is finalised, these procedures should be reviewed to make sure they are still appropriate and amended, as required.

Environmental / health monitoring is not included as considered unnecessary. However, if monitoring forms part of any consent conditions, then it can be added, as required.

6.2 Setting Up and Securing the Work Site

The following measures shall be implemented prior to remediation works starting, this is especially important as the landfills are on publicly accessible land:

- The work area(s) shall be delineated and secured to prevent unauthorised access, including keeping the works site secure outside working hours.
- Contamination hazard signs shall be displayed.
- A decontamination area shall be established to wash down equipment before leaving the work site.
- Clean and dirty areas shall be established for site workers to prevent contaminated equipment and clothing from leaving the work site. If contaminated items (excluding waste materials) are removed from the work site, they shall be in sealed bags or containers.
- Hand washing and dedicated eating facilities shall be established for site workers.

6.3 Excavation

The following measures shall be implemented during excavation works on or adjacent to the landfills.

- Excavations shall be staged and managed to minimise uncontrolled collapse of waste materials onto the beach, including from sea inundation.
- Where practical, excavation works should be undertaken during periods of settled weather to minimise the generation of dust or stormwater/sediment runoff.
- Preference shall be for excavated waste materials to be placed directly into trucks for off-site disposal.
- Stockpiling of waste materials should be avoided except in specific circumstances (see Section 6.7).
- Excessively wet waste materials shall be allowed to drain back into the excavation prior to loading into trucks.

6.4 Dust Control

The main causes of dust generation are:

- Mechanical disturbance of soil by excavator.
- Wind blowing across loose, dry soil.
- Traffic movements.

To mitigate the effects of wind-blown dust, the following measures shall be implemented at the site:

- Plan work to avoid high wind conditions.

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- Where soil moisture is insufficient to prevent dust generation, waste materials shall be wetted using a water spray. The dampening process shall not result in excessive run off or saturation of soils.
- Limit drop heights when loading waste materials into trucks.
- Areas of bare ground resulting from excavation works shall be covered or seeded with grass (as appropriate) to minimise generation of dust.

6.5 Stormwater and Sediment Management

Stormwater and sediment management controls are used to prevent the discharge of potentially contaminated stormwater beyond the work site.

The project Erosion and Sediment Control Plan describes the relevant controls to minimise off-site discharge of contaminated stormwater.

6.6 Contaminated Materials on Vehicle Tyres

To minimise the off-site tracking of contaminated waste materials on vehicle tyres and wheels, the following procedures shall be implemented:

- Keep vehicle movements across unsealed ground to a minimum.
- Minimise the build-up of loose waste materials by cleaning up spills.
- Inspect vehicle tyres prior to vehicles leaving the work site. Excess soil shall be removed. Soil removal shall take place in a location that will not result in soil becoming a dust or stormwater run-off problem.
- Consider whether a wheel wash or soil removal grid is required.

6.7 Stockpile Management

Stockpiling of waste materials shall only be undertaken in the following circumstances:

- Emergency excavation as part of a contamination discovery situation.
- Small scale excavation, where stockpiling is of short duration and the materials can be removed from the work site before the end of the work day.

Should waste materials require stockpiling, the following controls shall be implemented:

- Stockpiles shall not be located in areas that could generate stormwater run-off or be close to watercourses, drains, soakage areas, etc.
- Stockpiles shall be placed on an impermeable base (for example, plastic sheeting or sealed surface), except where the area of stockpile placement forms part of the remediation area.
- Stockpiles shall be covered and/or wetted to minimise the potential for dust generation.
- Stockpiles shall be removed from site as soon as possible.

6.8 Off-site Transport and Disposal

Excavated waste materials shall be placed in trucks or lined bins (as required by the receiving landfill operator). Trucks shall be covered before leaving site.

Waste materials from the landfills is being disposed of at Palmerston Landfill.

Waste manifests shall be completed by the haulage contractor for all waste material removed from the landfills. As a minimum these documents shall include the following information:

- Site address/location of material origin.
- Description of the material including quantity, laboratory analysis results (if required) and volume.

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- Company name and dated signature of transporter.
- Waste receipts from the disposal facility.

7.0 Health and Safety Protection Measures

The Principal Contractor shall prepare a health and safety plan (HSP) which covers the risks documented in this CSMP (in addition to other non-contamination related health and safety matters). All personnel involved in the remediation works shall be briefed on the HSP.

Safe work method statements shall be prepared by the Contractor and sub-contractors, as required, to identify activity specific risks and mitigation of those risks with reference to this CSMP.

The health and safety measures documented in this CSMP are not intended to absolve the Contractor of its obligations under New Zealand health and safety legislation. The measures described in this CSMP are in relation to contamination, they are additional to the requirements under NZ health and safety legislation and other employer specific health and safety procedures for the remediation works.

7.1 Asbestos Management

These controls would be insufficient if asbestos fibres were identified above health criteria.

Ideally the waste materials should be sampled and laboratory tested for asbestos fibres (semi-quantitative) so that assessment of health risk can be undertaken. This is a gap in the site information.

The contractor may have to make a call on this and implement asbestos control measures accordingly.

Asbestos containing material has been identified within the landfills. However, the testing methodology did not allow assessment against human health criteria. Therefore, it is not known if the waste materials contain asbestos at concentrations which pose a risk to human health.

A conservative approach has been adopted for this CSMP and the following measures shall be undertaken to control exposure to asbestos fibres:

- During excavation works and when waste materials are exposed, dust suppression measures shall be implemented by wetting of materials to prevent drying out and generation of dust. Wetting of materials should be limited to the minimum required for suppression of dust and should not create pooling or runoff. If necessary, materials can be covered with plastic sheeting/tarpaulin to minimise release of airborne fibres.
- During excavation works, all personnel within the works area shall wear a P2 dust mask.

7.2 Personal Protective Equipment

The personal protective equipment (PPE) presented in **Table 4** is the minimum required when workers are exposed to waste materials. The purpose of PPE is to break the exposure pathway for contamination hazards, since elimination of risk is not possible due to the nature of the works. When combined with good hygiene practices (see Section 7.3), the prescribed PPE will prevent skin contact, inhalation and ingestion of contaminants.

Table 4 PPE Requirements for Contamination Hazards

Item
Full length coveralls or cotton shirt (long sleeved) and pants. No short trousers.
Safety boots (steel capped and steel soles if walking on waste materials). Note that non-laced boots are required for asbestos in soil situations.
Safety glasses
Cut resistant gloves

D R A F T

Dust mask (P2).

7.3 Personal Hygiene

Observing good personnel hygiene is important to minimise the effects of exposure to contaminants. The following good practice procedures shall be adopted:

- There shall be no eating, drinking, smoking or vaping in the work areas. Dedicated eating facilities shall be established outside the work areas.
- People leaving the work area shall undergo personal decontamination including removing contaminated PPE and washing face and hands. Dedicated facilities shall be established to allow decontamination.

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8.0 Unexpected Discovery Protocol

While the lateral extents of filling have been investigated, the landfill boundaries are not known definitively. The approximate landfill boundaries are shown on **Figure 2 and Figure 3 (Appendix A)**.

During excavation of waste materials, including potential 'chasing' of waste beyond the approximated landfill boundaries, it is possible that waste materials may be encountered which are unexpected. The sections below describe the procedures for managing such situations.

8.1 Evidence of Contamination

The site is a former landfill and waste materials will be encountered during excavation works. Indicators for unexpected contamination situations are:

- Containers with unknown liquids.
- Soil with unusual colour, staining or odour.
- Hydrocarbon sheens on water. Though leachate can cause iridescent sheens on water resulting from iron oxidising bacteria.
- Discoloured and/or odorous seeps.
- Fibrous materials in a deteriorated condition.

8.2 Communication and Notification

If unexpected contamination situations are encountered, the following immediate actions shall be taken:

- Stop work and immediately inform the Site Supervisor.
- Assess potential immediate hazards. If unsafe move away from the area of discovery and secure the area.
- Consult with a SQEP, as required, and await further instruction.
- Work shall not resume in the area of discovery unless authorised by the Site Supervisor/SQEP.

8.3 Further Actions

The following actions may be undertaken:

- The SQEP may arrange for the materials to be sampled.
- If required and to minimise dust / vapour exposure, the material may be covered with soil, tarpaulin, etc. while waiting for inspection. Depending on the nature of the contamination encountered (as advised by the SQEP), works may be able to continue in other parts of the site which are beyond the secured area.
- Temporary bunding may be used to divert surface water run-off from the potentially contaminated materials in the event of rain.
- If deemed safe by the SQEP, material may be excavated and stockpiled and covered and bunded on a sealed surface while waiting to be tested and awaiting analytical results.

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9.0 Consent Application Summary

The consents applications applicable to the site(s) are summarised in Table 5.

To be updated with Consent Document references

Table 5 Consent Summary

Activity	Rule	Status
Otago Regional Council – Regional Plan: Waste for Otago		
Disturbance of land at contaminated sites, and associated discharges to land and air.	5.6.1	Discretionary
Waitaki District Council – Waitaki District Plan / NES[1] Contaminated Soils		
Earthworks above permitted volumes and within a Significant Coastal Landscape	4.3.3.12	Discretionary
Soil disturbance and removal at a contaminated site	Regulation 10	Restricted Discretionary

[1] Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations, 2011.

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Appendix A – Figures

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AECOM

PROJECT

BEACH ROAD LANDFILL

CLIENT

WAITAKI DISTRICT COUNCIL

CONSULTANT

AECOM New Zealand Limited
www.aecom.com

PROJECT MANAGEMENT INITIALS

Approved	LK	Date	13/3/2023
Checked	LK	Date	13/3/2023
Designed	SS	Date	13/3/2023
Drawn	SS	Date	13/3/2023

ISSUE/REVISION

Rev	Date	Description
A	13/3/2023	DRAFT

PROJECT NUMBER

60697520

SHEET TITLE

SITE LOCATION PLAN

MAP NUMBER

FIGURE 1

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AECOM

PROJECT

BEACH ROAD LANDFILL

CLIENT

WAITAKI DISTRICT COUNCIL

CONSULTANT

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PROJECT MANAGEMENT INITIALS

Approved	LK	Date	15/3/2023
Checked	LK	Date	15/3/2023
Designed	SS	Date	15/3/2023
Drawn	SS	Date	15/3/2023

ISSUE/REVISION

Rev	Date	Description
A	15/3/2023	DRAFT

PROJECT NUMBER

60697520

SHEET TITLE

LANDFILL 1

MAP NUMBER

FIGURE 2

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BEACH ROAD LANDFILL

CLIENT

WAITAKI DISTRICT COUNCIL

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PROJECT MANAGEMENT INITIALS

Approved	LK	Date	15/3/2023
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Designed	SS	Date	15/3/2023
Drawn	SS	Date	15/3/2023

ISSUE/REVISION

Rev	Date	Description
A	15/3/2023	DRAFT

PROJECT NUMBER

60697520

SHEET TITLE

LANDFILL 2

MAP NUMBER

FIGURE 3

Appendix E

Draft Consent Conditions

Proposed Draft Consent conditions

ORC Consent: To disturb a contaminated site for the purpose of undertaking remediation works at two closed uncontrolled disposal sites at Beach Road

1. The disturbance of a contaminated site must be carried out in accordance with the plans and all information submitted with the application, detailed below, and all referenced by the Consent Authority as consent number RMXXXXXX.
2. All earthworks undertaken for the remediation of the closed uncontrolled disposal sites must be overseen at all times by a Chartered Professional Engineer and a Suitably Qualified and Experienced Practitioner (SQEP).
3. Soil or waste materials removed from the contaminated area must be deposited at a disposal site that holds a consent to accept the relevant level of contamination except in circumstances where:
    a. The soil or waste materials meet the definition of 'cleanfill' with reference to the Ministry for the Environment's 'A guide to the management of cleanfills (2002); and
    b. Notice is given to the Consent Authority five working days prior its removal from the subject site.
4. The Consent Holder must ensure that the area and volume of exposed contaminated soils at the site of excavation is kept to the minimum practicable throughout the duration of the work.
5. No contaminated sediment or landfill materials shall be discharged to the coastal marine area as a result of the exercise of this consent.
6. The Consent Holder must notify the Consent Authority in writing of the commencement date of many remedial works no less than 10 working days prior to the commencement of works at each closed uncontrolled disposal site.
7. At least ten working days prior to the disturbance of the closed uncontrolled disposal sites, the Consent Holder must submit to the Consent Authority a Final Contaminated Materials Management Plan (CMMP). The CMMP must contain sufficient detail to address the following matters:
    a. A brief summary of the works to be undertaken with references to other relevant documents;
    b. A description of the known or suspected contamination present;
    c. Relevant contact information of those onsite and managing the construction or earthwork activities.
    d. Allocation of responsibilities, including who is responsible for implementing and monitoring the controls detailed within the CMMP.
    e. A description of relevant regulatory requirements and conditions of consent;
    f. Soil management procedures during the works, including siting and management of soil stockpiles, and erosion, sediment and dust control procedures;
    g. Handling and disposal procedures for any contaminated material encountered during the activity including recommended personal protective equipment (PPE);
    h. Soil, air quality, groundwater and/or surface water monitoring requirements;
    i. Contingency measures to address any unexpected or accidental discoveries of contamination or discharges identified at the site;
    j. A Site Health and Safety Plan for the remediation earthworks that identifies hazards associated with the works, and outlines measures to eliminate, isolate or minimise these hazards, to ensure that during the works public safety is maintained ; and
    k. Measures to verify all contaminated materials are removed from the closed uncontrolled disposal sites at the completion of the remediation process.

8. At least ten working days prior to the disturbance of the landfill, the Consent Holder must submit to the Consent Authority a Final Erosion and Sediment Control Plan (ESCP). The ESCP must contain sufficient detail to address the following matters:
    a. Specific erosion and sediment control works (locations, dimensions, capacity etc);
    b. Supporting calculations and design drawings;
    c. Catchment boundaries and contour information;
    d. Details of construction methods;
    e. Timing and duration of construction and operation of control works;
    f. Details relating to the management of exposed areas;
    g. Monitoring and maintenance requirements; and
    h. Emergency response measures to be implemented prior to adverse weather events such as; high rainfall events, storm surges or extreme high tides.
9. Prior to commencing vegetation removal at each site, vegetation manipulation shall be completed to minimise potential effects on lizards, using the following methodology:
    a. Mowing should occur over a period of 4 weeks where vegetation height is reduced to 500mm in the first week.
    b. At the end of the second week, vegetation height is reduced to 300mm.
    c. At the end of the 3rd week vegetation is reduced to 50mm.
    d. At the end of the 4th week vegetation will be reduced to ground level.
10. Where earthworks are proposed to occur during the penguin nesting period (August to February) a site inspection shall be carried out at prior to works occurring by a suitably qualified and experienced ecologist. If any penguins are observed during the site inspection, works at that site should stop immediately.
    Note: works can proceed at the site that does not have penguins nesting.
11. Within two months of the completion of remedial (waste removal) work at each closed uncontrolled disposal site, the following must be provided to the Consent Authority.
    a. The location and dimensions of the excavations carried out, including a relevant site plan;
    b. Records of contamination encountered during the works including soil validation results, if applicable; and
    c. Copies of the disposal dockets for the material removed from the site.
12. The Consent Holder must maintain a record of complaints related to the remedial works. The register must include, but not be limited to:
    a. The date, time, location and nature of the complaint;
    b. The name, phone number, and address of the complainant, unless the complainant elects not to supply this information;
    c. action taken by Consent Holder to remedy the situation and any policies or methods put in place to avoid or mitigate the problem occurring again.

    The Consent Holder must, within 24 hours, inform the Consent Authority of any complaints received from any person about activities on the site associated with the consented works.
13. All machinery, chemicals, rubbish, debris and other materials must be removed upon completion of the works.
14. In the event that an unidentified archaeological site is located during works, the following will apply;
    a. Work must cease immediately at that place and within 20 metres around the site.
    b. All machinery must be shut down, the area must be secured, and the Heritage New Zealand Pouhere Taonga Regional Archaeologist and the Consent Authority must be notified.
    c. If the site is of Maori origin, the Consent Holder must also notify the appropriate iwi groups or kaitiaki representative of the discovery and ensure site access to enable appropriate cultural procedures and tikanga to be undertaken, as long as all statutory requirements

under legislation are met (Heritage New Zealand Pouhere Taonga Act 2014, Protected Objects Act 1975).

d. If human remains (koiwi tangata) are uncovered the Consent Holder must advise the Heritage New Zealand Pouhere Taonga Regional Archaeologist, NZ Police, the Consent Authority and the appropriate iwi groups or kaitiaki representative and the above process under (c) will apply. Remains are not to be disturbed or moved until such time as iwi and Heritage New Zealand Pouhere Taonga have responded.
e. Works affecting the archaeological site and any human remains (koiwi tangata) must not resume until Heritage New Zealand Pouhere Taonga gives written approval for work to continue. Further assessment by an archaeologist may be required.
f. Where iwi so request, any information recorded as the result of the find such as a description of location and content, must be provided for their records.

ORC Consent: To discharge contaminants to air for the purpose of undertaking remediation works two closed uncontrolled disposal sites at Beach Road

1. The discharge of contaminants to air must be carried out in accordance with the plans and all information submitted with the application, detailed below, and all referenced by the Consent Authority as consent number RMXXXXXX.
2. The Consent Holder must notify the Consent Authority in writing of the commencement date of any works no less than 10 working days prior to the commencement of works.
3. The Consent Holder must maintain a record of any air quality complaints. The register must include, but not be limited to:
    a. The location where the discharge was detected by the complainant;
    b. The date and time when the discharge was detected;
    c. A description of the discharge detected by the complainant;
    d. The name, phone number, and address of the complainant, unless the complainant elects not to supply this information;
    e. A description of the weather conditions, including approximate wind speed and direction when the discharge was detected by the complainant;
    f. Action taken by Consent Holder to avoid, remedy or mitigate the discharge detected by the complainant and any policies or methods put in place to avoid the discharge occurring again.

    The Consent Holder must, within 24 hours, inform the Consent Authority of any complaints received from any person about activities on the site associated with the consented works.
4. There must be no odour or dust emission resulting from the Consent Holder's activities that in the opinion of the Consent Authority, is offensive or objectionable to such an extent that it has an adverse effect on the environment downwind of the site.
5. The Consent Holder must adopt the best practicable option to avoid and/or mitigate any adverse effect on the environment resulting from the discharge of dust during the disturbance. This must include:
    a. limiting the amount of material to be excavated as much as practicable;
    b. providing water for wet suppression to prevent dust emissions if necessary; and
    c. covering of excavated material as required.

WDC Consent: Land use consent to complete earthworks, and the disturbance and removal of contaminated soil

1. That the activity be carried out in general accordance with the application and plans lodged by AECOM New Zealand Limited on behalf of the applicant, submitted with application XXX XXX and received by Council on XX March 2023, except where modified by conditions of consent.

2. That all construction activities shall be limited to between 0700 hours and 1800 hours daily.
3. At least ten working days prior to the disturbance of the landfill, the consent holder must submit to the Council for approval a Final Contaminated Materials Management Plan (CMMP). The CMMP must contain sufficient detail to address the following matters:
    a. A brief summary of the works to be undertaken with references to other relevant documents;
    b. A description of the known or suspected contamination present;
    c. Relevant contact information of those onsite and managing the construction or earthwork activities.
    d. Allocation of responsibilities, including who is responsible for implementing and monitoring the controls detailed within the CMMP.
    e. A description of relevant regulatory requirements and conditions of consent;
    f. Soil management procedures during the works, including siting and management of soil stockpiles, and erosion, sediment and dust control procedures;
    g. Handling and disposal procedures for any contaminated material encountered during the activity including recommended personal protective equipment (PPE);
    h. Soil, air quality, groundwater and/or surface water monitoring requirements;
    i. Contingency measures to address any unexpected or accidental discoveries of contamination or discharges identified at the site
    j. A Site Health and Safety Plan for the remediation earthworks that identifies hazards associated with the works, and outlines measures to eliminate, isolate or minimise these hazards, to ensure that during the works public safety is maintained; and
    k. Measures to verify all contaminated materials are removed from the closed landfill sites at the completion of the remediation process.
4. All earthworks and land disturbance activities shall be finished in a manner which is consistent with existing landforms at the site.
5. Prior to commencing vegetation removal at each site, vegetation manipulation shall be completed to minimise potential effects on lizards, using the following methodology:
    a. Mowing should occur over a period of 4 weeks where vegetation height is reduced to 500mm in the first week.
    b. At the end of the second week, vegetation height is reduced to 300mm.
    c. At the end of the 3rd week vegetation is reduced to 50mm.
    d. At the end of the 4th week vegetation will be reduced to ground level.
6. Where earthworks are proposed to occur during the penguin nesting period (August to February) a site inspection shall be carried out at prior to works occurring by a suitably qualified and experienced ecologist. If any penguins are observed during the site inspection, works at that site should stop immediately.
   Note: works can proceed at the site that does not have penguins nesting.
7. All debris, waste and unused structures, materials, plant and machinery ancillary to the completion of the works shall be removed upon completion of the works. The sites shall be left in a tidy condition.
8. During periods of dry weather, adequate dust control measures must be in place to prevent dust nuisance to neighbouring properties.
9. All earthworks related construction activities shall meet relevant noise limits in Tables 2 and 3 of NZS 6803:1999 Acoustics - Construction Noise, when measured and assessed in accordance with that standard.

10. The consent holder shall ensure that a Traffic Management Plan has been approved by the relevant roading authority (Waitaki District Council), for all construction activities within a road reserve, prior to construction activities commencing.

Appendix F

Ecological Impact Assessment

Prepared for
Waitaki district Council
Co No.: N/A

DRAFT

Ecological Impact Assessment

Beach Road Landfills Remediation

27 March 2023

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Delivering a better world

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Ecological Impact Assessment

Beach Road Landfills Remediation

Client: Waitaki District Council

Co No.: N/A

Prepared by

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27 March 2023

Job No.: 60697520

D R A F T

Quality Information

Document Ecological Impact Assessment

Ref 60697520

Date 27 March 2023

Prepared by Alvar Koning Principal Environmental Scientist

Reviewed by Fiona Davies Associate Director Natural Resources

Revision History

Rev	Revision Date	Details	Authorised	
			Name/Position	Signature
1	03/03/2023	Draft Assessment Internal Review	Fiona Davies	
2	27/03/2023	Draft for Consultation	Helen Lawrence	

Table of Contents

1.0 Project Background

Waitaki District Council (WDC) have identified two historic unofficial landfills located along the coastal cliffs on Beach Road, Oamaru (the 'sites'), which are at risk of coastal erosion and consequently the uncontrolled release of contaminated material.

The two landfill sites, referred to as Landfill 1 and Landfill 2, are located along Beach Road, approximately 3 km south of Oamaru (Figure 1-1). The landfills are located within existing gullies along a steep, eroding, coastal cliff between Beach Road and the Pacific Ocean.

Landfill 1 is located approximately 220 m northeast from the intersection with Awamoa Road and Beach Road and has an approximate total site area of 677 m^2. Landfill 2 is approximately 10 m southwest of the intersection and has an approximate total site area of 722 m^2. Beach Road traverses' Landfill 1 and passes inland of Landfill 2.

Figure 1-1: Project location

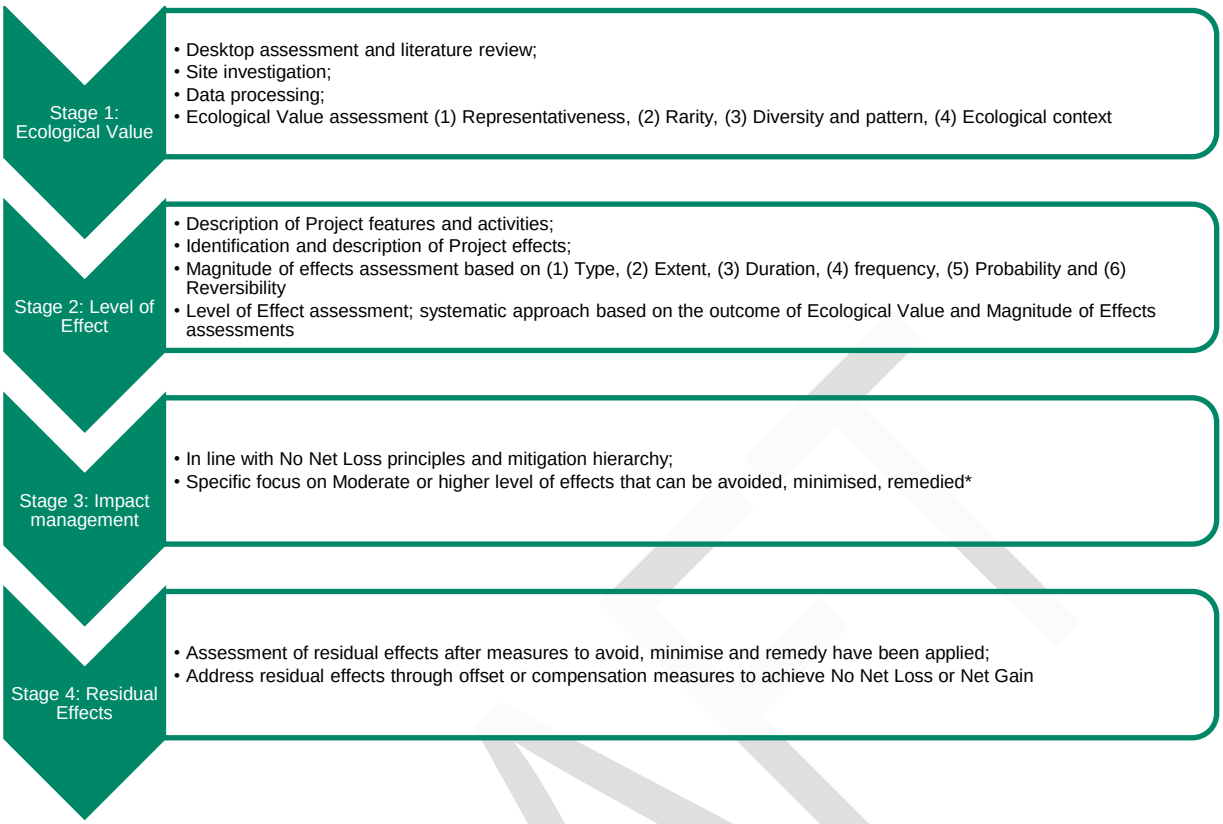
2.0 Assessment Methodology

2.1 EcIA Methodology

This ecological impact assessment (EcIA) has been undertaken in accordance with the EcIA Guidelines, published by the Ecological Institute of Australia and New Zealand (Roper Lindsay et al., 2018) (hereinafter referred to as the EIANZ Guidelines)

Using the EIANZ Guidelines, ecological value was assigned to ecological features including terrestrial and aquatic habitats and their fauna (outlined in Section 4.0), and an assessment of the magnitude of effects was made based on predicted impacts for the construction and operation stages of the Project. Where the overall level of effect (value x magnitude) was considered to be **Moderate** or greater, impact management was recommended, and where residual effects remained, these have been addressed through offset/compensation.

The EcIA approach is represented in Figure 2-1.



* The Wildlife Act 1953 must be complied with, as such management measures must always be implemented to ensure that Project activities do not injure or kill native wildlife.

Figure 2-1: Process followed for this EcIA (EIANZ, 2018)

2.2 Project Area and Zone of Influence

The Zone of Influence (ZOI) of the Project relates to an area occupied by habitats and species that are adjacent to and may go beyond the boundary of the Project Area. It is defined in the EIANZ Guidelines as "the areas/resources that may be affected by the biophysical changes caused by the proposed Project and associated activities." The distance of the ZOI and type of effect from the Project can be different for different species and habitat types. ZOI is used throughout this report to describe the impacts of the Project (construction and operation) on adjacent or connected terrestrial, freshwater and wetland habitats and associated native species.

It should be noted that presence within the ZOI of a Project does not necessarily mean the ecological feature will be impacted by the Project.

2.3 Desktop Review

To gain an understanding of the ecological features of value that could potentially be impacted by the proposed works, a desktop review of aquatic and terrestrial ecological records was undertaken in February 2023, based on the following:

- Department of Conservation Threat Classification Series;
- Department of Conservation (DOC) Bioweb records;
- New Zealand Bird Atlas (eBird database);
- Ecological Regions and Districts of New Zealand (McEwen, 1987);

- Department of Conservation (DOC) Bioweb records[1];
- iNaturalist records[2];
- Classification of New Zealand's terrestrial ecosystems (Singers & Rogers, 2014); and
- DOC and Penguin Rescue consultation.

2.4 Terrestrial Ecology

2.4.1 Terrestrial habitats/vegetation communities

A site walkover was undertaken between 7 – 8 February 2023, to map and describe the habitats[3] present within and adjacent to the Project areas. Habitats were classified into ecosystem type based on those described in Singers et al. (2017). The habitats were also assessed as to their potential to support indigenous fauna, including birds, bats, lizards, fish and macroinvertebrates.

Broad indigenous vegetation communities were mapped on recent aerial photography. The vegetation assessment included recording the dominant or characteristic species present and the general quality described, including structure, maturity, presence of weeds and evidence of disturbance.

2.4.2 Fauna

Incidental observations of any native species seen during the site walkover were recorded. For lizard species, this included incidental searches of natural/artificial refugia, such as turning over logs/wood/debris on the ground. For birds, incidental observations were made.

2.5 Aquatic Ecology

During the initial desktop assessment, no potential aquatic habitat was identified. This was confirmed during the site walkover.

2.6 Wetland Ecology

During the initial desktop assessment, no potential wetland habitat was identified. This was confirmed during the site walkover.

[1] https://www.doc.govt.nz/our-work/monitoring-reporting/request-monitoring-data/
[2] https://www.inaturalist.org/
[3] Ecosystem codes from Singers *et al* (2017) were used to describe the habitats encountered on site.

3.0 Planning Considerations

This EcIA has been prepared to highlight the ecological effects of the Project and associated impact management. In addition, statutory considerations are also being met with the Project consent requirements detailed in Table 3-1. Wildlife Act (1953) requirements are also highlighted in Section 4.2

Reasons for consent along with the relevant section of this EcIA are specified in Table 3-1 below.

Table 3-1 Consents required

Activity	Rule	Status	Relevant section of report
Otago Regional Council – Regional Plan: Waste for Otago			
Disturbance of land at contaminated sites, and associated discharges to land and air	5.6.1	Discretionary	Section 4.3
Waitaki District Council – Waitaki District Plan / NES Contaminated Soils			
Earthworks above permitted volumes and within a Significant Coastal Landscape	4.3.3.12	Discretionary	Section 4.4
Soil disturbance and removal at a contaminated site.	Regulation 10	Restricted discretionary	Section 4.4

4.0 Ecological Baseline and Value

4.1 Ecological Context

Both Sites are located within the Wainono Ecological Region and Oamaru Ecological District (DOC, 1987). The Site is classified as northern downlands and eastern hill country ecosystem zones (Wildlands, 2017) and is subject to extensive historic native vegetation clearance.

The area is identified under the Waitaki District Plan as a Significant Coastal Landscape. This Significant Coastal Landscape stretches from Oamaru in the north to Moeraki in the south. The area has high habitat value for the threatened, yellow-eyed penguin (*Megadyptes antipodes*) and the at risk little blue penguin (*Eudyptula minor*). This coastline also supports a diversity of waders and seabirds.

The Oamaru Ecological District mainly include areas of coastal lowlands below 300m above sea level. Limestone topography is present within a varied coastline between some marine basalts. The ecological district typically has a low rainfall and comprise deep silty soils and dark heavy textured soils from limestone. Historic vegetation comprises short tussock land, but now the area is mainly farmed.

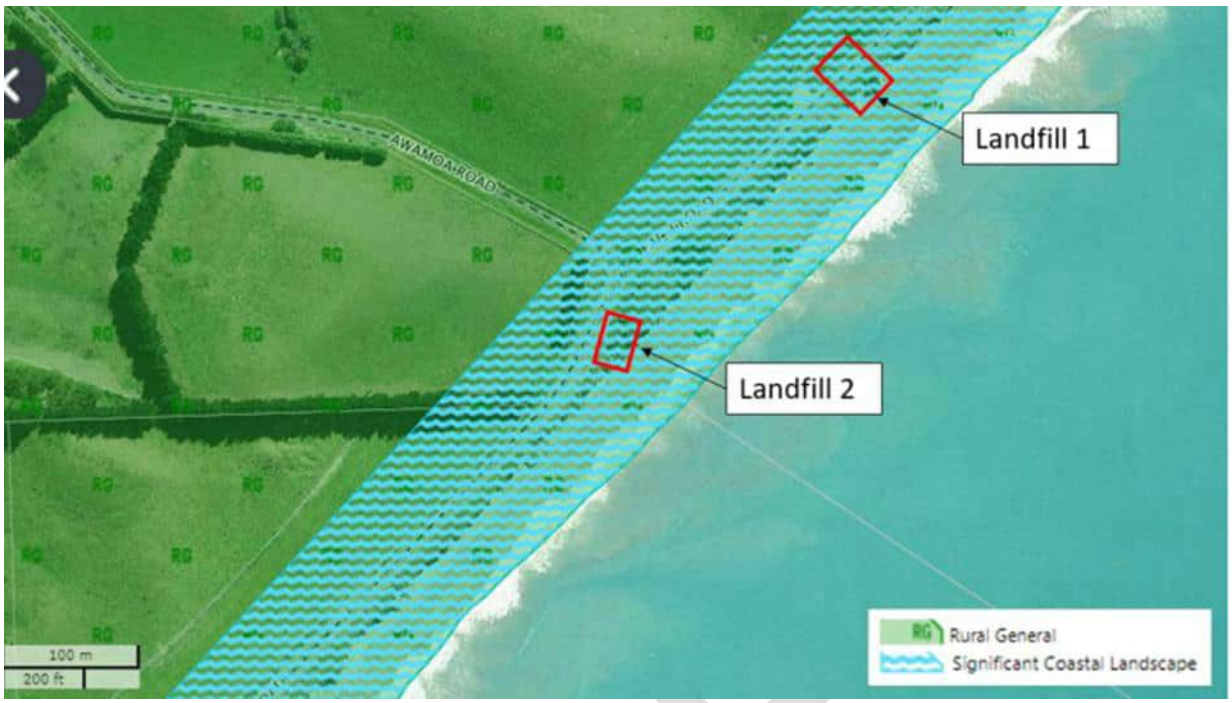


Figure 4-1: Waitaki District Council overlay

4.2 Terrestrial Ecology

4.2.1 Terrestrial Habitat Types/Vegetation Communities

The terrestrial habitats within the Project Area that were identified during the site walkover included:

- Exotic grassland (EG) (both rank unmanaged grass and mown / managed); and
- Exotic shrub (ES) with > 50% cover/biomass of exotic secondary scrub or shrubland.

Table 4-1 presents the terrestrial habitat types classified according to Singers *et al.* (2017) as well as the approximate habitat areas within the Project Area. Habitat areas for Landfill 1 are shown in Table 4-1 and habitat areas for Landfill 2 are shown in Table 4-2.

Table 4-1 Existing vegetation/habitat types within Landfill 1

Vegetation type (Singers et al. 2017)	Areal extent/ location	Description	Photograph
Exotic grassland (EG)	The total extent of vegetation present at Landfill 1 comprises this vegetation type. The Project will result of a total loss of 250m^2 of this habitat type.	Grassland dominated by exotic species. This includes rank grass (unmanaged/uncut) and managed mown areas. Dominant species include paspalum grass (*Paspalum spp.)*	

D R A F T

Table 4-2 Existing vegetation/habitat types within Landfill 2

Vegetation type (Singers et al. 2017)	Areal extent/ location	Description	Photograph
Exotic grassland (EG)	Approx. 90% of the Landfill 2 is dominated by this vegetation type. The Project will result of a total loss of 650m^2 of this habitat type.	Grassland dominated by exotic species. This includes rank grass (unmanaged/uncut) and managed mown areas. Dominant species include paspalum grass (*Paspalum spp.)*	

D R A F T

Vegetation type (Singers et al. 2017)	Areal extent/ location	Description	Photograph
Exotic shrub (ES)	Approx. 10% of Landfill 2 is dominated by this vegetation type. The Project will result of a total loss of 70m^2 of this habitat type.	Exotic secondary scrub or shrubland with >50% cover/biomass of exotic species.	

4.2.1.1 Bats

According to DOC records no bat records exist within 20km from the site. No sufficiently large (>15cm diameter breast height (DBH) trees will be affected by the proposed works. Due to their unlikely presence, bats will not be discussed further in this assessment.

4.2.1.2 Birds

New Zealand Bird Atlas[4] and iNaturalist[2] databases identified 44 native and introduced bird species within 5 km of the Site. Table 4-3 lists the bird species identified within the desktop assessment with the potential to occur within the Project Area. Seven native bird species (three Introduced and Naturalised and 4 Not threatened species) were observed during incidental observations during the Site walkover, these are highlighted with an asterisk in Table 4-3.

The desktop survey indicates that thirteen Threatened At Risk (TAR) species are potentially resident or visitors to the Project Area. Two of these species are the Nationally Endangered, yellow-eyed penguin and the At Risk – Declining little blue penguin. No potential penguin breeding sites associated with the Project area was identified through consultation with Penguin Rescue New Zealand.

It is unlikely that any of the other TAR species will be resident within the Project ZOI.

Table 4-3 Desktop records of bird species within a 5km radius of the Project Area (New Zealand Bird Atlas and iNaturalist) and those recorded incidentally during Site investigations

Common name	Species (including latin name)	Conservation status (Robertson *et al.* 2017)	Source
Australasian Harrier	*Circus aproximans*	Not threatened	iNaturalist, NZ Bird Atlas
Australian Magpie*	*Gymnorhina tibicen*	Introduced and Naturalised	NZ Bird Atlas
Banded Dotterel	*Charadrius bicinctus*	Nationally vulnerable	iNaturalist
Bellbird/Korimako	*Anthornis melanura*	Not threatened	iNaturalist, NZ Bird Atlas
Black Shag	*Phalacrocorax carbo*	Naturally Uncommon	iNaturalist, NZ Bird Atlas
Black-billed Gull	*Larus bulleri*	Declining	NZ Bird Atlas
Blackbird*	*Turdus merula*	Introduced and Naturalised	iNaturalist, NZ Bird Atlas
Blue Duck	*Poliocephalus rufopectus*	Nationally vulnerable	NZ Bird Atlas
Brown Creeper	*Mohoua novaeseelandiae*	Not Threatened	iNaturalist
Canada Goose	*Branta canadensis*	Introduced and Naturalised	iNaturalist, NZ Bird Atlas
Chaffinch*	*Fringilla coelebs*	Introduced and Naturalised	iNaturalist, NZ Bird Atlas
Chukar partridge	*Alectoris chukar*	Introduced and Naturalised	iNaturalist, NZ Bird Atlas
Fantail	*Rhipidura fuliginosa*	Recovering	NZ Bird Atlas
Goldfinch*	*Carduelis carduelis*	Not threatened	iNaturalist, NZ Bird Atlas
Greenfinch	*Carduelis chloris*	Introduced and Naturalised	iNaturalist, NZ Bird Atlas
Grey Duck	*Anas superciliosa*	National critical	iNaturalist
Hedge Sparrow	*Prunella modularis*	Introduced and Naturalised	NZ Bird Atlas

[4] https://birdatlas.co.nz/

D R A F T

Common name	Species (including latin name)	Conservation status (Robertson *et al.* 2017)	Source
Kaka	*Nestor meridionalis*	Recovering	iNaturalist, NZ Bird Atlas
Kea	*Nestor notabilis*	Nationally endangered	iNaturalist
Kereru	*Hemiphaga novaeseelandiae*	Not threatened	iNaturalist, NZ Bird Atlas
Little blue penguin	(*Eudyptula minor*).	Declining	iNaturalist, NZ Bird Atlas
Little Shag	*Phalacrocorax sulcirostris*	Naturally Uncommon	iNaturalist, NZ Bird Atlas
Long-tailed Cuckoo	*Eudynamys taitensis*	Naturally uncommon	iNaturalist, NZ Bird Atlas
Mallard Duck	*Anas platyrhynchos*	Introduced and Naturalised	iNaturalist, NZ Bird Atlas
Morepork	*Ninox novaeseelandiae*	Not threatened	iNaturalist, NZ Bird Atlas
New Zealand Falcon	*Falca novaeseelandiae*	Recovering	iNaturalist, NZ Bird Atlas
New Zealand Kingfisher	*Todiramphus sanctus*	Not threatened	iNaturalist, NZ Bird Atlas
New Zealand Scaup	*Aythya novaeseelandiae*	Not threatened	iNaturalist, NZ Bird Atlas
Paradise Shelduck	*Tadorna variegata*	Not threatened	iNaturalist, NZ Bird Atlas
Pied Oystercatcher	*Haematopus finschi*	Declining	iNaturalist, NZ Bird Atlas
Pipit	*Anthus novaeseelandiae*	Declining	iNaturalist, NZ Bird Atlas
Redpoll	*Carduelis flammea*	Introduced and Naturalised	iNaturalist, NZ Bird Atlas
Rifleman	*Acanthisitta chloris*	Not threatened	iNaturalist, NZ Bird Atlas
Rock Pigeon	*Columba livia*	Introduced and Naturalised	iNaturalist, NZ Bird Atlas
Shining Cuckoo	*Chrysococcyx lucidus*	Not threatened	iNaturalist, NZ Bird Atlas
Silvereye*	*Zosterops lateralis*	Not threatened	iNaturalist, NZ Bird Atlas
Skylark	*Alauda arvensis*	Introduced and Naturalised	iNaturalist, NZ Bird Atlas
South Island Robin	*Petroica australis*	Declining	iNaturalist, NZ Bird Atlas
Southern Black-backed Gull*	*Larus dominicanus*	Not threatened	NZ Bird Atlas
Spur-winged Plover	*Vanellus miles*	Not threatened	iNaturalist, NZ Bird Atlas
Starling	*Sturnus vulgaris*	Introduced and Naturalised	iNaturalist, NZ Bird Atlas
Welcome Swallow*	*Hirundo neoxena*	Not threatened	iNaturalist, NZ Bird Atlas
Yellow-crowned Parakeet	*Cyanoramphus auriceps*	Not threatened	iNaturalist, NZ Bird Atlas
Yellow-eyed penguin	*Megadyptes antipodes*	Nationally Endangered	iNaturalist, NZ Bird Atlas

*Species observed during site walkover,

4.2.1.3 Herpetofauna

Two species of native lizard (herpetofauna) have been recorded within 10km of the Site (Table 4-4) Korero gecko (*Woodworthia Otago Large)* is classified as At Risk – Declining and McCann's skink (*Oligosoma maccanni*) is classified as Not Threatened by DOC (Hitchmough et al. 2015). In general, the Otago area is poorly surveyed for lizards and therefore a 10 km search area was used to review of the DOC Bioweb database and the iNaturalist website.

During the site investigations, no indigenous lizards were identified during incidental observations. The Not Threatened McCann's skink is however widespread and several records occur within 2 km of the Site. Habitat availability for this species was confirmed at both landfill sites during the Site walkovers, within the rank grass (EG) (Figure 4-3 Photo 1). During the site investigations, no suitable habitat of contiguous forest vegetation or rocky outcrops was present, that could sustain a population of the At Risk – Declining Korero gecko.

Table 4-4 Indigenous herpetofauna species and their Threat Classification from the Otago Region

Common Name	Latin Name	Threat Class (Hitchmough et al., 2021)	Record source
McCann's skink	*Oligosoma maccanni*	Not Threatened	iNaturalist, DOC Amphibian and Reptile Distribution Scheme
Korero gecko	*Woodworthia Otago Large*	At Risk - Declining	DOC Amphibian and Reptile Distribution Scheme

Figure 4-2**Photo 1:** Potential suitable habitat (EG – rank grass) for McCannn's skink associated with the Project area

4.2.2 Assessment of Terrestrial Ecological Value

The terrestrial habitats within the Project Area are dominated by exotic grasslands (EG) (managed cut grassland and rank grass)

These vegetation types although of limited value botanically provide some value in terms of ecosystem function, such as, bank stability. These vegetation types do not provide suitable habitat for any TAR bird species. They may however provide habitat utilised by McCanns skink (Not Threatened).

These habitat provisioning aspects of ecological value have been considered in the overall assessment of terrestrial habitats presented in Table 4-5.

Table 4-5 Terrestrial habitat ecological value assessment

Terrestrial habitat assessment	Exotic Grassland (EG)- rank	Exotic Shrub (ES)
Matter 1 - Representativeness	1	2
Matter 2 - Rarity/distinctiveness	0	1
Matter 3 - Diversity and pattern	1	1
Matter 4 - Ecological context	0	0
Overall value	**Negligible**	**Negligible**

Table 4-6 presents the ecological value for the terrestrial fauna species identified during the site walkover or that are likely to occur within the Project Area or ZOI and is consistent with the EIANZ Guidelines (2018). The relevant terrestrial habitats listed in Table 4-6 that are used by these species are also described.

Table 4-6 Ecological value for terrestrial fauna

Fauna type	Species within habitat	Habitat units description	Threat status (NZ Classification system)	Ecological Value
Lizards	McCann' s skink	Rank grass all areas of vegetation (Exotic Grassland (EG)	Not Threatened	Low

5.0 Assessment of Ecological Effects and Mitigation

The overall ecological effects methodology is outlined in Section 2.1. The effects assessment detailed in this section includes a systematic assessment of the magnitude of ecological effects related to the proposed works (refer Section 5.1). Once the magnitude of effect and the value of the ecological feature (determined during baseline surveys – refer Section 4.0) have been determined, the level of effect can be assigned. This provides an overall level of effect prior to mitigation (but after due consideration to any embedded controls (Section 5-2) and existing avoidance measures).

5.1 Proposed Works

The proposed works will include the removal of all waste from the two landfills and dispose of the waste at the Palmerston Landfill, located approximately 55km south. Approximately 250m^2 of vegetation will be removed at Landfill 1 as part of the remediation works and approximately 720m^2 of vegetation will be lost at Landfill 2.

On completion of the waste removal, the sites will be re-established to pre-landfill ground levels to allow for natural coastal erosion processes to occur in line with the surrounding coastline.

5.2 Embedded Controls

The proposed works have the potential to have both direct and indirect impacts on ecological features present within the Project Area and the ZOI, without mitigation. The effects assessment is based around the following assumptions and embedded controls during construction and operation:

- A site-specific Erosion and Sediment Control Plan for the Site must be compiled and will be utilised to manage any effects of sedimentation specific to the earthworks that the proposed works requires and other activities in vicinity of water bodies/receiving environment. Therefore, it will be assumed that issues related to sediment generation and potential contamination are adequately mitigated and will not lead to adverse environmental effects. Additionally, any areas of bare soil will be re-vegetated prior to the completion of the proposed works.
- A site-specific Planting Plan for the Sitemust be compiled in order to ensure that suitable native vegetation is used when the vegetation is reinstated. This will result in a positive effect during the Operational phase

5.3 Construction Phase Assessment of Effects and Mitigation

Table 5-1 lists the potential effects (direct and indirect) from the Project on terrestrial habitats and species. An overall level of effect is calculated for each feature, prior to and then after mitigation. Mitigation is required where the level of effect is considered to be **Moderate** or greater. Where effects are **Low** or **Very low**, mitigation is generally not required. The Project will also need to comply with the Wildlife Act 1953 in regards to the protection of indigenous fauna.

Table 5-1 Magnitude of effect and subsequent level of effect (without and then with mitigation) from the Project upon terrestrial, aquatic and wetland features present within the Project Area and ZOI (Construction).

Effect no.	Ecological feature	Ecological Value	Effects Description	Magnitude of Effect	Justification of Magnitude	Level of Effect, Without Mitigation	Mitigation	Level of Effect After Mitigation
1	Exotic grassland (EG) – mown and rank Exotic shrub (ES)	Negligible	Approximately 900m^2 of exotic grassland at both Landfill sites will be removed. These areas will be reinstated once the landfills have been removed. This will lead to temporary loss of habitat. Approximately 70m^2 of this habitat will be removed. These areas will be reinstated once the landfills have been removed. This will lead to temporary loss of habitat.	Low	Direct localised impact. Temporary removal of habitats, with short term impacts during construction.	Very Low	**No mitigation required**	N/A

Effect no.	Ecological feature	Ecological Value	Effects Description	Magnitude of Effect	Justification of Magnitude	Level of Effect, Without Mitigation	Mitigation	Level of Effect After Mitigation
2	McCann's Skink – Not threatened	Low	Vegetation clearance during remediation works could kill or injure McCann's skink.	Very high	Direct impact on Not Threatened native species are very likely, assuming native McCann's skink are present. Irreversible.	Moderate	Native skink management recommendations are presented in Section 5.4.	Very low
3	Yellow-eyed penguin Little blue penguin	Very high	Disturbance and displacement to roosts and individuals due to remediation activities	Low	Direct, localised impact. Temporary disturbance with short term impact.	Moderate	Penguin management recommendations are presented in Section 5.5	Low

5.4 Native Skink Management

Due to the small area of vegetation removal and the fact that the vegetation will be reinstated, there is a low risk for lizard injury or mortality and therefor, a Lizard Management Plan will not be required. It is recommended that a vegetation manipulation approach is followed and/or a lizard salvage is completed by a DOC permitted herpetologist. Typically, vegetation manipulation will include the mowing of the vegetation on site, prior to commencement of the vegetation removal. Mowing should occur over a period of 4 weeks where vegetation height is reduced to 500mm in the first week. At the end of the second week, vegetation height is reduced to 300mm. At the end of the 3rd week vegetation is reduced to 50mm. At the end of the 4th week vegetation will be reduced to ground level.

5.5 Penguin Management

To mitigate the possible disturbance of penguins any works must be avoided between mid- August to early February. Should there be a need to undertake work during the breeding and nesting period (August – February) a site inspection needs to be carried out prior to any work starting for the day. If any penguins are observed during this site inspection, works should stop immediately and consultation with DOC and Penguin Rescue should be undertaken in order to minimise any adverse effects on the yellow-eyed and little blue penguins in the area.

5.6 Operational Phase Assessment of Effects and Mitigation

Considering the reinstatement of the habitat subsequent to the removal of all waste associated with Landfill 1 and Landfill 2 the level of effect during this phase is considered to be **Positive.**

6.0 Conclusion

The vegetation within the Project Area were considered **Negligible** value. Due to the value of the vegetation and the isolated impacts, no mitigation will be required.

The Not threatened McCann's skink is likely to be present throughout the landfill areas. For this species the Project works results in **Moderate** level of effects, prior to mitigation. As such mitigation is proposed including the vegetation manipulation approach to lizard management. It is considered that if these effects are implemented appropriately then the level of effect will be reduced to **Low**.

The National endangered, yellow-eyed penguin and little blue penguin is likely to be present within the ZOI. For this species the Project works results in **Moderate** level of effects in relation to construction disturbance, prior to mitigation. As such mitigation is proposed including penguin management. It is considered that if these effects are implemented appropriately then the level of effect will be reduced to **Low**.

7.0 References

Baling, M., van Winkel, D., Hitchmough, R. (2018). Reptiles and Amphibians of New Zealand: A Field Guide. New Zealand: Auckland University Press.

Clarkson B. R., (2013) A Vegetation tool for wetland delineation in New Zealand, Landcare Research

Department of Conservation (2021). Moving freshwater species. Retrieved from: https://www.doc.govt.nz/get-involved/apply-for-permits/interacting-with-freshwater-species/moving-freshwater-species.

EIANZ Roper-Lindsay, J., Fuller S.A., Hooson, S., Sanders, M.D., Ussher, G.T. (2018). Ecological impact assessment. Environment Institute Australia and New Zealand guidelines for use in New Zealand: terrestrial and freshwater ecosystems. 2nd edition.

Fraser, S., Singleton, P., & Clarkson, B., (2018) Hydric Soils – Field Identification Guide, Landcare Research Manaaki Whenua, Tasman District Council

Hitchmough, R.A., Barr, B., Knox, C., Lettink, M., Monks, J. M., Patterson, G.B., Reardon, J.T, van Winkel, D., Rolfe, J., & Michel P., (2021). Conservation Status of New Zealand Reptiles *New Zealand Threat Classification Series 35.* Department of Conservation: Wellington.

Ministry for the Environment (MfE) 2021. Defining 'natural wetlands' and 'natural inland wetlands'. Wellington: Ministry for the Environment.

Ministry for the Environment (MfE) 2020 National Policy Statement for Freshwater Management

Ministry for the Environment (MfE) (2001) A Guide for the Management of Closing and Closed Landfills in New Zealand. Freated by Tonkin and Taylor for Ministry of the Environment.

Robertson, H.A., Baird, K., Dowding, J.E., Elliott, G.P., Hitchmough, R.A., Miskelly, C.M., McArthur, N., O'Donnell, C.F.J., Sagar, P.M., Scofield, R.P., Taylor, G.A. (2017). Conservation status of New Zealand birds.

Singers, N., Osborne, B., Lovegrove, T., Jamieson, A., Boow, J., Sawyer, J., Hill, K., Andrews, J., Hill, S. & Webb, C. (2017). Indigenous terrestrial and wetland ecosystems of Auckland. Auckland Council: Auckland, New Zealand.

van Winkel, D., Baling, M. & Hitchmough, R. (2018). *Reptiles and Amphibians of New Zealand: A field guide*. Auckland: Auckland University Press, 376 pp.

Walker, S., Price, R., Rutledge, D. (2008) New Zealand's remaining indigenous cover: recent changes and biodiversity protection needs. Science for Conservation 284. Department of Conservation, Wellington.

Appendix G

Coastal Processes Effects Assessment

Prepared for
Waitaki District Council
Co No.: 9429041922798

Beach Road Landfills Remediation

Coastal Processes Effects Assessment

01-Mar-2023

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Beach Road Landfills Remediation

Coastal Processes Effects Assessment

Client: Waitaki District Council

Co No.: 9429041922798

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01-Mar-2023

Job No.: 60697520

AECOM in Australia and New Zealand is certified to ISO9001, ISO14001 and ISO45001.

Quality Information

Document	Beach Road Landfills Remediation
Ref	60697520
Date	01-Mar-2023
Originator	Charlotte Parker
Checker/s	
Verifier/s	Rose Coulter

Revision History

Rev	Revision Date	Details	Approved	
			Name/Position	Signature
R001	01-Mar-2023	Final	Rose Coulter Associate Director Engineering Geology and Applied Geomorphology	

Table of Contents

1.0 Introduction

AECOM New Zealand Limited (AECOM) have been engaged by GHC Consulting on the behalf of Waitaki District Council (WDC) to provide planning and technical services to prepare resource consent applications and assessment of environmental effects (AEE) for the remediation of two historical landfills (Landfill 1 and Landfill 2) located along the coastal cliffs on Beach Road, Oamaru.

AECOM understands that the two landfills were never explicitly opened or approved by the council. The sites have been investigated and partially remediated in 2017. A detailed site investigation was undertaken by WSP in 2021 to characterise the contamination risk at each site.

This report summarises the geomorphic setting of the site, the coastal processes and hazards and the potential effects on the coastal geomorphic environment from the proposed landfill remediation construction works.

2.0 Scope of work

As the project is focused on remediation without any long-term infrastructure, any potential impacts to the coastal environment are likely to relate predominately to construction practises and final landform design. The final landform should generally conform with similar existing landforms. The scope for this assessment included:

- Review of existing site data including reports and photographs.
- Literature review of coastal processes and hazards for the site.
- Review of any nearby unmodified coastal gullies to identify ‘natural’ processes and landform change overtime, as well as for input into final landform concept design.
- Assessment of potential effects on the coastal geomorphic environment of the remediation plans and construction methodology

3.0 Site description

The two landfill sites, referred to as Landfill 1 and Landfill 2, are located along Beach Road, approximately 3 km south of Oamaru near the Awamoa Road intersection (Figure 1). The landfills are located within existing natural gullies along a steep, eroding, coastal cliff adjacent to Beach Road. The coastal cliff is within an approximately 7 km long bay, oriented northeast southwest that is confined by Cape Wanbrow to the north and Kakanui to the south. This is one of several bays within an overall larger embayment along the east coast of the South Island that is bound by the Cape Wanbrow to the north and Moeraki headland to the south.

Road level, the top of the landfills is approximately 17 m above sea level. Landfill 1 extends from the coastline and traverses beneath Beach Road, it is approximately 20 m to 30 m wide and 36 m in length. Landfill 2 is on the eastern side of Beach Road and is approximately 10 m to 20 m wide and 47 m in length.

Figure 1 Site location. Inset on top left to illustrate wider coastal setting (Google Earth).

4.0 Data sources

4.1 Field inspection

A visual inspection of the landfill sites was completed by an AECOM engineering geologist and civil engineer, accompanied by Dave Hanan, principal environmental engineer from GHC Consulting, on 25th January 2023. The inspection was completed around low tide.

4.2 Existing site data

Previous investigations at the site have been completed and are reported in the following documents. No information on coastal processes is included in these reports.

- Preliminary Site Investigation: Beach Road Landfills, Oamaru (Otago Regional Council, 2018)
- Beach Road closed landfills. Detailed site investigation (WSP, 2021)

4.3 Published literature

Previous studies relating to coastal landforms and processes along the northern Otago coastal region have been undertaken by various groups. Review of data from the following documents have been used in this report.

- Waitaki District Coastal Hazards, prepared for the Otago Regional Council. NIWA (2019)
- Ministry for the Environment (MfE), 2017. Coastal Hazards and Climate Change. A Guidance Manual for Local Government in New Zealand.
- Waitaki District Council. Report on Engineering Issues of a Coastal Roads Strategy. Opus (2009)

- Planning on a retreating coastline: Oamaru, North Otago, New Zealand, GNS Science Report. P.J Forsyth (2009)
- Otago Regional Council Storm Surge Modelling Study. NIWA Client Report. Lane et al. (2008)

5.0 Coastal landform setting

5.1 Cliffs

The section of coastline between Beach Road and the Pacific Ocean is a subvertical cliff in the location of the landfills. The cliffs are typically 15 to 17 m in height and comprise unconsolidated sediments, predominantly loess. Sand with beds of gravel is exposed at the base of the cliff, the contact between the sand and loess was not able to be determined on site due to being obscured by collapsed cliff material at the base of the cliff.

NIWA (2019) reports that *unconsolidated sediments have a low competency, and the retreat of these cliffs is directly correlated to wave and sea level action. The sediment that falls off the cliff is reworked by waves and forms a beach at the foot of the cliffs, which, in turn protects the cliff from waves.*

Figure 2 below illustrates the collapsed cliff material accumulated at the base of the cliff adjacent to Landfill 2. As illustrated in Figure 2, high tide reaches the base of these cliffs along the extent of the coastline in the vicinity of the landfills.

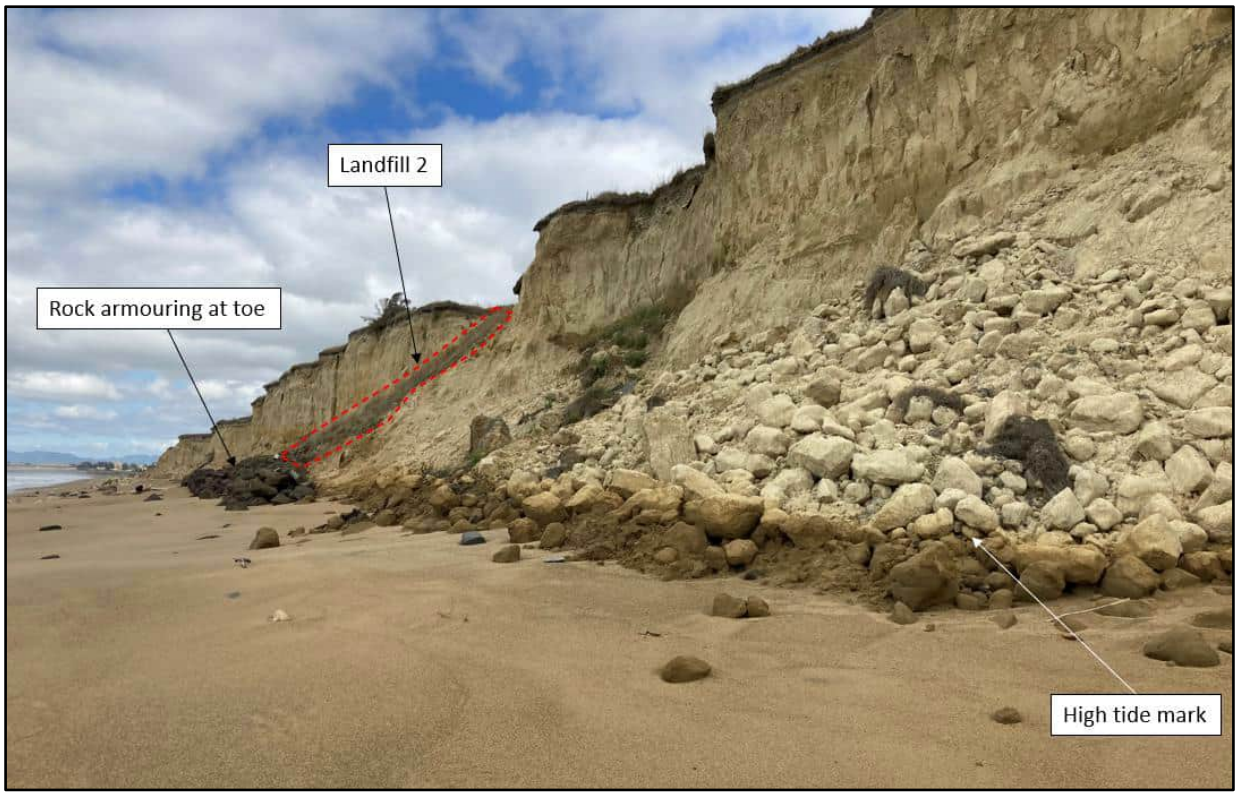

Figure 2 Cliffs adjacent to Landfill 2. High tide mark illustrated within the material accumulated at the base of the cliff.

5.2 Gullies

Several natural gullies are present along the coastal cliffs, two of which have historically been utilised as landfills. The natural gullies vary in width and length and are typically confined between Beach Road and the cliff edge.

Based on historic aerial imagery from 1955, the gullies were unmodified. The natural gully Landfill 1 resides in extends inland 50 m perpendicular to the cliff and is approximately 20 m to 30 m wide. The

contact between the refuse and natural material was observed at the northern extent, which slopes at approximately 35 to 45 degrees.

At Landfill 2 the natural gully slope angles are estimated at approximately 35 to 40 degrees at the southern end and slightly steeper, 45 degrees, at the northern end. Historical aerial imagery indicates the gully to be oblique to the cliff edge, extending approximately 50 m in a northward direction and approximately 10 to 20 m wide.

Figure 3 below illustrates the extent and geometry of the two gullies prior to refuse filling.

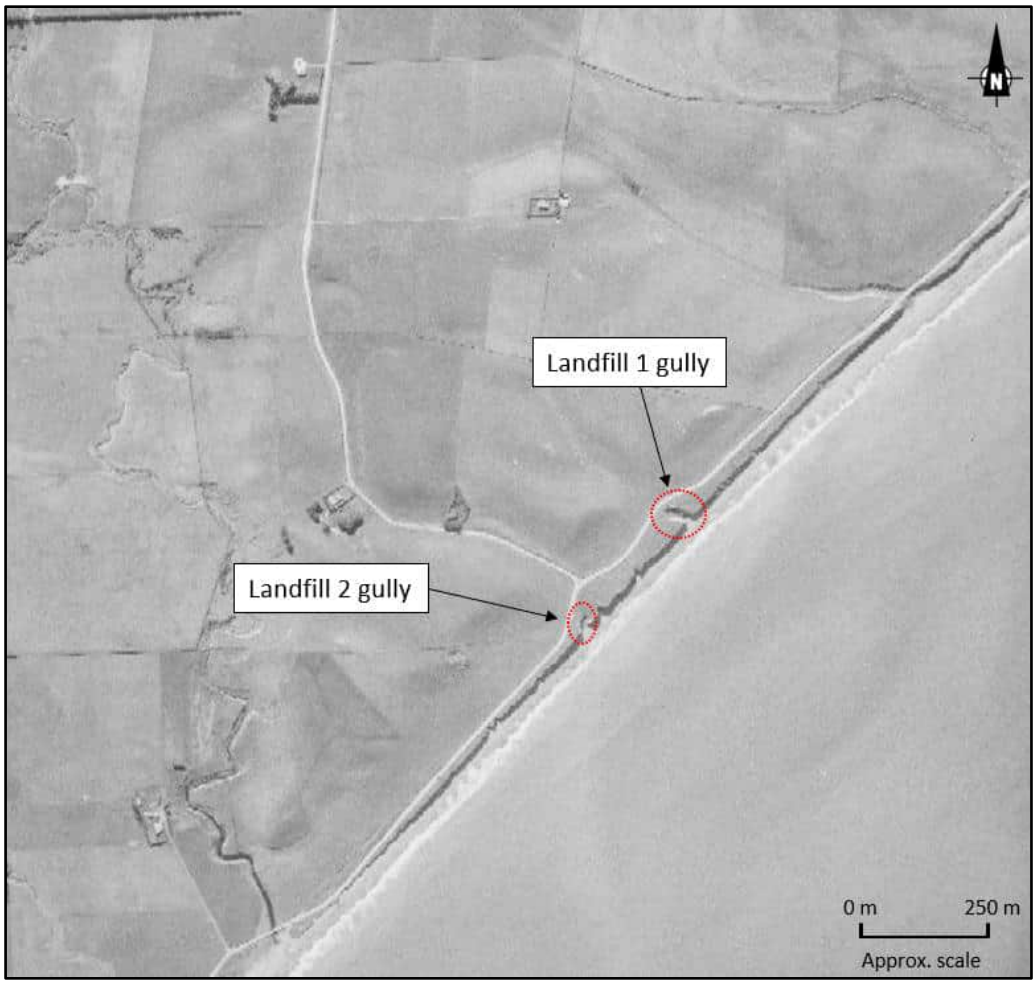

Figure 3 1955 Retrolens imagery illustrating the gully landforms prior to refuse filling.

5.3 Beach

The beach area in front of the two landfills is approximately 20 to 30 m at low tide as illustrated in Figure 4. Based on site observations, high tide reaches the base of the cliff therefore a beach is not always present at the sites.

The beach materials are dominantly sand with occasional rounded gravels. Rock armouring has been placed at the toe of each landfill and protrudes slightly further out onto the beach than the cliff edge, this is illustrated in Figure 2 at Landfill 2.

Figure 4 Overview of Landfill 1 illustrating the landforms. An access track has been formed on the left of the image.

6.0 Coastal processes and hazards

6.1 Coastal erosion

Coastal erosion is the key process occurring along the northern Otago coast. NIWA (2019) classifies Beach Road to be an erosional hot spot, experiencing dramatic shoreline retreat. Cliff retreat from coastal erosion was observed at both sites during the site walkover. Both sites have rock armour placed at the base of the slopes to provide short term protection to the landfills from wave action.

There has been a range of reported coastal erosion rates along Beach Road, with highly variable values ranging from 0.4 to 1.5 m/yr.

Between 1957 and 2002 the average rate of cliff retreat was approximately 0.5 m/yr (Forsyth 2009) and a 2002 consultancy report estimated that there had been 29 m of cliff retreat over 28 years in some places along Beach Road (reported in Forsyth 2009). In recent years, NIWA (2019) reports retreat areas of approximately 12 m between 2006 and 2014, equating to an annual retreat rate of 1.5 m and resulting in the closure of a section of Beach Road.

NIWA (2019) estimate the current erosion rate along the southern portion of Beach Road in the vicinity of the site area to be 0.4 to 0.5 m/yr as illustrated in Figure 5.

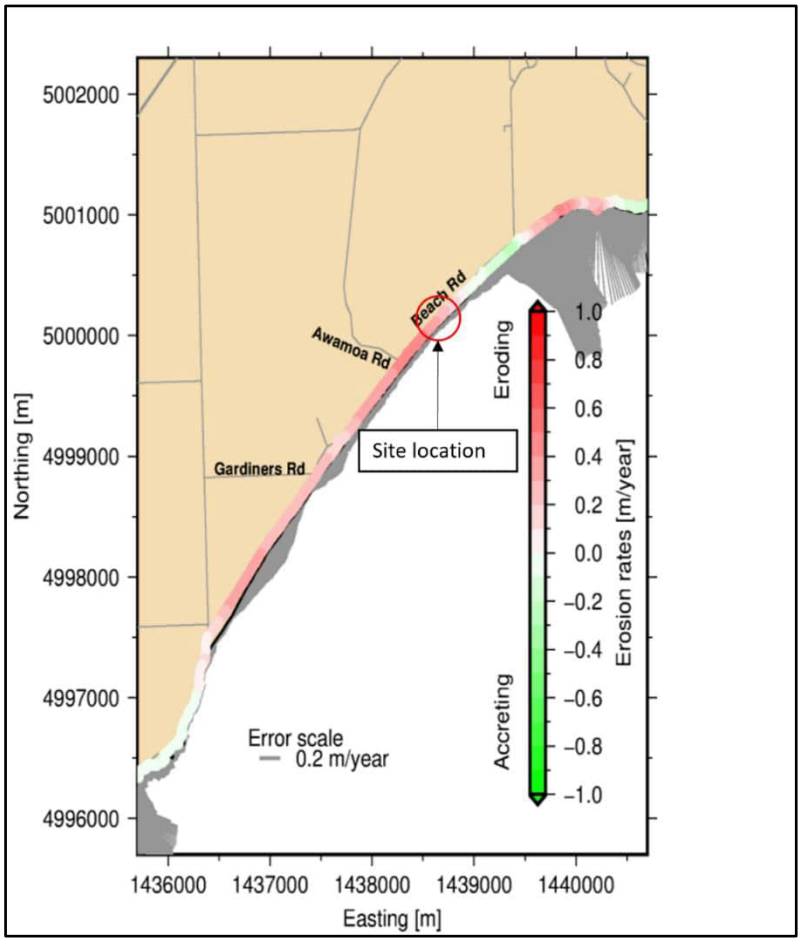

Figure 5 Extract from NIWA, calculated erosion rate [m/year] trends along Beach Road (NIWA 2019)

The Otago Regional Council natural hazards portal presents coastal erosion predictions along the Oamaru coastline including two outlook periods (50 and 100 years) and two risk levels (CHZ50 and CHZ95), illustrated in Figure 6. The CHZ50 line represents a 50% probability, and the CHZ95 a 5% probability of erosion extending up to or landward of this line over the designated outlook period.

As illustrated in Figure 6, it is estimated that the entire extent of both landfills has at least a 50% probability of eroding within 50 years. From the current cliff edge at each landfill to the CHZ50 line, this equates to approximately 40 m of coastal retreat over the 50-year period, an erosion rate of 1.25 m/yr. This rate was determined from estimates of the future shoreline position combined with an allowance for processes that cause short term shoreline fluctuations and/or backslope failure, NIWA (2019). This calculated rate does not take into account climate change which will likely increase the erosion rate.

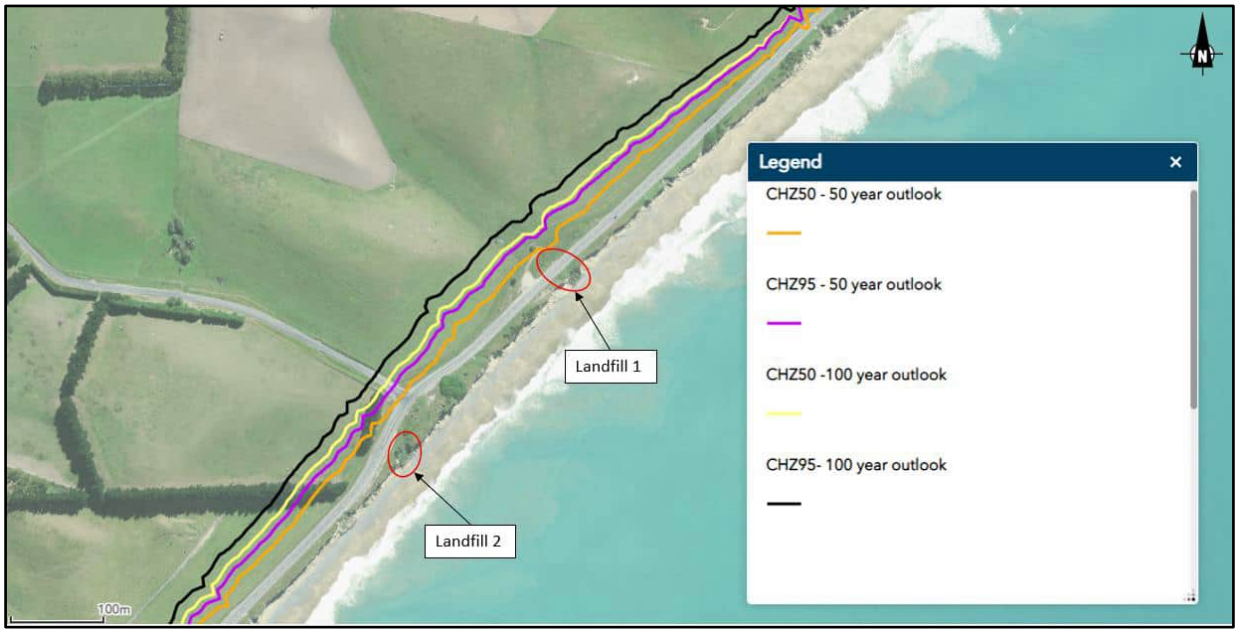

Figure 6 Coastal erosion hazard zone predictions (Otago Natural Hazards Portal).

6.2 Sea level rise

Sea level is currently rising and is expected to continue for several centuries due to climate change effects. Sea level rise in New Zealand has been approximately 0.2 m since 1900 (MfE, 2017).

NZ SeaRise, a research program to project sea level rise shows that on average sea level is expected to rise by 5 to 6 mm/yr near the landfill sites as illustrated in Figure 7. This sea level rise prediction is based on a SSP2 4.5 climate change scenario, defined as a ‘middle of the road’ scenario.

Sea level rise will contribute to an increase in the long-term coastal erosion rate and delivery of sediment to the system.

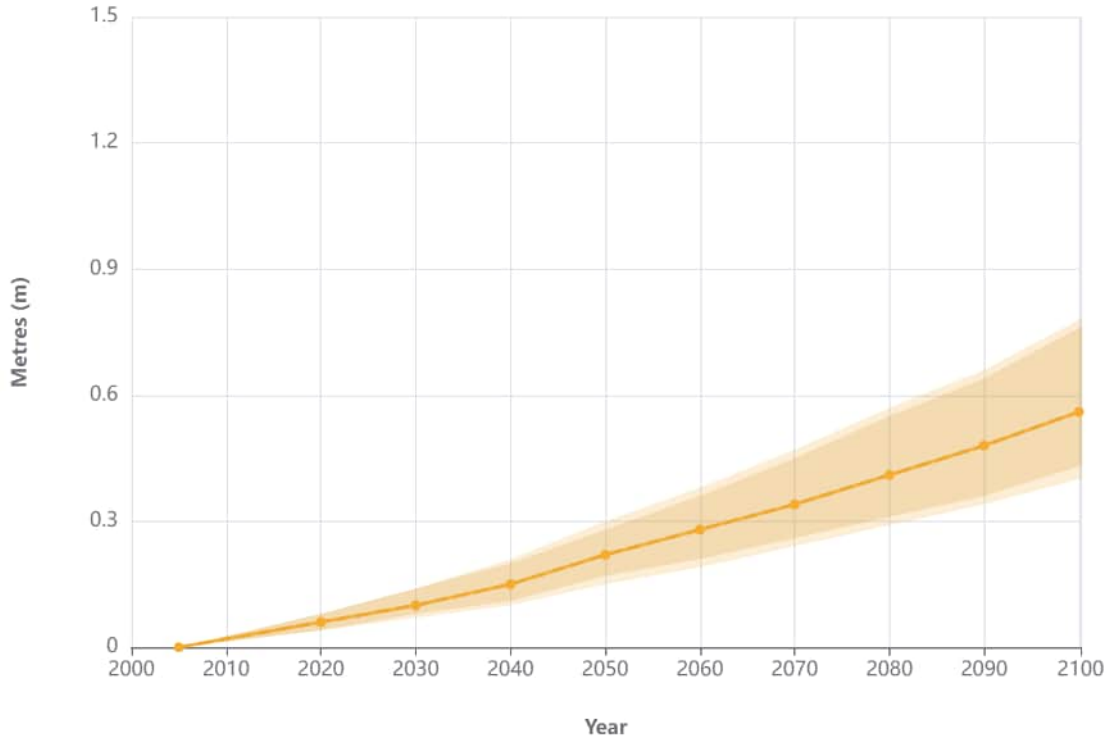

Figure 7 Sea level rise predictions for Beach Road near the landfill sites, for SSP2 4.5 scenario (NZ SeaRise).

6.3 Longshore drift

Longshore drift is the process of sediment transportation along the shore by waves approaching the beach at an angle. The beach slightly widens north of Landfill 1 indicating a small amount of sediment accumulation from longshore drift. The sediment is accumulated due to Cape Wanbrow forming a barrier for sediment transportation further north.

7.0 Effect of climate change on coastal processes

Climate change is expected to increase the effects of coastal erosion through the rise of sea level and changes in storms and wave conditions (MfE 2017).

Forsyth (2009) states that low cliffs of weak sedimentary materials, with little or no gravel at the foot (similar to the cliffs in the location of the landfills) will experience similar or greater rates of erosion in the near and distant future as a result of climate change. The increased erosion will result in an increase in sediment locally available for transport.

8.0 Review of nearby coastal gullies

A review of nearby, unmodified coastal gullies to identify ‘natural’ processes and landform change overtime has been completed based on aerial imagery sourced from Retrolens, LINZ and Google Earth, dated between 1955 and 2020.

Based on the earliest available imagery, 1955, the gully landforms where Landfill 1 and Landfill 2 exist appear to be the largest and most distinct along the coastline in the surrounding area, which is likely the reason they were used as landfill sites (Figure 3). No similar gullies of the same extent have been identified close to the site, but smaller gullies have been identified and used to assess the landform change over time.

Poor resolution, distortion of the aerial imagery and shadow angles present along the cliffs has made it difficult to distinguish detailed change of the individual gullies over time. The imagery does however

show that no significant inland regression of the gully landforms has occurred between 1955 and 2020 relative to the coastal cliff edge. The natural gullies do not appear to be eroding at a greater rate than the remainder of the coastline.

Based on the aerial imagery and a site visit, the natural processes occurring at unmodified natural gully sites include coastal erosion, cliff collapse and erosion from surface water runoff. Figure 8 below illustrates a small gully where material has collapsed along the beach front and this material has then been removed by wave action within a month, demonstrating the active coastal erosion occurring.

During the site visit it was noted that some of these eroded areas along the irregular cliff have been exacerbated by surface water runoff particularly in unvegetated areas.

Figure 8 Left: Google Earth imagery dated July 2019 illustrating a natural gully with eroded material present on the beach. Right: Google Earth imagery dated August 2019 illustrating the same gully with most of the material on the beach washed away by wave action. Gully indicated by red arrow.

9.0 Assessment of Potential Effects

The assessment of potential effects on the coastal processes and geomorphic environment of the remediation plans and construction methodology is discussed below.

9.1 Remediation plans

At the time of writing this report the proposed remediation of the landfill sites include:

- Removal of all landfill material from both sites
- Finished landform details of:
  - Overall maximum slope height = 15 m
  - Overall slope angle = 60°
  - Bench slope max. height = 4 m
  - Bench slope angle = 80°
  - Bench width = 2 m
  - Bench grade = 5%
- Rock armour to be gathered and placed at the toe of the proposed cut slope where Landfill 2 is.

Once the landfill material has been removed the area will be left as a void, similar to the pre-existing gully, but with benched slopes as detailed above.

9.2 Construction methodology

In the absence of a specific construction methodology at the time of this assessment, the following assumptions have been made:

- Construction is to be completed from the landward side of the landfill at each site
- No material will be stockpiled on the foreshore, it will be loaded directly into trucks
- All construction operations will be performed on dry land
- Sediment controls will be used during the construction stage.

9.3 Potential effects on the coastal geomorphic landforms from the remediation plans and construction methodology

9.3.1 Effects on the geomorphic landforms

The proposed works will remove gully fill (landfill material), modifying the current landforms and affecting the erosion potential of the local environment. The small spatial footprint of the landfill sites (approximately 766 m² and 722 m² respectively) will limit these effects. Removal of the fill will expose underlying sediment to the elements, with rainfall, wind and wave action having the potential to cause erosion.

As the landfill sites have been built up artificially rather than by natural processes, the removal of the landfill material will return the sites to a condition similar to that existing before the gullies were filled. The main difference, excluding minor morphological changes on the gully edges (which are now proposed to have benches cut to aid stability), is the presence of vegetation in the base of the gullies. It is likely that the gullies were somewhat vegetated before the landfills were created which would have helped to stabilise the loess in the gullies.

Following landfill material removal, bare exposed loess will be more susceptible to erosion until vegetation is re-established. The steep batters and narrow benches in the remediation design will help to limit erosion effects, but there remains the likelihood for accelerated erosion post construction, prior to the re- establishment of vegetation on the site. We note that erosion of bare soils will also be a potential impact during construction, should moderate to heavy rainfall occur, however sediment runoff

can be controlled during construction. After construction it will be more difficult to remove or reposition sediment.

9.3.2 Effects on coastal processes

Effects of landfill removal on the beach environment are anticipated to be negligible. The toe of the landfills is located around the high tide line and are (currently) protected by rock armouring. Loess eroded from the remediated landfill site will be deposited onto the beach, where it will subsequently be removed by wave action. This is consistent with the existing natural processes. Once vegetation is established, a return to pre-landfill conditions will be established.

Rock armouring would have a much greater effect on the beach processes than removal of landfill material. In storm surge events this rock armouring acts to dissipate wave energy and slow erosion. While the area immediately behind the armouring is protected, the presence of this armouring does have the capacity to result in accelerated erosion adjacent to the armouring. Removal of the armouring would return the beach to a more natural environment, resulting in more equal rates of natural erosion along the cliff.

The removal of landfill material will prevent that material entering the ocean, however its removal is not anticipated to have a material effect on the coast itself.

10.0 Limitations

The information, interpretation, recommendations and opinions contained in this report are based on a desk study and site walkover as described in this report. Inferences about ground conditions over the site are made using geological principles and engineering judgement. However, it is possible that conditions over the site may vary and it is therefore not possible to guarantee the continuity of ground conditions away from the existing investigation locations.

This report has been prepared for the particular project and purpose described in the brief and in this report, and no responsibility is accepted for the use of any part of this report in any other context or for any other purposes.

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Appendix H

Archaeological Assessment

New Zealand Heritage Properties Ltd
Investing In Our Heritage

Former Hampden and Awamoa Landfills

An Archaeological Appraisal

Report Prepared for the Waitaki District Council
Author: India Gillespie
Reviewed by: Dr Dawn Cropper

New Zealand Heritage Properties Ltd
Investing In Our Heritage

Former Hampden and Awamoa Landfills

An Archaeological Appraisal

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Project Details

Site Address	**Former Hampden Landfill:** (Carlisle Street Road Reserve; Sections 9-12, Block XVII, Town of Hampden; and Section 18, Block LXIV, Town of Hampden). **Two Former Awamoa Landfills:** (Beach Road Road Reserve; and Section 70, Block IV, Oamaru SD).
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Client Contact	Steve Clarke
Client Address	Waitaki District Council Private Bag 50058 Oamaru Otago 9444
Report Authors	India Gillespie
Reviewed By	Dr Dawn Cropper
Report Submitted To	Waitaki District Council; and GHC Consulting Limited
Document Control ID	J011407_AP_REV B

Document Control

Revision No.	Date Submitted	Description	Prepared By	Reviewed By
A	20/02/2023	Issued to client.	IG	DC
B	20/02/2023	Revised to include comments from client; issued.	IG	DC

Ownership and Disclaimer

Cover Photo: Bicknell, F. (1900). Woman and children on a beach road [photograph]. System ID 160500: Waitaki Archive. Retrieved from https://collection.culturewaitaki.org.nz/objects/160500/woman-and-children-on-a-beach-road

1 Introduction

The Waitaki District Council (WDC) are proposing to undertake remedial works at three former landfill sites located in Hampden and Awamoa. New Zealand Heritage Properties Ltd (NZHP) has been commissioned by Steve Clarke on behalf of the WDC to undertake an archaeological appraisal of the former Hampden landfill (Carlisle Street Road Reserve; Sections 9-12, Block XVII, Town of Hampden; and Section 18, Block LXIV, Town of Hampden) and two former landfills at Awamoa (Beach Road Road Reserve; Lot 2 DP 21053; and Section 70, Block IV, Oamaru SD). The purpose of this report is to determine if there are any archaeological requirements for the proposed remedial earthworks, as per the Heritage New Zealand Pouhere Taonga Act 2014 (HNZPTA 2014). This appraisal comprises desktop research only, and consultation has not been undertaken with manawhenua.

The HNZPTA 2014 defines an archaeological site as any place in New Zealand, including any building or structure (or part of a building or structure), that (i) was associated with human activity that occurred before 1900 or is the site of the wreck of any vessel where the wreck occurred before 1900; and (ii) provides or may provide, through investigation by archaeological methods, evidence relating to the history of New Zealand; and (b) includes a site for which a declaration is made under section 43(1).

1.1 Project Area

The project areas are defined as the former Hampden landfill (Carlisle Street Road Reserve; Sections 9-12, Block XVII, Town of Hampden; and Section 18, Block LXIV, Town of Hampden) and two former landfills at Awamoa (Beach Road Road Reserve; and Section 70, Block IV, Oamaru SD), encompassing eight land parcels, and a summary of the project area is provided in Table 1-1 and shown in Figure 2-1 and Figure 3-1. Within the project area there are no previously recorded archaeological sites, and no significant and valued historical and cultural heritage places are included on the New Zealand Heritage List/Rārangi Kōrero ('the List'). Both project areas intersect with items scheduled in the Waitaki District Plan as Significant Coastal Landscapes or as a Designation Area or Site. The project area is not within a Statutory Acknowledgement Area. This appraisal has identified that Section 70, Block IV, Oamaru SD is subject to Section 59 Land Act 1948; Reserves and Domains Act 1953; and to Part 9 of the Ngāi Tahu Claims Settlement Act 1998.

Table 1-1. Summary of project area.

Site Address	Former Hampden and Awamoa Landfills
Landowner/Occupier	Waitaki District Council
Legal Description	**Former Hampden Landfill:** (Carlisle Street Road Reserve; Sections 9-12, Block XVII, Town of Hampden; and Section 18, Block LXIV, Town of Hampden). **Two Former Awamoa Landfills:** (Beach Road Road Reserve; and Section 70, Block IV, Oamaru SD).
Territorial Authority	Waitaki District Council
New Zealand Heritage List/Rārangi Kōrero	-
Covenant or Heritage Order	**Section 70, Block IV, Oamaru SD:** Subject to Section 59 Land Act 1948; Subject to Reserves and Domains Act 1953; Subject to Part 9 of the Ngāi Tahu claims settlement act 1998 (which provides for certain disposals relating to the land to which this certificate of title relates to be offered for purchase or lease to Te Rūnanga o Ngāi Tahu in certain circumstances)
Scheduled on District Plan	**Hampden:** scheduled on the Waitaki District Plan as a Significant Coastal Landscape and a Designation Area or Site. **Awamoa:** scheduled on the Waitaki District Plan as a Significant Coastal Landscape.
Reserve Status	Road Reserve Recreation Reserve
Statutory Acknowledgement Area	-
Customary Marine Title	-

2 Former Hampden Landfill

The following sections give an overview of Māori and Pākehā settlement in the general Hampden area to provide context to understand the site-specific history of the project area (Figure 2-1). Through this research it is possible to begin to identify what type of physical, cultural, and social processes have shaped the form and distribution of archaeological material. Additionally, historical background can be used to inform the interpretation of archaeological contexts and material whenever they are encountered.

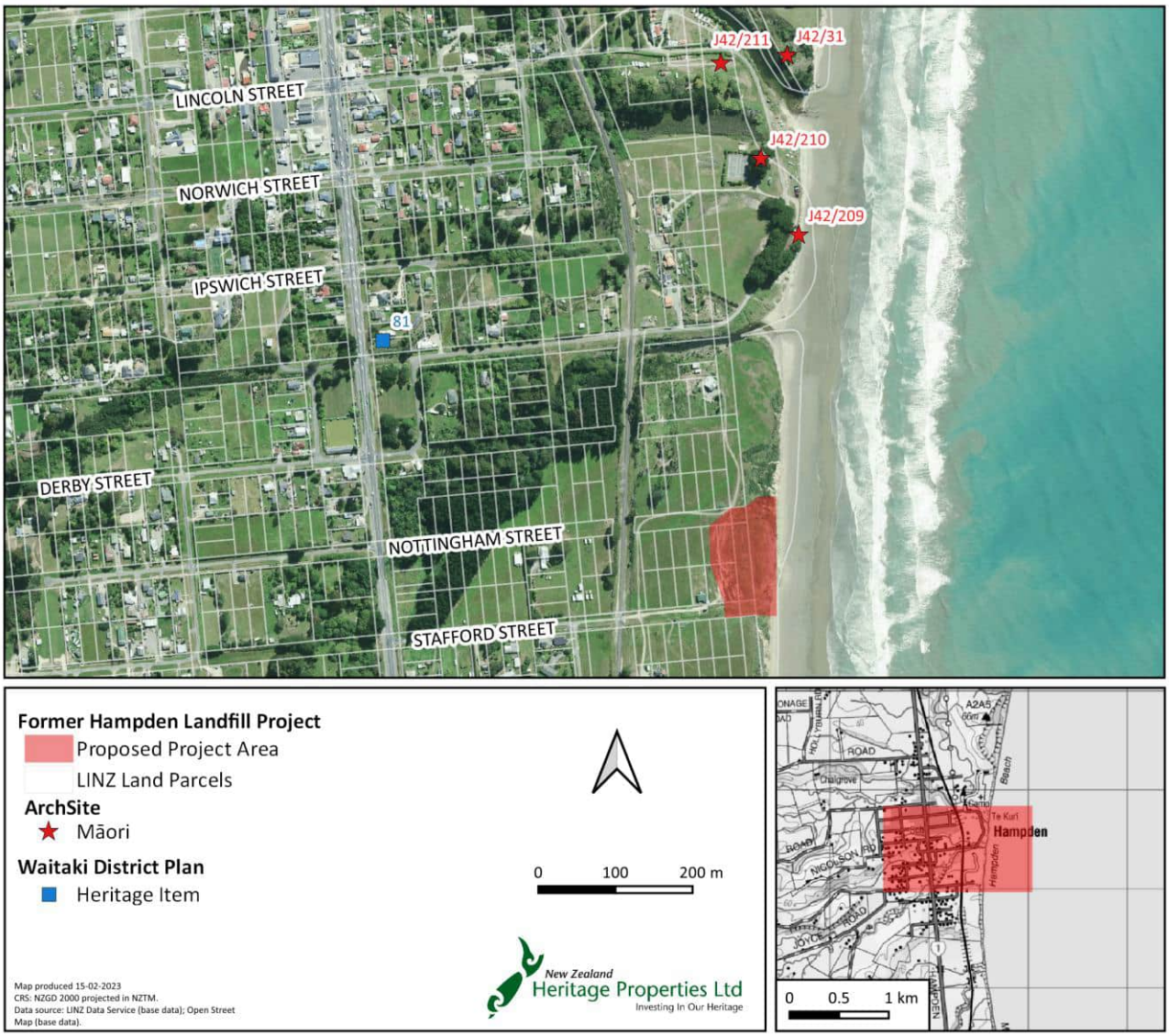


Figure 2-1. Map showing the location of the proposed project area in relation to nearby archaeological and heritage sites.

2.1 Māori Occupation

A rich local record of Māori traditions and place names recount some of the earliest Polynesian settlers to Te Waipounamu (South Island) and the areas near Matakaea (Shag Point). Three principal streams of descent are recognized in the traditions of Kāi Tahu manawhenua (Waitaha, Kāti Mamoe and Kāi Tahu).

The lower Waitaki area of North Otago saw a concentration of early settlements, particularly around the coast (Figure 2-2). Archaeological evidence indicates that there has been Māori occupation of the Waitaki area from at least 1000 years ago, with more extensive settlement during the time that moa existed, as shown in the widespread archaeological remains of moa bones in cultural contexts (Symon, 2007). The archaeological record indicates that early groups accessed various resources from the lakes, rivers and valleys in the interior, establishing smaller

"transient" nohoaka (camps) and kāika (villages) that served as semi-permanent sedentary bases. Recorded archaeological sites have uncovered evidence of Māori lifeways such as cooking features and food resources (including kaimoana); stone resources for the production of tools and ornaments; re-purposed animal bone used in the production of tools and ornaments; timber and plant resources used in the construction of buildings, waka and smaller objects and in the production of textiles (*e.g.,* harakeke and kareao).

Beattie's annotated maps of Otago depict a range of pre-1840 Māori placenames in the vicinity of Hampden (Beattie, n.d). The source of information for Beattie's annotations stem from a combination of the recollections of Māori informants, fragments of Māori tradition, and notes on historical observations, archaeological discoveries, and analyses of placenames. While the sources for this information differ, the frequency of placenames attest to the length of Māori occupation in this area. The name "Waiwherowhero" is shown in closest proximity to the project area (Figure 2-2), while the Hampden area itself was often referred to as Te Kurī.

Figure 2-2. Detail of James Herries Beattie's map showing Māori placenames in Otago and Southland before 1840 (Beattie, n.d.).

Te Kurī is located north of Moeraki on the coastline, near the present-day township of Hampden. Kurinui Creek intersects with Te Kurī running from the hinterland to the coast where the township would later emerge. Pākehā later named two branches of the creek that intersected with Hampden township Little Kuri and Big Kuri Creeks. According to Herries Beattie, Te Kurī/Hampden Beach was also called Kakaho Beach. Ara tawhito are traditional travel routes, and an ara tawhito connecting the northern extent of Te Waipounamu with Murihiku, extends along the coastline to the west of the project area. This ara tawhito is stated as basically following the same alignment as the current railway line from Ōamaru to Orepuki (Te Rūnanga o Ngāi Tahu, 2019).

In 1861 Block I of the Otepopo Survey District was laid out. Within the Kuri Bush reserve, ten acres was set aside as a 'Maori Bush Reserve' (Figure 2-3). It was originally on the north-west border of the township of Hampden. In 1878 the Hampden Road Board noted that manawhenua had applied to the Waste Lands Board for the unsurveyed portion of Block I, Otepopo Survey District. The Road Board wrote an objection to the Commissioner of the Waste Lands Board on the basis 'it would be an injustice to the settlers' (Oamaru Mail, 1878). Te Kurī is also recognised as a kāika mahika kai (Te Runanga o Ngāi Tahu, 2021).

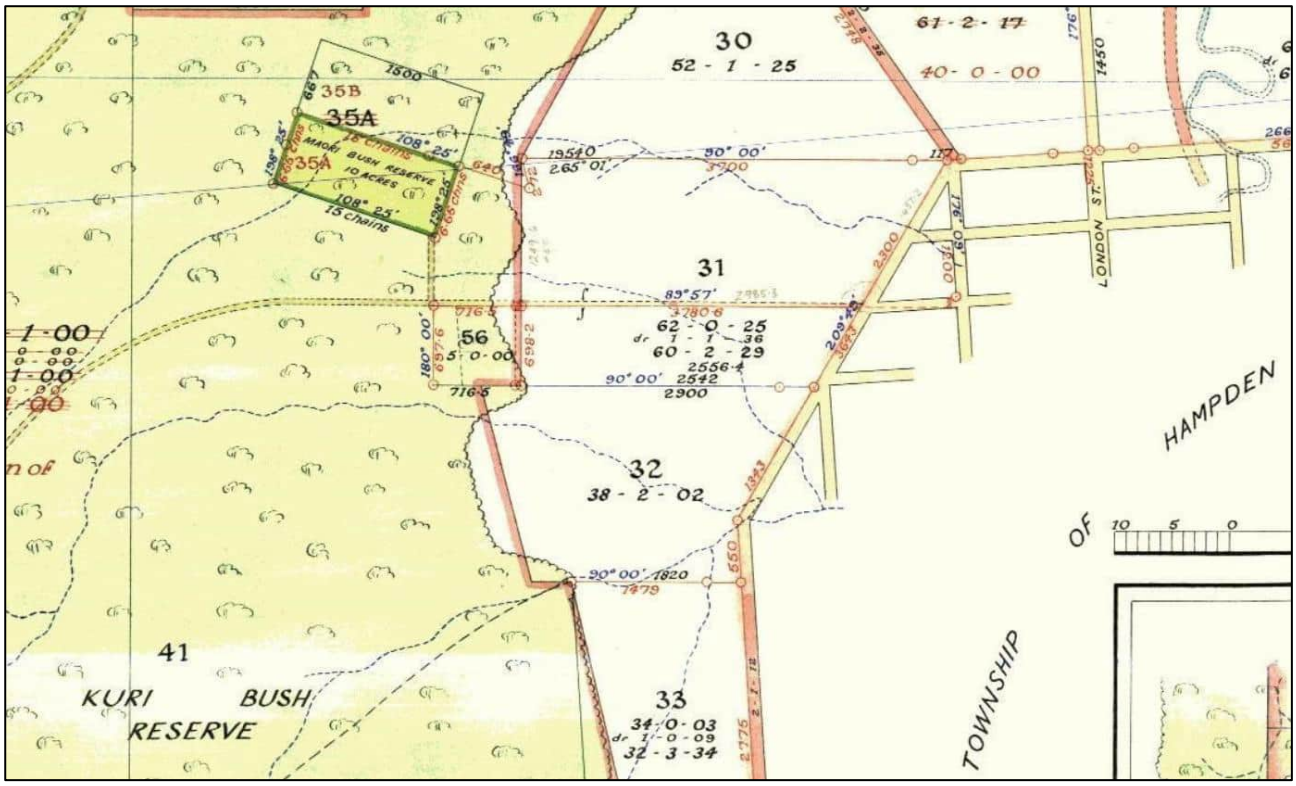


Figure 2-3. The area noted as 'Maori Bush Reserve' in the Borough of Hampden (SO 1351).

At Hampden Beach, just north of the project area, small excavations were undertaken by Michael Trotter in 1965-7. The excavations uncovered what is believed to be a moa-hunter site that is estimated to extent over one hectare in area, with moa, bird, and fish bones as well as silcrete blades and basalt flakes uncovered (New Zealand Archaeological Association, 2020). Four previously recorded archaeological sites, J42/31 and J42/209-11, are situated between approximately 300-500m north of the project area (see Figure 2-1), and in 2020, these sites were again investigated by Trotter (2020). Trotter notes that although these sites have been previously damaged, there is reasonable cause to suspect that occupational deposits remain *in situ* westwards in the dune system. This theory is reinforced by the presence of artefacts, notably lithics (Figure 2-4), slowly eroding onto the surface in this area.

Figure 2-4. Lithics recovered from Site J42/210 in 2020 (Trotter, 2020).

NZHP consulted numerous sources of historic evidence and combined with recent archaeological investigations, has found that there is reasonable cause to suspect that a Māori archaeological site may be present within the project area. Many of the prominent nohoaka (temporary settlement or camp sites), mahika kai areas, and ara tawhito associated with past lifeways activities in the wider Hampden area are situated along the foreshore. Four significant archaeological sites associated with early Māori lifeways activities are located within 500m of the project area, and recent investigations suggest archaeological material remains *in situ* in this area.

2.2 Post-Contact Occupation

Due to its desirable location close to the port at Moeraki, farming communities established themselves in and around Hampden in the 1850s (Muirhead, 1990). There are two streams that run through the township of Hampden, the Big and Little Kuri Streams. The first area of Pākehā settlement near Hampden was near Baghdad Bush and the lower reaches of Little Kuri Stream. In 1852 an accommodation house was constructed by Mr G B Wright on land nearby, with the house constructed from timbers felled from Baghdad Bush (Muirhead, 1990). In the early days, this was the only accommodation house between Dunedin and the Rangitata River.

Named after the Hampden Run, the survey of the new township was completed by December 1860. The earliest formal survey plan of the project area dates to 1860 when the Township of Hampden was surveyed in preparation for the issuing of Crown Grants (see Figure 2-5). The Crown Grant Map details that the project area originally intersected with five historic land parcels (Sections 9-12, Block XVII, Town of Hampden; and Section 18, Block LXIV, Town of Hampden) and three road reserves (Carlisle, Stafford, and Nottingham Streets). This map indicates that the project area is owned by the Borough of Hampden at this time, with sections set aside for a Municipal Reserve. The area was originally 'thickly covered with native bush, but the timber proved to be so valuable for building and fencing' that very little of the bush remained by the turn of the century (Cyclopedia Company Limited, 1905). Eighty lots in the fledgling township were put up for sale in 1861 (Otago Witness, 1859, 1860).

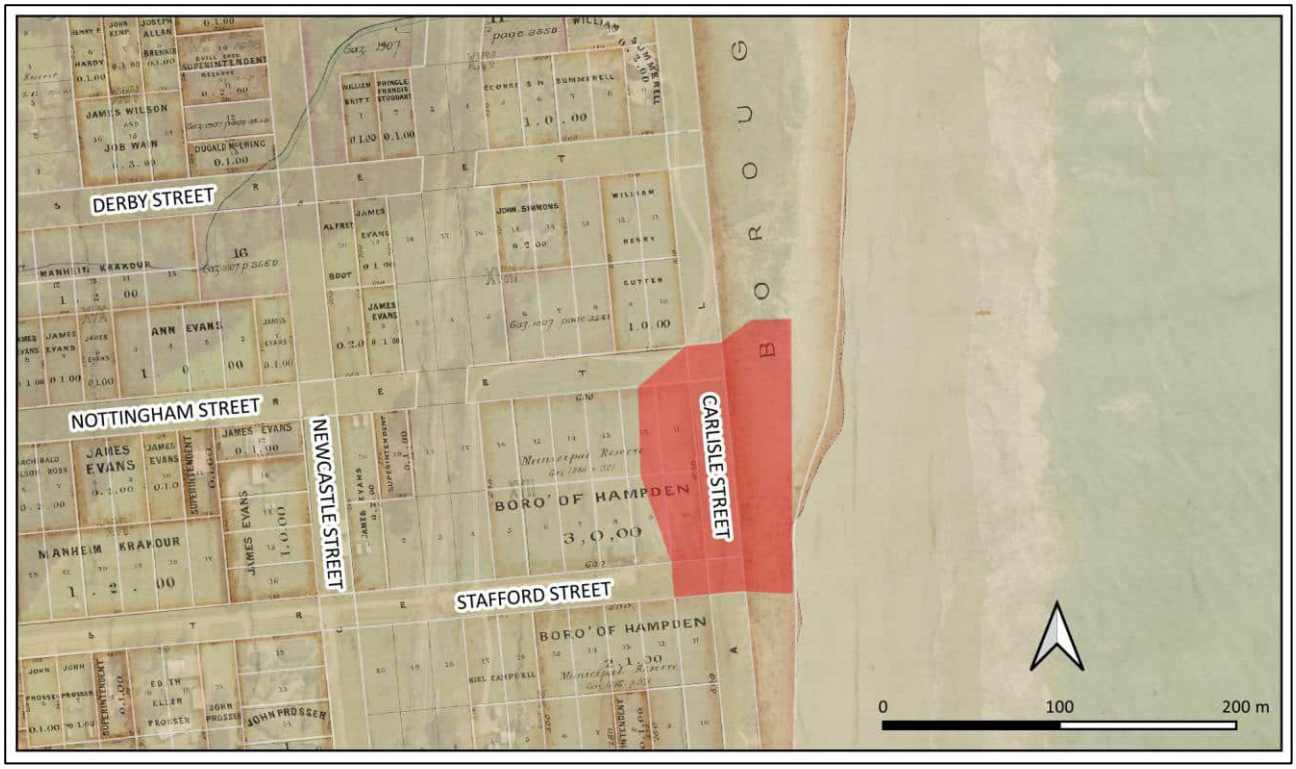


Figure 2-5. Georeferenced Crown Grant Map overlain on aerial imagery with the proposed project area highlighted red (Reid, 1860).

The township of Hampden was proclaimed a municipality in September 1879; one of the smallest boroughs in New Zealand (Muirhead, 1990). By 1893, Hampden had a police station, railway station, library, dairy factory, post

and telegraph station. and five boarding houses (Muirhead, 1990). By 1905, Hampden was described as a 'pleasantly situated borough on the main line of railway... Hampden, as a progressive borough, has done much to beautify the district, and bathing sheds have been erected on the beach for the free use of residents and visitors' (Cyclopedia Company Limited, 1905). Established gardens and fences can also be seen around the town in two 1907 photographs (see Figure 2-6 and Figure 2-7). However, these photographs do not show any such structures or modifications in the vicinity of the proposed project area. The Hampden landfill commenced accepting waste around 1970, and closed on 16 December 1996, having buried around 33,000m³ of Municipal Solid Waste (Waitaki District Council, 2021). An aerial photograph from 1987 (Figure 2-8) clearly shows the landfill and surrounding disturbance to the dune system.

NZHP consulted a range of historic sources and found that there is no reasonable cause to suspect that a post-contact archaeological site is within the project area. There is no prior evidence of any activity at the proposed project area until dumping commenced at the landfill in the 1970s.

Figure 2-6. Early twentieth century photograph with the project area indicated (Muir & Moodie, 1907b).

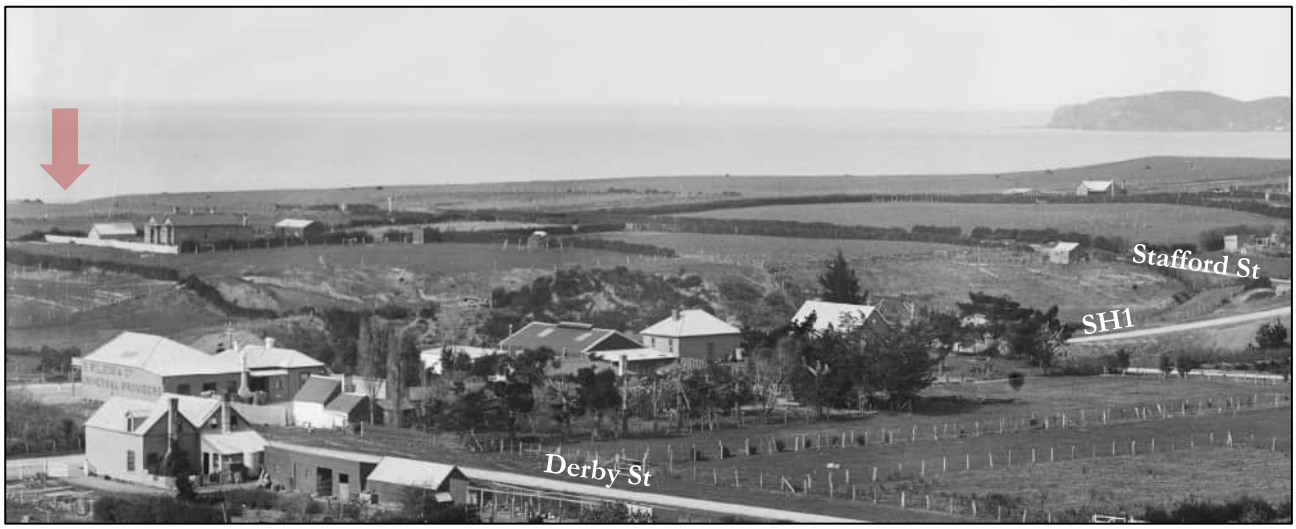


Figure 2-7. Early twentieth century photograph with the project area indicated (Muir & Moodie, 1907a).

Figure 2-8. Late-twentieth century aerial photograph with the project area indicated (LINZ, 1987).

3 Former Awamoa Landfills

The following sections give an overview of Māori and Pākehā settlement in the general Ōamaru area to provide context to understand the site-specific history of the proposed Awamoa project areas (Figure 3-1). Through this research it is possible to begin to identify what type of physical, cultural, and social processes have shaped the form and distribution of archaeological material. Additionally, historical background can be used to inform the interpretation of archaeological contexts and material whenever they are encountered.

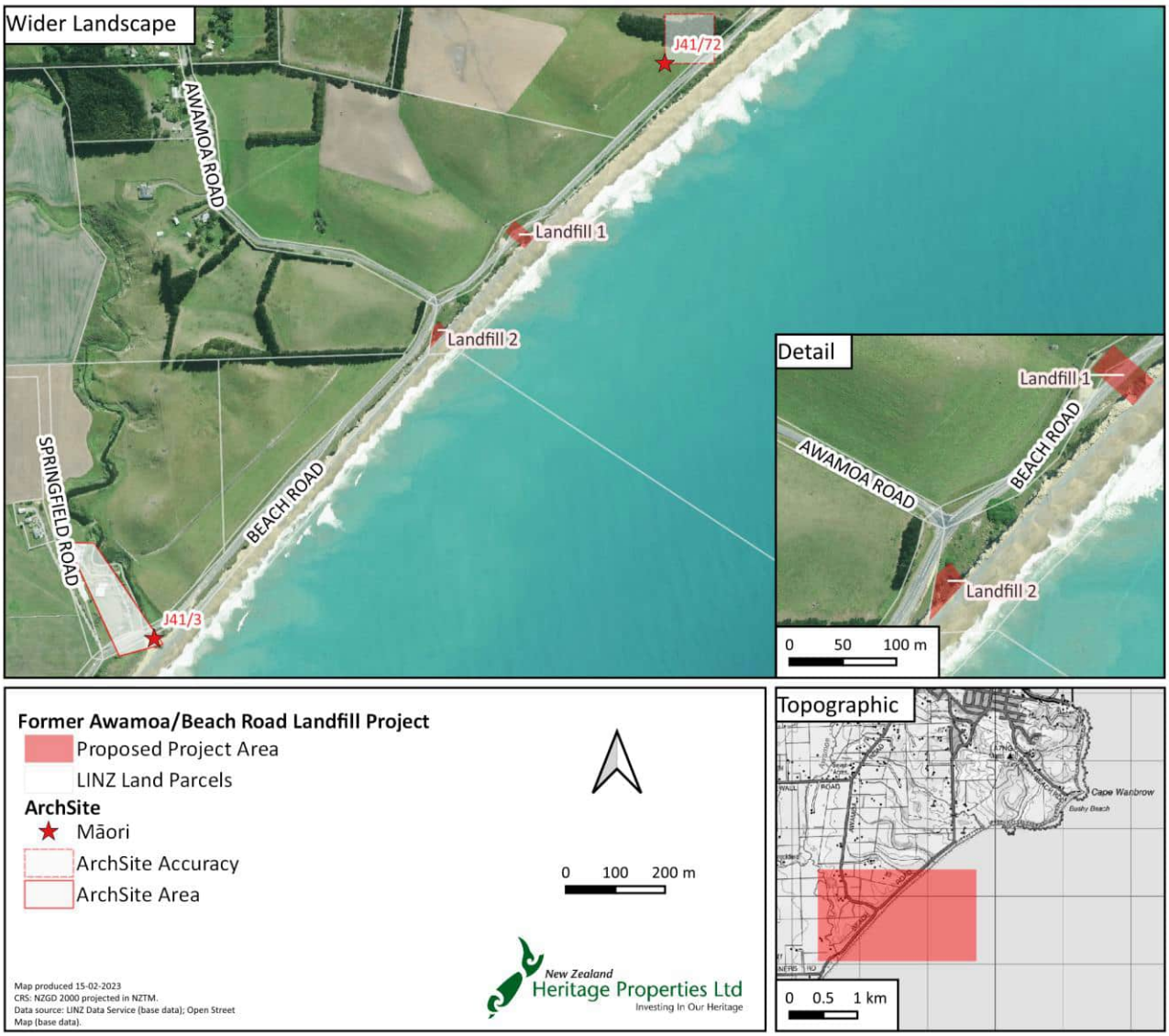


Figure 3-1. Map showing the location of the proposed project area in relation to nearby archaeological and heritage sites.

3.1 Māori Occupation

The wider Ōamaru area was part of the extensive network of nohoaka and mahika kai areas located along Te Tai-o-Ārai-te-uru (the Otago coastline). During the 1879 Smith-Nairn Royal Commission of Inquiry into the Kāi Tahu land claims, Rāwiri Te Māmaru and other Kāi Tahu kaumātua recorded Ōamaru as a kāika nohoaka, pā tūturu, and a kāika mahika kai where tuna (eels), īnaka (whitebait) and kōareare (edible root or rhizome of raupō/bulrush) were gathered (Te Rūnanga o Ngāi Tahu, 2019). Nohoaka, literally meaning a place to sit, traditionally refers to seasonally occupied sites which were an important part of Māori lifeways. The moa (*Dinornithiformes*) populations in the Waitaki District were high during the early phases of manawhenua settlement, and there is evidence for moa hunting to have been a major lifeways activity in the area (McDonald, 1962). This is shown by the high number of moa bones within cultural contexts that have been encountered within archaeological sites in the Waitaki District

(Anderson, 1989). Pākehā have historically referred to these nohoaka and early archaeological sites as 'moa-hunter' sites, although lifeways relied on many other forms of resources alongside moa.

Within the Waitaki District, the earliest archaeological sites were mostly located along the coast, many situated adjacent to streams and larger watercourses, and up the Waitaki River. Not only did the streams provide water and freshwater food resources, larger waterways also served in transporting moa carcasses hunted further inland downstream to kāika (Anderson, 1989).

There are thirteen Māori occupation sites recorded along the coast between Kākaunui and Ōamaru (NZAA Site Recording Scheme, February 2023). Of these, many are early Māori sites and consist of middens and ovens. One of the largest such sites is at Awamoa (site J41/3), which is located approximately 800m south-west of the proposed project area. Even though this site has been subjected to continual fossicking following its discovery by government agent, Walter Mantell, in the nineteenth century, enough evidence could be gleaned from more thorough and documented excavations undertaken from the 1960s onwards. The site is likely to have covered an area of roughly 1.5 hectares. Moa bone was retrieved from both middens and large ovens; the latter often cut through earlier occupation layers, suggesting a long (but possibly intermittent) occupation of the site (Trotter, 1979, 2022).

Along the coastline to the north of the proposed project area (see Figure 3-2), there are clusters of archaeological sites, classified as midden/oven site types, largely relating to early and contact period lifeways activities. Although these sites have been recorded, they have not been systematically investigated. Archaeological investigations have focused instead on the early settlement of North Otago which was centred around settlements established at the mouth of the Waitaki River, the Awamoko River, and in Moeraki (Shaw, 1995). Occupation between these areas of more permanent settlement appears to have been sporadic with seasonal hunting and gathering activities likely forming part of the lifeways systems of Māori along Te Tai-o-Ārai-te-uru (Shaw, 1995).

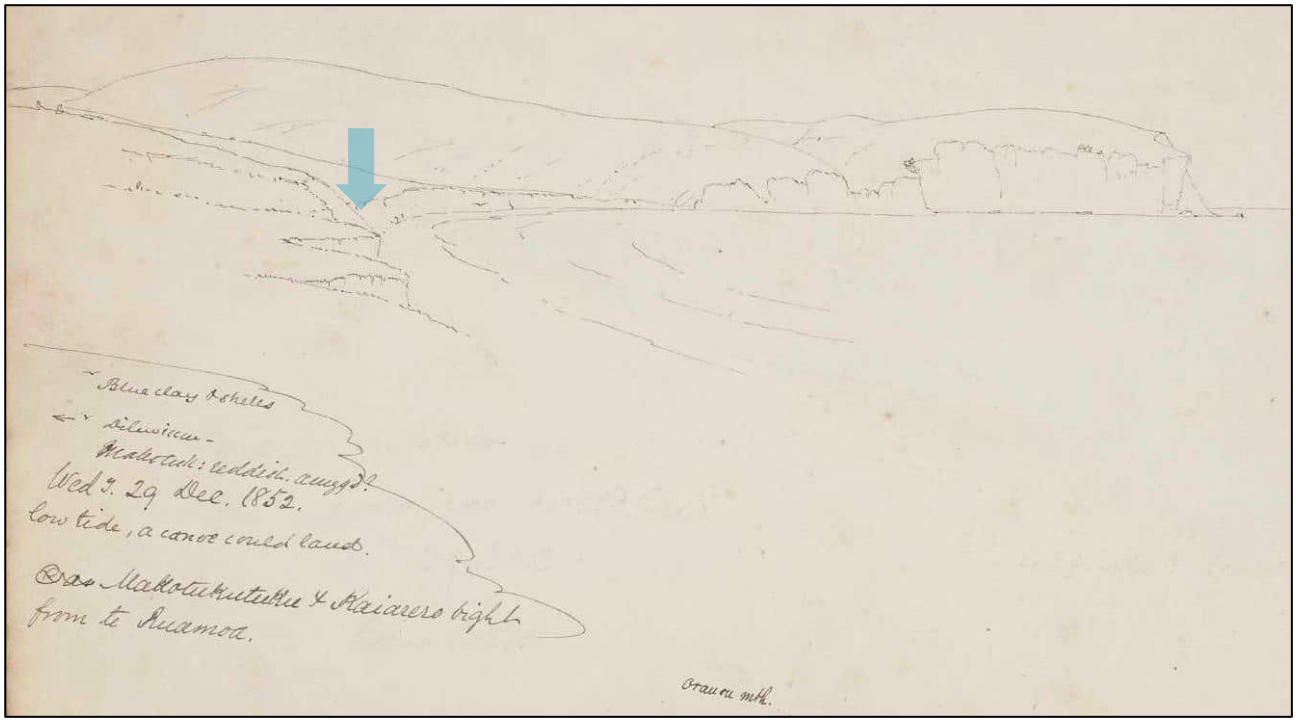


Figure 3-2. Sketch of the landscape north of Awamoa, looking towards Maktuktuku (Cape Wanbrow) with the approximate location of the project area indicated (Mantell, 1852).

NZHP consulted numerous sources of historic evidence and combined with recent archaeological investigations, has found that there is reasonable cause to suspect that a Māori archaeological site may be present within the project area. Many of the prominent nohoaka (temporary settlement or camp sites), mahika kai areas, and ara

tawhito associated with past lifeways activities in the wider Ōamaru and Awamoa areas are situated along the foreshore. A significant archaeological site associated with early Māori lifeways is located within 800m of the project area, and recent investigations suggest archaeological material remains *in situ* in this area.

3.2 Post-Contact Occupation

During the early years of the Pākehā settlement of the Ōamaru area there was a focus on accommodating and supplying the coastal travellers coming by both land and sea. It was the geographical setting of Ōamaru that made it an attractive place to establish a supply post, with South Hill sheltering the town from the worst of the cold southern winds, and the small peninsula (Makotukutuku/Cape Wanbrow) creating a partially sheltered landing place for ships. Crown Grants of land began to be formalised during the late 1850s and 1860s, and during this time, Ōamaru and the wider agricultural landscape developed rapidly. The township flourished on the boom brought about by the grain and wool supply flowing through the town and out to the rest of New Zealand via the burgeoning port.

A survey of the Ōamaru District was completed in 1866 (see Figure 3-3) and details the project area on the seward side of the Beach Road road reserve, near the head of a small gully. Tenders for the proper formation and gravelling of Beach Road, from Ōamaru to Kākaunui, were advertised in 1879 (North Otago Times, 1879). Photographs from around the turn of the twentieth century show Beach Road and the adjacent coastal beach reserve as rugged and windswept (Figure 3-4).

The proposed project area, situated to the east of the intersection of Awamoa and Beach Roads, was utilised by the public, with no involvement from the WDC, as *ad hoc* dump sites from the 1940s (see Figure 3-5) until ~1975 (Baddiley, 2020). Aerial photographs from the mid-twentieth do not show any structures or significant anthropogenic modifications, aside from pasture establishment and road construction, to the wider coastal landscape (Figure 3-6).

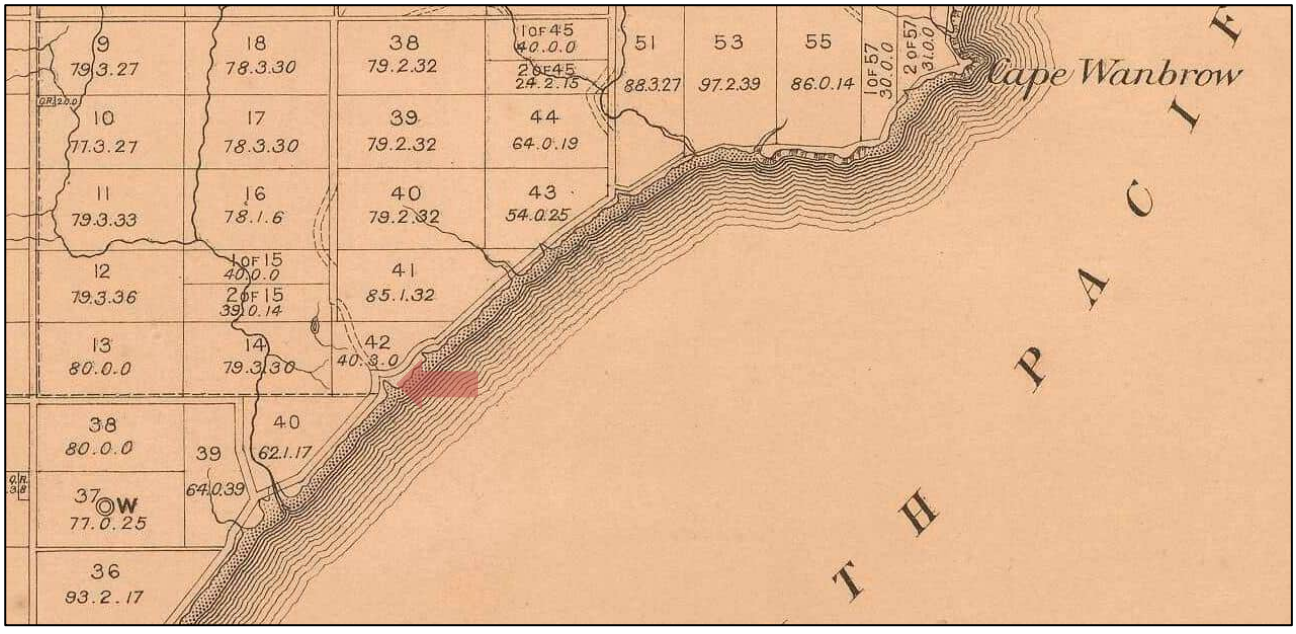
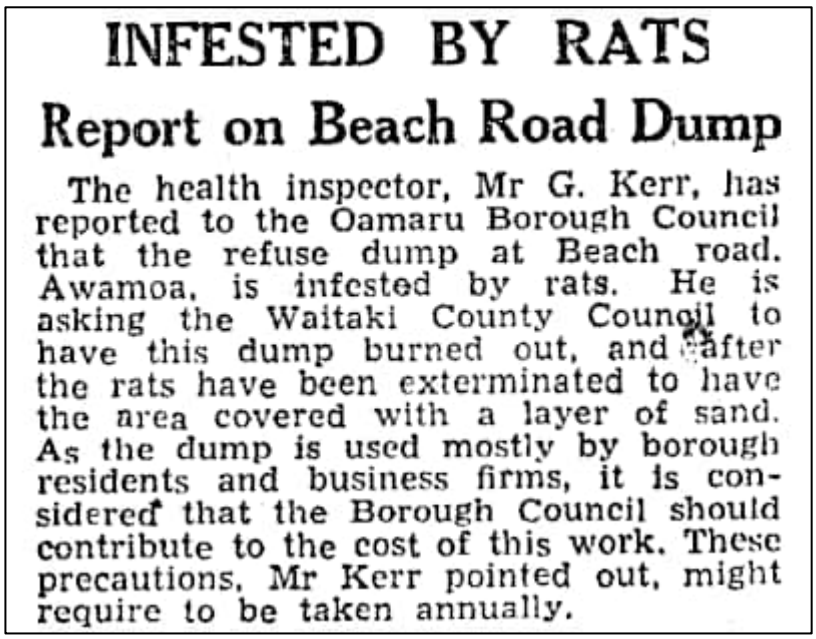


Figure 3-3. Detail of the Ōamaru Survey District, with the project area indicated (Thomson, 1866).

Figure 3-4. Photograph looking south along Beach Road towards the proposed project area, which is approximately indicated (Bicknell, 1900).



INFESTED BY RATS

Report on Beach Road Dump

The health inspector, Mr G. Kerr, has reported to the Oamaru Borough Council that the refuse dump at Beach road, Awamoa, is infested by rats. He is asking the Waitaki County Council to have this dump burned out, and after the rats have been exterminated to have the area covered with a layer of sand. As the dump is used mostly by borough residents and business firms, it is considered that the Borough Council should contribute to the cost of this work. These precautions, Mr Kerr pointed out, might require to be taken annually.

Figure 3-5. Detail from a newspaper article describing the rats plaguing the Beach Road dump (Otago Daily Times, 1948).

Recent investigations, comprising boreholes and other environmental tests, have been undertaken at the Awamoa project area (Baddiley, 2020). Some of the resulting borehole logs, while noting modern inclusions within the matrix, also note deposits of shell, charcoal, and ash. These may be related to either various pre-1900 lifeways activities in the area, or the twentieth century dumping activities undertaken at the site; there was no archaeological involvement in the environmental site investigation.

NZHP consulted a range of historic sources and found that there is no reasonable cause to suspect that a post-contact archaeological site is within the project area. There is no prior evidence of any activity at the proposed project area until dumping commenced at the landfills in the 1940s.

Figure 3-6. Mid-twentieth century aerial photograph with the project areas indicated (LINZ, 1955).

4 Conclusions and Recommendations

This appraisal has demonstrated that there is reasonable cause to suspect that archaeological sites, as defined by the HNZPTA 2014, may be within the project areas and could be modified or destroyed by the proposed remediation works. Many of prominent nohoaka, mahika kai areas, and ara tawhito associated with past lifeways activities in the wider Hampden and Awamoa areas are situated along the foreshore. There are significant archaeological sites associated with early Māori lifeways activities located within 1km of the project areas, and recent investigations suggest archaeological material remains *in situ* in the surrounding landscape. However, the twentieth century landfill extents are clearly demarcated by slumping, erosion, and stratigraphic changes. Based on the description of proposed works provided, NZHP recommends the following approach.

1. As a first step, a pedestrian survey should be carried out to determine if there are any visible archaeological remains eroding from the surface within the three areas of proposed works.
    a. If there are visible archaeological remains that may be affected by the proposed remediation that cannot be avoided by the works, an authority will be required. The steps involved in this process are outlined in Point 4 below.
    b. If there is no visible archaeology at the site, NZHP recommends site avoidance with the assistance of an archaeologist.
2. As a first principal, every practical effort should be made to avoid damage to any archaeological site, whether known or discovered during the proposed project works.
3. **Site avoidance monitoring**.
    a. An archaeologist be on site for the start of works to advocate for site avoidance and to brief the contractors on the possibility of encountering archaeology, how to identify archaeology, and their responsibilities in regard to notification of any archaeological discoveries.
    b. NZHP would also recommend that tangata whenua be consulted and given the opportunity to be actively involved in the project.
    c. Works must operate under an Accidental Discovery Protocol (see Appendix A), which should be supplied to all contractors involved in earthworks.
    d. The works must avoid archaeology if it is encountered, negating the need for an archaeological authority.
    e. Should archaeological materials be suspected or observed during the project works, all work within a 5m radius (or 25m if human remains are present or suspected) of the find must stop and be cordoned off to ensure it is safe. Work can continue outside the area.
        i. If the archaeology cannot be avoided, an authority will be required to modify or destroy the site if the archaeology cannot be avoided and left *in situ*. The steps involved in this process are outlined in Point 4 below.
4. **Steps for seeking an authority:**
    a. An authority is required where archaeology will be modified or destroyed.
    b. An assessment be prepared that considers the archaeological values of the site and the effects of the work on those values.
    c. Consultation with tangata whenua be undertaken.
    d. An application to HNZPT is made for an archaeological authority.
    e. The archaeological site(s) should be recorded on the New Zealand Archaeological Association
5. The recommendations provided here relate only to the scope of works described in Section 1. Should the proposed works change, further appraisal is recommended.

5 References

Anderson, A. (1989). *Prodigious Birds: Moas and moa-hunting in prehistoric New Zealand*. Cambridge: Cambridge University Press.

Baddiley, M. (2020). Beach Road Closed Landfills: Detailed Site Investigation. Alexandra: Unpublished Report Prepared for the Waitaki District Council by WSP.

Beattie, J. H. (n.d.). Map showing Maori placenames in Southland and Otago before 1840] [map with ms annotations]. Ref: Map showing Maori placenames in Southland and Otago before 1840] [map with ms annotations], National Librarry.

Bicknell, F. (1900). Woman and children on a beach road [photograph]. System ID 160500: Waitaki Archive. Retrieved from https://collection.culturewaitaki.org.nz/objects/160500/woman-and-children-on-a-beach-road

Cyclopedia Company Limited. (1905). Hampden, in The Cyclopedia of New Zealand [Otago & Southland Provincial Districts]. The Cyclopedia Company, Limited, 1905, Christchurch.

LINZ. (1861). Crown Grant Index Record Map, Otepopo Surevy District. Ref: R10302813, Archives NZ.

LINZ. (1955). SN503 [aerial photograph]. Survey Number: SN503: Retrolens. Retrieved from https://files.interpret.co.nz/Retrolens/Imagery/SN503/Crown_503_1344_32/High.jpg

LINZ. (1987). SN8743 [aerial photograph]. Survey Number: SN8743: Retrolens. Retrieved from https://files.interpret.co.nz/Retrolens/Imagery/SN8743/Crown_8743_F_8/High.jpg

Mantell, W. B. D. (1852). Makotukutuku and Kaiarero bight from Te Ruamoa. Wedy. 29 Dec. 1852 [sketch]. Tiaki Reference Number: E-332-065: National Library of New Zealand. Retrieved from https://ndhadeliver.natlib.govt.nz/delivery/DeliveryManagerServlet?dps_pid=IE25695488

McDonald, K. C. (1962). *White Stone Country - the story of North Otago*. Dunedin: The Otago Daily Times & Witness Newspapers Co., Ltd.

Muir & Moodie. (1907a). Hampden [photograph]. Registration Number C.013541: Museum of New Zealand Te Papa Tongarewa. Retrieved from https://collections.tepapa.govt.nz/object/19007

Muir & Moodie. (1907b). Hampden and Beach [photograph]. Registration Number C.013547: Museum of New Zealand Te Papa Tongarewa. Retrieved from https://collections.tepapa.govt.nz/object/19157

Muirhead, S. (1990). *Historic North Otago: Comprising a selection from those articles first published on the feature page of the Oamaru Mail in the 1980s*. Oamaru: Oamaru Mail Company Limited.

New Zealand Archaeological Association. (2020). Ovens and midden (J42/31).

North Otago Times. (1879). Page 3 Advertisements Column 2. Volume XXVIII, Issue 2236: 28 June 1879, Page 3. Retrieved from https://paperspast.natlib.govt.nz/newspapers/NOT18790628.2.17.2

Oamaru Mail. (1878). The Evening Mail. Volume III, Issue 653, 6 June 1878.

Otago Daily Times. (1948). Infested by Rats. Issue 26782: 27 May 1948, Page 3. Retrieved from https://paperspast.natlib.govt.nz/newspapers/ODT19480527.2.15.10

Otago Witness. (1859, October). Page 3 Advertisements Column 3. *Issue 411*, p. 3.

Otago Witness. (1860). Page 9 Advertisements Column 5. Issue 473, 22 December 1860, Page 9.

Reid, J. (1860). Town of Hampden [Crown Grant Index Record Map]. Item Code: R10302870: Archives New Zealand. Retrieved from https://ndhadeliver.natlib.govt.nz/delivery/DeliveryManagerServlet?dps_pid=IE33572362

Shaw, P. (1995). *Whitestone Oamaru: A Victorian Architectural Heritage*. Nelson: Craig Potton Publishing.

Te Runanga o Ngāi Tahu. (2021). "Te Kuri", Kā Huru Manu.

Te Rūnanga o Ngāi Tahu. (2019). Kā Huru Manu. Retrieved from https://www.kahurumanu.co.nz/atlas

Thomson, J. T. (1866). Oamaru Survey District [map]. Alma MMSID: 9913878333502836: Otago Survey Lithographic Press. Retrieved from https://ndhadeliver.natlib.govt.nz/delivery/DeliveryManagerServlet?dps_pid=IE3734525

Trotter, M. M. (1979). Investigations at Awamoa archaeological site, S136/4 [manuscript].

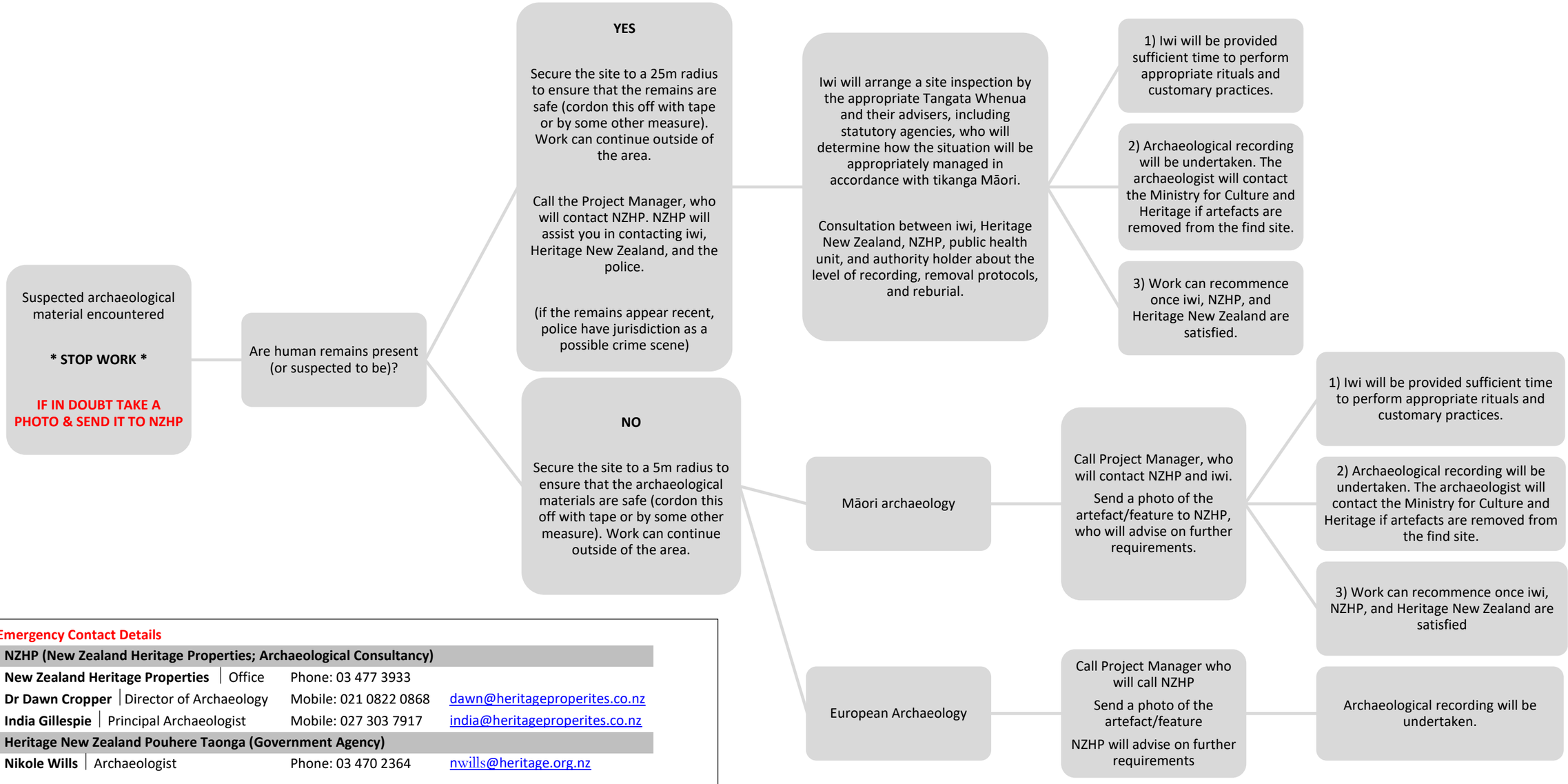
Trotter, M. M. (2020). Hampden Beach Revisited: A new look at archaeological sites on Hampden Beach, North Otago. Kaiapoi: Unpublished Report Prepared by Michael Trotter, Archaeological Consultant.

Trotter, M. M. (2022). Site Record Form for J41/3. New Zealand Archaeological Association. Retrieved from https://archsite.eaglegis.co.nz/NZAA/Site/?id=J41/3

Waitaki District Council. (2021). Hampden Closed Landfill: Post Closure Care and Management Plan. Oamaru: Unpublished Report Prepared by Waitaki District Council and Waugh Infrastructure Management Ltd.

Appendix A

Accidental Discovery Protocol



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GEOFF TROTTER

Hampden Beach, looking northwest, with the Big Kuri Creek at the far end.

Hampden Beach Revisited

Michael Trotter

24 April 2020

A new look at archaeological sites
on Hampden Beach, North Otago

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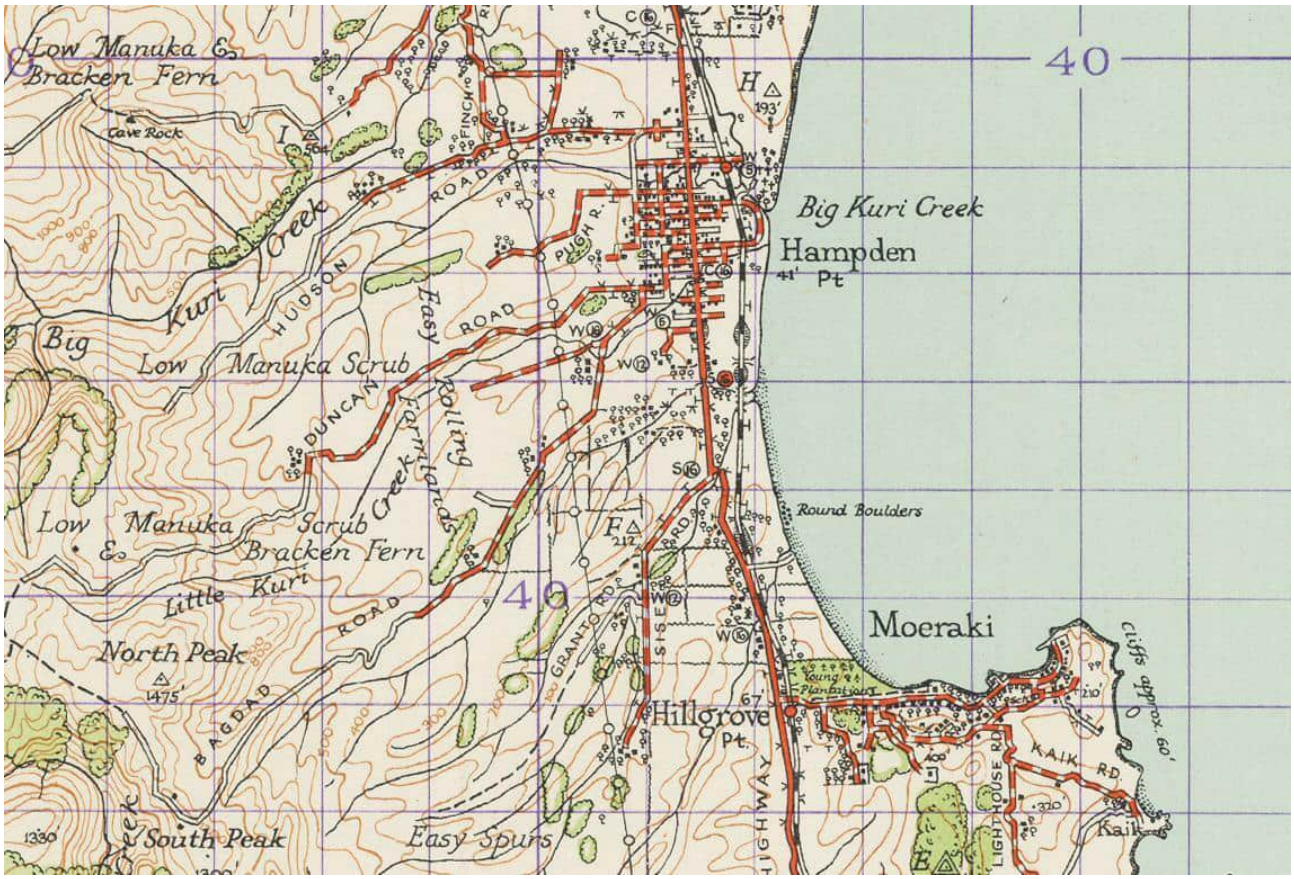
[Illustrations in this report have been compressed to facilitate electronic transmission.]



NZMS1 S146 1959

Introduction

Hampden is a township on the North Otago coast some twenty-six kilometres south of Oamaru (thirty by road) and about four kilometres north of Moeraki (see the above topographical map). There is archaeological evidence of human occupation going back about 600 years at one place on the beach, and other evidence of pre-European occupation has been recorded elsewhere on the beach and further inland. European settlement of the Hampden locality commenced in the 1850s, though it was generally referred to a Kuri Bush, Kuri, or Moeraki – the survey of the township and sale of sections did not commence until 1860[1].

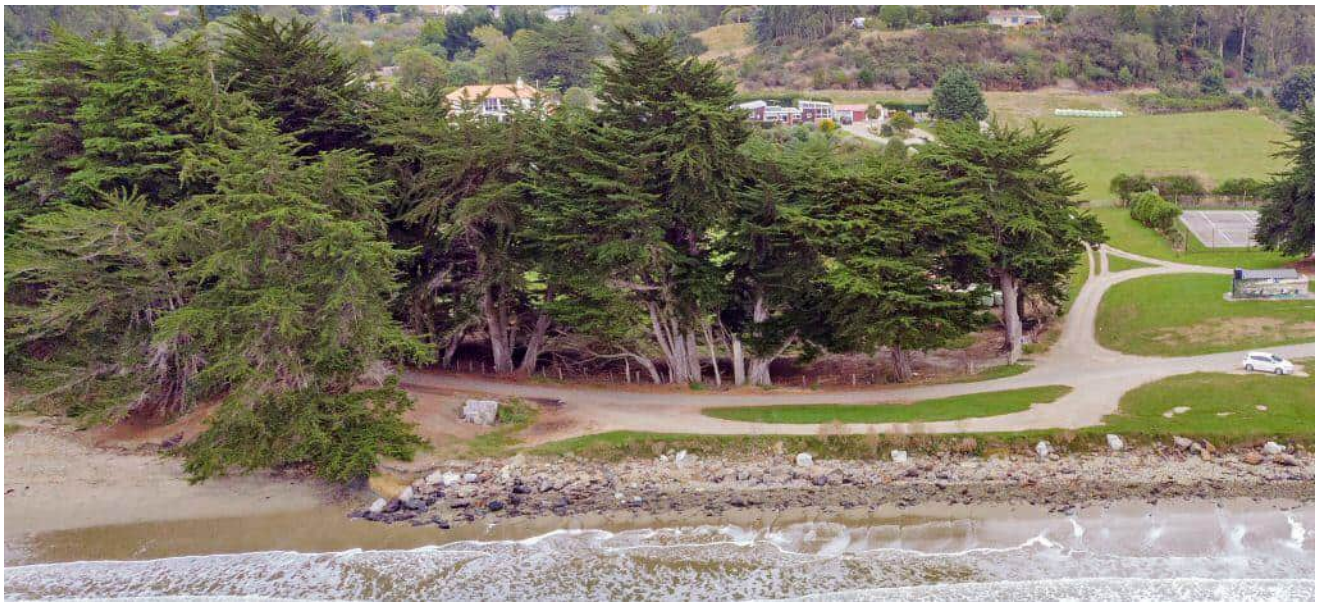
The main beach – the part most frequented by visitors, picnickers, and campers – is that part which occurs between the mouths of the Little Kuri Creek and the Big Kuri Creek as marked on the aerial mapping image on the right.

CANTERBURY MAPS

[1] Otago Witness 1860b; Reid 1861.

During the 1950s anecdotal records of accidentally discovered evidence of pre-European occupation at Hampden were collected from some local residents (Trotter 1951-55, 1955-58, 1959-65, 1959); by the end of the decade thirteen such finds had been recorded. For the most part these were recollections of stone adze-heads that had been found near the beach or in the village, descriptions of the material and the exact locations were often vague. As well as these, one recounter said that her father often ploughed up "greenstone and moa bones" near the beach, and another that "several Maori chisels, some of which got broken" were ploughed up in the paddock between the two swamps behind the beach.

Archaeological Site J42/209



GEOFF TROTTER

Further information came from field observations. Erosion of a beach bank caused by a storm with high seas in 1957 revealed an occupational deposit near the southern end of the main beach. (The above photograph shows the area in 2020 with a considerable amount of rock placed along the beach bank to inhibit further erosion.)

This site comprised an occupational deposit of blackened earth nearly 23 centimetres thick, lying on a mixture of clay and gravel, and overlaid with about 25 centimetres of wind-deposited beach sand. The exposed portion contained firestones – that is, greywacke river stones that had been stained and broken by heat, as in a cooking fire or 'oven' – and the tibia of a small moa, which had recently been broken, was projecting from the bank. There were also two hand-held artefacts, a flaked stone knife and a hammerstone (photograph below).[2]

In 1963 there was more erosion and another moa bone, this time part of a tarsometatarsus, was found projecting from the bank.[3]

Two years later an archaeological site record (number S146/16) covering the whole of Hampden Beach was made in the New Zealand Archaeological Association's site recording scheme, which was and still is responsible for site records for the whole of the country. That record has now been renumbered and divided into four separate sites – including this one as J42/209 – on the nation-wide archaeological site database, ArchSite.

[2] Trotter 1955-58: 243.
[3] Trotter 1959-65: 56.

RETROLENS/LINZ 1353/24 1960

(At that time the bank where the occupational deposit was exposed was close to a bathing shed, which was a single building containing four or five in-line units for changing before and after swimming. This and a second bathing shed nearly 450 metres further south, just north of an unformed extension of Stafford Street, existed until at least the 1960s. The latter part of the beach was not much frequented in the middle of the twentieth century but was possibly more popular when the sheds were built, probably early in the twentieth century. Both bathing sheds are visible and indicated by arrows in the 1960 aerial mapping photograph on the left.)

Returning to site J42/109, in 2020 the effect of further erosion was evident – the pointed piece of land beneath the upper arrow in the 1960 photograph was now reduced to a slight rounded projection – and there was no surface sign of the bathing shed. The photograph below shows the deposit of firestones in the blackened matrix and there were also slight indications of darkened soil for five metres to the left. The post and disturbance to the right of the metre-long scale are of twentieth century origin, possibly relate to the bathing shed that used to be here.

CANTERBURY MAPS

Aerial mapping photograph showing locations of recorded archaeological sites at Hampden Beach in 2020. Earlier aerial photographs show a pond directly north of the ploughed paddock, and swampy ground in the low-lying area adjacent to site J42/209.

Archaeological Site J42/210

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Behind the central part of the main Hampden Beach there is a small area of flat land, about one-and-a-half hectares in size, on which are public toilets, tennis courts, and a skateboard area, with most of the remainder currently being used for grazing sheep – see the aerial photograph on the previous page. In the past much of this area had been ploughed and cultivated – parallel lines of differential grass growth show on aerial photographs under some conditions. Anecdotal reports refer to moa bones and artefacts being ploughed up here[4] (it is less likely that the flat area behind site J42/209 was ploughed in the past as it was swampy until drained in the 1940s) – the adze-head on the right being one of those ploughed up – but no archaeological evidence was visible of the surface here when inspected in the 1950s.

However, on inspection in 2020 several artefacts were found in a small patch of bare ground (photograph below) beneath macrocarpa trees, at the point indicated by the arrow in the above photograph.

[4] Trotter 1951-55: 12; 1955-58: 243; 1959-65: 10.

These artefacts are figured on the right. From the left on top is an adze-head preform of slightly schistose greywacke; a well-made flake knife of Central Otago[5] porcellanite; and a small waste flake of argillite with one of black chert beneath it. Along the bottom are two flakes of orthoquartzite (silcrete) from inland Otago; a well-made knife of chalcedony, and there is a small waste flake in the centre. The chalcedony is probably from Moeraki.[6]

On the basis of these finds and the 1950s anecdotal reports, this site has the potential of being of considerable importance if further occupational material remains in the ploughed paddock area or in the vicinity of J42/211. No earthworks should be undertaken in here without prior archaeological assessment.

Archaeological Site J42/211

In 1958 sparse scattered shell midden was visible on the surface amongst pine trees growing alongside the camping ground at Hampden Beach.[7] Amongst the midden was the piece of sandstone grindstone in this photograph, approximately nine centimetres square in size. The top and the right side have been flattened by use as a grindstone – the X lines scratched on it are probably the result of mechanical ground preparation for planting the trees. The artefact was later placed in the Canterbury Museum.

Shortly after the observation the Hampden Borough Council (on whose land the trees were growing) had the trees cut down and bulldozed a quantity of surface soil into an adjacent swamp to prepare the ground for a car park, doubtless taking archaeological evidence with it.

In 2020 there was no sign of any early archaeological material in bare patches of ground in this area, though it is possible that remnants of the site still occur beneath the surface here and in the adjacent camping ground.

[5] Suggested source locations are from hand specimen comparison only.
[6] Four of these artefacts have been registered with the Ministry for Culture and Heritage.
[7] Trotter 1955-58: 335.

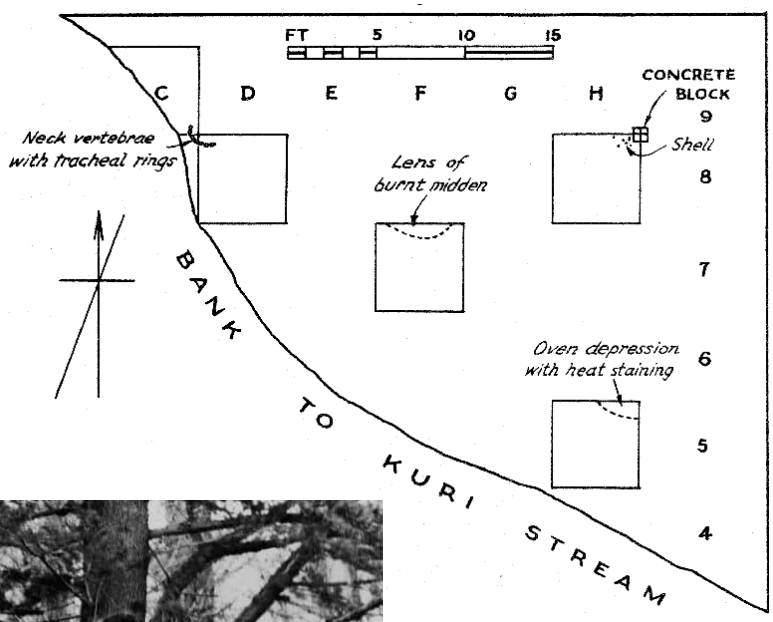
Archaeological Site J42/31

RETROLENS/ LINZ 1353/24 1960

In the 1950s it had been noted that a dark layer of occupational material could be seen in the left bank of the Big Kuri Creek, and it was clear that more of this site extended beneath a small plantation of pine trees that grew there. (The 1960 aerial photograph on the left shows the trees on both sides of the Big Kuri creek with the locations of both sites J42/211 and J42/31 marked.)

Having seen the destruction of archaeological evidence when a similar plot of trees was harvested on the opposite side of the creek (site J42/211) it was arranged for a small investigative excavation to be made beneath the trees on this site (J42/31) before similar damage was inflicted on it.

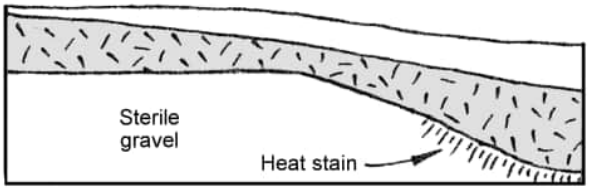
On 29 May 1965 a group of volunteers from North Otago Scientific and Historical Society, based in Oamaru, excavated four and a half five-foot (equals approximately 1.5 metres) squares, laid out as shown in the adjacent 1965 plan.[8] Each square was identified by a letter-number combination – for example the lowest on the plan was referred to as square H5.



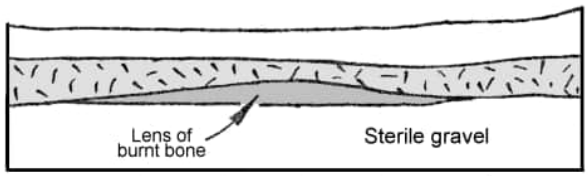
BRYAN TROTTER 1965

A datum peg was set in concrete at square H8 (beneath the theodolite in this photograph) so that it would be possible to return to the site in future years and work out where the excavation took place. (In the event when revisiting the site in 2020 it was found that the peg and concrete block no longer existed.)

[8] From Trotter 1967a.



NORTH SIDE OF SQUARE H5

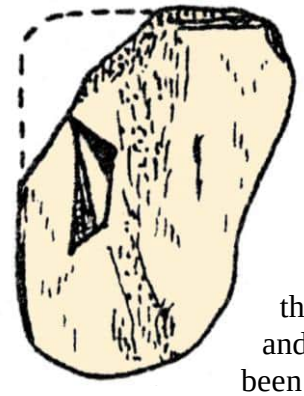


NORTH SIDE OF SQUARE F7

In general, the occupational deposit – that is, the material left behind by the people who had lived here – was covered by up to twenty centimetres of gravely soil, and the deposit itself was up to twenty-three centimetres thick. It was distinguishable from the natural river gravel by being stained with charcoal and other organic refuse, and it contained mainly burnt stones and broken moa bones with a few artefacts. The above diagrams show the stratigraphy on the northern sides of two of the five-foot squares excavated, with the occupational deposit shaded.

Over 750 whole and broken pieces of bones of at least three individual *Euryapteryx curtus*[9] moas were recovered, including a neck with a skull, quadrates, vertebrae and tracheal rings in approximate anatomical position crossing between squares C9 and D8. This would have been discarded at the time of butchering, and suggested that the supply of meat – and hence moas – was plentiful at the time. Most of the bones showed considerable breakage – in the case of leg bones this may have been to select pieces for the manufacture of fish-hooks, pendants and other objects, but pelves had also been broken up, though this bone is unlikely to have been of much use.

Skulls	3
Quadrates	2
Tracheal rings	18
Vertebrae	45
Ribs	9
Pelves	9
Sterna	2
Femora	6
Tibiotarsi	7
Fibulae	8
Tarsometatarsi	3
Toes	32
Claws	14
Total identified	*158*

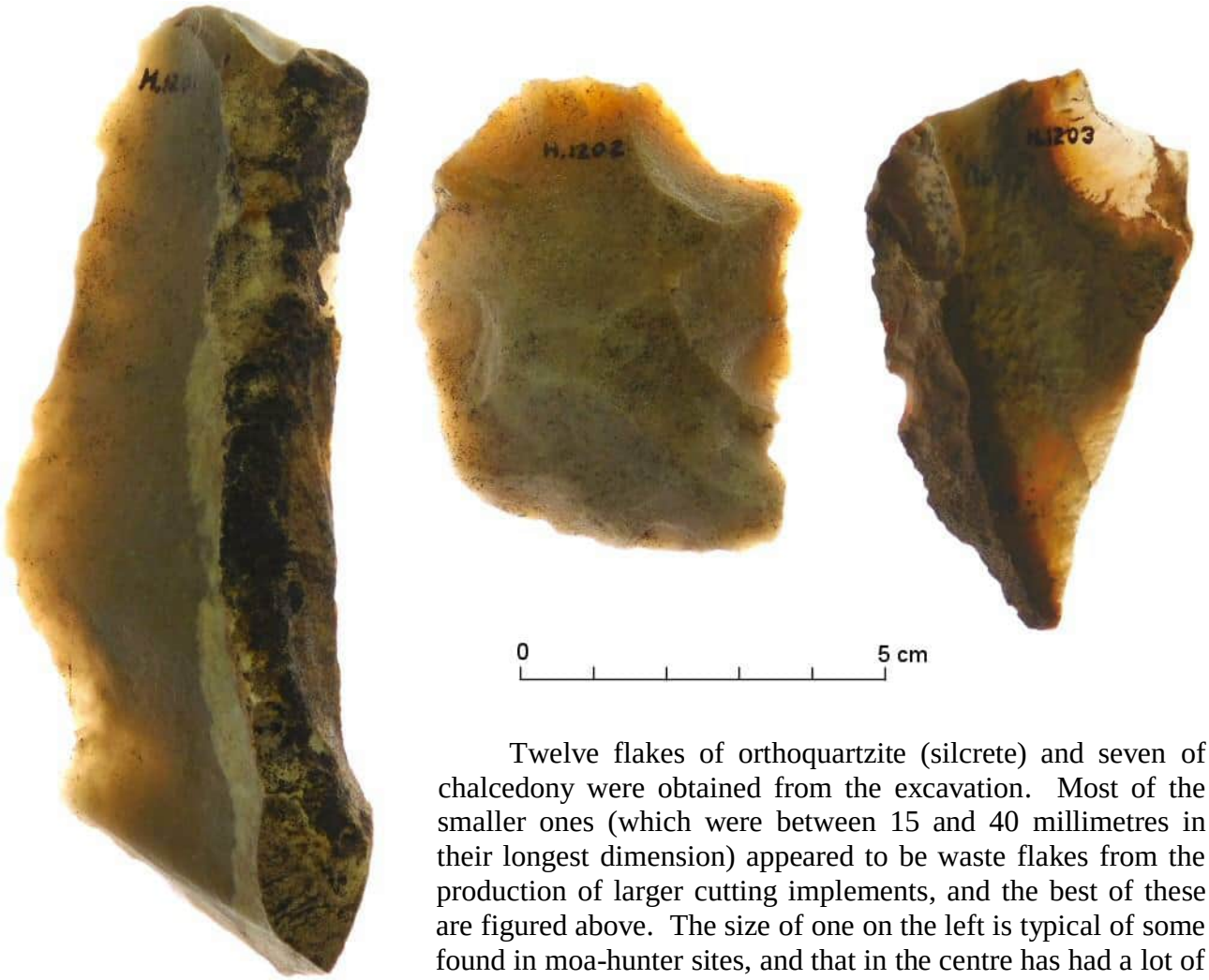


Details of the moa bones and pieces recovered were given in the 1967 report,[10] and the adjacent table gives numbers from different parts of the bodies of those identified Besides these were 594 smaller fragments. The bone material had been placed in Canterbury Museum in 1965 but was not available for checking in 2020.

This bone material included four pieces of worked moa bone, one being the shaped blank for a one-piece fish-hook, which was found in three pieces and would have been about six centimetres high – the illustration on the left has been taken from a sketch in the 1967 report. There were also six pieces of bone from a penguin species and three of dog, both of which species were used for food.

Mollusc shells were few (photograph on the right) and all but the operculum of a catseye (*Lunella smaragda*) in the centre were broken or fragmentary. With the exception of a turret shell (*Maoricolpus roseus*) near the top centre in the photograph on the right, they appear to come from food species – catseyes, oysters (neither of which occur on Hampden Beach) and an unidentified bivalve. Turret shells were sometimes used for ornamental purposes such as necklaces, a small hole being drilled near the opening for suspension,[11] (which is where the Hampden shell is broken).

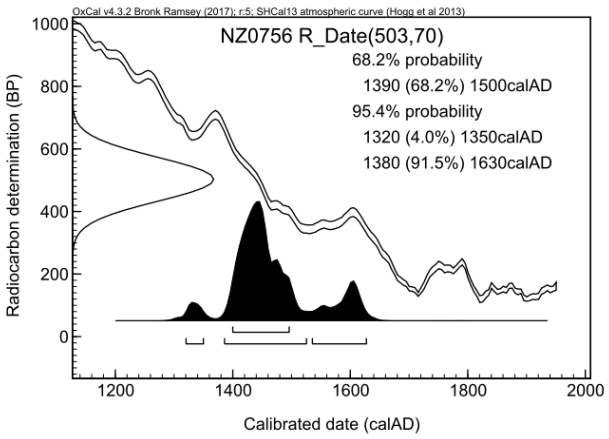
[9] Species nomenclature as per Bunce et al 2009.
[10] Trotter 1967a.
[11] See for example Trotter 1975: 203.

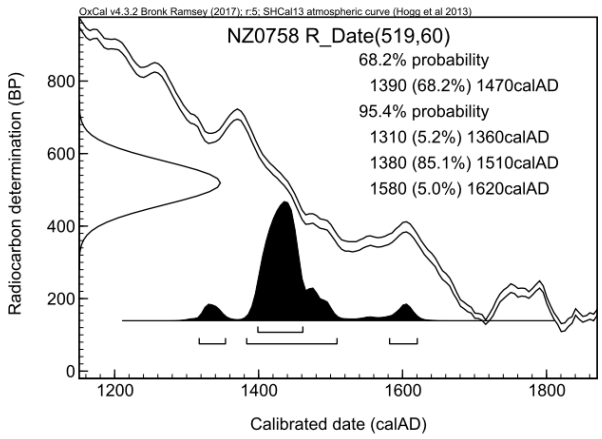


Twelve flakes of orthoquartzite (silcrete) and seven of chalcedony were obtained from the excavation. Most of the smaller ones (which were between 15 and 40 millimetres in their longest dimension) appeared to be waste flakes from the production of larger cutting implements, and the best of these are figured above. The size of one on the left is typical of some found in moa-hunter sites, and that in the centre has had a lot of retouching to produce the desired shape. There was also a hammer stone that may well have been used in their production.

One interesting artefact was a lump of baked clay. This particular piece was rather shapeless, but pieces found on other Otago sites have clearly been shaped, and other pieces have been found on sites throughout New Zealand, though their purpose is not known.[12]

Radiocarbon dates that were obtained for the site in 1967[13] and which have been recalibrated in 2020 unfortunately have a rather large plus-or-minus range – the results are given below. The diagram on the left is for moa bone collagen from square D8, and that on the right from the lens of burnt (or heat stained) moa bone in F7 – and the likely time of occupation is a little under 600 years ago, somewhere in the early fifteenth century AD.





[12] Trotter 2012.
[13] Trotter 1967b: 140.

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As the above 2020 photograph of the site shows, it is very different today from the pine plantation covered area of the 1950s and 60s. Back then there was some occupational evidence – sometimes sparse – between the points A and B, a distance of at least fifty metres, and the occupational deposit could be seen as a layer in the eroding creek bank to the right of A, where there is now redeposited soil. (The area where the excavations were carried out was a little to the right of A.)

When the trees were harvested some years ago the ground appears to have been windrowed and a lot of topsoil bulldozed off the surface taking most of the site with it. In 2020 there were some stumps, piles of waste branches and roots, with the ground covered with grass and weeds, plus some wilding pines. The scraped up soil had probably been pushed over the edge of the bank to be washed away by the Big Kuri when in flood. All that could be found on inspection was some disturbed occupational material in the eroding bank near point A – photograph below with a metre long scale.

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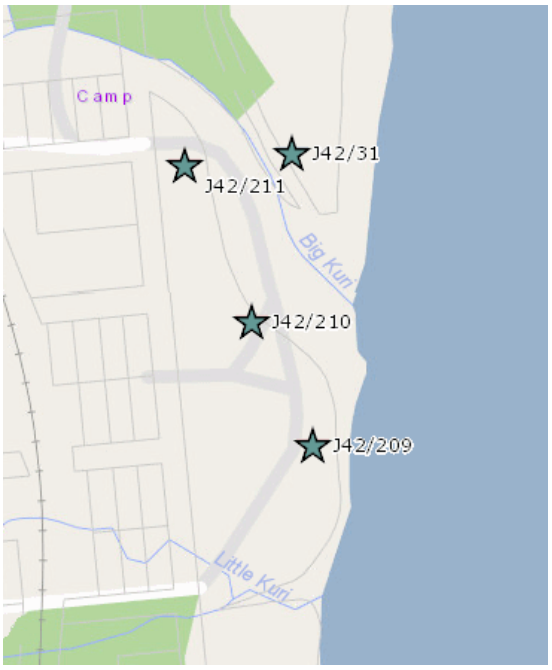
As late as 1978 the occupational layer had been still visible in the bank when it was described as a 10–15 centimetres thick layer of blackened soil with charcoal, many burnt and broken stones, small lenses of moa, bird and fish bone midden, a few flakes of basalt, and concentrations of ashy soil exposed for 20 metres along the face of a low scarp.[14] (No fish bones or flakes of basalt were observed here in 1965.)

A final note on the 2020 field observations at Hampden Beach – at a point 37 metres northwest of point A of the J42/31 site there was a solitary valve of a kahitua shell (the southern tuatua, *Paphies donacina*) embedded in a sloping bank (marked 'Shell' on the map on page 5). The size of the kahitua makes it an excellent food species, but it is not impossible that it got into the bank by natural means – possibly dropped by a seagull and become covered by slumping of the soil.

Discussion

Archaeological evidence of pre-European occupation on Hampden Beach has been located in four separate locations, and these have been recorded on ArchSite (modified extract on right). All these sites have suffered damage to a greater or lesser extent, and three, if not all, of them are likely to have been occupied at least five to six hundred years ago.



MODIFIED FROM ARCHSITE 2020

Site J42/209 near the southern end of main beach has been eroded by wave action considerably since it was first revealed by earlier erosion, but there is a reasonable likelihood that the occupational deposit continues further into the bank. The moa bones found there are likely to be the result of hunting, and more information could doubtless be obtained from excavation.

Site J42/210 in a central position behind the beach has suffered from ploughing and associated cultivation as well as the construction of amenities. Artefacts described in this report (pages 6-7) and the previously reported finding of moa bones point to early occupation. This is likely to have been a large site, possibly even about a hectare in area, and there is the potential for it to contain invaluable archaeological evidence. All archaeological sites are protected by legislation – currently the *Heritage New Zealand Act* of 2014 – but it must be stressed that any proposed works that would disturb the ground here, such as construction, cultivation or tree-felling, need to be done under archaeological supervision.

Very little can be deduced about site J42/211 and it may well be completely destroyed though there is the possibility for occupational material to occur beneath the present surface.

[14] Smith 1978.

The limited excavation that was carried out on site J42/31 on the left bank of the Big Kuri indicated that it was an early site where butchering of moas was carried out, as well as at least one penguin and one dog. Other activities appear to have included the manufacture of at least one fish-hook, the preparation of shell(s) for personal ornamentation, and the cooking of food. It is possible that shellfish for consumption was brought here from some distance away. It is extremely unfortunate that this site has been virtually destroyed. Currently proposed tree-planting and track formation here will avoid the small area remaining in order to prevent further damage.

GPS co-ordinates

Global Positioning System co-ordinates for Hampden Beach sites (New Zealand Transverse Mercator projection).

Site J42/31	1429548 x 4978777
Site J42/209	1429563 x 4978544
Site J42/210	1429514 x 4978643
Site J42/211	1429462 x 4978767
Kahitua shell	1429511 x 4978829
Bathing Shed	1429463 x 4978545
Bathing Shed	1429520 x 4978115

Co-ordinates are for central locations of existing sites as recorded in February 2020, or as calculated from aerial photos for bathing sheds.

Acknowledgements

Sincere thanks to Alison MacTavish for facilitating the 2020 fieldwork and to Alison and Dugald MacTavish for assistance on site J42/31, Geoff Trotter for unmanned aerial vehicle and surface photography plus assistance in the field, Fiona Petchey for calibrating the radiocarbon dates, and Emma Brooks for locating some of the Hampden material in the Canterbury Museum and making it available for photography. As usual, good use was made of the invaluable internet facilities given by *Canterbury Maps*, *Papers Past*, and *RetroLens* that are provided by Environment Canterbury, the National Library of New Zealand, and Land Information New Zealand respectively.

Big Kuri Creek mouth

GEOFF TROTTER

The Name "Kuri"

Throughout this report the names of the two streams that flow onto Hampden Beach are referred to as the Big Kuri and Little Kuri respectively, though neither of these names appears on the current official topographical maps.[15]

Since at least 1861 the two streams at Hampden have been known as the Big Kuri and Little Kuri[16] but in 1985 they were officially changed to "Kurinui" and Kuriiti,[17] reference being given to publications by W. H. S. Roberts and G. B. Stevenson. (The proposal to assign the names had been made the previous year.[18]) Both of these cited sources actually spelled the name as Kuri-nui and Kuri-iti (with a hyphen between the two words), and while Roberts is generally considered to have been knowledgeable on Maori place names, Stevenson is best known for his book on North Otago,[19] and very likely got his information on the Kuri from Roberts, whom he acknowledges in respect to the Little Kuri.

Roberts had written in the *North Otago Times* in 1896 that "the big Kuri's proper name is Kokomoko, or Kokomako, most likely the latter, as it was the name of the Bell bird."[20] A few days later, however, Frederick Chapman, a well-regarded authority on Maori place names responded: "Kuri is the correct name of the Big Kuri and Little Kuri; it is not uncommon to find two creeks with the same name—it is the name of the block. There is some confusion about Kokomako given by Mr Roberts."[21]

Some other names given by Mr Roberts are new to me. It Ra-moa is genuine it is interesting, as I only know two genuine names in this island containing the word moa, *i.e.*, Oraumoa near Blenheim, and Ohine-te-moa, Waikouaiti beach. Kuri is the correct name of the Big Kuri and Little Kuri; it is not uncommon to find two creeks with the same name—it is the name of the block. There is some confusion about Kokomako given by Mr Roberts. Te-awa-kokomuka is Rotten Creek, while Kakatumauka is the name of two creeks which come out together on the Hampden beach on the way to Moeraki.

Chapman, Frederick, 1896. "North Otago Nomenclature" (Letter to the Editor) *North Otago Times*, 9 March 1896, page 1

In early days the place was known as "The Kuri" (dog). The Maori name of the Big Kuri, as long as it ran among the hills, was Koko-muka (the name of a species of veronica shrub); but from the end of the bush to its mouth it was "Kuri-nui" (Big Kuri). In some old maps it was misspelt Kaka-mokau. Little Kuri runs through the borough from the south-west. Its proper Maori name is Kuri-iti-mara ("the dog's little cultivation"). The first surveyors named the Little Kuri the Ouse River.

Southland Times, 28 June 1913, page 8

Roberts, in subsequent published correspondence, thanked Chapman for the information,[22] and by 1908 had changed his opinion (this time in the *Oamaru Mail* and later in the *Southland Times*, as on the left) to "In early days the name of the place was "The Kuri" (dog). The Maori name of the Big Kuri, as long as it ran among the hills, was Koko-muka (the name of a species of veronica shrub); but from the end of the bush to its mouth it was "Kuri-nui" (Big Kuri)."[23]

One of the earliest records of the name was made by explorer and surveyor Frederick Tuckett who in 1844 followed the course of the "Kauri" for some miles inland when walking northwards from Moeraki, and later his Maori guide referred to "the little & big Kaui"[24] – the unusual spelling of Kuri may be attributed to Tuckett's defective hearing which he mentioned at the time, though this spelling has also been used elsewhere[25] (example below).

At Moeraki Beach, gold of a very fine description is found in the sands of the seashore, mixed with iron-sand and fragmentary gems. Washing operations are now carried on opposite the town of Hampden, between the Big Kauri and Little Kauri streams. But the entire beach, as far as Shag Point, appears to consist of similar deposits. Gold, at the rate of 100 ounces to the ton, has been obtained from the clean-washed sand, and it would seem that if science and capital were brought to bear, a magnificent yield would be the result.

Otago Daily Times, 23 September 1862, page 6

[15] The last topographical map to show Big and Little Kuri was probably the 1978 edition of NZMS1, S146 Moeraki.
[16] Otago Witness 1861a, 1961b.
[17] New Zealand Gazetteer 2020.
[18] New Zealand Gazette 1984.
[19] Stevenson 1947.
[20] Roberts 1896a.
[21] Chapman 1896.
[22] Roberts 1896b.
[23] Roberts 1908; 1913; also reprinted in book form.
[24] Franklin 2005: 37, 39.
[25] For example, Otago Daily Times 1862.

A few years later in 1848 Walter Mantell while in the process of establishing reserves for the Kāi Tahu, had his surveyor Alfred Wills set aside a reserve of ten acres to provide timber for those at Moeraki, which he referred to in his diary as the "Kuri reserve", at the Kuri bush.[26] (The following year in an official report he advised the Governor of New Zealand (Sir George Grey) of the above but this time referred to it "a wood called Te Kuri".[27]

KURI BUSH, MOERAKI.

ACCOMMODATION HOUSE.

J. S. YOUNG begs respectfully to inform TRAVELLERS that he has opened the above HOUSE, which will be found to afford comfortable Accommodation to all who may favour him with their patronage.

Good Stabling, Oats, and Hay.

Otago Witness, 13 August 1859, page 2

In an 1853 letter to the Governor, Walter Mantell, now Commissioner of Crown Lands for Otago, urged the provision of allotments at Onekakara (Moeraki) and "Kuri Grove". He suggested that the first step would be to lay down a road from Onekakara to "the little Kuri (Winterbourne) across the Reserve to the fittest spot on the Big Kuri (Glyndebourne) for a bridge…" He also suggested that because the name Kuri occurred elsewhere in the Province that English names should be conferred,[28] presumably those he had given in parenthesis. The reply suggested choosing names distinguished in British history.

Hampden is marked on an 1856 map of the Province of Otago[29] and the name Hampden was being used locally around the same,[30] though Kuri Bush was also in use for the locality.[31] An editorial in the *Otago Witness* in 1860 referred, rather picturesquely, to "Hampden, on the Kuri" (extract on the left), and sections in the Township of Hampden were advertised for sale later that year.[32]

Oamaru is the first of a series of towns which will arise on our Northern seaboard: Hampden, on the Kuri, will next be open; then Moeraki and Waikouaiti.

Otago Witness, 10 November 1860, page 4

From 1861 Big Kuri was in common use (though one government report in 1871 rendered as the "Great Kuri"), but to revert to Maori sources two twentieth century publications are worth noting:

In *Lore and History of the South Island Maori* W. A. Taylor wrote "Te Kuri is the well-known stream at Hampden."[33] Taylor obtained much of his information by interviewing elderly Maori on cycling trips about the South Island, visiting and photographing historic sites.

Herries Beattie, a highly respected authority on Maori place names and allied matters who obtained information directly from informants in the early decades of the twentieth century, referred in his book *Maori Place-names of Otago* to a map of the South Island on which "best-informed elders" wrote place names including "Te Kuri" for the "well-known creek at Hampden".[34] This was without doubt the large size but small-scale "Taiaroa Map" reproduced in Beattie's posthumously published book *Traditional Lifeways of the Southern Maori*[35] on which TE KURI has been written a short distance north of the Moeraki headland. In the same publication Beattie refered to one of his informants pointing out Hampden as Te Kuri.[36]

In summary, Roberts' accounts appear to be somewhat confused and are not confirmed from other sources; Stevenson's information probably came from Roberts. All other available accounts from a variety of sources indicate that Te Kuri was the pre-European name of the locality now known as Hampden and/or the creeks that flow through it. It is suggested here that it is likely that the addition of 'Big' and 'Little' (initially sometimes without capitalisation) to 'Kuri' occurred around the time that Europeans first came into the area in order to differentiate between the two Kuri creeks. The supposition that Kurinui and Kuriiti were the original Maori names for these streams is not supported by the historical records, and cannot be justified on those grounds.

[26] Mantell 1848.
[27] Mantell 1849.
[28] Mantell 1853.
[29] Maling 1999.
[30] Otago Witness 1857.
[31] Otago Witness 1859.
[32] Otago Witness 1860a, 1860b.
[33] Taylor 1950: 102.
[34] Beattie 1944: 7.
[35] Beattie 2009.
[36] Beattie 2009: 576.

References

ARCHSITE, 2020. https://archsite.eaglegis.co.nz/NZAA/Site/Search. New Zealand Archaeological Association.

BEATTIE, Herries, 1944. *Maori Place-names of Otago.* Otago Daily Times Press, Dunedin. [Page 7 reference to a 1879 map of the South Island with "Te Kuri" hand printed for the creek(s).]

BEATTIE, Herries, 1954. *Our Southernmost Maoris.* Otago Daily Times Press, Dunedin. [Page 121 reference to a Maori track at Hampden.]

BEATTIE, James Herries, 2009. *Traditional Lifeways of the Southern Maori.* (Edited by Atholl Anderson.) Otago University Press, Dunedin. [Hampden referred to as "Te Kuri" on page 21 reproduction of 1879 map, and on page 576.]

BUNCE, M., WORTHY, T. H., PHILLIPS, M. J., HOLDAWAY, R. N., WILLERSLEV, E., HAILE, J., SHAPIRO, B., SCOFIELD, R. P., DRUMMOND, A., KAMP, P. J. J. and COOPER, A., 2009. The evolutionary history of the extinct ratite moa and New Zealand Neogene paleogeography. *Proceedings of the National Academy of Sciences of the United States of America*, [PNAS] 106(49): 20646–20651.

CANTERBURY MAPS, 2020. https://mapviewer.canterburymaps.govt.nz/?webmap= 9ac1f8370dfe4a44808bec8fb1dccb24. Environment Canterbury Regional Council.

CHAPMAN, Frederick, 1896. Letter to the Editor in response to Roberts 1896 in the *North Otago Times,* 9 March 1896, page 1. [Kuri is correct name for both streams.]

FRANKLIN, Gerald (ed), 2005. *The 1844 Expedition & Otago Survey, The Diary and Letters of Frederick Tuckett et al.* The Frenchay Tuckett Society. http://www.enzb.auckland.ac.nz/ document/?wid=5190&page=1&action=null [Page 37, 19 April 1844, reference to "Kauri".]

MALING, Peter B., 1999. *Historic Charts & Maps of New Zealand.* Reed Books, Auckland. [Plate 124 on page 277, an 1856 map of the Province of Otago showing Hampden.]

MANTELL, Walter B. D., 1848. *Outline Journal Kaiapoi to Otago 1848-9.* Alexander Turnbull Library, Wellington. [Typescript at http://ndhadeliver.natlib.govt.nz/delivery/ DeliveryManagerServlet?dps_pid=IE9226344 (MSX-8802_51.tif)]. [22 November 1848, reference to "Kuri reserve" and "Kuri bush".]

MANTELL, Walter, 1849. Report to the Governor of New Zealand, 30 January 1849. "Reports Relative to Land Purchases and the Condition of the Natives in the Middle Island" in *Appendix to the Journals of the House of Representatives 1858 Session I,* page 5. [https://paperspast.natlib.govt.nz/parliamentary/AJHR1858-I.2.1.4.3.]

MANTELL, Walter, 1853. Letter to the Governor suggesting allotments and road be established at "Kuri Grove", 12 July 1853. *Votes and Proceedings of the House of Representatives 1854 Session I-II*. [Downloaded from https://paperspast.natlib.govt.nz/parliamentary/votes-and-proceedings-of-the-house-of-representatives/1854/I-II/398.]

NEW ZEALAND GAZETTE, The, 1984. Government Printer, Wellington, Number 204, 8 November 1984, page 4798. [Notice of intention to assign place names Kurinui and Kuriiti by the New Zealand Geographic Board,]

NEW ZEALAND GAZETTEER, 2020. https://gazetteer.linz.govt.nz/place/2612. Land Information New Zealand. Number 155, page 3636. [Names Kurinui and Kuriiti assigned in 1985.]

OAMARU TIMES, 1868. "General Summary". *The Oamaru Times,* 4 August 1868, page 2. [Reference to "a stone and iron bridge over little Kuri Stream, at Hampden."]

OTAGO DAILY TIMES, 1862. Reference to "Big Kauri and Little Kauri streams." *Otago Daily Times,* 23 September 1862, page 6.

OTAGO WITNESS, 1857. Advertisement referring to Hampden Run. *Otago Witness,* 14 March 1857, page 3.

OTAGO WITNESS, 1859. Advertisement for an Accommodation House at Kuri Bush, Moeraki. *Otago Witness,* 13 August 1859, page 2.

OTAGO WITNESS, 1860a. Editorial referring to "Hampden, on the Kuri". *Otago Witness,* 10 November 1860, page 4.

OTAGO WITNESS, 1860b. Advertisement re Hampden sections for sale. *Otago Witness*, 22 December 1860, page 9.

OTAGO WITNESS, 1861a. Advertisement referring to Little Kuri River. *Otago Witness*, 2 March 1861, page 4.

OTAGO WITNESS, 1861b. Advertisement referring to Big Kuri Stream. *Otago Witness*, 5 October 1861, page 4.

PAPERSPAST, 2020. https://paperspast.natlib.govt.nz/newspapers. National Library of New Zealand.

REID, John, 1861. *General Plan of the Town of Hampden*. Drawn by John Reid from Official Surveys. https://ndhadeliver.natlib.govt.nz/delivery/DeliveryManagerServlet?dps_pid=IE18283315 [Creeks labelled Big Kuri River and Little Kuri River; two swamps at beach.]

RETROLENS, 2020. http://retrolens.nz/map/#/1428372.4714114785/4978130.841962899/1429679.066863618/4979118.551687689/2193/12 Local Government Geospatial Alliance [LINZ aerial mapping photographs taken in 1947, 1960, 1975.]

ROBERTS, W. H. S., 1896a. "North Otago Momenclature". Article in the *North Otago Times*, 4 March 1896, page 1. [Correct name for Big Kuri is "Kakomako".]

ROBERTS, W. H. S., 1896b. Letter to the Editor in the *North Otago Times*, 12 March 1896, page 1. [Response and thanks to Chapman's letter of 6 March 1896.]

ROBERTS, W. H. S., 1908. "The Nomenclature of Otago". One of a series of articles in the *Oamaru Mail*, 20 July 1908, page 4. [Correct name for Big Kuri is Koko-muka and Kuri-nui.]

ROBERTS, W. H. S., 1913. "Place Names of Otago and Southland". One of a series of articles in the *Southland Times*, 28 June 1913, page 8. [Essentially a reprint of Roberts 1908.]

SMITH, I. W. G., 1978. Site record form S146/16. [Now J42/31] ArchSite, New Zealand Archaeological Association.

STEVENSON, G. B., 1947. *Maori and Pakeha in North Otago.* A. H. & A. W. Reed Wellington. [Hampden on page 82.]

TAYLOR, W. A., 1950. *Lore and History of the South Island Maori.* Bascands Limited, Christchurch. [Page 103: "Te Kuri is the well-known stream at Hampden."]

TROTTER, Michael, 1951-55. Field Book 1, 1951-1955. Held by the Otago Museum, Dunedin.

TROTTER, Michael, 1955-58. Field Book 2, 1955-1958. Held by the Otago Museum, Dunedin.

TROTTER, Michael, 1959. Archaeological Investigations in North Otago. *New Zealand Archaeological Association Newsletter,* 2(3): 10-13.

TROTTER, Michael, 1959-65. Field Book 3, 1959-1965. Held by the Otago Museum, Dunedin.

TROTTER, Michael, 1965. Site record form S146/16, now metricated to J42/31. ArchSite, New Zealand Archaeological Association.

TROTTER, Michael, 1967a. Excavation at Hampden Beach, North Otago. *New Zealand Archaeological Association Newsletter,* 10(2): 56-61.

TROTTER, Michael, 1967b. Radiocarbon Dates from North Otago. *New Zealand Archaeological Association Newsletter,* 10(4): 137-142.

TROTTER, Michael, 1968. North Otago Archaeological Sites. *New Zealand Archaeological Association Newsletter,* 11(3): 94-102.

TROTTER, Michael, 1975. Archaeological Investigations at Redcliffs, Canterbury New Zealand. *Records of the Canterbury Museum* 9(3): 189-220.

TROTTER, Michael, 2009. *Hampden Prehistory*. Heritage New Zealand Archaeological Reports Digital Library. [A modified version was included in *Hampden* District, published 2012.]

TROTTER, Michael, 2012. Maori Clay Balls. *Archaeology in New Zealand,* 55(3): 167–170.

TROTTER, Michael, and MCCULLOCH, Beverley, 1989. *Unearthing New Zealand.* Government Printing Office, Wellington. [Second edition published in 1997 as *Digging up the Past – New Zealand's Archaeological History.* Viking, Penguin Books Ltd., Auckland.]

Appendix I

Detailed Site Investigation

Appendix J

Consultation Details

Department of Conservation
Te Papa Atawhai

18 May 2023

AECOM New Zealand Limited on behalf of Waitaki District Council
via email: helen.lawrence@aecom.com

Dear Helen

Request for Approval: s95E Resource Management Act 1991 – Beach Road Landfill remediation, Awamoa – 23 February 2023

I have considered your request for approval in terms of s95E of the RMA and am pleased to advise that I grant my approval as an affected person.

My approval is granted on the basis that the proposal is as described, is for the purposes described, and will have the effects on the Department of Conservation (Department)'s interests as described in the application dated 23 February 2023, and as also described in additional email communication dated 2 May 2023.

This approval is limited to the likely adverse effects of the proposal on the Department's interests and should not be construed as approval to effects on the environment generally.

This approval is specific to the above application and is for the purposes of s95E of the RMA only. It is not indicative of any associated concession or other statutory approval which may be required from the Department in regard to this proposal.

This approval will be rendered null and void if the proposal to which it refers is changed between the date of this approval and its consideration by the consent authority without referral back to me for my further assessment.

Please be advised that the original of this letter has been sent to the consent authority for their records.

If you have any questions regarding this approval, please contact Ranger Ben Davies via phone 0272663992 or email bedavies@doc.govt.nz

Yours sincerely

Elizabeth Anne Wallace
Operations Manager
Pursuant to delegated authority.

cc Manager Consents, Otago Regional Council

Department of Conservation *Te Papa Atawhai*
Ōtepoti / Dunedin Office
PO Box 5244, Dunedin 9058,
www.doc.govt.nz

From: Rebecca Jackson <Rebecca.Jackson@orc.govt.nz>
Sent: Friday, 14 April 2023 10:55 AM
To: Dave Hanan; Lawrence, Helen
Cc: Steve Clarke
Subject: RE: Beach Road Landfill Pre app

Hi all,

That is great if you can get DoC approval from the get go as it means we can discount the effect associated with them.

The draft application looks good. A few comments from me:

> I think given it is considered to be a significant coastal landscape the AEE should cover off natural character/ amenity effects in more detail. Furthermore I think more comment is needed around effects on air quality given consent is required for this activity.
>
> A further thought I have had around the consents already authorised. They allow for disturbance associated with placing rip rap for erosion protection. If disturbance of the CMA is required for the purposes of removing landfill material an additional consent would be required. I don't anticipate much more would be required in terms of an AEE however the objectives and policy assessment would need to be updated.

Hope this helps

Rebecca

From: Dave Hanan <dave@ghcconsulting.co.nz>
Sent: Thursday, 13 April 2023 2:06 p.m.
To: Rebecca Jackson <Rebecca.Jackson@orc.govt.nz>; 'Lawrence, Helen' <helen.lawrence@aecom.com>
Cc: Steve Clarke <sclarke@waitaki.govt.nz>
Subject: RE: Beach Road Landfill Pre app

Hi Rebecca
Thanks for taking the time to review it. The wider team and I are appreciative.

FYI, I have consulted with DoC who will sign the section 8A. They are keen to support a project that removes what is a very obvious environmental hazard. They are also pleased that an ecologist is on board to ensure that the site/s are penguin free before commencement.

I have also forwarded the document to Aukaha and I have been trying (4 times) to get the consents officer appointed to review the project to engage. So far they have yet to respond. However, I suspect since we have undertaken an archaeological assessment, and will be working under the accidental discovery protocol procedure, the project should also be received favourably.

Many thanks. We look forward to your feedback and a smooth consenting process.

Dave Hanan
Director and Principal Environmental Engineer
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1 Thomas Burns Street, Dunedin 9045, New Zealand

From: Rebecca Jackson <Rebecca.Jackson@orc.govt.nz>
Sent: Thursday, April 13, 2023 12:51 PM
To: Lawrence, Helen <helen.lawrence@aecom.com>
Cc: Steve Clarke <sclarke@waitaki.govt.nz>; dave@ghcconsulting.co.nz
Subject: RE: Beach Road Landfill Pre app

Hi Helen,

Terribly sorry somehow your email slipped through the cracks. I will review and get back to you by the end of the week.

Kind regards,

Rebecca

From: Lawrence, Helen <helen.lawrence@aecom.com>
Sent: Monday, 3 April 2023 11:30 a.m.
To: Rebecca Jackson <Rebecca.Jackson@orc.govt.nz>
Cc: Steve Clarke <sclarke@waitaki.govt.nz>; dave@ghcconsulting.co.nz
Subject: RE: Beach Road Landfill Pre app

Hi Rebecca,

We have worked through the majority of the draft for this application. It is currently with WDC to discuss with iwi, DoC and the adjacent landowners, and also to add details of the road system around the site in terms of the closure of part of Beach Rd. Attached is a draft of the AEE, with the majority of the appendices. If you/your team are still happy to review a draft it would be great to get any feedback you have.

Happy to talk through if that would be helpful.

Kind regards,

Helen Lawrence

Principal Environmental Planner, ANZ NZ
M +6427 605 2170
helen.lawrence@aecom.com

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From: Rebecca Jackson <Rebecca.Jackson@orc.govt.nz>
Sent: Thursday, 9 February 2023 1:01 PM
To: Lawrence, Helen <helen.lawrence@aecom.com>
Subject: RE: Beach Road Landfill Pre app

Hi Helen,

Attached is the archaeological assessment. Please sing out if you need anything else from me or have any other questions. As discussed we are happy to review a draft before it is lodged.

Thanks,

Rebecca

From: Lawrence, Helen <helen.lawrence@aecom.com>
Sent: Tuesday, 7 February 2023 4:26 p.m.
To: Rebecca Jackson <Rebecca.Jackson@orc.govt.nz>
Subject: RE: Beach Road Landfill Pre app

Hi Rebecca,

Thanks for your time on Friday for the pre-app, it was helpful to clarify things.

I have a bit of a random request – the coastal permit consents (RM11.079.01-03) included with the consent application an independent archaeological assessment. I have asked WDC if they have a copy of that assessment but they haven't been able to find it. Probably a long shot but just wondering if that report would be saved on the consent file at ORC?

Kind regards,

Helen Lawrence

Principal Environmental Planner, ANZ NZ
M +6427 605 2170
helen.lawrence@aecom.com

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From: Rebecca Jackson <Rebecca.Jackson@orc.govt.nz>
Sent: Monday, 23 January 2023 11:46 AM
To: Lawrence, Helen <helen.lawrence@aecom.com>
Cc: Steve Clarke <sclarke@waitaki.govt.nz>; Joon van der Linde <Joon.vanderLinde@orc.govt.nz>
Subject: Beach Road Landfill Pre app

Good morning Helen,

I have received your pre application meeting request to discuss the Beach Road landfills. I am happy to set up a TEAMS meeting at a time that suits your team to discuss the proposal. Could you please let me know a few dates and times that suit your team and I will see what works for us and book something in.

Kind regards,

Rebecca

Otago Regional Council

Rebecca Jackson
TEAM LEADER CONSENTS (ACTING)

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