
Residential Development on Swamp Land

ENVIRONMENTAL IMPACT ASESMENT REPORT

10 January 2024

Prepared for:

Ngatupuna Rere

Report prepared by:

TURANGI Geotechnical Services

REF No. E2316

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Appendices

A – Site Plans and Cross Sections

Glossary of Terms Executive Summary

CEMP	Construction Environmental Management Plan
CIIC	Cook Islands Investment Corporation
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
NES	National Environment Service
REA	Rarotonga Environment Authority
TOR	Terms of Reference
TTV	To Tatou Vai

1. Introduction

This EIA Report has been prepared for Ngatupuna Rere (land owner), to provide recommendations with regards to the development of a raised building platform over the low-lying swamp depression property, for the purpose of providing for a stable platform for the new residential dwelling.



Figure 1: General location of the property (Map source: Google Earth Pro)

The property is located within the Tauae and Takuvaive taro swamp area; reference to the 1970s Rarotonga Land-use Map has identified this place as ‘Food Swamps’ land-use. Over the years, has seen that several swamp areas were filled to accommodate ‘residential development’ within the Tauae – Takuvaive Village.

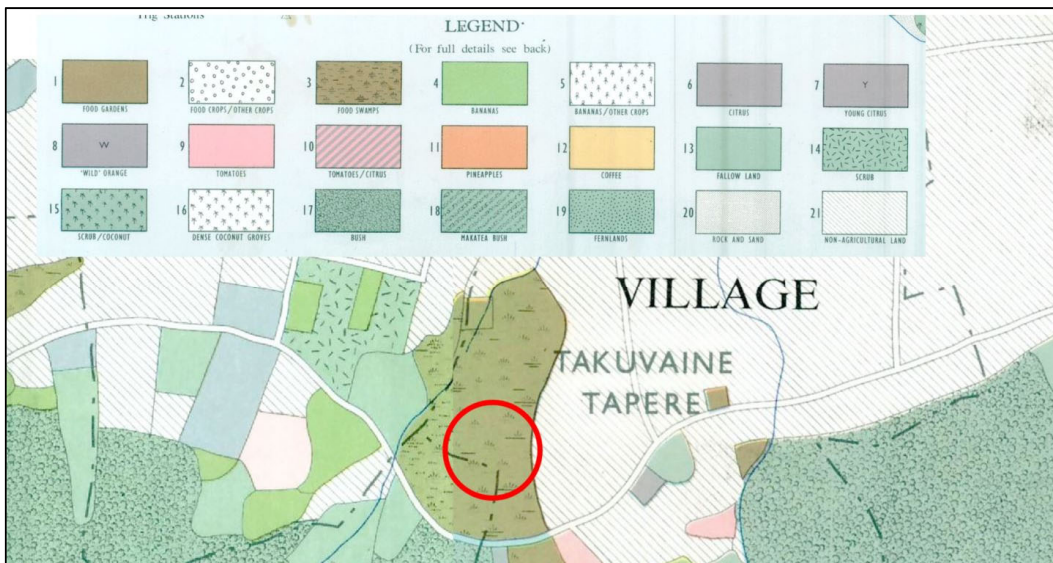


Figure 2: 1970s Rarotonga Land-Use Map for the Tauae - Takuvaive area

At this stage the land owner has already purchase a 'kit-set building' and plans to build the new house on this property, following approval from the National Environment Services, and receipt of a building permit from the relevant authorities, namely Public Health (Ministry of Health) and Infrastructure Cook Islands.

It is understood, that this is the only land made available to Mr Ngatupuna Rere and his family on Rarotonga. Mr Rere received the 'Order Granting Right of Occupation'; via the High Courts of the Cook Islands on 22nd April 2016. The High Court has stated that the land be used as a site for Residential purposes only.

The findings of this Report, presented herein will be used to support an Environment Significance Declaration (ESD) application.

2. Proposed Development

A new residential dwelling is to be constructed on the existing 'Taro Swamp' property, specialized earthworks will be required to provide for a stable and level building platform, which will be raised above the current low-depression area.

The general property area will be cleared of shrub vegetation, prior to any fill placement, to reduce the impact of compressible organic materials beneath the new building platform.

Cohesive-Granular fill is recommended to be used as the engineered fill, to provide suitable ground foundation strength overlying the natural swamp soils. Geotech Fabrics will also be placed prior to fill placement to aid in retaining the finer soils and allowing water to seep through. Anticipate that the new platform will be raised approximate 1m from the low-lying depression to match the existing raised height of the neighboring property.

The new dwelling comprises a timber frame structure, which will be constructed on timber piles above the raised platform.

Rows of vetiver grass is recommended to be grown along the top of the new fill embankment, to provide long-term slope stability and minimize erosion.

A new driveway will be required to provide access from the main Ara Metua road to the property, the new driveway is 30m long by 4m wide, and will comprise a compacted gravel road cover surface. Road side drains will slope towards the general swamp area.

General earthworks quantities:

- Approximate area for shrub clearing - **445m²**;
- New Driveway formation, surface area - **125.50m²**
 - 30m long by 4m wide
- Engineered Fill volume – **445m³**
- Geotech Fabric (45m by 6m roll) – will require **2 rolls**
- Vetiver Grass – will require **224** 'propagate' plants

Ground soils will be routinely assessed, inspected and tested to ensure suitable subsoils strengths are achieved and maintained during the earthworks activities.

3. Alternatives Considered

Land Property

We understand this is the only land been made available to Ngatupuna Rere and his family for the main purpose for a residential dwelling. Therefore, no other properties were assessed or considered.

Construction Methodology

The recommended earthworks provided in this report is typical for raised 'Engineered-Fill' building platform over swamp depressions. Alternatively, having the entire building and driveway on suspended timber piles was considered unfeasible, with potential long term impacts, such as maintenance and building upkeep.

4. Project Manager

All general enquiries are to be directed to the 'Project Manager', **Ngatupuna Rere**.

Contact Details:

- Name: Ngatupuna Rere
- Phone: +649 626 5844 (NZ)
- Mobile: +64 2102205681 (NZ)
- Email: nga.flyaway@yahoo.co.nz

The Contractor has been identified as 'T&M Contractors Ltd' with Jojo Heather as the Contractor Site Supervisor.

5. Project Funding and Duration

This proposal is to be funded by the applicant, Ngatupuna Rere.

The total project cost is estimated at \$20k to \$30k. The new building platform formation is anticipated to be completed in 10 days (2 weeks), pending favorable weather.

6. Policy and Legal Framework

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:

No excavation, dredging, clearing, paving, grading, ploughing, dumping, reclamation, removal of trees or other activity of any kind which may alter the natural configuration of the wetlands shall be undertaken on any wetlands, nor shall any building or structure be erected or altered on any wetlands, without the written consent of the permitting authority.

The Environment Act 2003 stipulates and enforces Section 50 Part 8 – Specific Areas of Concern, #58 *Protection of wetlands*.

7. Site Description

The subject property is legally described as **Matiekura Pt Sec 110, Tauae Tapere, Avarua District**; it is irregular in shape and covers a total area of **530m²**. The property is located along the coastal floodplains of Tauae and Takuvaine; access to the property is some 30m away from the Ara Metua (Back Road), there is no formed road or driveway to the property.

Residential homes occupy the neighboring north-western side of the property.

The bulk of the property occupies a swamp depression, with relative level ground, the swamp embankment runs along the north-western boundary perimeter, with the western property elevated some 1m above the property. The southern neighboring property is also raised, the remaining surrounding western side remain as a taro swamp.

Several mature trees were observed along the western boundary perimeter, running adjacent and along the top of the embankment.

From discussions with the land owner and site observations, the property has not been used for planting taro in the last 8 years, and therefore considered a dormant taro planting area.

The Vaikapuangi Stream is some 100m away to the north-west of the property.

Typical insects such as moths, spiders, ants and wasp were observed around the dense shrubs. No wondering animals were observed during our visit.

Geology

A walkover inspection of the site carried out on June 2023 indicates that the site is underlain by alluvial and alluvium derived deposits. These soils typically comprise soft to firm clays, silts and gravels of variable plasticity, including organic inclusions, otherwise referred to as ‘Soils of the poorly drained depressions and flood plains’.

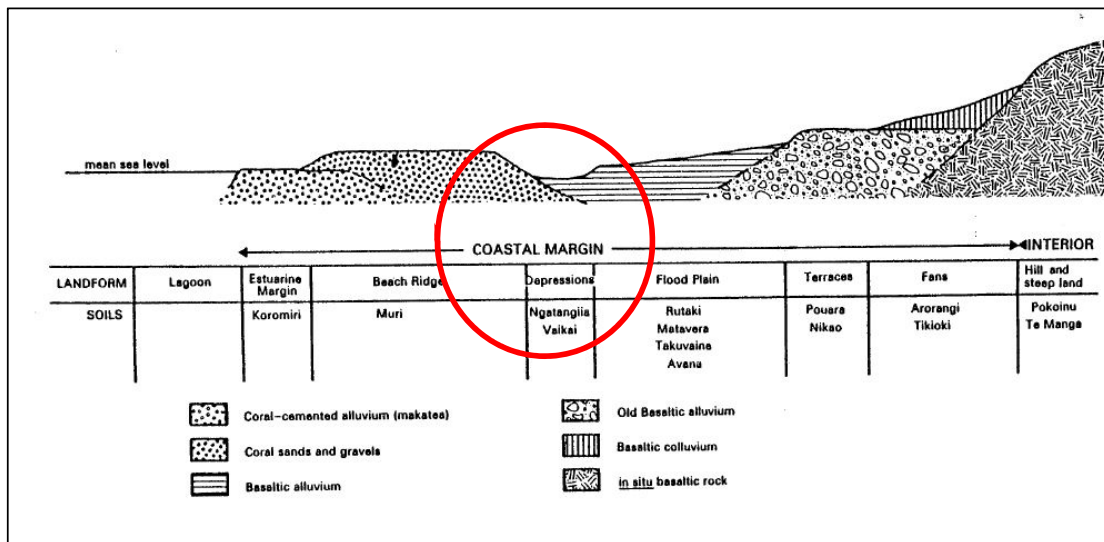


Figure 3: Diagrammatic cross-section of Rarotonga, showing relationship of soils to landscape and geology (source: D.M. Leslie, 1980)

Reference has been made to the published report titled ‘*Geology of the Cook Islands, Bulletin NO. 82*’ prepared by the New Zealand Geological Survey, 1970. Along with the technical report titled

'Soils of Rarotonga, Cook Islands, NZ Soil Survey Report #49', by D. M. Leslie, NZ Soil Bureau DSIR, dated 1980. These reports along with the Geological Map of Rarotonga, indicates that the site is underlain by a distinct soil types, Coastal margin; *Depressions*, described as **Vaikai Soils**.

8. Project Justification

Land attainment

Ngatupuna Rere, has acquired the property in 2016, through approval from the family, for the purpose of a residential development. At present this is the only property made available to Mr Rere and his family, considering the scarcity of available vacant land on Rarotonga, especially with the distribution of land shares to families, it will be challenging for Mr Rere in acquiring another property for a similar purpose.

High Court 'Order Granting Right of Occupation'

The High Court has granted Mr Rere on April 2016, the order granting right of occupation, pursuant to Section 50 of the Cook Islands Amendment Act 1946 the following conditions to the right of occupation:

1. That the said land shall be used as a site for **Residential purposes only**.
2. That the construction upon the said land of the dwelling house be commenced within 5 years and completed with **7 years** from the date of this order: Provided that this period may upon application being made to the Court be extended by a period not exceeding 3 years.
3. That this order shall lapse automatically upon failure to comply with conditions (3) above.
4. That the right of occupation hereby granted may be used by the owner of the right of occupation as a security for any loans or monies advanced to him by any person or lending institution approved by the Minister of Finance for the purpose of the construction of a dwelling house and to carry out such renovations repairs and extensions or such other purposes as may be necessary on the land described in the schedule hereto.
5. That in the event of any default by the person in whose favor the right of occupation has been granted in the repayment of any monies lent or advanced pursuant to condition (4) above the lender may occupy and use the right of occupation for a period not exceeding 15 years or such shorter period as may be necessary for the purpose of securing the repayment of any monies due and owing by the holder of the right of occupation.
6. That the owners of the right of occupation may nominate any person to occupy such right of occupation.
7. That the **Right of way** is ordered as per plan.

Development suitability, Engineered Building Platform

Similar developments have been observe around Rarotonga, where filling has occurred at several swamp-depression areas for residential development.

The recommended Engineered Fill is typical for general earthworks of this nature, building a solid platform that provides suitable foundation strength while maintaining natural groundwater flows beneath the ground. It is for this reason that a cohesive-granular fill comprising a mixture of soils

and gravels be used. The composition of granular gravels improves ground permeability allowing water to flow through reducing surface water ponding and maintaining groundwater circulation.

Geotech Fabric placed beneath the engineered fill helps ensure that water seeps through and finer soils and gravels are retained, reducing potential ground differential settlement.



Figure 4: Geotech Fabric placed beneath granular fill over soft ground (image source: Cirtex GeoSynthetic Solutions)

The new fill is to be compacted by an appropriate compaction roller, to ensure and maintain suitable ground foundation strengths. Routine soil testing will monitor the ground compaction.

Timber-frame House on Piles

The new timber frame dwelling house, will be founded on timber piles embedded within the engineered building platform, this will provide suitable foundation strength for the new dwelling.

9. Project Description

Engineered Fill Building Platform

General Scope of Works, following approval from NES to proceed is described as follows:

1. A Land Surveyor will be engaged to locate and clearly peg out all boundary pegs.
2. The *Project Manager* with the *Contractor Site Supervisor* will notify all nearby residence a minimum of 1 week advance with regards to the commencement of the earthworks.
3. Service Utilities will be engaged to mark out all the services (power, water and phone) in the area. All damaged services are the responsibility of the Contractor.
4. The Contractor will install appropriate temporary safety signage and where required, set-up safety barriers.
5. Heavy plant machinery will then be mobilised to the site to commence earthworks, which will comprise but not limited to:

- a. Hydraulic Excavator
 - b. Front-End Loader
 - c. 10 ton Tip Truck
 - d. Roller Compactor
6. The new Right-of-Way driveway will be formed to provide access to and from the property, especially for the Tip Truck. A minimum 100mm thick gravel layer placed on top of a Geotech Fabric, and appropriately compacted to form the new driveway.
 7. Vegetation Shrub Clearing will commence, where possible the cleared shrub will be stockpiled on site, to be dried and later burnt, alternatively the cleared shrub will be carted away to the Contractors landfill site in Arorangi.
 8. Once vegetation shrubs are cleared, Geotech Fabric rolls will be spread-out along the ground, in preparation for the cohesive-granular fill.
 9. The contractor will import granular fill material from there Arorangi stockpile, this will comprise quarried volcanic rock with overburden soil, free of organics. We estimate approximately **44 truckloads** will be required (445m³).
 10. The imported fill will be compacted in layers not exceeding 150mm thick, by an appropriate Roller Compactor or similar plant machinery. Routine soil compaction testing will monitor the ground strength.
 11. A surficial topsoil layer will cover the surface once the fill levels are achieved, topsoil is recommended to promote grass growth and help establish the vetiver grass in provide long-term embankment stability.
 12. The Contractor will tidy up the site, along with other areas prior to departing from the property. Carry out repairs where required.
 13. All temporary site safety signage, traffic cones and barrier will be removed.

10. Likely impacts

Tauae – Takuvaive Taro Swamp Wetland

Wetlands provide several beneficial functions, improves water quality through retaining sediments, reduce flood flows, and absorbs excessive nutrients from fertilizers, leaking septic tanks and animal waste.

Diverse native species of plants, insects, reptiles, birds and fish rely on wetlands for food, habitat and shelter.

The combined current estimated Tauae-TakuvaiveArorangi swamp area is 26, 534m², the filling of the 530m² property will occupy approximately 2% of the swamp.

Traffic Management

The contractor will ensure the mobilization of plant machinery to and from the property will not affect the residence of the Tauae 'Ara Metua' area. All machinery movement along the access road and the Ara Metua should be done outside the typical peak traffic times, such as 8am (morning traffic) and 4pm (afternoon traffic).

Suitable traffic signs, safety cones and fencing be erected, where required to provide awareness and safety to the community regarding the earthworks.

Stormwater Management

Erosion and sediment control measures where required, will need to be implemented to reduce adverse impacts to the receiving surrounding area, especially the neighboring residential property.

All newly formed road side drains are to flow towards the existing swamp area. No surface flow-paths are to flow towards the neighboring property or allowed to run along the new fill area and embankment without appropriate surface protection and designated drainage path.

Vegetation clearing to be carried out in stages, with preference to commencing clearance from the new driveway southern side, once 30% cleared the geotech fabric can cover that area and allow partial filling to anchor down the fabric and cover the exposed soil area, the works will replicated for the remaining 60% and 100% stage.

Where adverse sediment run-off is observed, especially following prolonged heavy rainfall events, then an additional silt fence will be erected to provide further sediment control.

Table 1: Risk factors and associated mitigation measures

<u>RISK FACTORS</u>	<u>MITIGATION MEASURES</u>
Adverse weather; heavy rainfall	Track weather forecast 5 day and 10 day advance. Ensure no clearing-works during prolonged heavy rainfall periods, maintain and improve existing stormwater management measures.
Limited Contractors available	Engaged experienced and well-resourced contractor to undertake the project.
Contractors working in hazardous ‘swamp terrain’	Develop and implement a health and safety plan.
Disruption and restrictive access to the Tauae properties, up along the formed road.	Develop and implement a traffic management plan. Notify the respective agencies in advance prior to any earthwork activity, have all existing services marked on the ground, and ‘where required’ have representatives utilities present during the clearing works.
Community disengaged and not supportive	Keep the community informed via all communication channels such as newsletters, Facebook, community meetings to keep community engaged. Meet individually with those concerned.

11. Environment Management Plan

Environmental Issues	Mitigation Measures	Location	Timeframe	Implementation	Monitoring Parameter	Monitoring Frequency	Monitoring Responsibility	Supervision
Tauae and Takuvaine Community	The Tauae Valley residents will be informed prior, during and the completion of works, via media release and face to face meetings	Vainganau Pt Sec 110 property	Earthworks 10 days (2 weeks)	Contractor	Community feedbacks & complaints received	Daily progress reports	Contractors Site Supervisor	Project Manager
Cleared vegetation	Stockpile cleared vegetation away from the fill area, to be dried and later burnt, alternatively cart away to the Contractors landfill in Arorangi.	Vainganau Pt Sec 110 property	Earthworks 10 days (2 weeks)	Contractor	Daily observations	Daily progress reports	Contractors Site Supervisor	Project Manager
Imported Fill	Ensure FILL is free of organics and unsuitable materials, carry out routine inspection at the Contractors yard before carting to site.	T&M Arorangi Yard Vainganau Pt Sec 110 property	Earthworks 10 days (2 weeks)	Contractor	Daily observations	Daily progress reports	Contractors Site Supervisor	Project Manager

Environmental Issues	Mitigation Measures	Location	Timeframe	Implementation	Monitoring Parameter	Monitoring Frequency	Monitoring Responsibility	Supervision
Air pollution, machinery exhaust	The contractor will ensure all construction machinery and equipment are serviced and operating efficiently	Vainganau Pt Sec 110 property	Earthworks 10 days (2 weeks)	Contractor	Daily observations	Daily progress reports	Contractors Site Supervisor	Project Manager
Excessive noise	Ensure all work during daylight hours, 8am to 5pm.	Vainganau Pt Sec 110 property	Earthworks 10 days (2 weeks)	Contractor	Community feedbacks & complaints received	Daily progress reports	Contractors Site Supervisor	Project Manager
Spills of fuels and other hazardous materials	The contractor will ensure no hazardous materials is to be stored on site, no servicing of machinery on the property.	Vainganau Pt Sec 110 property	Earthworks 10 days (2 weeks)	Contractor	Daily observations	Daily progress reports	Contractors Site Supervisor	Project Manager
Health and Safety	Implementation of Health & Safety Plan. All construction workers are provided with adequate PPE and facilities. Implementation of Traffic Management Plans.	Vainganau Pt Sec 110 property	Earthworks 10 days (2 weeks)	Contractor	Daily observations	Daily progress reports	Contractors Site Supervisor	Project Manager

Environmental Issues	Mitigation Measures	Location	Timeframe	Implementation	Monitoring Parameter	Monitoring Frequency	Monitoring Responsibility	Supervision
Erosion and sediment Control	Monitor all existing and new drains in the area. Where required, in anticipation of adverse storm events, Install Silt fence along the toe of the fill embankment.	Vainganau Pt Sec 110 property	Earthworks 10 days (2 weeks)	Contractor	Daily observations	Daily progress reports	Contractors Site Supervisor	Project Manager
Natural Hazards & Emergency	Receipt confirmation of potential hazard, such as Cyclone, all works will cease, all heavy plant machineries and equipment will be returned to the contractor's compound.	Vainganau Pt Sec 110 property	Earthworks 10 days (2 weeks)	Contractor	Weather alert form EMCI and the Met Office.	Maintain frequent weather forecast updates	Contractors Site Supervisor	Project Manager
Traffic Management	Develop and implement a Traffic Management Plan; Where required, a traffic controllers will be put in place to monitor all machinery movement into the property.	Vainganau Pt Sec 110 property	Earthworks 10 days (2 weeks)	Contractor	Daily observations	Daily progress reports	Contractors Site Supervisor	Project Manager

12. Conclusion and Recommendation

Conclusion

This technical report and ESD permit application by the proponent Ngatupuna Rere, is for approval by the National Environment Services.

The objective of the proposal is to undertake construct a raised building platform above the Tauae swamp on the property; Matiekura Pt Sec 110, along the inland Ara Metua of Tauae Tapere.

The Proposed works include:

- Engaging a land surveyor to confirm (mark out) the property boundary location, prior to any work commencing.
- Contractor to undertake earthworks for a raised building platform within the property boundary.

A finalized, Environment Management Plan, Traffic Management Plan and Health & Safety Plan will be prepared and made available to NES upon request. 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.

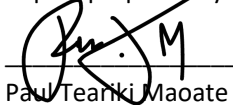
The methodology of works has been used in previous projects of a similar nature around Rarotonga without causing detrimental environmental effects. The neighboring raised property serves as an adequate example.

Recommendations

The following recommendations are based on mitigation measures:

- The earthworks for the residential development on swamp land, is to be carried out by a contractor experience in this type of work, and is well resourced with heavy plant machinery, operators and other supporting services.
- All machinery shall be operated in a manner that ensures that spillage of fuel, oil and similar contaminants are prevented, particularly during earthworks operation in the swamp area. No refueling and lubrication activities shall be carried out at the property, all such activities to be done at the Contractors yard in Arorangi.
- Any amendments to the Environment Environmental Management Plan, shall be prepared and submitted to the NES for approval prior to construction works authorized by this approval being undertaken.
- On-going consultation with the Tauae community will be facilitated as required. Progress reports will be made available to NES upon request, the Project Manager will update the general public via social media, and where required face to face meetings.

Report prepared by:



Paul Teariki Maoate

Geotechnical Engineer

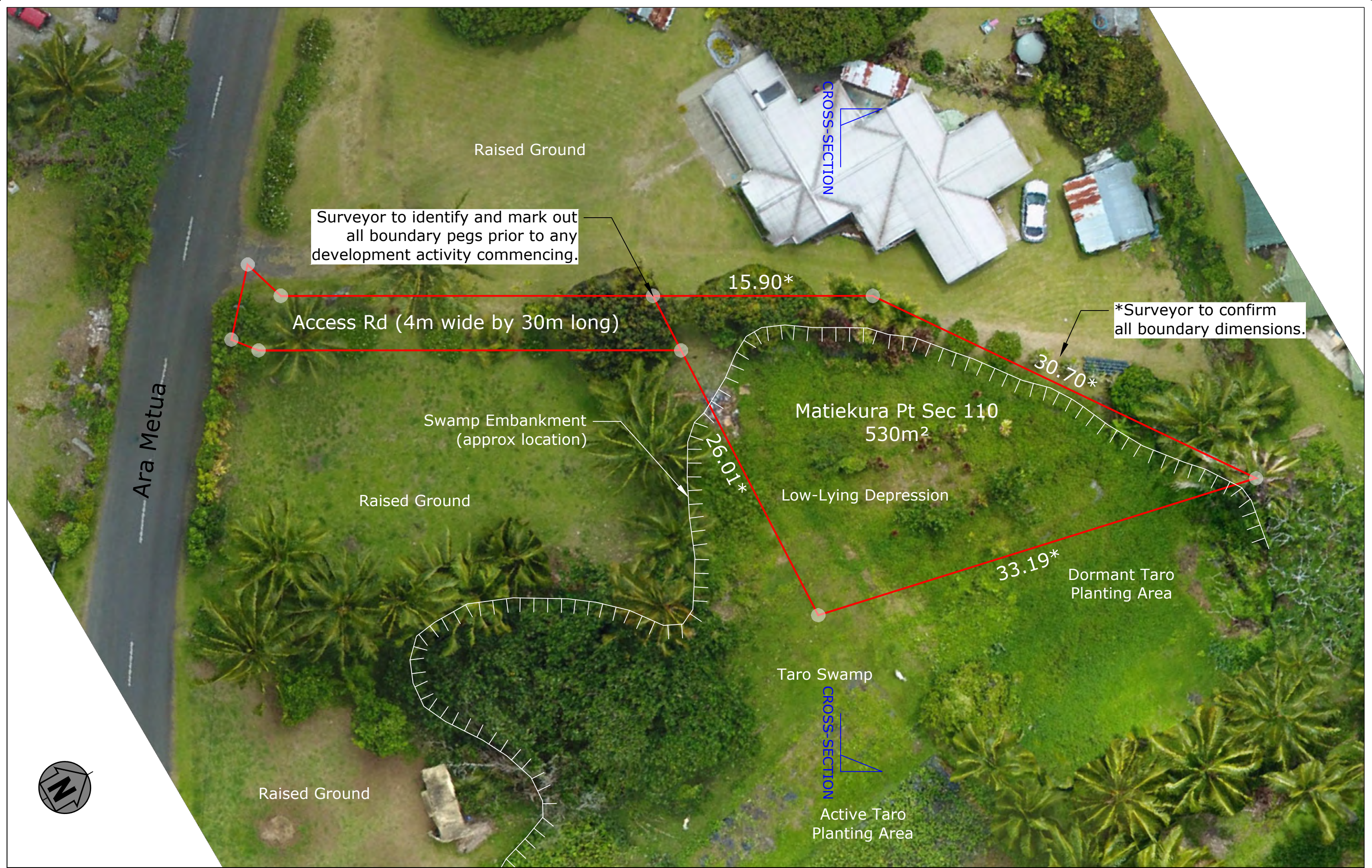
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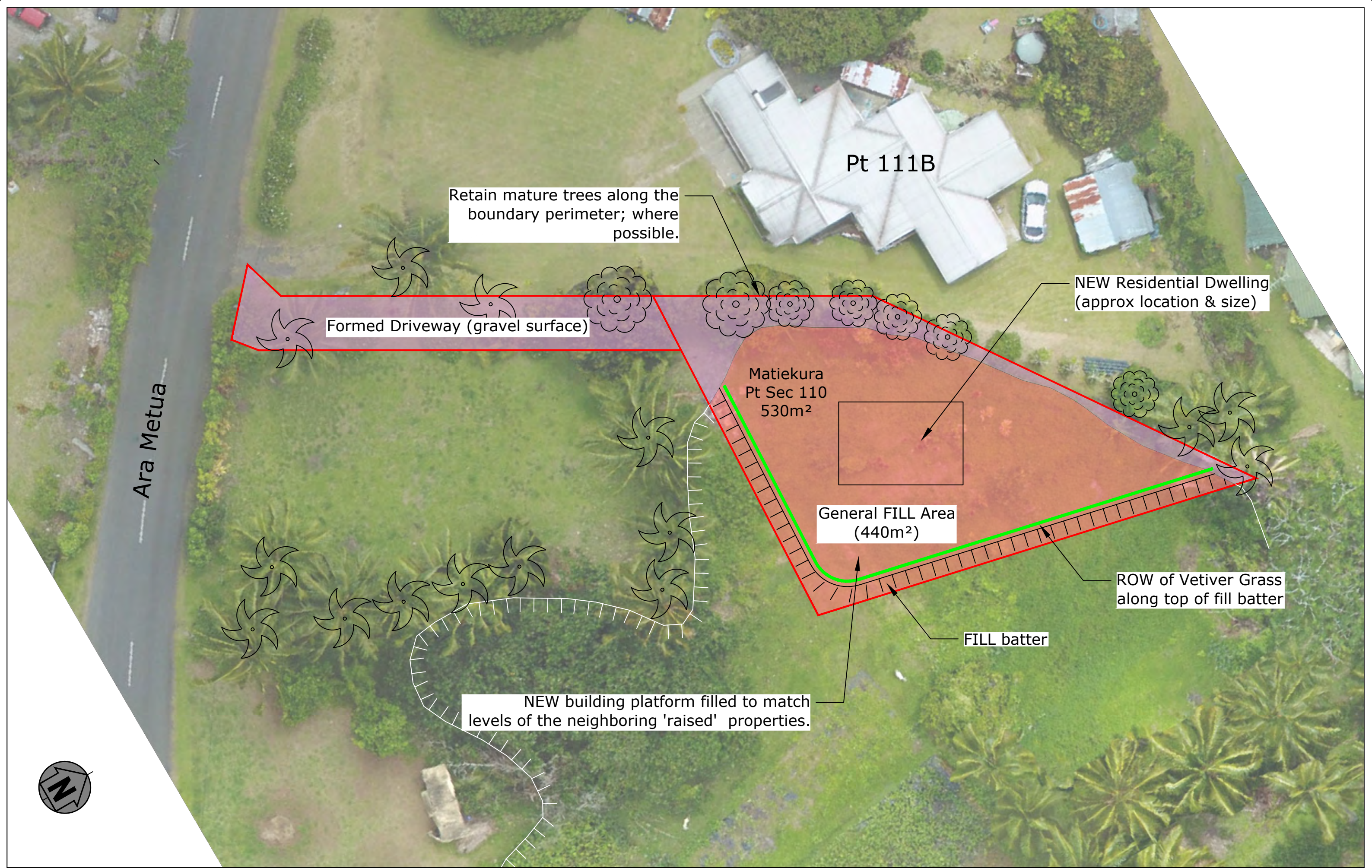
Mobile: **+682 56363**



REVISION:	BY:	APP'D:	DATE:	PROJECT TITLE:	DRAWING TITLE:	CLIENT:	JOB REF:	DATE	SHEET No.	Total No. of SHEETS:	
				Residential Development	SITE PLAN	N. Rere	E2316	03/09/23	S01	S05	
				Matiekura Pt 110, Tauae	Tauae & Takuvaime Properties	CAD REF:	E2316.dwg	CHECKED:			
						SCALE:	N.T.S.	APPROVED:			



REVISION:	BY:	APP'D:	DATE:	PROJECT TITLE:	DRAWING TITLE:	CLIENT:	JOB REF:	DATE	SHEET No.	Total No. of SHEETS:
				Residential Development	SITE PLAN	N. Rere	E2316	03/09/23	S02	Sxx
				Matiekura Pt 110, Tauae	Existing Site Features		DRAWN BY:			
							PZ			
						CAD REF:	E2316.dwg	CHECKED:		
						SCALE:	N.T.S.	APPROVED:		

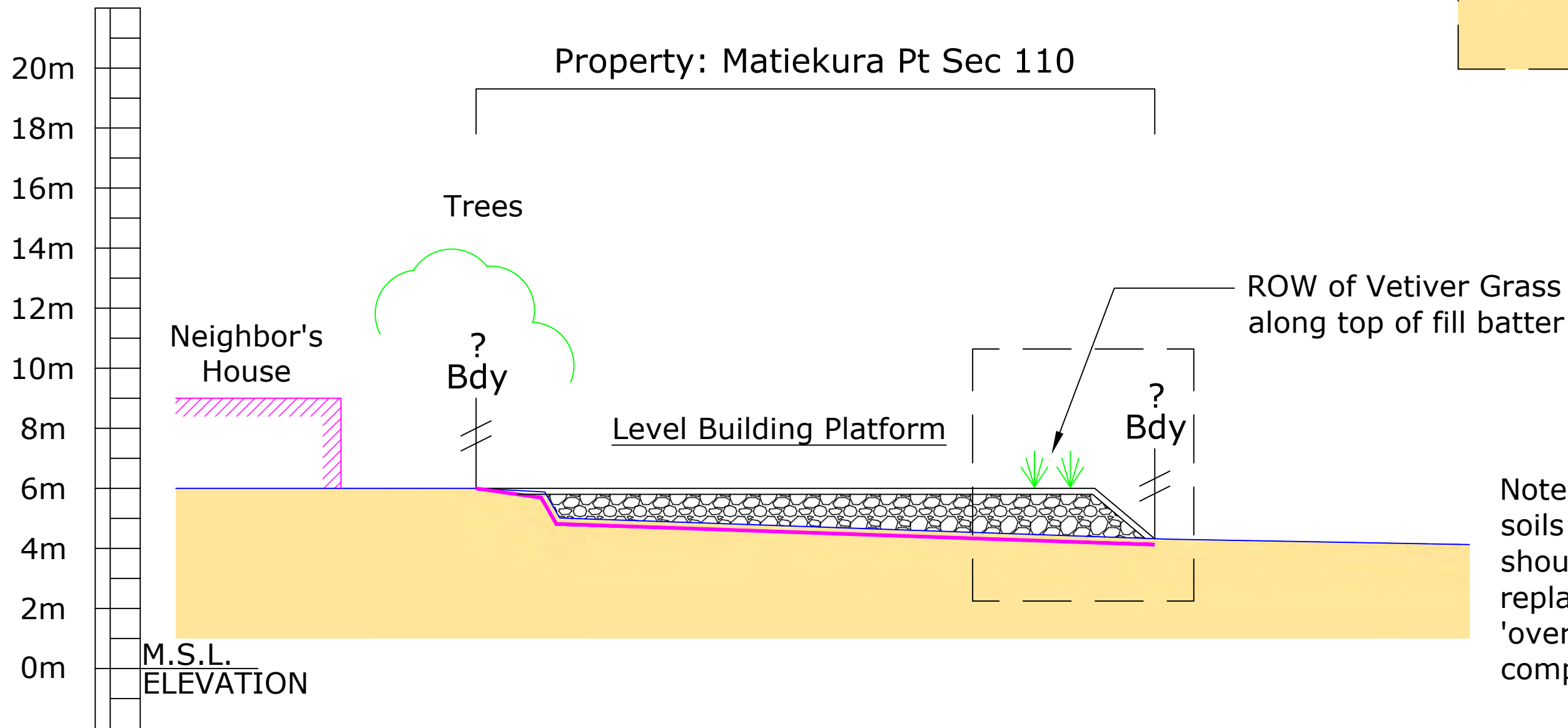
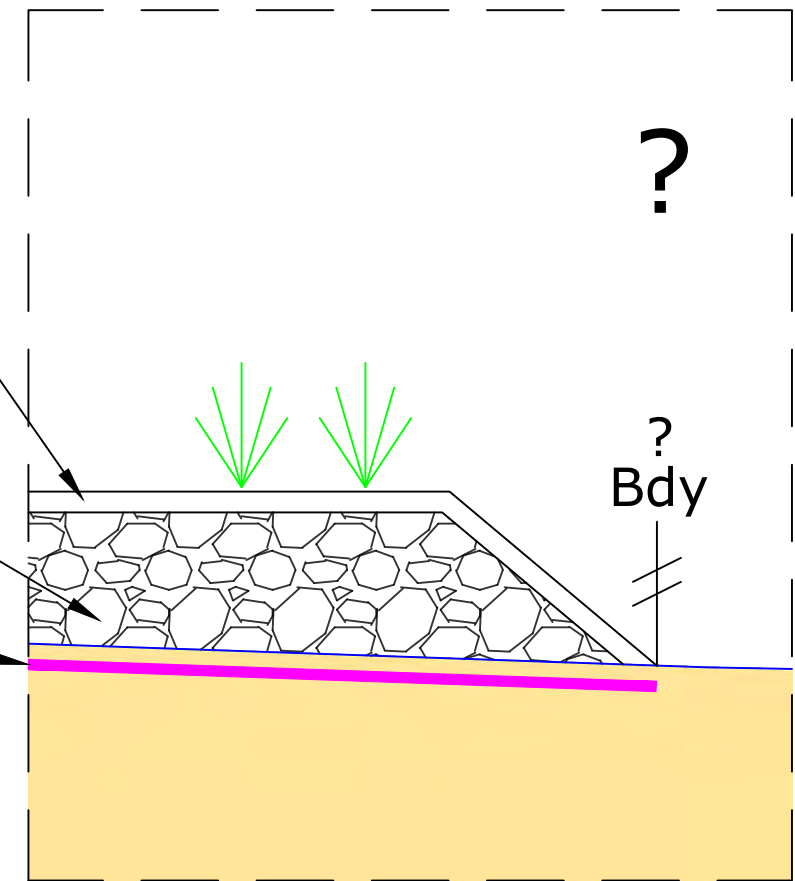


REVISION:	BY:	APP'D:	DATE:	PROJECT TITLE:	DRAWING TITLE:	CLIENT:	JOB REF:	DATE	SHEET No.	Total No. of SHEETS:	
				Residential Development	SITE PLAN	N. Rere	E2316	03/09/23	S03	S05	
				Matiekura Pt 110, Tauae	Proposed Development	CAD REF:	E2316.dwg	CHECKED:			
						SCALE:	N.T.S.	APPROVED:			

TOPSOIL veneer cover (100mm to 200mm) along surface to aid with vegetation (grass) growth.

ENGINEERED FILL comprised mix of cohesive and granular soil-rock fill free of organic and compressible materials, well compacted.

GEOTECH FABRIC suitable permeable fabric with appropriate strength that allows water to drain through while preventing soils going through.



Note: Where highly organic soils are encountered, these should be dug out and replaced (filled) with 'overside' rock to provide competent ground.

REVISION:	BY:	APP'D:	DATE:	PROJECT TITLE:	DRAWING TITLE:	CLIENT:	JOB REF:	DATE	SHEET No.	Total No. of SHEETS:
				Residential Development	CROSS SECTION	N. Rere	E2316	03/09/23	S05	S05
				Matiekura Pt 110, Tauae	Proposed Ground Profile	E2316.dwg	PZ			
						N.T.S.				