Tikioki Property Coastal Protection

ENVIRONMENT IMPACT ASSESSMENT REPORT

10 December 2023

Prepared for:
Michael Connal
Report prepared by:
TURANGI Geotechnical Services

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DEFINITIONS AND LIST OF ABBREVIATIONS

Terms, abbreviations and acronyms	Meaning
CIIC	Cook Islands Investment Corporation
CIG	Cook Islands Government
CIPA	Cook Islands Ports Authority
CEMP	Construction Environment Management Plan
EIA	Environment Impact Assessment
EMP	Environment Management Plan
HSP	Health and Safety Plan
MMR	Ministry of Marine Resources
MSL	Mean Sea Level
NES	National Environment Services
NGO	Non-Government Organisations
TMP	Traffic Management Plan
TOR	Terms of Reference
ICI	Infrastructure Cook Islands

EXECUTIVE SUMMARY

This EIA Report has been prepared for **Mr Michael Connal**, to provide support with regards to coastal protection of the Tikioki property, following the events of the high seas and storm surge experienced in July 2022, the Tikioki property along with many adjacent foreshore properties along the eastern, southern and western side of Rarotonga, suffered extensive damage as a result of extreme wave run-up, causing inundation and scouring with significant loss of sand along the beach embankment, causing potential instability to the existing building foundations. The 2022 high seas cleared many vegetated foreshore areas leaving them vulnerable and expose to further erosion.

Discussions with government officials following the July 2022 high seas event, have advised the residence that there are plans in place to address this issue, However, the delays and continuous foreshore scouring has left Michael Connal and several others very concerned.

Cook Islands Meteorological Service and Emergency Management Cook Islands on the 27th April 2023 issued 'Wave Swell Warning' further highlight the continued risk, in addition the recent National Climate Outlook Forum held on the 20th November 2023, focused on the outlook for November 2023 to April 2024 (3 to 6 month period) covering the current El Nino event, namely; tropical cyclones, rainfall, air temperature, sea temperature and sea levels. It is forecasted that Rarotonga would anticipate 2 to 3 cyclones, with high probability of cyclones to occur in February (based on past cyclone events).

To ensure the protection of the Tikioki property and minimise further coastal erosion, Mr Michael Connal seek to privately fund the respective coastal protection works for the area.

The new proposed Rock Revetment Wall, comprise a total length of 18m long by 3m high, using volcanic basalt rock boulders ranging in size from 1.2 ton to 2.4 ton approximate weight. Competent and experienced contractor will be engaged to facilitate the rockwall construction.

This EIA Report adheres and makes reference to the report titled "Guidance for Coastal Protection Works in the Pacific Island Countries" prepared by the Pacific Region Infrastructure Facility (PRIF), in partnership with several regional agencies, and published in November 2017.

This EIA confirms that the effects of this proposal will not be significant. It is considered that with the implementation of the EMP, along with other management plans, that any potential effects of the proposal will be minimised.

1. INTRODUCTION

This Environmental Impact Assessment (EIA) report has been prepared to assess the impact for the construction of the Rock Revetment Foreshore Protection, for the Tikioki property.

This report will identify potential impacts, provide justification and also include measures to mitigate any negative impacts on the environment. Alternatives considered will also be explained.

The major findings of this report are based on qualitative and quantitative assessments from available resources, including site visits from July 2022 to November 2023. In brief the assessment methodology comprise; field data collected, consultation, desktop reviews, experience and professional judgement. This EIA has been produced in accordance with the Environmental Act 2003.

1.1. Proposal Proponent

Mr Michael Connal is a Cook Islander, local resident and land owner whom advocates for the coastal protection works.

1.1.1. Contact details for the proponent/project manager

All general enquiries are to be directed to the 'Project Manager', Michael Connal.

Contact Details:

- Name: Michael Connal
- Mobile: +682 76855
- Email: mihaelconnal58@gmail.com

1.2. Project Description

Coastal Protection

The preferred Coastal Protection methodology is the Rock Revetment Wall or otherwise referred to as Rockwall, the high porosity of the voids between each rock boulder following staking, together with the embankment slope, provide a form of wave energy dissipation reducing wave refraction and dispersing the extent of wave run-up across the property.

The new Rock Revetment Wall, comprise a total length of 18m long by 3m high, using volcanic basalt rock boulders ranging in size from 1.2 ton to 2.4 ton approximate weight, will be constructed along the property beachfront.

Along the top of the beach, above the general swash zone and embankment (eroded area) will be shaped to form a 1 in 1 slope. The revetment toe will be deepened to a minimum of 1.0m below current ground level or to the bedrock, to form a suitable revetment anchor-footing. A geotextile fabric layer will be placed first prior to the placement of rocks to prevent loss of fine materials.

Selective rocks will be placed first overlying the geotex cloth, appropriate ground markers will be used to ensure the design slope is maintained, and appropriate Rockwall thickness is achieved. The remaining rocks will be placed and positioned appropriately to ensure a sufficient semi-rigid rockwall is achieved, without any loose boulders. A raised crest of approximately 1m above current ground level is recommended to minimize wave over-topping.

An access paths of stairs and ramps will be constructed at a later stage to provide safe access over the rockwall.

Plant Equipment required comprise 20ton excavator, supported by a front end loader and bobcat. Permission will be sort from the neighboring property owners for machinery and rock haulage access.

Project Funding and Duration

The Coastal Protection Rockwall is to be privately funded by the proponent.

The total cost to supply and construct the Rockwall is estimated to range from $25k to $38k, with the construction of the Coastal Protection Rockwall to be completed within 5 working days, pending favorable weather and provided that the Contractor already has ample stockpile of rock boulders.

Construction Management

Where required, the Contractor with guidance from the Project Manager, and appointed Civil Engineer will prepare a Construction Environment Management Plan (CEMP), and a Health and Safety Plan for the construction period. The CEMP will include, but not be limited to a Traffic Management Plan (TMP).

These plans will be provided to the National Environment Authority for approval prior to construction commencing. Conditions stipulating the above are suggested as conditions of approval. Construction will be monitored by a suitably qualified engineer appointed by the proponent.

Traffic and Access

The Rockwall construction area is located away from the main road (Ara Tapu) and therefore poses little disturbance to general traffic flow in Tikioki, during the construction period.

The proposed Traffic Management Plan will address the general mobilization of heavy plant machinery including the delivery of rock boulders to the property.

Landowner consent for beach access will be obtained first, prior to any mobilizations to the property.

The contractor will minimise disruptions to the daily traffic peak times, typically in the mornings 7am to 9am and in the afternoon 2pm to 4pm.

The Contractor will apply appropriate measures to cordon off the construction area with barriers and signage. Access to the construction area will be restricted and closed off to the general public.

Work hours

Works will generally be undertaken between the hours of 7am and 5pm, Monday to Friday. Saturday work which does not create significant noise nuisance will be undertaken with the agreement of the local community.

Disaster Risk Management

Works will cease and all heavy plant machinery will be evacuated in the event of extreme weather events, following the emergency alerts issued by the Cook Island Meteorological Services and Emergency Cook Islands.

1.3. Project Objectives and Scope

At this stage, the primary objective is to provide for an immediate protection of the foreshore property with the construction of an 18m long Rock Revetment Rockwall.

The Coastal Protection project is to provide for:

- Reduce further erosion and strengthen the resilience of the foreshore property, providing appropriate climate-proofing to existing structures and terrain.
- Rock revetments are semi-rigid structures able to move under wave loading, allowing some energy to dissipate, often used for higher wave environments such as sandy beaches.
- Reduce impacts to the Environment and the Community.

The environment and social objectives of the project:

- All heavy plant machinery to operate within the designated Rockwall construction area, and not to other sensitive areas such as within the lagoon and neighboring beaches, especially those in use by swimmers.
- The new Rockwall is not to alter or retain the natural water flows, the permeable geotex fabric along with the Rockwall voids will retain sediments and allow natural flows, both surface and sub-surface water flows.
- A safe working environment for the contractors, and the community.
- A methodology that has appropriate plans in place to address potential hazards.

Alternatives

Two alternatives were considered:

1. Geosynthetic Container Revetment
2. Do Nothing

Geosynthetic Container Revetment

Geotextile containers (GSC) are commonly referred to as “geobags”. They comprise a geotextile pillow filled with sand. They have been widely used throughout the world. Commonly available sizes in Australia are 2.5 cubic metres (m3) and 0.75 m3, although smaller bags can be manufactured. Empty containers are light and can be transported readily; however, larger bags require filling frames and slurry pumps with mechanical plant to assist in placement.

The Geobags is an alternative coastal protection structure to the Rock Revetment.

Do Nothing

This highlights the consequences of not proceeding with the proposal, we would anticipate natural destructive processes to continue, continued erosion extending closer and closer to existing building structure while undermining trees and removing more sand.

Potential risk to the building, especially when the foundations are undermined and weaken, the building may therefore be deemed unsafe to live.

Economic impacts are also a potential risk, the building is also used to accommodate tourist, and a form of earning for the proponent, the inability to secure and protect the foreshore will certainly provide a negative tourism review for the Cook Islands as a whole.

1.4. Environment Impact Assessment (EIA) Process

1.4.1. Methodology of the EIA

The EIA process is an important planning and implementation process for any project that has the potential to significantly affect the environment.

The stages as they relate to this project are described below.

1) Application stage

August 2023 NES advised that the proposal was assessed under Section 36 of the Environment Act 2003, the outcome of the assessment determined that the project is likely to cause significant environmental impact, which puts the project in ‘Tier Three Activities’, and therefore an Environmental Impact Assessment (EIA) would be required.

The EIA Terms of Reference (ToR) provided by NES for similar coastal protection proposal forms the basis of this EIA Report.

2) Public notification stage

Section 36(5) of the Environment Act 2003 requires the EIA report be publicly notified so that interested or affected persons have the opportunity to provide feedback on the proposal. This formal public consultation period is for a 30 day period from the date the NES notifies the EIA report.

As public submissions are received, the NES will provide the applicant with the relevant matters raised, which are to be addressed and comments provided back to the NES.

3) Decision stage

Once the matters raised during the consultation period have been addressed by the applicant, the NES provides a recommendation on the proposal to the Rarotonga Environment Authority (REA) for their consideration and eventual decision. There are three possible outcomes:

1) The application is approved. The NES provides the applicant with an EIA Approval with conditions;

2) The application is deferred until the applicant has satisfactorily addressed issues raised by the REA; or

3) The application is declined.

1.4.2. Objectives of the EIA

The objectives of this EIA are to ensure that possible adverse environmental, social and economic impacts are identified and avoided, minimized or mitigated; and inform the public about the proposal and receive feedback.

1.4.3. Submissions

All submission is to be sent to NES, within the formal public notification period of 30 days. As public submissions are received, the NES will provide the proponent with the relevant matters raised, which are to be addressed and commented provided back to the NES.

1.5. Public Consultation

Recent community meetings held only addressed the Vaimaanga foreshore concerns, there has not been any public meeting specifically for Tikioki, however Michael Connal has met privately with neighboring landowners (family members) and gained positive support to carry out foreshore protection, especially for the vulnerable unprotected areas.

It is anticipated, that further consultation is expected during the 30 day Public Notification Stage.

1.5.1. Relevant Legislation and Policy Requirement

The National Environmental Services (Tu'Anga Taporoporo) are an organization, which is committed to ensuring the safety of people and the environment. Given the legal authority under the Environment Act 2003, Island Environment Authority will consent to carry out development in 'Specific Areas of Concern' provided that:

- Coastal development or any other environmental impacts have been accounted for and mitigated to both environmental and engineering standards.

The Environment Act 2003 stipulates and enforces Section 50 Part 8 – Protection of foreshore and Cook Island Waters.

1.5.2. Planning Process and Standards

The EIA is working to meet the requirements of the Environment Act 2003 and related National Environment Service process.

2. PROPOSAL NEED AND STANDARDS

2.1. Proposal justification

Coastal Protection

Coastal erosion is an ongoing and serious concern for coastal communities, made worst by the effects of climate change combine and other factors (no coastal management plans) which has accelerated the risk of erosion. Although Rarotonga has yet to encounter a cyclone since 2005, the 2022 July high seas is testament that events of this nature can produce similar damages.

The recent April 'Wave Swell' warning and the increased frequency of high seas, storm surges including the tropical depression impacts, are easily comparable to a tropical cyclone event.

This report focuses on 'protection', whereby the property, the existing building structures including the people are protected against the impacts of coastal erosion. Therefore it is prudent that a Rockwall or similar structure be constructed to provide protection to the foreshore.

Rock Revetments are considered as 'semi-rigid structures', they are able to move under wave loading, allowing some energy to be dissipated and for the structure to settle, as changes occur due to erosion or settlement, therefore often best suited to higher wave environments and to dynamic environments such as sandy beaches compared to rigid structures. Due to the flexibility of the outer layer, a filter layer is required to contain the fine land materials behind. This filter comprise smaller aggregate with a geotextile fabric, to form a barrier between the land and sea, with the armour providing protection to the filter from wave attack.

Rock revetments otherwise known as Armour Rock are well used around Rarotonga and in the Pacific, typically have long design lives and moderate construction cost, where materials are readily available. Cost increases when materials are to be transported over long distances to remote locations.

Environment Act 2003

The proposal to construct a Rock revetment gives support to the Environment Act, Part 8 Specific Areas of Concern – Protection of foreshore and Cook Island Waters.

Community Importance

Following the 2022 high seas event that impacted several foreshore communities including Tikioki, there is strong support for the protection of foreshore properties as supported by recent family meetings.

2.2. Alternatives to the Proposal

Alternative 1: 'Do nothing' approach

Doing nothing is not considered appropriate.

This highlights the consequences of not proceeding with the proposal, we would anticipate natural destructive processes to continue, continued erosion extending closer and closer to existing building structure while undermining trees and removing more sand.

Potential risk to the building, especially when the foundations are undermined and weaken, the building may therefore be deemed unsafe to live.

Economic impacts are also a potential risk, the property owner has invested a lot of money into the development of the property with a residential building, that is also used to accommodate tourist, a form of earning for the proponent, the inability to secure and protect the foreshore will certainly provide a negative tourism review for the Cook Islands as a whole.

Alternative 2: Geosynthetic Container Revetment

Geotextile containers (GSC) are commonly referred to as "geobags". They comprise a geotextile pillow filled with sand. Their use in Australia has been documented in Coghlan et al. (2009) and Hornsey et al. (2011). They have been widely used throughout the world. Commonly available sizes in Australia are 2.5 cubic metres (m3) and 0.75 m3, although smaller bags can be manufactured. Empty containers are light and can be transported readily; however, larger bags require filling frames and slurry pumps with mechanical plant to assist in placement.

Figure 1: Construction of Geobags at Avana in November 2011, photo 23/11/2020.

The inaugural construction using 0.75m3 Elcorock geotextile containers, to protect some 50m linear length of foreshore at the Avana Jetty, typically referred to as the Vaka Village in commemoration of the 1992 Festival of Pacific Arts.

The geobags is an alternative solution to the Rock Revetment Rockwall.

Coastal Protection Works Comparison

Protection Option	Social Impact	Environmental Impact	Estimated Cost	Design Life (years)	Suitability for Site
Rock Revetment – volcanic rocks	Rockwall ends causing scouring to adjacent properties. Rockwalls take up more space along the beach, in some cases restricting access.	Interruption to natural pathways of wildlife between the land and the sea. Rock boulder supplies are becoming more difficult on Rarotonga.	Slightly cheaper than Geobags, where rock boulders are sourced locally.	50 years	All wave climates (pending availability of larger rocks) Sandy and rocky foreshore.
Geocontainer - Geobags	Poor aesthetics, some prefer that the rockwall has a more natural look than the row of stacked geobags.	Potential for breakdown of synthetic materials such as geotextiles.	Geobags need to be procured from NZ or Australia.	10 year – single layer 20 years – double layer	Sandy and rocky foreshore (extra care to prevent damage from rocky seabed)

Information source for table above from PRIF 2018 Guidance for Coastal Protection Works report.

3. DESCRIPTION OF PROJECT DEVELOPMENT

3.1. Location of the site

The property is located along the southern foreshore of Rarotonga, within the Village of Tikioki, and is access directly from the Main Road (Ara Tapu).

The property sits adjacent to the iconic ‘Fruits of Raro’ a popular tourist area for snorkling within the Ngati-Raina Tikioki Raui (Marine Protection Area).

3.2. Staging

No staging required, as the construction of the 18m long Rock Revetment is anticipated to be completed within 5 working days, pending favourable weather.

3.3. Emergency management

In the event a natural disaster warning has been issued, being an approaching cyclone or tsunami, where possible, the contractor will removed off-site all machinery, equipment and loose construction material. If removal off-site is not achievable, then the contractor is to make secure all loose materials and equipment. Work will recommence once the respective authorities; Police and Emergency Management Cook Islands (EMCI) has issued the all clear notification.

Accidents and emergencies will be managed through the development and implementation of a Construction Management Plan with the necessary equipment and personnel training provided.

3.4. Infrastructure requirement

The construction of the Rock Revetment is some 20m away from the main road, away from major service utilities, such as TAU power line, Vodafone communication line and TTV water pipeline.

3.4.1. Transport

The relative small scale of the project will unlikely disrupt normal traffic movements in the Tikioki area. The contractor will ensure that all materials, equipment and machineries are delivered to the site outside of peak traffic hours, morning and afternoon.

3.4.2. Stormwater Drainage

There are no formed public drainage system running across the property, the natural sands are free draining.

The new Rock Revetment will include a geotextile fabric underlay, which will retain the sands and allow water to run through.

3.4.3. Mining of Materials

No materials will be mined from the site, all Rock Revetment materials will be imported to the property from the Contractor's stockyard.

4. ENVIRONMENT VALUES AND MANAGEMENT OF IMPACTS

Description of the Baseline Environment

4.1. Land

4.1.1. Description of Environmental Values

Impacts to the land in this area is considered low, as the objective of this proposal is to protect the foreshore from natural hazards, such as high seas and cyclones, reducing the ongoing loss of sand and sediments.

4.1.2. Soils

Geology

Reference has been made to the published report titled 'Geology of the Cook Islands, Bulletin N0. 82 prepared by the New Zealand Geological Survey, 1970'. The report along with the Geological Map of Rarotonga, indicates that the physiography of the site is 'Beach Ridge Deposits', described as **Muri Soils**.

4.1.3. Landuse/Characteristics

Land Tenure

The property is owned by Mr Michael Connal.

Landscape Characteristics

The landscape of the area comprise an existing building occupying a relatively level ground some 3m above mean sea level, with a beachfront along the southern property boundary.

4.1.4. Landscape Character

Land Use

The current land use of the property is both a residential and commercial purpose, the 'Titikaveka Club Pacific'.

The beach is openly used by all, the community and guest.

4.1.5. Potential Impacts and Mitigation Measures

The proposed Rock Revetment will not restrict access to the general public along the beach.

The construction of the Rock Revetment will ensure the land is maintained and further erosion is minimised.

4.1.6. Landuse Suitability

The significant landuse change will be the new Rock Revetment which is suitable for the protection of the foreshore property.

4.1.7. Land Contamination

All waste generated during the installation phase will be removed from the site on a daily basis. No heavy plant machinery will operate within the lagoon waterways.

4.2. Water Resource & Quality

4.2.1. Description of Environmental Values

For almost a decade, the Ministry of Marine Resources (MMR) has been undertaking water quality analysis for Rarotonga lagoons and streams, the water quality monitoring is also undertaken on selected outer islands.

MMR captures water quality information into three main sections:

1. **Nutrients**, the testing parameters include; temperature, salinity, dissolved oxygen, pH, and nitrates and orthophosphates that are the primary nutrients responsible for eutrophication.
2. **Bacteria** levels (i.e., Enterococci and Enterolett bacteria) are also monitored to determine the levels of faecal matter entering the lagoon.
3. **Water Clarity** levels are also monitored, the parameters comprise Total Suspended Solids (TSS) and Chlorophyll a.

The water quality samples are tested at the MMR lab, with results included in the Rarotonga Water Quality Reports and Report Cards, these are available on the MMR website www.mmr.gov.ck.

LEVEL		RECOMMENDED STANDARDS USED		
		Dissolved Oxygen (%)	Enterococci (MPN/100mL)	Suspended Solids (mg/L)
Excellent	A	> 95	< 41	< 1.0
Very Good	B	90 ≥ 95	41 ≥ 100	1.0 ≥ 2.5
Good	C	80 ≥ 90	100 ≥ 200	2.5 ≥ 5.0
Poor	D	60 ≥ 80	200 ≥ 350	5 ≥ 10
Very Poor	E	40 ≥ 60	350 ≥ 500	10 ≥ 20
Extremely Poor	F	< 40	> 500	> 20

Figure 2: MMR water quality grading scale and parameters used.

The nearest MMR water quality monitoring site to the property is **Tikioki Packing Shed – RAM06**. Located along at the Tikioki Hotel, commonly referred to as the Sheraton Resort. The Papua Stream runs along this area.

In summary, the water quality results (based on the 2021 Rarotonga Water Quality Report)) for the Tikioki area (nearest monitoring station is Tikioki Packing Shed site id RAM06) indicates the following:

1. Dissolved Oxygen are 'Poor'
2. Enterococci are 'Excellent'
3. Suspended Solids are 'Poor'

4.2.2. Potential Impacts and Mitigation Measures

The potential impacts are considered low as the Rockwall will be built above the existing mean high water mark and will not disturb any natural water flows into the receiving lagoon.

The contractor will comply with the Environment Management Plan for mitigation measures.

4.3. Waste

4.3.1. Description of Environmental Values

Construction of the Rock Revetment

Low waste volumes is expected during the construction stage, as this will comprise typical packaging and empty containers which will all be removed off site.

Rock Revetment

The new Rockwall will not generate waste, long-term regular inspection and maintenance will be required.

4.3.2. Potential Impacts and Mitigation Measures

All waste generated will be removed, at the end of each working day and no waste to remain at the completion of the works, the contractor is responsible for maintaining a waste free and tidy site.

No solid waste, either generated or imported to be disposed in any landfill on the coastal property. All solid waste is to be carted offsite at the end of each day.

No landfill or disposal areas permitted in the area.

4.4. Social

4.4.1. Description of Environmental Values

The Tikioki beachfront is enjoyed by all beach users, the timing of the Rockwall construction is to coincide with the tourist off-peak, and preferably before the anticipated cyclone season, estimated to occur in February.

The Tikioki beach is typically used for recreation activities (swimming and sun bathing), kayaking, fishing, and health-fitness.

4.4.2. Potential Impacts and Mitigation Measures

The project manager along will advise the general public with regards to the commencement of the project, via social media, local newspaper and other suitable media outlets, the start date and expected completion date.

The contractor will apply site safe practises to ensure the safety of both the general public and the workers. Appropriate safety signs will be installed around the project site, along with barrier fencing and caution tape.

The contractor will abide to the Environment Management Plan, to ensure that safety to the public is maintained at all times and disruptions to the Tikioki traffic are kept to a minimum.

4.5. Health and Safety

4.5.1. Description of Environmental Values

The general public, most notably the Tikioki community and guest actively enjoy the beachfront.

4.5.2. Potential Impacts and Mitigation Measures

The Project Manager will ensure that the contractor implements the activities of the health and safety measures as stipulated in the environment management plan.

For the construction period, a complete first aid kit is to be made available at all times, and its location made known to all. The contractor will familiarise to the location of the nearest ‘Automated External Defibrillator’ AED machine, and identify whom has first aid certificate.

All accidents encountered during the installation phase is to be recorded, discussed and included in the contractors progress reporting.

All contractors are to wear the appropriate ‘Personal Protective Equipment’ (PPE), a minimum of a safety boot and reflective vest. When working under machinery or under objects, appropriate hard-hat is required. Protective Ear-muff to be worn when working with excessive noise power tools, or nearby a loud noise source (generator).

4.6. Economy

4.6.1. Description of Environmental Values

Tourism contributes over 60% to the total GDP of the Cook Islands, prior to the covid pandemic arrivals were in excess of 180k for 2019. The government has since relax covid restrictions and allowed ease of access into the Cook Islands, visitor arrivals were reduced to 30k for 2020 and 2021, with slight increase expected for 2022 (source https://www.mfem.gov.ck/statistics/social-statistics/tourism-and-migration)

Several tourist accommodations occupy the Tikioki beachfront, the 'Fruits of Raro' is an iconic tourist attraction providing snorkling with fishes in the Raui (marine protection area) and are usually filled by tourist during the peak tourist season, with positive reviews gained over the years.

It is Rarotonga; friendly hospitality, unspoilt natural beauty and simplicity are some values that attracts tourism, however, detrimental foreshore erosion would certainly influence negative experience to visitors.

The new Rock Revetment will complement the natural surrounds and provide for a robust coastal protection structure, strengthening the resilience to climate change impacts, further minimising the impact to the economy.

4.6.2. Potential Impacts and Mitigation Measures

The new Rockwall will ensure the foreshore property, the land and building is protected. To maintain active economic growth of the Tikioki area.

4.7. Hazards and Risks

4.7.1. Description of Environmental Values

In 2022, Rarotonga has experienced several natural hazards, namely:

- January mini-tsunami resulting from Tonga's volcanic eruption, the surging waves caused minor-damages to boats moored at both the Avarua and Avatiu Harbour.
- January tropical depression TD05F, the week-long elevated tides and surging waves caused substantial damages along the northern to eastern coastline of Rarotonga.
- July extreme high seas event, a similar week-long elevated tides and surging waves caused further coastal damages, with the worst affected areas along the southern to eastern coastline.

The increase frequency of high seas induce storm surge along the Rarotonga foreshore contributes to ongoing erosion issues.

4.7.2. Potential Impacts and Mitigation Measures

Unprotected foreshore is vulnerable to the impacts of natural hazards, such as high seas and cyclones.

The new Rock Revetment serves to provide an effective coastal protection structure, especially for the vulnerable areas.

4.8. Erosion Control

4.8.1. Description of Environmental Values

Active foreshore erosion is ongoing for the Tikioki property, with extreme scouring occurring during high seas events. Eroded sand and sediments from the property are deposited into the nearby lagoon, regularly covering the corals, impacting the lagoon biodiversity.

4.8.2. Potential Impacts and Mitigation Measures

The geotextile fabric layer incorporated into the Rock Revetment will overlay the placement of rocks to prevent loss of fine materials.

Preference for the Rockwall construction to be carried out during fine weather, and not during heavy rainfall events.

Where required, temporary silt fences may be installed to retain sediments and prevent scouring at selective locations, as deemed appropriate by the Civil Engineer.

5. ENVIRONMENTAL MANAGEMENT

5.1. Purpose of this Plan

The purpose of the EMP is to provide for the protection of the environment during the proposed works and to minimize potential adverse environmental, social and economic effects that cannot be avoided. This EMP will be used by the Contractor to prepare a detailed Construction EMP, which will be used throughout the proposed works.

5.2. Environmental objective

To undertake the proposed works in compliance with the conditions of approval, in keeping with the principles of the Environment Act and avoiding wherever possible any significant negative environmental impacts, whether covered by plans and approvals, or not.

5.3. Environmental policies

General environmental principles shall be:

- Installation of the new wastewater treatment works and activities will not commence until the EIA and CEMP has been approved;
- Installation of the new wastewater treatment works will be undertaken in compliance with all current legislation and any conditions imposed on the EIA Approval;
- The new wastewater treatment works will utilize the best practicable options to ensure adverse environmental effects are avoided, remedied or mitigated.
- Social disturbance as a result of the project will be minimized as far as practicable.
- Areas outside the bounds of permanent works, which were developed or altered in any way, shall be reinstated to the condition as at commencement of the Contract.

5.4. Table 1 Summary of Potential Impacts, Mitigation Measures, Monitoring and Responsibilities

Environmental Issue	Mitigation Measures	Locations	Timeframe	Implementation	Monitoring Parameter	Monitoring Frequency	Monitoring Responsibility	Supervision
Impacts on landscape and visual amenity values	Following the completion of the Rockwall, the area will be landscaped and planted with appropriate vegetation, such as the vetiver grass.	Tikioki Property	1 Week (5 working days)	Contractor	Visual inspection	Daily observations	Contractor Site Supervisor	Project Manager
Dust nuisance	Important that the cartage of rocks to the site, that all rocks are appropriately cleaned without dust before delivery to the site.	Tikioki Property	1 Week (5 working days)	Contractor	Visual inspection Feedback /complaints received	Daily monitoring at the contractor stockyard	Contractor Site Supervisor	Project Manager
Excessive noise during construction.	Ensure construction during normal working hours 7am to 5pm Monday to Friday. Maintain ongoing communication with the local community.	Tikioki Property	1 Week (5 working days)	Contractor	Construction Feedback /complaints received	Daily observations	Contractor Site Supervisor	Project Manager
Health and Safety	All personal to wear at all times Personal Protection Equipment (PPE). Health & a safety is reiterated at every toolbox meeting, first aid is available on site at all times.	Tikioki Property	1 Week (5 working days)	Contractor	Toolbox meeting records.	Daily observations	Contractor Site Supervisor	Project Manager

Environmental Issue	Mitigation Measures	Locations	Timeframe	Implementation	Monitoring Parameter	Monitoring Frequency	Monitoring Responsibility	Supervision
Site Hazards	Appropriate signage and barriers are installed (where required) to restrict general public entry into the construction area. The contractor will ensure there is a dedicated spotter whom is responsible for overseeing both the movement of heavy plant machinery and the general public.	Tikioki Property	1 Week (5 working days)	Contractor	Toolbox meeting records.	Daily observations	Contractor Site Supervisor	Project Manager
Erosion Control	Install and maintain appropriate erosion control devices, such as silt fences (where required).	Tikioki Property	1 Week (5 working days)	Contractor	Toolbox meeting records.	Daily observations	Contractor Site Supervisor	Project Manager
Emergency management	Once a hazard warning has been issued or made known, all work will cease, all machinery, equipment and material removed off-site. Work to recommence once all clear notification is issued.	Tikioki Property	Pending the duration of the hazard.	Contractor	Notification reports.	Hazard observations	Contractor Site Supervisor	Project Manager
Stormwater Drainage	No drainage formation required.	Tikioki Property	1 Week (5 working days)	Contractor	Toolbox meeting records.	Daily observations	Contractor Site Supervisor	Project Manager

Environmental Issue	Mitigation Measures	Locations	Timeframe	Implementation	Monitoring Parameter	Monitoring Frequency	Monitoring Responsibility	Supervision
Mining of Materials.	No materials to be mined from the site.	Tikioki Property	1 Week (5 working days)	Contractor	Toolbox meeting records.	Daily observations	Contractor Site Supervisor	Project Manager
Waste generated during the installation period.	All waste materials to be removed off site at the end of each working day. No landfill or disposal areas permitted in the area.	Tikioki Property	1 Week (5 working days)	Contractor	Progress reports.	Daily observations	Contractor Site Supervisor	Project Manager
Water resource and quality.	No heavy plant machinery to operate within the lagoon waterways.	Tikioki Property	1 Week (5 working days)	Contractor	Progress reports.	Daily observations	Contractor Site Supervisor	Project Manager
Tikioki traffic.	A traffic management plan will be develop, and implemented. No main road closure at any time. No delivery of materials during peak traffic times.	Tikioki Property	1 Week (5 working days)	Contractor	Complaints received.	Daily observations	Contractor Site Supervisor	Project Manager

6. CONCLUSIONS AND RECOMMENDATIONS

6.1. Conclusion

This EIA application by Mr Michael Connal, for approval by NES to construct a Rock Revetment to provide coastal protection to the Tikioki foreshore property.

The environment and social objectives of the project:

- A Rockwall that does not discharge harmful contaminants directly into the receiving waterways.
- A Rockwall that is appropriate to address adverse natural hazard events, able to withstand high seas and coastal inundation.
- A Rockwall that does not restrict public access along the beach, easily maintained and safe.
- A safe working environment for the contractors, and the community.

The key phases of the project comprise:

1. Mobilizing of heavy plant machinery, equipment and rock materials to the Tikioki property.
2. Preparation and cordon off construction area from the general public.
3. Construction of the Rockwall.
4. Final inspection following completion works.
5. Demobilization from the Tikioki property.

This project is necessary to protect the vulnerable foreshore and strengthen the resilience to adverse climate impacts, high seas and cyclones. This project will have a positive effect on the economy and improve well-being of both the community and visitors to Rarotonga.

An updated Environment Management Plan will be prepared and made available to NES prior to works commencing. It is considered that with the implementation of the Plans, the potential adverse effects of the proposal on the environment, social values and the economy will not be significant. The project will be undertaken within the Tikioki property area. The methodology of works has been used in previous projects of a similar nature around Rarotonga without causing detrimental environmental effects.

6.2. Recommended Conditions of Approval

In addition to NES standard conditions of approval, the following are some suggested conditions of approval, based on mitigation measures proposed throughout this EIA:

- The construction of the Rock Revetment to be carried out by an experienced, competent and reputable contractor, with supervision by a NES registered Civil Engineer.
- The updated technical drawings is to be made available to NES prior to work being carried out.
- A practical completion report is to be made available to NES within 10 days following the completion of the tertiary system installation.
- All machinery shall be operated away from the adjacent waterways, so that any contaminant such leaking fuel or oil does not enter the coastal marine area.
- On-going consultation with the Tikioki community will be facilitated as required. Progress reports will be released to the public via social media.

7. STUDY TEAM

The following professionals contributed to the development of the EIA Report.

Name	Qualifications	Key Experience
Paul Teariki Maoate	Masters in Business Administration NZ Certificate in Civil Engineering Graduate Certificate in Ridge to Reef Sustainable Development	Experience in Geotechnical, Coastal and Three Waters Engineering. Member of the Institute of Professional Engineers Cook Islands

8. REFERENCES

Wood, L.B. & Hay R.F. 1970. Geology of the Cook Islands. NZDSIR Geological Bulletin Report.

USP, Pacific Centre for Environment and Sustainable Development, 2015, Coastal Protection – Best Practices in the Pacific.

PRIF, Pacific Region Infrastructure Facility, 2017, Affordable Coastal Protection in the Pacific Islands.

PRIF, Pacific Region Infrastructure Facility, 2018, Guidance for Coastal Protection Works in the Pacific Islands.

Appendix A

National Environment Services
EIA Terms of Reference

TERMS OF REFERENCE (TOR) FOR AN ENVIRONMENTAL IMPACT ASSESSMENT (EIA) REPORT

TIKIOKI RESIDENTIAL

COASTAL PROTECTION

Tikioki

Takitumu

Rarotonga

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A3 Study Team
A4 Consultation Report
A5 Specialist Studies
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Part A. Information and Advice on the preparation of the EIA.

1. Introduction

This document forms the Terms of Reference (TOR) for an Environmental Impact Assessment Report (EIA) for the Cook Islands Project. The objective of the TOR is to

identify those matters that should be addressed in the EIA report. The TOR is based on the outline of the proposed proposal given as part of the application and also the National Environment Service's (NES) own assessment of the project site.

In order to clarify the nature and level of investigations that are envisaged in the TOR, the proponent may consult further with relevant stakeholders, ie. Government representatives and authorities, community interest organisations and groups to participate in the process especially during the preparation of the EIA to ensure that all matters as conveyed in the TOR are addressed.

An executive summary should be provided in the EIA and be able to be provided separately for public information.

2. EIA Objectives

The objective of the EIA is to identify potential environmental, social and economic impacts of the proposal and to ensure that adverse impacts are avoided where possible. Consistent with this objective, the EIA should be a self-contained and comprehensive document containing sufficient information to make an informed decision on the potential impacts. This document should provide:

- *for interested bodies and persons*: a basis for understanding the proposal, alternatives and preferred solutions, the existing environment that would be affected, both on and off the site, the impacts that may occur, and the measures to be taken to mitigate all adverse impacts.

- *for groups or persons with rights or interests in land*: an outline of the effects of the proposed proposal on that land, including access arrangements.

- *for government decision makers*: a framework against which decision-makers are able to consider the environmental aspects of the proposed proposal in view of legislative and policy provisions and provide sufficient information to decide whether the proposal can proceed; OR as appropriate, set conditions for approval to ensure environmentally sound development and, where required by legislation, recommend an environmental management and monitoring program.

- *for the proponent*: a definitive statement of measures or actions to be undertaken to minimise any adverse impacts during and following the implementation of the proposed proposal. A draft Environmental Management Plan (EMP) that describes acceptable impacts and environmental management strategies to agreed performances criteria is the recommended means of achieving this objective.

The proponent is required to address the TOR to the satisfaction of the National Environment Service and the completion of the EIA does not mean that the proposal will necessarily be approved.

The EIA should be a standalone document and it should contain sufficient information and other appended studies/surveys to avoid the need to retrieve previous reports.

3. Stakeholder Consultation

To facilitate the assessment process, the proponent is strongly encouraged to regularly consult with relevant/appropriate stakeholders throughout the EIA process.
It is the responsibility of the proponent, in consultation with appropriate stakeholders, to identify legislation, policies and methodologies relevant to the EIA process, and to determine the appropriate parts of the community to be consulted. Copies of the EIA shall be provided to the community and, on request, to relevant individuals with an interest in the proposal.

4. General EIA Format

The EIA should be written in a format matching the TOR. The EIA must include appendices containing at least the following:

- a copy of this TOR
- a list of persons and agencies consulted during the EIA with their contacts
- the names of, and work undertaken by, all personnel involved in the preparation of the EIA.

Maps, diagrams and other illustrative material should be included in the EIA.
The EIA should be produced on A4 size paper capable of being photocopied, with maps and diagrams on A4 or A3 size. An electronic copy of the EIA should also be submitted to the National Environment Service for display on the NES website during the consultation period of the project

Part B. Content of the EIA.

(It is strongly recommended that the Environmental Impact Assessment (EIA) Report follow the heading structure of the Terms of Reference (TOR))

EXECUTIVE SUMMARY

The Executive Summary should be written as a standalone, able to be reproduced on request and distributed to interested parties who may not wish to read or purchase the EIA as a whole. The structure of the Executive Summary should generally follow that of the EIA but focus on key issues to enable the reader to obtain a clear understanding of the proposal and its potential adverse and beneficial environmental, social and economic impacts and the management measures to be implemented by the proponent to mitigate all residual impacts.

The Executive Summary must include:

- the title of the proposal;
- name and contact details of the proponent, and a discussion of previous projects undertaken by the proponent and their commitment to effective environmental management;
- a concise statement of the aims and objectives of the proposal;
- the legal framework, decision-making authorities and advisory agencies;
- an outline of the background to and need for the proposal, including the consequences of not proceeding with the proposal;
- an outline of the alternative options considered and reasons for the selection of the proposed development option;
- a brief description of the proposal (pre-construction, construction and operational activities) and the existing environment, utilising visual aids where appropriate;
- an outline of the principal environmental impacts predicted and the proposed environmental management strategies (including waste minimisation and management) and commitments to minimise the significance of these impacts.

GLOSSARY OF TERMS

A glossary of technical terms, acronyms and abbreviations should be provided.

1. INTRODUCTION

The function of the introduction is to explain why the EIA has been prepared and what it sets out to achieve. In particular, the introduction should address the level of detail of information required to meet the level of approval being sought (for example, whether the proponent is seeking only a preliminary approval or a full approval from NES).

1.1 Proposal Proponent

Provide details of the proposal proponents, including details of any joint venture, if any.

1.2 Proposal Description

A brief description of the key elements of the proposal should be provided and illustrated. Any major associated infrastructure requirements should also be summarised. A brief description should be provided of studies or surveys that have been undertaken for the purposes of developing the proposal and preparing the EIA. This should include reference to relevant baseline studies or investigations undertaken previously.

1.3 Proposal Objectives and Scope

A statement of the objectives which have led to the development of the proposal and a brief outline of the events leading up to the proposal's formulation, including alternatives, envisaged time scale for implementation, anticipated establishment costs and actions already undertaken within the proposal area. Describe the current status of the proposal and outline the relationship of the proposal to other developments or actions that may relate whether or not they

have been approved. The consequences of not proceeding with the proposal should also be discussed.

1.4 Environmental Impact Assessment (EIA) Process

The purpose of this section is to make clear the methodology and objectives of the environmental impact assessment under the relevant legislation.

1.4.1 Methodology of the EIA

This section should provide a description of the EIA process steps, timing and decisions to be made for relevant stages of the proposal. This section should also indicate how the consultation process (which will be described in detail in section 1.5) would integrate with the other components of the impact assessment, including the stages, timing and mechanisms for public input and participation.

The information in this section is required to ensure:

- that relevant legislation is addressed;
- readers are informed of the process to be followed;
- that stakeholders are aware of any opportunities for input and participation.

1.4.2 Objectives of the EIA

While the TOR provides guidance on the scope of the information requested for the proposal, the TOR should not be seen as exhaustive or limiting. It is important for proponents and their consultants to recognise that there cannot be perfect knowledge in advance of undertaking an EIA of what the EIA studies may find.

In addition, it is essential that the main text of the EIA should address all relevant matters concerning environmental values, impacts on those values and proposed mitigation measures. No relevant matter should be raised for the first time in an appendix or the draft environmental management plan (EMP).

The EIA is a public document. Its purpose is not only to provide information to regulatory agencies, but also to inform the public of the scope, impacts and mitigation measures of the proposal. As such the main text should be written in plain English avoiding jargon as much as possible. Additional technical detail may be provided in appendices. The main text should not assume that a reader would have a prior knowledge of the proposal site. It should not be necessary for the reader to have visited the site to understand the issues involved in the proposal.

In brief, the EIA objectives should be to provide public information on the need for and likely effects of the proposal, to set out acceptable standards and levels of impacts (both beneficial and adverse) on environmental values, and demonstrate how environmental impacts can be managed through the protection and enhancement of the environmental values. Discussion of options and alternatives and their likely relative environmental management outcomes is a key aspect of the EIA.

The role of the EIA in providing the proposal's draft EMP should also be discussed, with particular reference to the EMP's role in providing management measures that can be carried over into conditions that would be attached to NES approval.

1.4.3 Submissions

The reader should be informed as to how and when public submissions on the EIA will be addressed and taken into account in the decision-making process.

1.5 Public Consultation

It is recommended that an open community consultation process be carried out in addition to the legislated environmental impact assessment process. Copies of the draft EIA will be provided to all relevant stakeholders and individuals with an interest in the proposal.

Public consultation should commence as early as possible especially in **Tikioki Community,** and should be comprehensive and promote discussion on all aspects of the proposal including strategic decision making and design. It may include interviews with individuals, public meetings, interest group meetings, production of regular summary information and updates, and other consultation mechanisms to encourage and facilitate active public consultation.

The public consultation process should identify broad issues of concern and provide information to local community and specific interest groups. Consultation should have a specific focus on impact identification and mitigation of adverse social, economic and environmental issues, and it should directly inform all other relevant components of the EIA (particularly social impact analysis).

Details of the public consultation process and the major issues emerging from that process should be clearly addressed in the EIA. The consultation process should be integrated with the social assessment component of the EIA. Matters which become apparent through the consultation process such as community conflict or concerns which derive from fears about impacts from the proposal on the natural environment should be included in the social impact assessment section of the EIA.

1.5.1 Relevant Legislation and Policy Requirement

This section should explain the legislation and policies controlling the approval process. Reference should be made to the Environment Act 2003 and other relevant Cook Islands laws relevant to the proposal.

This information is required to assess how the legislation applies to the proposal, which agencies have jurisdiction, and whether the proposed impact assessment process is appropriate

1.5.2 Planning Process and Standards

This section should discuss the proposal's consistency with existing land uses or long-term policy framework for the area, if any, and with legislation, standards, codes or guidelines available to monitor and control operations on site.

2. PROPOSAL NEED AND STANDARDS

2.1 Proposal Justification

The justification for the proposal should be described, with particular reference made to the economic and social benefits, including employment and spin-off business development, which the proposal may provide.

2.2 Alternatives to the Proposal

This section should describe feasible alternatives especially in terms of the sites and designs. For example if the **Tikioki Community** are not in favour of the proposed site, will there be any alternative site for the project OR are there any alternative designs if the community asked for other alternative designs? Such alternatives, if any, should be discussed in sufficient details to enable full understanding of such options.

3. DESCRIPTION OF PROPOSAL/DEVELOPMENT

3.1 Location

This section should describe the local context of the proposal and associated infrastructure and illustrated on maps at suitable scales, including identification and potential impacts on surrounding land uses. Real property descriptions of the proposal site should be provided. This section shall also demonstrate how the proposal relates to the **Tikioki** village and the **Takitumu District** as a whole.

Maps should show the precise location of the proposal area, and in particular the location and boundaries of land tenures, in place or proposed, to which the proposal area is or will be subject

The following information should be provided for all components of the proposal:

- distances to boundaries of land resumptions;
- slopes and elevations;
- site drainage and erosion controls;
- proposals for rehabilitation, if any;
- access arrangements, daily traffic generated, and internal roads.

3.2 Staging

Details of the likely staging of the proposal and timing of the staging are required, if any. A plan showing the likely sequencing of such development stages for the project should be incorporated and indicate the natural features to be retained

during the stages and management measures to maintain the natural features during these stages.

The staging of the project should be described and illustrated showing approximate site boundaries, development sequencing and timeframes. The estimated numbers of people to be employed during the life of the project should also be provided.

3.3 Emergency Management

In relation to emergency management, provide:

- details of emergency management plans to be put in place during construction, including procedures and notifications;
- emergency access provisions;
- an assessment of the potential disruption to community utility networks (i.e., water, electricity);
- details as to any permanent and/or temporary road closures or vehicle limitations to existing public road access.

3.4 Infrastructure Requirement

This section should provide descriptions, with concept and layout plans, of requirements, if any, for constructing, upgrading or relocating all infrastructures required supporting the proposed development

The matters to be considered include such infrastructure as roads (traffic), pedestrian pathways, and power lines and other cables, telecommunications, water etc.

3.4.1 Transport

Describe:

- existing road infrastructure Airport Infrastructure and all other infrastructure contained within the reserves within of the site boundaries, including private roads and public roads which are disrupted or expected to be used by construction employees especially for the transportation of materials to the site during construction and operational phases for each stage of development;

Information should also be provided on road transportation requirements on public roads for each of the proposed stages, including:

- Connectivity from the proposed development site to the existing main road. It is anticipated that the proposed scale of development will disrupt normal traffic movements at the **Tikioki** area;

- The volume, composition (types and quantities), origin and destination of goods to be moved including construction materials, plant, wastes, hazardous materials , if any;
- The volume of traffic generated by workforce personnel, visitors and service vehicles;
- Details of vehicle traffic and transport of heavy and oversize indivisible loads (including types and composition);
- Any alternate proposal for relocation or realignment of access to the project site which will surely be disrupted by heavy transportation during the construction process;

3.4.2 Storm Water Drainage

A description should be provided especially to the existing storm water drainage system in the area. The EIA should indicate the sources of the drainage water, e.g. wetlands, road and the potential quality and location of discharge to the lagoon.

Surface water runoffs will also collect on site especially at times of construction therefore will there be any new drainage to be done for that?

− Storm water collection/drainage systems.

- A detailed environmental management plan that sets out the framework for management and mitigation of environmental impacts including contingencies for managing system failures and incidents.

- A description of any potential releases of contaminants, the environmental impacts and the actions that will be taken to prevent the likelihood of environmental harm.

3.4.2 Mining of Materials

A description should be provided especially to identify the existing materials present in the area. The EIA should indicate the sources of where the materials will be mined, the amount of materials that will be mined for the project.

- The general location of the area of which the material will be mined (e.g. Maps, Design etc.)
- A detailed environmental management plan that sets out the framework for management and mitigation of environmental impacts including contingencies for managing system failures and incidents.
- Any alternate source sites for mining if the proposed site is not enough to complete the work.
- Indicate what equipment's or machinery will be used to carry out the mining phase.
- A description to be provided as to how the mined site will be restored to its natural state after the project is complete.

3.5 Waste Management

3.5.1 Character and Quantities of Waste Materials

Provide an inventory of wastes, likely to be generated by the proposal and methods of disposal having regard to the best practice waste management strategies. In particular, identify proposals for waste avoidance, reuse, recycling, treatment and disposal in the appropriate sub-section below.

3.5.2 Solid Waste Disposal

In general terms describe the proposed location, site suitability, dimensions and volume of any landfill/disposal site requirements for solid wastes generated by the proposal.

4. ENVIRONMENT VALUES AND MANAGEMENT OF IMPACTS

The functions of this section are to:

- Describe the existing environmental values of the area which may be affected by the proposal;
- Describe the potential adverse and beneficial impacts of the proposal on the identified environmental values. Any likely environmental harm on the environmental values should be described;
- Present environmental protection objectives and the standards and measurable indicators to be achieved;
- Examine viable alternative strategies for managing impacts. These alternatives should be presented and compared in view of the stated objectives and standards to be achieved. Available techniques, including best practice, to control and manage impacts to the nominated objectives should be discussed. This section should detail the environmental protection measures incorporated in the planning, construction, operations, decommissioning, rehabilitation and associated works for the proposal. Measures should minimise environmental harm and maximise socioeconomic and environmental benefits of the proposal. Preferred measures should be identified and described in more detail than other alternatives.

This section should address all elements of the environment, such as land, water, coast, air, waste, noise, nature conservation (incl biodiversity and any relevant protected areas), cultural heritage, social and community, health and safety, economy, hazards and risk, in a way that is comprehensive and clear. To achieve this, the following issues should be considered for each environmental value relevant to the proposal:

- **Environmental values affected** — describe the existing environmental values of the area to be affected.

- **Impact on environmental values** — describe quantitatively the likely impact of the proposal on the identified;

- **Monitoring programs** — describe the monitoring parameters, monitoring points, frequency, data interpretation and reporting proposals. Auditing programs: describe how progress towards achievement of the objectives will be measured, reported and whether external auditors will be employed. Include scope, methods and frequency of auditing proposed;

- **Management strategies** — describe the strategies to be used to ensure the environmental protection objectives are achieved and control strategies implemented eg. continuous improvement framework including details of corrective action options, reporting (including any public reporting), monitoring, staff training, management responsibility pathway, and any environmental management systems and how they are relevant to each element of the environment;

- **Information quality** — information given under each element should also state the sources of the information, how recent the information is, how any background studies were undertaken (e.g. intensity of field work sampling), how the reliability of the information was tested, and what uncertainties (if any) are in the information

4.1 Land

4.1.1 Description of Environment Values

This section describes the existing environment values of the land area that may be affected by the proposal. It should also define and describe the objectives and practical measures for protecting or enhancing land-based environmental values, describe how nominated quantitative standards and indicators may be achieved, and how the achievement of the objectives will be monitored, audited and managed.

4.1.1.1 Soils

A soil profile for the surrounding **Tikioki** area should be conducted at a suitable scale, with particular reference to the physical and chemical properties of the materials that will influence erosion potential and storm water run-off quality.

Information should also be provided on soil stability and suitability especially the proposed site.

4.1.1.2 Landuse/Characteristics

The EIA should provide a description of past and current land tenures and land uses of the site and surrounding areas, and also maps at suitable scales showing

existing land uses and tenures, as well as the proposal footprint, should be provided for the entire proposal area and surrounding land that could be affected by the development. The maps should identify areas of conservation value and areas in any locality that may be impacted by the proposal.

4.1.1.3 Landscape Character

This section should describe in general terms the existing character of the landscape that will be affected by the proposal.
The landscape character of the property and its surrounds should be described in the context of landscape ecology and incorporate the concepts of patch-corridor matrix in describing the pattern of existing vegetation.

4.1.2 Potential Impacts and Mitigation Measures

This section defines and describes the objectives and practical measures for protecting or enhancing the land-based environmental values identified through the studies outlined in the previous section. It should describe how nominated quantitative standards and indicators may be achieved, and how the achievement of the objectives will be monitored, audited and managed.

4.1.2.1 Land use Suitability

The potential for the proposal to change existing and potential land uses on the site and adjacent areas should be detailed.

The potential environmental harm caused by the proposal on the adjacent areas currently used for nature conservation, agriculture, urban development, transport corridors, recreation, tourism, other business.

4.1.2.2 Land Contamination

The EIA should describe the possible contamination of land from aspects of the proposals including waste, irrigation with treated effluent, reject product/materials and spills at chemical and fuel storage areas.
The EIA should also address management of any existing or potentially contaminated land in addition to preventing and managing land contamination resulting from project activities.

4.2 Water Resources & Quality

4.2.1 Description of Environmental Values

This section describes the existing environment for water resources & quality that may be affected by the proposal in the context of environmental values. i.e. - Surface waterways

- Groundwater - General (temp, salinity, pH, clarity, BOD etc…)
- Turbidity of suspends solids
- Eutrophications (DO, N, P)
- Harmful or Toxic substances

- Sanitation (Coli form, E Coli)

4.2.2 Potential Impacts and Mitigation Measures

This section is to assess potential impacts on water resource environmental values identified in the previous section. It will also define and describe the objectives and practical measures for protecting or enhancing water resource environmental values, to describe how nominated quantitative standards and indicators may be achieved, and how the achievement of the objectives will be monitored, audited and managed.

Water management controls should be described, addressing surface and groundwater quality, quantity, drainage patterns and sediment movements. The beneficial (environmental, production and recreational) use of nearby surface and groundwater should be discussed, along with the proposal for the diversion of affected creeks and the stabilisation of those works. Monitoring programs should be described which will assess the effectiveness of management strategies for protecting water quality during the construction and operation of the proposal.

4.3 Waste

4.3.1 Description of Environmental Values

This section should complement other sections of the EIA by providing technical details of waste treatment and minimisation, with proposed emission, discharge and disposal criteria, while other sections describe how those emissions, discharges and disposals would impact on the relevant environmental values. The purpose of this format is to concentrate the technical information on waste management into one section in order to facilitate its transfer into the EMP. Ensure that waste is stored and disposed of appropriately, with minimum impacts on the environment

4.3.2 Potential Impacts and Mitigation Measures

This section defines and describes the objectives and practical measures for protecting or enhancing environmental values from impacts by wastes, describes how nominated quantitative standards and indicators may be achieved for waste management, and how the achievement of the objectives will be monitored, audited and managed.

This section should assess the potential impact of all wastes to be generated and provide details of each waste in terms of:

- on-site treatment methods proposed for the wastes ;
- methods of disposal (including the need to transport wastes off-site for disposal) proposed to be used for any trade wastes, liquid wastes and solid wastes;
- the potential level of impact on the surrounding community due to nuisance;
- proposed discharge/disposal criteria for liquid and solid wastes;

- Plan works to minimise the waste of materials; Reuse old materials suitable for other uses where possible;
- Recycle waste where possible;
- Store waste from ablution facilities appropriately (eg in tanks)
- Store waste in enclosed bins with no exposure to the elements
- Avoid large stockpiles of materials on site
- Avoid overloading bins
- Avoid storing waste on site for long periods of time
- Provide sufficient recycling and waste bins on site
- Use licensed contractors for the disposal of waste
- Dispose of waste on a regular basis or as needed
- Maintain records of disposal times and contractors

4.4 Social

4.4.1 Description of Environmental Values

This section describes the existing social values that may be affected by the proposal and should also include future social benefits resulting from the proposal including increased access and mobility.

The social amenity and use of the proposal area and adjacent areas for recreational, industrial, educational, community and government, centres, residential and other relevant purposes should be described. Consideration should be given to:

- Community infrastructure and services, access and mobility;
- Description of how the environmental impacts (noise, dust, water quality, waste treatment etc) of any onsite accommodation, during construction, will be managed;
- Recreational, cultural, leisure, community and sporting facilities and activities in relation to the affected area.

4.4.2 Potential Impacts and Mitigation Measures

This section defines and describes the objectives and practical measures for protecting or enhancing social values, describes how nominated quantitative standards and indicators may be achieved for social impacts management, and how the achievement of the objectives will be monitored, audited and managed.

The social impact assessment of the proposal should consider the information gathered in the community consultation program and the analysis of the existing socio-economic environment, and describe the proposal's impact, both beneficial and adverse, on the local community. The impacts of the proposal on local residents, community services and recreational activities are to be analysed and discussed.

4.5 Health and Safety

4.5.1 Description of Environmental Values

This section describes the existing community values for public health and safety that may be affected by the proposal. For proposals proposing air emissions, and/or those with the potential to emit odours, nearby and other potentially affected populations should be identified and described. Particular attention should be paid to those sections of the population, such as children and the elderly, who are especially sensitive to environmental health factors.

Consideration must also be given to health and safety aspects of erosion control structures and water storages or other structures that may impact on public health and safety especially for children in and near waterways and drainage infrastructure.

The protection of the health and safety of the public, is to ensure that the hazards and risk to public health and safety is minimised

4.5.2 Potential Impacts and Mitigation Measure

This section defines and describes the objectives and practical measures for protecting or enhancing health and safety community values, describes how nominated quantitative standards and indicators may be achieved for social impacts management, and how the achievement of the objectives will be monitored, audited and managed.

The EIA should assess the effects on the proposal workforce of occupational health and safety risks and the impacts on the community in terms of health, safety, and quality of life from proposal operations and emissions. Any impacts on the health and safety of the community, workforce, suppliers and other stakeholders should be detailed in terms of health, safety, quality of life from factors such as air emissions, odour, dust and noise.

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4.6 Economy

4.6.1 Description of Environmental Values

This section describes the existing economic environment that may be affected by the proposal. The character and basis of the local economy should be described including:

- existing housing market, particularly rental accommodation which may be available for the proposal workforce, transportation etc.
- economic viability (including economic base and economic activity, future economic opportunities)

The economic impact statement should include estimates of the opportunity cost of the proposal.

4.6.2 Potential Impacts and Mitigation Measures

The function of this section is to define and describe the objectives and practical measures for protecting or enhancing economic values, to describe how nominated quantitative standards and indicators may be achieved for economic management, and how the achievement of the objectives will be monitored, audited and managed.

4.7 Hazards and Risk

4.7.1 Description of Environmental Values

This section describes the potential hazards and risk that may be associated with the proposal. An analysis is to be conducted into the potential impacts of both natural and induced emergency situations and counter disaster and rescue procedures as a result of the proposal on existing and proposed sensitive areas such as residential areas, water reserves, roads, places of residence and work, and recreational areas. The degree and sensitivity of risk should be detailed
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4.7.2 Potential Impacts and Mitigation Measures

The EIA should define and describe the objectives and practical measures for protecting people and places from hazards and risk, describes how nominated quantitative standards and indicators may be achieved for hazard and risk management, and how the achievement of the objectives will be monitored, audited and managed. Storms and Sea surge may pose risks and procedures to minimise the impacts on the project.

4.8 Erosion Control

4.8.1 Description of Environmental Values

This section addresses the reduction of potential erosion of sand, soil and waterways by ensuring that works are managed to minimise risk of erosion

4.8.2 Potential Impacts and Mitigation Measures

- Manage storm water appropriately - Establish sediment and erosion controls around stockpiles where appropriate
- Minimise size of stockpiles
- Minimise the creation of hard, impervious surfaces
- Establish diversion drains around disturbed area
- Drain storm water into appropriate infrastructure
- Minimise the risk of erosion caused by machinery and disturbance to soils/land - Control access points to a limited number
- Fence off and restrict access to areas with a high potential for erosion (e.g. waterway outlets)
- Minimise the use of large machinery

Store machinery and construction materials away from sensitive areas

- Minimise the risk of erosion caused by vegetation clearance -Minimise extent of clearance required
- Progressively mulch and re-vegetate areas cleared as part of works
- Prepare re-vegetation plan for larger operations
- Use drift fencing to control sand movement created by vegetation clearance restrict access to areas of high erosion potential
- Beach erosion
- Sediment deposition

5. ENVIRONMENT MANAGEMENT PLAN (EMP)

The EMP should be developed from the mitigation measures detailed above. Its purpose is to set out the proponents' commitments to environmental management. That is, how environmental values will be protected and enhanced.

The EMP is an integral part of the EIA, but should be capable of being read as a stand-alone document without reference to other parts of the EIA. The EMP should not raise any issues or propose mitigation measures not already addressed in the body of the EIA.

The general contents of the EMP should comprise:

- The mechanisms for implementation of the EMP in association with the staging and timing of the development and ongoing management once the development is completed;
- The proponents' commitments to acceptable levels of environmental performance, including environmental objectives, i.e. levels of expected environmental harm, performance standards and associated measurable indicators, performance monitoring and reporting;
- Impact prevention or mitigation actions to implement the commitments to the project;
- Corrective actions to rectify any deviation from performance standards;

A complaints mechanism should be established as part of the EMP to address community issues. A complaints register could log details of all complaints received and action taken.

Through the EMP, the EIA's commitments to environmental performance can be used as regulatory controls through conditions to comply with those commitments. Therefore, the EMP is a relevant document for proposal approvals, environmental authorities and permits, and may be referenced by them.

6. REFERENCES

All references consulted should be presented in the EIA in a recognised format

7. RECOMMENDED APPENDICES

A1 Final TOR for this EIA

A copy of the TOR should be included in the EIS. Where it is intended to bind appendices in a separate volume from the main body of the EIA, the TOR at least should be bound with the main body of the EIA for ease of cross-referencing.

A2 Final Project Design/Drawings

All A3 OR A4 drawings and designs be included

A3 Study Team

The qualifications and experience of the study team and specialist sub consultants and expert reviewers should be provided.

A4 Consultation Report

Outcomes of consultation meetings in the **Tikioki** community should be recorded and included. The Consultation Report should summarise the results of the community consultation program, providing a summary of the groups and individuals consulted, the issues raised, and the means by which the issues were addressed. The discussion should include the methodology used in the community consultation program including criteria for identifying stakeholders and the communication methods used. The consultation process should be integrated with the social impact assessment component of the EIA. Matters which become apparent through the consultation process such as community conflict or fears about impacts of the proposal on the natural environment should also be recorded in the social impact assessment of the EIA.

A5 Specialist Studies

Any reports generated on specialist studies undertaken as part of the EIA are to be included as appendices. These may include:

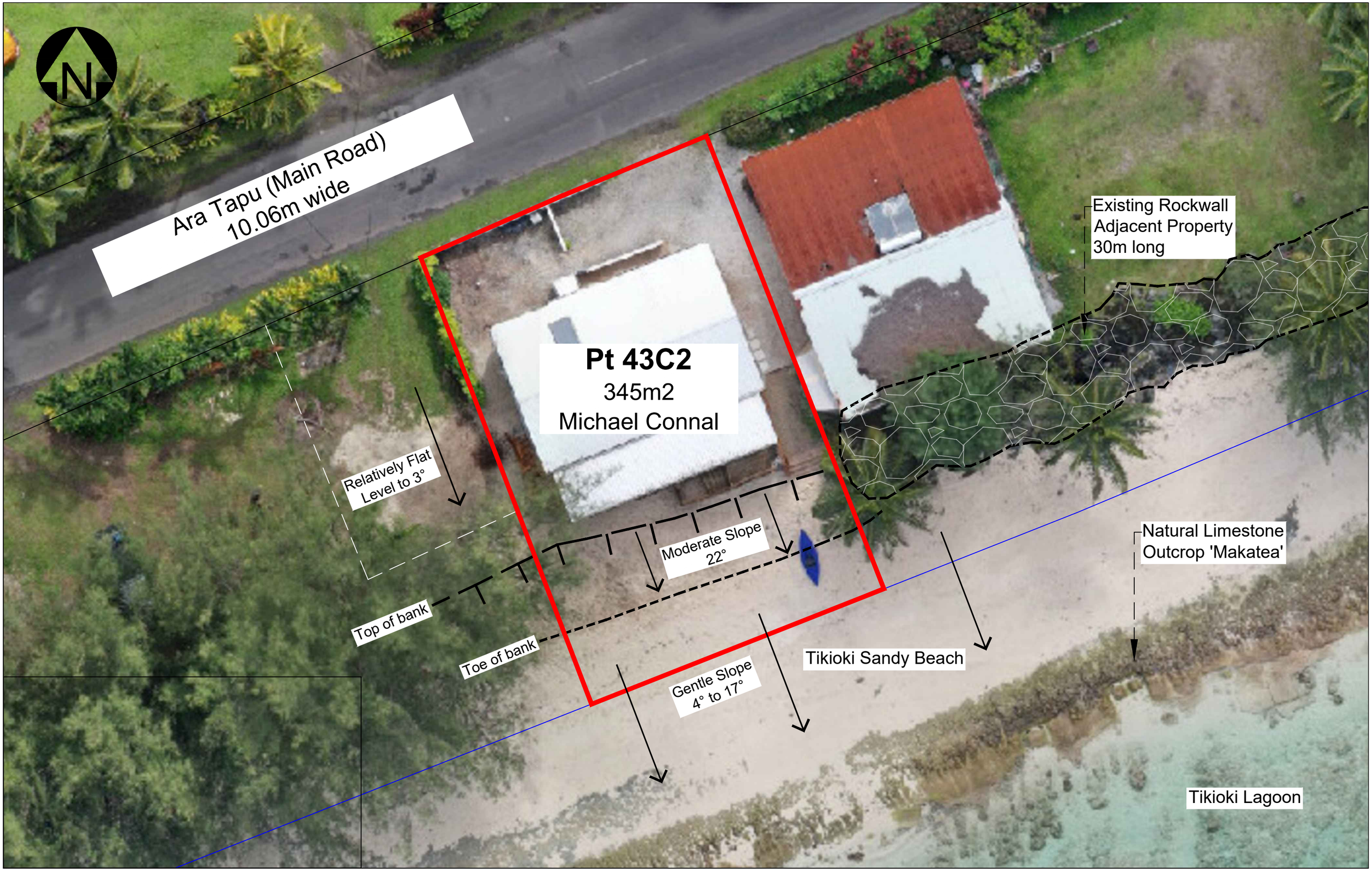
□ geology □ soil survey and land suitability □ groundwater □ flora and fauna □ coral survey □ noise and air quality □ Hydrographical Survey □ Environmental Action plan to supplement EMP □ Site investigations □ Excavation plans and equipment Biodiversity & ecosystems

A6 Contacts

Contacts of relevant experts/professionals interviewed or has contributions to the EIA.

Appendix B

Development Plans



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				Tikioki Coastal Protection	Site Plan	M. Connal		DRAWN BY:	PZ	10/12/23	S01	S04
				For Michael Connal	Property & Existing Features	CAD REF:	E2324.dwg	CHECKED:				
						SCALE:	N.T.S.	APPROVED:				

REVISION:	BY:	APP'D:	DATE:	PROJECT TITLE:	DRAWING TITLE:	CLIENT:		JOB REF: E2324		DATE	SHEET No.	Total No. of SHEETS:
				Tikioki Coastal Protection	Site Plan	M. Connal		DRAWN BY:	PZ	10/12/23	S02	S04
				For Michael Connal	2022 High Seas Impact	CAD REF:	E2324.dwg	CHECKED:				
						SCALE:	N.T.S.	APPROVED:				

REVISION:	BY:	APP'D:	DATE:	PROJECT TITLE:	DRAWING TITLE:	CLIENT:		JOB REF: E2324		DATE	SHEET No.	Total No. of SHEETS:
				Tikioki Coastal Protection	Site Plan	M. Connal		DRAWN BY:	PZ	10/12/23	S03	S04
				For Michael Connal	Rock Revetment Construction	CAD REF:	E2324.dwg	CHECKED:				
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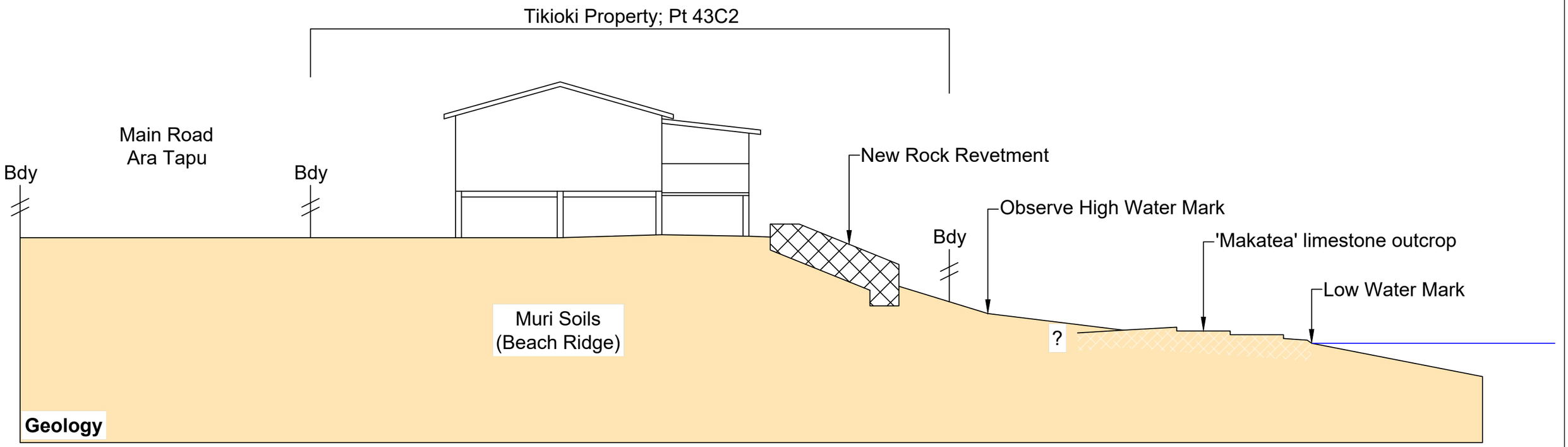

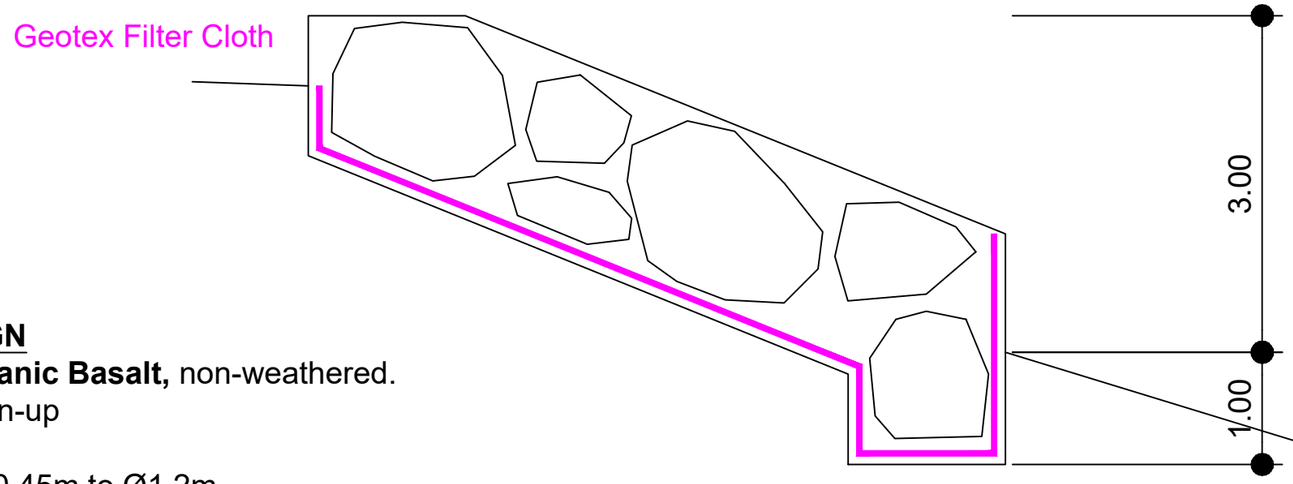

ARMOUR ROCK DESIGN

* Rock Description: **Volcanic Basalt,** non-weathered.
* Wave Height: +3.0m run-up
* Armour Rock Layer:
  * Diameter range Ø0.45m to Ø1.2m

REVISION:	BY:	APP'D:	DATE:	PROJECT TITLE:	DRAWING TITLE:	CLIENT:		JOB REF: E2324		DATE	SHEET No.	Total No. of SHEETS:
				Tikioki Coastal Protection	Cross Section	M. Connal		DRAWN BY:	PZ	10/12/23	S04	S04
				For Michael Connal	Rock Revetment Construction	CAD REF:	E2324.dwg	CHECKED:				
						SCALE:	N.T.S.	APPROVED:				