Job# S1815-J04981

Lot 13 DP 546644 Waianga Place Omapere

Site Suitability Report

8 November 2021

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Site Suitability Report

Geotechnical Investigation and Assessment Report for a Proposed New Garage, Retaining Walls and a Future New Dwelling, at: Lot 13 DP 546644, Waianga Place, Omapere

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01	12 August 2022	Change in garage area; reworking for stormwater attenuation.
02	25 August 2022	Change in Client proposal; reworking for stormwater attenuation.

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EXECUTIVE SUMMARY

Report Applicability and Plan Review
• Specifically, on this site, this report is provided to accord solely with the Client development proposal and the information made available to TMC at the time of report writing. • No building plans for the future garage (only indicative) have been provided at the time of report writing. We strongly recommend that TMC be engaged to undertake a review of both this report and finalised garage plans (when available), to confirm appropriateness and alignment with the recommendations provided therein, or otherwise.

Ground Conditions	See Section 6
Soil Types	The investigated site consists of stiff to very stiff Silty CLAY and very stiff Clayey SILT, with up to 1.7 m of FILL (comprised firm to very stiff Silty CLAY and Clayey SILT, with organic soils) overlying in; BH1, BH3, BH4 and BH5. Approximately 0.2 m of TOPSOIL was overlying BH2.
Natural Soil Sensitivity & Expansiveness	The natural soils on-site are assessed as Insensitive, Normal to Sensitive and in terms of expansiveness are classified as **CLASS M, Moderately Expansive**.
Groundwater	Water ingress was noted at a depth of approximately 2.4 m in both BH2 and BH5.
Mapped Hazards	At the time of report writing, TMC are unaware of any mapped hazards associated with the property.
Seismic Subsoil Class	Based on the results of our investigation, we consider the site to be **Class C** in accordance with NZS1170.5:2004

Foundations and Retaining See Section 7

FILL onsite. All excavations will require inspection and testing by Chartered Professional Engineer or their Agent who is familiar with this site and the contents of this suitability report. Where unsuitable materials are encountered, they should, in general, be undercut and replaced with Engineer approved compacted fill, or as otherwise recommended by the Engineer.

Where the depth of fill encountered is excessive, foundations should be piled / excavated to embed into competent Engineer approved natural soils.

All foundations will require Specific Engineering Design (SED) to account for Moderately Expansive soils (CLASS M) in accordance with AS2870:2011 and the NZ Building Code (NZBC).

The following bearing capacity values are considered appropriate for design purposes for the foundation on / in the natural site soils: Ultimate Bearing Capacity - 300 kPa

Foundation Type	Design Conditions
Reinforced Concrete Raft Type Slab	A Characteristic Surface Movement (ys) of 40 mm should be used in the design of the raft foundation for CLASS M (Moderately Expansive) soils. Alternatively, the slab can be placed on Engineer approved compacted hardfill that also extends a minimum of 1.0 m out beyond the building footprint to reduce the value of ys (see Section 6.3.3).
Timber Piles in Bored Concrete Footings	The detailed design of the foundations will determine the final foundation depths, etc. and provide an appropriate embedment depth to minimise ground swelling and shrinkage effects in alignment with the soil expansivity class. A minimum founding depth of 0.6 m below cleared ground levels into Engineer approved competent soils is recommended to mitigate against the shrink-swell effects of CLASS M (Moderately Expansive) soils.

Shallow Load-Bearing Strip Footings	Design parameters as above and in Section 7.1.1 and 7.1.3.
Retaining Structures	Retaining walls should be designed and constructed in accordance with Section 7.2.

Construction
• All works must be undertaken in accordance with the Health and Safety at Work Act 2015. • Services Present. The Development Designer will need to confirm the locations of all on-site / adjacent services prior to the commencement of design / any construction works, etc. • It is strongly recommended that no construction works are undertaken until the appropriate Consent / Approvals, etc. have been granted. • All earthworks should be undertaken in accordance with both the District and Regional rules. • Site Specific Inspection Requirements (at the time of report writing) are provided in Section 7.4.2. • Site Specific Earthworks Requirements are provided in Section 7.5.2.

On-Site Stormwater Management See Section 7.6
• Stormwater run-off from the development should be appropriately controlled and managed on-site both in accordance with the New Zealand Building Code and as per Council requirements. • Stormwater attenuation design is provided in Section 7.6. Attenuation summary is provided below:

	Orifice diameter	**Orifice invert location**	
ARI 10	**55 mm**	**1,000**	**mm** below overflow invert
ARI 100	**41 mm**	**350**	**mm** below overflow invert
Tank Size	**2 x**	**8,000**	**litres** As per attached detail
	Height:	**1.00**	**m**
ARI 10		**10,419.3**	**litres**
ARI 100		**15,958.2**	**litres**

1. INTRODUCTION

This Site Suitability Report (SSR) has been prepared by TMC Consulting Engineers Ltd. (TMC) for Nick Yakas (the "Client") in accordance with instructions received from them with regard to the above property, and in accordance with the short form agreement dated 28 September 2021.

The report has been revised following changes in Client proposal and a request for further information (RFI) from Far North District Council (FNDC), subsequently stormwater attenuation calculations have been revised for the changes in proposed impermeable surfaces.

The purpose of TMC's work was to evaluate the surface and subsurface conditions at the site by undertaking a geotechnical investigation to determine the suitability of the site for the proposed development including on-site stormwater management.

This report presents the results of the geotechnical investigation, describes the existing conditions, details any identifiable geological hazards affecting the site and provides geotechnical recommendations against the requirements of NZS3604:2011 where appropriate.

The geotechnical assessment is based on site conditions as observed during the site walkover and site investigation fieldworks carried out by TMC on 15 October 2021.

1.1 CLIENT SUPPLIED & OTHER INFORMATION

In preparing this SSR, we have also reviewed the following documentation:

Document Type	Reference
Request for Further Information	Far North District Council. (28/07/2022). *Further Information Request – Building Followup.* Reference Number: EBC-2022-1376/0.
Building Plans	Totalspan Buildings. (28/07/2022). *Site Plan, Building Proposed For: Nicholas & Tina Yakas.*
Architect Site Plan	Mealings Architecture. (Received by TMC 15/08/2022). *Waianga Pl Omapere Proposed Dwelling.* Sheet 0.02, 0.03.
Subdivision Plan	Thomson Survey. (15/11/2019). *Proposed Subdivision of Lot 7 DP 525890.* Ref. No. 9608.

This report must be read in conjunction with the above documentation and is based solely on our fieldwork assessment and the supplied / 3rd party available information to TMC at the time of report writing. TMC cannot warrant the accuracy, validity, etc. of any of the supplied / 3rd party available information.

In addition to the above, we strongly recommend as follows:

i. Should any additional relevant information become available then TMC must be contacted to ensure that this report and the recommendations contained therein are appropriate, and;

ii. Once the final plans for the proposed development is known, that the plans be reviewed by TMC, to;

- Verify that the recommendations contained in this report remain valid, and;
- That with regard to geotechnical aspects only, that the proposed foundation design both aligns satisfactorily with the recommendations provided in the TMC SSR and is appropriate.

The sourcing and provision of a Land Information Memorandum (LIM) or Project Information Memorandum (PIM) from the Far North District Council (FNDC) has not been included in our brief.

However, it may be prudent for the Client / Development Designer to obtain this documentation to provide an early stage capture of any further information about the area from any records on the FNDC GIS database. The LIM / PIM may provide information on relevant considerations, hazards, etc. that could later be raised at the time of a building consent application.

2. DEVELOPMENT PROPOSAL

The Plans show that an approximate 52 m^2 Totalspan dwelling with a 42 m^2 verandah is to be constructed at the northern end of the property. A future garage has also been shown on the plans provided currently proposed as approximately 56 m^2, shown to the south of the proposed dwelling, within the western half of the property.

We understand that the proposed dwelling is to be supported on a reinforced concrete slab with the verandah supported timber piles. The future garage foundation type is yet to be confirmed.

In addition, the design proposal includes the construction of an engineered cut/fill building platform to accommodate the dwelling foundation. Timber retaining walls are proposed for forming the permanent vehicle access to the property.

Refer; ‘Site Plan’ attached in the appendices.

3. SITE DESCRIPTION

The property (legally described as Lot 13 DP 546644) is located on the south-western side of Waianga Place approximately 200 m from State Highway 12 to the west. The property is sized at approximately 1,829 m^2 and is irregular in shape.

The property is currently accessed via a gravelled vehicle track leading northwards from Waianga Place to the proposed Totalspan building site.

The property is bounded by Waianga Place along the north-eastern boundary. The property has general fall to the southwest averaging approximately 15°. A pond is located at the eastern end of the property. A stormwater flow path runs along the southern property boundary, downslope of the pond. The pond and flow path are within an easement within the property. A levelled platform has been created at the proposed dwelling location in the northern end of the property. A vehicle track has been cut into the slope running northwards from Waianga Place to the proposed dwelling site.

Dwelling Site

> The proposed dwelling site has been levelled as mentioned above. The cut batter on the upslope eastern side of the dwelling site is currently sloping at approximately 1V:1H and is proposed to be retained. The cut is approximately 1.6 m high and the ground above the cut slopes up to the road (Waianga Place) at approximately 20°. The western side of the site has been filled and is sloping at up to approximately 25° to the southwest.
>
> No earthworks documentation has been provided to TMC with regards to placement of this fill, etc.

Future Garage

> The proposed future garage site is on sloping ground to the south of the proposed dwelling site. The slope within the future garage site is approximately 15° falling southwest.

The property is covered largely with disturbed surface soils with sparse grass and other foliage regrowth. Debris in the form of dead vegetation is also scattered across the property. Some mature trees are present within the property namely cabbage palms. The existing vehicle track and dwelling platform are gravelled.

The walkover of the proposed development undertaken at the time of the site fieldworks provided no evidence of recent or historic natural ground movement on or adjacent to the site. Vegetation and disturbed surface soils obscured any signs of natural ground instability.

Council services are present adjacent to the property boundaries.

All service locations, depths, etc. will need to be confirmed by the Development Designer prior to both the design of the foundations, etc. and construction works. Design to allow both for any disturbance or surcharge on the services and comply with Asset Owners off-set, etc. requirements. Approval is required from Council / Asset Owners to construct within the minimum required offsets or over Council / other services.

4. GEOLOGY AND NATURAL HAZARDS

4.1 GEOLOGY

Local geology at the property is shown and described on the GNS Science New Zealand Geology Web Map, Scale 1:250,000, as; Waitiiti Formation (Otaua Group) (Mot): Massive to poorly bedded mudstone and muddy sandstone, refer; 'GNS Science Website.'

The soils map of the area indicates that the site is within an area of Omanaia clay loam with coarse-structured subsoil (ONe). Sutherland, C. F.; Cox, J. E.; Taylor, N. H.; Wright, A. C. S. 1980: Soil map of Waipoua-Aranga area (sheets O06/07), North Island, New Zealand. Scale 1:100,000 N.Z. Soil Bureau Map 185.

Refer; 'NRC Soil Factsheet (3.2.1)' attached in the appendices.

4.2 NATURAL HAZARDS

At the time of report writing, TMC are unaware of any mapped hazards associated with the property.

5. FIELDWORKS INVESTIGATION SUMMARY

The purpose of the following intrusive fieldworks investigation was to provide information on the general soil profile, the variability, relative density and strength of soils together with any observed groundwater levels within the proposed building site area.

TMC undertook a shallow ground investigation comprising 5 hand auger boreholes (BH) of 50 - 75 mm diameter to depths of up to 3.0 m below ground level (bgl).

Scala Penetrometer tests (SP) were undertaken commencing from ground level adjacent to the boreholes to a depth of 1.5 m. SP tests were restarted in the base of the boreholes to depths up to 3.9 m to assess the strength and consistency of the strata beyond the depth of the boreholes.

Refer, 'Borehole Logs & Scala Penetrometer Data' attached in the appendices.

Approximate locations of the BH and SP tests are shown on the 'Site Plan' attached.

In-situ hand undrained shear vane tests were carried out at 0.3 m depth intervals in accordance with the New Zealand Geotechnical Society (NZGS); Guidelines for Hand Held Shear Vane Testing, August 2001, and classified in accordance with the NZGS Field Classification Guidelines; Table 2.10, December 2005.

Classification of the recovered soil borehole arisings was carried out in accordance with the "Field Description of Soil and Rock", NZGS, December 2005.

6. FINDINGS AND CONCLUSIONS

6.1 GROUND CONDITIONS

The ground conditions encountered during the shallow ground investigation have been interpreted from the BH logs, shear vane and Scala Penetrometer testing undertaken.

The natural subsurface conditions encountered are considered to be generally consistent with the published geological information.

The investigated site consists of stiff to very stiff Silty CLAY and very stiff Clayey SILT, with up to 1.7 m of FILL (comprised firm to very stiff Silty CLAY and Clayey SILT, with organic soils) overlying in; BH1, BH3, BH4 and BH5. Approximately 0.2 m of TOPSOIL was overlying BH2, refer: 'BH Logs' attached.

It should be noted that actual ground conditions may vary across the investigated development site, and in some locations may differ from those described.

6.2 SOIL SHEAR STRENGTHS

Natural Soils

Shear vane dial readings (corrected) of the soil tested in the Boreholes ranges from 60 kPa (36 kPa remoulded) to in excess of 199 kPa.

Where measurable, the average of peak and remoulded shear strength ratio for the site soils investigated ranged between 1.4 to 4.2 indicating that these soils are of a range; Insensitive, Normal to Sensitive as per the NZGS Guidelines.

Fill

Shear vane dial readings (corrected) of the soil tested in the Boreholes ranges from 43 kPa (14 kPa remoulded) to 125 kPa (14 kPa remoulded).

Where measurable, the average of peak and remoulded shear strength ratio for the site soils investigated ranged between 2.0 to 8.8 indicating that these soils are of a range; Moderately Sensitive to Extra Sensitive as per the NZGS Guidelines.

- Fill materials generally have lower strengths than the natural soils.
- Higher soil sensitivity is typical in reworked (fill) materials.

6.3 EXPANSIVE SOILS

6.3.1 General

Based on the results of our fieldwork investigation, along with our knowledge and experience with these soils, we classify the investigated site as CLASS M, Moderately Expansive in terms of AS2870:2011.

A Characteristic Surface Movement (y_s) of 40 mm should be used in foundation design. Alternatively, hardfill can be placed beneath the building footprint to reduce y_s, see Section 6.3.3.

Reworking or exposure of these soils during wet weather or winter months can damage these soils resulting in much lower bearing capacities, the potential for seasonal shrinkage / swelling and slab cracking.

These soils do not meet the NZS3604:2011 definition of 'Good Ground'. Foundations / structures will therefore need to be designed accordingly and care must be taken when both planning and undertaking the site earthworks.

Refer, 'Notes' attached in appendix and report Section 7.

6.3.2 Effects of Tree Roots

A wide range of tree and shrub species have high groundwater demands during summer months. The effects of such moisture demands on expansive soils can be substantial and can lead to differential building settlement. Particularly high-water demand species include, but not limited to;

Gum, Willow, Cypress/Radiata Pine, Oak, Poplar, Ficus (Fig trees), Elm, Norfolk Pine.

Planting of trees should be avoided near the foundation of a building on expansive soils as they can cause damage due to drying of the clay at substantial distances. To reduce, but not necessarily eliminate, the possibility of damage, tree planting should be restricted to a minimum distance from the building as follows:

i.) 1.5 x mature height of tree for Class E; Extremely Expansive soil sites.
ii.) 1 x mature height of tree for Class H; Highly Expansive soil sites.
iii.) 0.75 x mature height of tree for Class M; Moderately Expansive soil sites.

Where groups or rows of trees are involved, the planting distance from the building should be increased. Removal of trees from the site can also produce similar problems.

The level to which these measures are implemented depends on the expansivity of the site soils. The above planting distances and measures apply mainly to masonry buildings and masonry veneer buildings. For frame buildings clad with timber or sheeting, lesser precautions *may* be appropriate.

Alternatively, the foundation system may be designed for the effect of trees in accordance with Appendix H of AS2870:2011.

Refer, 'Notes' attached in appendix and report Section 7.

6.3.3 Effects of Engineered Hardfill on Soil Expansivity

To aid in mitigating the effects of expansive soils at the building site, compacted hardfill can be placed beneath the building footprint. The non-expansive hardfill is considered to reduce the characteristic surface movement (ys) across the building footprint and therefore reduce the design forces on the foundation.

The existing cleared ground level should be undercut, extending a minimum of 1m outside the building footprint, and then replaced with engineered compacted and approved hardfill. The following minimum layers of compacted hardfill can provide the following reductions in the characteristic surface movement, y_s;

Depth of Engineered Hardfill	Characteristic Surface Movement (y_s) Reduction
Unmodified site	0 mm
0.25m undercut and replaced with engineered hardfill	18 mm
0.45m undercut and replaced with engineered hardfill	32 mm

Alternatively, Specific Engineering Design (SED) should be used to calculate the specific surface movement reduction for varying depths of engineered hardfill.

6.4 GROUNDWATER

Water ingress was noted at a depth of approximately 2.4 m in both BH2 and BH5. No other groundwater water was encountered.

Groundwater levels may rise during wet winter conditions or following periods of heavy or prolonged rainfall / other events.

6.5 SCALA PENETROMETER TEST RESULTS

Scala Penetrometer test values in terms of (number of blows /100mm ground penetration) were noted commencing adjacent to, and at the base of BH: 1-5.

This testing was undertaken to provide an indicative allowable bearing capacity of the site soils encountered with depth and to determine any uniformity in ground conditions across the investigated site, refer; ‘Scala Penetrometer Resistance Test Results’ attached in the report appendices.

- The blow counts: 18 blows being the highest and 0.25 blows being the lowest.
- Blow counts generally increased with depth.
- Scala Penetrometer test values were generally lower in the fill materials.

In general terms of soil bearing capacity, NZS3604:2011 for the Construction of Timber-Framed Buildings defines ‘Good Ground’ as having an allowable bearing capacity of at least 100 kPa: indicatively 5 blows per 100 mm.

6.6 SEISMIC SETTING AND CONSIDERATIONS

There are no active faults currently mapped within the Northland region (refer; NZS 1170.5:2004 Table 3.3), while the whole Northland peninsula is generally regarded as tectonically stable.

Earthquake risk in Omapere is therefore considered to be relatively low.

Considering the:

- Regional seismic risk,
- depth of any groundwater,
- lack of active faults near the property, and
- the soil types encountered,

It is our opinion that there is a low risk of ground rupture and liquefaction induced settlement at the property.

Proposed structures will need to be designed to account for seismic shaking and ground motions.

Based on the results of our investigation, we consider the site to be **Class C** in accordance with NZS1170.5:2004.

6.7 NATURAL HAZARDS

Site Stability

The property is not currently mapped for stability risk.

Local geology at the property both mapped and as investigated is: Waitiiti Formation (Otaua Group) (Mot).

Mapped site soils are: Omanaia clay loam with coarse-structured subsoil (ONe).

The site soils encountered are also considered to be generally consistent with the published geological information.

With regard to these soils and their stability, the Northland Regional Council (NRC) soil factsheet (3.2.1) describes their features as follows:

> *"Sandstone is a harder basement rock and supports steep slopes where slip erosion is common".*
>
> *"These soils are prone to tunnel gullying, which in turn can trigger extensive slumping and earthflow erosion".*

The NRC soil factsheet provides information on Erosion risks and control as follows:

Erosion risks	Soil type	Specific problems	Possible solutions
Landslide erosion (slips and slumps)	All young sandstone soils on steeper slopes, especially Puhoi suite and Omanaia suite soil types	Clay washed downwards by rain creates a slip plane known as a 'greasy back'. During high intensity rain storms following dry weather, water penetrates cracks in soils and lubricates the slip plane, triggering slips. Deep slips >1 m can occur on Whangaripo clay and clay loam (WRe, WReH, WR, WRH). Whirinaki clay loam (WN, WNH) is prone to slip erosion and deep seated mass movement on steeper slopes	On actively eroding areas, densely plant at 5m spacings at the foot of slips, expanding to 8-10m spacings upslope. Open plant poplars across hillsides at 15m spacing as a preventative measure. Oversow and fertilise slip scars for faster revegetation. Use contour cultivation for cropping on slopes under 15°
Gully erosion	Omanaia suite especially	More mature soils are prone to gully erosion	Plant poplar or willow poles in a zigzag pattern along the gully

The existing proposed dwelling site has been previously levelled. The existing slope of the proposed future garage site is approximately 15°.

A review of historical aerial photography commencing from 1942 provides no clear evidence of previous natural instability at the property, refer; 'Retrolens Historical Image Resource Website.'

No recent or historic natural ground movement was visibly evident at the proposed building site or in the immediate surrounds at the time of the fieldwork investigation.

No evidence of natural ground movement was provided by the fieldworks and ground investigation testing.

However, uncertified FILL is present on the property.

We have therefore provided our foundation recommendations to align with both the soil instability ranges and the above observations.

Please refer also, report Sections: 'Foundations', 'Earthworks', 'Retaining' and 'Stormwater and Drainage'.

<u>Natural Hazards: Summary</u>

For the proposed dwelling only, provided that all the recommendations of this report are correctly implemented and subject to satisfactory TMC Development Review, with regard to the Building Act 2004; Sections 71-72, we believe on reasonable grounds that;

i. The land on which the building work is to take place is neither subject to, nor likely to be subject to subsidence and slippage; and
ii. The building work itself is not likely to accelerate, worsen or result in subsidence or slippage of that land or any other property.

In the statement provided above, the 'land' referred to applies to that of the proposed building footprint.

For the proposed future developments, once the final arrangement, design, details, etc. have been finalised, an Engineer familiar with both the site and contents of this report should be engaged to review the plans, advise accordingly and thereafter provide comments with regard to the Building Act 2004.

7. RECOMMENDATIONS

7.1 FOUNDATIONS

7.1.1 General

FILL onsite. All excavations will require inspection and testing by Chartered Professional Engineer or their Agent who is familiar with this site and the contents of this suitability report. Where unsuitable materials are encountered, they should, in general, be undercut and replaced with Engineer approved compacted fill, or as otherwise recommended by the Engineer.

<u>Where the depth of fill encountered is excessive, foundations should be piled / excavated to embed into competent Engineer approved natural soils.</u>

The results of our investigation indicate that the soils onsite <u>do not meet</u> the NZS3604:2011 definition of 'Good Ground'. All foundations will require Specific Engineering Design (SED) to account forsoils (CLASS M) in accordance with AS2870:2011 and the NZ Building Code (NZBC).

The final depth of foundations, etc. may be governed by structural loads. This aspect can be addressed during the foundation design process.

From the site soil investigation and assessment, the following bearing capacity values are considered appropriate for design purposes for the foundation <u>on / in the natural site soils</u>:

Ultimate Bearing Capacity	300 kPa
Dependable Bearing Capacity (F.O.S =2)	150 kPa
Allowable Bearing Capacity (F.O.S =3)	100 kPa

Based on the information provided to TMC at the time of report writing we understand that the proposed dwelling is to be supported on a reinforced concrete slab with the verandah supported timber piles. The future garage foundation type is yet to be confirmed.

A description of the foundations follows with design parameters as above.

7.1.2 Reinforced Concrete Raft Type Slab on Engineered Fill

Following undercutting and replacement of any unsuitable materials, uncertified fill, etc. or piling if required.

A Characteristic Surface Movement (y_s) of 40 mm should be used in the design of the raft foundation for CLASS M (Moderately Expansive) soils.

Alternatively, the slab can be placed on Engineer approved compacted hardfill that also extends a minimum of 1.0 m out beyond the building footprint to reduce the value of y_s (see Section 6.3.3). The depth of the above hardfill layer is to be confirmed by the Designer during the detailed design process.

For filling to form a final subgrade for the slab, it is recommended that clean, well graded compacted hardfill is used such as; GAP 20 to GAP 65, or as otherwise approved by the Engineer.

7.1.3 Timber Piles in Bored Concrete Footings

For shallow foundations in expansive soils:

- The detailed design of the foundations will determine the final foundation depths, etc. and provide an appropriate embedment depth to minimise ground swelling and shrinkage effects in alignment with the soil expansivity class. A minimum founding depth of 0.6 m below cleared ground levels into Engineer approved competent soils is recommended to mitigate against the shrink-swell effects of CLASS M (Moderately Expansive) soils.

- Embedment into competent natural materials and as above, etc. to be checked and approved by the Inspecting Engineer.

Specifically, on this site, bored pile holes and drilling tailings will need to be inspected by an Engineer familiar with both the contents of this report and the site to ensure that all piles are sufficiently embedded in the appropriate materials.

7.1.4 Reinforced Concrete Slab on Engineered Fill with Shallow Load-Bearing Strip Footings

Design parameters as above in Section 7.1.1 and 7.1.3.

7.1.5 Foundations Adjacent to or Above Services

Services onsite.

Subsequent to confirmation of all services by Development Designer:

Foundations / structures adjacent to or above any underground services such as Council sanitary sewer, stormwater lines and other assets must be supported on piles to both a design specification and embedment to meet both the Council / Asset owners and Design Engineers requirements.

Foundations within the line of influence from the services should comprise bored piles that both extend to well below the invert level of the pipe and with side clearances to the pipe in accordance with the above requirements.

The bearing capacities provided above are considered appropriate for bridging pile design.

7.2 RETAINING STRUCTURES

7.2.1 General

Proposed development indicates retaining walls will be required.

Retaining structures exceeding 1.5 m and/or supporting any surcharge loads will need to be designed by a Chartered Professional Engineer and constructed in a safe manner.

Factors of safety and surcharge loadings appropriate to the conditions should be in accordance with "Retaining Wall Design Notes – Ministry of Works Department, NZ, Issue C: July 1973".

Due consideration to surcharges, retained heights and levels, etc. must be undertaken for each retaining structure throughout the design process. In addition, retaining design will need to be in accordance with Council surcharge requirements by boundaries.

All retaining walls / structures should be constructed with appropriate toe drainage and should be backfilled to within 0.3m of their full height with lightly tamped, free draining granular backfill material. Toe drainage: Proprietary perforated pipe drain / strip drain should be installed at a basal location behind all retaining walls to provide appropriate drainage and avoid the risk of a build-up of hydrostatic pressures / water levels.

All drainage should be connected into an approved stormwater disposal system, or as otherwise appropriate. If required, all waterproofing details should be specified by the building Designer.

Subsequent to construction of retaining structure(s), a programme of regular monitoring must be initiated to assess the continuance of both effective retention and drainage functions. Thereafter, if necessary, any maintenance required can be undertaken to ensure fully effective drainage, function, etc.

7.2.2 Soil and Design Parameters

FILL onsite.

- Retaining to be sufficiently embedded into Engineer approved competent natural materials.
- Specifically, on this site all retaining excavations will need to be inspected by an Engineer familiar with both the contents of this report and the site.

Soil and design parameters for; natural soil, fill material and different wall types are provided in the Table below.

Natural Soil			
Retaining Wall Type	**Soil Parameters**		**Design Parameters and Notes**
Timber Pole	Soil cohesion c' =	5 kPa	Passive resistance in front of the retaining wall poles can be determined using Broms Method generally assuming an undrained shear strength Cu = 80 kPa.
	Internal soil friction angle ϕ =	30°	
	Soil density γ =	18 kN/m^3	
Cantilevered: Free Standing or Propped	As Above		For design, soil pressures may be determined for active pressure conditions using a Ka value of no less than 0.3
Rigid Retaining	As Above		For the design of retaining walls integrated into the building structure which are relatively rigid and unyielding, soil pressures should be determined for at-rest pressure conditions using an earth pressure coefficient K_0 of no less than 0.5
Fill Material			
As per the types above	Soil cohesion c' =	1 kPa	Use these parameters for any fill material being retained, assuming an undrained shear strength Cu = 40 kPa
	Internal soil friction angle ϕ =	26°	
	Soil density γ =	17 kN/m^3	

Table: Soil and retaining design parameters

7.3 SAFETY IN DESIGN AND CONSTRUCTION RISK MANAGEMENT

7.3.1 Design

In addition to the prevailing Health and Safety legislation, the TMC recommendations provided in this report have also been made with regards to Safety in Design, which should be considered during the design phase.

'Health and Safety by Design' is the process of managing health and safety risks throughout the lifecycle of structures, plant, substance or other products. Designers are in a strong position to make work healthy and safe from the start of the design process. Health and Safety by Design is not a separate concept from good design – they are the same thing.

Aside from statutory Healthy and Safety requirements, TMC recommend that all design should be undertaken in full accordance with the following good practice guidelines (and any successor publications), in particular:

Health and Safety by Design, An Introduction: August 2018.

Refer for download the above Worksafe documentation as below:

https://www.worksafe.govt.nz/topic-and-industry/health-and-safety-by-design/health-and-safety-by-design-gpg/

7.3.2 Construction Risk Management

Any and all works including (but not limited to); design, construction, operations and maintenance must be undertaken in accordance with the Health and Safety at Work Act 2015.

Services present.

The Development Designer will need to confirm the locations of all on-site / adjacent services including for site access prior to the commencement of design / any construction works, etc.

Any open excavations should be fenced off or covered, and/or access restricted as appropriate.

With all excavation and construction work there is a risk of collapse. Whenever ground conditions are suspect, bad weather conditions are forecast or when there is a risk of damage to adjacent property, excavations should all be carried out in a "hit and miss" pattern and / or temporary ground support, cover protection used.

The Contractor is responsible for determining the width of each excavation to suit his plant and construction programme.

Cut faces should not be left unsupported. Similarly, cut faces should not be left uncovered for any length of time, especially during periods of rain.

The Contractor is responsible at all times for ensuring that all necessary precautions are taken to protect all aspects of the works, adjacent structures and services, etc.

7.4 CONSTRUCTION INSPECTIONS

7.4.1 General

It is increasingly common for the Building Consent Authorities' (BCA) to require a Producer Statement; PS4, this is an important document. The purpose of the PS4 is to confirm the Engineers' professional opinion to the BCA that aspects of a building's design comply with the Building Code, or that elements of construction have been completed satisfactorily in accordance with the approved Building Consent (BC).

If you require TMC to issue a PS4 we will need to carry out inspection of the work at the key construction stages as per the BC, any SED, and Council requirements. TMC must have a PDF copy of the BC and the relevant associated documentation provided to us prior to attending any site construction inspection.

Specific designs / SED will likely require an Engineer to inspect that aspect of the work and confirm satisfactory completion.

During construction, site inspections also allow the timely provision of solutions and recommendations should any engineering problems arise.

Prior to works commencement, the Engineer should be contacted to confirm the construction methodologies, inspection, and testing frequency.

Upon satisfactory completion of all the inspected work aspects, TMC would then be in a position to issue the PS4 as required by Council.

We require at least 48 hours' notice for site inspections. An additional call out fee will apply if a requested inspection is undertaken at short notice.

To request a PS4 from TMC: ensure all works have been satisfactorily completed and checked, and all documentation complete. Send an email and a PDF copy of the Building Consent to: office@tmcengineers.co.nz ensuring the subject line has: "PS4 request", followed by the "property address". A minimum fee of $200 + gst for PS4 processing and issue will apply.

7.4.2 Site Specific Inspection Requirements

Based on our ground investigation and site assessment, together with the information provided to TMC at the time of report writing, we recommend the following Engineer inspections during construction as a minimum:

- Site cut check;
- Compaction – Fill;
- Bored pile holes and drilling tailings;
- Footings;
- Reinforced Concrete Slab / Raft Type Slab (pre-pour).

It should be noted that additional construction inspections will likely be required by the; Structural Engineer, BCA, etc. as part of the Building Consent compliance and other Quality Assurance processes.

7.5 EARTHWORKS

7.5.1 General

All earthworks should be undertaken in accordance with both the District and Regional rules.

In addition, we recommend that all earthworks activities be carried out in full accordance with the following technical publications, in particular:

i. Erosion and Sediment Control Guide for Land Disturbing Activities in the Auckland Region June 2016 Guideline Document 2016/005.

ii. Auckland Council; Building on small sites - Doing it right. BC5850.

Refer for downloads the above Auckland Council documentation as below:

https://ourauckland.aucklandcouncil.govt.nz/articles/news/2017/09/auckland-council-leads-the-way-in-erosion-and-sediment-control/

https://www.aucklandcouncil.govt.nz/building-and-consents/understanding-building-consents-process/starting-building-renovation-work/Documents/bc5850-building-small-sites-brochure.pdf

iii. New Zealand Standard Code of Practice for Earthfill for Residential Development, NZS 4431:2022.

iv. Code of Practice for Urban Land Subdivision – NZS 4404:2010, and

v. Any other relevant publications, including any of the above as superseded.

Some general recommendations are provided below, however where possible site-specific advice should be sought from an appropriately experienced Engineer.

We strongly recommend that earthworks are not undertaken during wet or, extreme dry conditions, etc.

7.5.2 Site Specific Earthworks Requirements

We strongly recommend to the Designer of any site works that involve cutting or filling, that the proposal be discussed with an Engineer at an early design stage.

Preceding any site development works, a Geotechnical Engineer should be contacted to discuss the earthworks methodology, inspection requirements and testing frequency.

<u>FILL onsite. All excavations will require inspection and testing by Chartered Professional Engineer or their Agent who is familiar with this site and the contents of this suitability report.</u>

Engineer approved horizontal benching should be undertaken across all sloping ground prior to the placement of any fill material.

Cuts and fills within 3 m of buildings / structures and in excess of 0.5 m should be suitably retained or battered at safe angles not exceeding 1V:3H unless approved otherwise by an Engineer.

Appropriate drainage should be installed as required, above and at the toe of all unretained cuts.

Any fill placement within 3.0 m of the building envelope will be subject to controlled filling operations, with fill placement inspection, testing and approval by an Engineer.

Measures must be taken to protect the exposed moist soils from drying out. Maintaining the natural moisture content of the subgrade soils may be achieved by fine spraying with water. An impermeable membrane or similar should be placed immediately above the subgrade after the excavation of the topsoil, etc.

Thereafter; All exposed soils should be re-grassed, planted, covered, or paved as soon as practicable to reduce the risk of erosion, scour, etc.

7.5.3 Site Clearance and Preparation

All deleterious material including any uncontrolled fill, vegetation, topsoil, etc. should be removed from all proposed foundation / construction areas.

Wherever any deposits of soft, or other unsuitable material is encountered at the surface cut / foundation level at the building site, it should in general be undercut and replaced with Engineer approved compacted fill, or as otherwise recommended by the Engineer.

If cut and / or imported materials are stockpiled on site, stockpiles must be located well clear of the works and formed in an appropriate manner so that land stability and / or existing structures, etc. are not compromised.

7.5.4 Temporary and Permanent Earthworks

Particular care should be taken during the construction phase with respect to excavations to form the benches for building platforms, access driveways, retaining walls, etc.

The building sites should be shaped to assist in stormwater run-off. Any excavation left open should be protected and or left in a state as to not pond water. Saturating site soils may result in a reduction of bearing capacities.

Depending on the ground conditions and groundwater levels, etc. at the time of construction, temporary support may be required to stabilise any cuts that are excavated. In addition, all cuts / exposed soils should be adequately protected to prevent inclement moisture changes to the exposed soils.

7.6 STORMWATER AND DRAINAGE

7.6.1 Stormwater and Surface Water Control

Stormwater run-off from the development should be appropriately controlled and managed on-site both in accordance with the New Zealand Building Code and as per Council requirements.

Stormwater flows must not be allowed to run onto or over site slopes, or to saturate the ground so as to adversely affect slope stability or foundation conditions, etc.

As a minimum, runoff from any higher ground should be intercepted by means of shallow surface drains or small bunds to ensure protection of the building platform(s) from both saturation and erosion.

Water collected in interceptor drains should be diverted away from the building site to a disposal point as appropriate.

Concentrated stormwater flows from driveways, tanks, roofed and paved areas, etc. must be collected and carried in sealed pipes or drains and discharged in a controlled manner to a disposal point as appropriate.

Subsequent to drainage construction, a programme of regular monitoring must be initiated to assess the continued effectiveness of drainage function and if necessary, the instigation of any maintenance required to ensure fully effective drainage, etc.

The Development Designer will need to confirm the drainage proposals compliance with all of the above requirements.

7.6.2 Stormwater Assessment Criteria

The outline, design and recommendations contained within this report are in accordance with the following requirements and documentation;

- New Zealand Building Code Clause E1 – Surface water.
- The Regional Rules.
- At the Far North District Councils (FNDC) request and instructions, TMC have utilised the FNDC supplied spreadsheet for stormwater calculations in this report.

7.6.3 Stormwater Design

The proposed stormwater system is designed to take the increased stormwater runoff generated from the impermeable areas formed in the construction of the proposed new development, and to attenuate and manage these flows as below:

- A collection system is to be installed to direct developed surface runoff from the proposed development to two 8,000 L 'Promax' underground or equivalent water tanks for stormwater attenuation, Refer; 'Promax 8,000L Tank Drawing' attached in appendices.

- It is recommended that the managed overflow from the attenuation tanks be piped to the stormwater flow path which runs along the southern property boundary.

7.6.4 Design Parameters

Based on the plans and information provided at the time of report writing, we have designed for proposed impermeable surfaces as below:

- 52 m^2 dwelling
- 56 m^2 future garage
- 180 m^2 concrete
- 30 m^2 paving blocks (semi-permeable)

At the Client's specific request, we have allowed for an additional future impermeable surface area to utilise the full storage capacity of the proposed tanks for attenuation. Based on the Client supplied information available at the time of report writing this gives a potential future impermeable area of up to approximately 250 m^2.

The total additional impermeable area for the attenuation design has therefore been assessed as; 150 m^2 for roof areas, and 210 m^2 of driveway areas plus 250 m^2 of future impermeable allowance. This being a total of approximately 610 m^2.

7.6.5 Attenuation Design

<u>Attenuation Tanks</u>

Two 8,000 litre attenuation tanks are to be utilised receiving discharge from the proposed development. The two tanks are to be plumbed together to act as one vessel.

Two orifice outlets to the attenuation tanks, arranged as above, are to be installed to reduce post development discharge from the property.

Stormwater overflow from the tanks is to be via a minimum 100 mm diameter overflow pipe at the top of the tanks and is to be thereafter piped to the stormwater flow path which runs along the southern property boundary, subject to Council approvals, etc.

The tanks should be positioned in such a way to allow sufficient gravity-fall from the tank outlet to the stormwater flow path.

Suitable litter filters or leaf slides shall be installed in line between the roof catchments and the attenuation tanks. The filters will require regular inspection and cleaning in accordance with the manufacturers recommendations to ensure the effective operation of the system. The frequency of cleaning will also depend on any future plantings around the proposed development, etc.

Tank system dimensions and volumes are shown in the Table below and on the attached calculation sheets.

	Orifice diameter	Orifice invert location	
ARI 10	**55 mm**	**1,000**	**mm** below overflow invert
ARI 100	**41 mm**	**350**	**mm** below overflow invert
Tank Size	**2 x**	**8,000**	**litres** As per attached detail
	Height:	**1.00**	**m**
ARI 10		**10,419.3**	**litres**
ARI 100		**15,958.2**	**litres**

Table: Overall Attenuation Tank System Dimensions and Volumes

LIMITATIONS

This report has been prepared solely for the use of our Client with respect to both the particular brief and specific purpose provided to TMC Consulting Engineers Ltd. (TMC), with regard to the specific project described herein. No liability or any duty of care is acknowledged or accepted for the use of any part of this report in any other context or for any other purpose, or by any other person, other party or entity.

This document is both the property and copyright © of TMC. Any unauthorised employment or reproduction, in full or part is forbidden. This report may not be read or reproduced other than in its entirety. This report does not address matters relating to the National Environmental Standard for Contaminated Sites.

The opinions, recommendations and comments given in this report are the result from the application of accepted industry methods of site investigation.

As factual evidence has been obtained solely from boreholes, shear vanes and Scala Penetrometer tests which by their nature only provide information about a relatively small volume of subsoils at that exact location, there may be special conditions pertaining to this site which have not been disclosed by the investigation and which have not been taken into account in our report.

Inferences are made about the nature and continuity of subsoils away from and beyond the testing locations but cannot be guaranteed. The soil descriptions detailed on the exploratory bore logs provided are based on the field descriptions of the soils encountered.

During the processes of site development and construction, an Engineer competent to judge whether the conditions are compatible with the assumptions made in this report should examine the site. In all circumstances, if any variations in the ground conditions occur which differ from those described or are assumed to exist, and then it is essential that the matter be referred back to TMC immediately to advise accordingly.

The soil performance behaviour outlined by this report is dependent on the construction activity and actions of the builder/contractor. Inappropriate actions before or during the construction phase may cause behaviour outside the limits provided in this report.

With regard to the design of an on-site stormwater system in this report, all concept drainage design is up to the external connection point for any new building / structures / slabs; Designs for internal plumbing or any other stormwater related work, etc. are excluded.

All future owners of this property should seek professional geotechnical advice to satisfy themselves as to its ongoing suitability for their intended use.

APPENDICES

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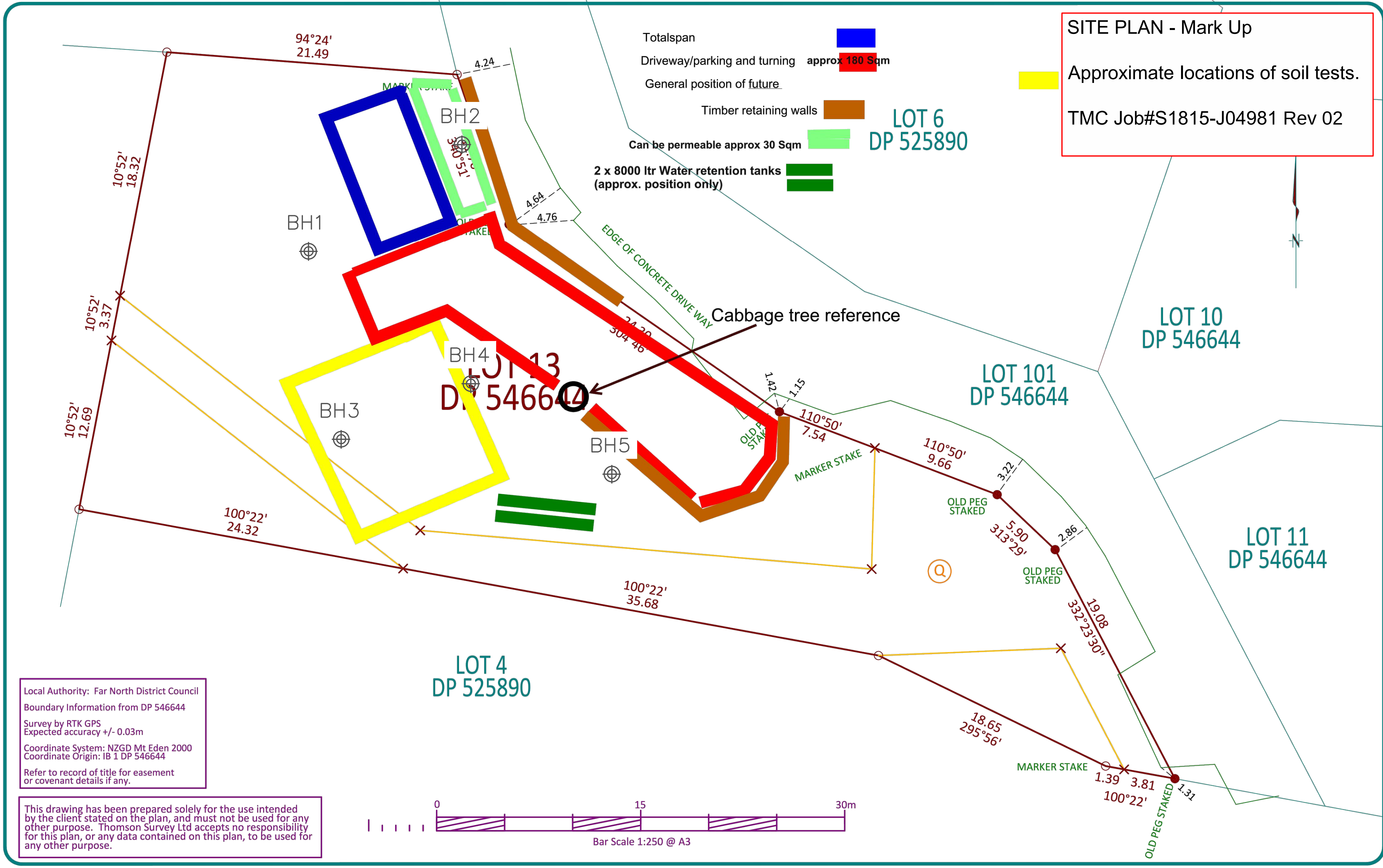
Client Supplied Information:
Architect Site Plan Building Plan Subdivision Plan FNDC Request for Further Information
Notes and Guidance:
Expansive Soils NRC Soil Factsheet (3.2.1) Promax 8,000L Tank Drawing



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Ph: (09) 4077360
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Registered Land Surveyors, Planners & Land Development Consultants

STAKE SURVEY OF LOT 13 DP 546644

Waianga Place

PREPARED FOR: Yakas. N

	Name	Date
Survey	GB	26/05/21
Design		
Drawn	GB	31/05/21
Approved		
Rev		

10045 redef 26-05-21.lcd

ORIGINAL SCALE 1:250 | SHEET SIZE A3

Surveyors Ref. No: 10045

Series

Sheet 1 of 1

BOREHOLE LOG 1

Project: Lot 13 DP 546644 Waianga Place, Omapere
Client: Nick Yakas
Job No: S1815-J04981
Date: 15/10/2021

TMC CONSULTING ENGINEERS

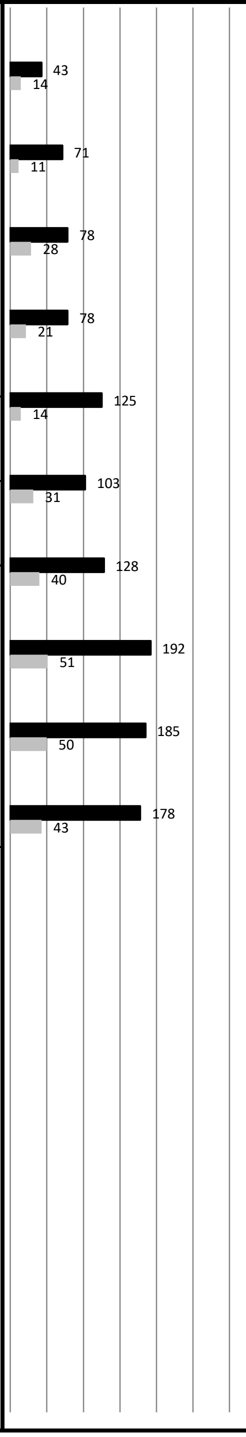
Graphic Symbol: **Fill** · **Rock** · **Cobbles** · **Gravel** · **Sand** · **Silt** · **Clay** · **Organic Soil**

In situ shear vane reading
Remoulded shear vane reading
Scala Penetrometer
5 blows/100 mm (Scala)

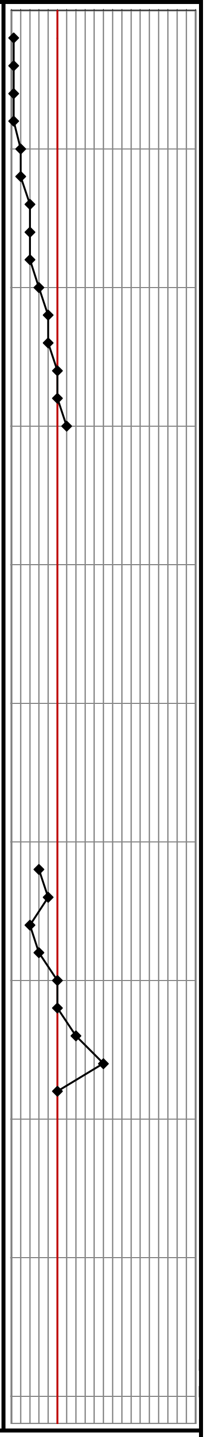
Depth mm	G.W.L	Geology	Field Description
0 – 1400	No groundwater observed	Waitiiti Formation (Otaua Group) (Mot)	FILL (Silty CLAY), orangish brown mottled grey, moist, plastic, firm wet, surface water ingress stiff inclusions of organic soil trace rootlets
1400 – 1700			FILL (Clayey SILT), brown mottled grey, moist, friable, very stiff
1700 – 2000			Silty CLAY, orangish brown mottled grey, moist, plastic, very stiff
2000 – 3000			Clayey SILT, brown and grey, moist, friable, very stiff brown and grey mottled bluish grey
3000			Auger terminated at 3.0 m

Depth scale (mm): 300, 600, 900, 1200, 1500, 1800, 2100, 2400, 2700, 3000, 3300, 3600, 3900, 4200, 4500, 4800, 5100

Undrained Shear Strength (kPa) Corrected (Per NZGS guideline)



Scala Penetrometer (blows/ 100 mm)



Drill Method	50 - 75 mm hand auger		
Location	Refer to site plan	NOTES 1) The subsurface data described above has been determined at this specific borehole location. The data will not identify any variations away from this location.	
Inspector	CH	2) UTP - Unable to penetrate	
Shear Vane No	2465		

CUT BATTER / BOREHOLE LOG 2

Project: Lot 13 DP 546644 Waianga Place, Omapere
Client: Nick Yakas
Job No: S1815-J04981
Date: 15/10/2021

TMC CONSULTING ENGINEERS

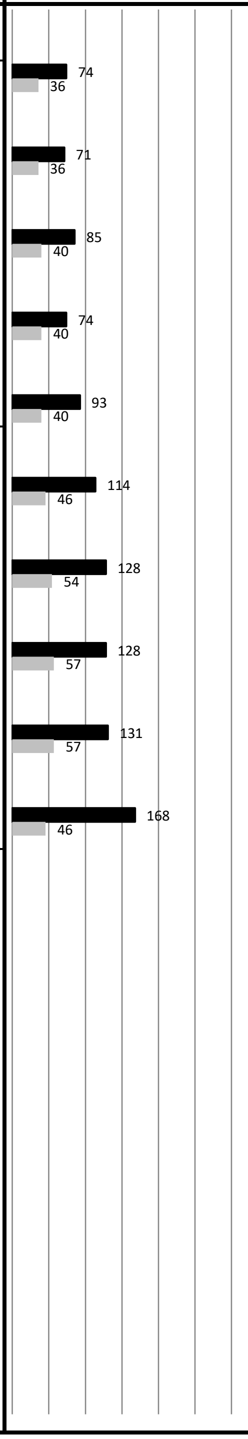
Graphic Symbol: Fill, Rock, Cobbles, Gravel, Sand, Silt, Clay, Organic Soil

In situ shear vane reading
Remoulded shear vane reading
Scala Penetrometer
5 blows/100 mm (Scala)

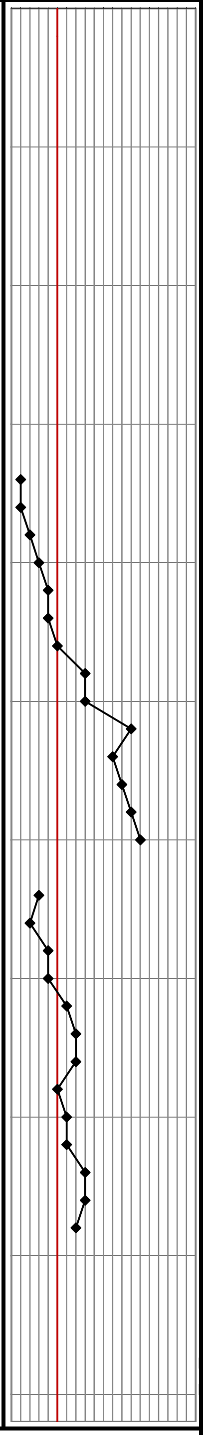
Depth mm	G.W.L	Geology	Graphic Log	Field Description
0–200	Groundwater level not reached	Waitiiti Formation (Otaua Group) (Mot)	Organic Soil	Cut Face Log: 200 mm TOPSOIL, light brown, moist, friable
200–1500			Clay/Silt	Silty CLAY, orangish brown, moist, low plasticity, stiff water observed in drain at toe of cut
1500–3000			Clay/Silt	Borehole Log: Silty CLAY, bluish grey mottled brown, moist, plastic, very stiff groundwater ingress, moist - wet
3000				Auger terminated at 3.0 m

Depth mm: 300, 600, 900, 1200, 1500, 1800, 2100, 2400, 2700, 3000, 3300, 3600, 3900, 4200, 4500, 4800, 5100

Undrained Shear Strength (kPa) Corrected (Per NZGS guideline)



Scala Penetrometer (blows/ 100 mm)



Drill Method	50 - 75 mm hand auger	
Location	Refer to site plan	NOTES 1) The subsurface data described above has been determined at this specific borehole location. The data will not identify any variations away from this location.
Inspector	CH	2) UTP - Unable to penetrate
Shear Vane No	2465	

BOREHOLE LOG 3

Project: Lot 13 DP 546644 Waianga Place, Omapere
Client: Nick Yakas
Job No: S1815-J04981
Date: 15/10/2021

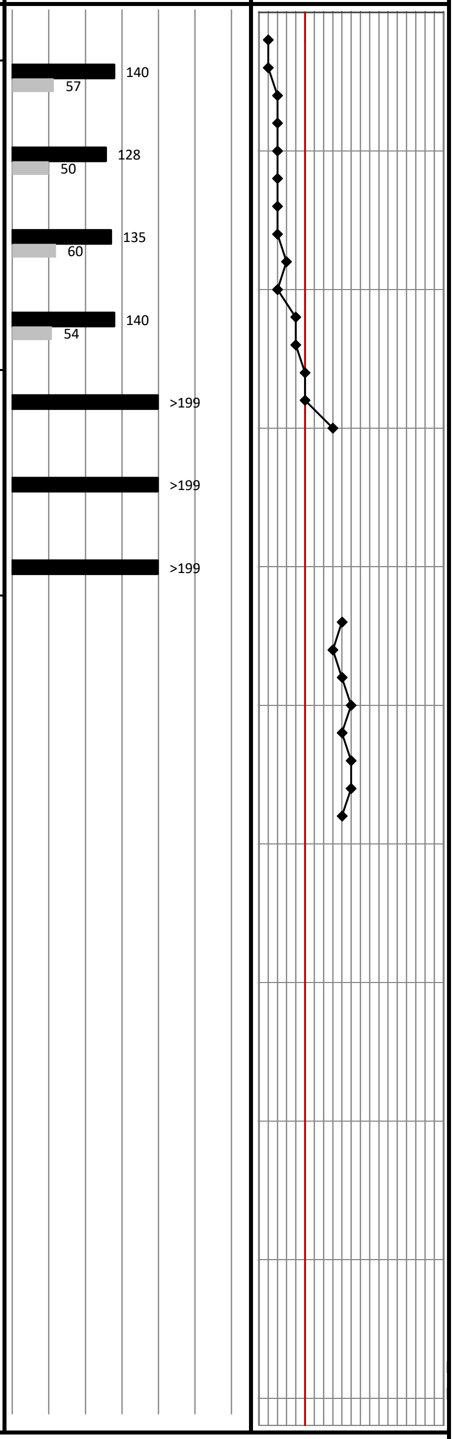
Graphic Symbol: Fill, Rock, Cobbles, Gravel, Sand, Silt, Clay, Organic Soil

In situ shear vane reading
Remoulded shear vane reading
Scala Penetrometer
5 blows/100 mm (Scala)

Depth mm	G.W.L	Geology	Graphic Log	Field Description
0–200	No groundwater observed	Waitiiti Formation (Otaua Group) (Mot)	Fill	200 mm FILL (Silty CLAY), dark brown, moist - wet, low plasticity, organic
200–1300			Clay	Silty CLAY, orangish brown, moist, low plasticity - plastic, very stiff orangish brown mottled grey
1300–2100			Silt	Clayey SILT, orangish brown mottled grey, moist, friable, very stiff orangish brown mottled grey and bluish grey
2100				Auger terminated at 2.1 m

Depth scale (mm): 300, 600, 900, 1200, 1500, 1800, 2100, 2400, 2700, 3000, 3300, 3600, 3900, 4200, 4500, 4800, 5100

Undrained Shear Strength (kPa) Corrected (Per NZGS guideline) | Scala Penetrometer (blows/ 100 mm)



Drill Method	50 - 75 mm hand auger
Location	Refer to site plan
Inspector	CH
Shear Vane No	2465

NOTES 1) The subsurface data described above has been determined at this specific borehole location. The data will not identify any variations away from this location.
2) UTP - Unable to penetrate

BOREHOLE LOG 4

Project: Lot 13 DP 546644 Waianga Place, Omapere
Client: Nick Yakas
Job No: S1815-J04981
Date: 15/10/2021

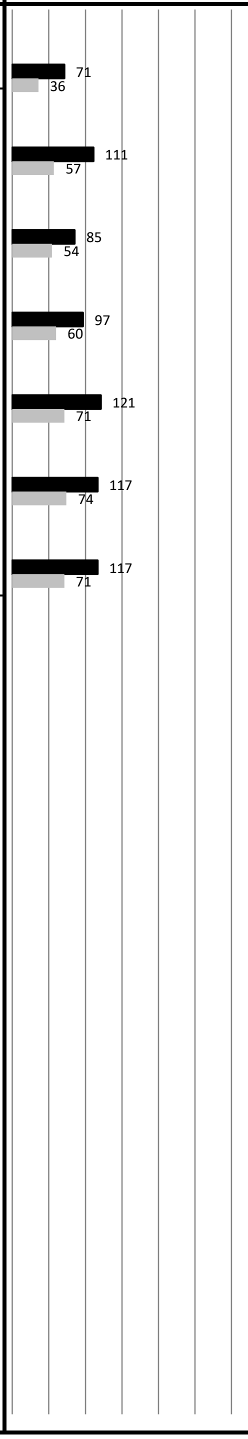
Graphic Symbol: Fill, Rock, Cobbles, Gravel, Sand, Silt, Clay, Organic Soil

In situ shear vane reading
Remoulded shear vane reading
Scala Penetrometer
5 blows/100 mm (Scala)

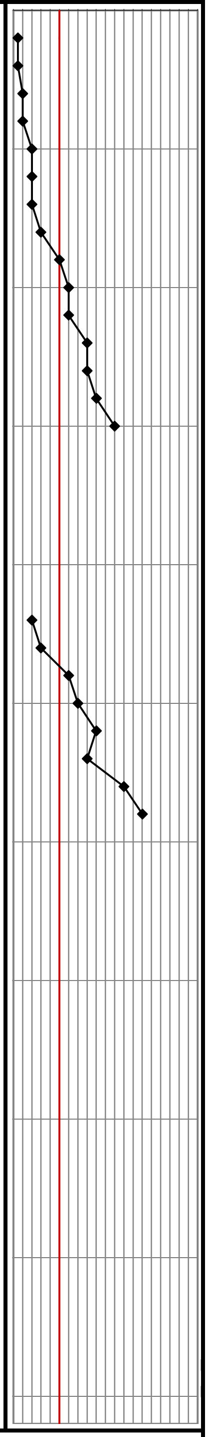
Depth mm	G.W.L	Geology	Graphic Log	Field Description
0 – 300	No groundwater observed	Waitiiti Formation (Otaua Group) (Mot)	Fill	300 mm FILL (Silty CLAY), dark brown, moist - wet, low plasticity, organic
300 – 2100			Clay	Silty CLAY, orangish brown mottled grey, moist - wet, plastic, very stiff moist stiff very stiff bluish grey
2100				Auger terminated at 2.1 m

Depth scale (mm): 300, 600, 900, 1200, 1500, 1800, 2100, 2400, 2700, 3000, 3300, 3600, 3900, 4200, 4500, 4800, 5100

Undrained Shear Strength (kPa) Corrected (Per NZGS guideline)



Scala Penetrometer (blows/ 100 mm)



Drill Method	50 - 75 mm hand auger		
Location	Refer to site plan	NOTES 1) The subsurface data described above has been determined at this specific borehole location. The data will not identify any variations away from this location.	
Inspector	CH		
Shear Vane No	2465	2) UTP - Unable to penetrate	

TMC Consulting Engineers Ltd, 41 Norfolk Street, Whangarei, www.tmcengineers.co.nz

BOREHOLE LOG 5

Project: Lot 13 DP 546644 Waianga Place, Omapere
Client: Nick Yakas
Job No: S1815-J04981
Date: 15/10/2021

TMC CONSULTING ENGINEERS

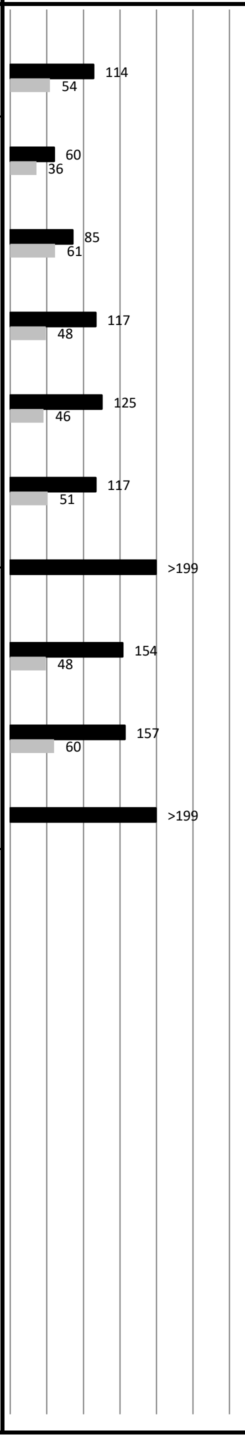
Graphic Symbol: Fill, Rock, Cobbles, Gravel, Sand, Silt, Clay, Organic Soil

In situ shear vane reading
Remoulded shear vane reading
Scala Penetrometer
5 blows/100 mm (Scala)

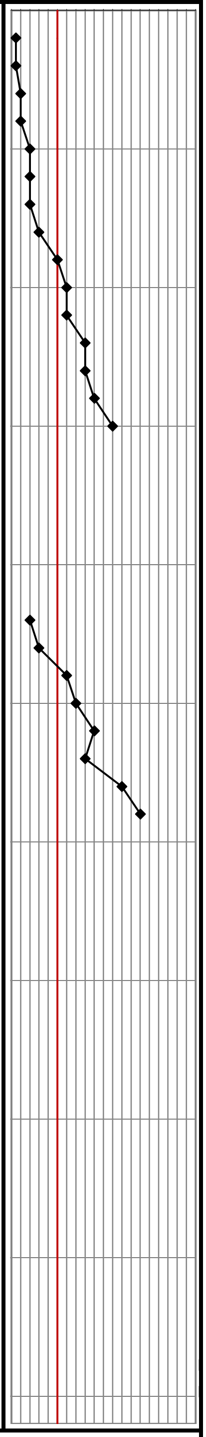
Depth mm	G.W.L	Geology	Field Description
0–400	Groundwater level not reached	Waitiiti Formation (Otaua Group) (Mot)	FILL (Silty CLAY), grey and dark brown, moist - wet, low plasticity, organic
400–2000			Silty CLAY, orangish brown mottled grey, moist, plastic, stiff
1200			trace rootlets, very stiff
1500			greenish grey, low plasticity - friable
1800			low plasticity, trace sand
2000–3000			Clayey SILT trace sand, bluish grey mottled brown, moist, friable, very stiff
2400			moist - wet, groundwater ingress
2700			very hard to auger
3000			Auger terminated at 3.0 m

Depth scale (mm): 300, 600, 900, 1200, 1500, 1800, 2100, 2400, 2700, 3000, 3300, 3600, 3900, 4200, 4500, 4800, 5100

Undrained Shear Strength (kPa) Corrected (Per NZGS guideline)



Scala Penetrometer (blows/ 100 mm)



Drill Method	50 - 75 mm hand auger		
Location	Refer to site plan	NOTES 1) The subsurface data described above has been determined at this specific borehole location. The data will not identify any variations away from this location.	
Inspector	CH		
Shear Vane No	2465	2) UTP - Unable to penetrate	

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Stormwater Calculations – FNDC Supplied Spreadsheet | **Date:** 17/08/2022

Lot 13 DP 546644
Waianga Place Omapere | **Designed:** CH

On-site Attenuation Design | **Job#:** S1815-J04981

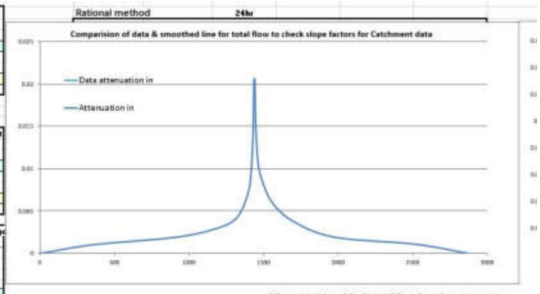
10 year | **Revision:** 02

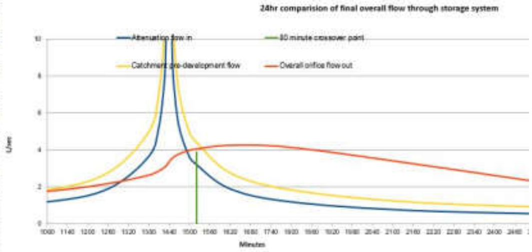
1 Rational method 48hr

Pre – Development water flow (Original water flow)						Sparse Grass Cover	
Total area.	Area (m^2)	1 (m^2)	2 (m^2)	3 (m^2)	4 (m^2)	5 (m^2)	6 (m^2)
	610.00	0	0	0	0	610	0
Runoff coefficent		Ci (coefficient)	Ci (coefficient)	Ci (coefficient)	Ci (coefficient)	Ci (coefficient)	Ci (coefficient)
Use "C" values from FNDC TR55 chart		FALSE	FALSE	FALSE	FALSE	0.72	FALSE
Generally do not use slope adjustment Ci factor if using TR		0	0	0	0	0.72	0
Rainfall intensity		I (mm/hr)	I (mm/hr)	I (mm/hr)	I (mm/hr)	I (mm/hr)	I (mm/hr)
Rainfall Data from NIWA. Hirds 4, RCP6, 2081-2100. Use an appropriate event for the situation		2.91	2.91	2.91	2.91	2.91	2.91
Flow rate of surface water		Qc (m^3/sec)	Qc (m^3/sec)	Qc (m^3/sec)	Qc (m^3/sec)	Qc (m^3/sec)	Qc (m^3/sec)
		0.000	0.000	0.000	0.000	0.000	0.000
Pre – development flow of developed area		Qp (m^3/sec)	Qp (L/sec)				
		0.0004	0.36				

Pre-development Slope %	10
Ci correction	0.00
Post-development Slope %	10
Ci correction	0.00

Post – Development water flow		Any area where there is a change in the impermiablity values				Pre-development area where there a change in impermeable surfaces not collected in atenuation system		Any area where there is no change to the impermiablity values	
		Dweling and Verandah Roof	Future Garage Roof	Paved + Future Driveway	Paving Blocks Hardstand				
Total area.	Area (m^2)	1 (m^2)	2 (m^2)	3 (m^2)	4 (m^2)	5 (m^2)	6 (m^2)	7 (m^2)	8 (m^2)
	610.00	34	56	430	30	0	0	0	0
OK		Ci (coefficient)	Ci (coefficient)	Ci (coefficient)	Ci (coefficient)	Ci (coefficient)	Ci (coefficient)	Ci (coefficient)	Ci (coefficient)
Use "C" values from FNDC TR55 chart		0.96	0.96	0.96	0.83	0	0	FALSE	FALSE
Generally do not use slope adjustment Ci factor if using TR		0.96	0.96	0.96	0.83	"C" value difference between Pre & Post. Maximum value 0.2 (at the moment)		0	0
Rainfall intensity rate		I (mm/hr)	I (mm/hr)	I (mm/hr)	I (mm/hr)	I (mm/hr)	I (mm/hr)	I (mm/hr)	I (mm/hr)
Rainfall Data from NIWA. Hirds 4, RCP6, 2081-2100. Use an appropriate event for the situation		3.25	3.25	3.25	3.25	2.91	2.91	2.91	2.91
Flow rate of surface water		Qc (m^3/sec)	Qc (m^3/sec)	Qc (m^3/sec)	Qc (m^3/sec)	Qc (m^3/sec)	Qc (m^3/sec)	Qc (m^3/sec)	Qc (m^3/sec)
		0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
		Qc (L/sec)	Qc (L/sec)	Qc (L/sec)	Qc (L/sec)	Qc (L/sec)	Qc (L/sec)	Qc (L/sec)	Qc (L/sec)
		0.08	0.05	0.37	0.02	0.00	0.00	0.00	0.00
Total included in attenuation system calc's post - development flow		Qs (m^3/sec)	Qs (L/sec)			Total impermeable excluded from attenuation system collection		Total no change, excluded from attenuation system calc's	
						Qby (m^3/sec)	Qby (L/sec)	Qby (m^3/sec)	Qby (L/sec)
		0.000	0.17			0.000	0.00	0.000	0.00
Post – Pre development flow		Qtpp (m^3/sec)	Qtpp (L/sec)						
		0.0002	0.17						
Total post development flow. Developed flow + undeveloped flow		Qtt (m^3/sec)	Qtt (L/sec)						
0 to 10min		0.0005	0.53						





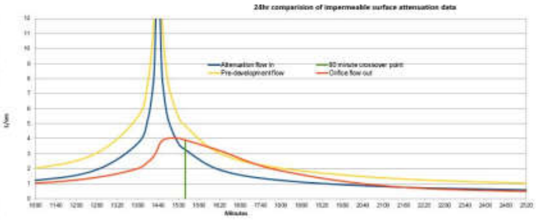
24hr comparison of impermeable surface attenuation data

1b Rational method 48hr

Total catchment pre-development flow						Sparse Grass Cover	
Total area.	Area (m^2)	1 (m^2)	2 (m^2)	3 (m^2)	4 (m^2)	5 (m^2)	6 (m^2)
	610.00	0	0	0	0	610	0
Runoff coefficent		Ci (coefficient)	Ci (coefficient)	Ci (coefficient)	Ci (coefficient)	Ci (coefficient)	Ci (coefficient)
Use "C" values from FNDC TR55 chart		FALSE	FALSE	FALSE	FALSE	0.72	FALSE
Generally do not use slope adjustment Ci factor if using TR		0	0	0.60	0	0.72	0
Rainfall intensity		I (mm/hr)	I (mm/hr)	I (mm/hr)	I (mm/hr)	I (mm/hr)	I (mm/hr)
Rainfall Data from NIWA. Hirds 4, RCP6, 2081-2100. Use an appropriate event for the situation		2.91	2.91	2.91	2.91	2.91	2.91
Flow rate of surface water		Qc (m^3/sec)	Qc (m^3/sec)	Qc (m^3/sec)	Qc (m^3/sec)	Qc (m^3/sec)	Qc (m^3/sec)
		0.000	0.000	0.000	0.000	0.000	0.000
Catchment area pre – development flow		Qcap (m^3/sec)	Qcap (L/sec)				
		0.0004	0.36				

Pre-development Slope %	10
Ci correction	0.00
Post-development Slope %	10
Ci correction	0.00

312.1818108 17.56640628



	Round	Square		Calculation (initial) Total tank area	Calculation (initial) Total tank volume	Calculation (initial) usable height	Calculation (final) Additional area	Num. Of tanks	Slope out control (volume) 1930min (row4235)	2130min (row4435)	2160min (line4465)	
				m^2	m^3	hmax (m)	m^2	1	0.00809	0.00743	0.0073284	Vin
Select 1 for type of tank/area, 0 for other	0	1						r (m)				
				16.00	10.40	0.65	Nil	1.9	0.00828	0.00760	0.0074976	Vout
Estimate storage volume			Tank radius			OK	Total area	m^2 for fixed H68 height	0.01899	0.01715	0.016919	
Adjust to match max Vstored	Num. Of tanks		r (m)		Initial calculation	OK	Same as initial	11.34		If using slope contr	0.000234	
Round area	0		0	0.00	hstor max.	0.651	Final volume	Not used			Diff. = 0.0015+-0.0005	
	Num. Of tanks	Width	Length	m^2	Vstored max.	10.42	Same as initial	Trench width	80 minute crossover		minute steps	
Square/rectangular area	2	1	8	16.00	Vstored min.	0.032		5	1500	1520	1620	Original flow
					0.05 to3.5% left @ 48hr	0.31		Trench length	0.00265	0.00234	0.00138	Qpre (m/sec)
Short tube, 0.76	Orifice type "u"	g				OK	Same as initial	16.6	0.00182	0.00172	0.00123	Qod (m/sec)
Thin sharp, 0.62	0.76	9.8067			Graph, 24hr Vstored 2520m	0.090	Not used	m^2 for fixed H68 height	-0.00082	-0.00062	-0.00015	Orifice flow out
					Max.10% left @ 24hr from initial calc.	0.86	0.86	83.00		Minimise L76		
					or add extra volume			Not used				

	48hr	24hr	12hr	6hr	2hr	60	30	20	10
Pre – development flow	C20	L20	U20	AD20	AM20	AV20	BE20	BN20	BW20
of developed area	0.00036	0.00057	0.00090	0.00138	0.00265	0.00392	0.00573	0.00714	0.01032

Line to compare pre-develpoment original line with crossover line changes at point

minute steps	Qpre (L/sec)	Qs (L/sec)
1445	10.3	6.3
1450	7.1	4.3
1455	5.7	3.5
1470	3.9	2.4
1500	2.6	1.6
1620	1.4	0.8
1800	0.9	0.5
2160	0.6	0.3

							Slope factor adjustment at Min.crossover		
Pre-development flow matches 2hr 40min. Intensity	Qp (m^3/sec)	Qp (L/sec)		Qin max.					
Uses (80min.crossover O126) as a source value	0.0019	1.8675		0.00632		48hr program			
Do not change	OK					Min.crossover	Chart point (min.)	1080min (K2305)	2520min (K5185)
For calculation purposes this section changes	Dia check	Dia	Area	Iout 1520 (L/sec	Qout (m^3/sec)	Chart point (min.)	0.91	Qod (L/sec)	Qod (L/sec)
the dia only and thereby the area	0.0296	0.02960	0.0007	1.723	0.00172	1520	peak flow	0.36168	0.17326
The information is not used for anything else		29.60		0		1520	Chart point (max.)	0.18843	Diff. >0 normally
If additional storage is required use the original/inital orifice size and calc. height							0.15		

4

Calculate maximum storage volume Chart intensity hr values steps used	Chart intensity accumulated minute steps	Storm duration- THR (hr)	Storm duration- Event data, TMIN mins	Attenuation calc. t Direct to Atten. Qa (L/sec)	Catchment pre-devel plus orifice flow out Qtin (L/sec)	For period 2081-2100 CC (RCP6) Intensity. Post-devel I, (mm/hr) 10 yr	Omapere Current(0 deg) Pre-devl I, (mm/hr) 10 yr	Chart step factor	Check Adjust step factor if required	Catchment pre-dev Chart step factor	Catchment pre-dev Adjust step factor if required	Accumulated minute steps	Pre devel. Original flow Qpre (L/sec)
												0	0
48	720	12.00	720	0.17	0.47	3.25	2.91	1.4		1.4		120	0.36
24	1080	6.00	360	0.3	0.8	5.3	4.69	1	OK	1	OK	720	0.57
12	1260	3.00	180	0.5	1.3	8.5	7.36	0.4	OK	0.55	OK	1080	0.90
6	1380	2.00	120	0.8	1.9	13.3	11.3	0.56	OK	0.56	OK	1260	1.38
2	1410	0.50	30	1.6	3.4	26.2	21.7	0.9	OK	0.9	OK	1380	2.65
1	1425	0.25	15	2.4	4.9	39	32.1	0.8	OK	0.8	OK	1410	3.92
30	1430	0.08	5	3.5	6.9	57.1	47	0.04	OK	0.04	OK	1425	5.73
20	1435	0.08	5	4.3	8.4	71	58.5	1.0	OK	1.0	OK	1430	7.14
10	1440	0.08	5	6.3	11.7	103	84.6	1.0	OK	1.0	OK	1435	10.32
10	1445	0.08	5	6.3	11.7	103	84.6	1.5	OK	1.5	OK	1440	11.87
20	1450	0.08	5	4.3	8.9	71	58.5	1.0	OK	1.0	OK	1445	10.32
30	1455	0.08	5	3.5	7.6	57.1	47	0.9	OK	0.9	OK	1450	7.14
	1470	0.25	15	2.4	5.8	39	32.1	0.75	OK	0.8	OK	1455	5.73
2	1500	0.50	30	1.6	4.5	26.2	21.7	1.1	OK	1.1	OK	1470	3.92
6	1620	2.00	120	0.8	2.6	13.3	11.3	1	OK	1	OK	1500	2.65
12	1800	3.00	180	0.5	1.4	8.5	7.36	1	OK	1	OK	1520	2.34
24	2160	6.00	360	0.3	0.8	5.3	4.69	0.7	OK	0.8	OK	1620	1.38
48	2880	12.00	720	0.2	0.5	3.25	2.91	0.8		0.8		1800	0.90
												2160	0.57
												2760	0.36
												2880	0

	Qcap max.	Qp (m^3/sec)	Qp (L/sec)	Qout max. (m^3/sec)	Qout max. (L/sec)	Vstored max. Vol. stored, (m^3)
Catchment flow Qpat (cell MAX(P109:P130) Catchment flow = orifice flow out + catchment pre-development flow	6.560	0.0066	6.6	0.00656	6.56	10.398
						OK
For calculation purposes this section changes	Dia check	Dia	Area			OK
the dia only and thereby the area	0.0555	0.05548	0.0024			
The information is not used for anything else		55.48				
		Use this orifice size for final design				

Stormwater Calculations – FNDC Supplied Spreadsheet | **Date:** 17/08/2022

Lot 13 DP 546644
Waianga Place Omapere | **Designed:** CH

On-site Attenuation Design | **Job#:** S1815-J04981

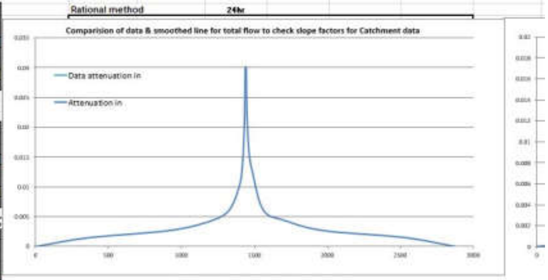
100 year | **Revision:** 02

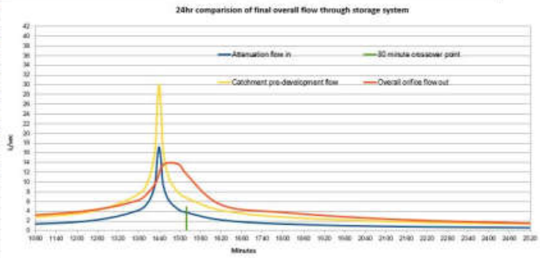
1 — Rational method — 48hr

Pre – Development water flow (Original water flow)						
					Sparse Grass Cover	
Total area. Area (m^2)	1(m^2)	2(m^2)	3(m^2)	4(m^2)	5(m^2)	6(m^2)
610.00	0	0	0	0	610	0
Runoff coefficent	Ci (coefficient)	Ci (coefficient)	Ci (coefficient)	Ci (coefficient)	Ci (coefficient)	Ci (coefficient)
Use "C" values from FNDC TR55 chart	FALSE	FALSE	FALSE	FALSE	0.72	FALSE
Generally do not use slope adjustment Ci factor if using TR55	0	0	0	0	0.72	0
Rainfall intensity	I (mm/hr)	I (mm/hr)	I (mm/hr)	I (mm/hr)	I (mm/hr)	I (mm/hr)
Rainfall Data from NIWA. Hirds 4, RCP6, 2081-2100	4.52	4.52	4.52	4.52	4.52	4.52
Use an appropiate event for the situation						
Flow rate of surface water	Qc (m^3/sec)	Qc (m^3/sec)	Qc (m^3/sec)	Qc (m^3/sec)	Qc (m^3/sec)	Qc (m^3/sec)
	0.000	0.000	0.000	0.000	0.001	0.000
Pre – development flow	Qp (m^3/sec)	Qp (L/sec)				
of developed area	0.0006	0.55				

Pre-development Slope %	10
Ci correction	0.00
Post-development Slope %	10
Ci correction	0.00

Post – Development water flow	Any area where there is a change in the impermiablity values				Pre-development area where there a change in impermeable surfaces not collected in atenuation system		Any area where there is no change to the impermiablity values	
	Roofs	Paved Driveway	Paving Blocks Hardstand	Future Allowance				
Total area. Area (m^2)	1(m^2)	2(m^2)	3(m^2)	4(m^2)	5(m^2)	6(m^2)	7(m^2)	8(m^2)
610.00	150	180	30	250	0	0	0	0
OK	Ci (coefficient)	Ci (coefficient)	Ci (coefficient)	Ci (coefficient)	Ci (coefficient)	Ci (coefficient)	Ci (coefficient)	Ci (coefficient)
Use "C" values from FNDC TR55 chart	0.96	0.96	0.83	0.96	0	0	FALSE	FALSE
Generally do not use slope adjustment Ci factor if using TR55	0.96	0.96	0.83	0.96	"C" value difference between Pre & Post Maximum value 0.2 (at the moment)		0	0
Rainfall intensity rate	I (mm/hr)	I (mm/hr)	I (mm/hr)	I (mm/hr)	I (mm/hr)	I (mm/hr)	I (mm/hr)	I (mm/hr)
Rainfall Data from NIWA. Hirds 4, RCP6, 2081-2100	5.07	5.07	5.07	5.07	4.52	4.52	4.52	4.52
Use an appropiate event for the situation								
Flow rate of surface water	Qc (m^3/sec)	Qc (m^3/sec)	Qc (m^3/sec)	Qc (m^3/sec)	Qc (m^3/sec)	Qc (m^3/sec)	Qc (m^3/sec)	Qc (m^3/sec)
	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
	Qc (L/sec)	Qc (L/sec)	Qc (L/sec)	Qc (L/sec)	Qc (L/sec)	Qc (L/sec)	Qc (L/sec)	Qc (L/sec)
	0.20	0.24	0.04	0.34	0.00	0.00	0.00	0.00
Total included in attenuation system calc's	Qs (m^3/sec)	Qs (L/sec)			Total impermeable excluded from attenuation system collection		Total no change, excluded from attenuation system calc's	
post – development flow	0.000	0.27			Qby (m^3/sec)	Qby (L/sec)	Qby (m^3/sec)	Qby (L/sec)
					0.000	0.00	0.000	0.00
Post – Pre development flow	Qtpp (m^3/sec)	Qtpp (L/sec)						
	0.0003	0.27						
Total post development flow								
Developed flow + undeveloped flow	Qvn (m^3/sec)	Qvn (L/sec)						
0 to 10min	0.0009	0.82						

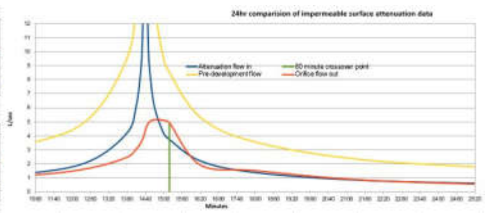




1b — Rational method — 48hr

Total catchment pre-development flow						
					Sparse Grass Cover	
Total area. Area (m^2)	1(m^2)	2(m^2)	3(m^2)	4(m^2)	5(m^2)	6(m^2)
610.00	0	0	0	0	610	0
Runoff coefficent	Ci (coefficient)	Ci (coefficient)	Ci (coefficient)	Ci (coefficient)	Ci (coefficient)	Ci (coefficient)
Use "C" values from FNDC TR55 chart	FALSE	FALSE	FALSE	FALSE	0.72	FALSE
Generally do not use slope adjustment Ci factor if using TR55	0	0	0	0	0.72	0
Rainfall intensity	I (mm/hr)	I (mm/hr)	I (mm/hr)	I (mm/hr)	I (mm/hr)	I (mm/hr)
Rainfall Data from NIWA. Hirds 4, RCP6, 2081-2100	4.52	4.52	4.52	4.52	4.52	4.52
Use an appropiate event for the situation						
Flow rate of surface water	Qc (m^3/sec)	Qc (m^3/sec)	Qc (m^3/sec)	Qc (m^3/sec)	Qc (m^3/sec)	Qc (m^3/sec)
	0.000	0.000	0.000	0.000	0.001	0.000
Catchment area pre – development flow	Qcap (m^3/sec)	Qcap (L/sec)				
	0.0006	0.55				

Pre-development Slope %	10
Ci correction	0.00
Post-development Slope %	10
Ci correction	0.00



	Round	Square		Calculation (initial) Total tank area	Calculation (initial) Total tank volume	Calculation (initial) usable height	Calculation (final) Additional area	Num. Of tanks	Slope out control (volume) 1930min (row4235)	2130min (row4435)	2160min (line4465)	
						hmax (m)	m^2	1				
								r (m)	0.01284	0.01177	0.0116063	Vin
Select 1 for type of tank/area, 0 for other	0	1		m^2	m^3	1	Nil	1.9	0.01315	0.01205	0.0118899	Vout
Estimate storage volume			Tank radius	16.00	16.00	OK	Total area	m^2 for fixed H68 height	0.03168	0.02876	0.028363	
Adjust to match max Vstored	Num. Of tanks		r (m)		Initial calculation	OK	Same as initial	11.34		If using slope contr	0.000396	
Round area	0		0	0.00	hstor max.	0.997	Final volume	Not used		Diff. = 0.0015+-0.0005		
	Num. Of tanks	Width	Length	m^2	Vstored max.	15.96	Same as initial	Trench width	80 minute crossover		minute steps	
Square/rectangular area	2	1	8	16.00	Vstored min.	0.036		5	1500	1520	1620	Original flow
					0.05 to3.5% left @ 48hr	0.23		Trench length	0.00403	0.00356	0.00211	Qpre (m/sec)
Short tube, 0.76	Orifice type "u"	g				OK	Same as initial	16.6	0.00278	0.00264	0.00096	Qod (m/sec)
Thin sharp, 0.62	0.76	9.8067			Graph, 24hr Vstored 2520m	0.146	Not used	m^2 for fixed H68 height	-0.00124	-0.00093	-0.00115	Orifice flow out
					Max.10% left @ 24hr from initial calc.	0.92	0.92	83.00	Minimise L76			
					or add extra volume			Not used		Line to compare pre-develpoment original		
	48hr	24hr	12hr	6hr	2hr	60	30	20	10	line with crossover line changes at point		
Pre – development flow	C20	L20	U20	AD20	AM20	AV20	BE20	BN20	BW20	minute steps	Qpre (L/sec)	Qs (L/sec)
3 of developed area	0.00055	0.00088	0.00138	0.00211	0.00403	0.00592	0.00863	0.01070	0.01537	1445	15.4	9.5
							Slope factor			1450	10.7	6.6
Pre-development flow matches 2hr 40min. Intensity	Qp (m^3/sec)	Qp (L/sec)		Qin max.			adjustment at			1455	8.6	5.3
Uses (80min.crossover O126) as a source value	0.0029	2.8568		0.00951		48hr program	Min.crossover			1470	5.9	3.7
Do not change	OK					Min.crossover	Chart point (min.)	1080min (K2305)	2520min (K5185)	1500	4.0	2.4
For calculation purposes this section changes	Dia check	Dia	Area	Iout 1520 (L/sec	Qout (m^3/sec)	Chart point (min.)	0.91	Qod (L/sec)	Qod (L/sec)	1620	2.1	1.2
the dia only and thereby the area	0.0329	0.03287	0.0008	2.638	0.00264	1520	peak flow	0.57269	0.27290	1800	1.4	0.8
The information is not used for anything else		32.87		0		1520	Chart point (max.)	0.29978	Diff. > 0 normally	2160	0.9	0.5
	If additional storage is required use the original/inital orifice size and calc. height						0.15					

4

Calculate maximum storage volume

Chart intensity hr values steps used	Chart intensity accumulated minute steps	Storm duration-THR (hr)	Storm duration-Event data, TMIN mins	Attenuation calc. t Direct to Atten. Qa (L/sec)	Catchment pre-devel plus orifice flow out Qtin (L/sec)	For period 2081-2100 CC (RCP6) Intensity Post-devel I, (mm/hr) 100 yr	Omapere Current(0 deg) Pre-devel I, (mm/hr) 100 yr	Chart step factor	Check Adjust step factor if required	Catchment pre-dev Chart step factor	Catchment pre-dev Adjust step factor if required	Accumulated minute steps	Pre devel. Original flow Qpre (L/sec)
48	720	12.00	720	0.27	0.73	5.07	4.52	1.4		1.4		0	0
24	1080	6.00	360	0.5	1.3	8.25	7.23	1	OK	1	OK	120	0.55
12	1260	3.00	180	0.8	2.0	13.2	11.3	0.5	OK	0.55	OK	720	0.88
6	1380	2.00	120	1.2	2.9	20.6	17.3	0.56	OK	0.56	OK	1080	1.38
2	1410	0.50	30	2.4	5.2	40	33	0.9	OK	0.9	OK	1260	2.11
1	1425	0.25	15	3.7	7.5	59.3	48.5	0.8	OK	0.8	OK	1380	4.03
30	1430	0.08	5	5.3	10.5	86.3	70.7	0.04	OK	0.04	OK	1410	5.92
20	1435	0.08	5	6.6	12.7	107	87.7	1.0	OK	1.0	OK	1425	8.63
10	1440	0.08	5	9.5	17.5	154	126	1.0	OK	1.0	OK	1430	10.70
10	1445	0.08	5	9.5	17.5	154	126	1.5	OK	1.5	OK	1435	15.37
20	1450	0.08	5	6.6	13.4	107	87.7	1.0	OK	1.0	OK	1440	17.68
30	1455	0.08	5	5.3	11.4	86.3	70.7	0.9	OK	0.9	OK	1445	15.37
	1470	0.25	15	3.7	8.8	59.3	48.5	0.8	OK	0.8	OK	1450	10.70
2	1500	0.50	30	2.4	6.8	40	33	1.1	OK	1.1	OK	1455	8.63
6	1620	2.00	120	1.2	3.1	20.6	17.3	1	OK	1	OK	1470	5.92
12	1800	3.00	180	0.8	2.1	13.2	11.3	1	OK	1	OK	1500	4.03
24	2160	6.00	360	0.5	1.3	8.25	7.23	0.7	OK	0.8	OK	1520	3.56
48	2880	12.00	720	0.3	0.8	5.07	4.52	0.8		0.8		1620	2.11
												1800	1.38
												2160	0.88
												2760	0.55
												2880	0

				Qout max.	Qout max.	Vstored max.
Catchment flow Qpat (cell MAX(P109:P130))	Qcap max.	Qp (m^3/sec)	Qp (L/sec)	(m^3/sec)	(L/sec)	Vol. stored (m^3)
Catchment flow = orifice flow out + catchment	9.800	0.0098	9.8	0.00978	9.78	15.943
pre-development flow						OK
For calculation purposes this section changes	Dia check	Dia	Area			
the dia only and thereby the area	0.0610	0.06089	0.0029			
The information is not used for anything else		60.89				
		Use this orifice size for final design				

Stormwater Calculations – FNDC Supplied Spreadsheet | **Date:** 17/08/2022

Lot 13 DP 546644
Waianga Place Omapere | **Designed:** CH

On-site Attenuation Design | **Job#:** S1815-J04981

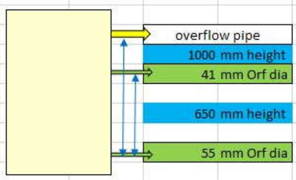
Orifice | **Revision:** 02

	Fixed value	100yr	10yr	
u	g	Desc hrs	Desc hrs	
0.76	9.8067	0.64	0.624	**Adjust until orifices are closest to the values of tab 10yr & 100yr "cell D136"**

Change orifice factor "u" to suit, short tube 0.76 & thin sharp edge 0.62

	Va100yr	Qav	**ho100yr**	hav	Or100yr	
100yr	15.96	0.0069	1	0.50	0.0609	
100yr tab	***Cell H71***		***Cell H67***		60.9	
	Va10yr	Qav	**ho10yr**	hav	**Or10yr**	
10yr	10.42	0.0046	0.65	0.33	0.0555	
10yr tab	***Cell H71***		***Cell H67***		55.5	
	Vdet	Qav	htop	hhalf		
100 - 10yr	5.54	0.0024	0.35	0.18	0.1750	
	Vocomb	Qav	hchart	hav	OK	
10yr cor.	11.75	0.0052	0.83	0.41	0.0555	0.0024
						Area
	Vtop	Qav	htop	hav	**Ortop**	
100-10yrcor	4.21	0.0018	0.35	0.175	0.0406	

1.00	**ho100yr**	Total storage height required		
0.055	**Or10yr**	Size of lower orifice (fitted 150mm above bottom/base if tank for attenuation only)		
0.65	**ho10yr**	Storage height at which Ortop is fitted	0.35	Height from overflow outlet invert to Ortop invert
0.041	**Ortop**	Size of second orifice (fitted at ho10yr above lower orifice Or10yr)		



Attenuation System Parameters

	Orifice diameter	Orifice invert location	
ARI 10	55 mm	1000 mm below overflow invert	
ARI 100	41 mm	350 mm below overflow invert	
Tank Size	2 x	8,000 litres	As per attached detail
	Height:	1.00 m	
ARI 10	10,419.3 litres		
ARI 100	15,958.2 litres		

13 WAIANGA PLACE, OMAPERE
LOT 13 DP 546644

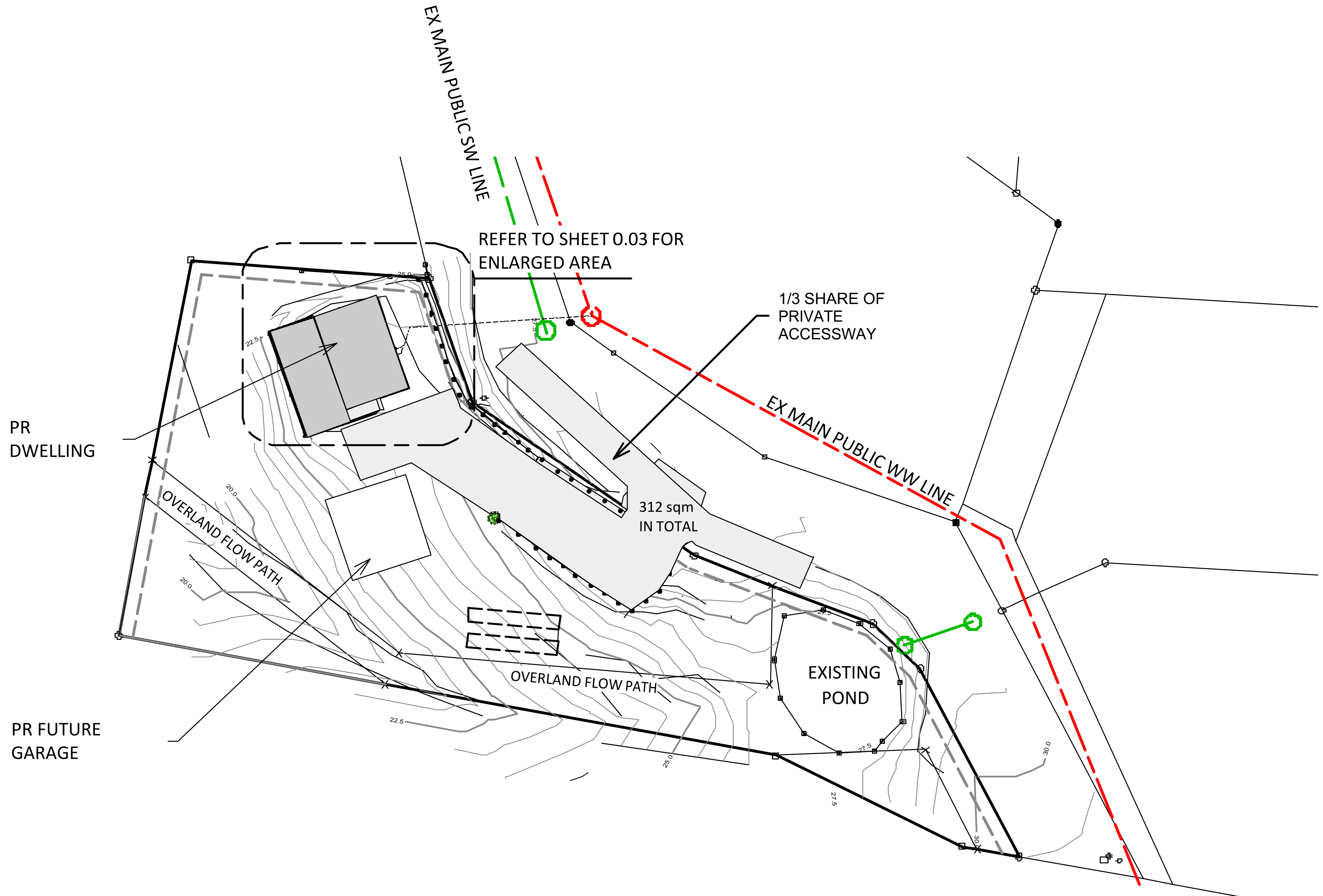
WIND ZONE: VERY HIGH
EARTHQUAKE ZONE: 1
EXPOSURE ZONE: D
CLIMATE ZONE: 1
SNOW LOADING: NO
SITE AREA: 1828 SQM
DISTRICT ZONE: FAR NORTH DISTRICT COUNCIL
COASTAL RESIDENTIAL

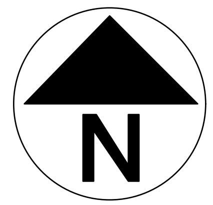
STORMWATER MANAGEMENT
THE MAX PROPORTION OF THE GROSS SITE AREA COVERED BY BUILDINGS & OTHER IMPERMEABLE SURFACES SHALL BE 50% OR 1000 sqm WHICH EVER IS THE LESSER
COMPLIES

SETBACK FROM BOUNDARIES
THE MINIMUM BUILDING SET BACK FROM ROAD BOUDARIES SHALL BE 3m AND THE MINIMUM SETBACK FROM ANY BOUNDARY APART FROM A ROAD BOUNDARY IS 1.2m
COMPLIES

BUILDING HEIGHT
THE MAXIMUM HEIGHT OF ANY BUILDING SHALL BE 8m
COMPLIES

SUNLIGHT
NO PART OF ANY BUILDING SHALL PROJECT BEYOND A 45 DEGREE RECESSION PLANE AS MEASURED INWARDS FROM ANY POINT 2m VERTICALLY ABOVE GROUND LEVEL ON ANY SITE BOUNDARY
COMPLIES





SITE PLAN
SCALE 1:500 @ A3

ISSUE	DATE	REVISION

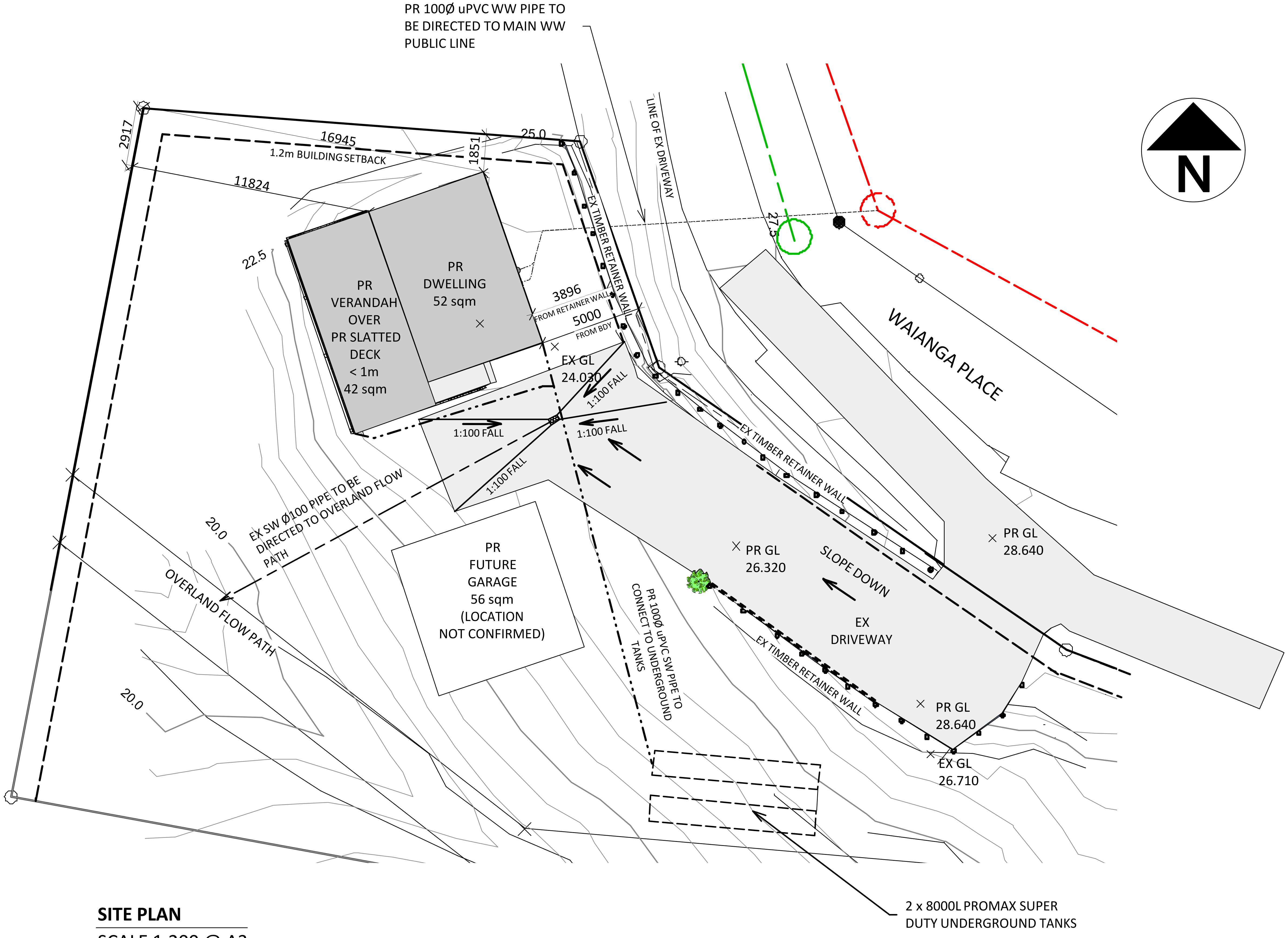
230 Hariru Rd
Ohaeawai 0472
hayleymealings@gmail.com

mealings architecture

PROJECT: **13 Waianga Pl Omapere Proposed Dwelling**
CLIENT: **Nick Yakas**
FILE: 13 Waienga Place - BC 1 Pr Dwelling Consent 2 .vwx

DRAWING: **SITE PLAN**
PROJECT: BUILDING CONSENT ISSUE

SHT: **0.02**
SCALE: **1:500 @ A3**
DATE: **03/11/21**
DRAWN: **HM**



SITE PLAN

SCALE 1:200 @ A3

ISSUE	DATE	REVISION

230 Hariru Rd
Ohaeawai 0472
hayleymealings@gmail.com

mealings architecture

PROJECT: 13 Waianga Pl
Omapere
Proposed Dwelling

CLIENT: Nick Yakas

FILE: 13 Waienga Place - BC 1 Pr Dwelling Consent 2 .vwx

DRAWING: SITE PLAN - ENLARGED

PROJECT: BUILDING CONSENT ISSUE

SHT: 0.03

SCALE: 1:200 @ A3

DATE: 03/11/21

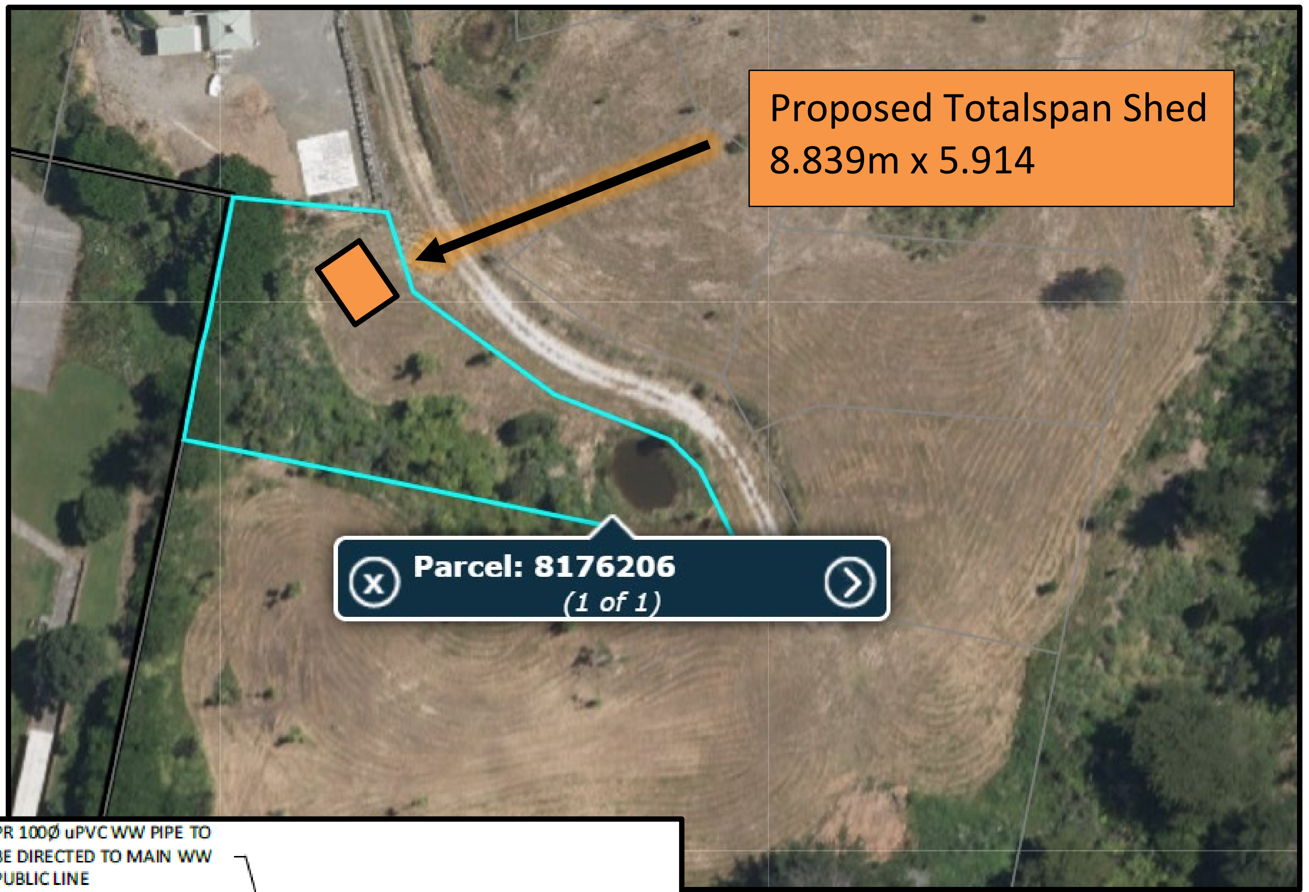
DRAWN: HM

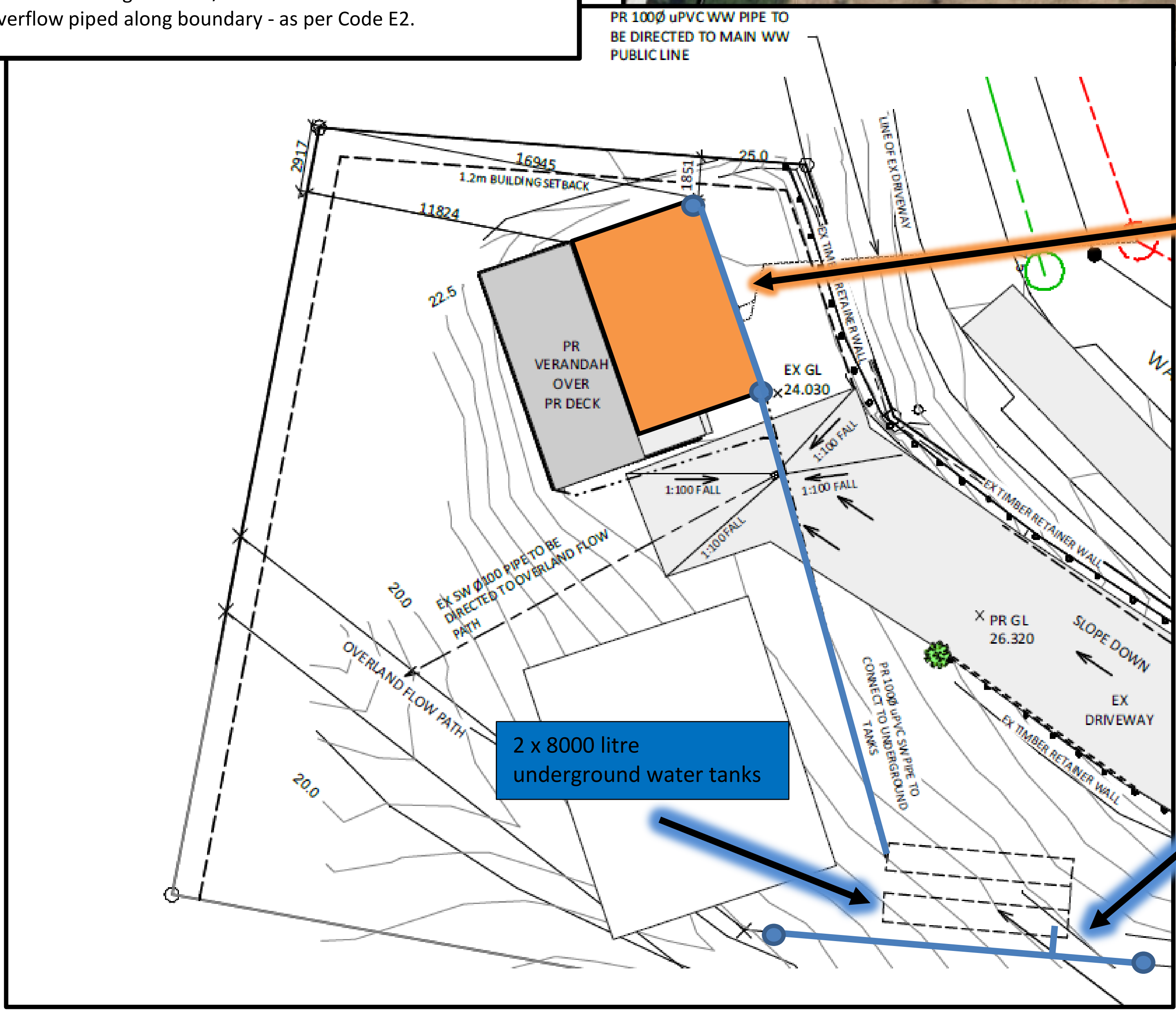
SITEPLAN

District Plan Zoning: Coastal Residential	
Corrosion: D	
Shed Colour: Karaka	
Wind Zone as per AS/NZS 1170.2:	47.51m/s
Site Area:	1828 m2
Existing Buildings & Driveways:	0 m2
Proposed Building M2:	52.273m2
Total Site Coverage:	52.273m2
Impermeable Surfaces (%)Building Use:	Less than 1%
Building Use:	IL2 – Shell

Earthworks:
200mm site scrape of topsoil only, of less than 20 cubic meters. All soil to remain on site.

Stormwater:
To be directed through 80mm Ø PVC DPs and led to tank as shown with overflow piped along boundary - as per Code E2.





TOTALSPAN
STEEL BUILDINGS
WHO CAN? TOTALSPAN!

Big BOI Sheds Ltd T/A Totalspan Bay of Island/Hokianga
1235B State Highway 10, RD3 Kerikeri 0293, New Zealand.
Phone: 09 407 7875
Email: Julia.Edwards@ Totalspan.co.nz

Building Proposed For:
Nicholas & Tina Yakas
Customer Site Address:
Waianga Place, Omapere 0473
Lot 13 DP 546644

Date: 28/07/2022
NOT TO SCALE
ALL DIMENSIONS IN METRES UNLESS STATED

N
W E
S

Key

- Proposed Totalspan Shed
- Downpipes & Tanks
- Distance Marker
- Boundary Marker
- Surveyed Boundary

MEMORANDUM OF EASEMENTS

PURPOSE	SHOWN	SERVIENT TENEMENT	DOMINANT TENEMENT
RIGHT OF WAY, TELECOM ELECTRICITY CONVEY WATER, DRAIN WATER & SEWAGE	A B C	LOT 12 HEREON	LOTS 7 - 11 HEREON
	D & E	LOT 12 HEREON	LOTS 7 8 & 9 HEREON
SEWAGE	G	LOT 12 HEREON	LOTS 7 & 8 HEREON
	H	LOT 10 HEREON	LOT 9 HEREON

ALL EXISTING EASEMENTS TO REMAIN
See attached Detail page
ADDITIONAL EASEMENTS MAY BE REQUIRED

0 7.5 15 30 45 60 75 m

Local Authority: Far North District Council

Comprised in: 842903
Title Area: 1.7449 Ha

Zoning: Coastal Residential

AREAS AND MEASUREMENTS ARE SUBJECT TO FINAL SURVEY

TOPOGRAPHICAL DETAIL IS APPROXIMATE ONLY AND SCALED FROM AERIAL PHOTOGRAPHY

AMALGAMATION CONDITION: LOT 100 TO BE HELD IN EQUAL UNDIVIDED SHARES BY LOTS 7, 8 & 9 HEREON

AMALGAMATION CONDITION: LOT 101 TO BE HELD IN EQUAL UNDIVIDED SHARES BY LOTS 10, 11 & 13 HEREON

THOMSON SURVEY LIMITED
315 Kerikeri Rd
P.O. Box 372 Kerikeri
Email: kerikeri@tsurvey.co.nz
Ph: (09) 4077360 Fax (09) 4077322
Registered Land Surveyors, Planners & Land Development Consultants

PROPOSED SUBDIVISION OF LOT 7 DP 525890

WAIANGA PLACE - OMAPERE

PREPARED FOR: CLEARY

	Name	Date	ORIGINAL	
Survey			SCALE	SHEET SIZE
Design				
Drawn	SL	13.08.19	1:750	A3
Approved				
Rev	SL	15.11.19		

9608 SCHEME C.LCD

Surveyors Ref. No: 9608

Far North District Council

28 July 2022

Nicholas William Yakas and Tina Kathleen Yakas
C/- Totalspan Bay of Islands/Hokianga
1235B State Highway 10
RD 3
Kerikeri 0293

Reference Number: EBC-2022-1376/0
Property Address: Lot 13, Waianga Place, Omapere 0473
Property ID # 3362439
Description: IL1 Totalspan Shed

Dear Sir / Madam

Further Information Request – Building Followup

Work on your application has been suspended because further information is required to demonstrate compliance with the New Zealand Building Code. Processing of your application will resume on receipt of all of the information listed below:

1. Flashing details provided include a number of things which don't appear to be a part of the shed proposal such as, lining, insulation, building wrap, a cavity, a bearer to post fixing detail…….. Please clarify & provide flashing details that are consistent with the shed proposal to avoid confusion during construction.
2. There is no longer a proposed carport shown on the site plan. The site plan has also been revised to include the correct building coverage of 52.2m2. However the stormwater report still shows a 48m2 shed, please revise the stormwater report and make sure the calculations are based on the correct shed size.
3. Revisions to the site plan have been made, downpipes comply with E1 and 2 x 8000ltr water tanks have been provided. However the site plan doesn't locate the tanks onsite or state how the overflow is managed. Please locate the water tanks on the site plan and provide detail of how the overflow is managed.

To reduce further processing costs and delays, please email ALL the listed information in one response to bsg@fndc.govt.nz.

If you are a registered customer, select the link below to provide this information:
https://online.fndc.govt.nz/ePathway/Production/Web/GeneralEnquiry/ExternalRequestBroker.aspx?Type=L-BDAP&Module=EGELAP&Class=BUILD&ResponseType=FINFO&ApplicationId=914145&DocumentId=4465166&ForceLogin=true

If there are good reasons why you cannot supply this information, please contact us urgently. We may be able to assist or arrange an extension of time.

We will hold your application for **20 working days** from the date of this letter. If we do not hear from you or receive the outstanding information in that time we may refuse the application.

Should you have further questions please contact the building team on 0800 920029 or 09 401 5200 or email us at bsg@fndc.govt.nz.

Yours faithfully,

E Ramsay
PP
Leon Roper
Building Control Officer
District Services

Emailed to: Julia.Edwards@totalspan.co.nz

NOTES:

Expansive Soils

Expansive soils are soils which experience volume changes upon wetting and drying. Expansion and swelling appears to be the dominant factor under certain conditions with fine grained soil containing considerable amounts of clay. Expansion and swelling may cause distress which is often experienced in light buildings.

In many parts of New Zealand there is a significant hazard to foundations for light buildings including homes with concrete slab floors. The volumetric expansion and contraction can cause houses and other structures to heave or settle resulting in damage that is sometimes severe. Soil movement can occur in both directions (vertical and horizontal) at different rates which results in distress and subsequent damage to the structure.

The extent of the damage varies from relatively minor brick veneer cracking and internal cracking on wall corners with attendant door and windows jamming, through to extensive and severe cracking including cracking of driveways, sidewalks, etc.

Expansive soils such as clay, claystone, mudstone, argillaceous rocks and shale all contain clay minerals. These minerals are very sensitive to changes in humidity. When expansive clayey soils get wet, these minerals absorb water molecules and consequently expand. When dry they shrink, leaving large voids in the soil which result in a reduction in bearing capacity of the soil.

Apart from seasonal moisture changes (wet winters/ dry summer), other factors can influence soil moisture such as:

- Irrigation of garden close to the dwelling foundation.
- Site drainage close to the structure.
- Plantation of large trees close to building foundations on expansive soils. A wide range of tree and shrub species have high groundwater demands during summer months. The effects of such demands on expansive soils can be substantial and can lead to differential building settlements. Accordingly, it is good housekeeping measure to ensure that high water demand species (such as gum, willow, cypress, etc.) are not planted close to buildings.
- Plumbing leaks.
- Prevalent or initial moisture conditions at construction time.

It should be also noted that the shear strength of expansive soil also changes with variations in humidity, and a stability problem may arise.

Expansive soils cause major damage to light foundations and associated structures. Heavy foundations and structures can resist the swelling uplift pressure.

Damage is dependent on the amount of movement experienced by the foundation, the non-uniformity in movement, which are all related to percentage of clay in the expansive soil, variation in moisture content, type of foundation, building construction and materials, etc.

Young sandstone soils

Soil types in this group

- Atuanui clay steepland soil - ANS
- Autea clay - AEe, AEeH
- Autea clay loam/silty clay loam - AE, AEH
- Omanaia clay loam - ON, ONH
- Omanaia clay loam with coarse-structured subsoil - ONe
- Omahuta clay - OF, OFH
- Puhoi clay loam - PB, PBH
- Puhoi light brown clay loam - PBu, PBuH
- Purua clay loam - PUeH
- Purua silt loam - PU
- Tanoa sandy clay loam - TN, TNH
- Tanoa sandy loam and sandy clay loam - TNa, RNaH
- Taumata clay loam - TM, TMH
- Tautoro clay loam steepland soil - TLS
- Waiotira brown clay loam - YCr, YCrH
- Waiotira clay - YCe, YCeH
- Waiotira clay loam - YC, YCH
- Waiotira gravelly sandy loam - YCgH
- Whangaripo clay - WRe, WReH
- Whangaripo clay loam - WR, WRH
- Whirinaki clay loam - WN, WNH
- White Cone sandy clay loam steepland soil - WCS

Waiotira clay loam (YC, YCH) soil profile

*The H denotes the hill variant of this soil type, which occurs on slopes over 20° and has a shallower profile.

This fact sheet uses NZ Soil Bureau map series soil type names and abbreviations.

Features of young sandstone soils

- These soils formed from banded, massive and shattered sandstone, and sandstone–mudstone basement rocks
- They are part of the Puhoi, Purua, Omanaia and Waiotira suites
- Sandstone is a harder basement rock and supports steep slopes where slip erosion is common
- These soils are prone to tunnel gullying, which in turn can trigger extensive slumping and earthflow erosion
- Because basement rocks differ, these soils vary widely in their natural fertility

Structure and drainage management

Issues	Management tips
Soils are all winter wet and prone to pugging	Maintaining good pasture covers helps build soil organic matter and improve soil structure Consider draining wet pasture, creating or protecting wetlands
Young sandstone soils are difficult to cultivate because of high clay content in topsoils	Oversow or direct drill for pasture renewal where clay prohibits a fine tilth
Soil structures vary due to different parent material and hill gradients, so management needs to be specific to different soil properties	Consider retiring very steep or marginal pastoral land from grazing if pastoral returns are poor and/or weed invasion is a problem

Erosion control

Erosion risks	Soil type	Specific problems	Possible solutions
Landslide erosion (slips and slumps)	All young sandstone soils on steeper slopes, especially Puhoi suite and Omanaia suite soil types	Clay washed downwards by rain creates a slip plane known as a 'greasy back' During high intensity rain storms following dry weather, water penetrates cracks in soils and lubricates the slip plane, triggering slips Deep slips >1 m can occur on Whangaripo clay and clay loam (WRe, WReH, WR, WRH) Whirinaki clay loam (WN, WNH) is prone to slip erosion and deep seated mass movement on steeper slopes	On actively eroding areas, densely plant at 5m spacings at the foot of slips, expanding to 8-10m spacings upslope Open plant poplars across hillsides at 15m spacing as a preventative measure Consider retiring very steep or marginal pastoral land from grazing if pastoral returns are poor and/or weed invasion is a problem Oversow and fertilise slip scars for faster revegetation Use contour cultivation for cropping on slopes under 15°
Gully erosion	Omanaia suite especially	More mature soils are prone to gully erosion	Plant poplar or willow poles in a zig-zag pattern along the gully
Tunnel gully erosion (severe)	Waiotira suite, especially Waiotira clay loam (YC, YCH) and Waiotira gravelly sandy loam (YCg)	Tunnels 2–3 m underground cut their way downslope, unnoticed until the surface collapses Holes (tomos) then open As well as creating a stock and vehicle hazard, these holes generate sediment and destabilise hillsides	Plant poplar or tree willow poles adjacent to, or directly into, the holes (if able) and along the tunnel path

Typical young sandstone Waiotira hill country

Nutrient management

Soil type	Nutrient status	Management strategies
All young sandstone soils	Nutrient status varies considerably in this group	Differences in basement rock make detailed knowledge of soil types and nutrient status essential for good management. Test your soils regularly
Younger soils, e.g. Waiotira clay loam	Naturally more acidic than older soils	More lime is required to achieve optimal pH which unlocks nutrients bound to clay and makes them available to plants
Waiotira suite	Low in sulphur because of massive sandstone basement rock	Little and often sulphur inputs are recommended

Drainage classes

Soil symbol	Full name	Drainage class
PUHOI SUITE Basement rock: banded sandstone		
ANS	Atuanui clay steepland soil	4 - Well drained
TM, TMH	Taumata clay loam	4⇌3 - Moderately well drained
WR, WRH	Whangaripo clay loam	3 - Moderately drained
PBu, PBuH	Puhoi light brown clay loam	3⇌2 - Moderately to imperfectly drained
OF, OFH	Omahuta clay	3⇌2 - Moderately to imperfectly drained
WRe, WReH	Whangaripo clay	2⇌1 - Imperfectly to poorly drained
PB, PBH	Puhoi clay loam	1 - Poorly drained
OMANAIA SUITE Basement rock: sandstone–mudstone complex		
AE, AEH	Autea clay loam/silty clay loam	3 - Moderately drained
WN, WNH	Whirinaki clay loam	3⇌2 - Moderately to imperfectly drained
ON, ONH	Omanaia clay loam	3⇌2 - Moderately to imperfectly drained
AEe, AEeH	Autea clay	2⇌1 - Imperfectly to poorly drained
ONe	Omanaia clay loam with coarse-structured subsoil	1 - Poorly drained
WAIOTIRA SUITE Basement rock: massive sandstone		
WCS	White Cone sandy clay loam steepland soil	4 - Well drained
YCgH	Waiotira gravelly sandy loam	3 - Moderately drained
YC, YCH	Waiotira clay loam	3 - Moderately drained
YCr, YCrH	Waiotira brown clay loam	3⇌2 - Moderately to imperfectly drained
YCe, YCeH	Waiotira clay	2 - Imperfectly drained
PURUA SUITE Basement rock: shattered sandstone		
TLS	Tautoro clay loam steepland soil	4 - Well drained
PU	Purua silt loam	3 - Moderately drained
TN, TNH	Tanoa sandy clay loam	3 - Moderately drained
TNa, TNaH	Tanoa sandy clay loam	3 - Moderately drained
PUeH	Purua clay loam	3⇌2 - Moderately to imperfectly drained

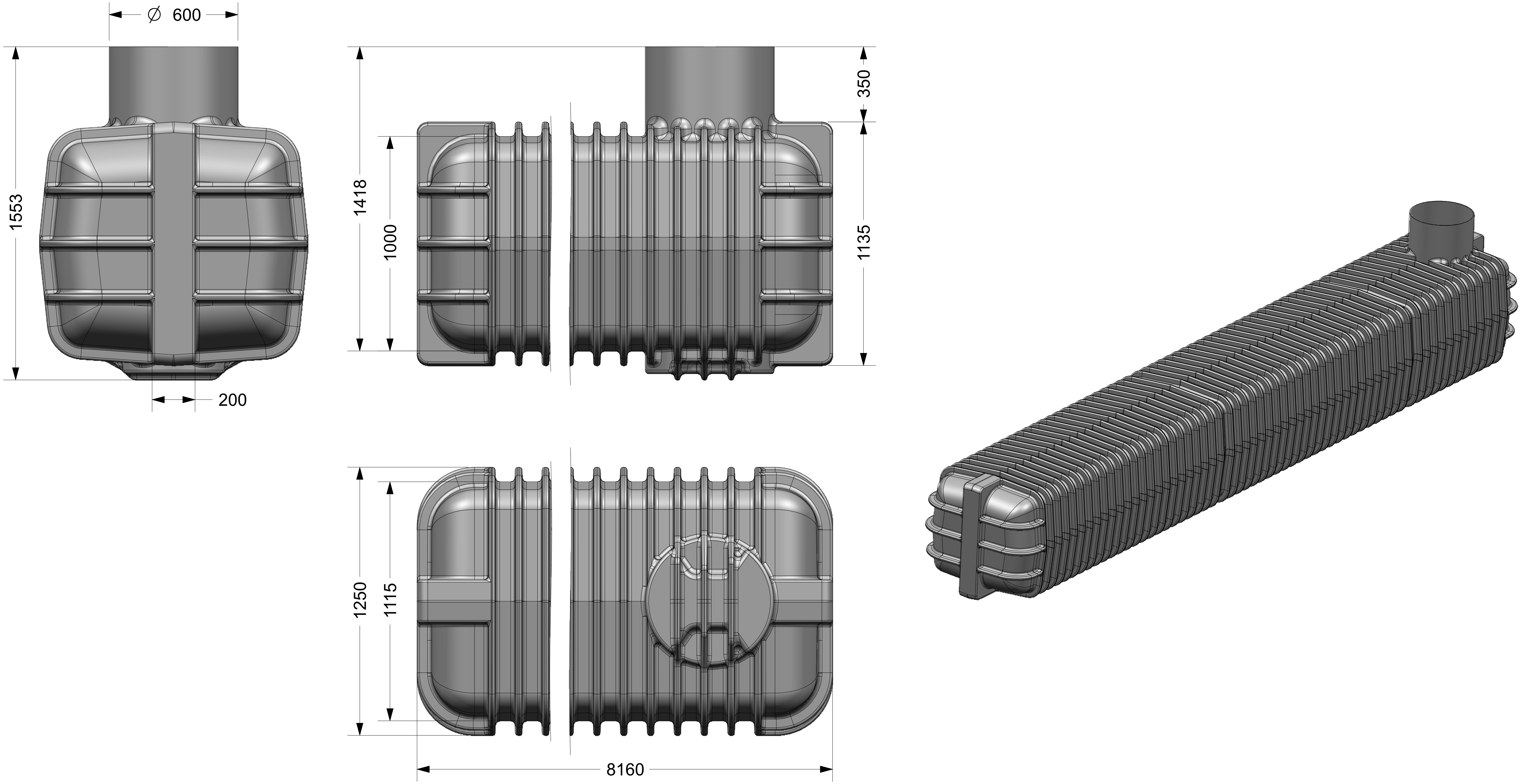
Waiotira hillside showing the later stages of the tunnel gully process

Northland soil factsheet series

- Northland's climate, topography, historic vegetation and mixed geology have combined to form a complex pattern of soils across the region. There are over 320 soil types in Northland. Other regions in New Zealand average only 20 soil types per region.
- The information in this fact sheet is based on a 1:50,000 mapping scale. Therefore, it is not specific to individual farms or properties. However, it may help you to understand general features and management options for recent alluvial soils.
- Knowing your soils' capabilities and limitations is the key to sustainable production in Northland. Northland Regional Council (NRC) land management advisors are available to work with landowners to provide free soil conservation advice, plans and maps specific to your property.
- Regular soil tests are recommended. If you are concerned about your soil structure or health, the Visual Soil Assessment test could be useful. Contact the land management advisors at Northland Regional Council for more information.
- Further background information about the processes that have formed these soils can be found here: **www.nrc.govt.nz/soilfactsheets**

Contact a land management advisor on
0800 002 004 or visit **www.nrc.govt.nz/land**

Northland REGIONAL COUNCIL



1. Dry Weight - 650 kg
2. Certified to AS/NZS:4766:2020
3*. Due to the moulding process, measurements will vary between tanks

Promax

LIQUID MANAGEMENT SOLUTIONS

UNLESS OTHERWISE SPECIFIEDTHE INFORMATION WITHIN THIS TITLE BLOCK SHALL APPLY		DES BY A.P. 22 AUG 2021	
-		DRAWN BY	
		CHECK BY	
		APPR BY J.A. 22 AUG 2021	
*DIMENSIONS ARE IN: MM UNSPECIFIED DIMS IN 3D * DIMENSIONS FOR REFERENCE*	CAGE CODE -	TITLE Promax Super Duty Underground Tank - 8000L	
MATERIAL -		SIZE A3	DWG NO PMXUS08000 1.0 / REV -
FINISH -		SCALE 1:18 / MASS UNSP	SHEET 1 OF 1