



**10 PIONEER CRESCENT, OMOKOROA**

# LIM

# Land Information Memorandum

## Information in a LIM:

### Rates and Water Rates

- Current Rating Valuation.
- Annual Rates.
- Outstanding Rates amounts.
- Water Charges.

### Sewer and Stormwater

- Whether the property has district sewer available and whether it is connected.

### Natural Hazards

- Actual and potential natural hazards.
- Actual and potential impacts of climate change that exacerbate natural hazards.
- Cumulative or combined effects of these hazards and impacts.

### Special Land Features

- Including potential avulsion, falling debris, slippage, alluvion, or inundation on the site which have not identified as natural hazards.
- The status of the land in relation to the contamination of soil by hazardous substances.
- Weathertight Homes information (if relevant).
- Any relevant reports or information held by council in relation to the property.

### Archaeological Sites

- Any relevant Archaeological sites.

### Building Consents, Licences and Requisitions

- Building Permits/Consents issued on the property.
- Any outstanding works, Code Compliance Certificates for consents issued since 1993.

- If a Compliance Schedule has been issued for the building and when the related Warrant of Fitness expires.

### Licences and Environmental Health

- Whether the property has a licence relating to the sale of food, the sale of liquor or any other licence (under Health Act 1956).

### Enforcements and Notices

- Any notice, order, or requisition affecting the land or any building on the land previously issued by Council.

### Planning and Resource Management

- Zoning of the property as defined by Operative and/or Proposed District Plans.
- All Resource Consents approved in relation to the property.
- Long term Community Plans.
- Structure Plans.

### Drainage and Water

- Information on public stormwater and wastewater pipelines on the property as shown on Councils log plans.
- Water toby location.

### Maps

- Maps relating to the property including Aerial Photo, Land Information, District Plan, Natural Hazards (not District Plan) and Archaeological Sites and Deposited Plan.

## Information not in a LIM:

- Building Plans.
- For information in relation to State Highways please contact the New Zealand Transport Authority (NZTA).
- Western Bay of Plenty District Council does not hold any information concerning electricity, gas and telephone connections.
- Records of Title (previously known as Certificates of Title).
- The Council records can be incomplete in some instances.
- The Council has not carried out an inspection of the land and/or buildings for the purpose of preparing this LIM. The Council records also may not show illegal or unauthorised building or works on the land.
- The Council does not provide interpretation or advice on how to interpret or utilise this information. If this required, the applicant should seek appropriate and independent professional advice.

## Disclaimer:

- Under section 44D of the Local Government Official Information and Meetings Act 1987 The territorial authority is not liable in a civil or criminal proceeding for making available in good faith the information in a land information memorandum that is known to the territorial authority about natural hazards that is required by s 44B. This includes information that identifies the following:
  - each natural hazard and each impact of climate change that exacerbates natural hazards, that affects the land concerned;
  - each potential natural hazard and each potential impact of climate change that exacerbates natural hazards to the extent that the territorial authority is satisfied that there is a reasonable possibility that the hazard or its impact may affect the land concerned (whether now or in the future);
  - the cumulative or combined effects of the hazards and impacts referred to above; and
  - any further information required by the regulations to make the information above more understandable.

# Land Information Memorandum

Sections 44A and 44B Local Government Official Information and Meetings Act 1987

13 February 2026

P/1064/13

KEANE, SAMUEL VIPOND  
725 MANIATUTU ROAD  
RD 6  
TE PUKE 3186

Kia orā

Thank you for your application for a Land Information Memorandum.

The original of this LIM has been prepared pursuant to Sections 44A and 44B of the Local Government Official Information and Meetings Act 1987, solely for the applicant, and contains information known to Council within its records and only relevant to the site requested. The reliance by other parties on the information within this LIM shall be at that other parties' sole risk. If any interpretation or explanation is required on any of the enclosed information or plans, the services of an independent advisor or consultant should be sought.

It is recommended that the Record of Title, which is not issued by Council, be searched by the purchaser. The LIM does not necessarily include information relating to private covenants or other memoranda affecting the title and those should be obtained from a Land Record search.

In preparing this report, no Council inspection of the property has been undertaken.

**This Land Information Memorandum is valid as at the date of issue only.**

Ngā mihi

The Consents Services Team (Resource Consents)

[limprocessors@westernbay.govt.nz](mailto:limprocessors@westernbay.govt.nz)

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## 1 Applicant

**Client Name:**

**Applicant Name:** KEANE, SAMUEL VIPOND  
725 MANIATUTU ROAD  
RD 6  
TE PUKE 3186

**Postal Address:** 725 MANIATUTU ROAD  
RD 6  
TE PUKE 3186

**Application Date:** 02 Feb 2026

**Issue Date:** 13 February 2026

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## 2 Property

**Property Owner:** KEANE, SAMUEL VIPOND  
RYTELEWSKA, MARTYNA SONIA

**Valuation No:** 06829 017 94

**Location:** 10 PIONEER CRESCENT CENTRAL

**Legal Description:** LOT 139 DP 550947

**Area (hectares):** 0.0349

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### 3 Rates and Water Rates

The information provided on rates/financial details in this report may not reflect the current details of the legal description/valuation on your application form. This may be due to the property being under subdivision or that the information has not yet been provided or updated for the current valuation and improvements for this financial year.

Note: Rates, Rateable Valuation Details and Water Rates relate to a valuation number. This may be linked to other properties, or a parent property. For this Land Information Memorandum, the valuation number 06829 017 94 is linked to:

Lot 139 Deposited Plan 550947

<b>Land Value:</b>	\$370,000
<b>Improvements:</b>	\$480,000
<b>Capital Value:</b>	\$850,000
<b>Tree Value:</b>	\$0
<b>Annual Rates:</b>	\$4,386.84
<b>Rates Owing:</b>	\$0.00

Note: For the period until rates are “set” the Current Annual Rates and Rateable Valuation Details should not be relied upon and any queries should be directed to the Rates Team.

Rates are charged in two equal instalments for the period commencing 1 July and ending 30 June each year.

**Water Rates** – This information applies to Western Bay of Plenty District Council (WBOPDC) systems only. In some parts of Tauriko, Papamoa, Pyes Pa and Oropi, properties are served by Tauranga City Council system.

<b>Metered Water</b>	YES
<b>Date of Last Reading</b>	15 Aug 2025
<b>Connected</b>	YES
<b>Available</b>	YES
<b>Owing</b>	\$0.00

**Water rates may be outstanding on this property as meter readings are completed six monthly.**



Further information about Council's water supply and water quality is available from Council's website. Please refer to the WBOPDC Water Supply System Bylaw 2008: [Water Supply System Bylaw 2008](#)



Rates information and valuation history can be found online at the WBOPDC website: [Rating Information Search](#)



For any information regarding Māori Land, please contact the Waiariki or Waikato/Maniapoto Office of the Māori Land Court or view their website and online records at: [Māori Land Court](#)

## 4 Building

This information is a record of details held on Council files and may not reflect the situation on site if work has been undertaken without consent. If Council holds any as-built drainage plans relevant to this property they will be included in the attachments section of this LIM.

### 4.1 Building Consents

BC	Project	Status of Consent
95182	CB. Single level, three bedroom home with attached double garage. Mixed cladding and profiled metal roofing	CCC FINAL ISSUED 01 Nov 2021

Building, Plumbing and Drainage Permits issued prior to 1993 will not have a Code Compliance Certificate as the requirement for this did not come into effect until 1 January 1993.

**Note:** Any information held by Council relating to Building Permits will be listed on the Historical Data page at the back of this section in your LIM.

#### **Information regarding buildings where Council holds no records of consents:**

The absence of records for building permits or consents may mean any of the following:

- The building was erected without a permit or consent.
- The building work may be exempt from requiring a permit/consent.
- A Council record is unable to be located.

If building work was carried out without a building permit prior to the 1991 Building Act, or without obtaining building consent under the Building Act 1991 or Building Act 2004, then there is no authority under those Acts for the Council to retrospectively issue a building consent for the work.

For buildings erected prior to the commencement of the Building Act 1991, without any building permit or for which Council holds no records, then Council is generally unlikely to take any action against the current owners of that building unless the building is unsafe or insanitary in terms of the Building Act 2004 or the Health Act 1956. This assumes that the building complies in all other respects with other statutory requirements.

For post-Building Act 1991/Building Act 2004 work, for which the Council holds no record, or the work is not exempt, it is likely that the building work was carried out without consent. If so, the property owner and the person who carried out the work may have contravened the Building Act 1991 and Building Act 2004, and enforcement action may be taken at the Council's discretion. However, some building work is exempt from requiring a permit/consent. This generally applies to small buildings or structures and minor alterations. Irrespective of whether consent is required the Building Act requires that all building work must comply with the Building Code. Potential purchasers of properties requiring further information on building work are advised to engage a qualified building professional to inspect and report.

A certificate of acceptance can be applied for when work is done without a building consent after 1 July 1992, or in specific circumstances when a code compliance certificate (CCC) can't be issued.

For further information go to – [Certificate of Acceptance Information](#)

## 4.2 Certificate of Acceptance

COA	Status
None Known	

## 4.3 Compliance Schedules / Building Warrant of Fitness:

Premise	Notes
None Known	

## 4.4 Earthquake Prone Buildings

There are no Earthquake Prone Buildings located on this land.

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# 5 Environmental Health

## 5.1 Premise Registration

Premises	Category	Licence Status
None Known		

## 5.2 Liquor Licenses

Type	Status	Licence No	Date Issued
None Known			

## 5.3 Enforcements and Notices

Parcel ID	Notice Type	Comments	Date Issued	Date Complied
None Known				

## 6 Natural Hazards

This section contains details of whether the land is affected by one or more natural hazards as defined in the Resource Management Act 1991:

“Natural hazard means any atmospheric or earth or water related occurrence (including earthquake, tsunami, erosion, volcanic and geothermal activity, landslip, subsidence, sedimentation, wind, drought, fire, or flooding) the action of which adversely affects or may adversely affect human life, property, or other aspects of the environment”.

This information should not be regarded as a full analysis of the site features of this land as there may be features that the Council is unaware and has no knowledge of. It is the landowner's responsibility to determine whether the property is suitable for any proposed activity or whether any proposed building site is suitable for development (and to undertake tests if necessary).

Notes: The WBOPDC's website linked below contains information about natural hazards which may be relevant to the site. Before using this website it is important that you read the terms of use to understand the limitations of that information. You are advised to seek expert advice regarding applicability and accuracy of the information as it relates to the site. The website does not replace a Land Information Memorandum (LIM), which is requested from the District Council, and may contain other information about natural hazards.

The website can be accessed at the following link: [Natural Hazards - Western Bay of Plenty District Council](#).

The Bay of Plenty Regional Council's **Bayhazards** website linked below also contains information about natural hazards which may be relevant to the site. Before using the Bayhazards website it is important that you read the terms of use to understand the limitations of that information. You are advised to seek expert advice regarding applicability and accuracy of the information as it relates to the site. The Bayhazards website does not replace a LIM which is requested from the District Council, and may contain other information about natural hazards. The **Bayhazards** website can be accessed at the following link: [Bayhazards Natural Hazards Viewer](#).

## **6.1 Natural Hazard Information sourced from Western Bay of Plenty Operative (District Plan)**

The District Plan maps currently identify coastal erosion, coastal inundation, flooding and land instability in some of the locations that may be susceptible to them. See the 'District Plan' map in the 'Maps' Section of this LIM.

Property specific Natural Hazard information relating to the Natural Hazards identified by the District Plan map can be found under Section '[6.3 Natural hazard information relating to the land concerned](#)'.

## **6.2 Natural Hazard Information Relating to the Building Act 2004**

This section contains details of:

- Whether a notification of a building consent that relates to a natural hazard on the land concerned has been provided for under section 73 of the Building Act 2004, or in accordance with section 36(2) of the Building Act 2004 or section 641A of the Local Government Act 1974.
- Signs or notices under section 133BT of the Building Act 2004 on or near building on the land.
- Entries on certificates of title under section 434 of the Building Act 2004

No information known to Council.

Note: If there is an Earthquake Prone Building located on this property it will be identified in Section "[Earthquake Prone Buildings](#)" of this LIM report.

## **6.3 Natural Hazard Information Relating to the Land Concerned**

### **6.3.1 Earthquake**

Note: If there is an Earthquake prone building located on this property it will be identified in Section "[Earthquake Prone Buildings](#)" of this LIM report.

### **6.3.2 Active Faults**

No information known to Council.

### **6.3.3 Liquefaction**

NOT DISTRICT PLAN

Regionwide

Tonkin + Taylor Ltd have prepared a report titled 'Bay of Plenty Regional Liquefaction Vulnerability Assessment' (April 2021). The report was commissioned by the Bay of Plenty Regional Council.

The report presents the results of a liquefaction mapping exercise for the Bay of Plenty Region.

The Report was prepared in accordance with the Ministry for the Environment (MfE) and Ministry of Business, Innovation and Employment (MBIE) 'Planning and Engineering Guidance for Potentially Liquefaction Prone Land' (2017) to a Level A (basic desktop assessment) level of detail.

The liquefaction maps from the report are shown on the map in this LIM titled 'Natural Hazards (Not District Plan)' and on Council's online natural hazards maps. The mapped categories are 'liquefaction damage is unlikely', 'liquefaction damage is possible' and 'liquefaction category is undetermined'.

The subject property is identified based on information contained in the report as having one or more of these categories.

'Liquefaction damage is unlikely' means a probability of more than 85 percent that liquefaction-induced ground damage will be none to minor in a 1-in-500 year earthquake shaking event.

'Liquefaction damage is possible' means a probability of more than 15 percent that liquefaction-induced ground damage will be minor to moderate (or more) in a 1-in-500 year earthquake shaking event.

'Liquefaction category is undetermined' means that a liquefaction vulnerability category is undetermined, either because a liquefaction assessment has not been undertaken for this area, or there is not enough information to determine the appropriate category with the required level of confidence.

The report can be viewed on Council's natural hazards webpage (liquefaction subpage) at [www.westernbay.govt.nz/liquefaction](http://www.westernbay.govt.nz/liquefaction)

#### **6.3.4 Tsunami**

No information known to Council.

#### **6.3.5 Coastal Erosion**

No information known to Council.

#### **6.3.6 Volcanic and Geothermal activity**

No information known to Council.

#### **6.3.7 Landslip**

No information known to Council.

#### **6.3.8 Subsidence**

No information known to Council.

#### **6.3.9 Sedimentation**

No information known to Council.

### **6.3.10 Wind**

No information known to Council.

### **6.3.11 Drought**

No information known to Council.

### **6.3.12 Fire**

No information known to Council.

### **6.3.13 Flooding**

No information known to Council.

### **6.3.14 Coastal Inundation**

No information known to Council.

### **6.3.15 Other General Natural Hazards Information**

#### FLOODING

Flood hazard information referenced here includes modelling produced at a nation-wide scale by Earth Sciences New Zealand (ESNZ). The national tool provides consistent flood hazard data across New Zealand and is zoomable to street level, but not to individual properties. For property-specific flood hazard information that may affect this property please refer to the following section of this Land Information Memorandum titled, "Natural Hazards Relevant to the Subject Property". The modelling produced by ESNZ is available to view at the following link: [Flood Hazard Modelling](#).

#### LANDSLIDE

Council holds information from a recent regional landslide study (2023) that identifies areas susceptible to landslide (from rainfall and earthquake) across the whole of the district. These results are high-level and not able to be shown at a property level. For more information go to the Land Instability pages on the Western Bay of Plenty District Council's [website](#).

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## **7 Special Feature(s) or Characteristic(s)**

This section contains information about other special features or characteristics of the land that is known to the Council, but is not apparent from a district plan under the [Resource Management Act 1991](#), including:

- potential avulsion, falling debris, slippage, alluvion, or inundation on the site which have not already identified as natural hazards above.
- the likely presence of hazardous substances on the site.

This information should not be regarded as a full analysis of the site as there may be features that the Council has no knowledge of. The applicant is solely responsible for ensuring that the land is suitable for a particular purpose.

### **7.1 Hazardous Substance(s)**

No information known to Council.

### **7.2 Site Contamination**

The land has been identified as having (or potentially having) an activity or industry from the MfE's HAIL and is registered on BOPRC's Land Use Register, it does not necessarily mean that it is contaminated. Instead, it means that it has historically or is currently being used for an activity or industry that could result in contamination. This property is categorised in that register as a 'Verified Suitable for Land Use Site' ref: LUR-WBP-00386.

Information about [Contaminated Land](#) can be found on the Bay of Plenty Regional Council's (BOPRC's) website and properties that are currently recorded on the BOPRC Land Use Register can be viewed via the BOPRC's [HAIL Site Viewer](#).

### **7.3 Hazardous Contaminant(s)**

No information known to Council.

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## **8 Historic Heritage Features and Archaeological Sites**

Please refer to the map section of this LIM. The Geographic Information Services (GIS) plan entitled 'Archaeological Sites' will identify any registered archaeological site(s) over the property (depicted as a "U" number in a red/pink box/circle). If a site(s) is recorded on the property, an 'archaeological sites report' will be attached.

Please also refer to the District Plan map, this will also identify any significant historic heritage features located on the property. If a significant historic heritage feature is recorded over the property, the provisions of Section 7 (Historic Heritage) of the Operative District Plan apply.

If the GIS plan or District Plan map does not identify any archaeological site(s) and/or historic heritage feature(s) it should not be assumed there are no sites or features, only that Council has no record of these. Property owners still have obligations under the Heritage New Zealand Pouhere Taonga Act 2014 in that it is an offence for anyone to destroy, damage or modify or cause to be destroyed, damaged or modified, the whole or part of any archaeological site, knowing or having reasonable cause to suspect it is an archaeological site.



Further information on Archaeological Sites and/or Historic Heritage Features in the Western Bay of Plenty District can be found here;

- [Operative District Plan](#)
  - [NZAA Arch Site Hub](#)
  - [Heritage New Zealand](#)
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## 9 Sewer and Stormwater

There are Council Services on this property (refer to the 'Land Information' map in the Maps section of this LIM).

District Sewer Connected: YES

District Sewer Available: YES

If a sewer is available, under the Local Government Act 1974, the property must connect to the sewer if it is within 30 metres of the property boundary or if the sewer is within 60 metres of the dwelling.

### 9.1 Septic Tanks and On-Site Effluent Treatment Systems (OSET)

Most septic tanks in the Western Bay of Plenty are permitted provided they are adequately maintained, however, when making dwelling additions you may need to upgrade the wastewater system, and this will require Building Consent under the Building Act 1991.

The removal and/or upgrade of existing septic tanks and/or OSET may also require Resource Consent from the Bay of Plenty Regional Council. Please contact Bay of Plenty Regional Council directly 0800 884 880 if you have any further questions about this.

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## 10 Network Utility Operators

The WBOPDC does not hold any information concerning electricity, telecommunication and gas connections. Information may be obtained from the relevant network utility providers.

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## 11 Projects

We work to provide good-quality local infrastructure and local services to our communities. Council projects tend to be one off, take place over the long term and impact a large area or community. You can read about Council projects here:



[Council Projects](#)

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## 12 Planning/Resource Management

### 12.1 The Western Bay of Plenty Operative District Plan

This property is zoned **Medium Density Residential Omokoroa**. See the District Plan map in the 'Maps' section of this LIM. The District Plan including rules, maps and performance standards, plus any current (and previous) Plan Changes can be found here:



[Operative District Plan](#)

[District Plan Changes](#)

### 12.2 Natural Hazards Identified in the District Plan

#### 12.2.1 Flooding

None known

#### 12.2.2 Coastal Erosion

None known

#### 12.2.3 Coastal Inundation

None known

#### 12.2.4 Land Instability

None known

### 12.3 Identified Significant Features

#### 12.3.1 Significant Ecological Feature(s)

None known

#### 12.3.2 Outstanding Landscape Feature(s)

None known

#### 12.3.3 Cultural and/or Built Heritage Feature(s)

None known

#### 12.3.4 Notable tree(s)

None known

### 12.3.5 Designation(s)

None known

### 12.3.6 Proposed Esplanade Strip(s) and /or Reserve(s)

None known

### 12.3.7 Esplanade Strip(s) and /or Reserve(s)

None known

### 12.3.8 Other

None known.

## 12.4 Resource Consents

RC Number	Status	Consent Type	Date Granted
10476	GRANTED	Remediation of contaminated site under NESCS	20/09/2017

#### Notes:

- Resource consents can lapse. Applicants are advised to verify the status of Resource Consents with Council staff.
- If a Resource Consent(s) has been granted on this property it does not infer that the conditions of the consent have been met. Applicants are advised to verify the status of Resource Consent(s) with Council's Customer Service Planner.

## 12.5 Other Consents, Certificates, and Licences

Any information held by council relating to Historic Planning Consents will be listed on the 'Historical Data' page attached to this LIM.

If there are any Consent Notices (and associated technical reports), Certificates, Bush Protection Inspections and/or Yard Exemption Statements relevant to this property they will be included in the 'Attachments' section of this LIM.

## 12.6 Community Plans

Council has a programme to help urban communities in the district develop long term plans that detail a vision for each community. Information regarding current Community Plans can be found here:



[Community Plans](#)

## 12.7 Structure Plans

Structure plans have been created by Council to assist in managing the District's growth. These identify new areas for development and show required infrastructure (roading, water supply, wastewater disposal, stormwater and recreation) and associated costs. These structure plans are contained in and shown on the Planning Maps.



[Structure Plans](#)

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## 13 Other Useful information

The WBOPDC provides the following discretionary information which it considers to be relevant in accordance with Section 44A(3) of the Local Government Official Information and Meetings Act 1987 (LGOIMA).

### 13.1 Council Website and ePlan

The Council's [Website](#) provides comprehensive information and resources, including details on building and resource consents topics such as natural hazards and zoning.



[Council Website](#)

The [ePlan](#) is an interactive electronic version of the District Plan. It aims to make it easier to find information relevant to your property and to have your say on changes to the District Plan.



[ePlan](#)

### 13.2 Reserve Management Plans

There are management plans in place for 222 reserves across the District, including plans covering each urban community.

Management plans are a statutory requirement under the Reserves Act. A plan provides a one-stop reference point that includes a reserves classification and legal status, the area it covers, infrastructure and funding for capital projects councils want to undertake.



[Reserve Management Plans](#)

Under Council's Reserve Management Plan(s) any property adjoining a public reserve is not permitted to encroach onto that reserve. Where new encroachments occur, or if an existing encroachment exists, Council will give notice to the encroacher to remove the encroachment and reinstate the reserve at their own cost. Please refer to the Reserve Management Plan.

### **13.3 The Bay of Plenty Regional Council**

Regional Council policies and plans may affect the use and management of land, water air and other natural and physical resources.

For further information on whether a property is affected by any Regional Planning instrument or by some other function of the Regional Council please contact Regional Council.



[Bay of Plenty Regional Council Website](#)

### **13.4 The Ministry for the Environment**

The Ministry for the Environment administer Acts, National Policy Statements, National Environmental Standards and other regulations.



[Act and Regulations](#)

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## **HISTORICAL DATA**

There are no historical building permit documents held for this property

There are no historical planning consent documents held for this property

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# **MAPS**

**Aerial Photography**

**Land Information**

**Land Information Legend**

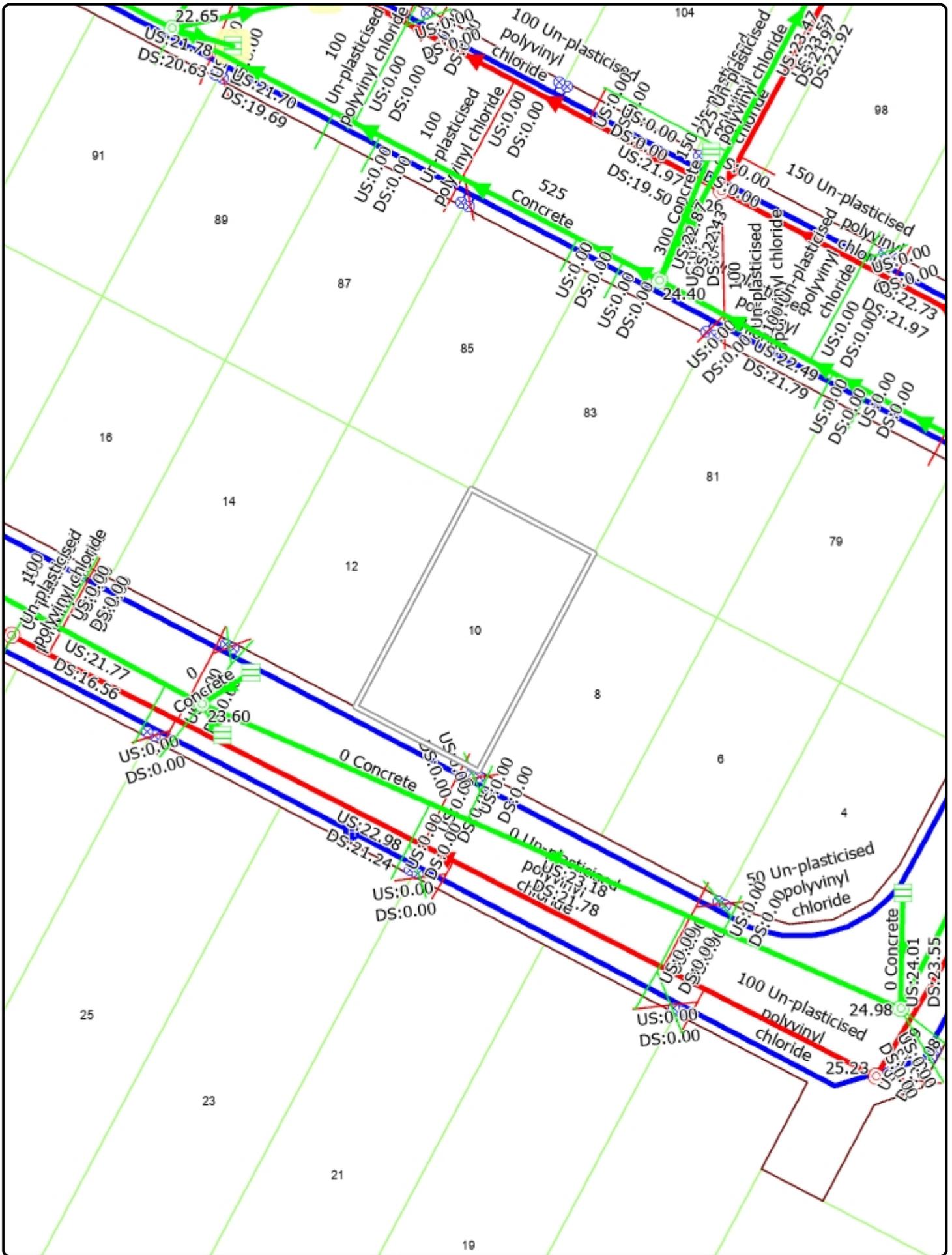
**District Plan**

**District Plan Legend**

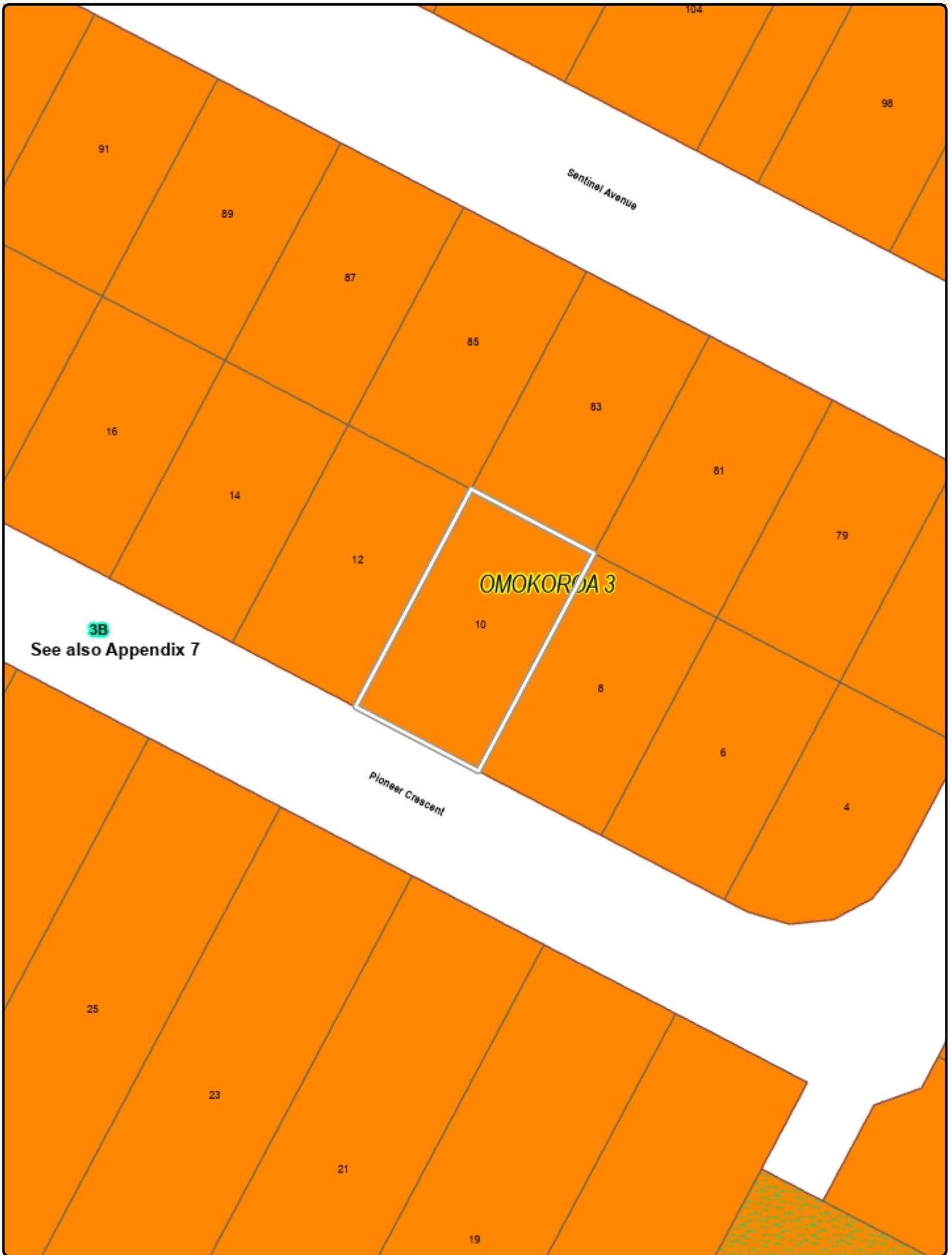
**Other Natural Hazards (not in District Plan)**

**Natural Hazards Legend**





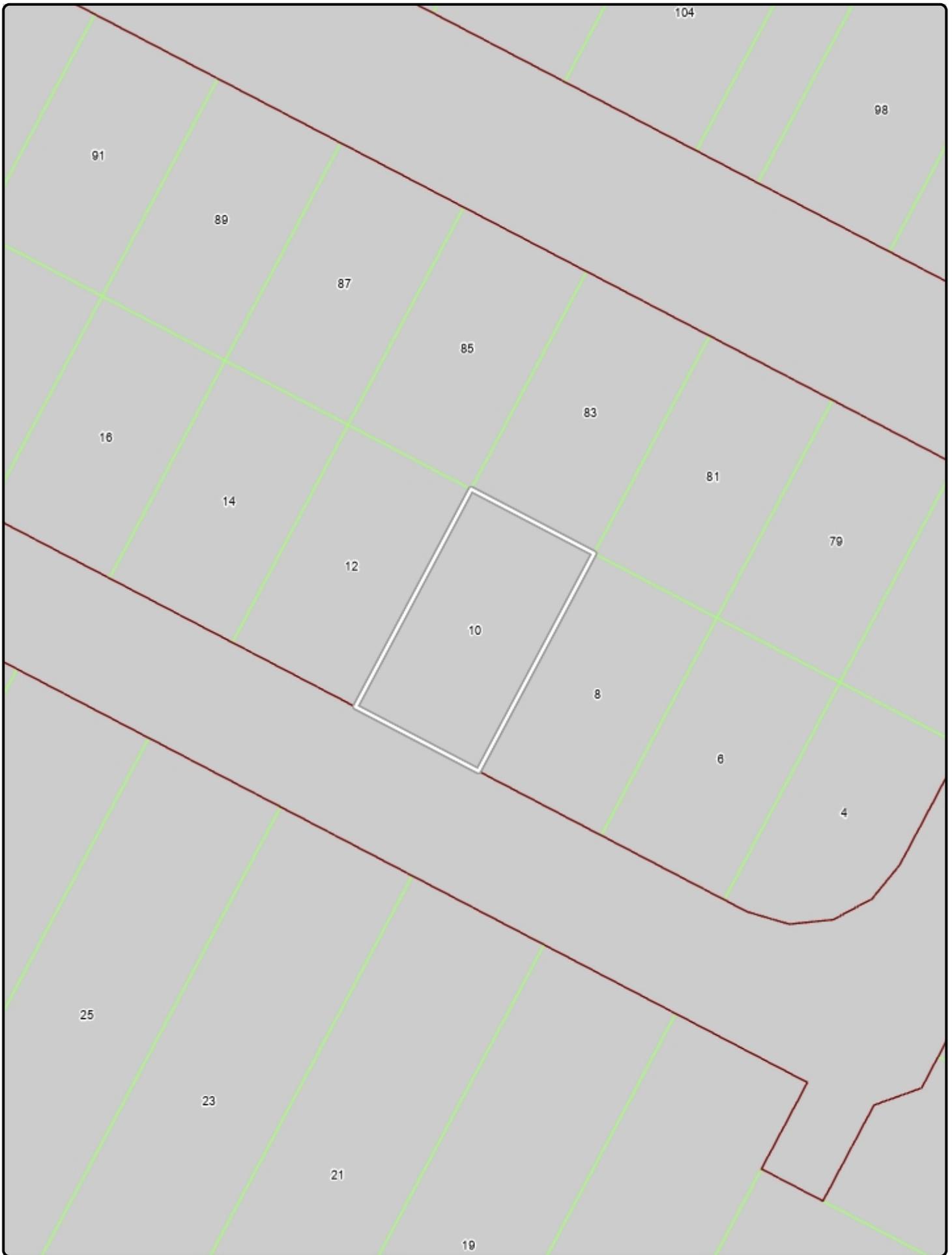
Water Supply	Main	Wastewater	Gravity Main
	Rider Main / Connection		Gravity Main (Below 1:2000)
	Instruments - Meter / Toby		Rising Main
	Valve - Air Release		Service Main / Connection
	Valve - Altitude		Chamber - Inspection Shaft
	Valve - Non Return / Backflow Preventer		Chamber - Manhole
	Valve - Butterfly		Mechanical - Grinder Pump
	Valve - Flow Control		Valve - Air / AirKnife
	Valve - Flow Meter		Valve - Non Return
	Valve - Hydrant		Valve - Pressure Reducing
Valve - Normally Closed	Valve - Scour /Knife		
Valve - Pressure Reducing	Valve - Sluice		
Valve - Pressure Sustaining	Inlet		
Valve - Scour	Treatment Plant		
Valve - Sluice	Junction		
End Cap	Outlet		
Junction	Instruments - Flow Meter		
Treatment Plant	Pump		
Containment Structure - Reservoir or Tank	Wastewater Pond		
Pump	Paper Road		
Well - Bore	Property or Restrictive Area		
Gravity Main Gravity Main (Below 1:2000) Pressure Main Service Main / Connection Open Drain Grass Swale Catchpit Chamber - Box Chamber - Inspection Shaft Chamber - Manhole Soakhole Valve - Flood Gate Valve - Sluice Wing Wall Inlet Junction Outlet Pump RAMM Culvert Stormwater Drainage Reserve Stormwater Pond			
Stormwater	Gravity Main	Property	Building
	Gravity Main (Below 1:2000)		Hydro
	Pressure Main		Railway
	Service Main / Connection		Road
	Open Drain		Parcel
	Grass Swale		TCC Water Catchment
	Catchpit		Statutory Acknowledgement Areas
	Chamber - Box		Consent Notice Covenant
	Chamber - Inspection Shaft		Ecological
	Chamber - Manhole		Conservation Covenant
Soakhole	QE II		
Valve - Flood Gate	RAP	Class 1	
Valve - Sluice		Class 2	
Wing Wall		Class 3	
Inlet	WBOP	Other Councils	
Junction		Western Bay of Plenty	
Outlet		Ocean, River, Stream	
Pump		Selected Parcel	
RAMM Culvert	<p>Crown Copyright Reserved.  LINZ Digital Licence No. HN/352200/03 &amp; TD093522.  Archaeological data supplied by NZ Historic Places Trust  <a href="http://www.archsite.org.nz">http://www.archsite.org.nz</a></p> <p>Location of Services is indicative only.  Council accepts no liability for any error.</p>		
Stormwater Drainage Reserve			
Stormwater Pond			



<b>Constraints</b>		Built Heritage Feature	<b>Structure Plans</b>		Greenlane
		Cultural Heritage Feature			Intersection Upgrades
		Cultural Heritage Feature Boundary			Pedestrian Bridge
		Coastal Erosion Area - Primary Risk (1)			Road Bridge
		Coastal Erosion Area - Secondary Risk (1)			Road
		Coastal Erosion Area - Access Yard			Walk / Cycle Way
		Coastal Erosion Area - Rural			Stormwater
		Coastal Inundation Area			Wastewater Pump Station
		Significant Ecological Feature / RAP			Wastewater
		Flood Hazard			Water Supply
		Outstanding Landscape Feature - 50m (S7a & S8a) - 40m (S9a)			Stormwater Pond
		Outstanding Landscape Feature			Identified Area (2)
		Stability Area - Minden A			Minden Lifestyle Structure Plan Area Overland Flowpaths & Local Ecological Features
		Stability Area - Minden B1			Omokoroa Mixed Use Residential Precinct
		Stability Area - Minden B2			Omokoroa Stages 3A, 3B and 3C
	Stability Area - Minden C		Te Puke Stormwater Management Area		
	Stability Area - Minden U		Reserve Area		
	Stability Area - General		Structure Plan Boundary		
	Stability Area - Landslip		Commercial		
	Viewshaft		Commercial Transition		
<b>Infrastructure</b>		Airport Approach Surface		Future Urban	
		Formed Roads		Horticulture Post Harvest	
		Limited Access State Highways		Industrial	
		Stop Bank		Light Industrial	
		Kaimai - Mamaku Forest Park Boundary		Lifestyle	
<b>Reserves</b>		Esplanade Strip		Medium Density Residential	
		Priority proposed esplanade strip/reserve		Natural Open Space	
		Proposed esplanade strip/reserve		Residential	
		Reserve		Rural	
<b>Urban Map Display</b>		Reserve, Department of Conservation		Rural Residential	
		Notable Trees		TECT All Terrain Park	
		Town Centre Boundary		Matakana Island Forested Sand Barrier	
		Designation		TNL 100m Building Line Setback	
				Electricity Transmission Line	
				Electricity Transmission Line Buffer 16m (3)	
				District Boundary	
				Firing Range Exclusion Zone	
				Quarry Effects Management Area	

Bay of Plenty Regional Council should be consulted before undertaking any activity in the vicinity of Mean High Water Springs to establish the actual line of Mean High Water Springs. Formed roads are indicated as white shading on the road land parcels. Unformed roads have the underlying zone indicated.

(1) Primary risk includes the whole of the red line and the land towards the sea. Secondary risk includes the whole of the green line up to the edge of the red line.  
(2) The identified areas include: the community service area at Rangioru, the central hub site within the All Terrain Park and buffer zones in Stage 2 Omokoroa and Binnie Road.  
(3) Compliance with NZECP 34:2001 is required in this area for buildings/structures and earthworks. The distance quoted is from the centreline of the transmission line.



**Other Natural Hazards**

- Coastal Erosion Year 2080
- Coastal Erosion Year 2130
- ☐ Tauranga Harbour Coastal Inundation
- ☐ Katikati Floodable Area
- ☐ Te Puke Floodable Area
- ☐ Waihi Beach Floodable Area
- ☐ Wairoa Floodable Area
- ☐ Rural / Small Settlements Floodable Area
- ☐ Tsunami Inundation (5m Wave Height)
- ☐ Tsunami Inundation (1 in 2500 Year Wave)
- ☐ Liquefaction Damage is Possible
- ☐ Liquefaction Damage is Unlikely
- ☐ Liquefaction Category is Undetermined

**Property**

- ☐ Paper Road
- ☐ Building
- ☐ Lease
- ☐ Property or Restrictive Area
- Hydro
- Railway
- Road
- Parcel
- ☐ Selected Parcel



Western Bay of Plenty District Council

For our people

**Natural Hazards Legend**

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## Attachments

A3478205: 2019-5-28 - Aurecon NZ Ltd - Asbestos Containment Cell - Ongoing Monitoring and Management Plan (OMMP) Sept 2018

A2972214: 2017-08-18 - Aurecon NZ Ltd - Remediation Options Appraisal - 255791-0000-REP-NN-0002 (RAP) verification

A2972219: 2017-08-18 - Aurecon NZ Ltd - Contaminated Site Management Plan - May 2017

A2996631: RC10476L LAND USE - DISCRETIONARY - WBOPDC Decision Report - 19.09.17

A2997532: RC10476L LAND USE - DISCRETIONARY - Remediation of Contaminated Site under NESCS

A3896215: RC10139 - stage 7 - 224 application Geotechnical Report  
TGA2016-0258BR Rev0 Stage 7 GCR 091020

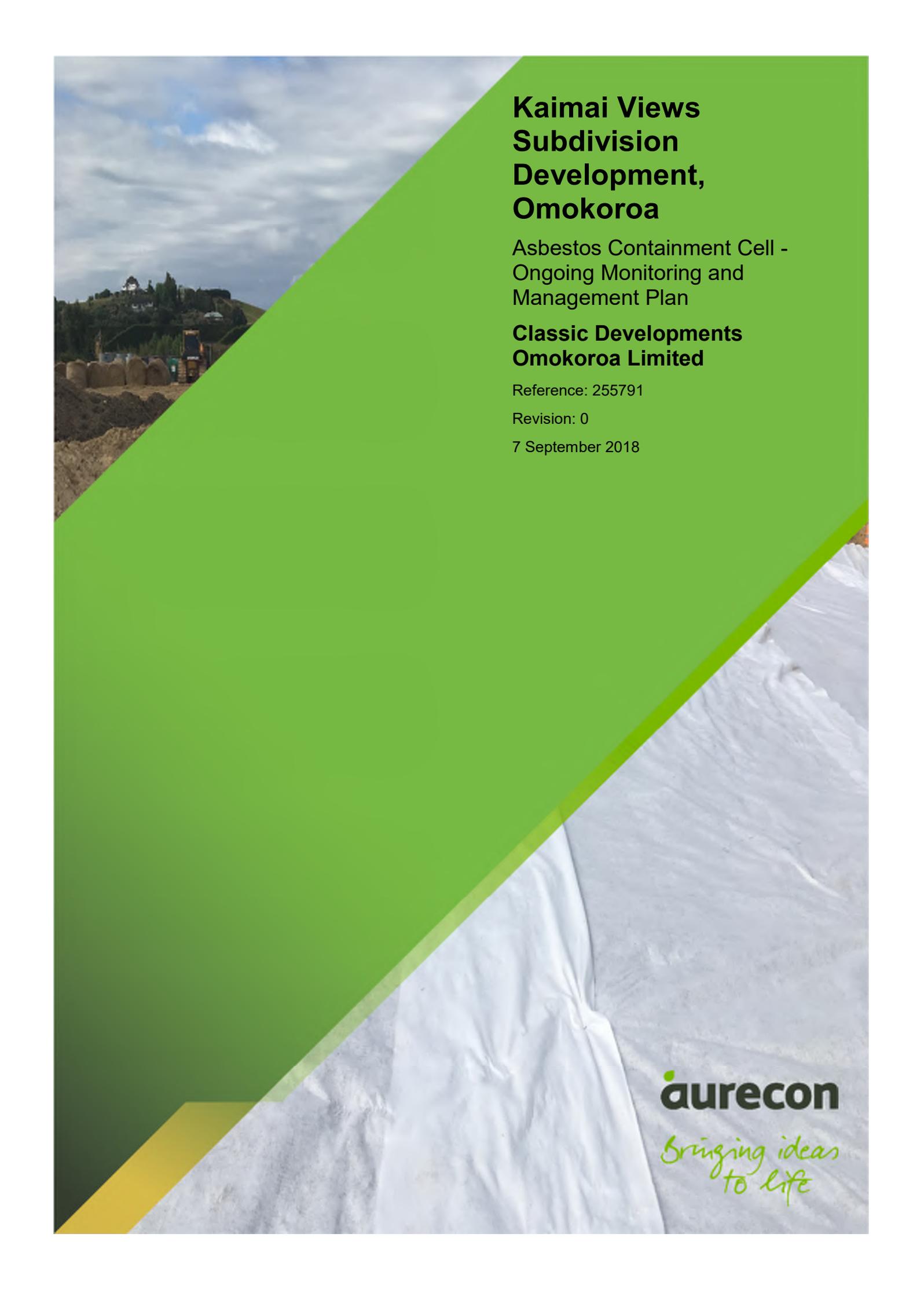
A3982364: 2021-02-03 - RC10139 - Consent Notice (2) - Stage 7 (doc 331778)

A4021268: 2021-02-03 - RC10139 - Consent Notice (3) - Stage 7 (doc 331778)

A4338924: BC95182 - Drainage - AS BUILTS

A4338928: BC95182 - Plumbing - AS BUILTS

A7143581: BC95182 Plumbing & Drainage Plan 2021-02-23  
Invoice



# **Kaimai Views Subdivision Development, Omokoroa**

Asbestos Containment Cell -  
Ongoing Monitoring and  
Management Plan

**Classic Developments  
Omokoroa Limited**

Reference: 255791

Revision: 0

7 September 2018

**aurecon**

*Bringing ideas  
to life*

# Document control record

Document prepared by:

**Aurecon New Zealand Limited**  
 Ground Level 247 Cameron Road  
 Tauranga 3110  
 PO Box 2292  
 Tauranga 3140  
 New Zealand

**T** +64 7 578 6183  
**F** +64 7 578 6143  
**E** tauranga@aurecongroup.com  
**W** aurecongroup.com

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<b>Name</b>		<b>Name</b>	
Luke Beirne		Timothy Dee	
<b>Title</b>		<b>Title</b>	
Environmental Geologist		Associate	

# Notes to owner

Listed below are parts of this Ongoing Monitoring and Management Plan (OMMP) which are of particular importance for the ongoing containment of asbestos contaminated material at Kaimai Views. These aspects should be considered and planned for by the site owner, and any contractor working within the area:

- The extent of the containment cell is presented on drawings 255791-0000-DRG-KF-001, 255791-0000-DRG-KF-002, and Lysaght's drawings within Appendix A. These drawings are completed using the most current publicly available aerial photograph, however should be updated once development on the site is complete to more accurately reflect current topography and layout.
- **Placement of clean capping material to the minimum design requirement of 1 m is not currently complete. Completion of the capping to full thickness and certification by a suitably qualified and experienced practitioner (SQEP) is required prior to any further works commencing in the area of the cell. This report should be updated upon completion.**
- Once completed, the cell will comprise a layer of clean soil capping 1 m in thickness overlying asbestos containing material (the full dimensions of which are shown within Aurecon's Site Validation Report). The top of the contaminated material is demarcated by white geotextile fabric. As built drawings of the cell are included in Appendix A.
- Intrusive works within the area of the containment cell should be avoided where at all possible. Any future works within the area of the containment cell will require advance planning and SQEP consultation before proceeding.
- Where the geotextile marker layer is encountered during future excavations on the site, or becomes visible by other means, works must stop immediately and a SQEP engaged to advise.
- Planting of the cell should be undertaken to consider of root depths, scour prevention, and other recommendations within this plan to avoid disruption of the marker layer and disturbance of asbestos contaminated soils. Measures should be put in place to control so to avoid burrowing of the cell by animals.
- Earthworks within the vicinity may affect the geotechnical stability of the cell, and should not be undertaken without a full review of the geotechnical reports produced by CMW Geosciences, TGA2016\_0258AK, and TGA2016\_0258AQ, included in Appendix B. A TCC Category 1 Geoprofessional may be required to provide geotechnical advice in advance of any future bulk earthworks or permanent development proposals.
- Inspections of the cell for evidence of instability will be required at least annually, and after extreme weather events. Topographic survey of the cell is recommended at regular 5-year intervals, Record sheets should be appended to this OMMP in Appendix E.
- This OMMP should be reviewed by a SQEP bi-annually to ensure it is relevant to the current legislation.

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# Introduction

## 1.1 General

Classic Developments Omokoroa Limited (the client) engaged Aurecon New Zealand Limited (Aurecon) to prepare an Ongoing Monitoring and Management Plan (OMMP) for contaminated material at the Kaimai Views Subdivision, Omokoroa (herein referred as Kaimai Views) located at 336, 340, and 344 Omokoroa Road, Omokoroa (the 'site'). A site location plan is included as drawings: 255791-0000-DRG-KF-001 and 255791-0000-DRG-KF-002 in Appendix A.

Contaminated material is encapsulated within an on-site asbestos containment cell constructed in part of site to be vested into reserve and managed by the Western Bay Of Plenty District Council (WBOPDC). This cell is designed to encapsulate and isolate asbestos contaminated soils from human and environmental contact.

The purpose of this OMMP is to assist with the management of future activities on the site where remediation has occurred, and residual contamination remaining on the site (within the containment cell). This OMMP covers the following:

- Site contamination status;
- Site administration;
- Outline health and safety measures associated with contamination for soil disturbance works;
- Environmental management procedures; and
- Further testing requirements.

This document provides some general guidance of handling and management of asbestos contaminated soils but does not supersede requirements for a works-specific Asbestos Removal Control Plan (ARCP) prepared by a Worksafe Accredited Class A license holder for any future works within asbestos impacted areas.

## 1.2 Legislative guidelines

The following legislation and guidelines have been considered for the preparation of this OMMP:

- *Bay of Plenty Regional Natural Resources Plan (updated May 2018)*
- *BRANZ: New Zealand Guidelines for Assessing and Managing Asbestos in Soil*
- *CIRIA 733 Asbestos in soil and made ground: a guide to understanding and managing risks (2014).*
- *Health and Safety at Work Act (2015);*
- *Health and Safety at Work Asbestos Regulations (2016);*
- *MfE Contaminated Land Management Guidelines, Volumes 1 to 5 (October 2011);*
- *MfE Module 2 – Hazardous Waste Guidelines: Landfill waste acceptance criteria and landfill classification (May 2004);*
- *National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health Regulations (October 2011);*
- *WasteMINZ; Technical Guidelines for Disposal to Land (Updated August 2018)*
- *Western Bay of Plenty District Council, (2012). Western Bay of Plenty District Plan;*
- *Western Australian Department of Health (WA DoH) 2009 Guidelines for the Assessment, Remediation and Management of Asbestos Contaminated Sites in Western Australia.*
- *Worksafe NZ - New Zealand guidelines for the management and removal of asbestos (December 2016)<sup>1</sup>;*

---

<sup>1</sup> <http://construction.worksafe.govt.nz/guides/acop-management-and-removal-of-asbestos/>

## 1.3 Applicable consents and permit conditions

### 1.3.1 Resource consent RM17-0346-AP– Bay of Plenty Regional Council

A resource consent was granted on 23 June 2017 to *discharge contaminants to land and to disturb and remediate contaminated land*. The conditions of the permit relate to establishment and maintenance of erosion and sediment and control measures, and works, including following undertaking the activities in accordance with Aurecon's ROA & RAP, and CSMP. For a full list of conditions, refer to a copy of the consent provided in Appendix C.

### 1.3.2 Resource consent RM17-0365-LC.01 – Bay of Plenty Regional Council

A resource consent was granted on 8 September 2017 for *remediation or disturbance of contaminated land*. The conditions of the permit relate to establishment and maintenance of erosion and sediment and control measures, and works, including following undertaking the activities in accordance with Aurecon's ROA & RAP, and CSMP. For a full list of conditions, refer to a copy of the consent provided in Appendix C.

## 1.4 Limitations of this Report

Aurecon performed the services in a manner consistent with the normal level of care and expertise exercised by members of the environmental profession. No warranties express or implied, are made. It should be noted that some information provided in this report is reliant on information provided by third parties. Aurecon takes no responsibility for the quality/accuracy of information provided by third parties.

The outcome of this report is limited to information supplied for the activities associated with the scope of works only. It is intended that this assessment provides a description of the identified contaminants sources, pathways and receptors and recommendations on how to address and manage any issues at the location in question.

This report has been prepared for the use of the client. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage the client may suffer as a result of using or relying on any such information or recommendations contained in this report, except to the extent Aurecon expressly indicates in this report that it has verified the information to its satisfaction. This report does not provide a complete assessment of the environmental status of the site, and it is limited to the scope defined herein. Should further information become available regarding the conditions at the site, including previously unknown likely sources of contaminants, migration pathways or receptors, Aurecon reserves the right to review the report in the context of the additional information.

The findings, observations and conclusions expressed by Aurecon are not, and should not be considered as an opinion concerning the commercial feasibility of the property or asset. The report may contain various remarks about and observations on legal documents and arrangements such as contracts, supply arrangements, leases, licences, permits and authorities. A consulting scientist can make remarks and observations about the technical aspects and implications of those documents and general remarks and observations of a non-legal nature about the context of those documents. However, as consulting scientists, Aurecon is not qualified, cannot express and should not be taken as in any way expressing any opinion or conclusion about the legal status, validity, enforceability, effect, completeness or effectiveness of those arrangements or documents or whether what is provided for is effectively provided for. They are matters for legal advice.

## 2 Site Contamination Status

### 2.1 Project background

Kaimai Views is a residential subdivision developed as part of the Omokoroa Special Housing Area – a development completed by a joint venture partnership between the client and WBOPDC creating 242 new residential lots and a reserve, within an area of former orchard and infilled gullies.

During earthworks to construct the design landform at Kaimai Views, asbestos containing materials (ACM) were discovered by construction personnel within two stockpiles of topsoil and non-engineered fill. Following this discovery, an area of in-situ non-engineered fill, and a derelict shed, both containing ACM were also identified. In addition to these four areas, a slope failure caused by heavy rain remobilised ACM from an in-situ area to the base of the stormwater reserve. Emergency works to remove impacted materials from the base of gully to allow continued construction of the stormwater reserve were undertaken during the week commencing 20 March 2017.

Aurecon conducted investigations at the site from 14 March 2017 to 28 March 2017, comprising 13 initial samples and 11 subsequent samples, to delineate the area of contamination. The ACM source is suspected to be as the result of historical infilling and waste disposal by the previous landowner; utilising imported material comprising demolition waste and ACM.

A Remediation Options Assessment and Remediation Action Plan (ROA & RAP, ref: 255791-0000-REP-NN-0002) was undertaken by Aurecon, in consultation with stakeholders, to define a remediation strategy for the site. The agreed remediation strategy selected for the site was to engineer an on-site containment cell to contain the ACM within. The asbestos containment cell was constructed in the part of site to be vested into WBOPDC reserve and designed to encapsulate and isolate asbestos contaminated soils from human and environmental contact. The cell is approximately 150 m long, and 50 m wide, formed of two benches of approximately 2.5 m in height, cut into the side of an embankment. The design of this cell is included within CMW Geotechnical report TGA2016\_0258AK Rev0 (refer to Appendix B).

Remediation works at the site were undertaken between 3 October 2017 and 29 May 2018, with validation works taking place concurrently, and are reported in Aurecon's Site Validation Report (SVR, ref: 255791-REP-NN-0004).

### 2.2 Previous reports

#### 2.2.1 Sitewide Reporting

A Detailed Site Investigation (DSI) of the site was undertaken by Lysaght Consultants Ltd. (Lysaght) to assess the potential for contamination to be present (*Detailed Contaminated Site Investigation – for 336, 340 and 344 Omokoroa Road, Omokoroa, ref: 163252, dated 9 August 2016*). The investigation identified arsenic and Total Petroleum Hydrocarbon (TPH) contaminant concentrations above the adopted human health guideline criteria, whereby an area of approximately 16 m<sup>3</sup>, across a number of hotspot areas, would require remediation prior to earthworks.

A Remediation Action Plan (RAP) and Site Management Plan (SMP) were prepared by Lysaght (*Remedial Action Plan and Contaminated Site Management Plan for 336, 340 and 344 Omokoroa Road, Omokoroa, ref: 163252, dated 12 August 2016*) for the excavation and offsite disposal of the contaminated material identified by the DSI and management of the above identified contaminated material onsite.

The following reports have been undertaken on this project:

- Lysaght. Detailed Contaminated Site Investigation – for 336, 340 and 344 Omokoroa Road, Omokoroa, ref: 163252, dated 9 August 2016; and
- Lysaght. Remedial Action Plan and Contaminated Site Management Plan for 336, 340 and 344 Omokoroa Road, Omokoroa, ref: 163252, dated 12 August 2016.

## 2.2.2 Asbestos reporting

Works undertaken by Aurecon are restricted to within the area identified on the drawing 255791-0000-DRG-KF-001, Appendix A. These works are related to the investigation, management, encapsulation, and validation of ACM within this area as discussed in Section 2.1.

The following reports have been undertaken on this project:

- Classic Preliminary Report on Asbestos Contamination at Kaimai Views. Internal report;
- Aurecon, Classic Developments – Kaimai Views Subdivision Development, Omokoroa, Remediation Options Appraisal and Remedial Action Plan, Rev.1, Ref: 255791-0000-REP-NN-0002 [1] RAP, dated 26 September 2017;
- Aurecon, Classic Developments – Kaimai Views Subdivision Development, Omokoroa, Contaminated Site Management Plan, Rev.3, Ref: 255791-0000-REP-NN-0001 [3] CSMP, dated 26 September 2017; and
- Aurecon, Classic Developments – Kaimai Views Subdivision Development, Omokoroa, Site Validation Report, Rev.0, Ref: 255791-0000-REP-NN-0004 [0], dated 18 July 2018.

The remediation of the wider site has been undertaken by Lysaght independently of Aurecon, and does not relate to asbestos, or asbestos contaminated areas. The above reports only relate to the areas of asbestos contamination identified within.

## 2.3 Summary of contamination

This OMMP applies to the containment cell, as shown on Drawing 255791-0000-REP-NN-0002. Details of Aurecon's investigation and validation of asbestos contaminated material surrounding the cell is detailed within Aurecon's Site Validation Report, ref: 255791-0000-REP-NN-0004.

The containment cell landform drops from north-east to south-west above a stormwater pond at a gradient of 1V:3H. To contain the volume of material a benched cut into the underlying natural ashes within the current landform was undertaken, forming two benches of 2.5 m height. The encapsulated material is overlain by geotextile, itself overlain by a designed 1 m of clean capping, which is not yet complete. As built surveys of the cell are contained within Appendix A.

## 3 Site Administration

### 3.1 Introduction

This section presents controls specific to contamination issues which may be encountered during future works at the site. When site earthworks cannot be avoided but are managed carefully the risk of exposing site workers and the public to contaminated soils can be reduced. It is assumed site controls implemented by the owner will be aligned with applicable statutory requirements and duty of care associated with engagement of a competent, experienced Contractor.

### 3.2 Ongoing monitoring (where no physical works proposed)

The capping material, once fully established, provides a physical barrier between contaminated soils and users of the site, proposed to be vested as public reserve. While the capping layer remains intact a completed 'source-pathway-receptor' exposure scenario does not exist.

Disruption of the capping layer by future earthworks or other means, negates the ability of the capping to contain material and an exposure scenario to asbestos fibres may exist. The purpose of the OMMP is to ensure ongoing competency of the clean capping layer during any future works proposed within the site.

Where physical disturbance works are not proposed we recommend inspections of the capping should be undertaken at least annually and following extreme weather events (rainfall in exceedance of 1 in 100-year events, drought) and other natural phenomenon (such as noticeable earthquakes). We recommend topographic survey of the cell surface at 5 years intervals to monitor for movement or instability against the established baseline.

### 3.3 Earthworks planning

Earthworks and excavations should be avoided within the area of the containment cell as shown on the drawing 255791-0000-DRG-GG-002 (Appendix A), where possible. Any shallow excavations, landscaping or construction activities shall be completed in such a manner as to not cause reduction of cap thickness, disturbance of the marker layer, permanent disruption of capping or increase in the likelihood of erosion and scour. Any proposals to design or construct permanent structures shall be reviewed by a SQEP during the design process.

Contractors undertaking any works within the area must be given a copy of this plan before commencing works. Earthworks within the vicinity may also affect the geotechnical stability of the cell and should not be undertaken without a full review of CMW reports TGA2016\_0258AK, and TGA2016\_0258AQ, included in Appendix B.

If remedial works are required to ensure the ongoing stability of the cell or to maintain the thickness of capping material, a suitably qualified and experienced practitioner (SQEP) should be engaged to advise on appropriate methodologies, and if a Worksafe-accredited asbestos specialist be engaged to plan and manage physical works on site.

Asbestos should be handled and managed in accordance with WorkSafe Approved Code of Practice for Management and Removal of Asbestos (November 2016), Health and Safety at Work (Asbestos) Regulations 2016, and BRANZ New Zealand Guidelines for Assessing and Managing Asbestos in Soil (2017).

### 3.4 Roles and Contact Information

This section summarises recommended roles that should be defined for the management of risks associated with any future works (Table 1). Further detail regarding these roles and their responsibilities are included in Appendix C.

All employees engaged in site works and under the direct control of the Contractor shall comply with the requirements of this plan, any project Environmental Management Plan and associated Health and Safety documentation and/or work plans.

**Table 1 Project Roles and Contact Information**

Role	Organisation and Name	Email	Phone
The Owner	Western Bay of Plenty District Council		0800 926 732
Principal Consultant	TBD		
Environmental Consultant (SQEP)	TBD		
TCC Category 1 Geoprofessional	TBD		
Principal Contractor	TBD		
Site Manager	TBD		
Earthworks Contractor	TBD		
Any specialist environmental or remedial contractors (if required)	TBD		
<b>Regulatory Authorities</b>			
Western Bay of Plenty District Council Compliance Officer		TBC	TBC
Bay of Plenty Regional Council – Compliance Officer		TBC	TBC
Senior Regulatory Project Officer – Contaminated Land and Waste		Emma Joss	027 200 7233
Bay of Plenty Regional Council Pollution Response Hotline		-	0800 884 883
WorkSafe NZ		info@worksafe.govt.nz	0800 030 040

### 3.5 Documentation

The owner shall maintain records of works occurring within the area of the containment cell, as well as records of inspections undertaken of the cell both prior to and following completion of works activities. This includes evidence that this document has been made available to those undertaking inspections or works within the area. A photographic record of inspections should be maintained and appended to this plan. This plan should be reviewed bi-annually to ensure it is relevant to current legislation. Any as-built drawings and figures should be updated to reflect any changes to landform or design.

## 3.6 Unexpected Contamination Discovery Protocol

The top of the contaminated material is demarcated by white geotextile fabric. Should this be encountered during excavations, or becomes visible by other means, works must immediately stop and a SQEP be engaged to advise on progression.

If contaminated or potentially contaminated materials, not identified by investigations conducted to date, are discovered during any future works, work must be stopped in the affected area. Contamination discoveries also include the presence of discoloured surface water (including sheens or slicks), unusual odours, gas bubbles in pooled surface water, oily substances, or fibrous materials such as fibre cement which may contain asbestos.

If newly discovered contaminated material is encountered, it must remain in situ until a SQEP has had the opportunity to assess and test the material. The excavation of the material prior to characterisation poses a risk of discharges, therefore it will need to be left as is and isolated / cordoned off until a SQEP can assess it further.

The Site Manager will consult with the SQEP to evaluate the material and determine the appropriate disposition and course of action. If asbestos is encountered, it should be handled and managed in accordance with *WorkSafe Approved Code of Practice for Management and Removal of Asbestos (November 2016)*, *Health and Safety at Work (Asbestos) Regulations 2016*, and *BRANZ New Zealand Guidelines for Assessing and Managing Asbestos in Soil (2017)*.

## 3.7 Complaints

A complaint log will be established for any works occurring within the area of the cell and will include the date/time the complaint was received, source and nature of the complaint, weather conditions, and resolution. The complaint log shall be maintained for the duration of the works.

## 4 Health and Safety Measures

This section presents health and safety considerations specific to contamination issues which may be encountered during any future planned earthworks at the site. It is assumed all other earthworks site health and safety measures implemented by the Contractor will be aligned with applicable statutory requirements and duty of care associated with engagement of a competent, experienced Contractor.

Excavations into the cell should be avoided, however the following measures will apply for unexpected contamination discovery (also refer to Section 3.5), and events whereby contamination is uncovered (e.g. natural disaster).

### 4.1 Inputs to Wider Site Management

As required by health and safety legislation, a comprehensive Health and Safety Plan will be developed by the Contractor prior to commencement of any works on the site and all contractors review this prior to starting.

All personnel must be inducted in terms of health and safety requirements (including hazards), and each person is then required to confirm that they have understood these requirements. The Health and Safety Plan and inductions should discuss actions that need to be taken for handling potentially contaminated soil as described in this plan. Access to contaminated areas shall be restricted to authorised personnel, and personnel shall be authorised following completion of appropriate site induction procedures.

Further information about general site contamination and management is provided in Aurecon's CSMP (ref: 255791-0000-REP-NN-0001 [3] CSMP) contained within Appendix B. The CSMP does not preclude the contractor's own responsibility for generating works-specific health and safety documentation and appointment of asbestos specialists, as required.

### 4.2 Personal Protective Equipment

During site induction, potential hazards associated with exposure to contaminants of potential concern (COPC) will be communicated to all site workers. Where site workers may be directly exposed to soils below cell capping, the following additional personal protective equipment (PPE) maybe required, and confirmed by an asbestos specialist as part of their specific method statements and safety plans:

- Chemical-resistant nitrile gloves;
- Eye protection;
- Disposable Type5/6 coveralls;
- Lace-free safety boots; and
- Half mask respirator with appropriate filter cartridges.

On-site decontamination (hand wash) facilities will be provided by the Contractor. Workers will be advised to wash hands frequently, particularly when leaving site or consuming food.

### 4.3 Public Exclusion

In addition to signage and fencing around the exclusion zone required by the Site Manager's health and safety plans and site protocols, the following exclusion methods will be required:

- In areas where asbestos is identified, fencing around the exclusion zone should be put in place in accordance with the BRANZ guidelines (e.g. fencing surrounded by a warning tape facing outwards indicating asbestos is present on site, warning signage, i.e. 'Danger - Asbestos Removal' required at any site access points); and

- Sediment and water runoff originating from the excavation must be captured and collected for testing within the exclusion zone, prior to disposal. At no point will the public be exposed to stormwater and/or contaminated material prior to disposal.

## 4.4 Asbestos in Soil

For soil disturbance and removal from beneath the capping of the cell, works will need to be completed in accordance with *WorkSafe Approved Code of Practice for Management and Removal of Asbestos (November 2016)*, *Health and Safety at Work (Asbestos) Regulations 2016*, and *BRANZ New Zealand Guidelines for Assessing and Managing Asbestos in Soil (2017)*. A SQEP and a Worksafe-accredited asbestos specialist must be engaged as mitigation controls are required when working with asbestos in soils, as well as air quality monitoring, the scope of which shall be determined by the asbestos specialist.

**Table 2** below is extracted from the BRANZ guidance and indicates the mitigation and control requirements for working with asbestos, which may need to be implemented in addition to those required by the Site Manager's health and safety plans and protocols. The licensed asbestos removalist will perform the appropriate controls and develop and implement an Asbestos Management Plan.

**Table 2 Primary Mitigation Control Requirements for Work Involving Asbestos (Source: BRANZ, 2017)**

Scenario	PPE	Respiratory protective equipment (RPE)	Dust/asbestos fibre suppression	Decontamination Facilities
Class A: Friable	Disposable coveralls rated type 5, category 3, nitrile gloves, steel toe capped gumboots or safety footwear with disposable overshoes.	Full-face P3 respirator with particulate filter. Consider increasing to power-assisted if required.	Water and asbestos-encapsulating polymer emulsion product applied before starting work and during as required.	Basic disposable wet decontamination tent or trailer. Consider powered and plumbed decontamination unit if project scale warrants.
Class B: Non-friable		Half-face P3 respirator with particulate filter. Consider increasing to full-face if friable ACM present.	Consider adding a surfactant to water for amphibole fibres (brown and blue).	Basic disposable decontamination tent and foot wash.
Asbestos related work		Disposable P2 dust mask.	Water via localised points. Addition of surfactants and polymers where the location is sensitive	
Unlicensed asbestos work	No asbestos-specific PPE if air monitoring confirms asbestos below 0.01 f/ml.		(such as adjacent to busy centres, schools). Temporary cover of contaminated area awaiting remediation.	Foot wash and used PPE collection area.

# 5 Environmental Management Procedures

## 5.1 General

This section presents environmental management considerations specific to contamination issues which may be encountered during future earthworks at the site. It is assumed all other earthworks environmental management procedures implemented by the Contractor will be aligned with applicable statutory requirements and duty of care associated with engagement of a competent, experienced Contractor.

The contractor shall ensure that the works are carried out in such a manner to minimise any adverse effects on the environment and the normal operation of the business and life of others. The contractor shall ensure that all materials and equipment removed from the site are either, stored; or disposed of legally and responsibly.

Measures required to protect the environment during activities on the site that disturb contaminated soils or groundwater shall be completed in accordance with Bay of Plenty Regional Council's *Environment Bay of Plenty Erosion and Sediment Control Guidelines for Land Disturbing Activities (2010)*.

## 5.2 Erosion and Sediment Controls

The cell shall be planted utilising species with a shallow root zone, to avoid roots penetrating the capping of the containment cell and uplifting contaminated material to the surface. Planting should be selected to stabilise the surface and prevent erosion and scour.

Burrowing animals may present a risk to the ongoing stability and thickness of capping material. Measures should be emplaced to prevent burrowing animals if evidence of burrowing is noted during inspections.

Pathways and areas of hardstanding established within the area of the containment cell should be constructed with consideration as to runoff creation and scour effects of surface water, with drainage installed where necessary.

If soil stockpiles are to be created on the cell, there will be designated stockpile areas established prior to generation of waste soil (refer to Section 5.4). Stockpiled soil will be managed to control excavation of underlying soil, erosion of the wider cell and management of any surface water in and around the stockpile. Priority is to be given to protection of adjacent watercourses and stormwater drains.

An Erosion and Sediment Control Plan will be prepared by any Contractor undertaking works within the area of the cell and provided to WBOPDC which details the location(s) and nature of the erosion and sediment control device(s), having regard to the anticipated extent and quantity of earthworks. The site-specific plan is to be available on site at all times during earthworks and is to be reviewed and amended if required upon the commencement of, and during, the works.

Earthworked areas are to be stabilised as soon as is practical to minimise erosion potential on site. The primary mechanism for sediment spreading on the site is spillage during excavation and tracking by machinery. Any soils tracked beyond the site boundary should be cleaned up promptly and appropriately disposed taking into consideration the potential to contain asbestos contamination.

## 5.3 Excavation

Earthworks and excavations should be avoided within the area of the containment cell, with the exception of shallow installations e.g. instatement of paths, foundations for play equipment.

Shallow excavation works shall be undertaken in accordance with *Worksafe's Good Practice Guideline for Excavation Safety* (July 2016). Excavations shall be managed to limit ingress of surface run off to avoid the creation of additional contaminant migration pathways. The Contractor is to ensure that no liquid passes from the site except to an appropriate and approved receptor. The contractor shall ensure that effective erosion and sediment control measures are in place to maintain the quality of site runoff water to that of normal rainwater runoff.

## 5.4 Stockpiling

No soil stockpiles shall be placed over the cell, to avoid potential settlement. Small volumes of material may be acceptable subject to prior review and approval by a geotechnical engineer.

Should stockpiling be required outside of the area of containment, the following procedures will be implemented (additional information regarding excavation and stockpiles is included in Section 5.2):

- All soil shall be certified clean by the SQEP. Asbestos impacted soils shall be placed directly into trucks for removal off-site where possible. No temporary stockpiling (for periods greater than two hours) of asbestos impacted soils shall be allowed.
- During the future works any excavated soil stockpiles will be defined in the Erosion and Sediment Control Plan prepared by the Contractor and provided to Council;
- Heavy duty plastic, such as high-density polyethylene (HDPE), will be placed in a designated area prior to placing stockpiled material. Soil stockpiles will be kept clean and tidy, no more than 2 m in height and with a compacted stable slope. Stockpiles will not be placed within 20 m of surface water bodies and vehicular movement over stockpiled soil will not be allowed;
- Bunds or sediment fences will be constructed or installed around the edges of the stockpile management area to prevent stormwater run-off from carrying contaminated or potentially contaminated soil away from the stockpile management area;
- Where stockpiled material is odorous it should be covered with an impermeable material or other form of odour suppression (e.g. application of odour suppression compounds) to limit the release of odour or vapour off site;
- All measures shall be taken to ensure prompt removal from the site of any material that is known to be heavily impacted with petroleum hydrocarbons and particularly if material is odorous. Prompt disposal of impacted material from the site will minimize the potential for impacted sediments to enter watercourses/stormwater systems and/or further contamination of soils;
- Stockpiles are generally short term and tend to be carted off-site on the same day or the day following excavation. Where necessary (e.g. for long term stockpiles of lightly impacted or clean spoil), perimeter controls may be installed around the stockpile itself to prevent sediment transport from the stockpile area;
- Impacted material is to be disposed of in accordance with applicable legislation; and
- Imported fill required for backfilling excavations may be temporarily stockpiled in a designated, clean area on site. All imported fill is required to be free of contaminants.

## 5.5 Dust and Odour Management

Excavation, stockpiling and transport of soils may generate dust and/or release odours. If required, the effects of dust and odour on the surrounding environment must be minimised by the most appropriate of the following:

- Suspending or limiting excavation, stockpiling and transport of soils during periods of high wind;
- Using water on exposed soils to suppress dust / odour, while ensuring that any water run-off is appropriately controlled;
- Covering areas of exposed soil with sheeting / tarpaulins; and/or
- Ensuring trucks transporting material from the site are covered and that vehicles are adequately cleaned.

The works management plan will be prepared by the Contractor and provided to WBOPDC for the site which details the location(s) and nature of the dust and odour control device(s), having regard to the anticipated extent and quantity of earthworks.

Where the excavation, stockpiling and/or transport of materials contains asbestos, additional controls must be employed to as advised by a licensed asbestos removalist to ensure that no dust is generated.

## 5.6 Groundwater management

Assessment of groundwater has not been completed to date as part of previous investigations. It is recommended that advanced investigation by a SQEP is completed to assess the quality of the groundwater prior to site works commencing to provide a more detailed methodology of groundwater management, if required.

Should surface water pool on the containment cell, this water can be allowed to soak back to the cell naturally. Should volumes exceed the capacity to soak naturally and disposal is required, this will require specific design by a chartered engineer. WBOPDC should also seek advice from BOPRC.

A large green geometric shape, possibly a stylized letter 'A' or a decorative element, with a diagonal line running from the top left to the bottom right. The shape is filled with a solid green color. At the bottom left corner, there is a small yellow triangle pointing upwards and to the right. The overall shape is roughly a parallelogram with a diagonal cut.

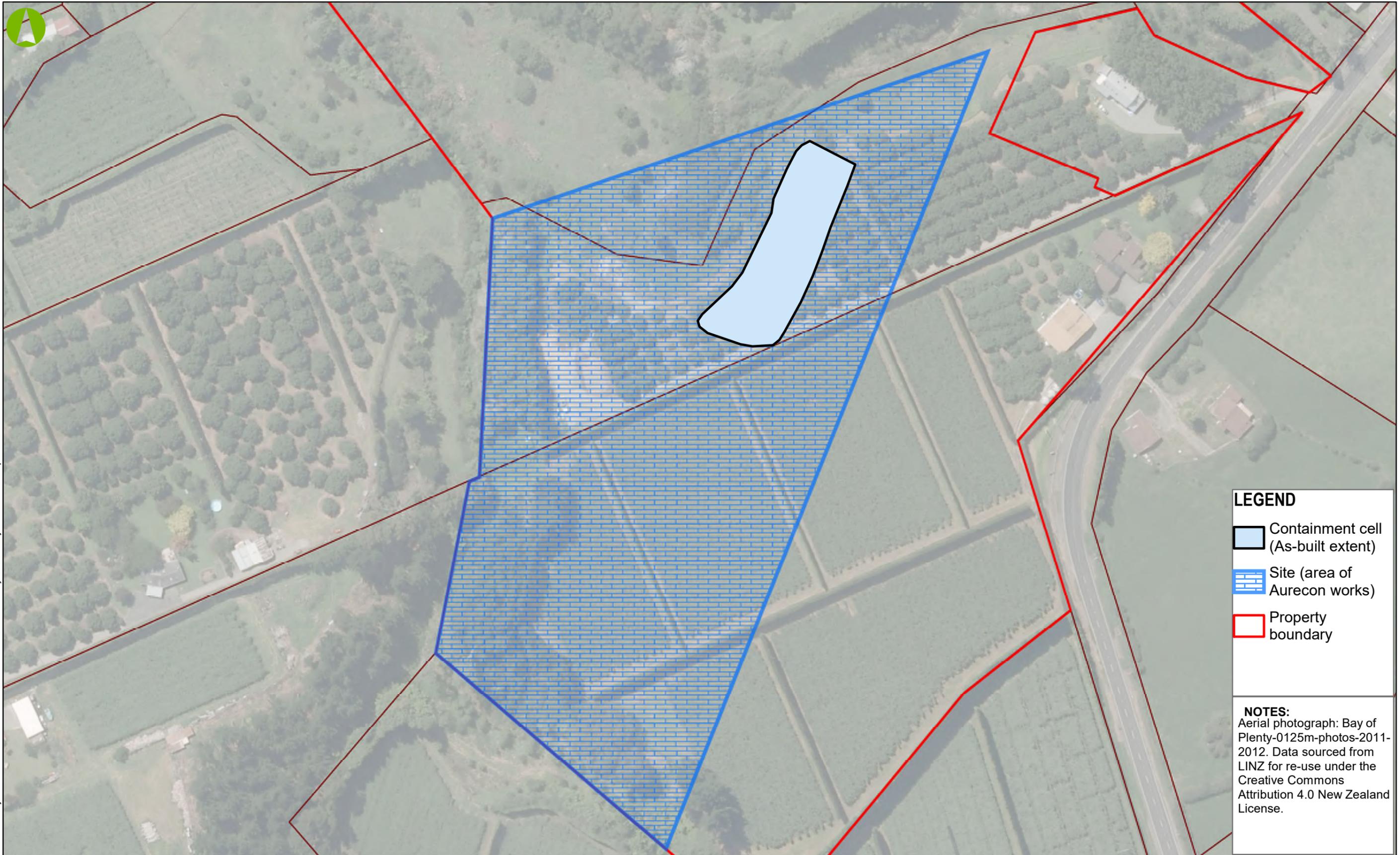
A

Report  
Drawings

# Appendix A

## Drawings

Coordinate System: NZGD 2000 Bay of Plenty Circuit  
 Path: P:\Projects\255791 - Classic Omokoroa Kaimai Views\Project Delivery\Geo\GIS\Ompmp Plan2.mxd Date: 7/09/2018



**LEGEND**

-  Containment cell (As-built extent)
-  Site (area of Aurecon works)
-  Property boundary

**NOTES:**  
 Aerial photograph: Bay of Plenty-0125m-photos-2011-2012. Data sourced from LINZ for re-use under the Creative Commons Attribution 4.0 New Zealand License.

**CLIENT**




REV	DATE	REVISION DETAILS	APPROVED
A	07.09.18	Client Issue	T.Deer

SCALE	SIZE
1:1500	A3
<b>DRAWN</b>	L. Beirne
<b>REVIEWED</b>	K. Altinkaynak
<b>VERIFIED</b>	R. Griffiths

NOT FOR CONSTRUCTION	PROJECT	Kaimai Views Ongoing Monitoring & Management Plan
APPROVED	TITLE	Site plan, 1:1500
T.Deer	DATE	07.09.18

<b>DRAWING No.</b>	<b>PROJECT No.</b>	<b>WBS</b>	<b>TYPE</b>	<b>DISC</b>	<b>NUMBER</b>	<b>REV</b>
255791	0000	DRG	GG	001	A	



**LEGEND**

-  Containment cell (As-built extent)
-  Site (area of Aurecon works)
-  Property Boundary

**NOTES:**  
 Aerial photograph: Bay of Plenty-0125m-photos-2011-2012. Data sourced from LINZ for re-use under the Creative Commons Attribution 4.0 New Zealand License.

Coordinate System: NZGD 2000 Bay of Plenty Circuit  
 Path: P:\Projects\255791 - Classic Omokoroa Kaimai Views\Project Delivery\Geo\GIS\Ommp Plan\_Zoom.mxd Date: 7/09/2018



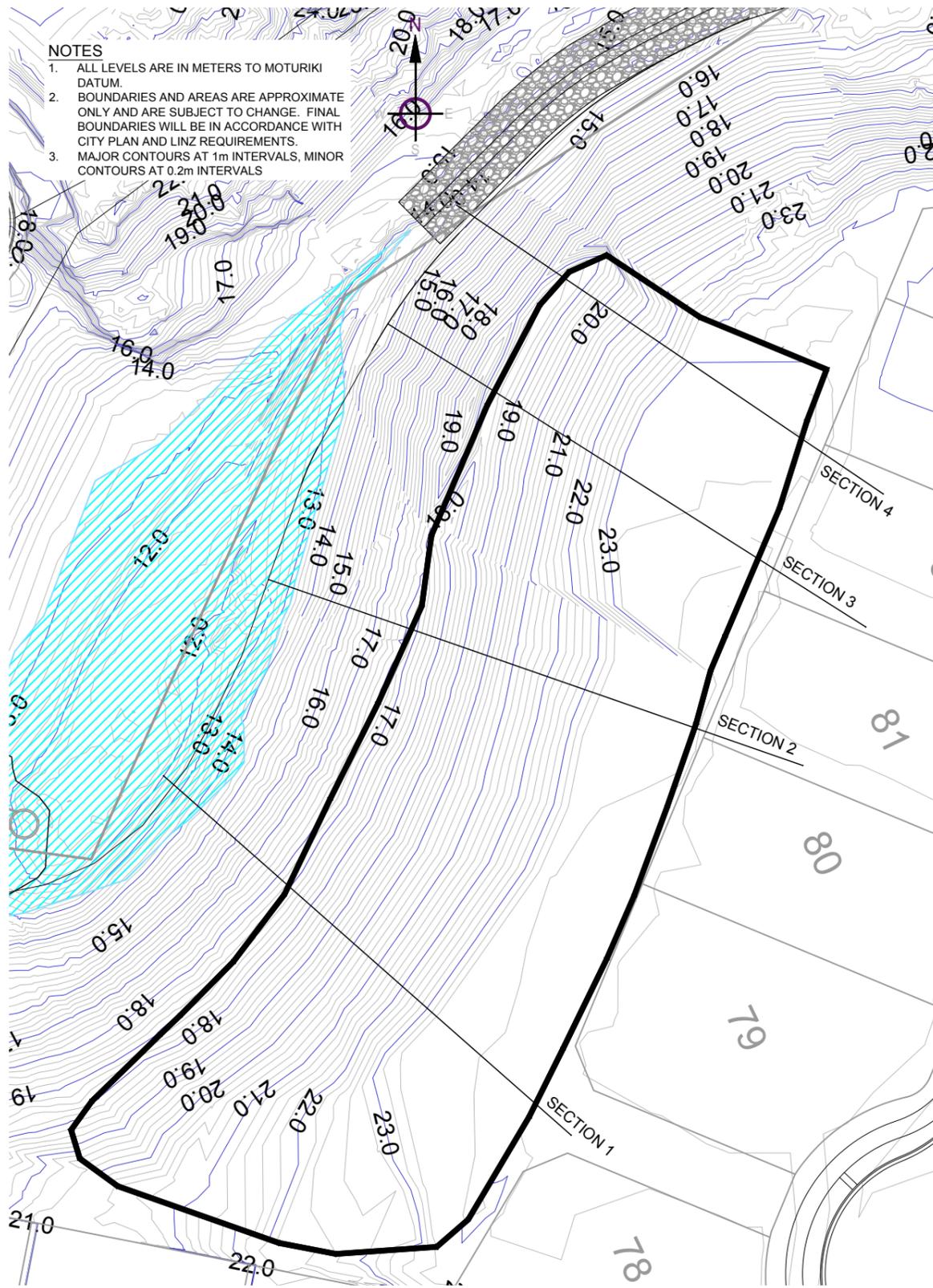
REV	DATE	REVISION DETAILS	APPROVED
A	07.09.18	Client Issue	T. Dee

SCALE	1:500
SIZE	A3
DRAWN	L. Beirne
REVIEWED	K. Altinkaynak
VERIFIED	R.Griffiths

NOT FOR CONSTRUCTION	
APPROVED	
T. Dee	
DATE	07.09.18

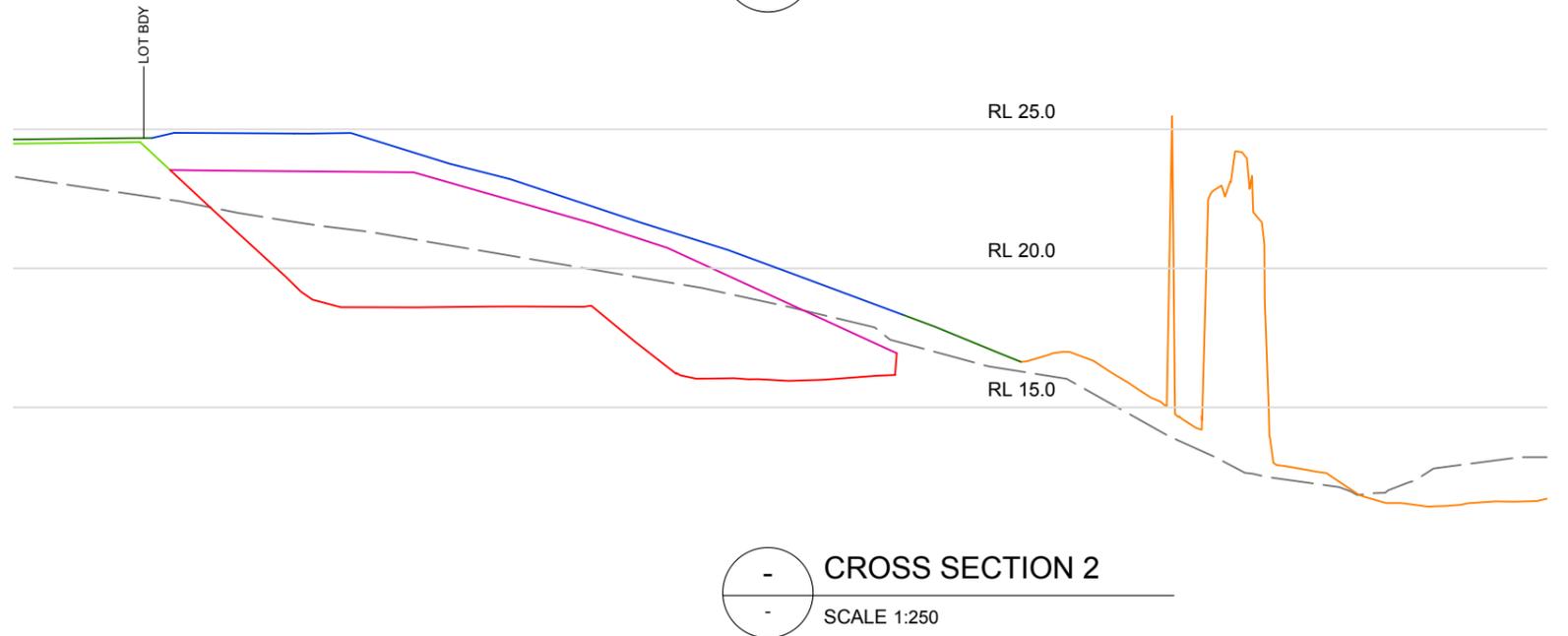
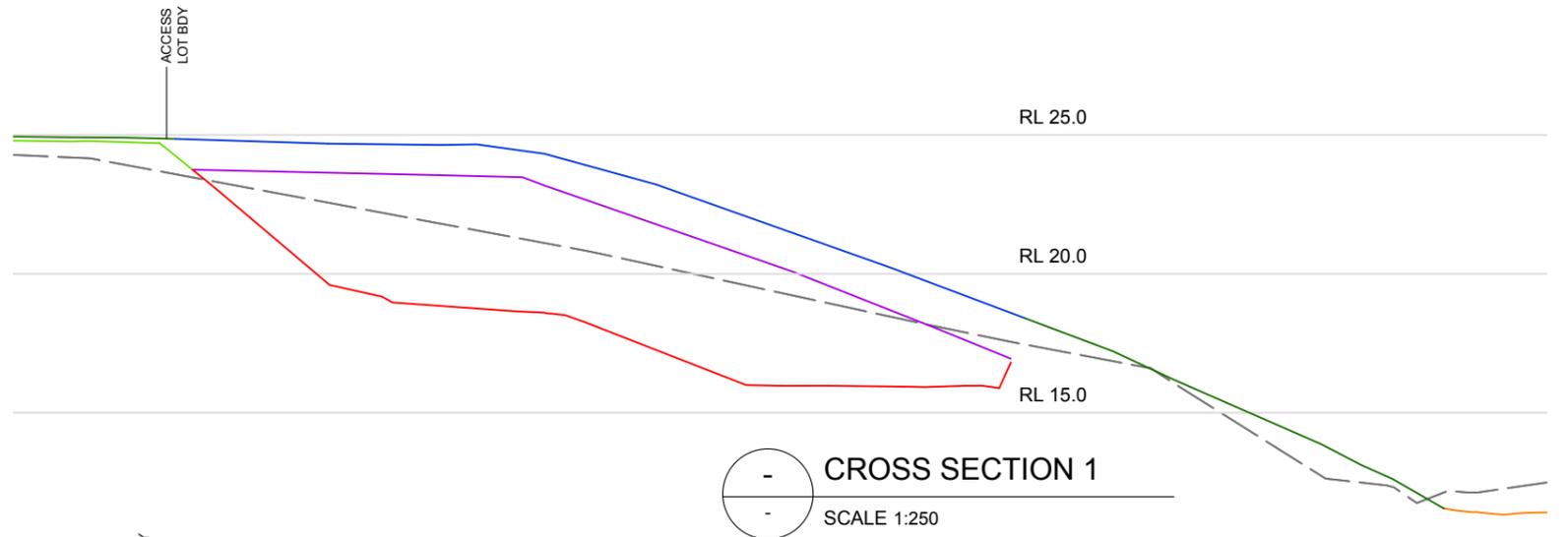
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TITLE	Site plan. 1:500					
DRAWING No.	PROJECT No.	WBS	TYPE	DISC	NUMBER	REV
	255791	0000	DRG	GG	002	A

- NOTES**
1. ALL LEVELS ARE IN METERS TO MOTURIKI DATUM.
  2. BOUNDARIES AND AREAS ARE APPROXIMATE ONLY AND ARE SUBJECT TO CHANGE. FINAL BOUNDARIES WILL BE IN ACCORDANCE WITH CITY PLAN AND LINZ REQUIREMENTS.
  3. MAJOR CONTOURS AT 1m INTERVALS, MINOR CONTOURS AT 0.2m INTERVALS



**LEGEND**

- EXISTING GROUND LEVEL
- BOTTOM OF ACM EXCAVATION
- FINISHED ACM
- FGL (CAPPING)
- FGL
- AS BUILT SUBGRADE
- DRONE 23.11.17



ASBUILT

Drawn	Signed	Date			
AV		04/07/18			
Designed	Signed	Date			
AV		04/07/18			
Verified	Signed	Date			
CJD		04/07/18			
Approved	Signed	Date			
CJD		04/07/18			
No.	Date	Revision Details	By	Ver.	App.
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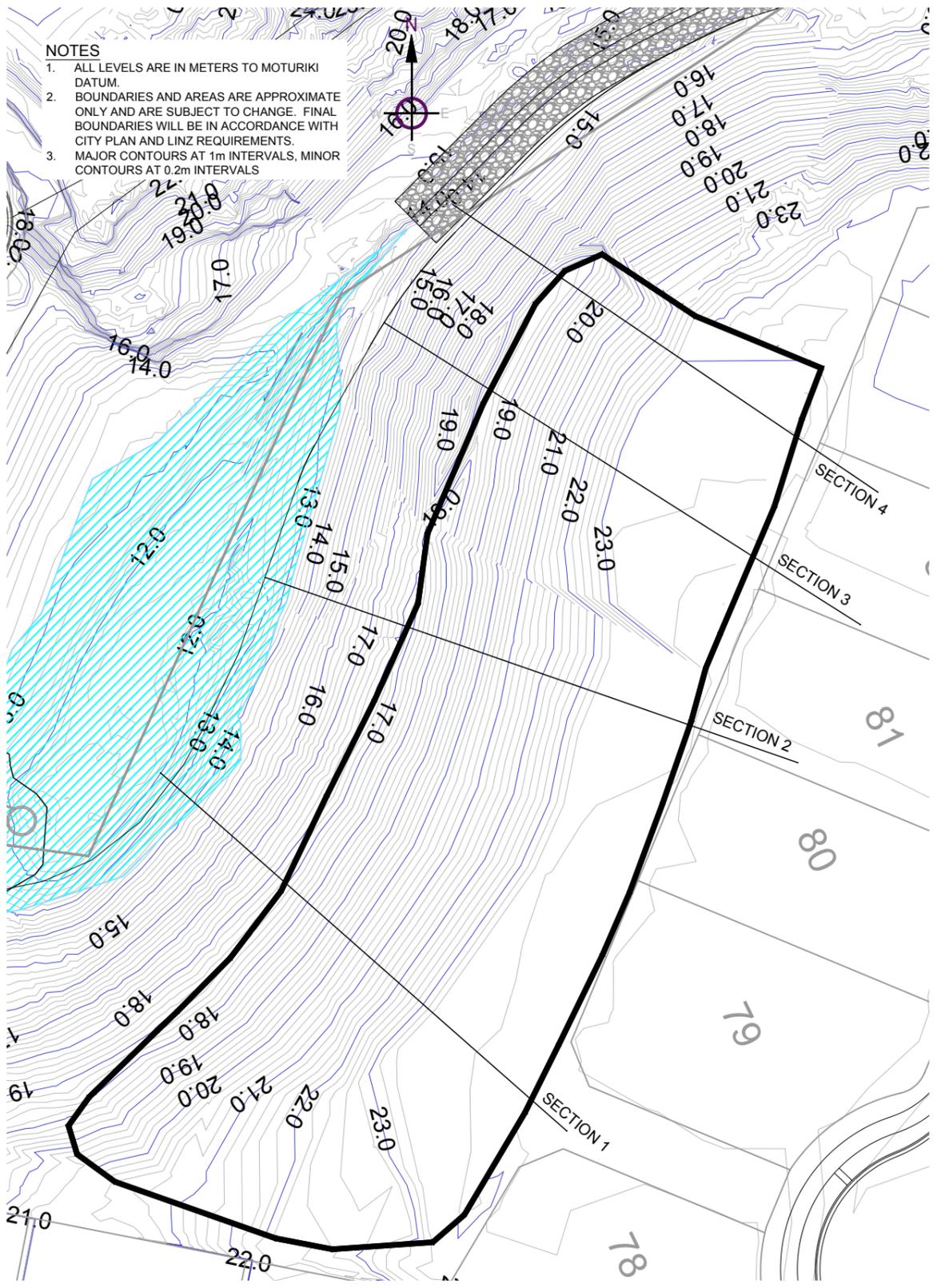
**SURVEYING, ENGINEERING & LAND DEVELOPMENT**  
19 Totara St, Mount Maunganui 3116 Ph 07 578 8798 www.lysaght.net.nz

Project:  
**CLASSIC DEVELOPMENTS  
 KAIMAI VIEWS  
 OMOKOROA SPECIAL HOUSING AREA  
 OMOKOROA**

Drawing Title:  
**ASBUILT  
 CONTAMINATED MATERIAL  
 FINISHED SUBGRADE  
 SHEET 1**

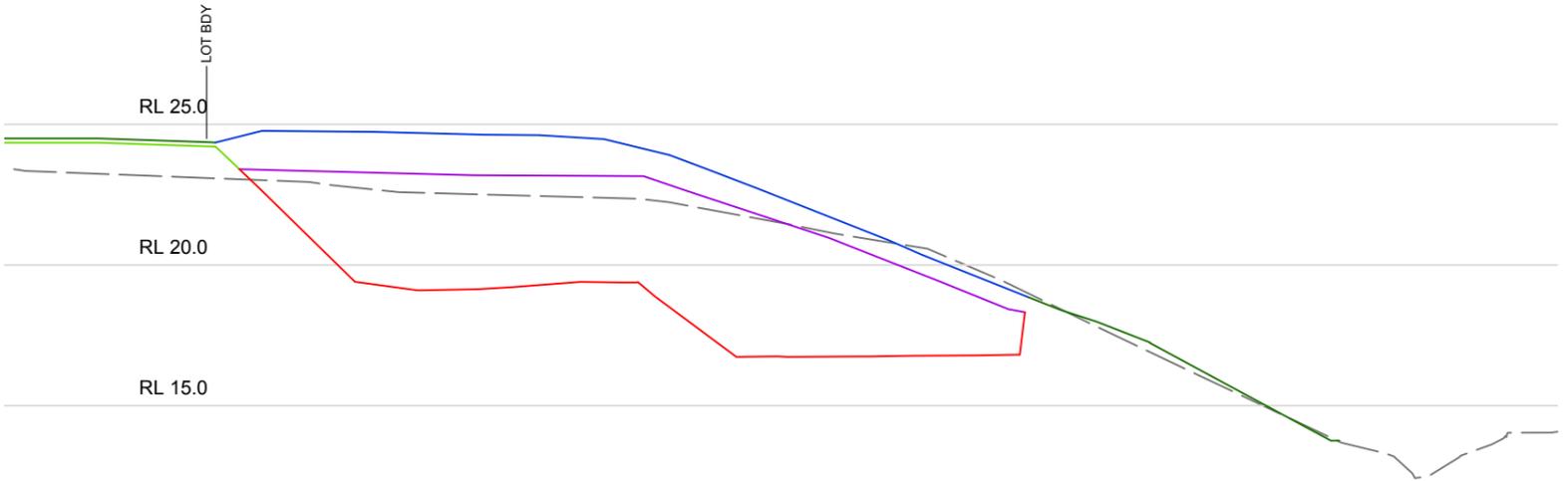
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Scale (A3)	AS SHOWN
Drawing No.	163252-AB-01
Rev.	1

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  2. BOUNDARIES AND AREAS ARE APPROXIMATE ONLY AND ARE SUBJECT TO CHANGE. FINAL BOUNDARIES WILL BE IN ACCORDANCE WITH CITY PLAN AND LINZ REQUIREMENTS.
  3. MAJOR CONTOURS AT 1m INTERVALS, MINOR CONTOURS AT 0.2m INTERVALS

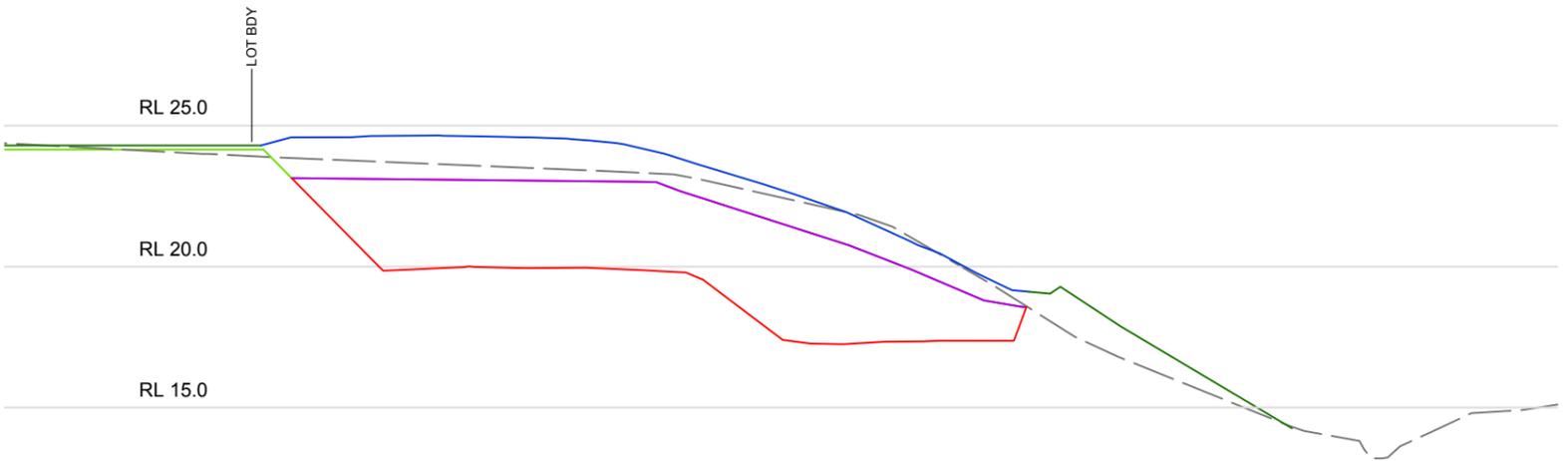


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- LEGEND**
- EXISTING GROUND LEVEL
  - BOTTOM OF ACM EXCAVATION
  - FINISHED ACM
  - FGL (CAPPING)
  - FGL
  - AS BUILT SUBGRADE
  - DRONE 23.11.17



CROSS SECTION 3  
SCALE 1:250



CROSS SECTION 4  
SCALE 1:250

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Designed	Signed	Date			
AV		04/07/18			
Verified	Signed	Date			
CJD		04/07/18			
Approved	Signed	Date			
CJD		04/07/18			
No.	Date	Revision Details	By	Ver.	App.
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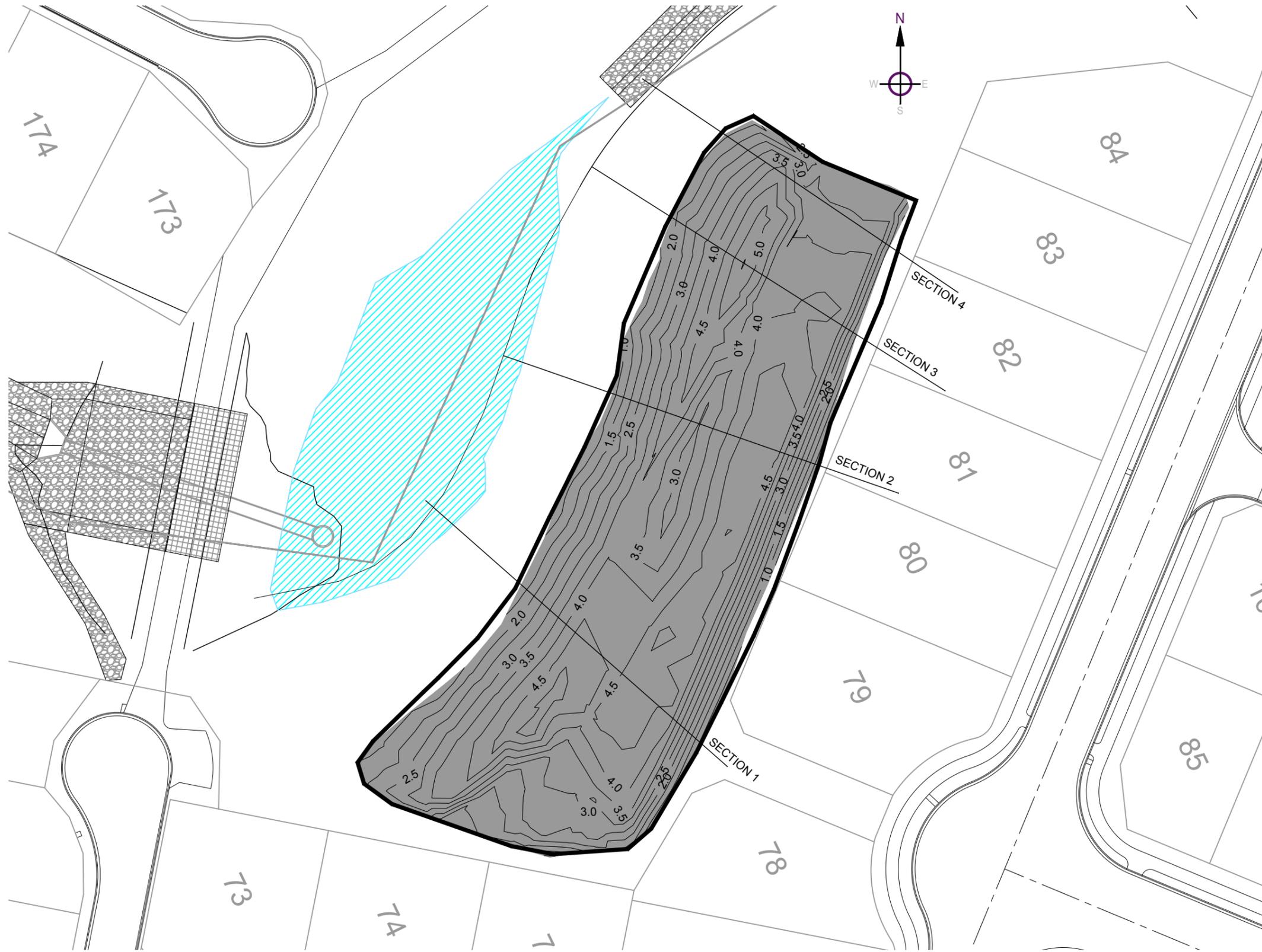
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Project:  
CLASSIC DEVELOPMENTS  
KAIMAI VIEWS  
OMOKOROA SPECIAL HOUSING AREA  
OMOKOROA

Drawing Title:  
ASBUILT  
CONTAMINATED MATERIAL  
FINISHED SUBGRADE  
SHEET 2

Project No.		ASBUILT
		163252
Scale (A3)		AS SHOWN
Drawing No.	Rev.	
163252-AB-02	1	



- NOTES**
1. ALL LEVELS ARE IN METERS TO MOTURIKI DATUM.
  2. BOUNDARIES AND AREAS ARE APPROXIMATE ONLY AND ARE SUBJECT TO CHANGE. FINAL BOUNDARIES WILL BE IN ACCORDANCE WITH CITY PLAN AND LINZ REQUIREMENTS.
  3. FILL CONTOURS AT 0.5m INTERVALS

SCALE 1:500

ASBUILT

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No.		Date		Revision Details									
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3. MAJOR CONTOURS AT 1m INTERVALS, MINOR CONTOURS AT 0.2m INTERVALS



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ASBUILT

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CJD		04/07/18

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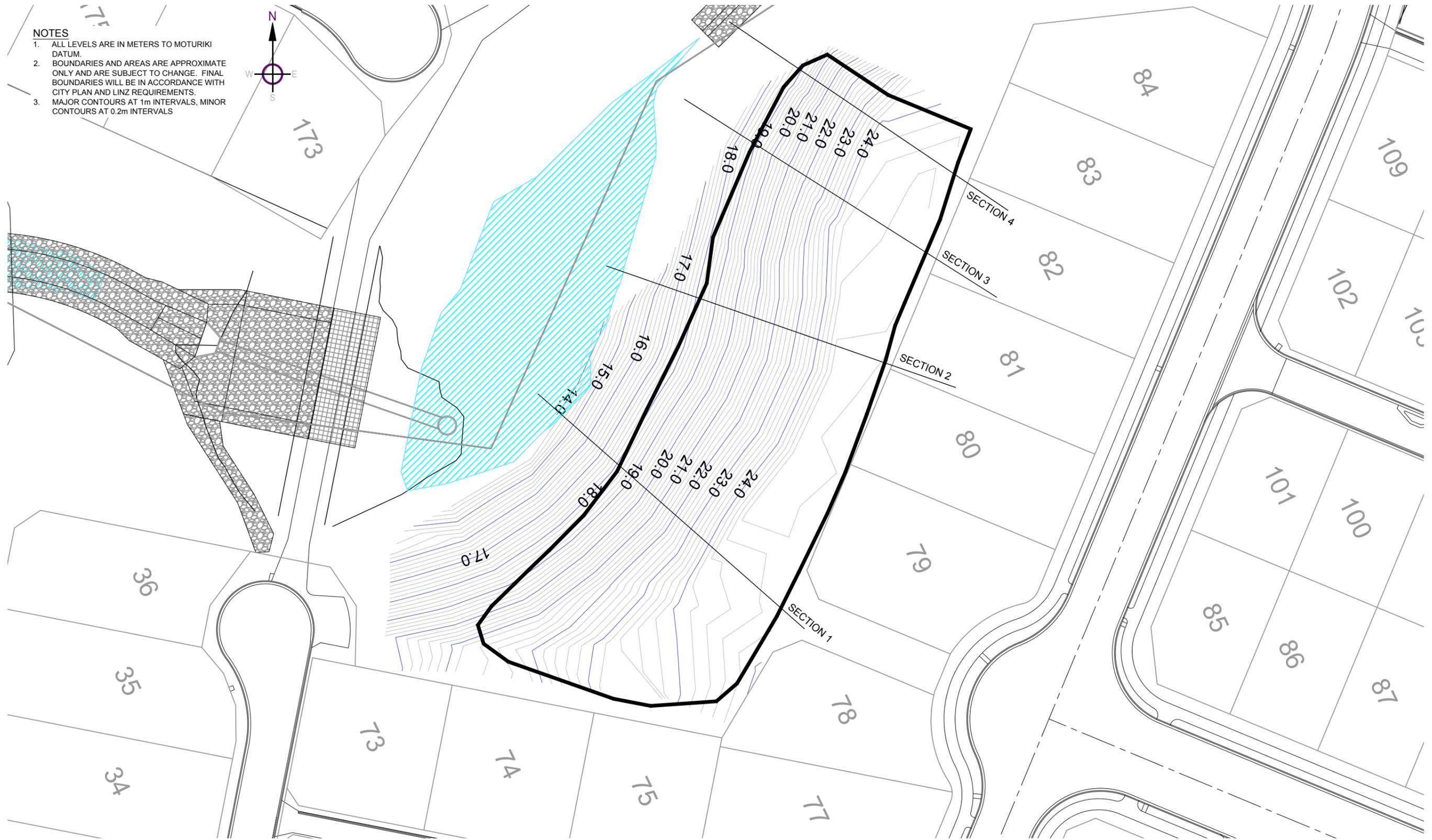
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19 Totara St, Mount Maunganui 3116 Ph 07 578 8798 www.lysaght.net.nz

Project:  
**CLASSIC DEVELOPMENTS**  
**KAIMAI VIEWS**  
**OMOKOROA SPECIAL HOUSING AREA**  
**OMOKOROA**

Drawing Title:  
**ASBUILT**  
**CONTAMINATED MATERIAL**  
**BASE OF ACM CONTOURS**

Project No.	163252
Scale (A3)	1:500
Drawing No.	163252-AB-010
Rev.	1

- NOTES**
1. ALL LEVELS ARE IN METERS TO MOTURIKI DATUM.
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No.	Date	Revision Details	By	Ver.	App.																			
1	04/07/18	AS BUILT	AV																					





**B**

Previous  
Reports

# Appendix B

## Previous Reports



**Kaimai Views Subdivision Development,  
Omokoroa**

Contaminated Site Management Plan

**Classic Developments Ltd.**

26 September 2017

Revision: 3

Reference: 255791

*Bringing ideas  
to life*

# Document control record

Document prepared by:

**Aurecon New Zealand Limited**  
 Ground Level 247 Cameron Road  
 Tauranga 3110  
 PO Box 2292  
 Tauranga 3140  
 New Zealand

**T** +64 7 578 6183  
**F** +64 7 578 6143  
**E** tauranga@aurecongroup.com  
**W** aurecongroup.com

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<b>Report title</b>		Contaminated Site Management Plan				
<b>Document ID</b>		255791-0000-REP-NN-0001-Rev3(CSMP).docx	<b>Project number</b>		255791	
<b>File path</b>		P:\Projects\255791 - Classic Omokoroa Kaimai Views\Project Delivery\Geo\Contamination\CSMP\Rev2\255791-0000-REP-NN-0001-Rev3(CSMP).docx				
<b>Client</b>		Classic Developments Ltd.				
<b>Client contact</b>		Kevin Hill / Bruce Cuff	<b>Client reference</b>		Kaimai Views	
<b>Rev</b>	<b>Date</b>	<b>Revision details/status</b>	<b>Author</b>	<b>Reviewer</b>	<b>Verifier (if required)</b>	<b>Approver</b>
0	24 March 2017	Draft issued for client comment and review	K Altinkaynak	R Griffiths CEnvP	R Griffiths CEnvP	
1	27 March 2017	Client issue	K Altinkaynak	R Griffiths CEnvP	R Griffiths CEnvP	A Collier
2	8 May 2017	Amended on advice of BOPRC	K Altinkaynak	R Griffiths CEnvP	R Griffiths CEnvP	A Collier
3	26 September 2017	Amended on request of BOPRC to include EMP	K Altinkaynak	L Beirne	R Griffiths CEnvP	A Collier
<b>Current revision</b>		<b>3</b>				

Approval			
<b>Author signature</b>		<b>Approver signature</b>	
			
<b>Name</b>		<b>Name</b>	
Dr Kim Altinkaynak		Aaron Collier	
<b>Title</b>		<b>Title</b>	
Environmental Geologist		Technical Director	



# Notes to contractor

**Asbestos or asbestos containing materials (ACM) has been confirmed on site** and is assumed to be present in areas of the site not demonstrated otherwise by testing or as specified within this report. As such all works on site related to ACM fall under the jurisdiction of the HSW Asbestos Regulations (2016). Works on site to disturb and encapsulate ACM must also be carried out in accordance with the conditions set out within; Western Bay Of Plenty District Council (WBOPDC) Consent RC10476L, Bay Of Plenty Regional Council (BOPRC) consent RM17-0365, and BOPRC consent RM16-0346. In general, the asbestos removal management controls will cover the following:

- Worksafe have a nominal notification period of one week before works involving asbestos can commence on site. BOPRC and WBOPDC also require notification one week before work can commence.
- **The Contractor coordinating or supervising the asbestos removal works shall be a qualified and Worksafe-recognised asbestos removals specialist, in this case ATL Group. ATL have provided their own Asbestos Removal Control Plan (ARCP) to comply with Worksafe requirements, included as appendix F.**
- **This specialist must be present on site at all times where works involving asbestos, or asbestos containing materials, are being undertaken.**
- **Any personnel handling the asbestos impacted soil or material must have the appropriate training and experience for handling asbestos materials** and of the required decontamination procedures. Only the licensed asbestos removal contractor will physically (by hand) remove fragments of asbestos containing materials from the ground surface.
- Personnel operating machinery involved in excavations, stockpiling and transferral of asbestos impacted soil must adhere to requirements within this plan and follow instructions from asbestos specialist and project manager.
- Access to asbestos removal area for inspections or similar by other work parties will only be allowed during 'tools down' periods under the direct supervision and control of the asbestos specialist.
- Access to any asbestos removal area will only be allowed by personnel at completion of asbestos removal by completion of excavation in the designated work areas. This access restriction will be lifted once the asbestos specialist has carried out a visual inspection and given clearance for the specific area that it is safe to do so. This clearance will require collection of soil samples by a Suitably Qualified Environmental Practitioner (SQEP)
- If no items of friable, other than fragments of ACM, has been encountered and air monitoring results all returning less than detectable readings, access to work area can be granted without the use of asbestos respiratory equipment given that no intrusive work will break the physical barrier. This shall be determined by the removals specialist.
- Decontamination and PPE disposal facilities must be provided and maintained by the asbestos contractor for all personnel working at the site.

# Site Contact Details

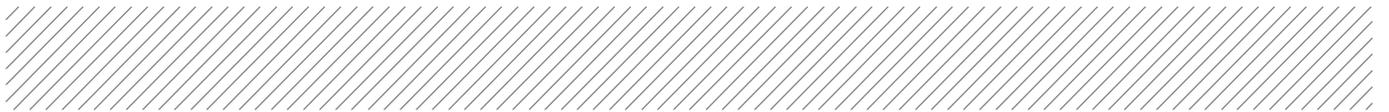
Table 1 Contact details for site personnel

Name	Organisation	Role	Contact phone number
Bruce Cuff	Classic Developments	Principal (Engineer to Contract)	021 190 0258
Brendon Maunder	JMC	Principal Contractor – Supervisor	027 214 9462
Tony Mather	JMC	Operations Manager	027 578 9461
Brian Ponton	JMC	Project Manager	027 577 8665
Aaron Kurth	JMC	Health and Safety	027 300 0686
Dave McFarlane	ATL	Asbestos Specialist - Class A Holder	022 658 1252
Richard Griffiths	Aurecon	Suitably Qualified Environmental Practitioner	021 244 1959
Luke Beirne	Aurecon	Environmental Geologist	021 526 031
Robert Taylor	CMW	Geotechnical Engineer	027 644 8881
Emma Joss	BOPRC	Regulator	0800 884 881
Blaise Williams	WBOPDC	Regulator	07 579 6610
Carlton Bidois	Ngati Ranginui Iwi Society Inc	Iwi Monitor	022 091 0557
Peter Holmes	CFG Heritage	Archaeologist	(09) 309 2426
	Worksafe	Health & Safety	0800 030 040



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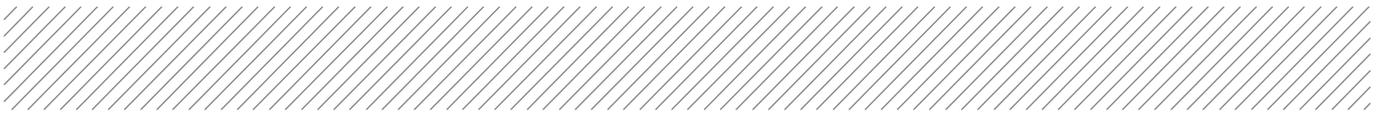
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# 1 Introduction

## 1.1 Project background

Aurecon New Zealand Ltd. (Aurecon) have been engaged by Classic Developments Ltd (Classic) to provide a Contaminated Site Management Plan (CSMP) to facilitate the safe management and encapsulation of asbestos containing materials at the Kaimai Views subdivision development site.

ACM was originally encountered during construction of a permanent stormwater pond below the main development landform. The ACM was identified within uncontrolled fill placed at the base of the gully in which the permanent pond is being constructed. The majority of the material excavated from the permanent pond area has been stockpiled at two locations, referred as Stockpile A and B (refer to Figure 1, plans in Appendix A and photos in Appendix B).

Following the discovery of ACM Aurecon were engaged by Classic to inspect the site and collect representative soil samples. This was undertaken on 14 March 2017. In addition to the aforementioned stockpiles, an additional area of in-situ fill exposed in the embankment behind a temporary stormwater pond was also found to contain ACM. As a result of previous heavy rainfall which caused in the failure of a slope near the temporary stormwater pond to collapse, some of this in-situ fill with suspected ACM fragments have fallen into the working area of the permanent pond.

Aurecon's Senior Environmental Geologist identified visible ACM fragments throughout Stockpile A, construction waste but no obvious ACM in Stockpile B and ACM fragments in fill that partially collapsed into the pond.

Figure 1: Panorama of works from Stockpile A (Aurecon, 14 March 2017)



The site needs to be made safe for construction workers and future site users. It was agreed as part of subsequent meetings with both councils that in the short term, as the pond construction is critical to the wider Omokoroa area, the impacted ACM on site would need to be made safe as a first stage of works while the issue of long term management of disposal options was resolved.



Revision 0, 1 and 2 of this CSMP was prepared in accordance with the Ministry for Environment (MfE) Contaminated Land Management Guidelines<sup>1</sup> in order to support required remedial earthworks of ACM from around the stormwater ponds and stockpiles, and to allow for the timely construction of the permanent stormwater pond while a final remediation options was chosen, designed and consented.

This current version of the CSMP (Revision 3) is to support management of earthworks through the construction of an encapsulation cell proposed within an area of public reserve outside of proposed residential areas. The specific remediation and management methodology for the construction of the cell is provided within Aurecon's Remediation Action Plan (255791-0000-NN-0002\_REV 1 (RAP) ISSUE, 26 September 2017) for asbestos at the Kaimai Views subdivision site.

The CSMP must be read in conjunction with the RAP, copies of which must be held on site for the duration of works. The CSMP (Revision 3) has been prepared to meet Condition 10 of the BOPRC resource consent RM 17-0365, requiring for an Environmental Management Plan (EMP) to be prepared for approval prior to commencement of works.

The CSMP is required by both the *National Environmental Standard for Assessing and Managing Contaminants in Soils to Protect Human Health Regulations (2012)* and the *Bay of Plenty Regional Water and Land Plan* to document the minimum procedures and standards to be followed in order to manage and/or remove the risks posed by contamination identified during site earthworks. Through implementation of this plan, the risk posed to site users (principally construction workers during redevelopment) and the surrounding environment (including human receptors) can be substantially reduced to an acceptable standard. This CSMP does not cover the active demolition or removal of building structures, external building materials, or other site features unrelated to soil and groundwater. This CSMP has been prepared to cover Stage 1 of remediation only.

## 1.2 Proposed site development

The site is to be developed into Omokoroa's Special Housing Area, a staged development whereby 50 percent of the dwellings are to be below the average median house price in the Western Bay of Plenty. The first stage comprises of 31 lots and the remaining stages to include approximately 240 dwellings in total.

An asbestos containment cell is to be constructed in part of site to be vested into reserve. This cell is designed to encapsulated and isolate asbestos contaminated soils from human and environmental contact. The cell is to be approximately 150 m long, and 50 m wide formed of two benches of approximately 2.5 m in height, cut into the side of an embankment. The design of this cell is included within CMW Geotechnical report for fill containment embankment TGA2016\_0258AK Rev0.

## 1.3 Approach

A staged approach was agreed upon with all parties involved in which Stage 1 will involve the excavation of contaminated material from the permanent pond, Stockpile A and downslope of Stockpile A, to be temporarily stockpiled elsewhere onsite. The stockpile and excavated slopes will be temporarily made safe to allow construction of the stormwater pond to continue. This CSMP is a requirement by BOPRC to manage and/or remove the risks posed by contamination identified for remediation works.

Due to the volume of material to be excavated an encapsulation cell has been designed for containment of contaminated material on-site.

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<sup>1</sup> CLMG No. 1 Reporting on Contaminated Sites in New Zealand (Revised October 2011 & draft 2016 editions)

## 1.4 Previous reporting

A Detailed Site Investigation (DSI) was undertaken by Lysaght Consultants Ltd. (Lysaght) to assess the potential for contamination to be present onsite (*Detailed Contaminated Site Investigation – for 336, 340 and 344 Omokoroa Road, Omokoroa, ref: 163252, dated 9 August 2016*).

The investigation identified arsenic and Total Petroleum Hydrocarbon (TPH) contaminant concentrations above the adopted human health guideline criteria, whereby an area of approximately 16 m<sup>3</sup> across a number of hotspot areas would require remediation prior to earthworks.

A Remediation Action Plan (RAP) and Site Management Plan (SMP) were prepared by Lysaght (*Remedial Action Plan and Contaminated Site Management Plan for 336, 340 and 344 Omokoroa Road, Omokoroa, ref: 163252, dated 12 August 2016*) for the excavation and offsite disposal of the contaminated material identified by the DSI and management of contaminated material onsite.

The following reports have been undertaken on this project:

- Lysaght. Detailed Contaminated Site Investigation – for 336, 340 and 344 Omokoroa Road, Omokoroa, ref: 163252, dated 9 August 2016
- Lysaght. Remedial Action Plan and Contaminated Site Management Plan for 336, 340 and 344 Omokoroa Road, Omokoroa, ref: 163252, dated 12 August 2016
- Classic Preliminary Report on Asbestos Contamination at Kaimai Views. Internal report.
- Aurecon. Kaimai Views Subdivision Development, Omokoroa. Remediation Options Appraisal and Remedial Action Plan. Ref 255791, Rev: 1, dated 26 September 2017.

The remediation of the wider site has been undertaken by Lysaght independently of Aurecon, and does not relate to asbestos, or asbestos contaminated areas. Aurecon's remediation options appraisal and remediation action plan, and this contaminated site management plan relate only to the areas of asbestos contamination identified within.

## 1.5 CSMP revision history

This CSMP should be considered a living document, and should remain active for as long as the project is advanced. If unforeseen conditions are encountered, the document should be re-evaluated and updated as required. The CSMP does not supersede any requirements established by the Client, or the Client's appointed subcontractors own management plans. Table 1 presents a summary of the CSMP revision history documenting changes and outcomes undertaken between issues:

Table 2 Summary of CSMP revision history

Revision	Date of issue	Purpose	Significant changes or alterations
0	24 March 2017	Draft issued for client comment and review	N/A
1	27 March 2017	Client issue	N/A
2	8 May 2017	Amended on advice of BOPRC	Addition of elements requested by BOPRC
3	26 September 2017	Revised to conform to the conditions of BOPRC RM17-0365 for construction of the encapsulation cell	Addition of elements requested by BOPRC through RM17-0365 to fulfil the requirements of an EMP. Inclusion of consent conditions as an appendix, addition of Section 7 (Cultural Management) and Section 8 (Complaints Procedures)



## 1.6 Relevant consented conditions

The works completed under the scope of this CSMP are consented (RM17-0365 and RM16-0346) by Bay of Plenty Regional Council (BOPRC) and (RC10476L) Western Bay of Plenty District Council (WBOPDC). A copy of the relevant consent conditions are presented in Appendix H. Pertinent conditions relevant to site operations under the scope of this document include:

- That all remediation works are to be supervised by a contractor who is suitably experienced in remediating contaminated land.
- That a suitably qualified asbestos removal contractor with a class a license shall be engaged to manage risks associated with asbestos and supervise all site activities where asbestos may be present in accordance with the Health and Safety at Work (Asbestos) Regulations 2016.
- The consent holder shall notify the Regional Council, in writing, no fewer than five working days before using this [RM17-0365] consent.
- There shall be no tracking of contaminated material off site or outside the remediation and disposal area.
- All erosion and sediment controls shall be installed prior to the commencement of the excavation and deposition of the contaminated soils.
- The consent holder shall adopt a proactive strategy for dust control.

## 2 Site setting

### 2.1 Site location and description

The site is located at 336, 340 and 344 Omokoroa Road, Omokoroa, approximately 16 km west of the Tauranga central business district. The site is legally described at PT Lot 1 DPS 65560, PT Lot 2 65560 and Lot 1 DPS 4524 and covers approximately 17 hectares (ha). The land is bounded in the North by the main rail link and includes an area adjacent to the Omokoroa sewerage pump station and Omokoroa Settlers Hall. The site currently zoned as 'commercial' and 'industrial' in accordance with the Western Bay of Plenty District Plan. A site location plan is presented in Appendix A.

At present the site, namely 344 Omokoroa Road, is being earthworked in preparation for lot development. For the full description of pre-development site conditions please refer to Lysaght's DSI report.

### 2.2 Geological and hydrological setting

#### 2.2.1 Geological setting

The mapped geology in the Tauranga basin is a Pleistocene, predominantly fluvial/estuarine basin (570 km<sup>2</sup>) which was partially infilled during a period of rapid subsidence after the eruption of the Waiteariki Ignimbrite (approximately 2 million years old). The infill in the basin is comprised of terrestrial and estuarine volcanoclastic sediments and non-welded or partially welded distal ignimbrites and airfall tephra. The site geology is presented on the Institute of Geological and Nuclear Sciences (IGNS) 1:250,000 scale map sheet 5 'Geology of the Rotorua Area'. The map indicates that the site is underlain by Pleistocene age deposits of the Matua Subgroup. The Matua Subgroup is described as '*pumice, crystal and ash rich sediments reworked from middle Quaternary ignimbrites in the northwest, and greywacke gravels in the east*'.

The Matua Subgroup is typically overlain by a thick mantle of Taupo Volcanic Zone tephra comprising (from youngest to oldest) the Younger Ash, Rotoehu Ash and Hamilton Ash beds. The Younger Ash deposits comprise inter-layered zones of silt ash interspersed with layers of pumice rich sandy silts. The Rotoehu Ash usually consists of a thin sand layer which overlies the Hamilton Ash deposits, which typically comprise older silt and clayey silt horizons. At the top of the Hamilton Ash there is often a distinctive palaeosol layer (old topsoil horizon) locally known as the 'Chocolate Layer'.

A review of the Bay of Plenty Regional Council soil mapping database indicates that the site is underlain by '*Katikati sandy loam*'. The sandy loam is described as an allophanic soil made up of thin rhyolitic tephra overlying weathered tephra and loess colluvial soil. The soil is well drained, and is noted to be moderately to strongly leached. Allophanic soils are dominated by allophane minerals which coat sand and silt grains, maintaining porosity and low density.

#### 2.2.2 Hydrogeological setting

An unnamed stream is located onsite, to the north of 340 Omokoroa Road and within 30 m north of works is currently being undertaken. The stream flows west into another unnamed stream which exits into the Tauranga Harbour approximately 2 km northeast of the site.

Wells No. 2027 and No. 100113 located onsite record standing water levels of 23.4 m and 24 m below ground level (bgl) respectively. The ground water level is therefore expected to be consistent with nearby stream levels and at depths of approximately 20-25 m bgl.

## 2.3 Summary of ground conditions, laboratory results and site contamination risk

### 2.3.1 Site contamination status

#### Detailed Site Investigation – Lysaght

Lysaght's DSI comprised a desktop study, site inspection and a staged soil sampling programme across the site. The preliminary risk review identified moderate to high risks, associated with pesticide bulk storage and use, to the health of current and future users due to the site's former history of agricultural and horticultural land use.

Laboratory analysis identified arsenic and TPH contaminant concentrations above the adopted human health guideline criteria. The arsenic contamination source is believed to be related to treated timber and the TPH due to a spillage of motor oil to site surfaces. Approximately 16 m<sup>3</sup> of material was identified in a number of hotspots requiring remediation prior to bulk earthworks. The potential for asbestos and/or undocumented fill was not identified during the DSI.

#### Preliminary report on asbestos contamination – Classic Developments

Possible ACM fragments were identified onsite on 08 March 2017 by Lysaght from within a stockpile of material which had been excavated from the permanent stormwater pond. Further suspected ACM fragments were identified in unworked areas of the site as well as some more minor evidence of general construction waste in a smaller stockpile. Samples of suspected ACM fragments taken by Lysaght were analysed by Hill Laboratories with the results confirming the presence of asbestos (Table 2, Appendix C).

Table 3 Results of laboratory testing

Sample ID	Date	Sample type	Asbestos presence / absence
AS801	11/03/2017	Fibre cement	Amosite (brown asbestos) and Chrysotile (white asbestos) detected
AS802	11/03/2017	Fibre cement	Amosite (brown asbestos) and Chrysotile (white asbestos) detected
AS803	11/03/2017	Fibre cement	Amosite (brown asbestos) and Chrysotile (white asbestos) detected

#### Contamination Assessment – Aurecon (14 March 2017)

Aurecon undertook an emergency inspection of the site when ACM was uncovered following a period of heavy rainfall. During heavy rainfall the wall of the temporary stormwater pond collapsed into a permanent stormwater pond exposing unidentified fill with ACM fragments. Aurecon's Senior Environmental Geologist identified visible ACM fragments throughout Stockpile A, construction waste but no obvious ACM in Stockpile B and ACM fragments in fill that partially collapsed into the pond following a site visit on 14 March 2017. As part of the inspection a total of five soil samples (A1 to A5) were collected from Stockpile A; four soil samples (B1 to B4) from Stockpile B and three soil samples (SP1 to SP3) collected from Area SP. An additional selection of tile fragments were collected from Area SP (SP-T) to confirm that waste construction debris comprised asbestos. Laboratory results confirm the presence of ACM in each of the stockpiles and in-situ area SP. ACM is present both as fibre cement, debris and loose fibres. A copy of the test results, prepared by Hill Laboratories, is presented in Appendix C. Photographs identifying the areas of concern are presented in Appendix B.

Undocumented and unidentified fill material consisting of various construction waste (concrete, bricks, fibrolite) has been pushed over the edge of the gully (and possibly buried) by the former land owner. It is unknown whether the former land owner has buried and/or filled in gullies in other parts of the development. Aurecon recommended that the former land owner be contacted and further ground



investigations be undertaken to de-risk other areas of the wider site. In addition, Aurecon has identified the possible transfer of ACM contaminated material from site plant to other parts of the site.

ACM in soil is a risk to health if fibres can become airborne as they may be inhaled, with the presence of ACM is considered to be above human health guidelines. Areas identified on the plan in Appendix A are considered to present significant risk and require specific management and/or remediation in advance of further earthworks onsite.

### 2.3.2 Risk discussion

A brief qualitative discussion of risks associated with asbestos contamination to ongoing development works is summarised as follows:

- The immediate risks associated with anticipated works to human health apply to site personnel involved in excavation works. These may result in relatively high exposure, albeit over a low duration period, however asbestos is typically recognised as a non-threshold carcinogen. Appropriate controls to manage asbestos risk will be required during earthworks to comply with Health and Safety at Work (Asbestos) Regulations 2016
- The long term risk to future site users (residents) would be significant if the ACM remained exposed in surface soils. In addition, commercial risks become significant as new lots become less appealing to prospective buyers where even trace amounts of fibres exist, and thus they become devalued. Remedial action is designed to eliminate these risks. Material presenting a human health risk will have its source-pathway-receptor linkage removed during remediation, and this would need to be validated following completion of works
- Adjacent site users will be exposed to both risks although to a lesser degree as the asbestos fibre will mix further with air before exposure. In that context it is unlikely that adjacent site users would be exposed to asbestos fibre in excess of the 0.1 respirable asbestos fibres per millilitre of air mandated by the Asbestos Regulations.

These risks can be best managed through implementation of a site specific management plan to mitigate exposure hazards from contaminated soil for the duration of earthworks that may be expected. Due to the presence of asbestos, excavation, handling, transport and disposal of soils must be supervised by a Class A specialist trained and qualified to handle asbestos containing materials.

## 2.4 Strategy for site management

As contaminated material has been identified in concentrations harmful to human health, the risk to current site users and site construction personnel is considered high within the area identified on the plan in Appendix A. **This area is also legislated by HSW (Asbestos) Regulations 2016 and work in this area will need to be supervised by a Class A holder until risk is deemed to have been removed.**

The primary remediation goal is to reduce to an acceptable level the risk posed by the presence of asbestos to future site users and construction and maintenance workers. Based on results obtained to date, this contamination is considered unacceptable for ongoing use. The remediation may be achieved in a practicable manner by physical removal of the affected soils, or isolation of the affected soils from potential users. Factors which influence the appropriate remediation option include the feasibility, extent of contamination, proven effectiveness, project timeframe, and future land use.

The risk material determined by our investigations comprises insitu or exsitu fill containing a mix of topsoil, ash and construction waste. These are easy to identify in stockpiles and where in situ, and our observations indicate that it directly overlies stiff orange brown natural ash soils.



Aurecon developed a Remediation Options Appraisal and Remediation Action Plan (RAP) to facilitate the management of asbestos-contaminated soils on the site. Based on the planned earthworks and subsequent development plans, the recommended remediation option is encapsulate of the material onsite within the area of proposed reserve. This removes unnecessary transport, and the costs and risks associated, and allows for a controlled, sustainable, long-term solution to be engineered. Further details of the encapsulation cell and recommended remediation methodology and sequence of operations are included in Aurecon's ROA/RAP document. The design and associated analysis of the encapsulation cell are provided in the report by CMW Geosciences (ref: TGA2016\_0258AK, dated 9 June 2017).

Prior to commencement of works the impacted area should be surveyed and a start-up meeting is recommended onsite to confirm methodology, roles and validation requirements. Where further information becomes available the methodology may be subject to alteration in discussion between the Suitably Qualified Environmental Practitioner (SQEP), principal contractor and remediation contractor (if required).

If during remedial works, further suspected ACM is observed within parts of the site where it has not yet been identified then the remedial works should cease immediately and the SQEP should review and assess the material in liaison with the remediation contractor.

## 3 Construction methodology

### 3.1 General

The asbestos containment cell is proposed to be constructed in stages, as detailed in the JMC methodology (Appendix G), in accordance with ATL's ARCP (Appendix F). The methodology is summarised below:

- Site establishment: Erection of further fencing, construction of haul roads, establishment of decontamination unit.
- Excavation of northern half of Stockpile A (SP-A): The northern half of SP-A is to be excavated and placed on top of the southern half. Stockpiles are to be kept covered when not being worked on.
- Material previously beneath the northern half of SP-A is to be validated before being cut in benches and the northern half of the containment cell constructed.
- ACM is to be placed into the northern half of the containment cell, with excess material from the southern half of SP-A stacked on top.
- Material previously beneath the southern half of SP-A is to be validated before being cut in benches and the southern half of the containment cell constructed.
- The southern half of the containment cell is to be filled with ACM, before the containment cell is sealed and covered, and the site validated.

### 3.2 Key project hold points

There are several key hold points throughout the duration of the remediation where works in an area may be held up for reasons detailed below.

- After the excavation of the northern half of SP-A Iwi or archaeological oversight will be required during topsoil stripping. Once this is complete, Aurecon will need to validate the removal of contamination from the surface before the clean material is excavated

- 
- After the excavation of the southern half of SP-A Iwi or archaeological oversight will be required during topsoil stripping. Once this is complete, Aurecon will need to validate the removal of contamination from the surface before the clean material is excavated
  - After each stockpile has been removed the area will need to be validated and the containment cell should not be sealed until all of the areas are confirmed clean.

## 4 Project roles and responsibilities

### 4.1 General

Appointed site contractors engaged directly by the Client shall be responsible for the implementation of this Plan in conjunction with the contractors' own health, safety and environmental management plans. The Client is the Principal for all works and for the purposes of the Health and Safety at Work act is the ultimate PCBU (Person Conducting Business or Undertaking). The Client is responsible for appointing the Principal Contractor and the Principal Consultant, where required. The Client may elect to appoint a project manager to represent their interests in addition to these parties.

The Contractor shall notify other parties (including subcontractors), who may be carrying out excavation works at the site, of the existence of the CSMP and shall provide an overview of its contents prior to works occurring. A summary of suggested roles and responsibilities is presented within this Section.

**All site staff undertaking work where asbestos may be present must have undergone asbestos awareness training. Where asbestos is determined to be present on site through the course of site disturbance, any contractor undertaking these works shall be licensed or certified by Worksafe as a competent to do so in line with the Health and Safety at Work (HSW) Asbestos Regulations 2016 or engage a specialist to provide advice and certified.**

### 4.2 Principal (Classic Developments)

This role may not be required on every project. The Principal is required to act on behalf of the Client to observe the works and provide reassurance that they are being carried out in accordance with the proposed design and that any variations to the design are documented and fit for purpose. The Principal is also responsible for advising on the need for and reasonableness of any changes to the contract of works. The Principal may recommend an Environmental Consultant to deliver specialist services related to contaminated land within this scope.

### 4.3 Principal Environmental Consultant / Suitably Qualified Environmental Practitioner (Aurecon)

The Principal Environmental Consultant / SQEP will be responsible for activities associated with inspection and/or sampling of soil, such as:

- Identify areas of potential soil contamination;
- Review soil validation data and provide advice with respect to appropriate management and/or off-site disposal of material;
- Review and evaluate analytical data obtained from monitoring programs the results of which will be presented within a Site Validation Report (SVR).



The SQEP will be available to provide on-going environmental advice and support to the Remediation Contractor as needed. Where necessary, the SQEP (with the Site Manager) will be responsible for on-going liaison with regulatory authorities and the community in relation to environmental issues.

#### **4.4 Principal Contractor (JMC)**

The Principal or the Proponent for the project is ultimately responsible for the overall compliance with prescribed legislation and guidelines relevant to the project. This is the company or organisation who hold the contract to complete the physical works. For asbestos related activities, the specialist asbestos handling and removals subcontractor may assume this role.

#### **4.5 Contractor's Site Manager**

The Contractor is responsible for ensuring that all employees and remediation subcontractors are fully cognisant of, and abide by, the CSMP. The responsibility for day-to-day site management lies with the appointed Contractor's Site Manager. The manager will be assisted by the nominated SQEP or asbestos specialist as necessary. The Contractor's Site Manager will take overall responsibility for the environmental performance during remediation.

The Site Manager has responsibility to ensure activities under their direct control are completed in compliance with this CSMP and related Work Procedures, Inspection Plans, Procedural Checklists and Environmental Management Plans, as applicable.

The Contractor will ensure all employees and subcontractors are responsible for putting into practice the CSMP and shall ensure that the factors that may compromise the achievement of overall project or environmental objectives are brought to the attention of the Site Manager and the Principal Environmental Consultant. The Contractor's Site Manager will:

- Be responsible for ensuring employee and Remediation Contractor adherence to this document;
- Maintain the content and implementation of induction training and tool box sessions;
- Undertake and implement procedures and controls with respect to asbestos containing material and management as outlined within this document;
- Instigate and maintain a program of environmental recording and (as appropriate) environmental reporting against key performance objectives as required by environmental management systems implemented by either JMC or any sub-contractors;
- Be responsible for reporting all incidents of breach of this document and any relevant EMPs to the Site Manager and Environmental Consultant.

The Contractors Site Manager and Environmental Consultant shall, in conjunction, be responsible for the following works:

- Identification of access controlled work areas; and
- Review and management of imported fill and/or waste materials.

#### **4.6 Remediation Contractor / Asbestos Specialist (Class A license holder) (ATL)**

The Remediation Contractor will report directly to the Site Manager and will be responsible for implementing this plan with assistance and direction from Site Manager or Principal Environmental Consultant. The Remediation Contractor nominates a Remediation Manager.



The Remediation Contractor has responsibility to ensure activities under their direct control are completed in compliance with this memo and related Work Procedures, Inspection Plans, Procedural Checklists and Environmental Management Plans, as applicable.

#### **4.7 Remediation Manager**

The responsibility for day-to-day site management lies with the Remediation Manager (who may be a registered asbestos removalist and if not must appoint one). The manager will be assisted by the nominated SQEP as necessary. The Remediation Manager will take overall responsibility for the environmental performance during remediation.

In the event of absence from site, the Remediation Manager will be represented by a delegate. The Remediation Manager is responsible for ensuring that all employees and remediation subcontractors are fully cognisant of, and abide by, this plan.

The Remediation Manager will ensure all employees and subcontractors are responsible for putting into practice this plan and shall ensure that the factors that may compromise the achievement of overall project or environmental objectives are brought to the attention of the Site Manager and the Environmental Consultant. The Remediation Manager will:

- Be the initial central point of contact for all site related environmental issues.
- Be responsible for ensuring employee and Remediation Contractor adherence to this document.
- Maintain the content and implementation of induction training and tool box sessions.
- Keep records of who has been trained and to advise the Environmental Consultant when new staff commence.
- Undertake and implement procedures and controls with respect to asbestos containing material and management as outlined within this document.
- Maintain a log of remedial earthworks operations and associated management and/or off-site disposal of material.
- Periodically inspect pollution management structures and equipment to confirm availability and completeness.
- Be responsible for reporting all incidents in breach of this document to the Site Manager and Environmental Consultant.

The Remediation Manager and Environmental Consultant shall, in conjunction, be responsible for the follow works:

- Inspection of excavations for residual asbestos material to determine extent of remediation.
- Identification of access controlled work areas.

Review and management of imported fill and/or waste materials.

## **5 Waste soil classification**

This section provides information regarding the definition of contaminated soil and the various waste soil classifications in New Zealand that will apply to any excavated material won from the site. Dependent on the level of contaminated material identified within soil excavated on site, the following definitions may be applied.

## 5.1 Cleanfill

The definition of 'cleanfill' is defined by MfE *Guide to the Management of Cleanfills* (2002) as:

*“Material that when buried will have no adverse effect on people or the environment. Cleanfill material includes virgin natural materials such as clay, soil and rock, and other inert materials such as concrete or brick that are free of:*

- *Combustible, putrescible, degradable or leachable components.*
- *Hazardous substances.*
- *Products or materials derived from hazardous waste treatment, hazardous waste stabilisation or hazardous waste disposal practices.*
- *Materials that may present a risk to human or animal health such as medical and veterinary waste, asbestos or radioactive substances.*
- *Liquid waste.”*

In simpler terms cleanfill includes materials such as uncontaminated soils, cured asphalt, bricks, unreinforced concrete, fibre cement building products (excluding asbestos) and glass. Non-cleanfill materials would include soils with analytical results showing detectable hydrocarbon compounds and/or exceedance of regional background concentrations of metals, asbestos containing materials, asphalt (new), greenwaste and household refuse.

## 5.2 Managed fill

Managed fill comprises:

- Soil containing metal contaminants above regional background concentrations.
- Soil containing detectable concentrations of hydrocarbon compounds.
- Soil containing contaminants of concern above ecological risk based guideline values.
- Soil that does not contain hazardous substances or materials in the form of household and industrial waste, organic waste or asbestos containing material.

The nearest fill sites available for disposal of managed fill from the site are listed as follows:

- Greenpark Landfill, Oropi – 396 McPhail Road, Oropi (c/- Peter Askey, OPUS, 07 308 0019)
- Leach's Landfill, Tirohia – Quarry Road, Tirohia (07 862 8727)
- Waste Management, 44/46 Te Tahi Street, Whakatane (07 308 9190). Note the final destination of material taken by Waste Management will be disposed to Redvale Landfill in Auckland.

## 5.3 Contaminated fill

Contaminated fill in the context of this assessment constitutes:

- Hazardous materials in the form of household and industrial waste, organic waste or asbestos containing material.
- Soil with contamination present above human health guideline values.

The nearest Class A fill sites available for disposal of managed fill from the site are listed as follows:

- Greenpark Landfill, Oropi – 396 McPhail Road, Oropi (c/- Peter Askey, OPUS, 07 308 0019)
- Leach's Landfill, Tirohia– Quarry Road, Tirohia (07 862 8727)
- Waste Management, 44/46 Te Tahi Street, Whakatane (07 308 9190). Note the final destination of material taken by Waste Management will be disposed to Redvale Landfill in Auckland.



Note that any fill material proposed to be disposed at these sites may require prior testing in advance of disposal, or haulage trucks will be turned away at the fill entrance. Please contact the fill sites for further advice prior to commencing works.

#### **5.4 Summary of waste classification**

Due to the presence of asbestos (above human health guideline criteria) in the area shown on the plan in Appendix A, the material within these areas are classified as 'contaminated fill' and will need to be disposed of within the containment cell to be created on site, or at a facility consented to accept such material for any surplus material. It is recommended that the appointed contractor confirms soil disposal location with WBOPDC and BOPRC in advance of works commencing.

## **6 Asbestos removal and management**

### **6.1 Overview**

This management plan applies to soil disturbance, excavation and removal works related to the removal of asbestos contaminated fill material, as defined by the site plans within Appendix A. This section outlines the safety requirements applicable for conducting site work and related asbestos remediation work by excavation of contaminated fill materials and where required surface hand picking and/or tilling of surface soils. This section of the plan outlines the general Health and Safety procedures, which must be implemented during the excavation of asbestos impacted soils to the site.

The following safety procedures must be implemented and adhered to during the removal of identified asbestos contaminated soils and/or the asbestos removal from site soils. Only asbestos removal ground personnel, personnel inspecting soils and/or affected by dust generated site activities are to adhere to the full scope of asbestos removal procedures described within this Section.

In the event that the asbestos specialist positively identifies additional contamination hotspots, asbestos materials pockets or any trace of material found to be of a friable nature all personnel are to cease work until materials are assessed and a comprehensive full friable asbestos removal procedure can be implemented.

These protocols must be read in conjunction with the most recent version of the Safe Work Method Statement (SWMS) provided by the Client and engaged subcontractors. The SWMS will be adopted by all workgroups involved in the remediation work and will be updated daily if needed by the asbestos contractor in conjunction with PM for the remediation works. A copy of the HSW Asbestos Regulations are presented in Appendix D.

### **6.2 Overall requirements**

In general, the asbestos removal management controls will cover the following:

- The Contractor coordinating the asbestos removal works, ATL, are a qualified and Worksafe-recognised asbestos removals specialist.
- Any personnel handling the asbestos impacted soil or material must have the appropriate training and experience for handling asbestos materials and of the required decontamination procedures. Only the licensed asbestos removal contractor will physically (by hand) remove fragments of asbestos containing materials from the ground surface.
- Personnel operating machinery involved in excavations, stockpiling and transferral of asbestos impacted soil must adhere to requirements within this plan and follow instructions from asbestos contractor and project leader.

- 
- Access to asbestos removal area for inspections or similar by other work parties will only be allowed during 'tools down' periods under the direct supervision and control of the asbestos removals contractor.
  - Access to any asbestos removal area will only be allowed by personnel at completion of asbestos removal by completion of excavation in the designated work area. This access restriction will be lifted once the asbestos specialist has carried out a visual inspection and given a clearance for the specific area. If no items of friable, other than fragments of ACM, has been encountered and air monitoring results all returning less than detectable readings, access to work area can be granted without the use of asbestos respiratory equipment given that no intrusive work will break the physical barrier.
  - Decontamination facilities are to be provided and maintained by the asbestos contractor for all personnel working at the site.

### **6.3 Pre-work notification**

Notification to Worksafe, BOPRC and WBOPDC will be required 5 days in advance of works commencing. As part of the notification, the following information shall be provided:

- Identification of proposed areas of works
- Summary of specific earthworks methodology (with plans where appropriate)
- Detailed Site Investigation (DSI) report, where appropriate
- Project specific site health, safety and environmental management plans
- Project specific Erosion, Sediment and Dewatering discharge control plans
- Project specific ARCP prepared by ATL.
- Details of who is responsible for on site management and compliance with consent conditions.
- Name and telephone number of the project manager, contractor and site owner
- Site address to which the consent relates
- Activity to which the consent relates
- Expected duration of works

### **6.4 Pre-work site protection**

Prior to works commencing, barricades (including safety tape) shall be erected to control access to the Designated Work Area. Warning signs will be erected indicating "No unauthorised access, Asbestos Removal Works in Progress".

The asbestos work area shall be segregated from the remaining areas of the site with safety tape placed at a minimum distance of 10 m from the works area (where practicable). Water will be required for dust control purposes.

### **6.5 Dust suppression**

Dust management procedures will vary according to the operations being conducted at the time. Remediation works are expected to be completed in less than two weeks. It is noted however, that the remediation schedule is dependent on the contractors work programme, which will be subject to ongoing review and approval by the SQEP.

The works shall be conducted, and dust suppression techniques shall be employed, such that there shall be no visible generation of dust. The site and open working areas used by machinery will be



dampened down periodically to reduce dust generation. During the remediation works, the following methods will be employed to minimise dust generation and distribution:

- Dampening the surface of the site and working area with hose or similar control;
- Protecting stockpiles/stored materials within sealed waste skips and / or wetting down the surface of the stockpile (if required);
- Ceasing work in strong winds; and
- Undertaking the loading or unloading of dry soil at the source to prevent the spread of loose material around the site.

## 6.6 Personal Protective Equipment (PPE)

Only personnel with appropriate personal protective equipment (PPE) and training will be allowed to work inside the asbestos contaminated area. The minimum additional protective equipment worn for personnel is as follows:

- Disposable Tyvek coveralls (outside of any high-vis)
- Washable Safety boots, i.e non laced boots with ankle support
- Gloves
- Safety goggles
- A minimum of P2 rated respirators fitted by supplier

The protective clothing will be provided daily to employees at the commencement of their work shift at the Change Area. Protective clothing is only for use in the Designated Work Area and will not be used outside of this area unless it has been thoroughly decontaminated. A copy of Worksafe PPE guidance when working with asbestos is presented in Appendix E.

## 6.7 Air monitoring

It is expected that works to remediate asbestos containing soils in will be completed in less than two weeks. Due to the nature of the work process and the potential risk of friable asbestos fibres being present within the soil and in dust generated during works, we recommend that an asbestos air monitoring program (as per Part 4 of the asbestos regulations) is implemented for the period of works to demonstrate that no asbestos fibres escape the designated work area(s) through the course of the planned work covered by this document. While air monitoring will not provide real time on-site monitoring of fibres generated, we recommend for it is undertaken to compare against an established baseline and provide validation that dust controls undertaken as part of the works were implemented successfully.

We recommend sampling is taken at the end of each day, and at one point following completion of works while validation results are being received. All air monitoring works will be performed by an independent licensed asbestos assessor (such as Air Matters) in accordance with the *WorkSafe New Zealand guidelines for the management and removal of asbestos* (November 2016).

In terms of protecting health of site workers and public, the target background level as defined by the Asbestos Regulations within the static air samplers will be the detection limit of 0.01 fibres/mL (10 times below the occupational limit). It is proposed that excavation work will cease while dust management procedures are reviewed if this target criterion is exceeded.

## 6.8 Decontamination

Decontamination must include the asbestos work area, all tools and equipment utilised and personal decontamination. All contaminated materials, including cleaning rags, plastic sheeting and PPE etc,



must be disposed of as contaminated waste. The advice provided within this document is generalised only, and shall be detailed by the asbestos contractor within their own methodologies and ARCP.

#### **6.8.1 Decontamination Area**

A decontamination area should be established on site for the use of the personnel conducting asbestos clean-up works. The decontamination area will comprise a segregated area where any contaminated work clothing and respirators are removed and discarded.

Prior to any work commencing on any of the Designated Work Areas, suitable barricades are to be erected around the boundary of the work site. Asbestos Warning Signage will be provided at suitable intervals and at all entrances detailing the restriction of access to the site.

Once workers are inside the Designated Work Area, they are not permitted outside of that area without proceeding through the appropriate decontamination procedures. No employee is permitted to remove any disposable protective clothing from the site. Contaminated overalls and PPE is to be disposed of with the asbestos contaminated waste materials in appropriately labelled waste bins or bags. These requirements are specified as a minimum standard and may be modified at the discretion of the remediation contractor and/or PM during the course of the remediation works.

The following procedures have been written utilising the decontamination procedures outlined in the *WorkSafe New Zealand guidelines for the management and removal of asbestos* (November 2016).

#### **6.8.2 Tools and equipment**

At the end of removal work all tools, where required, should be decontaminated in the following manner:

- Decontaminated using wet or dry decontamination methods as outlined in the *WorkSafe New Zealand guidelines for the management and removal of asbestos*; or
- Placed in sealed containers (and used only for asbestos removal work); or
- Disposed of as asbestos waste.

If tools cannot be decontaminated within the asbestos work area, or are to be re-used on another project, they should be tagged to indicate possible contamination and double bagged in asbestos waste bags before being removed from the asbestos work area. Work tools, plant and other equipment proposed to be reused should be swab tested to confirm decontamination completed successfully.

#### **6.8.3 Personal decontamination**

All personnel while working within the Designated Work Areas or in any other way being affected by asbestos contaminated material will be required to decontaminate at the end of each work shift (i.e. before morning tea, lunch and afternoon tea) and at the end of the work day.

The Change Area is the area in which potentially contaminated PPE must be removed prior to leaving the Designated Work Area. It is to be located at the entry to the work Designated Work Area. It must not be used for purposes other than decontamination. It must not be used as a materials storage area. All personnel leaving the asbestos work area must use the Change Area prior to leaving the site.

Personal respiratory protective equipment should continue to be worn until all contaminated disposable coveralls and clothing has been vacuumed and/or removed and bagged for disposal; and personal washing completed. Personnel are required to ensure that no asbestos soiled clothes or PPE leave the decontamination area to the 'clean end' of the area. PPE is to be provided to all personnel working in the Designated Work Areas and must be available within the decontamination area.

#### **6.8.4 Vehicle decontamination**

To prevent the spread of contaminated material back into remediated areas, a vehicle wash-down area will be provided on the exit route from contaminated areas to remove any soil adhering to vehicle tyres



and undercarriage within the designated decontamination area. The decontamination area is to be fitted with single ply plastic sheeting where the excavator will drive on to for decontamination. If required, vehicles leaving the contaminated zone will be cleaned using low pressure water sprays and brushing/shovelling where necessary. Any sediments which accumulate in the wash-down area will be considered waste and will be disposed of off-site to landfill after sampling and analyses to determine contaminant levels.

## **6.9 Stockpile, transport and disposal of ACM waste and impacted soils**

Machinery used to excavate asbestos contaminated material must have a closed cab with airconditioning on recirculation to avoid asbestos fibres being inhaled by the operator. The excavator bucket and tracks must be cleaned with water prior to exiting the contaminated area. Excavated material must be transported appropriately, as per below, to the temporary stockpile in order to avoid the unintentional transfer of contaminated material elsewhere onsite.

We understand that stockpiling of ACM waste outside of the current stockpile areas is not anticipated. Should asbestos contaminated material be stockpiled it will be placed on two layers of 0.2 mm polyethylene sheeting which is securely fastened. The stockpile should be dampened and covered with two layers of 0.2 mm polyethylene sheeting and/or geofabric and securely fastened by metal pegs fixed into the ground (or similar) to ensure no material is able to become airborne or access by workers and/or members of the public.

The trucks or bins used to transport the asbestos waste are to be lined with two layers of 0.2 mm polyethylene sheeting to facilitate decontamination after tipping of the waste. Alternatively leak proof vehicles may be used and decontaminated at the landfill. Trucks will not be tracking over exposed contaminated soil. Following decontamination the plastic sheeting is to be rolled up and placed in the final truck to leave the site. The loads on all trucks are to be covered with tarpaulins prior to leaving site, to minimise loss of contaminated materials and the generation of dust during transport.

After asbestos fragments and asbestos contaminated soils have been removed, all asbestos waste including soiled PPE, shall be placed into 0.2 mm polyethylene plastic bags marked with "Asbestos Waste" which are to be sealed by wire ties or tape and then suitably washed. The bags shall then be placed in bins lined with 0.2 mm polyethylene sheeting and transported in leak-proof vehicles for disposal at an approved regional asbestos waste disposal depot.

Should it be necessary to temporarily store asbestos waste prior to transport to the waste facility then all plastic bags containing the waste shall be held in leak-proof metal containers or bins suitably marked and held in a secured area displaying appropriate warning signs.

Solid asbestos waste (if encountered) shall be collected and double bagged in heavy duty, low-density polyethylene 0.2 mm thick bags. A maximum bag size of 1200 mm (length) x 900 mm (width) shall be observed and bags shall be filled to no more than 50 per cent capacity. The loaded weight of the bag shall not exceed 20 kg. Each bag or other container shall be labelled on its outermost surface with warning statements. Bags or primary containers which have held asbestos shall not be re-used, and containers marked as above shall not be used for any other purpose.

Transport of asbestos waste material shall be done so in plastic lined leak-proof vehicles or in air leak proof vehicles that are covered so that no spillage or dispersal of the waste to the atmosphere occurs. Care must be taken to ensure that the integrity of the plastic bags is not damaged during handling or transportation. In particular, bags of asbestos waste shall not be thrown or dropped from a height, (which may rupture the bag). Vehicles may be checked for cleanliness prior to leaving the Site.

Controlled wetting of waste shall be employed, where practicable, to reduce dust emission during bag sealing and in cases of accidental bag rupture during transportation. Excessive water logging shall be



avoided as the excess of contaminated water may leak out of the bags, thereby creating a future source of airborne dust.

The asbestos waste shall be disposed of at a site and in a manner as approved by consenting authority. Documentary evidence of the disposal shall be collected and provided. This will include name of the authorised tip, weighbridge docket and registration number of vehicle for every disposal. This information shall be passed to the SQEP for presentation within the Site Validation Report (SVR). Copies of waste disposal certificates and related documentation must be kept by the Remediation Contractor and supplied the Site Manager.

## 7 Cultural management measures

### 7.1 Introduction

An Archaeological Assessment was undertaken by CFG Heritage. The site has been highly modified, and no archaeological sites were found as part of the site investigations. However, the report recommended that an application to Heritage New Zealand for Authority to disturb and/or destroy archaeological sites be made. This has been made, in addition to consultation with Tangata Whenua (Pirirakau).

### 7.2 Cultural and heritage management during earthworks

Pirirakau Cultural Monitors are to be onsite for any operations involving topsoil stripping and cutting operations. The Principal Contractor is responsible for advising the Cultural Monitors of when these works will occur.

### 7.3 Accidental discovery

Conditions of consent include requirements for accidental discovery protocols and notifying the Regional Council if any accidental discoveries occur. In the event of discovery of sensitive material which is not expressly provided for by any resource consent or other statutory authority, standards and procedures set out below must apply. 'Sensitive material' for the purpose of this project means:

- Human remains and kōiwi;
- An archaeological site;
- A Māori cultural artefact/taonga tuturu; or
- A protected New Zealand object as defined in the Protected Objects Act 1975 (including any fossil or sub-fossil);

On discovery of any sensitive material, the owner of the site or the consent holder must take the following steps:

#### Cease works and secure the area

Immediately cease all works within 20 m of any part of the discovery, including shutting down all earth disturbing machinery and stopping all earth moving activities. Secure the area of the discovery, including a sufficient buffer area to ensure that all sensitive material remains undisturbed. Inform relevant authorities and parties including:

- The New Zealand Police if the discovery is of human remains or kōiwi;
- The Bay of Plenty Regional Council in all cases;

- 
- Heritage New Zealand Pouhere Taonga if the discovery is an archaeological site, Māori cultural artefact, human remains or kōiwi; and
  - Mana Whenua if the discovery is an archaeological site, Māori cultural artefact, or kōiwi.

#### Wait for and enable inspection of the site

Wait for and enable the site to be inspected by the relevant authority or agency:

- If the discovery is human remains or kōiwi the New Zealand Police are required to investigate the human remains to determine whether they are those of a missing person or are a crime scene. The remainder of this process will not apply until the New Zealand Police confirm that they have no further interest in the discovery; or
- If the discovery is of sensitive material, other than evidence of contaminants, a site inspection for the purpose of initial assessment and response will be arranged by the Council in consultation with Heritage New Zealand Pouhere Taonga and appropriate Mana Whenua representatives.

Following site inspection and consultation with all relevant parties (including the owner and consent holder), the Council will determine the area within which work must cease, and any changes that may occur from the accidental discovery.

#### Recommencement of work

Work within the area determined by the Council must not recommence until all of the following requirements, so far as relevant to the discovery, have been met:

- Heritage New Zealand has confirmed that an archaeological authority has been approved for the work or that none is required;
- Any required notification under the Protected Objects Act 1975 has been made to the Ministry for Culture and Heritage;
- Any material of scientific or educational importance must be recorded and if appropriate recovered and preserved;
- Where the site is of Māori origin and an authority from Heritage New Zealand Pouhere Taonga is not required the Council will confirm, in consultation with Mana Whenua, that:
  - Any kōiwi have either been retained where discovered or removed in accordance with the appropriate tikanga; and
  - Any agreed revisions to the planned works to be/have been made in order to address adverse effects on Māori cultural values.
- Resource consent has been granted to any alteration or amendment to the earthworks or land disturbance that may be necessary to avoid the sensitive materials and that is not otherwise permitted under the Plan or allowed by any existing resource consent.
- That there are no requirements in the case of archaeological sites that are not of Māori origin and are not covered by Heritage New Zealand Pouhere Taonga Act 2014.

## 8 Compliance procedures and complaints log

### 8.1 Compliance

Any works undertaken within the affected area should be documented and provided to WBOPDC and BOPRC on completion of works. Compliance reports should include but not be limited to:

- Date and time of works undertaken;
- Scope of works undertaken;

- 
- Summary of work methodology;
  - Location, dimensions and volume of any excavations undertaken;
  - Results of any further field screening or laboratory testing;
  - Confirmation of disposal routes, where soil material is removed from site (including cartage and waste disposal dockets); and
  - Confirmation of any fill material imported to site (origin, volume, demonstration of quality etc.).

## **8.2 Complaints log**

A complaint log will be established and will include the date/time the complaint was received, source and nature of the complaint, weather conditions, and resolution. The complaint log shall be maintained for the duration of the project.

## 9 Legislative guidelines

The following legislation and guidelines have been considered for the preparation of this CSMP:

- *MfE Contaminated Land Management Guidelines, Volumes 1 to 5 (October 2011);*
- *National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health Regulations (October 2011);*
- *MfE A Guide to the Management of Cleanfills (January 2002);*
- *MfE Module 2 – Hazardous Waste Guidelines: Landfill waste acceptance criteria and landfill classification (May 2004);*
- *Bay Of Plenty Regional Water and Land Plan (2008);*
- *Western Bay of Plenty District Council, (2012). Western Bay of Plenty District Plan;*
- *Worksafe NZ - New Zealand guidelines for the management and removal of asbestos (December 2016)<sup>2</sup>;*
- *Health and Safety at Work Act (2015);*
- *Health and Safety at Work Asbestos Regulations (2016);*
- *Heritage New Zealand Pouhere Taonga Act (2014);*
- *Protected Objects Act (1975)*
- *Western Australian Department of Health (WA DoH) 2009 Guidelines for the Assessment, Remediation and Management of Asbestos Contaminated Sites in Western Australia.*
- *CIRIA 733 Asbestos in soil and made ground: a guide to understanding and managing risks (2014).*

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<sup>2</sup> <http://construction.worksafe.govt.nz/guides/acop-management-and-removal-of-asbestos/>

## 10 References

- Ministry for Environment (April 2012) Users Guide: NES for Assessing and Managing Contaminants in Soil to Protect Human Health. Wellington. Ministry for the Environment
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- Hazardous Substances and New Organisms Act (HSNO,1996)
- Health and Safety at Work Act, 2015
- Resource Management Act, 1991



## 11 Limitations of this plan

Information provided in this CSMP and the subsequent findings herein are reliant on a limited selection of information provided by the Client. Aurecon takes no responsibility for the quality / accuracy of information provided by third parties.

The outcome of this report is limited to information supplied for the activities associated with the scope of works only. It is intended that this plan provides a description of the identified soil contamination and recommendations on how to address and manage any contamination issues at the location in question. Remediation advice is limited to surface asbestos impact only.

We note that this report has been prepared for the use by the Client and appointed subcontractors only and is based on information provided by them. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that the Client may suffer as a result of using or relying on any such information or recommendations contained in this report.

This report does not provide a complete assessment of the environmental status of the site, and it is limited to the scope defined herein. Should further information become available regarding the conditions at the site, including previously unknown likely sources of contamination, Aurecon reserves the right to review this report in the context of the additional information.

The report may contain various remarks about and observations on legal documents and arrangements such as contracts, supply arrangements, leases, licences, permits and authorities. A consulting engineer can make remarks and observations about the technical aspects and implications of those documents and general remarks and observations of a non-legal nature about the context of those documents. However, as a consulting engineer Aurecon is not qualified, cannot express and should not be taken as in any way expressing any opinion or conclusion about the legal status, validity, enforceability, effect, completeness or effectiveness of those arrangements or documents or whether what is provided for is effectively provided for. They are matters for legal advice.

# Kaimai Views Subdivision, Omokoroa

Site Validation Report

**Classic Developments  
Omokoroa Limited**

Reference: 255791

Revision: 0

2018-07-18

# Document control record

Document prepared by:

**Aurecon New Zealand Limited**  
 Ground Level 247 Cameron Road  
 Tauranga 3110  
 PO Box 2292  
 Tauranga 3140  
 New Zealand

**T** +64 7 578 6183  
**F** +64 7 578 6143  
**E** tauranga@aurecongroup.com  
**W** aurecongroup.com

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<b>Name</b>	Luke Beirne	<b>Name</b>	Colm Molloy
<b>Title</b>	Environmental Geologist	<b>Title</b>	Technical Director

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# 1 Introduction

## 1.1 Project background

Classic Developments Limited ('Classic Developments') have engaged Aurecon New Zealand Limited ('Aurecon') to provide environmental consultancy services for the remediation of asbestos impacted soil contamination at the Kaimai Views Subdivision, currently being constructed at 336, 340, and 344 Omokoroa Road, Omokoroa, (The Subdivision).

The Subdivision is being developed as part of the Omokoroa Special Housing Area – a joint venture development between Classic and the Western Bay of Plenty District Council (WBOPDC). As part of the development approximately 250 new residential lots will be created as shown on the Lysaght Consultants Limited (LCL) drawing No. 163252-220-EW, a copy of which is included in Appendix A.

A Detailed Site Investigation (DSI) for the Subdivision prepared by LCL (Report Ref. '*Detailed Contaminated Site Investigation – for 336, 340 and 344 Omokoroa Road, Omokoroa Reference: 163252*') confirms the previous land use as an orchard, and hotspots of arsenic and hydrocarbon (TPH) contamination were detected. Reported concentrations were in exceedance of the adopted human health Soil Contaminant Standards (SCS), and works by LCL to manage, remediate and validate these hotspots has been undertaken and reported separately (ref: *Site Remediation and Validation Report, for Kaimai Views Development, Omokoroa, Reference: 163252*).

During earthworks to construct the design landform at the Subdivision, asbestos containing materials (ACM) were discovered by construction personnel within two stockpiles of topsoil and non-engineered fill. Following this discovery, an additional area of in-situ non-engineered fill, and a derelict shed, both containing ACM were identified. This material is in the western half of the southern terrace, and Aurecon's works and subsequent validation are limited to this area, herein referred to as 'The Site'. The ACM source is suspected to be the result of historical infilling and waste disposal to land by the previous landowner; utilising imported material comprising demolition waste and ACM.

This Site Validation Report (SVR) presents a factual account of works undertaken to remediate these areas of asbestos contamination within The Site as identified by Aurecon. This report has been prepared in accordance with the *Ministry for the Environment (MfE) Contaminated Land Management Guidelines*, the *MfE National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (NES)* and the *Bay of Plenty Regional Natural Resources Plan*. This report provides the following:

- A brief summary of pre-remediation Site history and conditions;
- A methodology of remedial works undertaken on Site;
- A summary of validation sampling undertaken and results of laboratory analysis; and
- Conclusions and recommendations regarding ongoing suitability.

This SVR follows previous environmental scope of works undertaken by Aurecon and others for the Site and the wider Subdivision, and includes the following technical reports:

- *Aurecon, Classic Developments – Kaimai Views Subdivision Development, Omokoroa, Contaminated Site Management Plan, Rev.3, Ref: 255791-0000-REP-NN-0001 [3] CSMP, dated 26 September 2017;*
- *Aurecon, Classic Developments – Kaimai Views Subdivision Development, Omokoroa, Remediation Options Appraisal and Remedial Action Plan, Rev.1, Ref: 255791-0000-REP-NN-0002 [1] RAP, dated 26 September 2017;*
- *Lysaght, Classic Developments – Site remediation and Validation Report for Kaimai Views Development, Omokoroa. Reference 163252;*
- *Lysaght, Classic Developments – Remedial Action Plan, and Contaminated Site Management Plan for 336, 340, and 344 Omokoroa Road, Omokoroa. Reference 163252, dated 12 August 2016;*
- *Lysaght, Classic Developments – Detailed Contaminated Site Investigation for 336, 340, and 344 Omokoroa Road, Omokoroa. Reference 163252, dated 9 August 2016.*

## 1.2 Scope of works

As part of the remediation, the following scope of works was undertaken and is documented by this SVR:

- Characterisation and delineation of asbestos contamination;
- Emergency remediation of ACM impacted soils from base of gully following slips;
- Excavation and stockpiling of asbestos containing soils;
- Excavation of an encapsulation cell;
- Soil validation sampling of affected areas;
- Laboratory testing of validation samples for asbestos;
- Screening of laboratory testing to assess remaining concentrations against target criteria set out within the Remediation action plan; and
- Conclusions and recommendations in relation to Site status and requirements for further phased investigations and/or monitoring programmes.

## 1.3 Legislative guidelines

The remediation and validation works have been conducted in accordance with *Contaminated Land Management Guidelines*, within the framework of the *Resource Management Act 1991*. The SVR has been prepared in accordance with, or in consideration of, the following specific legislation or guidelines:

- Bay of Plenty Regional Council, (updated May 2018), Bay of Plenty Regional Natural Resources Plan;
- BRANZ (November 2017), New Zealand Guidelines for Assessing and Managing Asbestos in Soil;
- CIRIA C733, (March 2014), Asbestos in soil and made ground: a guide to understanding and managing risks;
- CIRIA C765, (February 2017), Asbestos in soil and made ground good practice site guide;
- Health and Safety at Work Act 2015;
- Health and Safety at Work (Asbestos) Regulations 2016;
- MfE (2011), Contaminated Land Management Guidelines No. 1, Reporting on Contaminated Sites in New Zealand, ME No. 1071;
- MfE, (2011), Contaminated Land Management Guidelines No. 2, Hierarchy and Application in New Zealand of Environmental Guideline Values, ME No. 1072;
- MfE, (2004), Contaminated Land Management Guidelines No. 3, Risk Screening System, ME No. 502;
- MfE, (2011), Contaminated Land Management Guidelines No. 5, Site Investigation and Analysis of Soils, ME No. 1073;
- MfE, (2011), Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations, SR 2011/361;
- Worksafe (November 2016), Approved Code of Practice: Management and Removal of Asbestos;
- Western Bay of Plenty District Council, (2012), Western Bay of Plenty District Plan;
- Western Australian Department of Health (WA DoH), (2009), Guidelines for the Assessment, Remediation and Management of Asbestos Contaminated Sites in Western Australia.

## 1.4 Applicable consents and permit conditions

### 1.4.1 Resource consent RM17-0346-AP – Bay of Plenty Regional Council

A resource consent was granted on 23 June 2017 to *discharge contaminants to land and to disturb and remediate contaminated land*. The conditions of the permit relate to establishment and maintenance of erosion and sediment and control measures, and works, including following undertaking the activities in accordance with Aurecon's ROA & RAP, and CSMP. For a full list of conditions, refer to a copy of the consent provided in Appendix B.

### 1.4.2 Resource consent RM17-0365-LC.01 – Bay of Plenty Regional Council

A resource consent was granted on 8 September 2017 for *remediation or disturbance of contaminated land*. The conditions of the permit relate to establishment and maintenance of erosion and sediment and control measures, and works, including following undertaking the activities in accordance with Aurecon's ROA & RAP, and CSMP. For a full list of conditions, refer to a copy of the consent provided in Appendix B.

## 1.5 Disclaimer

Aurecon has prepared this report in accordance with the brief as provided. The contents of the report are for the sole use of the Client and no responsibility or liability will be accepted to any third party. Data or opinions contained within the report may not be used in other contexts or for any other purposes without Aurecon's prior review and agreement.

This report does not provide a complete assessment of the environmental status of the site, and it is limited to the scope defined herein. Should further information become available regarding the conditions at the site, including previously unknown likely sources of contamination, Aurecon reserves the right to review this report in the context of the additional information.

This report has been prepared for the client for its own use and is based on information provided by them. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that the Client may suffer as a result of using or relying on any such information or recommendations contained in this report, except to the extent Aurecon expressly indicates in this report that it has verified the information to its satisfaction. This report is not to be reproduced either wholly or in part without our prior written permission.

## 2 Site setting

### 2.1 Site location and description

Originally addressed 336, 340, and 344 Omokoroa Road (legally described as PT Lot 2 DPS 65560, PT Lot 1 DPS 65560, and Lot 1 DPS 4524) the Subdivision is currently being developed as part of the Omokoroa Special Housing Area – a development completed in a joint venture partnership between Classic and WBOPDC. Approximately 250 new residential lots are to be developed, with adjacent reserves and civil infrastructure.

The Subdivision is being constructed across two irregularly shaped terraces raised at a moderate to steep gradient ~6 m above a central drainage gully and across which a new land bridge has been constructed. The southern terrace, is bounded to the north, south, and west by the gully, and to the east by Omokoroa Road. The northern terrace is bounded to the north, and south by the gully, and to the east by the East Coast Main Trunk (ECMT) railway line. The new land bridge connecting the two terraces is formed of the clean material undercut from the creation of the encapsulation cell.



Figure 1 The southern terrace viewed from its western boundary, as observed 14 March 2017 (Aurecon)

The subject site covered by this SVR (herein referred as the Site) is in the western half of the southern terrace of the subdivision. For the purpose of the SVR, the Site is recognised as the area where asbestos was identified, the routes along which that material was subsequently transported as part of remedial works, and the immediate vicinity thereof. A sketch location plan is presented as Figure 2.

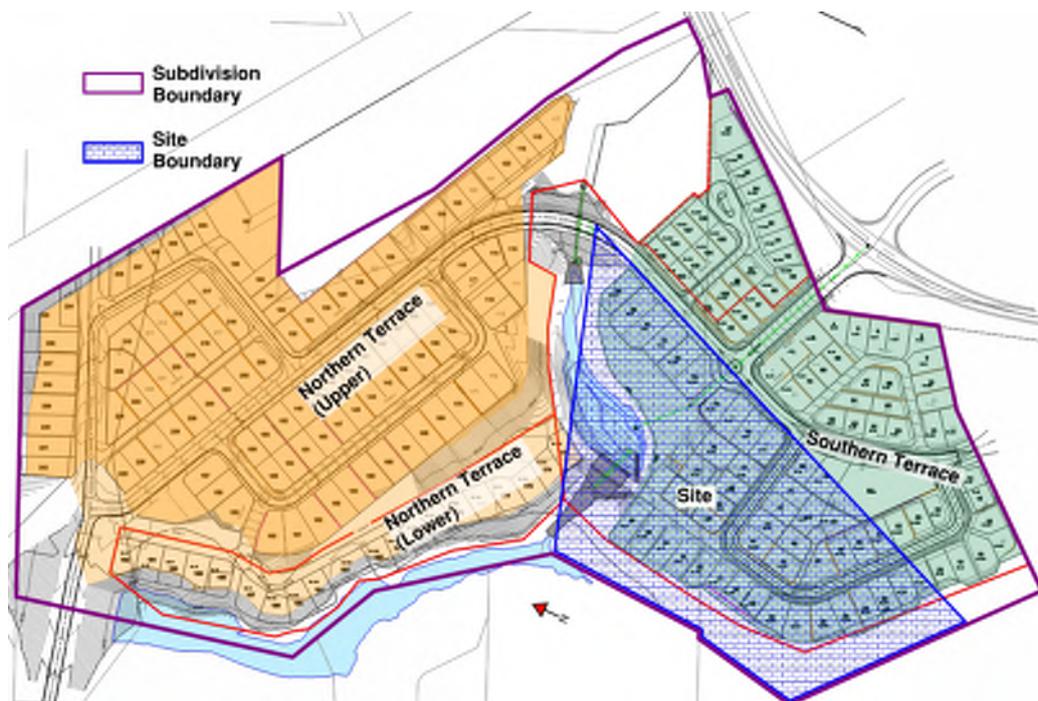


Figure 2 Location of Site within wider subdivision

A location and layout plan showing stockpile, remediation, and validation locations within the site is presented in Figures A1 Investigation Location Plan and A2 Validation Location Plan, within Appendix A.

## 2.2 Geological and hydrological setting

### 2.2.1 Geological

The geology underlying the Subdivision is presented on the IGNS 1:250,000 scale map sheet 5 'Geology of the Rotorua Area' and described in the accompanying memoir by Leonard et al. (2010)<sup>1</sup>. The map indicates that the Subdivision is underlain by Pleistocene age deposits of the Matua Subgroup. The Matua Subgroup is described as poorly to moderately sorted gravel with minor sand and silt underlying terraces, and can include minor colluvial fan deposits and loess.

The Matua Subgroup is typically overlain by a thick mantle of Taupo Volcanic Zone tephra's comprising (from youngest to oldest) the Younger Ash, Rotoehu Ash and Hamilton Ash beds. The Younger Ash deposits comprise inter-layered zones of silt ash interspersed with layers of pumice rich sandy silts. The Rotoehu Ash usually consists of a thin sand layer which overlies the Hamilton Ash deposits, which typically comprise older silt and clayey silt horizons. At the top of the Hamilton Ash there is often a distinctive palaeosol layer (old topsoil horizon) locally known as the 'Chocolate Layer'. The map shows the contact with the Waiteariki ignimbrite formation just east of the Subdivision, less than 50 m away. The ignimbrite is expected to underlie the Matua Subgroup at depth beneath the Subdivision.

Prior to development the Subdivision was covered by a layer of topsoil, with localised pockets of fill, which was removed as part of development or transferred to the encapsulation cell as part of remedial works.

### 2.2.2 Hydrological and hydrogeological

The Subdivision is bisected by a drainage gully which, as part of the current development, was converted into a stormwater attenuation reserve which services the Subdivision, as well as other subdivisions up-gradient to the south east. The stormwater reserve discharges to a stream located at the base of the gully which bounds the Subdivision along its western boundary. The stream drains to the Tauranga Harbour approximately 1.5 km to the north.

A review of the Bay of Plenty Regional Council (BOPRC) groundwater borehole database shows that the registered bore (No. 2027) is located adjacent to the Subdivision to the north. The well card information shows the bore to lie at 29 m RL and have a standing water level of 23 m. Regional groundwater is expected to flow north towards the Tauranga Harbour.

## 2.3 Summary of site history and record search

Aurecon's site history and record search was limited to a review of historical aerial photographs and previous reports of the Site to ascertain information limited to asbestos contamination. A DSI for the Subdivision had previously been carried out by LCL (Ref: 163252, dated 9 August 2016).

The DSI conducted by LCL identified "the Site has had orchard activities occurring from at least 1993. Prior to this, the Site was agricultural land. The Site is listed on the Selected Land Use Register under HAIL item A10 Persistent pesticide bulk storage or use including sport turfs, market gardens, orchards, glass houses or spray sheds." The DSI identified hotspots of arsenic and hydrocarbon (TPH) contamination with reported concentrations in exceedance of adopted 'tier 1' human health soil contaminant standards. Works by LCL to manage, remediate and validate these hotspots has been undertaken and reported separately in LCL's SVR.

Aurecon's review of historical aerial photographs showed that earthworks had been undertaken in the area that asbestos had been discovered. The earthworks occurred between 2007 and 2011, as evidenced by signs of soil disturbance activities and bare ground within aerial photographs sourced from Western Bay of Plenty District Council GIS (Figures 3 and 4).

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<sup>1</sup> Institute of Geological & Nuclear Sciences Ltd, Geology of the Rotorua Area, Sheet 5 1:250,000 G S Leonard et al, 2010.



Figure 3 2007 Aerial photograph (WBOPDC)



Figure 4 2011 Aerial photograph (WBOPDC)

The Subdivision was previously used for orcharding purposes, and at the time of Aurecon's first visit (14 March 2017), the southern terrace had been cleared of trees and vines, and largely cleared of topsoil. Excavations were occurring in the gully in the southern terrace's north-western corner to form a new stormwater pond. At the time of Aurecon's final validation samples being taken on 29 May 2018, the southern terrace had roads formed, civil infrastructure installed, and building platforms cut into the slope with retaining walls constructed.

## 3 Site contamination status

The risk being addressed by Aurecon on the Site is asbestos contamination, specifically in the western half of the southern terrace of the Subdivision, see Figure 2 (the site), and Figure A1 Appendix A. Aurecon have not conducted investigation outside of this area.

### 3.1 Site Investigation

#### 3.1.1 Initial investigation

Suspected ACM was discovered by LCL on 8 March 2017, and three samples (ASB01, ASB02, and ASB03) were submitted to Hill Laboratories for analysis. The three samples were confirmed to contain amosite and chrysotile asbestos in fibrous cement form.

Following confirmation of asbestos in LCL's samples, a walkover of the affected area was undertaken by Aurecon on the basis of which four areas of suspected asbestos contamination were identified: within two stockpiles (Stockpile A and Stockpile B); an area of in-situ fill (Area SP forming a slope batter); and a small shed (<2m<sup>2</sup>) which was observed to have suspected asbestos within the building fabric and some construction debris at the base (Area TP-6). A plan showing the location of these areas is presented on Figure A1, Appendix A.

In addition to these four areas, a slope failure caused by heavy rain remobilised ACM from Area SP to the gully floor immediately to the north, within the base of the stormwater reserve. Emergency works to remove impacted materials from the base of gully to allow continued construction of the stormwater reserve were undertaken during the week commencing 20 March 2017 (Refer Section 4.1).

As part of the initial walkover five soil samples (A1 to A5) were collected by Aurecon from Stockpile A, four soil samples (B1 to B4) from Stockpile B and three soil samples (SP-A to SP-C) collected from Area SP. Samples A1, A5, B3, SP-A, SP-B and SP-C tested positive for asbestos, in fibrous cement, loose fibres, and ACM debris forms. Aurecon attended Site on 17 March to collect a selection of tile fragments from within Area SP. This sample (SP-T) was confirmed to contain amosite, chrysotile, and crocidolite asbestos.

#### 3.1.2 Further Characterisation

Aurecon carried out further investigation on 28 March 2017 around Area SP, and along the western bank of the southern terrace. The purpose of this investigation was to:

- a) Confirm that topsoil material pushed over the side of the gully did not contain ACM; and
- b) Further characterise the volume and extent of ACM impacted fill material in Area SP.

The investigations within Area SP were undertaken in collaboration with CMW Geosciences (CMW), the appointed geotechnical engineer, to inform extent of uncontrolled fill placed over the embankment. Work undertaken by CMW is reported separately (ref: TGA2016\_0258AK). The following scope of works was completed as part of Aurecon's additional investigation:

- One hand dug, and four machine excavated test pits (TP1 to TP5) to a maximum depth of 2 m in Area SP. The base of fill was not reached due to test pit instability; and
- Six hand dug test pits (TP6-TP11) collected from the south facing embankment. The pits were excavated to confirm depth to natural soils.

A plan showing the location of these test positions is presented on Figure A1, Appendix A.

Five soil samples (TP1-TP5) were collected from four machine excavated test pits at the top of the southern slope of Area SP, and one hand excavated test pit further down this slope. The material was predominantly topsoil fill, with evidence of construction waste present throughout the fill profile. Test pits were excavated to a maximum depth of 2 m below ground level (bgl), however the unstable nature of the fill material caused collapse, and excavations were terminated without determining the depth and therefore the thickness of the fill. No asbestos was identified in these five fill samples, however based on visual inspections, anecdotal

evidence and constraints imparted by topography limiting the ability to appropriately delineate this material, it was recommended that all fill within Area SP should be considered as contaminated with asbestos.

Six soil samples (TP6-TP11) were collected from hand excavated test pits along the embankment above the gully bounding the western edge of the Site. This embankment had been recontoured using topsoil from the Subdivision and as such samples were collected to confirm the presence or absence of asbestos in the topsoil. The maximum thickness of topsoil encountered was 400mm, however it is assumed to be deeper in localised areas. The results of the investigation indicated that this topsoil did not contain ACM, however a small pile of construction waste was identified near a small shed in the vicinity of TP6. A tile sample was collected within this waste material and found to contain asbestos. The investigation sample locations are presented on Figure A1, Appendix A.

## 3.2 Summary of Site contamination

Based on the results of investigation and sampling works completed by Aurecon, the contamination was confirmed to be confined to the two stockpiles (A and B), an in-situ area of fill (Area SP), and Area TP6.

The investigation was completed before the release of the BRANZ guidelines, but in agreement with the client the positive identification of asbestos was utilised for screening purposes. In discussion with the client, the positive identification of ACM was considered an unacceptable risk to the proposed development and remediation was required under the supervision of a Suitably Qualified and Experienced Practitioner (SQEP).

Stockpile A, was located on the southern side of the east-west aligned gully escarpment through the centre of the Subdivision. Measuring 5-6 m high, and approximately 80 m in length, this stockpile represented the bulk of the known contaminated material on the Site. The pile included natural ash, construction waste, and topsoil, and had been created during earthworks, before asbestos was identified. The volume of the stockpile was assessed to be approximately 3600 m<sup>3</sup>.

Stockpile B was located at the top of the recontoured slope, on the western boundary, with a soil bund preventing run-off downslope. Comprised predominantly of topsoil, the pile contained the remains of burn pits, with construction waste present. The stockpile measured 2-2.5 m high, and approximately 20 m in length, and whilst no asbestos was identified visually, laboratory testing confirmed its presence. The volume of this stockpile was assessed to be 550 m<sup>3</sup>.

Area SP was an area of fill material on the western boundary of Site, forming a promontory at the confluence of two gullies, comprising topsoil and construction waste. Multiple large fragments of asbestos containing cementitious sheeting were present on the surface, and throughout the soil profile. The previous collapse, and subsequent investigation showed fill in this area to be up to 2 m thick. The volume of impacted in-situ material was assessed to be approximately 600 m<sup>3</sup>.

The western boundary of Site has been recontoured, now gently sloping to the gully marking the boundary of the Subdivision. Area TP6 was located at the top of the northern end of this slope. A small shed in a deteriorated condition stood near the crest of the slope, and a sample of asbestos tile was collected from the ground surface surrounding the shed, with more observed to be present within the sheds matrix. A soil sample was collected 10 m downslope of the shed, and found not to contain asbestos. The remediation area was set at 3 m surrounding this shed.

The agreed remediation strategy selected for the Site was to engineer an on-site encapsulation cell to contain the ACM within. This would be capped with a geotextile lining, and covered with 1 m of clean material. The methodology of deriving the remediation strategy is detailed within Aurecon's Remediation Options Appraisal and Remediation Action Plan (ROA & RAP) Ref: 255791-0000-REP-NN-0002. The geotechnical design for this cell was completed by CMW (ref: TGA2016\_0258AK, 09 June 2017). The environmental management and methodology for the filling of the encapsulation cell, and handling of ACM on Site is detailed within Aurecon's Contaminated Site Management Plan (CSMP).

## 4 Remediation strategies and works

### 4.1 Introduction

When suspected asbestos was identified on 8 March WBOPDC were notified, and works in the area stopped. When the results of the initial sampling were received, BOPRC and Worksafe were notified.

Emergency removal of material adjacent to the wall of the temporary stormwater pond was undertaken on the week commencing 20 March 2017 by JMC Limited (JMC) under guidance of ATL Group Ltd (ATL) and Aurecon's SQEP, in agreement with BOPRC, and having notified Worksafe. The non-engineered and uncontrolled asbestos containing collapsed fill was scraped back and placed onto Stockpile A, and the remaining material stabilised with a temporary geotextile lining placed over the top.

An assessment of remediation options was undertaken by Aurecon, in consultation with Classic, BOPRC, and WBOPDC. The remediation strategy selected for the Site was for on-site encapsulation, with off-site removal as a contingency for excess material. The reasoning behind this decision is detailed in Aurecon's ROA & RAP.

An on-site encapsulation cell was constructed within an area of proposed reserve on the northern boundary of the southern terrace, the location of which is shown on Figure 5, and Figure A2 Appendix A.



Figure 5 Location of the encapsulation cell within the subdivision layout

A sketch cross section of the encapsulation cell is presented in Figure 6.

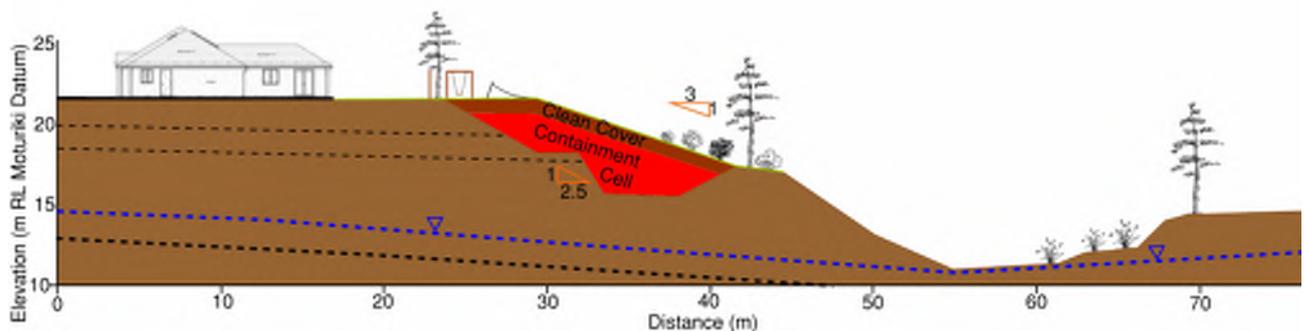


Figure 6 Idealised sketch cross section of encapsulation cell

The remediation works were undertaken in accordance with the methodology set out in Aurecon's Section 7.5 of the ROA & RAP. The bulk of the remediation works was undertaken from 12 October 2017 to 18 December 2017. Further remediation was undertaken on 29 May 2018, to remediate the area around a failed validation sample (V075). Refer to Appendix C for Site photographs.

The cell construction and remediation works were completed by JMC under supervision from ATL.

## 4.2 Remediation targets

Due to the sensitive nature of the end use of Site, the target for remediation areas was no asbestos detected within analysed samples in accordance with AS4964-2004, *Method for the qualitative identification of asbestos in soil samples*. In addition, the requirement was set for no presence of ACM fragments in a visual survey of the affected areas.

The design of the encapsulation cell was to be cut in 2 benches of 2.5m height, with drainage at the toe of each bench. The material was to be filled at a 1V:3H gradient, with a non-woven geotextile placed over the top, with 1m of clean capping. CMW's geotechnical specification (TGA2016\_0258AK) also required an undrained shear strength of 50kPa.

## 4.3 Remediation methodology

The remediation methodology has been set out in step by step detail within the Aurecon's RAP and ROA. A summary of the methodology is presented below:

- The consolidation of Stockpile A to allow for validation and subsequent undercut of clean material, and the creation of half of the encapsulation cell;
- The placement of Stockpile A into the created the lower half of the encapsulation cell, before the validation and subsequent undercut of clean material to allow for the creation of the second half of the encapsulation cell;
- The excavation of Area SP, Stockpile B, and the area surrounding the shed, and placement of this material within the cell;
- Validation sampling of the areas previously containing contaminated material, surrounding areas and the along key haul roads transporting impacted material to the cell;
- Covering and completion of the cell;
- Geotechnical validation of the completed cell by CMW and
- Further remediation of any areas failing validation.

Deviation from the above methodology was noted where the cell was overfilled above design capacity. Excess material was derived where Area SP and Stockpile A, upon excavation, was discovered to be larger than initially thought, and where contaminated material was over-excavated to ensure a resultant clean surface.

A series of photographs showing the remediation progress is presented in Appendix C.

## 5 Validation Works

### 5.1 Introduction

For the remediation area a systematic sampling pattern was chosen for validation in accordance with the methodology set out within *Contaminated Land Management Guide (CLMG) Vol. 5*, and in Section 8.3 of the RAP. Eighty-eight samples were collected from the Site surface, and a further fourteen from an excavation around a failed validation sample.

All soil samples were recovered using a trowel, decontaminated with a modified version of the ASTM D5088<sup>2</sup> procedure (the use of de-ionised water was not considered a requirement for the contaminants of concern). Wastewater from this procedure was disposed of in the ATL water disposal system. Tile fragments were collected with a gloved hand, with gloves changed between samples. Material was placed into clean jars provided by the laboratory and placed in a chilly bin for transport to the IANZ accredited Analytica Laboratories under chain of custody. Plans showing the location of validation samples are presented within Appendix A and certificate of the laboratory analyses included in Appendix D.

### 5.2 Environmental Validation of the Encapsulation Material

Before the encapsulation cell was excavated five additional soil samples (E1 to E5) were collected from the stockpiled asbestos containing material to ensure the material was suitable for containment on Site, and did not contain contaminants other than asbestos. The results of this sampling are presented in Table 1, and included in Appendix D. The location of these samples are shown on Figure A1, Appendix A.

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<sup>2</sup>Standard Practice for Decontamination of Field Equipment Used at Waste: ASTM D5088-15a; Subcommittee D18.21 on Groundwater and Vadose Zone Investigations.

Table 1 Environmental soil results

Analyte	Units	LOR	Background <sup>1</sup>	Tier 1 Criteria	Sample					
					E1	E2	E3	E4	E5	
<b>Metals in Soil</b>										
Arsenic	mg/kg dry wt	0.125	12.67	20 <sup>2</sup>	10.40	8.01	6.90	8.22	5.81	
Beryllium	mg/kg dry wt	0.013		20 <sup>4</sup>	0.82	0.82	0.84	0.92	0.74	
Boron	mg/kg dry wt	1.25		NL <sup>2</sup>	3.22	2.19	2.94	2.77	1.98	
Cadmium	mg/kg dry wt	0.005	0.28	3 <sup>2</sup>	0.32	0.15	0.27	0.27	0.24	
Chromium	mg/kg dry wt	0.125		460 <sup>2</sup>	11.40	6.22	5.17	6.58	4.42	
Copper	mg/kg dry wt	0.075	40.17	NL <sup>2</sup>	30.40	15.60	20.80	20.70	14.80	
Lead	mg/kg dry wt	0.05	30.08	210 <sup>2</sup>	32.50	14.50	13.80	19.30	16.00	
Mercury	mg/kg dry wt	0.025		310 <sup>2</sup>	0.17	0.10	0.10	0.13	0.12	
Nickel	mg/kg dry wt	0.05	32.88		4.68	2.56	1.76	2.88	2.11	
Zinc	mg/kg dry wt	0.05	101.8		92.80	59.10	61.10	92.60	61.60	
<b>TPH in Soil</b>										
C7-C9	mg/kg dry wt	10			<10	<10	<10	<10	<10	
C10-C14	mg/kg dry wt	15			<15	<15	<15	<15	<15	
C15-C36	mg/kg dry wt	25			<25	<25	<25	<25	<25	
C7-C36 (Total)	mg/kg dry wt	50			<50	<50	<50	<50	<50	
<b>PAH in Soil</b>										
1-Methylnaphthalene	mg/kg	0.01			<0.01	<0.01	<0.01	<0.01	<0.01	
2-Methylnaphthalene	mg/kg	0.01			<0.01	<0.01	<0.01	<0.01	<0.01	
Acenaphthene	mg/kg	0.01			<0.01	<0.01	<0.01	<0.01	<0.01	
Acenaphthylene	mg/kg	0.01			<0.01	<0.01	<0.01	<0.01	<0.01	
Anthracene	mg/kg	0.01			<0.01	<0.01	<0.01	<0.01	<0.01	
Benz[a]anthracene	mg/kg	0.02			<0.02	<0.02	<0.02	<0.02	<0.02	
Benzo[a]pyrene	mg/kg	0.01			<0.01	<0.01	<0.01	<0.01	<0.01	
Benzo[b]fluoranthene	mg/kg	0.02			<0.02	<0.02	<0.02	<0.02	<0.02	
Benzo[g,h,i]perylene	mg/kg	0.02			<0.02	<0.02	<0.02	<0.02	<0.02	
Benzo[k]fluoranthene	mg/kg	0.01			<0.01	<0.01	<0.01	<0.01	<0.01	
Chrysene	mg/kg	0.01			<0.01	<0.01	<0.01	<0.01	<0.01	
Dibenz[a,h]anthracene	mg/kg	0.01			<0.01	<0.01	<0.01	<0.01	<0.01	
Fluoranthene	mg/kg	0.02			<0.02	<0.02	<0.02	<0.02	<0.02	
Fluorene	mg/kg	0.01			<0.01	<0.01	<0.01	<0.01	<0.01	
Indeno[1,2,3-cd]pyrene	mg/kg	0.01		0.15 <sup>3</sup>	0.01	<0.01	<0.01	<0.01	<0.01	
Naphthalene	mg/kg	0.01			<0.01	<0.01	<0.01	<0.01	<0.01	
Phenanthrene	mg/kg	0.01			<0.01	<0.01	<0.01	<0.01	<0.01	
Pyrene	mg/kg	0.02			<0.02	<0.02	<0.02	<0.02	<0.02	
Benzo[a]pyrene TEQ (LOR)	mg/kg	0.01			0.03	0.03	0.03	0.03	0.03	
Benzo[a]pyrene TEQ (Zero)	mg/kg	0.01			<0.01	<0.01	<0.01	<0.01	<0.01	
Background <sup>1</sup>	Background values taken from PBC - Predicted Background Soil Concentrations, New Zealand Landcare Research Limited				<0.02	Result below method detection limit				
Tier 1 Criteria <sup>2</sup>	Methodology for Deriving Soil Guideline Values Protective of Human Health (MfE, 2011)				0.99	Result below background values				
Tier 1 Criteria <sup>3</sup>	Regional Screening Levels for Chemical Contaminants at Superfund Sites (US EPA regions 3, 6 and 9)				0.01	Result below adopted tier 1 screening criteria				
Tier 1 Criteria <sup>4</sup>	Guideline on the Investigation Levels for Soil and Groundwater (NEPC, 1999)									

### 5.3 Cell construction observations

The first stage of cell construction was to stockpile the lower half of Stockpile A onto the upper half, this material was then kept moist whilst the clean material below was sampled and validated before excavation for use elsewhere on site. 15 validation samples were collected, Kaimai Views 1 to 9 on 13 October 2017, and Kaimai Views 10 to 15 collected on 16 October 2017, shown on Figure A2, Appendix A.

During excavation, more contaminated material was found to be in-situ beneath the lower half of Stockpile A than was expected, and thus the decision was taken to excavate the full extent of the encapsulation cell, including the contingency space. The clean natural material was undercut, and drainage installed as per the encapsulation cell design<sup>3</sup>.

<sup>3</sup> TGA2016\_0258AK Rev0 Letter – Fill Containment 09062017



**Figure 7** Installation of drainage layer at base of lower tier of encapsulation cell

Once the lower half of the encapsulation cell had been constructed, the material from Stockpile A was placed into it from above, whilst being kept damp to prevent release of asbestos fibres. The material was then to be compacted in accordance with CMW's geotechnical specification under the regular supervision of the project geotechnical engineer.

Once Stockpile A was placed into the encapsulation cell, the natural material underlying its former location was sampled and validated before excavation for use elsewhere on site. 17 validation samples were collected, Kaimai Views 16 to 21 on 16 November 2017, and Kaimai Views 22 to 32 collected on 20 November 2017, shown on Figure A2, Appendix A. The clean natural material was then undercut, and drainage installed as per the encapsulation cell design.

The remaining asbestos containing materials from Area SP, Stockpile B, and Area TP-6 were excavated into 25 tonne dump trucks and placed into the upper half of the cell. The cell was then covered with a geotextile capping layer, before placement of clean capping material. CMW have provided certification of the geotechnical stability of the containment cell, *Fill Containment Embankment Certification Letter – 336-344 Omokoroa Road, Omokoroa, TGA2016\_0258AQ, July 2018*, included in Appendix E

## 5.4 Validation of the asbestos contaminated areas

Prior to collection of validation samples, a visual screening was undertaken in accordance with the methodology set out within Section 4.1.1 of the Western Australian guidelines<sup>4</sup> and identified no visible ACM-fragments on the Site surface. The Site surface presented for validation was natural ash soils. The contractor excavated the visible fill from the remediation areas, before scraping back the top surface (approximately 0.1 m depth) of the natural soils and placing this material in the encapsulation cell also.

<sup>4</sup>Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia – Western Australia May 2009

The results of the validation testing are included in Appendix D are summarised in Table 2.

**Table 2 Summary of validation testing**

Sample Name	Result
V041 to V058	No asbestos Detected
V060, V061, and V063 to V069	No Asbestos Detected
V075	Chrysotile (white asbestos) Fibres
V083, V084, V089 to V129	No Asbestos Detected

In total 70 validation samples were collected, in addition to the 30 previously collected from under Stockpile A, shown on Figure A2, Appendix A.

Asbestos fibres (chrysotile) were detected in one validation sample (V075), taken from the area surrounding the former shed.

## 5.5 Adjacent stockpile validation

A stockpile of topsoil intended for use as clean cover stood adjacent to the remediation area through the duration of the works. To ensure that wind-blown dust containing asbestos fibres had not been created during the works and caused contamination outside of the area, ten samples were collected from the surface of this stockpile and analysed. The results of this testing are presented in Table 3.

**Table 3 Topsoil stockpile results**

Sample Name	Reporting Limit	Total Sample Weight (g)	Analysis Result
TS1	0.01%	102.5	No asbestos detected
TS2	0.01%	112.5	No asbestos detected
TS3	0.01%	101.0	No asbestos detected
TS4	0.01%	97.5	No asbestos detected
TS5	0.01%	140.5	No asbestos detected
TS6	0.01%	161.0	No asbestos detected
TS7	0.01%	209.0	No asbestos detected
TS8	0.01%	110.0	No asbestos detected
TS9	0.01%	104.0	No asbestos detected
TS10	0.01%	97.0	No asbestos detected

## 5.6 Further remediation and validation

Validation sample V075 was found to contain chrysotile asbestos fibres. An exclusion zone set up and this area fenced off. Further excavation was undertaken in this area on 29 May, with the material being removed from Site to landfill. This works was overseen by ATL, and carried out by A&J Demolition Ltd in accordance with the asbestos removal control plan (ARCP) prepared by ATL which is presented in Appendix F. The excavator was parked on a platform above the affected area and loaded material directly into a lined tipper truck. The tipper truck was parked on a pad lined with geotextile for loading.

## 5.7 Waste disposal

All contaminated material was placed in the cell, with the exception of 19 m<sup>3</sup> excavated from the area surrounding V075 as part of rework to clean Area TP6. This material was disposed at Green Park landfill in Oropi. A copy of waste disposal records was provided by the Contractor and are presented in Appendix G of this report.

## 5.8 Air monitoring

In addition to the soil validation testing air monitoring was undertaken during the physical works on Site. The air monitoring did not record results above trace levels, as defined in the BRANZ Guidelines for Assessing and Managing Asbestos in soil (0.01 f/ml in air). The results of this air monitoring are presented in Appendix H.

## 5.9 Outstanding works

Due to lack of available site won clean cover at the time of completion, the capping cover over the containment cell has not been instated to its full proposed 1m thickness; current capping thickness is shown on LCL drawing 163252-AB-021 to range from 0.6 m to 1.4 m. We understand that it is proposed to fulfil the conditions of consent this work is to be carried out during the 2018-2019 earthworks season, a process for which should be included within the Ongoing Monitoring and Management Plan (OMMP). The completion of the capping layer, demonstrable by provision of updated as-built drawings shall be certified by Aurecon's SQEP, prior to any further landscaping works being undertaken or the area being made accessible for public access.

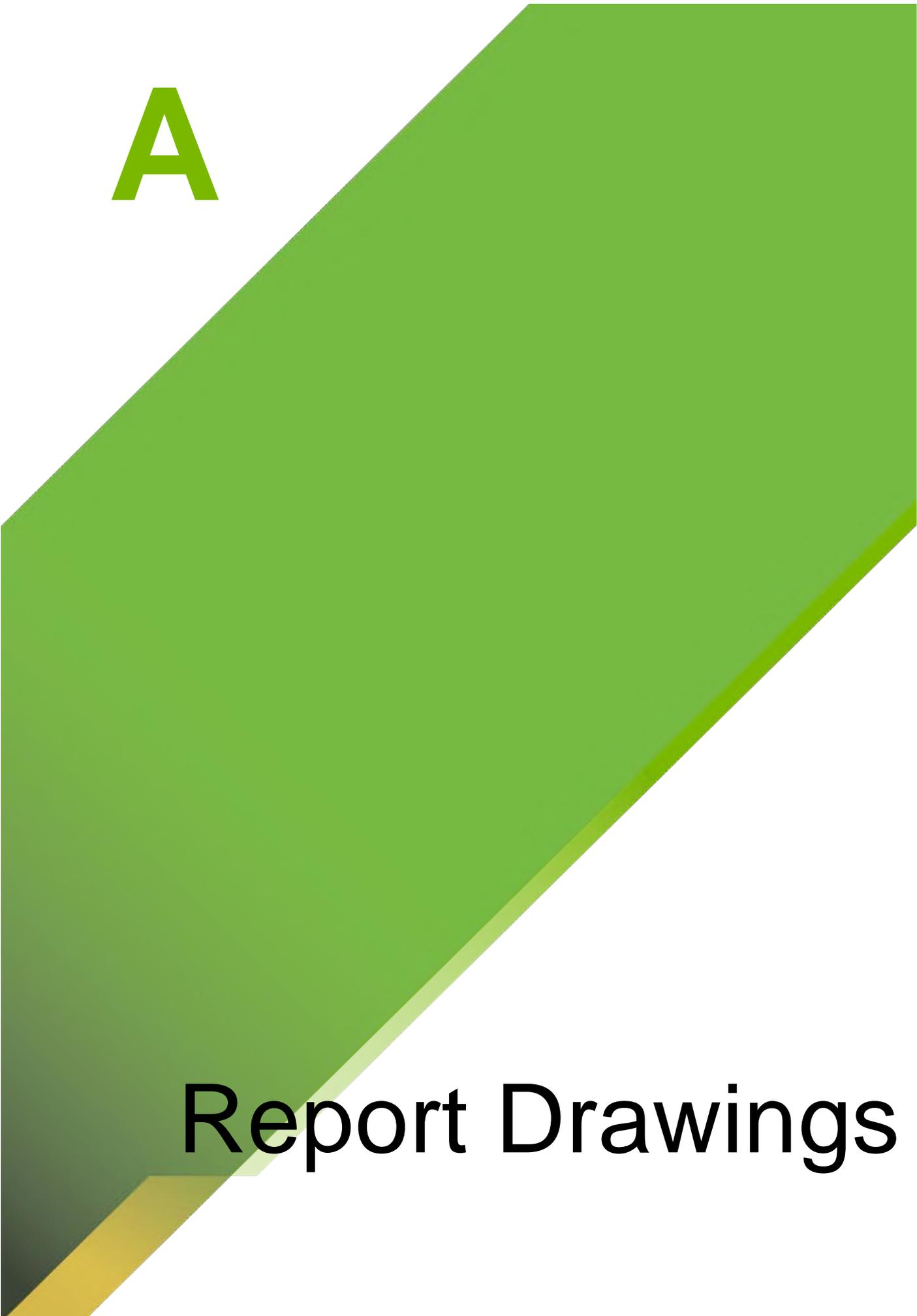
# 6 Summary of remediation effectiveness

The evidence provided as a result of documented earthworks, construction observations and validation testing demonstrate that the asbestos impacted material has been removed from all proposed residential areas of the site and contained within the encapsulation cell, and that the site is now suitable for residential development and as reserve (public open space). Earthworks outside of the asbestos encapsulation cell can continue without further asbestos related restrictions.

On the basis that the cleanfill capping over the top of the cell has not been placed to the full design thickness, the design requirements as set out within the SVR have not been achieved. We recommend that works to bring the capping layer to the design thickness shall be completed prior to any further landscaping or maintenance works being undertaken in the area of the cell, or it being made accessible for use to the public until the full cap thickness is established.

No further soil disturbance works should occur within the area of the encapsulation cell without engaging a SQEP and a Worksafe-accredited asbestos specialist. The reserve containing the containment cell has confirmed soil contamination, so any further development considerations (including future soil disturbance and removal) within the reserve shall be considered with respect to the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health Regulations and Bay of Plenty Natural Resources Plan.

All other works within the wider subdivision should be undertaken subject to recommendations made by LCL's validation reports. In the event further unidentified contamination is encountered on site it is recommended that work is stopped immediately and that a SQEP is consulted for further advice.



A

Report Drawings

# Appendix A

## Report Drawings



**B**

**Consents**

# Appendix B

## Consents

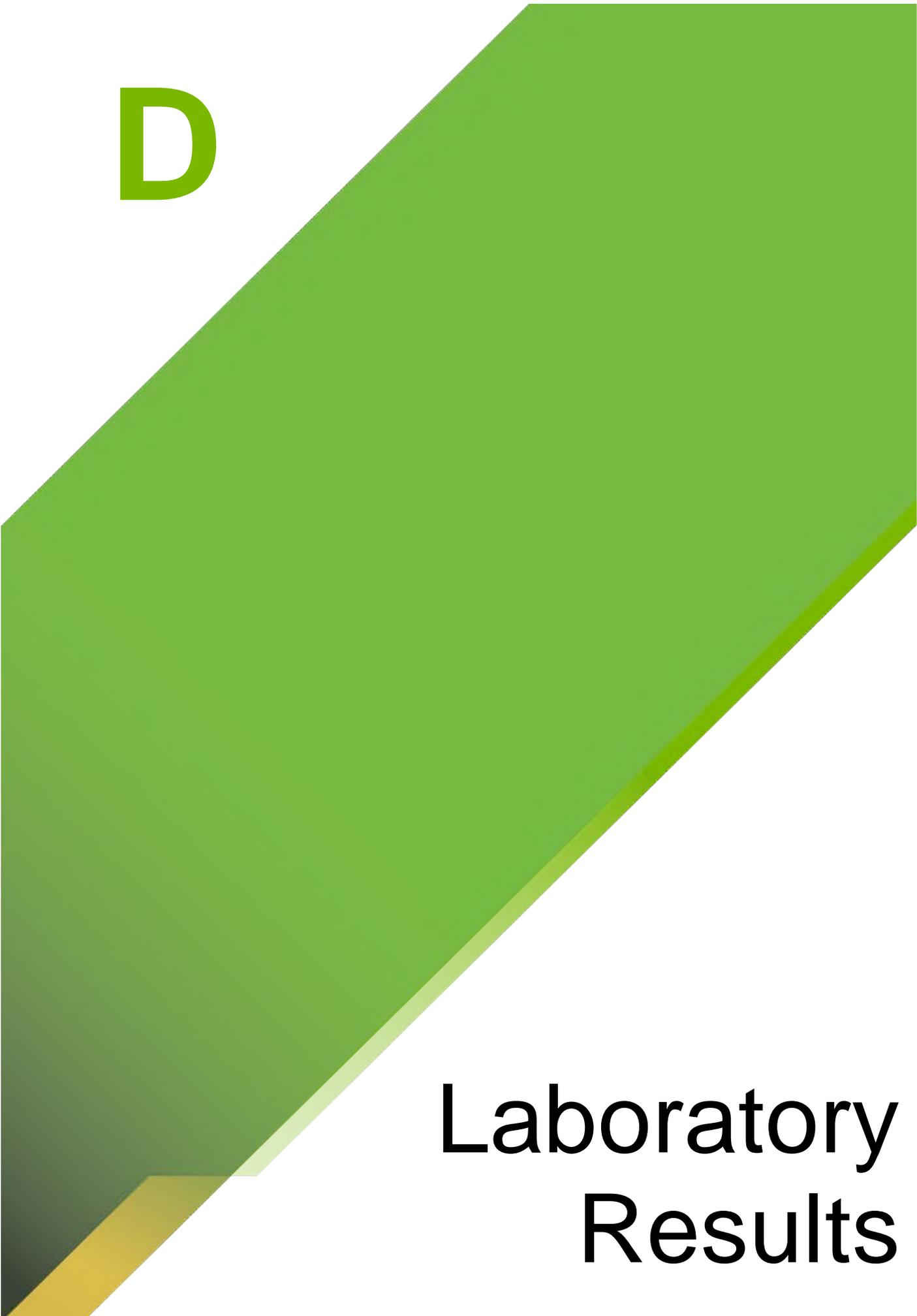


C

Site Photographs

# Appendix C

## Site Photographs



D

Laboratory  
Results

# Appendix D

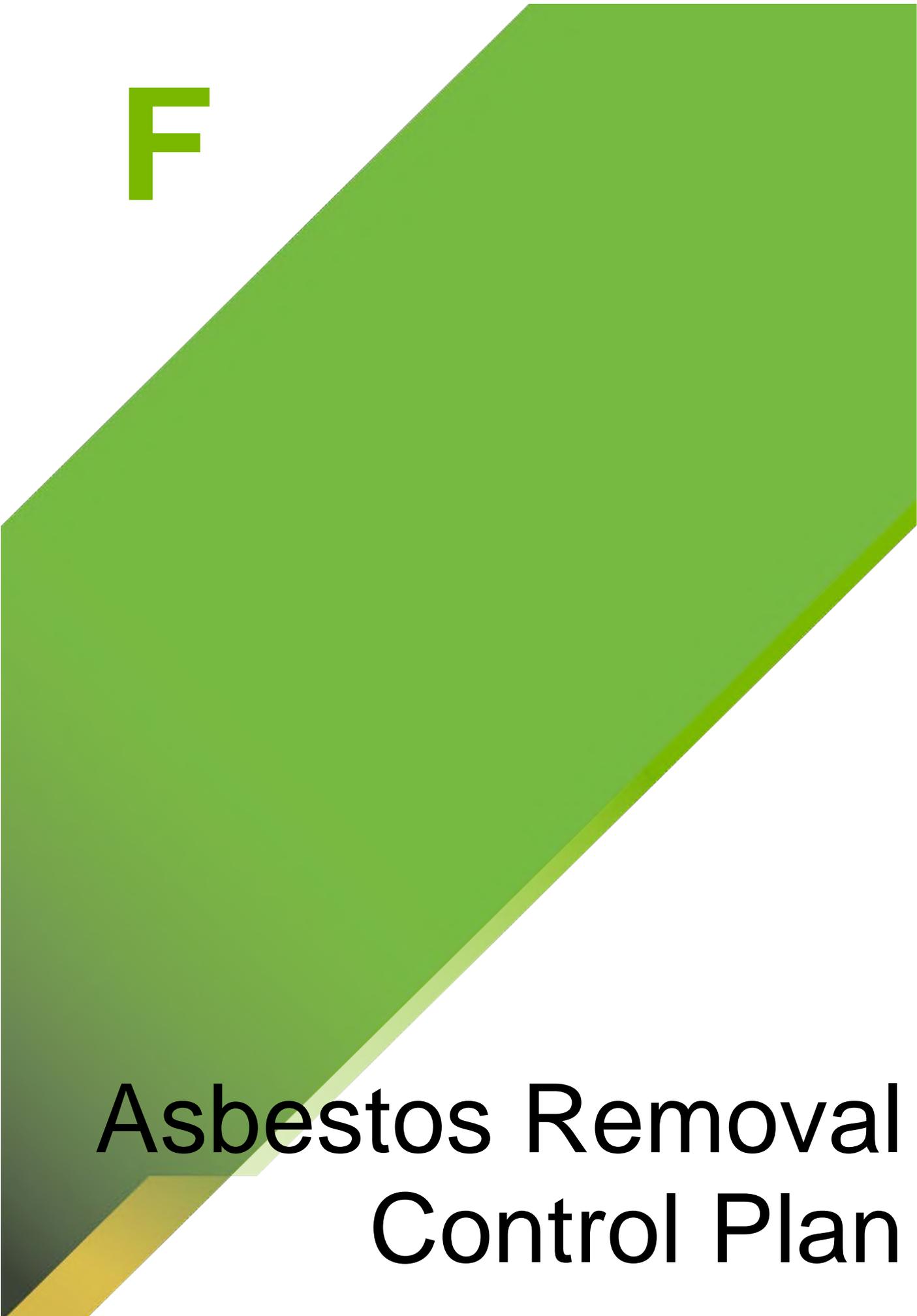
## Laboratory Results

A stylized graphic of a green leaf with a yellow stem and a large green letter 'E' in the upper left corner. The leaf is oriented vertically, with the stem at the bottom left and the tip at the top right. The main body of the leaf is a vibrant green, while the stem is a lighter, yellowish-green. The letter 'E' is a solid green color and is positioned in the upper left quadrant of the image.

E

Geotechnical  
Reports

Appendix E  
Geotechnical Reports



**F**

# Asbestos Removal Control Plan

# Appendix F

## Asbestos Removal Control Plan

A large green polygon with a diagonal cutout, containing a green letter 'G' and the text 'Waste Disposal Records'. The polygon is oriented with its top-left corner at the top-left of the page and its bottom-right corner at the bottom-right. The cutout is a smaller, similar polygon nested within the larger one, creating a diagonal gap. The letter 'G' is positioned in the upper-left area of the green shape. The text 'Waste Disposal Records' is located in the lower-right area, partially overlapping the cutout.

**G**

**Waste Disposal  
Records**

# Appendix G

## Waste Disposal Records

A large green graphic with a diagonal cutout. The top-left corner is cut off by a diagonal line. The bottom-left corner features a yellow wedge shape. The text 'H' is located in the upper left area, and 'Air Monitoring Results' is in the lower right area.

H

**Air Monitoring  
Results**

# Appendix H

## Air Monitoring Results

**Document prepared by**

**Aurecon New Zealand Limited**  
Ground Level 247 Cameron Road  
Tauranga 3110  
PO Box 2292  
Tauranga 3140  
New Zealand

**T** +64 7 578 6183  
**F** +64 7 578 6143  
**E** [tauranga@aurecongroup.com](mailto:tauranga@aurecongroup.com)  
**W** [aurecongroup.com](http://aurecongroup.com)

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Swaziland, Tanzania, Thailand, Uganda,  
United Arab Emirates, Vietnam, Zambia,



9 June 2017

Document Ref: TGA2016\_0258AK Rev0

Classic Developments Omokoroa Ltd  
PO Box 864  
Tauranga 3140

Attention: Bruce Cuff

Dear Bruce,

**RE: GEOTECHNICAL REPORT FOR FILL CONTAINMENT EMBANKMENT  
KAIMAI VIEW RESIDENTIAL SUBDIVISION – 336-344 OMOKOROA ROAD, OMOKOROA**

## **1 INTRODUCTION**

CMW Geosciences (NZ) Limited (CMW) have been engaged by Classic Developments Omokoroa Ltd to carry out a geotechnical assessment for a proposed fill embankment as part of the development of the Kaimai Views Residential Subdivision at 336-344 Omokoroa Road, Omokoroa (formerly known as Omokoroa Special Housing Area).

CMW has previously carried out a geotechnical investigation for the proposed subdivision development, with the results of the investigation presented in the CMW Geotechnical Investigation Report (GIR) for Omokoroa Road Special Housing Area (referenced TGA2016\_0258AB, dated 18 August 2016).

It is understood that recent earthworks on site has exposed some existing uncontrolled fill adjacent to a gully escarpment within the vicinity of proposed Lot 36. Inspection and testing of this fill by an Environmental Scientist from Aurecon has reported that approximately 5,000m<sup>3</sup> of uncontrolled fill contains various building materials including the presence of Asbestos. To minimise further handling and disturbance of the uncontrolled fill, it is planned to dispose of the fill on-site within a dedicated fill containment area where it is intended to not impose further risk to the proposed residential development. The proposed fill containment area is shown on the attached Figure 70.

This supplementary geotechnical assessment has been requested to evaluate the stability of the proposed fill embankment and to provide geotechnical recommendations with regards to embankment construction. This report is not intended to assess the environmental effects of the fill embankment, which is currently being completed by others.

## **2 LANDFORM**

The site of the proposed fill containment embankment originally contained an avocado orchard which has recently been removed in preparation for subdivision development. The general area comprises a broad elevated terrace at between RL 15.5m to RL 22m which gently grades at approximately 5 degrees to the horizontal towards an incised gully in the northwest. The gully comprises moderately steep escarpments of approximately 20 to 30 degrees to the horizontal which fall across a vertical distance of 5 to 7 metres.

A perennial watercourse is situated in the base of the gully, which feeds into the Kayelene Place stormwater system and Omokoroa Golf Course in the north. A stormwater attenuation pond is currently under construction within the gully immediately downstream (west) of the fill embankment which will operate as a sediment pond during earthworks over the following 12 months, and later a permanent stormwater attenuation pond following subdivision development. The Lysaght design drawings for the embankment dam indicate the crest of the emergency spillway will be at RL 15.4m (Moturiki Datum) (ie toe of fill embankment) and the long-term dead storage level of the pond at RL 13.21m.

The site has recently been cleared of vegetation and topsoil in preparation of bulk earthworks. Some filling has occurred upslope within the vicinity of the proposed allotments while the asbestos contaminated fill has been stockpiled within the fill disposal area. The stockpiles have been observed as part of the walkover assessment by an Engineering Geologist from CMW, which identified the uncontrolled fill as comprising predominantly sandy silt soils with some organic material and building rubble comprising concrete and timber.

### 3 PROPOSED DEVELOPMENT

The proposed fill embankment configuration is presented on the appended Lysaght Design Drawings and reproduced on the attached Figures 70 to 73.

Those drawings show that the proposed earthfill embankment extends across the elevated terrace above the gully escarpment, behind proposed lots 73 to 83, measuring approximately 150m in length and 50m wide. The fill volume of the embankment will be increased by excavating across the natural slope at approximate RL 15.5m (Moturiki Datum) where cuts of up to 5m will be required.

The excavation will be backfilled with the asbestos contaminated soils to RL 23m and a 1m cover of topsoil will be placed across the fill (to meet WBOPDC topsoil cover requirements) with a maximum cumulative fill thickness of 8.5m. The outer batter will be formed to 1:3 (vertical:horizontal) and graded towards the gully escarpment to the west. It is understood the area will become a dedicated council-owned reserve as part of the Kaimai Views Subdivision development.

It is understood a winter earthworks consent is being applied for with the intention to construct the containment as soon as possible to mitigate further environmental hazards associated with stockpiling this material on site. A Remedial Action Plan and Earthworks Construction Methodology is currently being prepared by others to address any contamination or health & safety concerns during construction.

### 4 PREVIOUS INVESTIGATIONS

A number of previous geotechnical investigations associated with the proposed subdivision development have been carried out within close proximity to the proposed fill embankment and are described in the following reports:

- CMW Geotechnical Investigation Report (GIR) for Omokoroa Road Special Housing Area (referenced TGA2016\_0258AB, dated 18 August 2016);
- CMW Geotechnical Design Report for Pond 1 Earthfill Embankment Dam (referenced TGA2016\_0293AB, dated 7 February 2017);
- CMW Technical Memorandum – Assessment of Proposed Borrow Area for Earthfill Dam Construction Materials (referenced TGA2016\_0258AG, dated 22 December 2016); and
- CMW Technical Memorandum – Assessment of Soil Conditions within 1200mm Diameter Stormwater Thrust Pipe (referenced TGA2016\_0258AH, dated 26 January 2017).

The approximate locations of the relevant investigation boreholes and Cone Penetrometer Tests (CPTs) referred to in the above reports are shown on Figure 70 attached.

## 5 GROUND MODEL

Based on the investigation results presented within the above reports and our experience with the site, the following ground model has been established:

- The main geological unit underlying the site comprises stiff to very stiff sandy silts and silty sands of the Matua Subgroup. Undrained shear strengths derived from hand shear vane results ranged from 70kPa to >190kPa, with the average value being approximately 80kPa.
- A layer of firm clayey silt occurs within the Matua Subgroup profile where recorded undrained shear strengths were noticeably lower, at around 40 to 60kPa. The firm clayey silts were encountered at a depth of approximately 7m below the upper terrace and also near the base of the gully.
- Beneath the Matua Subgroup, at approximately 10 to 15m below existing ground level, dense sands were encountered in the machine borehole drilled near the invert of the gully (MBH02) which coincide with an abrupt increase in the CPT cone resistance ( $q_c$ ) at this level, and is inferred to be weathered ignimbrite.
- Across the gently sloping upper terrace, the typical sequence of volcanic ash deposits were encountered beneath the topsoil layer, to collective depths of approximately 2.5m. The sequence comprised stiff to very stiff clayey silts of the Younger (Post-Rotoehu) ash underlain by fine grained sands of the Rotoehu ash, which was in turn underlain by Hamilton ash, comprising very stiff to hard clayey silts. Undrained shear strengths within the Younger ash ranged from 80kPa to 130kPa whilst undrained shear strengths in the Hamilton ash were >196kPa.
- Within the lower slopes of the gully escarpment, colluvium comprising stiff to very stiff clayey silt was encountered to a maximum depth of 1.8m. Undrained shear strengths within the colluvium ranged from 56kPa to 154kPa.
- Groundwater was not encountered in the investigation holes across the upper terrace, however was encountered in the majority of the hand auger boreholes located near the base of the gully and was encountered at a similar level to the stream water level.
- Some minor springs and groundwater seepage has been observed within the gully escarpments within the vicinity of the disposal site. Additionally, given the presence of the layered soil profile with contrasting permeability, it is considered there is the potential for perched groundwater levels to develop within the more permeable sandy soils during and following periods of intense or prolonged rainfall.

Representative ground profiles were generated from the Lysaght survey data provided and geological cross sections A-A to C-C were developed as shown on Figures 71 to 73.

## 6 ENGINEERING EVALUATION AND RECOMMENDATIONS

### 6.1 Slope Stability

#### 6.1.1 Assessment Criteria

Specific slope stability analyses were completed for the critical proposed ground profile across the site, represented by Cross Sections B-B, to assess the stability of the proposed fill embankment under a range of conditions and with respect to the following criteria:

<b>Slope Stability Case</b>	<b>Required Factor of Safety (FoS)</b>
Prevailing groundwater conditions	1.5
Elevated groundwater conditions	1.2
ULS seismic case	1.0

The analyses included an assessment of the Peak Ground Acceleration (PGA) for the Ultimate Limit State (ULS) design seismic event in accordance with the NZTA Bridge Manual (2014) and NZGS Earthquake Geotechnical Engineering Practice: Module 1 (2016). No information has been provided with regards to the Importance Level (IL) of the fill embankment, therefore analyses have considered a range of IL's between IL2 and IL4.

Calculations of the PGA adopted the conservative Class C site subsoil condition and assumed a 50 year design working life, and are summarised in Table 2 below:

<b>Importance Level (IL)</b>	<b>Subsoil Site Classification</b>	<b>PGA</b>
Importance Level 2 (1/500 Annual Probability of Exceedance)	Class C	0.29
Importance Level 3 (1/1000 Annual Probability of Exceedance)	Class C	0.37
Importance Level 4 (1/2500 Annual Probability of Exceedance)	Class C	0.52

### 6.1.2 Design Parameters

Shear strength parameters for the Matua Subgroup subsoils were calibrated by completing a back analysis of the pre-development ground profile under elevated groundwater conditions to achieve a factor of safety of close to 1. Effective stress soil parameters for the remaining units were based on the results of the investigation and past experience in modelling these materials. These parameters are summarised in Table 3 below:

<b>Soil Unit Name</b>	<b>Unit Weight (kN/m<sup>3</sup>)</b>	<b>Effective Stress Soil Cohesion (kPa)</b>	<b>Effective Stress Friction Angle (degrees)</b>	<b>Undrained Shear Strength (kPa)</b>
Engineer certified fill	16	5	30	150
Topsoil	14	2	28	50
Track-rolled Fill	15	2	30	50
Colluvium	16	5	30	50

Younger Ash	16	5	30	80
Hamilton Ash	17	10	25	120
Stiff to v.stiff sandy silt (Upper Matua Subgroup)	16	3	30	80
Firm clayey silt (Upper Matua Subgroup)	16	2	28	40
Stiff sandy silt (Lower Matua Subgroup)	16	3	30	80
Dense sand (Inferred Ignimbrite)	16	5	40	NA

A 12kPa uniformly distributed load has been applied to the area above the fill embankment to account for additional building loads imposed within the residential subdivision properties.

A sensitivity analyses has been completed for the track-rolled fill material to assess the suitability of the design batter gradient and the significance that the properties of the contained fill has on the overall embankment stability.

### 6.1.3 Analyses Results

Analyses were undertaken using the software package Slide Version 6, adopting the general Limit Equilibrium-Morgenstern Price method for the critical Cross Section B-B, with the results summarised in Table 4 below. Selected stability printouts are appended.

<b>Slope Stability Case</b>	<b>Min. Required Factor of Safety (FoS)</b>	<b>FoS Achieved</b>
Prevailing groundwater conditions	1.5	1.50
Elevated groundwater conditions	1.2	1.24
ULS seismic case – IL2	1.0	1.35
ULS seismic case – IL3	1.0	1.19
ULS seismic case – IL4	1.0	0.98

Results of the analyses indicate that the design fill embankment depicted by Cross Section B-B provides acceptable factors of safety (FoS) against slope instability under prevailing and elevated groundwater conditions. Furthermore, adopting a conservative subsoil Class C site and a 50 year design working life, the design fill embankment achieves the minimum global FoS requirement using the undrained shear strengths presented in Table 3 for an Importance Level 2 and 3 structure, however marginally falls outside the FoS requirement for an IL4 structure.

For the seismic case, the “yield” acceleration (ie the PGA to achieve a FoS = 1.0) is around 0.50g. Therefore, using the Ambraseys & Menu (1988)<sup>1</sup> the estimated displacement from the IL4 ULS design earthquake event is insignificant (ie <1mm). This indicates the magnitude of displacement of the fill embankment is likely to be relatively minor, and the release of release of any contained fill material as a result of an IL4 ULS seismic event is considered very low.

#### 6.1.4 Sensitivity Analyses

A sensitivity analyses was completed for the track-rolled fill material to assess the geological parameters for both the prevailing groundwater (typical long-term operating conditions) and elevated porewater pressure (ru) case and a design embankment gradient of 1:3 (vertical:horizontal). The results of the sensitivity analyses are summarised in Table 5 below and indicate the design fill embankment gradient of 1:3 is considered appropriate in maintaining internal stability of the contained uncontrolled fill:

Stability Case	Unit	Unit Weight (t/m <sup>3</sup> )	Effective Stress Soil Cohesion, c' (kPa)	Effective Stress Friction Angle, $\phi$ (degrees)	FoS Achieved
Prevailing groundwater (ru=0.1)	Track-rolled fill	15	0	25	1.43
Elevated porewater pressure (ru=0.3)	Track-rolled fill	15	0	25	1.05

## 6.2 Earthworks Recommendations

### 6.2.1 General

All earthworks must be carried out in general accordance with the requirements of NZS 4431 and the requirements of the WBOPDC 2009 Development Code under the guidance of a suitably qualified and experienced Geotechnical Engineer.

Earthworks must also be carried out in accordance with the recommendations provided in the following documents:

- GIR for the proposed subdivision development supplemented by the recommendations provided in this report; and
- The Remedial Action Plan and Earthworks Construction Methodology (currently being prepared by others).

### 6.2.2 Excavations

To provide adequate volumes for fill containment, excavation to approximate RL 15.5m (Moturiki Datum) are proposed. Beneath the topsoil layer, excavations are expected to encounter initially friable silts of the Younger ash, as outlined in the CMW subdivision GIR, dated 18 August 2016. These materials, together with the underlying Hamilton ash and intermediate lense of Rotoehu ash have been successfully earthworked around the region and typically require minimal moisture conditioning during the summer months to be suitable for use as engineered fill.

<sup>1</sup> N. N. Ambraseys & J. M. Menu, Earthquake-Induced Ground Displacements, *Earthquake engineering and Structural Dynamics*, Vol 16, pg 985-1006, 1998

Within deeper cuts beneath 2 to 2.5m, soils of the underlying Matua Subgroup are likely to be encountered, which typically contain much higher moisture contents, sometimes approaching the soil liquid limit and are highly sensitive, which can make them particularly challenging to earthwork. These materials can be used within engineered fills although the amount of drying, blending and compaction effort required should not be underestimated. Additionally, the non-plasticity fine-grained silt of the Matua Subgroup soils can make them susceptible to piping erosion, therefore these soils should be avoided where they may become exposed to surface or groundwater flows.

### 6.2.3 Cut and Fill Batters

To maintain adequate factors of safety against slope instability, permanent fill batters for the embankment comprising track-rolled variable fills and min. 1m thick topsoil cover should be formed to no steeper than 1:3 (V:H). Following topsoiling, surface protection against erosion shall be implemented, and may include mulching until vegetation is established or the use of geofabrics.

Temporary cut batters shall be formed no steeper than 1:1 (vertical:horizontal) where no signs of groundwater seepage is observed. Benches shall be provided at maximum 2.5m vertical heights to maintain an overall cut gradient (bench plus batter) of 1(V):2.5(H), as shown of Figures 71 to 73. Where temporary cut batters are proposed to exceed this grade during earthworks, further advice should be obtained from the project geotechnical engineer.

### 6.2.4 Subsoil Drains

Several springs have previously been identified in the general area, therefore, the likelihood of encountering springs/seepage during excavations is considered likely. Subsoil drainage must be installed at the toe of each cut batter and shall comprise 100mm diameter perforated drainage coil with filter sock along the toe with a cover of coarse sand or drainage aggregate wrapped in geotextile (ie Bidim A19 or similar). Each drain will terminate into a central subsoil drain that runs towards and discharges near the toe of the gully via a solid wall pipe. A 200mm thick drainage blanket comprising granular sand or pumice shall be applied across the base of the excavation with the excavation profiled to fall towards a central subsoil drain. Indicative subsoil drain locations have been shown on Figure 70, however shall be confirmed by the project geotechnical engineer on site.

All installed subsoil drains shall be surveyed by the project surveyor and included on the earthworks as-built plans.

### 6.2.5 Earthfill Construction

The prepared base and benched excavation should be inspected by the project geotechnical engineer. The uncontrolled fill may then be placed, spread and compacted within the excavation in controlled 200mm (loose) lifts under the supervision of a geotechnical engineer and environmental engineer in accordance with the requirements of the Asbestos Management Plan and construction specification.

Each lift should be compacted by track-rolling with at least 4 passes with a min. 20-tonne excavator. The moisture condition of the uncontrolled fill shall be controlled to maintain within a plastic state (for cohesive soils) and should be within  $\pm 2\%$  of Optimum Moisture Content. This may require wetting down during compaction and protecting stockpiles from infiltration of rain and stormwater runoff.

Each layer of fill shall be proof-rolled to confirm the construction methodology is suitable, fill conditions and an adequate level of uniform compaction is achieved, under the regular supervision of the project geotechnical engineer.

The topsoil cover should also be compacted using a similar methodology in 200mm layers with each layer compacted by either track-rolling with the excavator or the use of specific compaction plant.

## 7 LIMITATIONS

This report has been prepared for use by our client Classic Developments Omokoroa Ltd, their consultants and the Western Bay of Plenty District Council. Liability for its use is limited to these parties and to the scope of work for which it was prepared as it may not contain sufficient information for other parties or for other purposes.

It should be noted that factual data for this report has been obtained from discrete locations using normal geotechnical investigation techniques. As such investigation methods by their nature only provide information about a relatively small volume of subsoils, 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 the report. If variations in the subsoils occur from those described or assumed to exist then the matter should be referred back to CMW immediately.

**For and on behalf of  
CMW Geosciences (NZ) Ltd**

Prepared by:



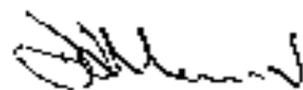
**Robert Taylor**  
Senior Geotechnical Engineer

Reviewed by:



**Matt Packard**  
Senior Geotechnical Engineer  
MIPENZ, CPEng  
TCC Category 1 Geotechnical Engineer

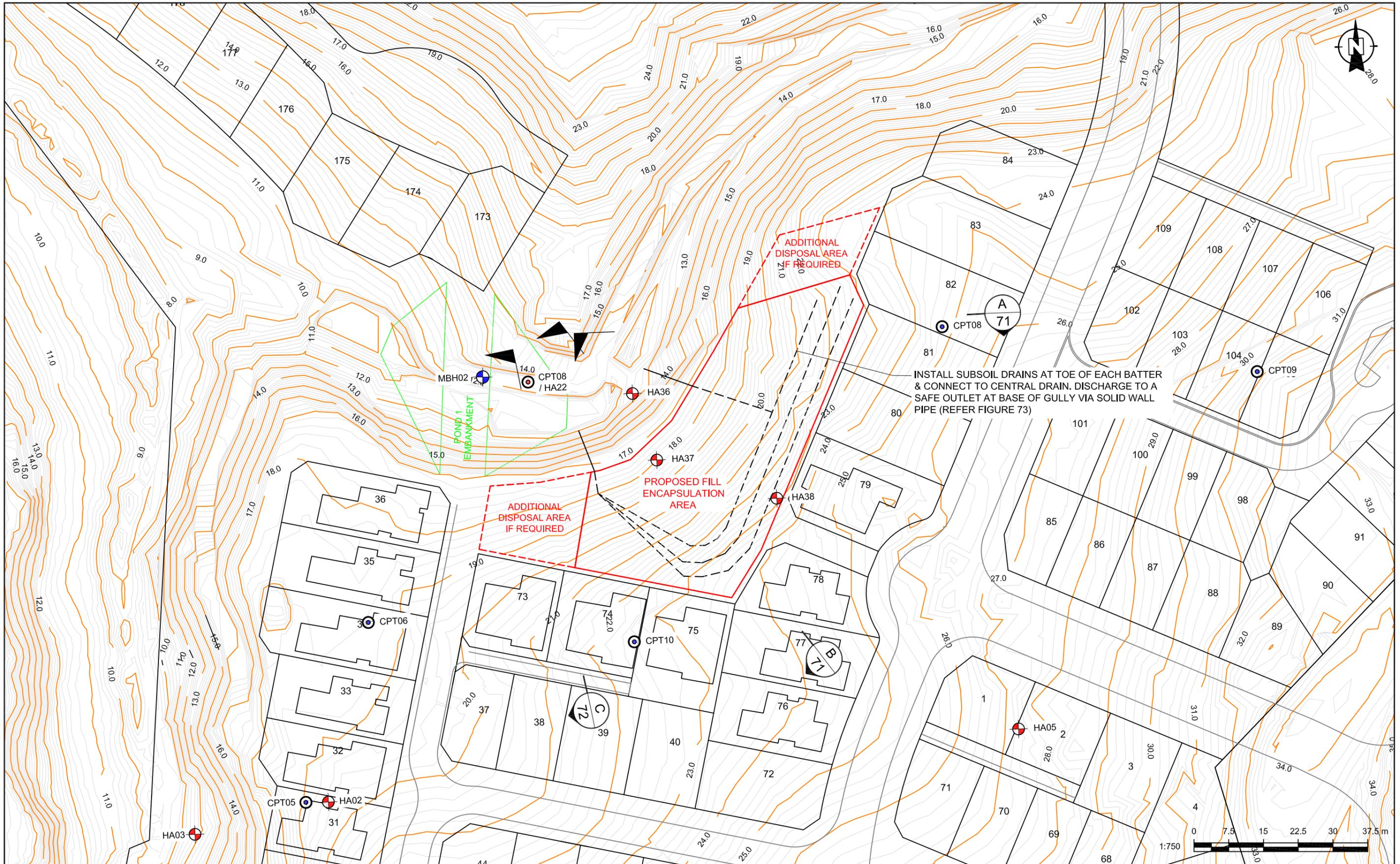
Reviewed and approved by:



**Dave Morton**  
Principal Geotechnical Engineer  
MIPENZ, CPEng  
TCC Category 1 Geotechnical Engineer

Attachments: *Figure 70 - Geotechnical Investigation Plan*  
*Figure 71 – Cross Section A-A*  
*Figure 72 – Cross Section B-B*  
*Figure 73 – Cross Section C-C*  
*Lysaght Consultant Limited Contaminated Material Disposal Plans, Drawings No's 163252-SKT-31 & -32 dated 10/03/2017*  
*Engineering Borehole Logs*  
*Cone Penetrometer Test (CPT) Results*  
*Select Slope Stability Outputs*

Distribution: 1 copy Classic Developments Omokoroa Limited (electronic)  
1 copy Lysaght Consultants Limited (electronic)  
Original held by CMW Geosciences Ltd



**LEGEND:**

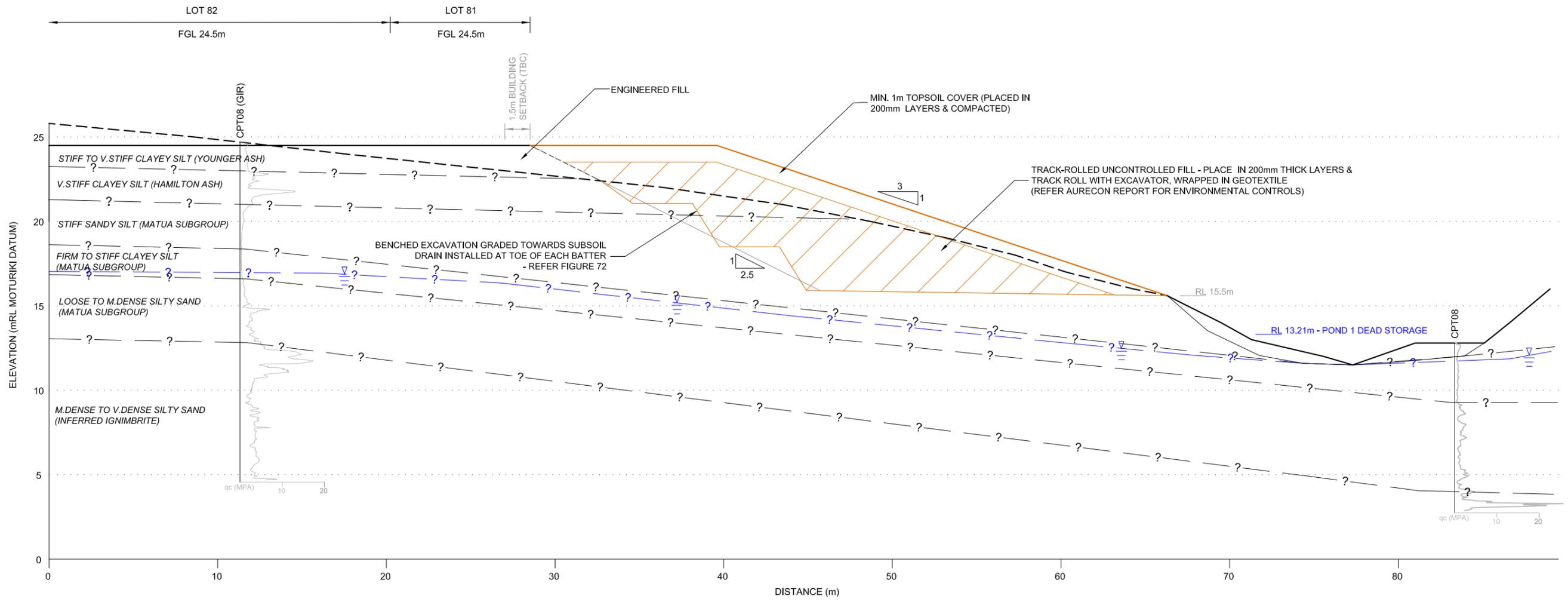
-  DENOTES APPROXIMATE EXTENT OF FILL DISPOSAL AREA
-  DENOTES HAND AUGER (HA) BOREHOLE (CMW GIR - NOV 2016)
-  DENOTES CONE PENETROMETER TEST (CPT) (CMW GIR - NOV 2016)
-  DENOTES MACHINE BOREHOLE (MBH) (CMW POND 1 DAM - FEB 2017)
-  DENOTES CONE PENETROMETER TEST (CPT) (CMW POND 1 DAM - FEB 2017)

**NOTES:**

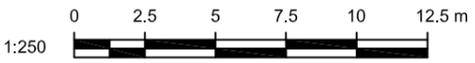
1. CONTOURS ARE PRE-DEVELOPMENT CONTOURS SHOWN AT 0.2 METRE INTERVALS (MOTURIKI DATUM)
2. DEVELOPMENT LAYOUT OBTAINED FROM LYSAGHT CONTOUR PLANS PROVIDED



CLIENT: <b>CLASSIC DEVELOPMENTS OMOKOROA LTD</b>	DRAWN: RT	PROJECT: TGA2016-0258
PROJECT: <b>KAIMAI VIEWS - STAGE 1 336-344 OMOKOROA ROAD, OMOKOROA</b>	CHECKED: MP	FIGURE: 70
TITLE: <b>SITE PLAN - ASBESTOS FILL DISPOSAL</b>	REVISION: 0	SCALE: 1:750
	DATE: 25/05/2017	SHEET: A3 L



CROSS SECTION A-A



**LEGEND:**

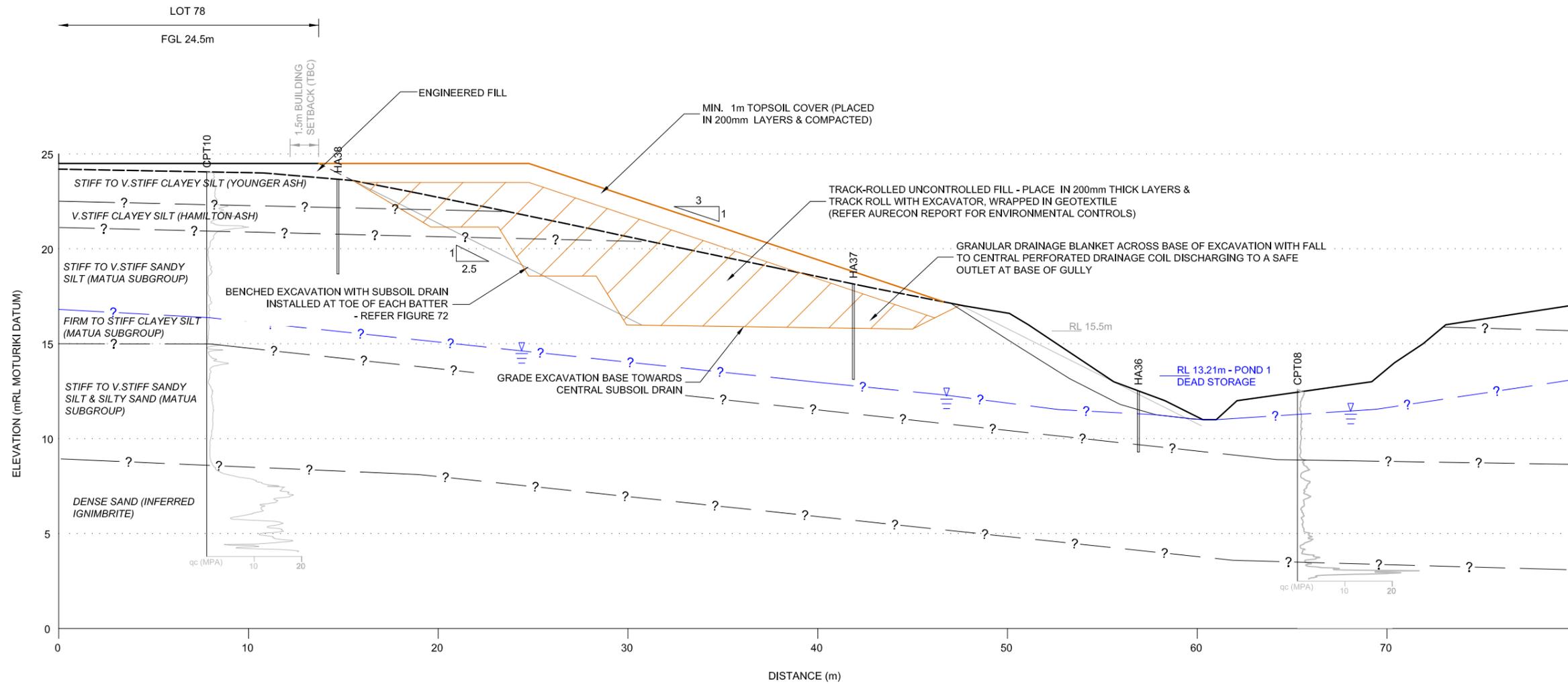
---	PRE-DEVELOPMENT GROUND SURFACE
—	PROPOSED GROUND SURFACE (POST DEVELOPMENT)
—	PROPOSED UNCONTROLLED FILL ENCAPSULATION

**NOTES:**

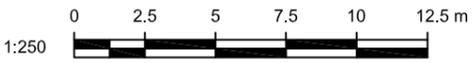
- CROSS SECTIONS DERIVED FROM LYSAGHT CONSULTANTS LTD CONTOUR PLANS REFERENCING BOTH SURVEY AND LIDAR DATA



CLIENT: <b>CLASSIC DEVELOPMENTS OMOKOROA LTD</b>	DRAWN: RT	PROJECT: TGA2016-0258
PROJECT: <b>KAIMAI VIEWS - FILL ENCAPSULATION</b> 336-344 OMOKOROA ROAD, OMOKOROA	CHECKED: MP	FIGURE: 71
TITLE: <b>CROSS SECTION A-A</b>	REVISION: 0	SCALE: 1:250
	DATE: 25/05/2017	SHEET: A3 L



CROSS SECTION B-B



**LEGEND:**

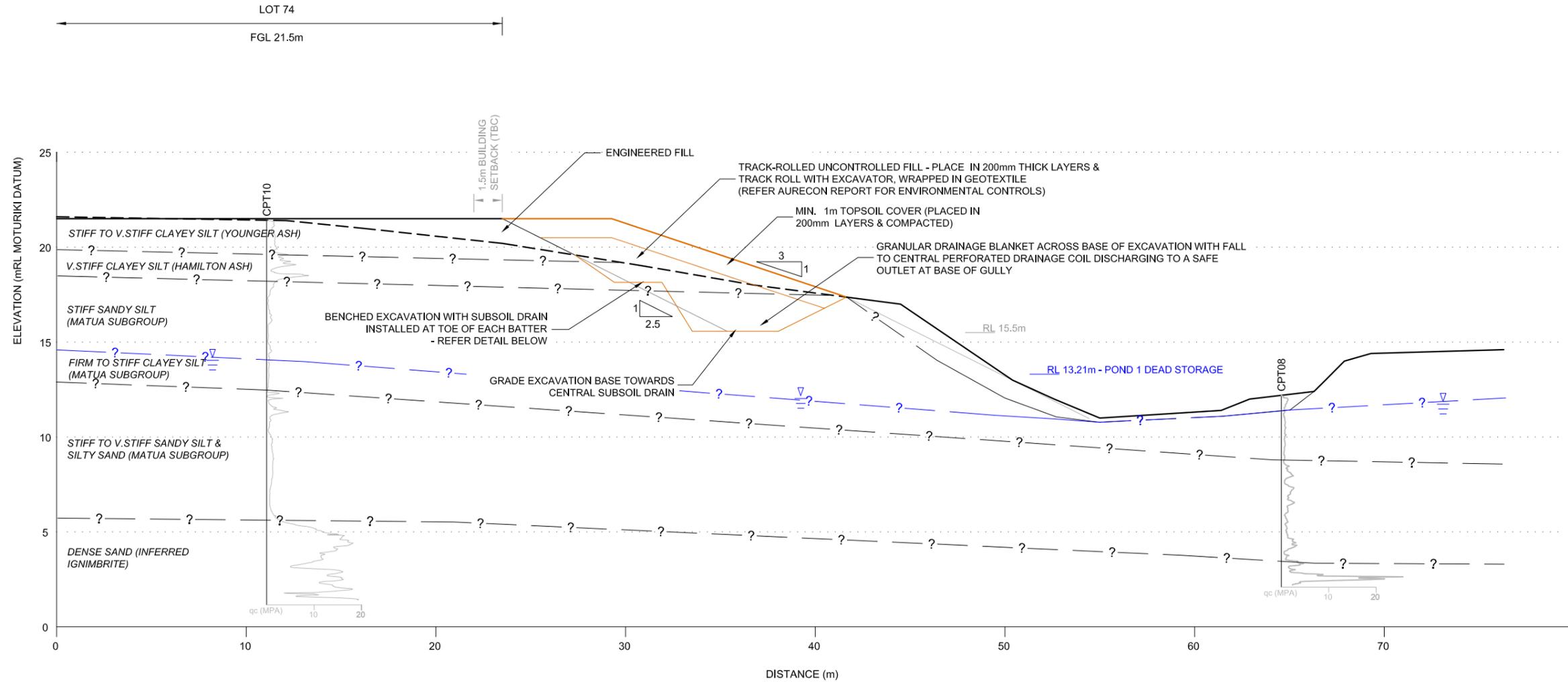
---	PRE-DEVELOPMENT GROUND SURFACE
—	PROPOSED GROUND SURFACE (POST DEVELOPMENT)
—	PROPOSED UNCONTROLLED FILL ENCAPSULATION

**NOTES:**

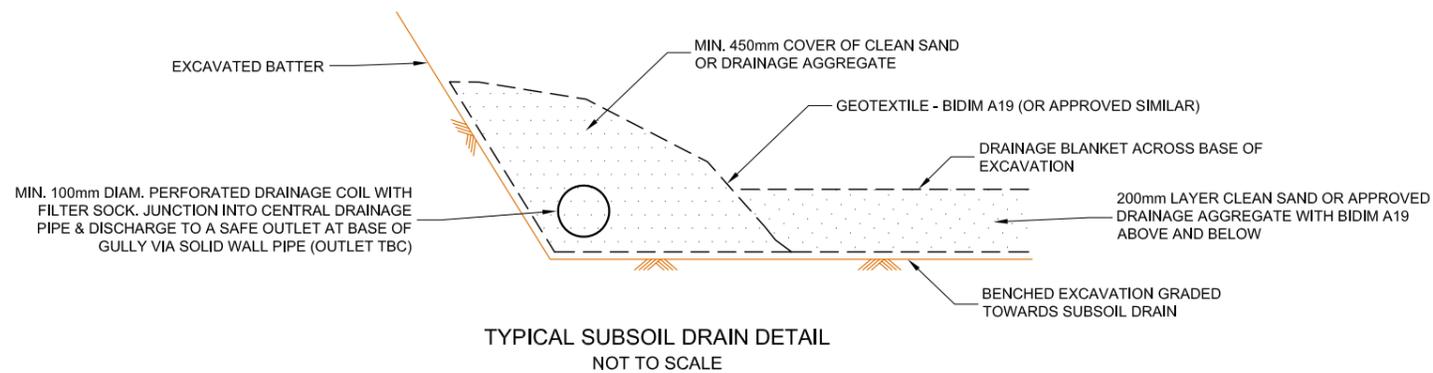
- CROSS SECTIONS DERIVED FROM LYSAGHT CONSULTANTS LTD CONTOUR PLANS REFERENCING BOTH SURVEY AND LIDAR DATA



CLIENT: <b>CLASSIC DEVELOPMENTS OMOKOROA LTD</b>	DRAWN: RT	PROJECT: TGA2016-0258
PROJECT: <b>KAIMAI VIEWS - FILL ENCAPSULATION</b> 336-344 OMOKOROA ROAD, OMOKOROA	CHECKED: MP	FIGURE: 72
TITLE: <b>CROSS SECTION B-B</b>	REVISION: 0	SCALE: 1:250
	DATE: 25/05/2017	SHEET: A3 L



CROSS SECTION C-C



**LEGEND:**

---	PRE-DEVELOPMENT GROUND SURFACE
—	PROPOSED GROUND SURFACE (POST DEVELOPMENT)
—	PROPOSED UNCONTROLLED FILL ENCAPSULATION

**NOTES:**

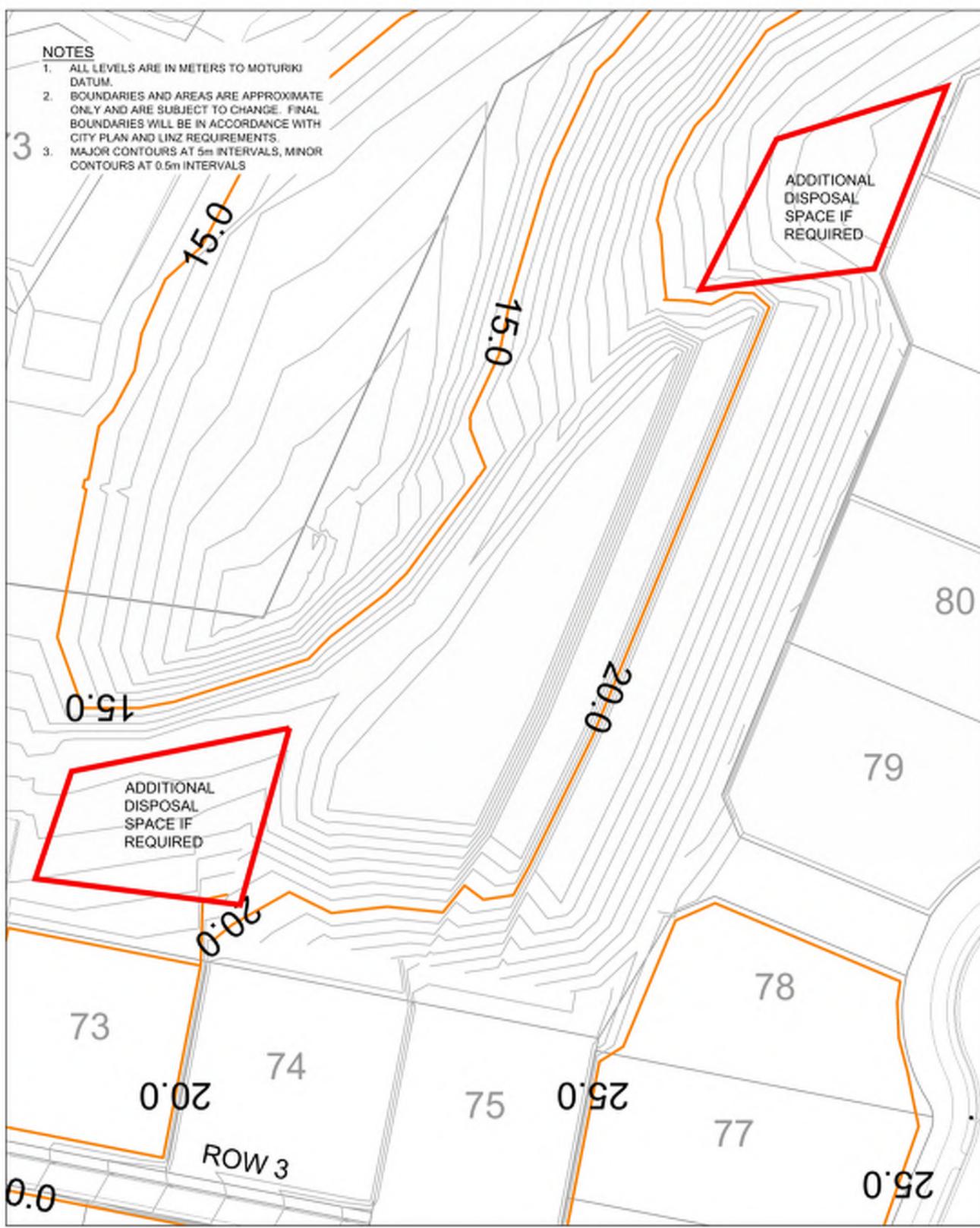
- CROSS SECTIONS DERIVED FROM LYSAGHT CONSULTANTS LTD CONTOUR PLANS REFERENCING BOTH SURVEY AND LIDAR DATA



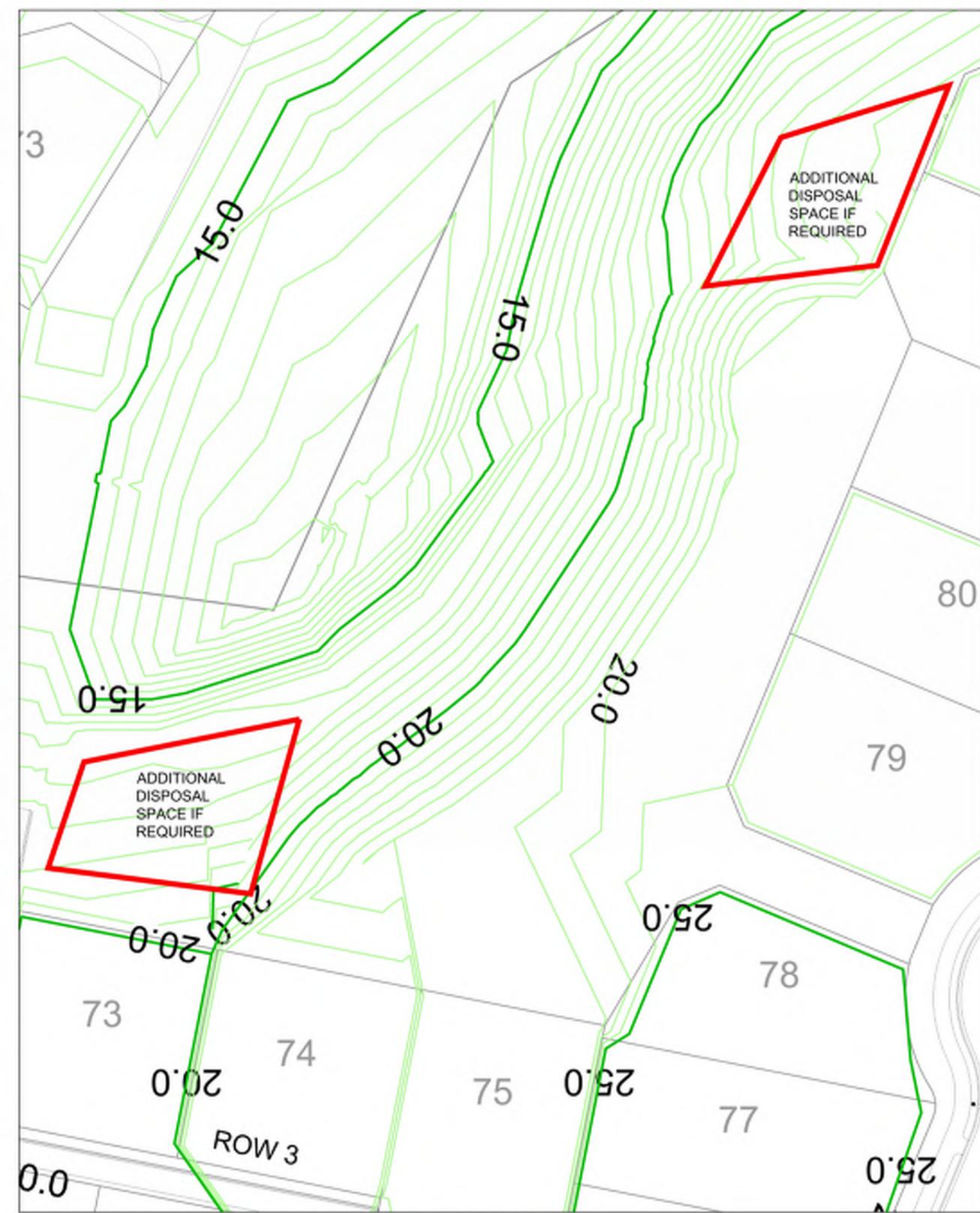
CLIENT: <b>CLASSIC DEVELOPMENTS OMOKOROA LTD</b>	DRAWN: RT	PROJECT: TGA2016-0258
PROJECT: <b>KAIMAI VIEWS - FILL ENCAPSULATION</b> 336-344 OMOKOROA ROAD, OMOKOROA	CHECKED: MP	FIGURE: 73
TITLE: <b>CROSS SECTION C-C</b>	REVISION: 0	SCALE: 1:250
	DATE: 25/05/2017	SHEET: A3 L



- NOTES**
1. ALL LEVELS ARE IN METERS TO MOTURIKI DATUM.
  2. BOUNDARIES AND AREAS ARE APPROXIMATE ONLY AND ARE SUBJECT TO CHANGE. FINAL BOUNDARIES WILL BE IN ACCORDANCE WITH CITY PLAN AND LINZ REQUIREMENTS.
  3. MAJOR CONTOURS AT 5m INTERVALS, MINOR CONTOURS AT 0.5m INTERVALS



EXCAVATION  
SCALE 1:500



FINISHED SURFACE  
SCALE 1:500

No.	Date	Revision Details	By	Ver.	App.
A	10/03/17	FOR APPROVAL	AV		

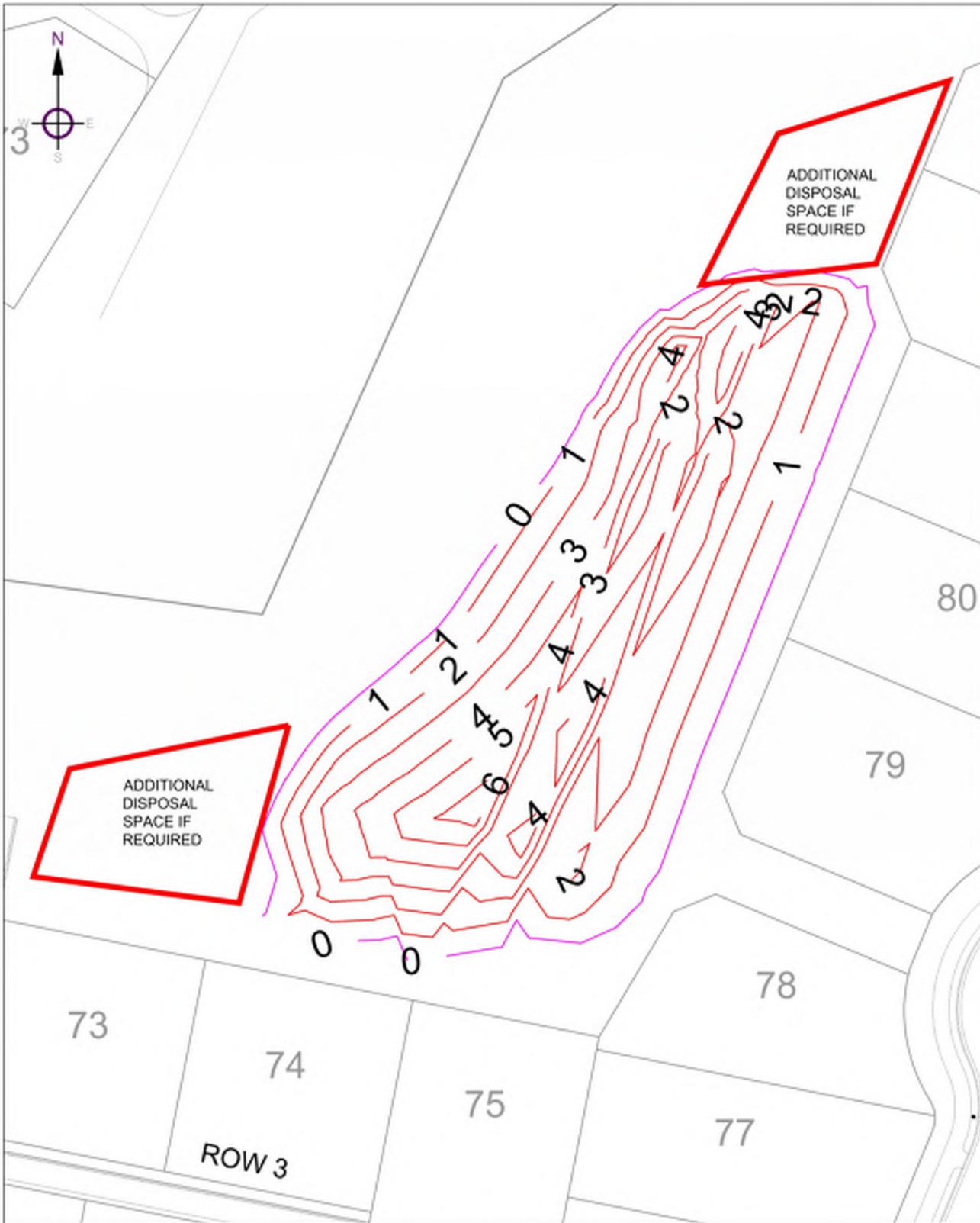

**LYSAGHT**  
 SURVEYING, ENGINEERING & LAND DEVELOPMENT  
 19 Totara St, Mount Maunganui 3116 Ph 07 578 8798 www.lysaght.net.nz

Project:  
 CLASSIC DEVELOPMENTS  
 KAIMAI VIEWS  
 OMOKOROA SPECIAL HOUSING AREA  
 OMOKOROA

Drawing Title:  
 SKETCH  
 CONTAMINATED MATERIAL DISPOSAL

Project No.		163252
Scale (A3)		1:500
Drawing No.	Rev.	
163252-SKT-31	A	

FOR INFORMATION



VOLUME CONTAMINATED MATERIAL TO BE DISPOSED OF:  
 MAIN STOCKPILE - 3600m<sup>3</sup>  
 SMALLER STOCKPILE - 550m<sup>3</sup>  
 IN-SITU 1 - 500m<sup>3</sup>  
 IN-SITU 2 - 100m<sup>3</sup>  
 TOTAL = 4750m<sup>3</sup>

ASSUMED COMPACTION FACTOR WITH TRACK ROLLED MACHINERY 1.2

VOLUME TO BE DISPOSED: 3960m<sup>3</sup>

VOLUME AVAILABLE AS PER DESIGN FOR 1m COVER BELOW DESIGN SURFACE: 4070m<sup>3</sup>

FINAL REMEDIATED AREA 2850m<sup>2</sup>  
 VOLUME OF CLEAN FILL @ 800mm THICK = 2120m<sup>3</sup>  
 PLACE TOPSOIL TO A DEPTH OF 200mm

○ DEPTH OF CONTAMINATED FILL  
 SCALE 1:500

FOR INFORMATION

<table border="1"> <tr> <td>Drawn</td> <td>Signed</td> <td>Date</td> </tr> <tr> <td>AV</td> <td></td> <td>10/03/17</td> </tr> <tr> <td>Designed</td> <td>Signed</td> <td>Date</td> </tr> <tr> <td>AV</td> <td></td> <td>10/03/17</td> </tr> <tr> <td>Verified</td> <td>Signed</td> <td>Date</td> </tr> <tr> <td>PM</td> <td></td> <td>10/03/17</td> </tr> <tr> <td>Approved</td> <td>Signed</td> <td>Date</td> </tr> <tr> <td>PM</td> <td></td> <td>10/03/17</td> </tr> </table>		Drawn	Signed	Date	AV		10/03/17	Designed	Signed	Date	AV		10/03/17	Verified	Signed	Date	PM		10/03/17	Approved	Signed	Date	PM		10/03/17	<p>THIS DRAWING REMAINS THE PROPERTY OF LYSAGHT CONSULTANTS LTD. NO LIABILITY SHALL BE ACCEPTED FOR THE UNAUTHORISED USE OF THIS DRAWING</p> <p><b>LYSAGHT</b></p> <p>SURVEYING, ENGINEERING &amp; LAND DEVELOPMENT        19 Totara St, Mount Maunganui 3116 Ph 07 578 8798 www.lysaght.net.nz</p>	<p>Project:        CLASSIC DEVELOPMENTS        KAIMAI VIEWS        OMOKOROA SPECIAL HOUSING AREA        OMOKOROA</p>	<p>Drawing Title:        SKETCH        CONTAMINATED MATERIAL DISPOSAL        DEPTH OF MATERIAL</p>	<p>Project No.        163252</p> <p>Scale (A3)        1:500</p> <p>Drawing No.        163252-SKT-32</p> <p>Rev.        A</p>
Drawn	Signed	Date																											
AV		10/03/17																											
Designed	Signed	Date																											
AV		10/03/17																											
Verified	Signed	Date																											
PM		10/03/17																											
Approved	Signed	Date																											
PM		10/03/17																											





# HAND AUGER BOREHOLE - HA22

Client: Classics Development Ltd  
 Project: 336, 340, 344 Omokoroa Rd  
 Site Address: Omokoroa, Tauranga  
 Project: TGA2016\_0258  
 Date: 04/11/2016  
 Borehole Location: Refer to Figure



1:25 Sheet 1 of 1

Logged by: LSP Checked by: LPM		Position: E.1875266.5m N.5826656.6m (NZTM) Survey Source: Hand Held GPS		Elevation: Datum:		Hole Diameter: 50mm Angle from horizontal: 90°			
Unit	Groundwater	RL (m)	Depth (m)	Graphic Log	Material Description Soil: USC; Soil type; colour; structure; strength; moisture; bedding; plasticity; sensitivity; additional comments Rock: Weathering; colour; fabric; rock name; strength; additional comments	Moisture Condition Consistency/Relative Density	Shear Strengths (kPa) Peak (Residual)	Dynamic Cone Penetrometer (Blow/100 mm) 5 10 15 20	Comments
Peat					Pt: PEAT: dark brown, mottled light brown, non plastic to low plasticity.		V-124(23)		
Alluvium					ML: Clayey SILT: light orange-brown, low to medium plasticity, sensitive to quick.	St to VSt	V-81(13)		
			1		... minor fine sand.	M	V-161(8)		
Matua Subgroup					ML: Sandy SILT: green-grey, mottled orange, non plastic, quick, sand is fine grained.		V-209(11)		
					ML: Clayey SILT, minor fine sand: blue-grey, low plasticity, insensitive to sensitive, trace green inclusions.		V-145(26)		
			2			Vst to H	V-100(13)		
						s	V-145(35)		
							V-129(77)		
			3		Borehole terminated at 3.0 m				
			4						
			5						

Termination reason: Target Depth Reached

Remarks: Shear vane number 2017.

# HAND AUGER BOREHOLE - HA36

Client: Classics Development Ltd  
 Project: 336, 340, 344 Omokoroa Rd  
 Site Address: Omokoroa, Tauranga  
 Project: TGA2016\_0258  
 Date: 28/11/2016  
 Borehole Location: SW Pipe Alignment



1:25 Sheet 1 of 1

Logged by: LSP Checked by: KB		Position: E.1866689.8m N.5828302.1m (NZTM) Survey Source: Hand Held GPS		Elevation: Datum:		Hole Diameter: 50mm Angle from horizontal: 90°			
Unit	Groundwater	RL (m)	Depth (m)	Graphic Log	Material Description Soil: USC; Soil type; colour; structure; strength; moisture; bedding; plasticity; sensitivity; additional comments Rock: Weathering; colour; fabric; rock name; strength; additional comments	Moisture Condition Consistency/Relative Density	Shear Strengths (kPa) Peak (Residual)	Dynamic Cone Penetrometer (Blow/100 mm) 5 10 15 20	Comments
TS					OL: Organic SILT, minor rootlets: dark brown.	D to M	VSt		
					ML: SILT, trace fine sand: orange-brown, non plastic, moderately sensitive. ... becoming light brown.				
Colluvium			1		ML: Clayey SILT, trace fine to coarse sand: light brown, speckled/mottled orange and grey, low to medium plasticity, moderately sensitive to sensitive. ... trace black inclusions, mottled dark brown.	M	St to VSt		
					ML: Clayey SILT, trace fine sand: brown, mottled dark brown, grey and orange, low plasticity, insensitive. ... poor recovery.				
					ML: Clayey SILT: white, mottled orange, medium plasticity, insensitive to moderately sensitive.				
					ML: Clayey SILT: white, mottled orange, medium plasticity, insensitive to moderately sensitive.				
Matua Subgroup			2		ML: Clayey SILT: white, mottled orange, medium plasticity, insensitive to moderately sensitive.	S	F to St		
					ML: Clayey SILT: white, mottled orange, medium plasticity, insensitive to moderately sensitive.				
					ML: Clayey SILT: white, mottled orange, medium plasticity, insensitive to moderately sensitive. ... becoming blue-grey.				
			3		ML: SILT, minor clay, trace fine sand: blue-grey, low plasticity. Borehole terminated at 3.3 m	H	V-UTP		3.3m: Refusal.
			4						
			5						

Termination reason: Refusal.

Remarks: Groundwater not encountered. Shear vane number 1861. TS stratigraphic code denotes Topsoil.

# HAND AUGER BOREHOLE - HA37

Client: Classics Development Ltd  
 Project: 336, 340, 344 Omokoroa Rd  
 Site Address: Omokoroa, Tauranga  
 Project: TGA2016\_0258  
 Date: 28/11/2016  
 Borehole Location: SW Pipe Alignment



1:25 Sheet 1 of 1

Logged by: LSP Checked by: KB		Position: E.1866704.3m N.5828288.4m (NZTM) Survey Source: Hand Held GPS		Elevation: Datum:		Hole Diameter: 50mm Angle from horizontal: 90°					
Unit	Groundwater	RL (m)	Depth (m)	Graphic Log	Material Description Soil: USC; Soil type; colour; structure; strength; moisture; bedding; plasticity; sensitivity; additional comments Rock: Weathering; colour; fabric; rock name; strength; additional comments	Moisture Condition Consistency/Relative Density	Shear Strengths (kPa) Peak (Residual)	Dynamic Cone Penetrometer (Blow/100 mm) 5 10 15 20	Comments		
Matua Subgroup			1	[Cross-hatched pattern]	ML: SILT, trace rootlets: light brown, mottled dark brown, non plastic, sensitive to extra sensitive.	D to M	V-169(34)				
					ML: SILT, minor fine to medium sand: light orange-brown, non plastic, moderately sensitive to sensitive. ... trace rootlets.		V->196(22)				
					... some fine to medium sand.		V-126(20)				
							V-73(31)				
							V->196(56)				
							V-99(28)				
							V-168(56)				
							V-165(56)				
							V-154(62)				
							V-112(64)				
Matua Subgroup			2	[Cross-hatched pattern]	ML: SILT, minor fine sand: light brown, mottled brown, non plastic, moderately sensitive.	St to VSt	V-95(48)				
					ML: Clayey SILT: light orange-brown, non plastic to low plasticity, moderately sensitive.		V-116(56)				
							V-126(84)				
Matua Subgroup			3	[Cross-hatched pattern]	... becoming light brown.	M					
					ML: Clayey SILT, trace fine sand: light brown, non plastic to low plasticity, insensitive to moderately sensitive.						
Matua Subgroup			4	[Cross-hatched pattern]	ML: Clayey SILT: light grey-brown, low plasticity, insensitive.						
					... mottled orange.						
Matua Subgroup			5	[Cross-hatched pattern]	ML: Clayey SILT: light orange, medium plasticity, insensitive.						
Borehole terminated at 5.0 m											

Termination reason: Target Depth Reached.

Remarks: Groundwater not encountered. Shear vane number 1861.

# HAND AUGER BOREHOLE - HA38

Client: Classics Development Ltd  
 Project: 336, 340, 344 Omokoroa Rd  
 Site Address: Omokoroa, Tauranga  
 Project: TGA2016\_0258  
 Date: 28/11/2016  
 Borehole Location: SW Pipe Alignment

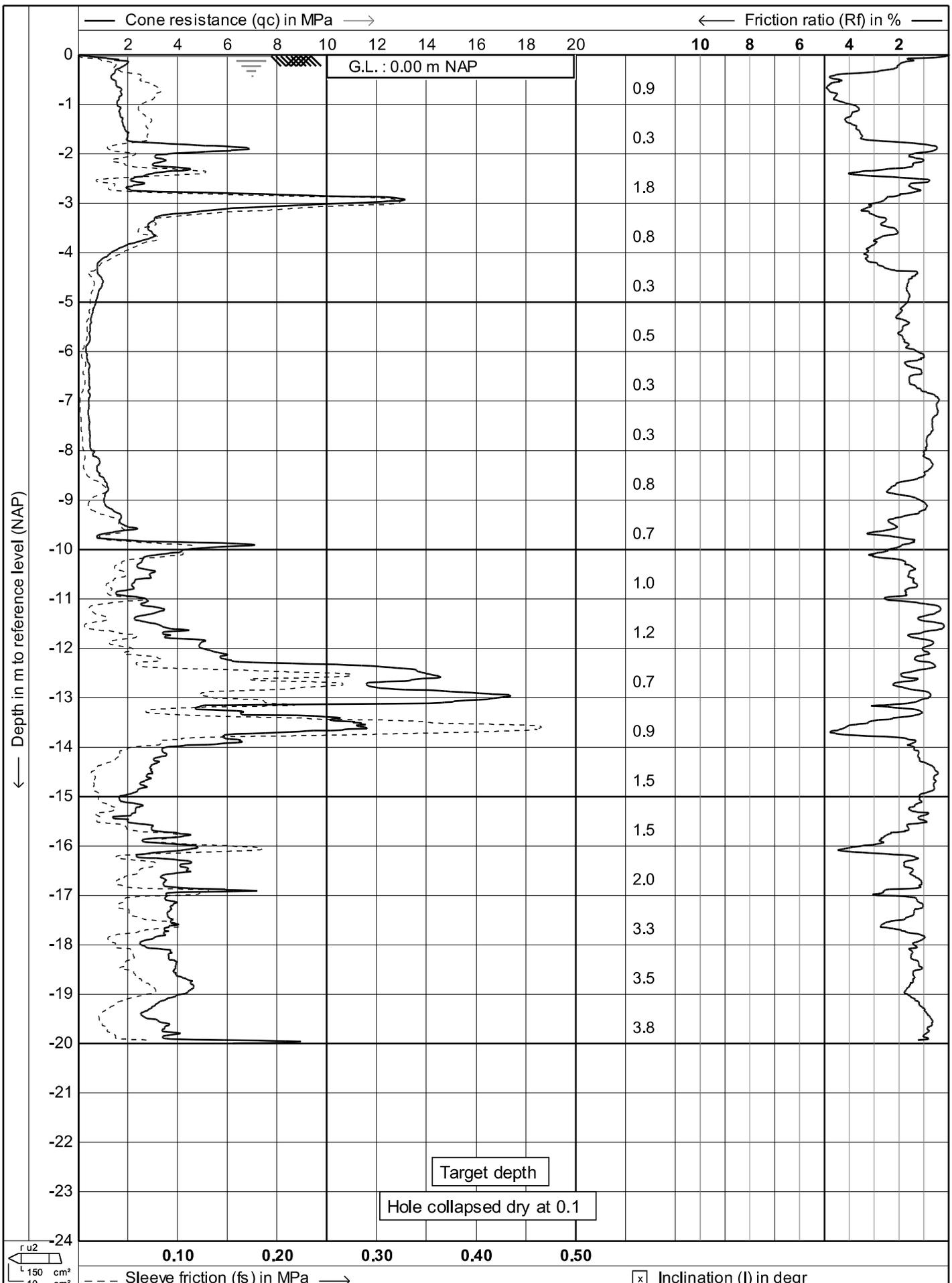


1:25 Sheet 1 of 1

Logged by: LSP Checked by: KB		Position: E.1866719.9m N.5828278.7m (NZTM) Survey Source: Hand Held GPS		Elevation: Datum:		Hole Diameter: 50mm Angle from horizontal: 90°				
Unit	Groundwater	RL (m)	Depth (m)	Graphic Log	Material Description Soil: USC; Soil type; colour; structure; strength; moisture; bedding; plasticity; sensitivity; additional comments Rock: Weathering; colour; fabric; rock name; strength; additional comments	Moisture Condition	Consistency/Relative Density	Shear Strengths (kPa) Peak (Residual)	Dynamic Cone Penetrometer (Blow/100 mm)	Comments
									5 10 15 20	
TS					OL: Organic SILT, minor rootlets: dark brown.					
Younger Ash					ML: SILT, trace fine sand: light orange-brown, mottled brown, non plastic, sensitive.	D to M	St to VSt	V-132(28)		
				ML: SILT, trace fine sand: light orange-brown, non plastic, moderately sensitive.	V-76(17)					
					... some fine sand.					
					SM: Silty fine to medium SAND: light orange-brown, poorly graded.					
RA			1		ML: Clayey SILT, trace fine sand: light creamy brown, non plastic to low plastic, trace black inclusions.	M				
				SP: Fine SAND: light grey, poorly graded.						
Hamilton Ash			2		ML: Clayey SILT: dark brown, low to medium plasticity.	D to M	H	V-UTP		
					ML: SILT: orange-brown, non plastic. ... poor recovery.			V-UTP		
Matua Subgroup			3		ML: Clayey SILT: orange, non plastic to low plasticity, moderately sensitive.	M	St to VSt	V-108(39)		
					ML: Clayey SILT: light brown, low to medium plasticity, insensitive to moderately sensitive.			V-109(32)		
				... trace fine sand and black inclusions.	V-84(39)					
				... mottled orange.	V-155(76)					
			4		Borehole terminated at 4.0 m			V-70(28)		
			5							

Termination reason: Target Depth Reached.

Remarks: Groundwater not encountered. Shear vane number 1861. TS stratigraphic code denotes Topsoil and RA stratigraphic code denotes Rotoehu Ash.



Test according A.S.T.M Standard D 5778-12

Project : **Site Investigations**

Location: **336**

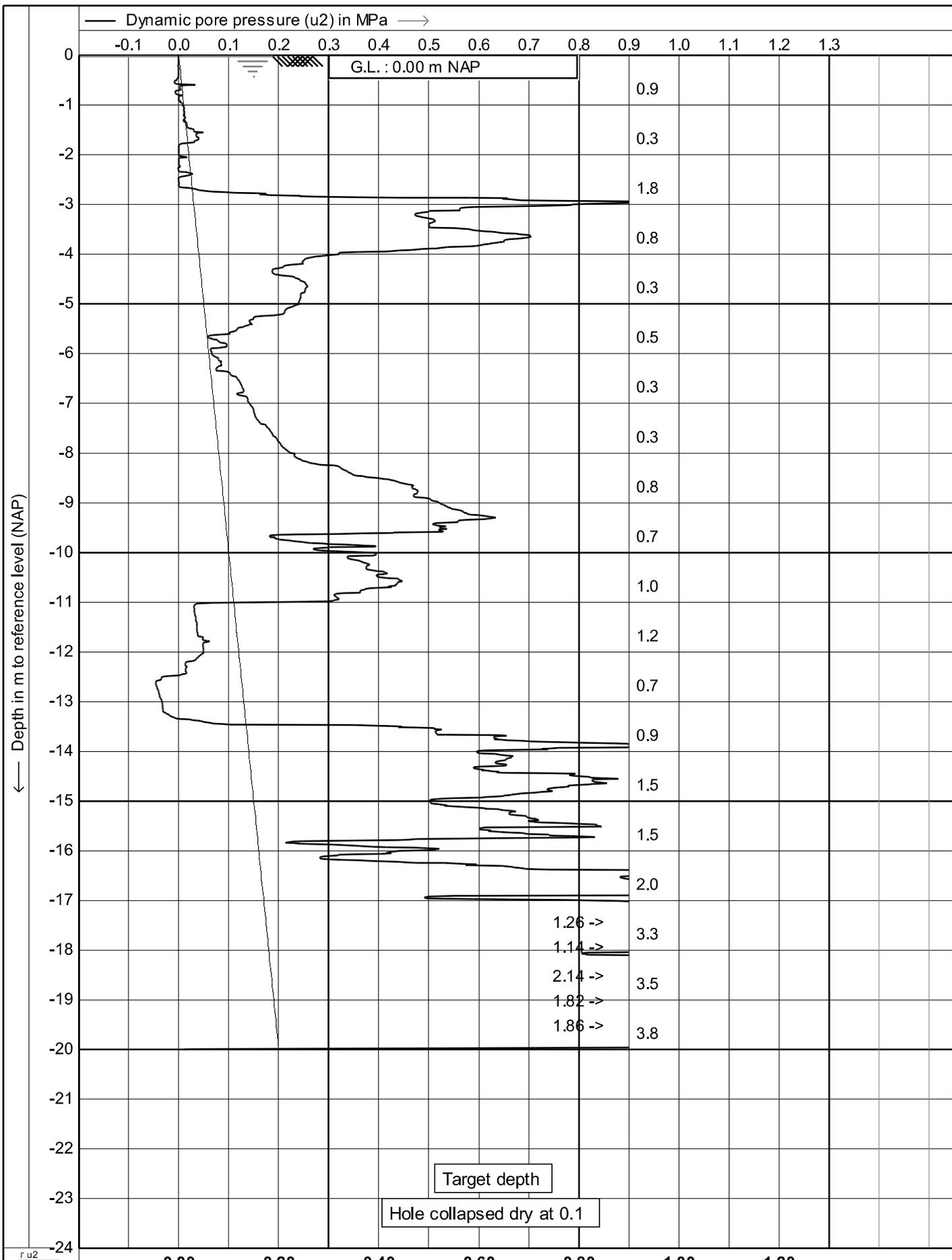
Position: **0, 0 RD**

Date : **20-6-2016**

Cone no. : **C10CFIP.C13082**

Project no. : **01CMW13**

CPT no. : **08**

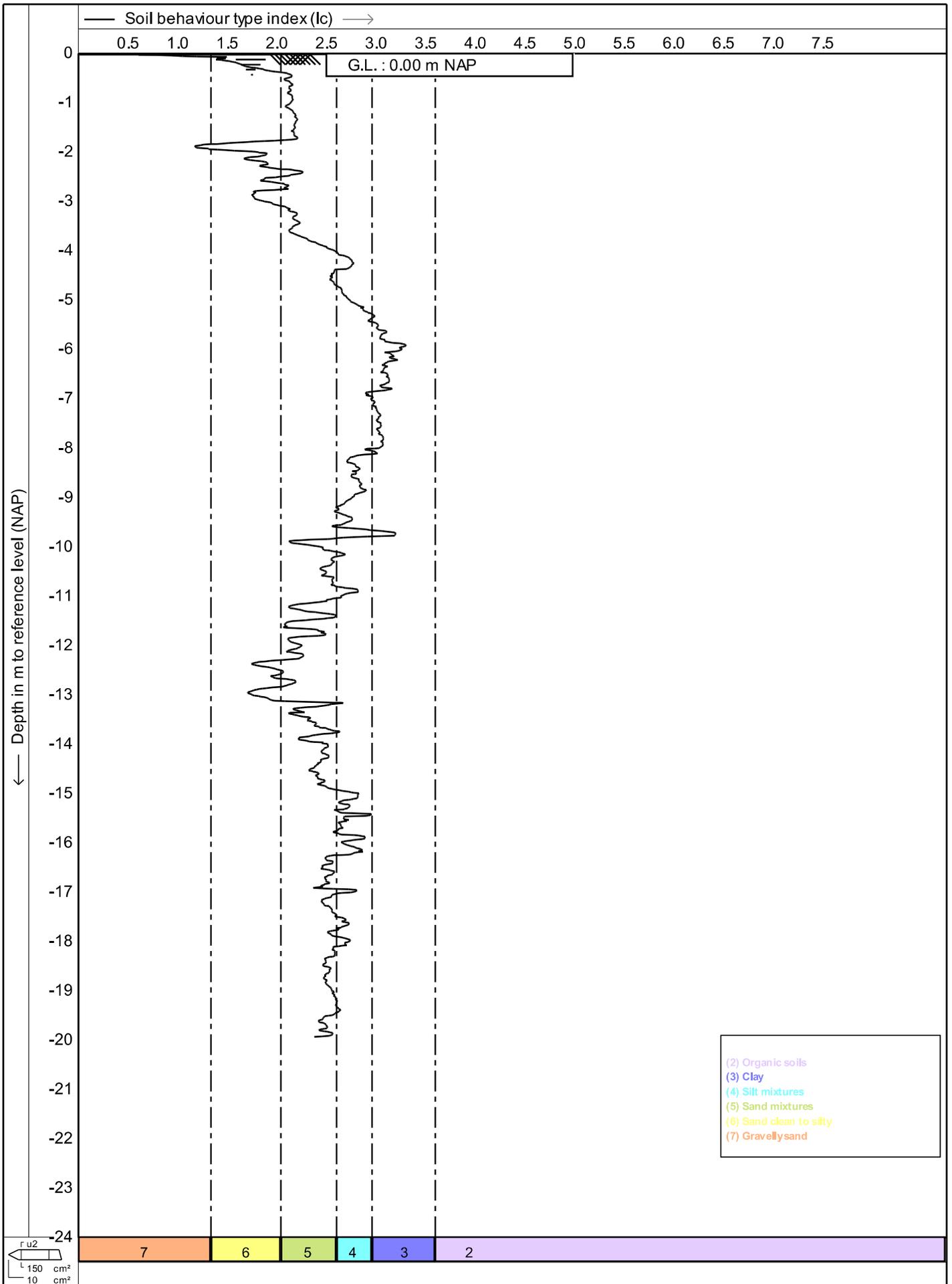


$r$   $u_2$   
 $L$  150  $cm^2$   
10  $cm^2$ 

 --- Equilibrium pore pressure ( $u_0$ ) in MPa  $\rightarrow$ 

 Inclination (I) in degr

	Test according A.S.T.M Standard D 5778-12	Date : 20-6-2016	
	Project : Site Investigations	Cone no. : C10CFIP.C13082	
	Location: 336	Project no. : 01CMW13	
	Position: 0, 0 RD	CPT no. : 08	2/14



Test according A.S.T.M Standard D 5778-12

Date : 20-6-2016

Cone no. : C10CFIP.C13082

Project : Site Investigations

Project no. : 01CMW13

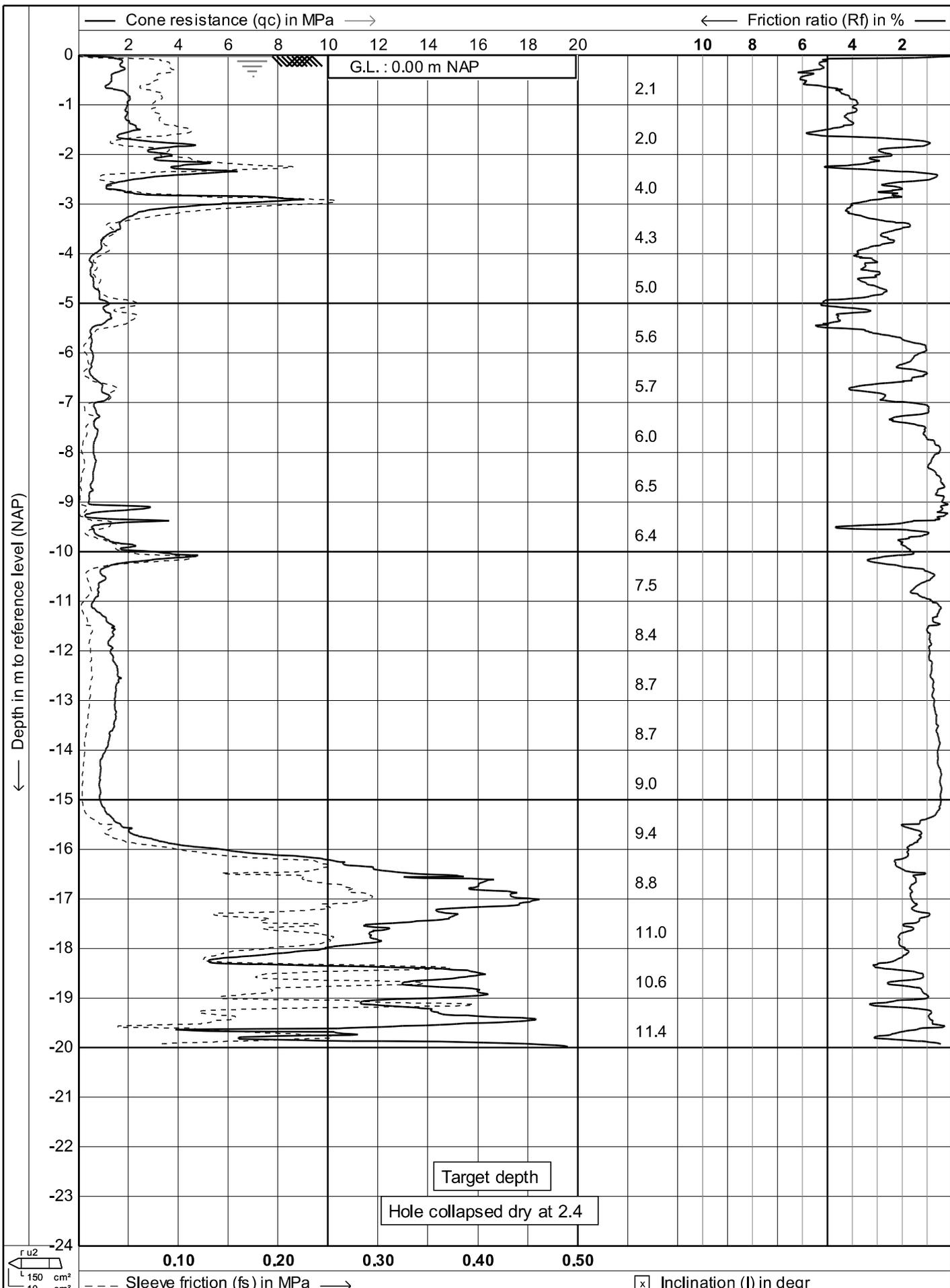
Location: 336

Position: 0, 0 RD

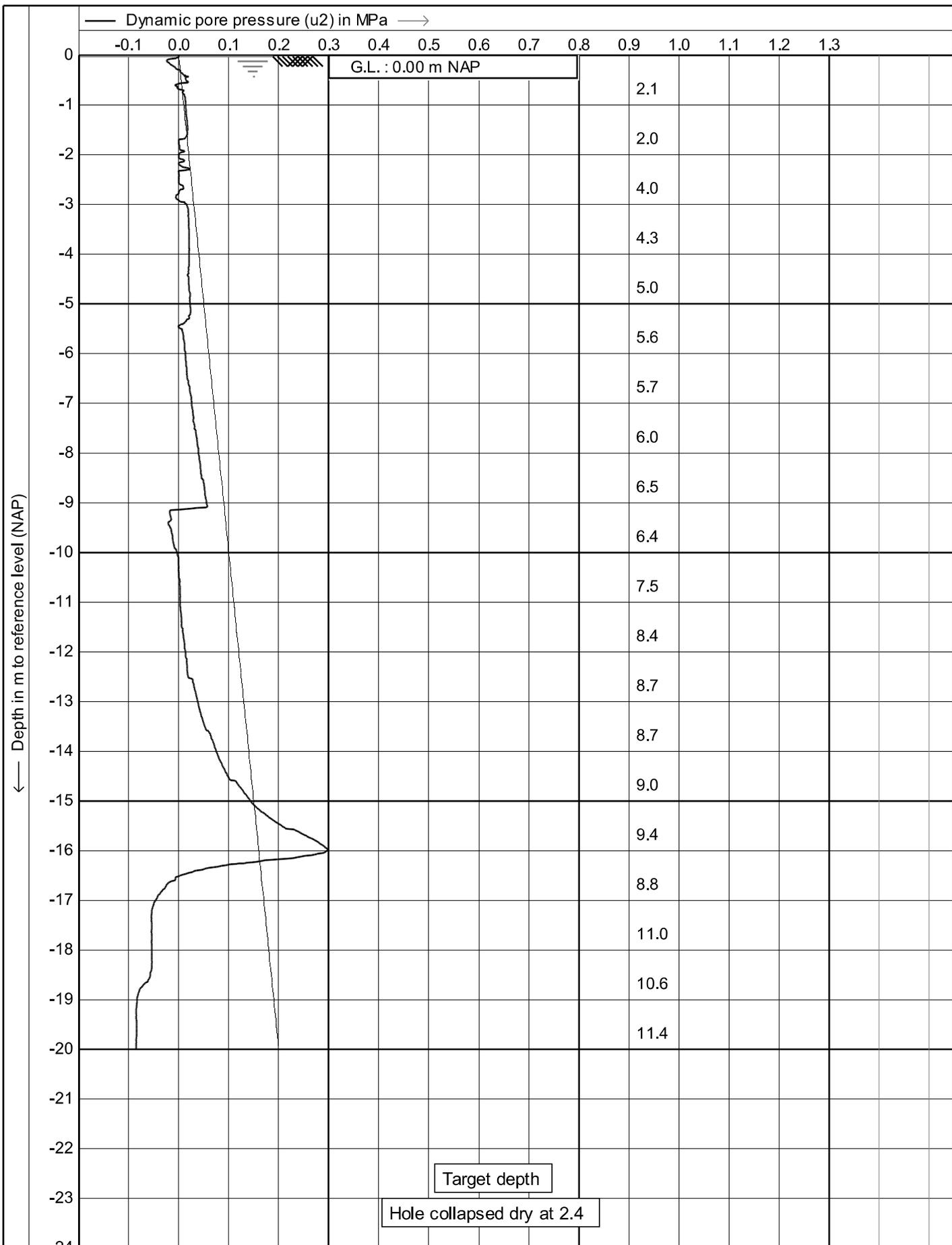
CPT no. : 08

9/14





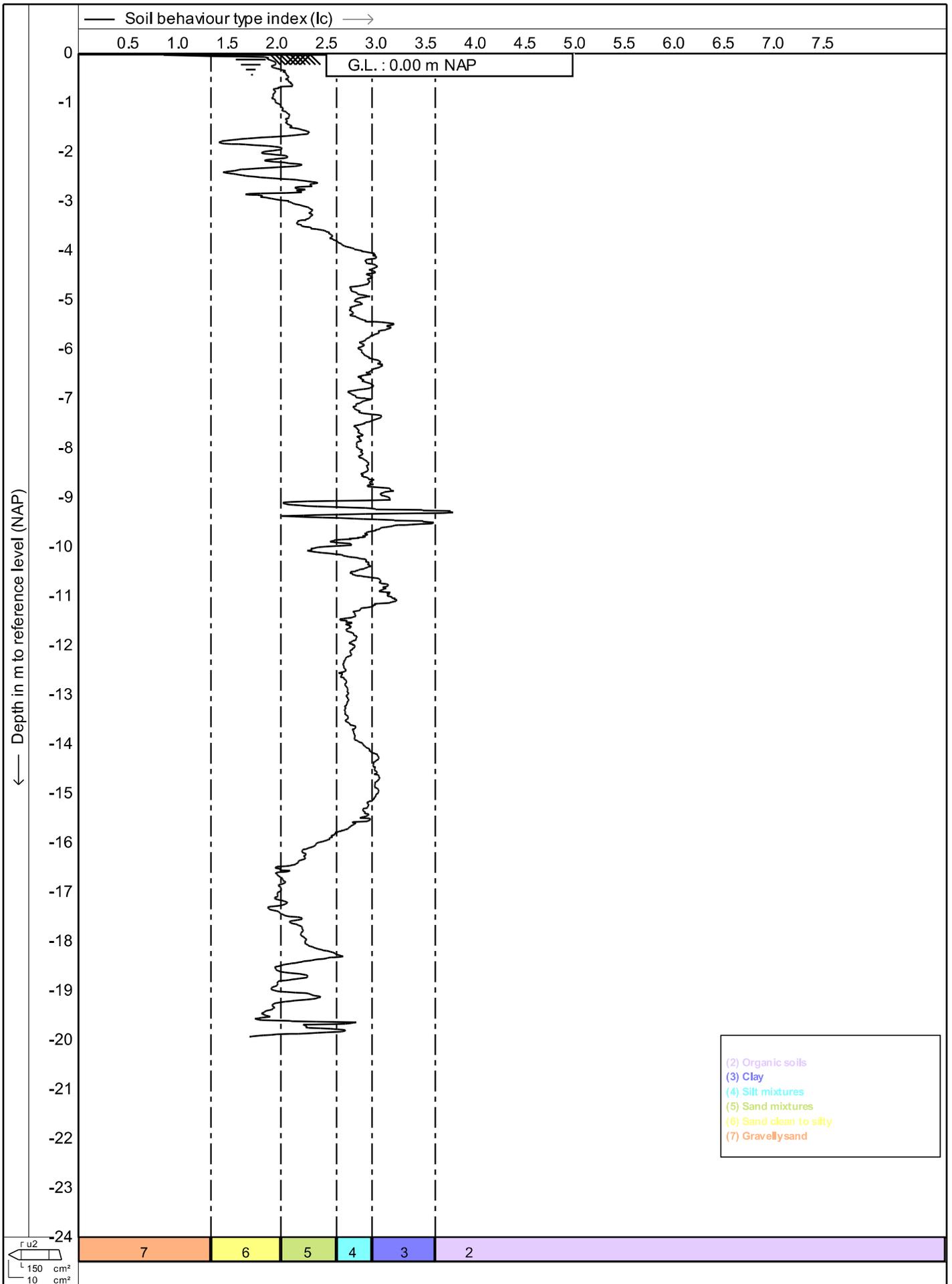
	Test according A.S.T.M Standard D 5778-12		Date : 23-6-2016	
	Project : Site Investigations		Cone no. : C10CFIP.C13082	
	Location: 336		Project no. : 01CMW14	
	Position: 0, 0 RD		CPT no. : 10	1/14



r u2  
150 cm<sup>2</sup>  
10 cm<sup>2</sup>

--- Equilibrium pore pressure (u0) in MPa →  Inclination (I) in degr

	Test according A.S.T.M Standard D 5778-12	Date : 23-6-2016	
	Project : <b>Site Investigations</b>	Cone no. : <b>C10CFIP.C13082</b>	
	Location: <b>336</b>	Project no. : <b>01CMW14</b>	
	Position: <b>0, 0 RD</b>	CPT no. : <b>10</b>	<b>2/14</b>



Test according A.S.T.M Standard D 5778-12

Date : 23-6-2016

Cone no. : C10CFIP.C13082

Project : Site Investigations

Project no. : 01CMW14

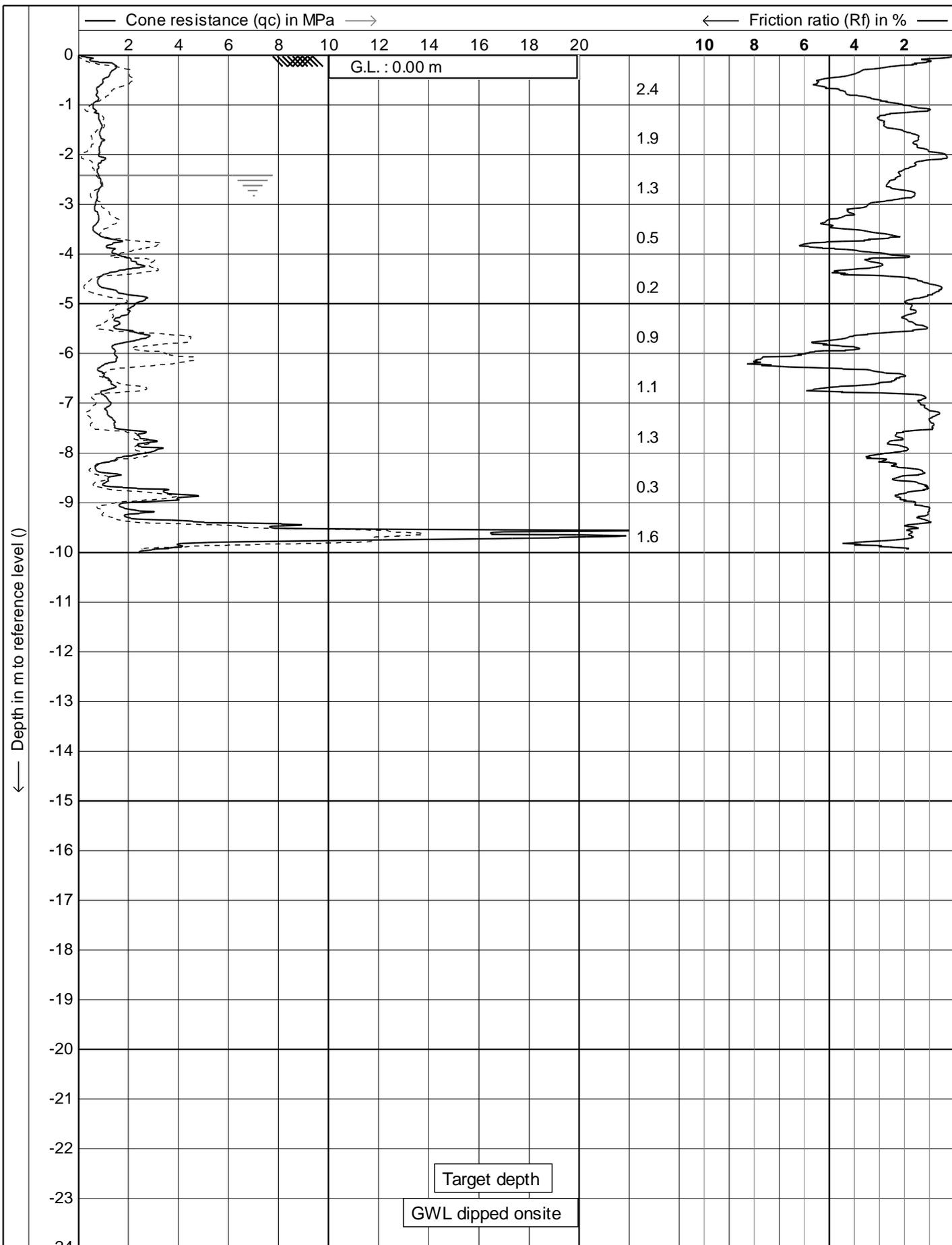
Location: 336

Position: 0, 0 RD

CPT no. : 10

9/14





CPTlogk V1.133



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

Location: **Settlers hall - Omokoroa**

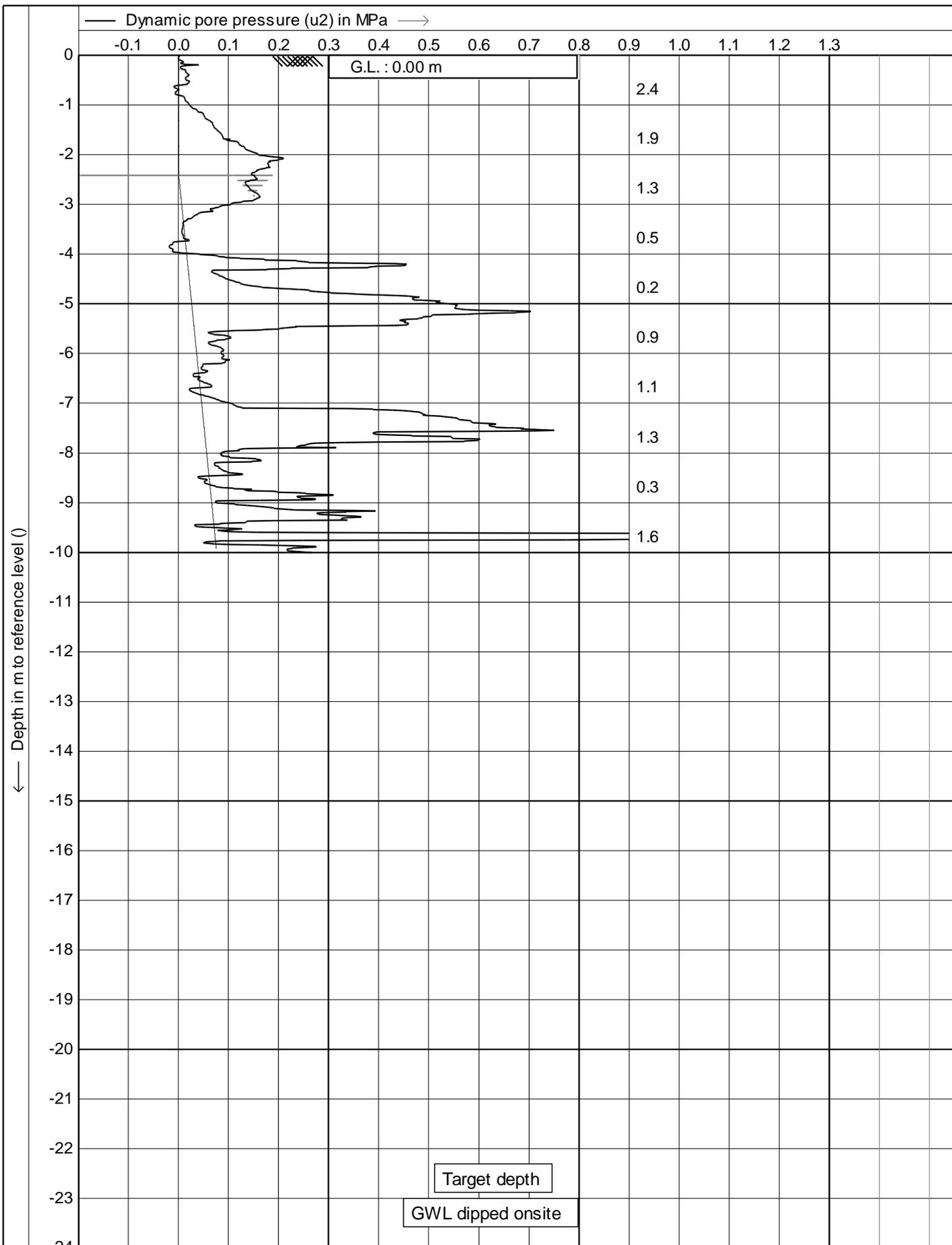
Date : **26-8-2016**

Cone no. : **C10CFIP.C14123**

Project no. : **02CMW7**

CPT no. : **08**

1/14



$\leftarrow$   $u_2$   
 $\leftarrow$   $u_0$   
 150  $\text{cm}^2$   
 10  $\text{cm}^2$



Test according A.S.T.M. Standard D 5778-12

Project : **Site Investigation**

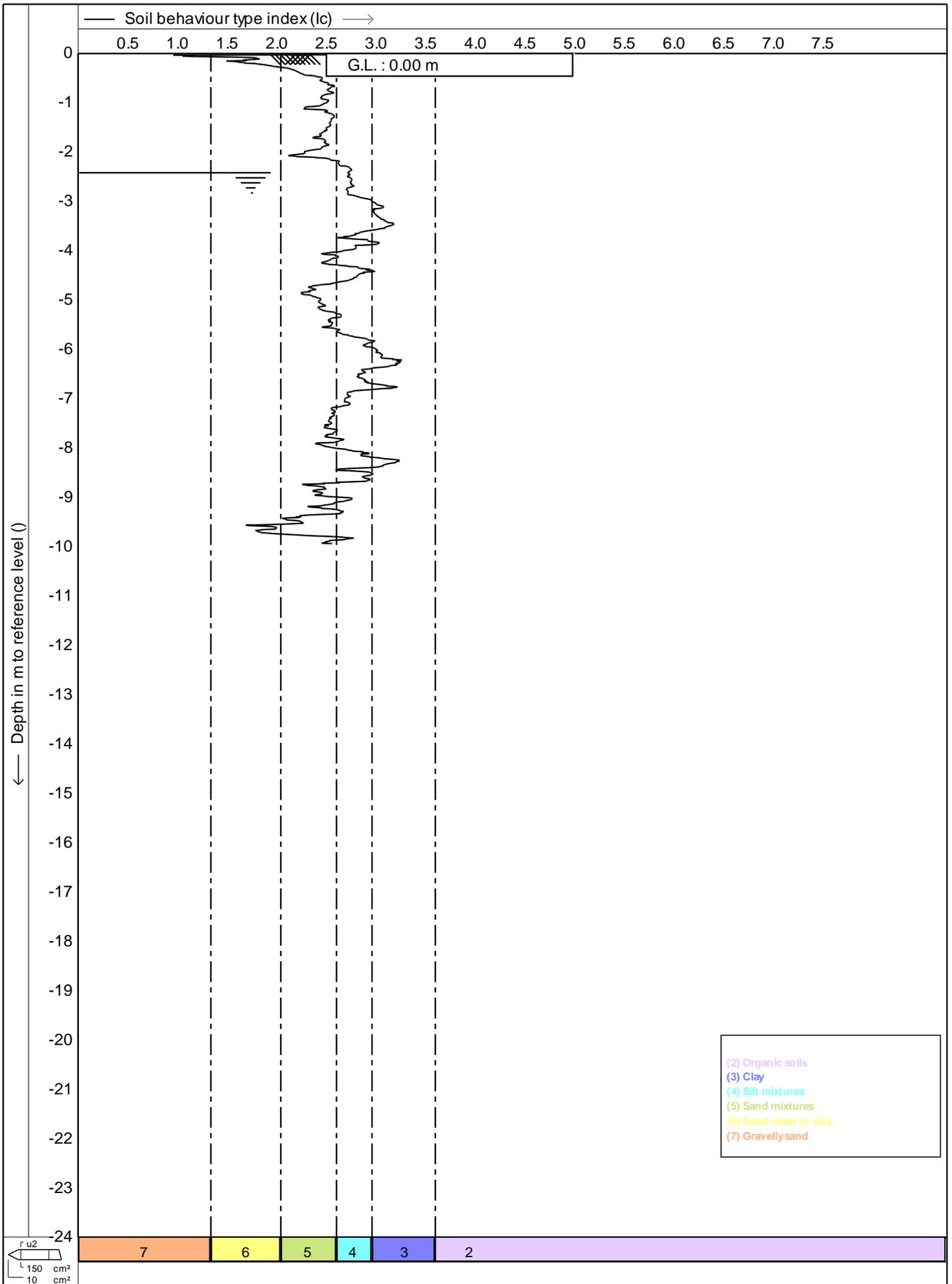
Location: **Settlers hall - Omokoroa**

Date : **26-8-2016**

Cone no. : **C10CFIP.C14123**

Project no. : **02CMW7**

CPT no. : **08** 2/14



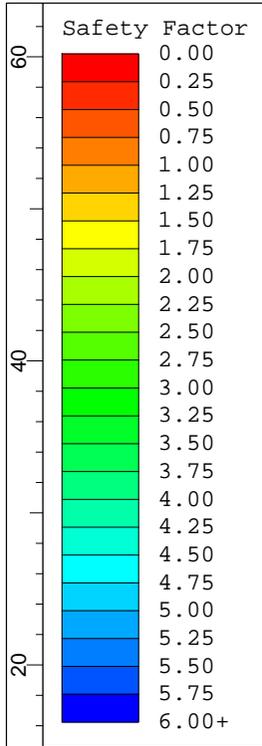
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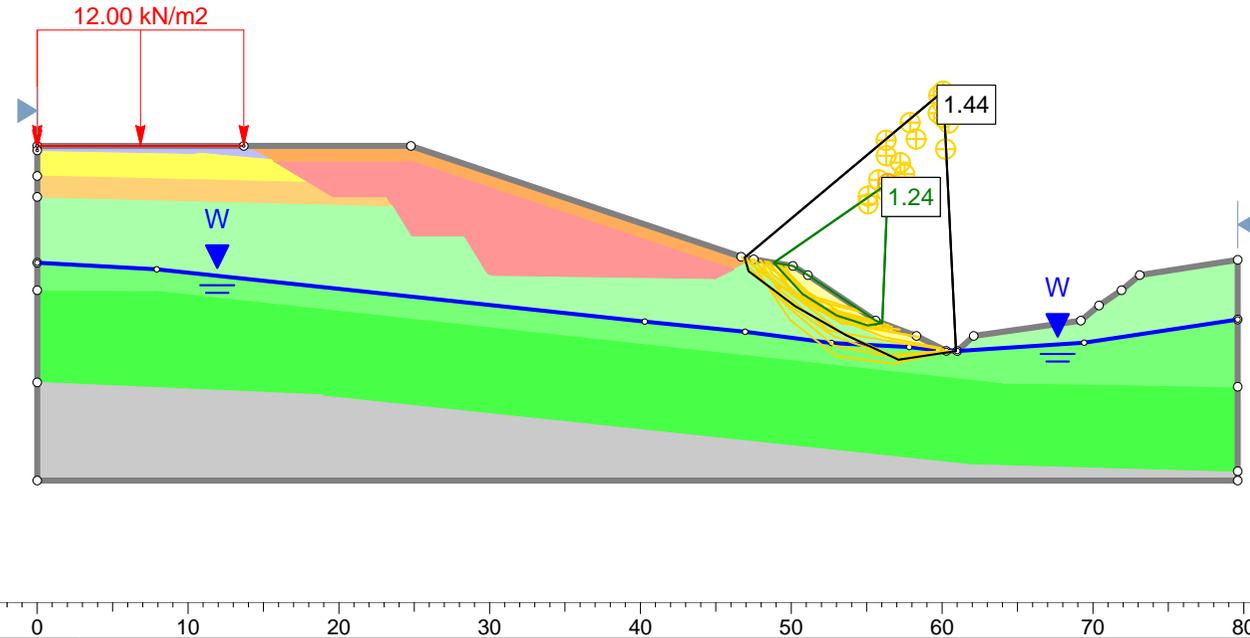
Test according A.S.T.M. Standard D 5778-12  
 Project : **Site Investigation**  
 Location: **Settlers hall - Omokoroa**

Date : **26-8-2016**  
 Cone no. : **C10CFIP.C14123**  
 Project no. : **02CMW7**  
 CPT no. : **08**      **9/14**

FACTORS OF SAFETY <1.5 SHOWN

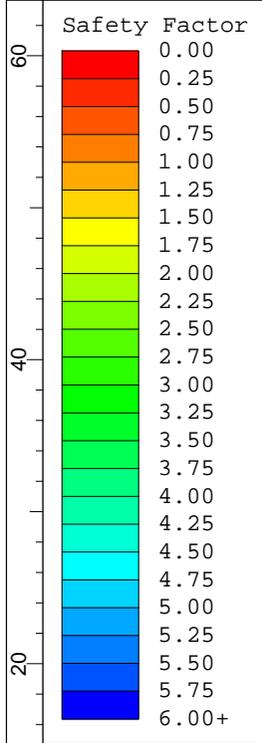


Material Name	Color	Unit Weight (kN/m <sup>3</sup> )	Strength Type	Cohesion (kPa)	Phi (deg)	Hu Type	Ru
Younger Ash: Stiff clayey silt	[Yellow]	16	Mohr-Coulomb	5	30		0.1
Hamilton Ash: V. stiff clayey silt	[Orange]	17	Mohr-Coulomb	10	25		0.1
Colluvium: Stiff clayey silt	[Light Yellow]	16	Mohr-Coulomb	3	25		0.1
Engineered Fill	[Light Blue]	16	Mohr-Coulomb	5	30		0.1
Tracked-rolled Fill	[Light Red]	15	Mohr-Coulomb	2	30		0.1
MS: Stiff to V.Stiff sandy silt	[Light Green]	16	Mohr-Coulomb	3	30		0.1
MS: Firm clayey silt	[Light Green]	16	Mohr-Coulomb	2	28	Automatically Calculated	
MS: Stiff sandy silt	[Light Green]	16	Mohr-Coulomb	3	30	Automatically Calculated	

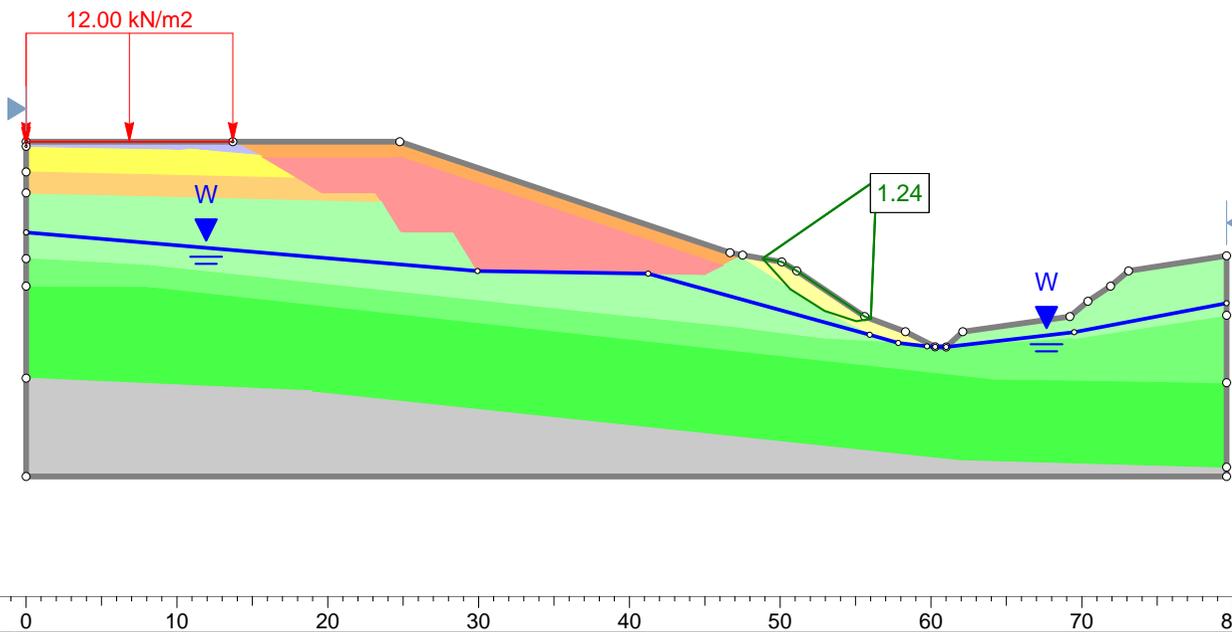


	Project		
	Kaimai Views Subdivision - Fill Encapsulation		
	Analysis Description		
	Cross Section B-B - Proposed GL - Prevailing GW conditions		
Drawn By	Scale	Company	
	1:500	Classic Developments Omokoroa Ltd	
Date	File Name		
23/05/2017	Fill Encapsulation - Section B - Proposed profile prevailing GWL.slim		

LOWEST FACTOR OF SAFETY SHOWN



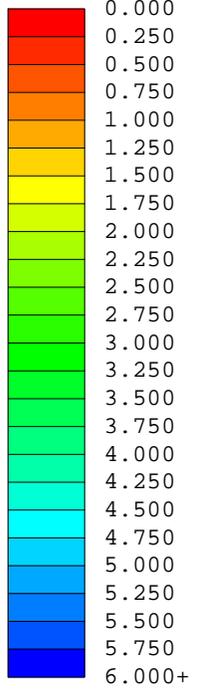
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Younger Ash: Stiff clayey silt	[Yellow]	16	Mohr-Coulomb	5	30	None		0.1
Hamilton Ash: V. stiff clayey silt	[Orange]	17	Mohr-Coulomb	10	25	None		0.1
Colluvium: Stiff clayey silt	[Light Yellow]	16	Mohr-Coulomb	3	25	None		0.1
Engineered Fill	[Light Blue]	16	Mohr-Coulomb	5	30	None		0.1
Tracked-rolled Fill	[Pink]	15	Mohr-Coulomb	2	30	None		0.1
MS: Stiff to V.Stiff sandy silt	[Light Green]	16	Mohr-Coulomb	3	30	Water Surface	Automatically Calculated	
MS: Firm clayey silt	[Green]	16	Mohr-Coulomb	2	28	Water Surface	Automatically Calculated	
MS: Stiff sandy silt	[Light Green]	16	Mohr-Coulomb	3	30	Water Surface	Automatically Calculated	
Dense Sand (inferred Ignimbrite)	[Grey]	16	Mohr-Coulomb	0	40	Water Surface	Automatically Calculated	
Topsoil	[Orange]	14	Mohr-Coulomb	2	25	None		0.1



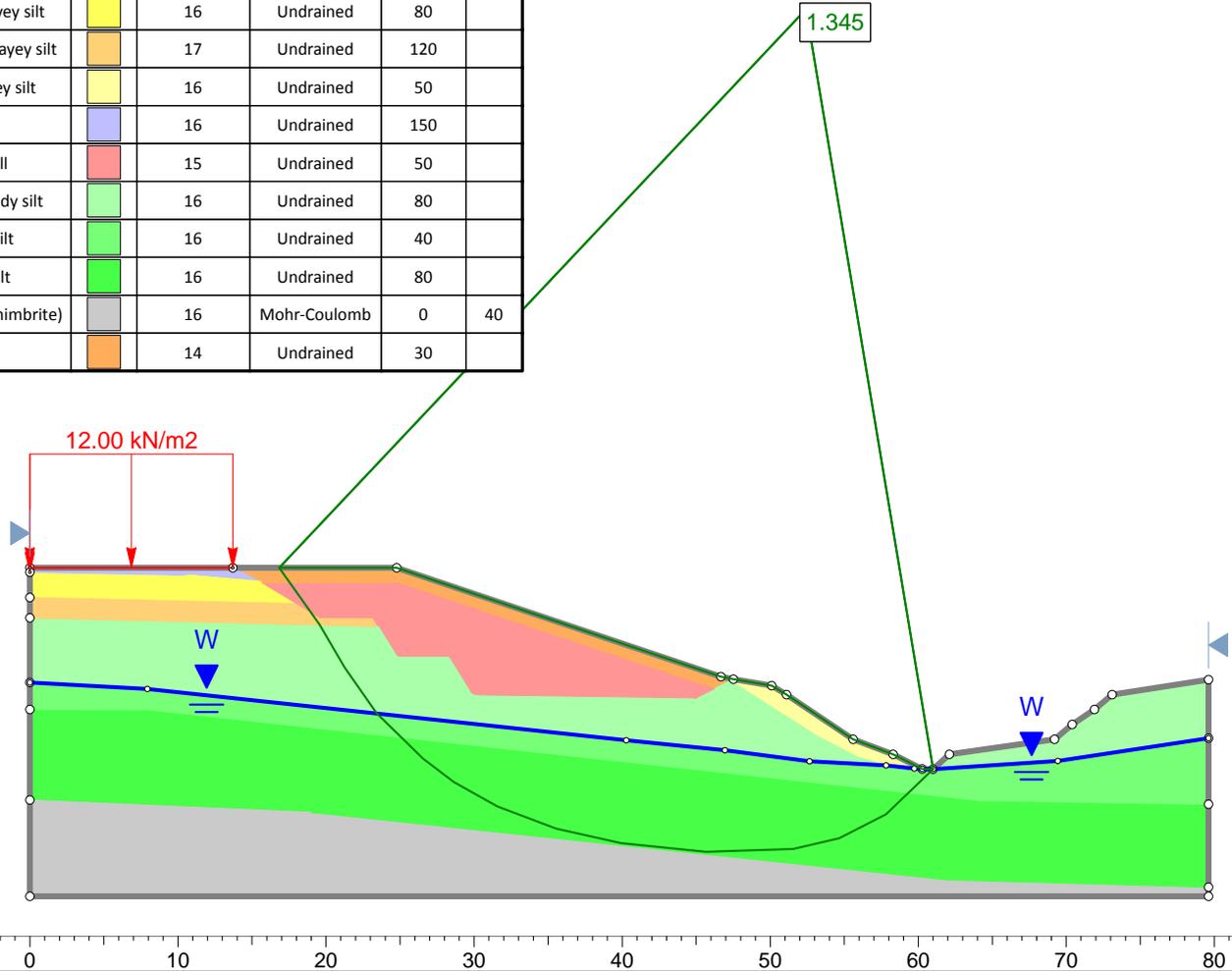
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	Kaimai Views Subdivision - Fill Encapsulation		
	Analysis Description		
	Cross Section B-B - Proposed GL - Elevated GW conditions		
Drawn By	Scale	Company	
	1:500	Classic Developments Omokoroa Ltd	
Date	File Name		
23/05/2017	Fill Encapsulation - Section B - Proposed profile elevated GWL.slim		

LOWEST FACTOR OF SAFETY SHOWN

Safety Factor

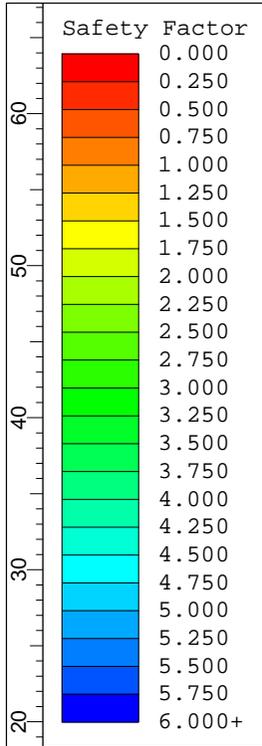


Material Name	Color	Unit Weight (kN/m <sup>3</sup> )	Strength Type	Cohesion (kPa)	Phi (deg)
Younger Ash: Stiff clayey silt	Yellow	16	Undrained	80	
Hamilton Ash: V. stiff clayey silt	Orange	17	Undrained	120	
Colluvium: Stiff clayey silt	Light Yellow	16	Undrained	50	
Engineered Fill	Light Blue	16	Undrained	150	
Tracked-rolled Fill	Red	15	Undrained	50	
MS: Stiff to V.Stiff sandy silt	Light Green	16	Undrained	80	
MS: Firm clayey silt	Green	16	Undrained	40	
MS: Stiff sandy silt	Light Green	16	Undrained	80	
Dense Sand (inferred Ignimbrite)	Grey	16	Mohr-Coulomb	0	40
Topsoil	Orange	14	Undrained	30	

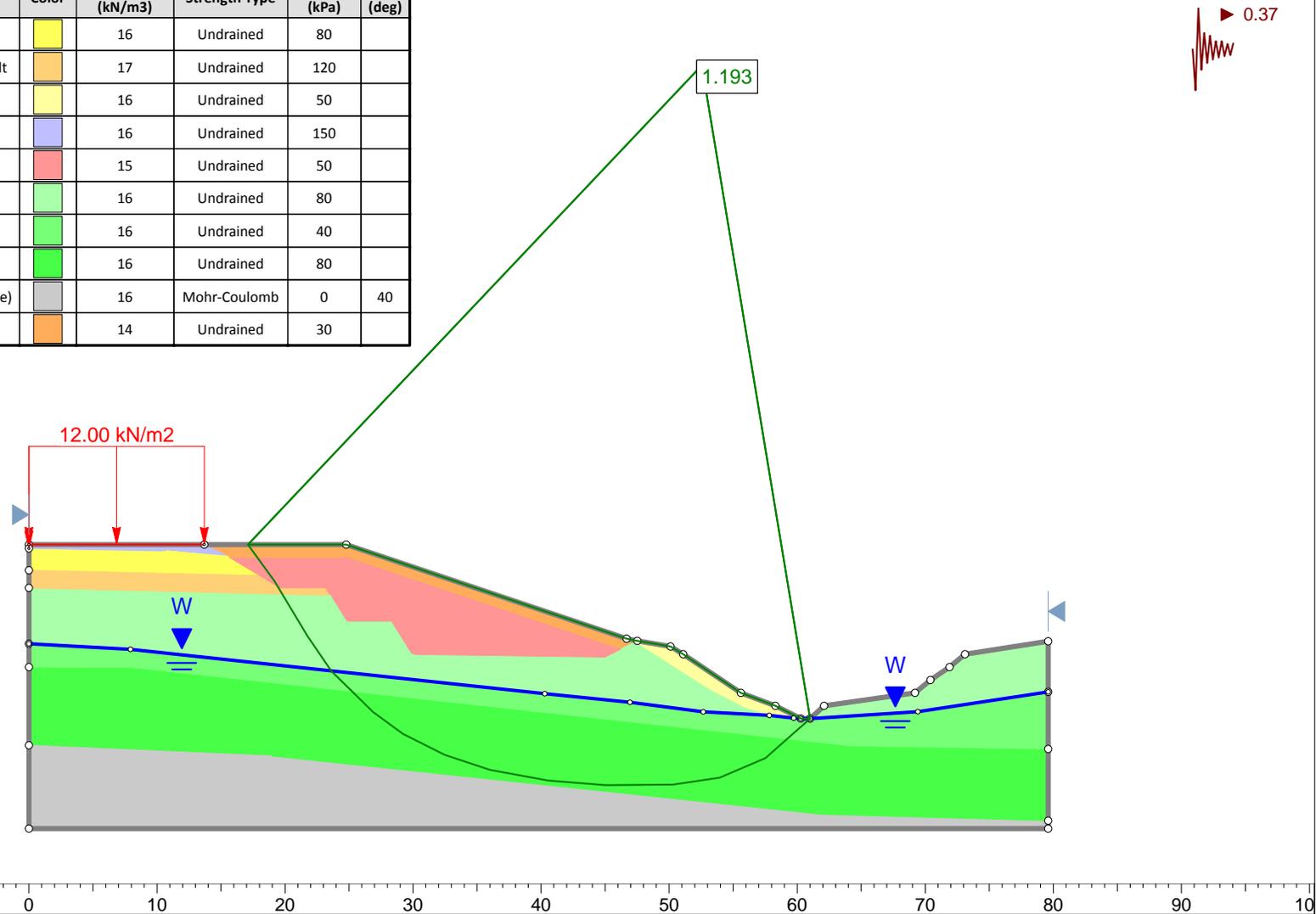


	Project		
	Kaimai Views Subdivision - Fill Encapsulation		
	Analysis Description		
	Cross Section B-B - IL2 ULS Seismic Case		
Drawn By	Scale	Company	
	1:500	Classic Developments Omokoroa Ltd	
Date	File Name		
23/05/2017	Fill Encapsulation - Section B - IL2 ULS Seismic Case.slim		

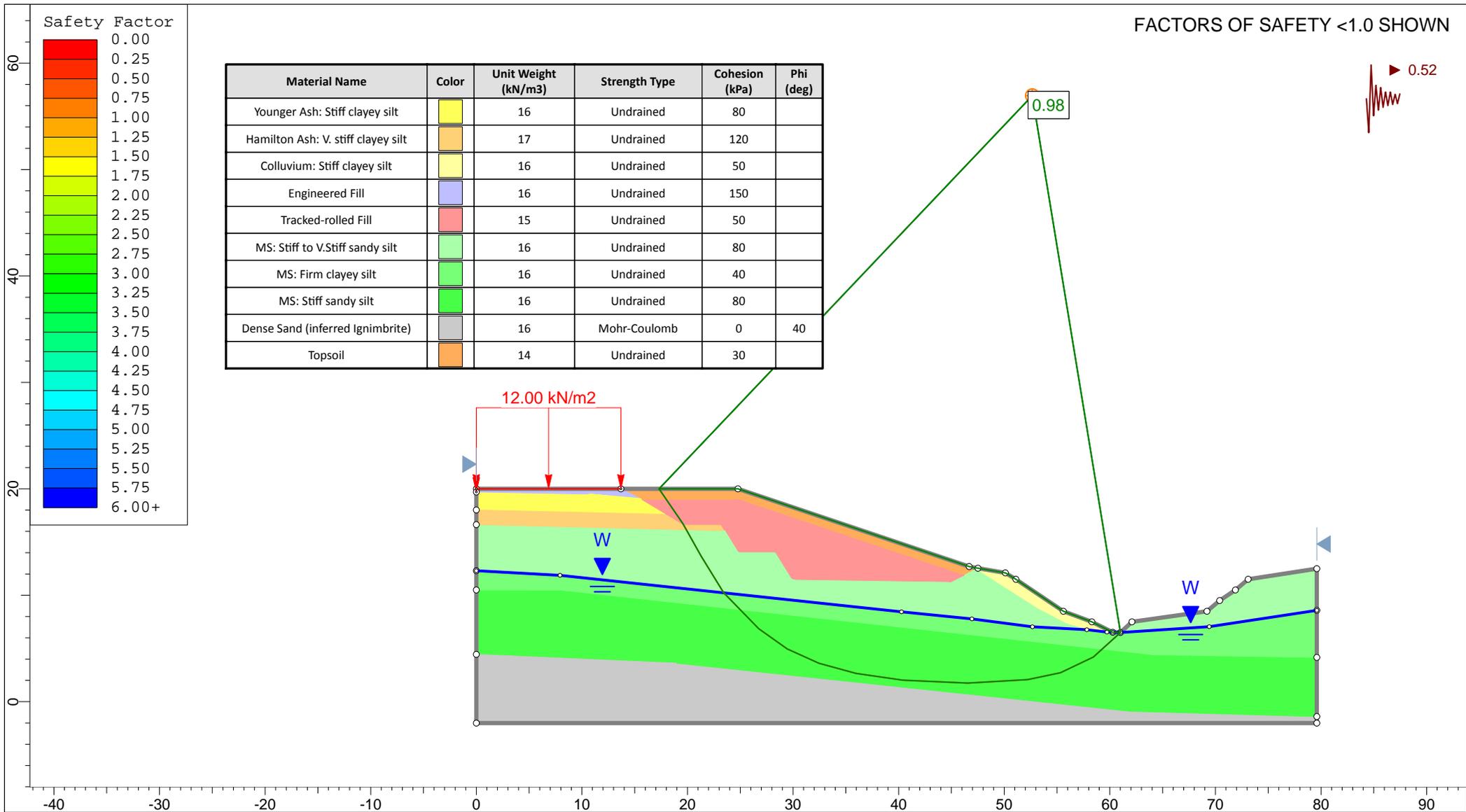
LOWEST FACTOR OF SAFETY SHOWN



Material Name	Color	Unit Weight (kN/m <sup>3</sup> )	Strength Type	Cohesion (kPa)	Phi (deg)
Younger Ash: Stiff clayey silt	Yellow	16	Undrained	80	
Hamilton Ash: V. stiff clayey silt	Orange	17	Undrained	120	
Colluvium: Stiff clayey silt	Light Yellow	16	Undrained	50	
Engineered Fill	Light Blue	16	Undrained	150	
Tracked-rolled Fill	Red	15	Undrained	50	
MS: Stiff to V.Stiff sandy silt	Light Green	16	Undrained	80	
MS: Firm clayey silt	Green	16	Undrained	40	
MS: Stiff sandy silt	Light Green	16	Undrained	80	
Dense Sand (inferred Ignimbrite)	Grey	16	Mohr-Coulomb	0	40
Topsoil	Orange	14	Undrained	30	



Project			Kaimai Views Subdivision - Fill Encapsulation		
Analysis Description			Cross Section B-B - IL3 ULS Seismic Case		
Drawn By	Scale	1:500	Company	Classic Developments Omokoroa Ltd	
Date	23/05/2017		File Name	Fill Encapsulation - Section B - IL3 ULS Seismic Case.slim	



	<b>Project</b> Kaimai Views Subdivision - Fill Encapsulation		
	<b>Analysis Description</b> Cross Section B-B - IL4 ULS Seismic Case		
	<b>Drawn By</b>	<b>Scale</b> 1:500	<b>Company</b> Classic Developments Omokoroa Ltd
	<b>Date</b> 23/05/2017	<b>File Name</b> Fill Encapsulation - Section B - IL4 ULS Seismic Case.slim	

4 July 2018

Document Ref: TGA2016\_0258AQ, Rev0

Classic Developments Omokoroa Ltd  
PO Box 864  
Tauranga 3140

Attention: Bruce Cuff

Dear Bruce,

**RE: GEOTECHNICAL CERTIFICATION LETTER FOR FILL CONTAINMENT EMBANKMENT  
KAIMAI VIEWS RESIDENTIAL SUBDIVISION – 336-344 OMOKOROA ROAD, OMOKOROA**

This letter confirms CMW Geosciences (CMW) visited the above site on several occasions between October 2017 and January 2018 to observe aspects of a fill containment embankment construction within the Kaimai Views Residential Subdivision, below lots 76 to 84, as shown on the attached Lysaght as-built plans. The observations were completed in general accordance with the conclusions and recommendations of the CMW Geotechnical Design Report (ref: TGA2016\_0258AK Rev0, dated 9 June 2016), which was prepared to provide specific geotechnical recommendations relating to the construction of an earthfill embankment to contain uncontrolled fill that was considered unsuitable to be used as structural fill encountered during subdivision earthwork activities.

The observations included verification of the following:

- That topsoil and unsuitable subsoils had been satisfactorily stripped from within the proposed fill area to expose natural stiff to hard clayey silts of the Tauranga Ash sequence and Matua Subgroup.
- That the sloping ground profile was benched prior to fill placement. Across each bench a drainage blanket was installed, which comprised minimum 300mm thick drainage aggregate wrapped in Bidim A19 with a 100mm diameter perforated drainage coil with a filter sock installed at the toe of each cut batter, as shown on the appended Lysaght as-built plan (Drawing No. 163252-AB-010 Rev. 1). The subsoils were piped to the toe of the gully via a solid wall pipe;
- Routine site visits included verification that the fill was being track rolled in 200mm lifts with a 20-tonne bulldozer and excavator. Due to Health and Safety constraints with handling the construction fill, CMW was unable to undertake strength testing within this material. However, the contractor undertook regular tests using a handheld shear vane apparatus and provided the results to CMW, with reported undrained shear strengths generally ranging between 45kPa and 120kPa.
- Routine site visits included observing the topsoil capping layer being track rolled in 200mm lifts under a similar methodology as the fill. The embankment was covered in mulch to protect against surface erosion; however, it is understood the embankment will be vegetated with various shrubs and trees in accordance with the subdivision landscape plans.

A review of the Lysaght as-built plans indicate:

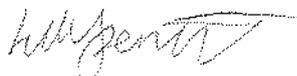
- the majority of the embankment was constructed to the design gradient of 1:3 (vertical:horizontal), with the exception of the northern portion of the embankment where final gradients of up to 1:2.5 were constructed. Additional stability analyses were carried out in accordance with the analyses methodology and stability criteria detailed in the design report for the as-built ground profiles provided by Lysaght. The additional stability results are appended and indicate the steeper gradient of 1:2.5 (vertical:horizontal) meets the stability criteria under prevailing and elevated groundwater conditions as well as the design seismic event.
- The 1m thick topsoil capping layer is only 0.5m thick in some areas of the embankment. Although unlikely to detrimentally affect the stability of the embankment, further works will be necessary to top up the capping layer during the landscape planting of the embankment to satisfy the minimum 1m thick topsoil cover stipulated by WBOPDC.

The ground conditions were as expected and appear similar to those described in the Geotechnical Design Report. Therefore, based on the site observations and results of the above slope stability analyses, and where the final topsoil capping layer is topped up to 1m thick during the landscape works, we are satisfied that the fill embankment has been constructed as per our design and recommendations, and therefore considered suitable to provide adequate support to the Kaimai Views residential subdivision upslope of the fill embankment.

Should you have any further queries, or require any other additional information, please do not hesitate to contact the undersigned.

**For and on behalf of  
CMW Geosciences**

Prepared by:



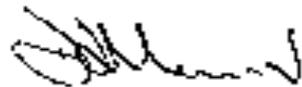
**Lilly Pendergast**  
Engineering Geologist

Reviewed by:



**Robert Taylor**  
Senior Geotechnical Engineer

Reviewed and Authorised by:

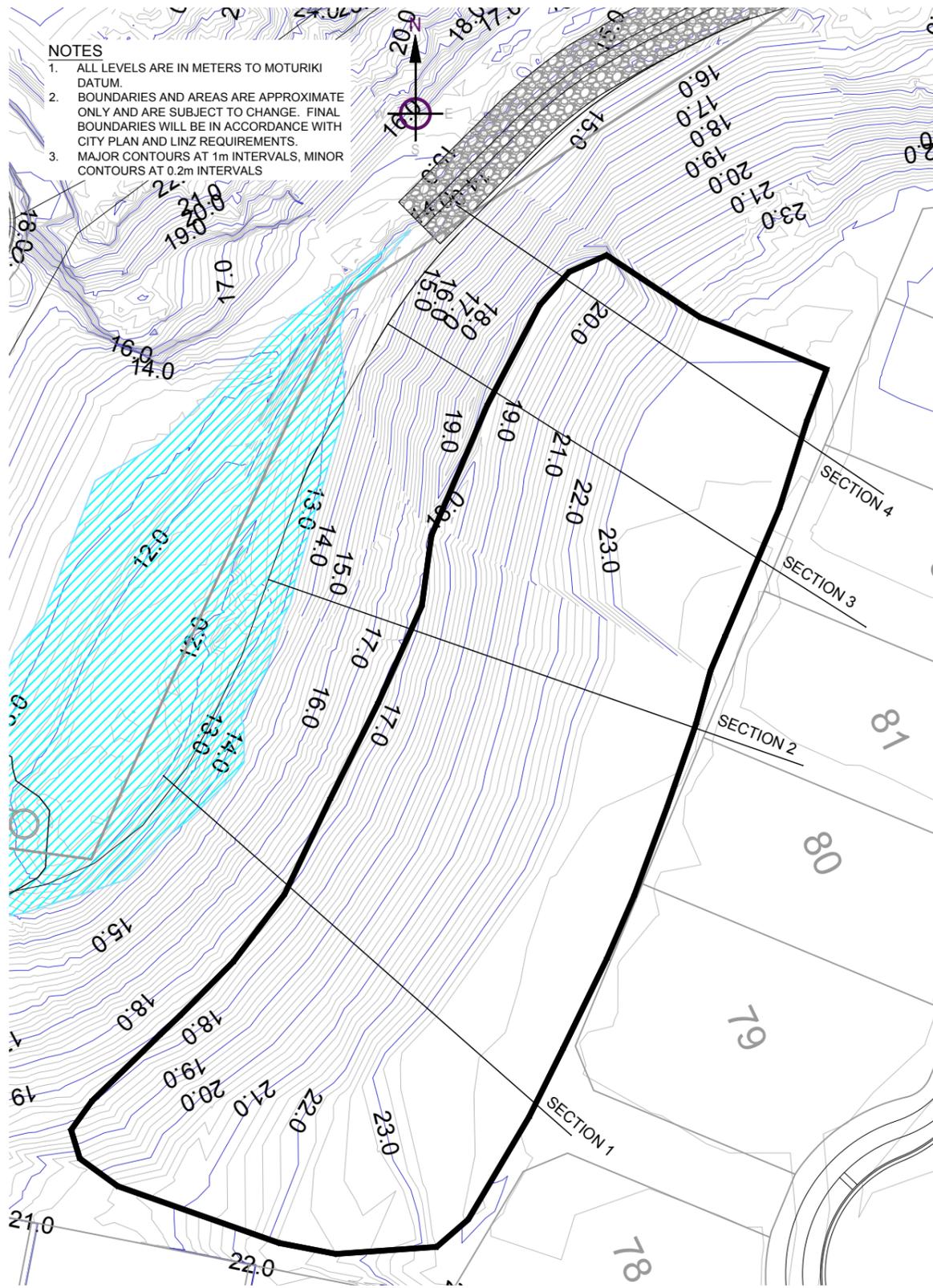


**Dave Morton**  
Principal Geotechnical Engineer  
CMEngNZ, CPEng  
TCC Category 1 Geotechnical Engineer

Attachments: Lysaght As-Built Plans  
Additional Slope Stability Analyses Outputs

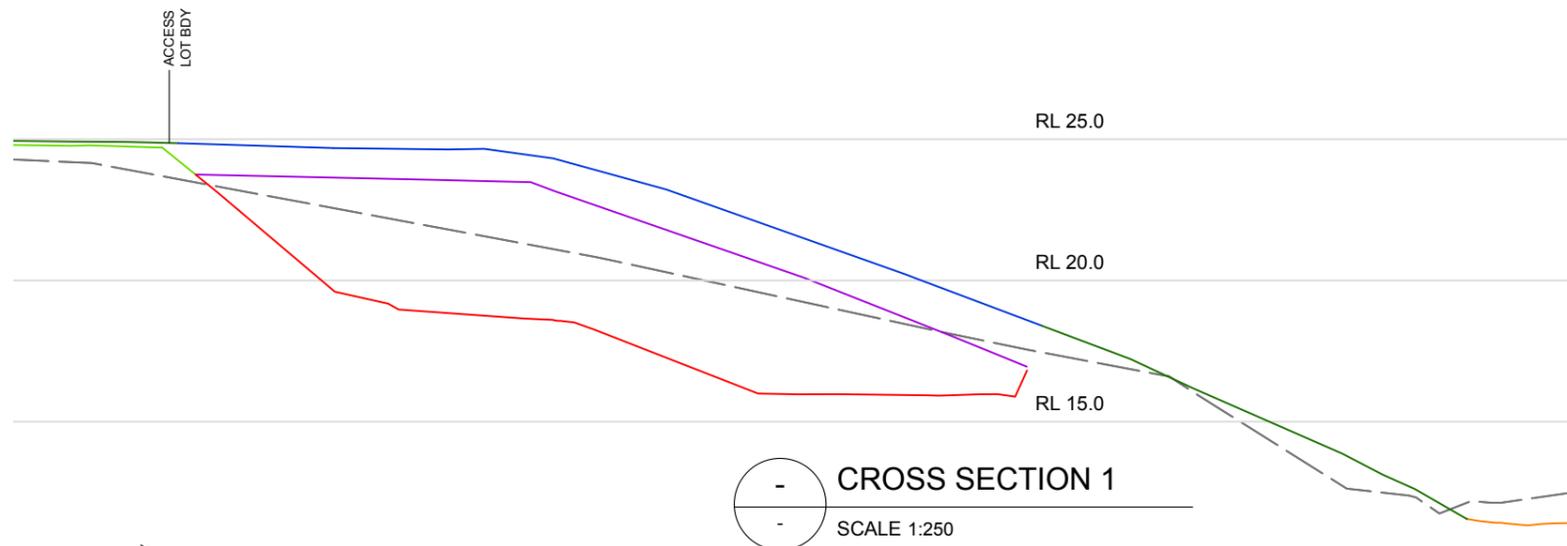
Distribution: 1 copy to Classic Developments Ltd (electronic)  
Original held by CMW Geosciences (hard copy)

- NOTES**
1. ALL LEVELS ARE IN METERS TO MOTURIKI DATUM.
  2. BOUNDARIES AND AREAS ARE APPROXIMATE ONLY AND ARE SUBJECT TO CHANGE. FINAL BOUNDARIES WILL BE IN ACCORDANCE WITH CITY PLAN AND LINZ REQUIREMENTS.
  3. MAJOR CONTOURS AT 1m INTERVALS, MINOR CONTOURS AT 0.2m INTERVALS



**LEGEND**

- EXISTING GROUND LEVEL
- BOTTOM OF ACM EXCAVATION
- FINISHED ACM
- FGL (CAPPING)
- FGL
- AS BUILT SUBGRADE
- DRONE 23.11.17



ASBUILT

Drawn	Signed	Date	AV	04/07/18
Designed	Signed	Date	AV	04/07/18
Verified	Signed	Date	CJD	04/07/18
Approved	Signed	Date	CJD	04/07/18

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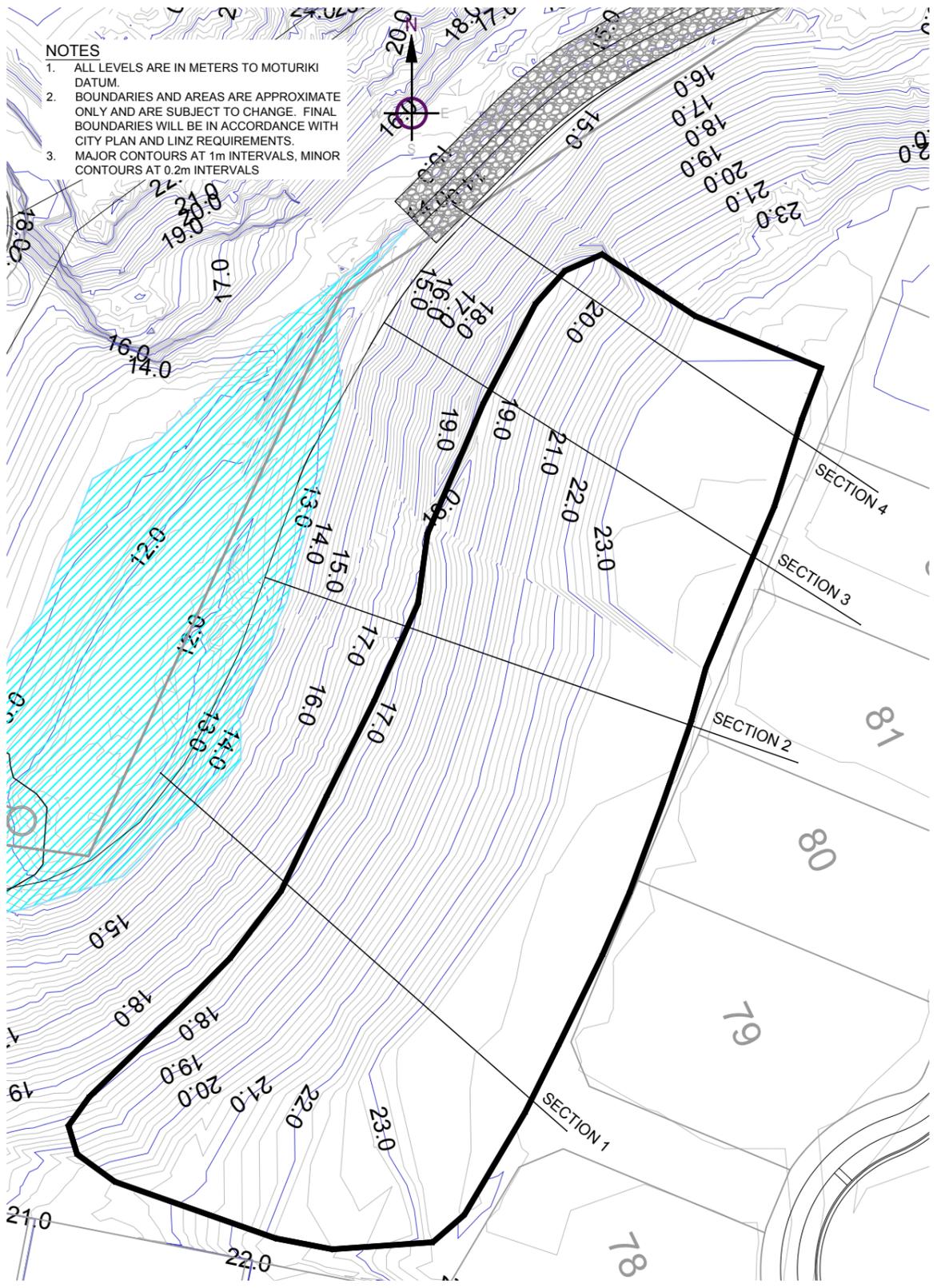
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**CLASSIC DEVELOPMENTS**  
**KAIMAI VIEWS**  
**OMOKOROA SPECIAL HOUSING AREA**  
**OMOKOROA**

Drawing Title:  
**ASBUILT**  
**CONTAMINATED MATERIAL**  
**FINISHED SUBGRADE**  
**SHEET 1**

Project No.	163252
Scale (A3)	AS SHOWN
Drawing No.	163252-AB-01
Rev.	1

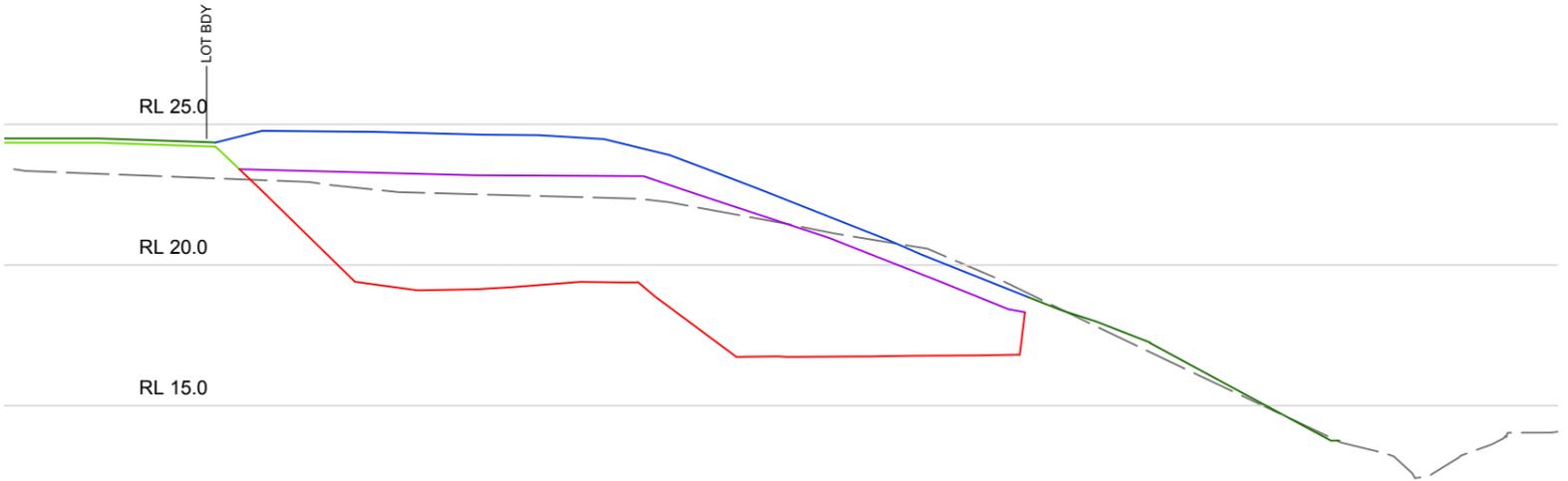
**NOTES**

1. ALL LEVELS ARE IN METERS TO MOTURIKI DATUM.
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3. MAJOR CONTOURS AT 1m INTERVALS, MINOR CONTOURS AT 0.2m INTERVALS

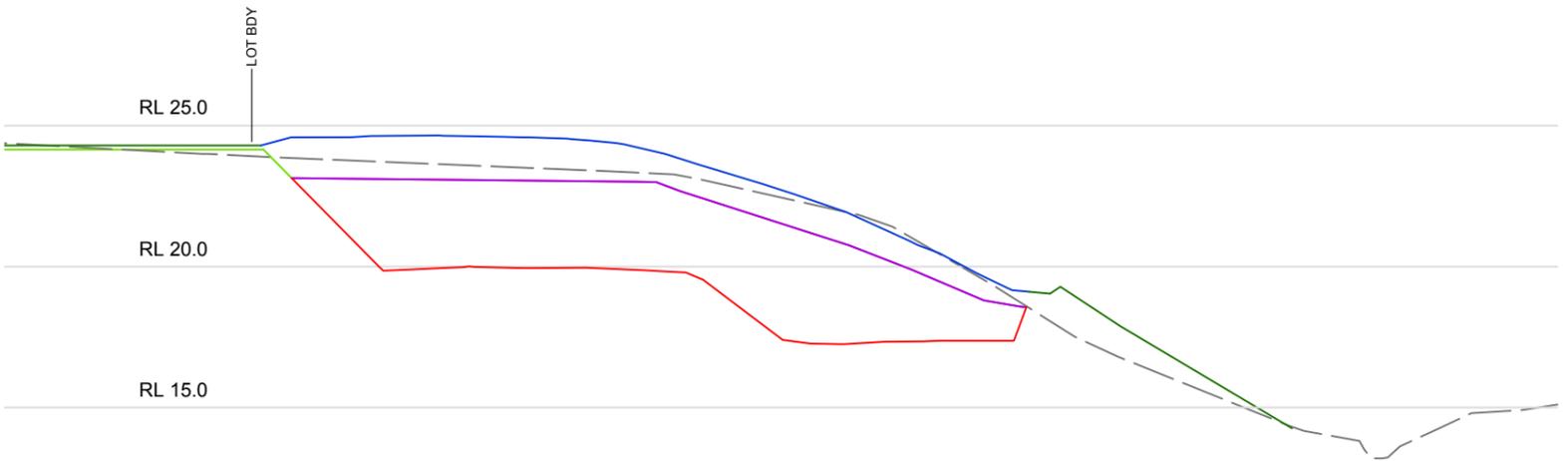


SCALE 1:500

- LEGEND**
- EXISTING GROUND LEVEL
  - BOTTOM OF ACM EXCAVATION
  - FINISHED ACM
  - FGL (CAPPING)
  - FGL
  - AS BUILT SUBGRADE
  - DRONE 23.11.17



CROSS SECTION 3  
SCALE 1:250



CROSS SECTION 4  
SCALE 1:250

Drawn	Signed	Date			
AV		04/07/18			
Designed	Signed	Date			
AV		04/07/18			
Verified	Signed	Date			
CJD		04/07/18			
Approved	Signed	Date			
CJD		04/07/18			
No.	Date	Revision Details	By	Ver.	App.
1	04/07/18	AS BUILT	AV		

**LYSAGHT**

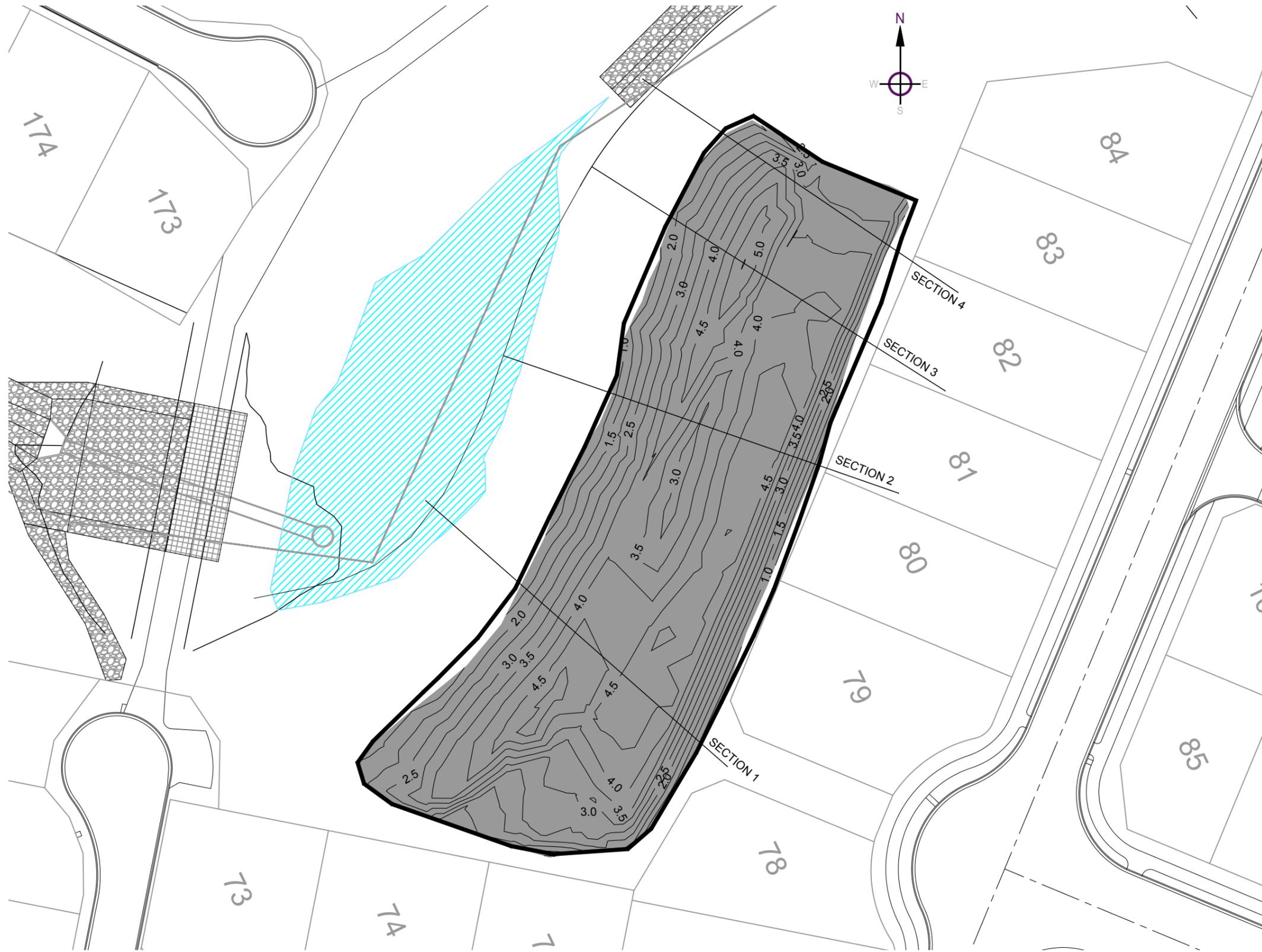
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Project:  
**CLASSIC DEVELOPMENTS  
 KAIMAI VIEWS  
 OMOKOROA SPECIAL HOUSING AREA  
 OMOKOROA**

Drawing Title:  
**ASBUILT  
 CONTAMINATED MATERIAL  
 FINISHED SUBGRADE  
 SHEET 2**

Project No.		ASBUILT
		163252
Scale (A3)		AS SHOWN
Drawing No.	Rev.	
163252-AB-02	1	



- NOTES**
1. ALL LEVELS ARE IN METERS TO MOTURIKI DATUM.
  2. BOUNDARIES AND AREAS ARE APPROXIMATE ONLY AND ARE SUBJECT TO CHANGE. FINAL BOUNDARIES WILL BE IN ACCORDANCE WITH CITY PLAN AND LINZ REQUIREMENTS.
  3. FILL CONTOURS AT 0.5m INTERVALS

SCALE 1:500

ASBUILT

Drawn		AV	Signed		Date	04/07/18	 <p>THIS DRAWING REMAINS THE PROPERTY OF LYSAGHT CONSULTANTS LTD. NO LIABILITY SHALL BE ACCEPTED FOR THE UNAUTHORISED USE OF THIS DRAWING DO NOT SCALE DRAWING</p>	<b>Project:</b> CLASSIC DEVELOPMENTS KAIMAI VIEWS OMOKOROA SPECIAL HOUSING AREA OMOKOROA	<b>Drawing Title:</b> ASBUILT CONTAMINATED MATERIAL ACM DEPTH COUTOURS	Project No.		163252	
Designed		AV	Signed		Date	04/07/18				Scale (A3)		1:500	
Verified		CJD	Signed		Date	04/07/18				Drawing No.		163252-AB-05	
Approved		CJD	Signed		Date	04/07/18				Rev.		1	
No.		Date	Revision Details		By	Ver.				App.			
SURVEYING, ENGINEERING & LAND DEVELOPMENT 19 Totara St, Mount Maunganui 3116 Ph 07 578 8798 www.lysaght.net.nz													

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  3. MAJOR CONTOURS AT 1m INTERVALS, MINOR CONTOURS AT 0.2m INTERVALS



SCALE 1:500

ASBUILT

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Designed	Signed	Date
AV		04/07/18
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CJD		04/07/18
Approved	Signed	Date
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No.	Date	Revision Details
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By	Ver.	App.
AV		


  
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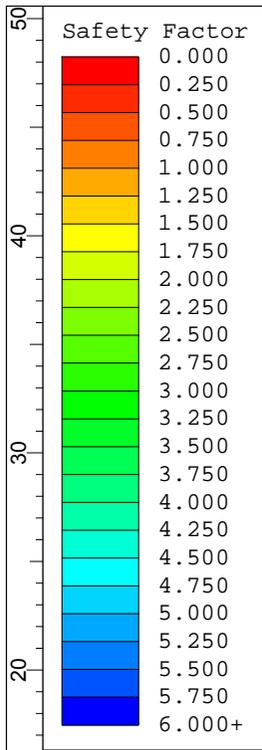
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 CLASSIC DEVELOPMENTS  
 KAIMAI VIEWS  
 OMOKOROA SPECIAL HOUSING AREA  
 OMOKOROA

Drawing Title:  
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 CONTAMINATED MATERIAL  
 BASE OF ACM CONTOURS

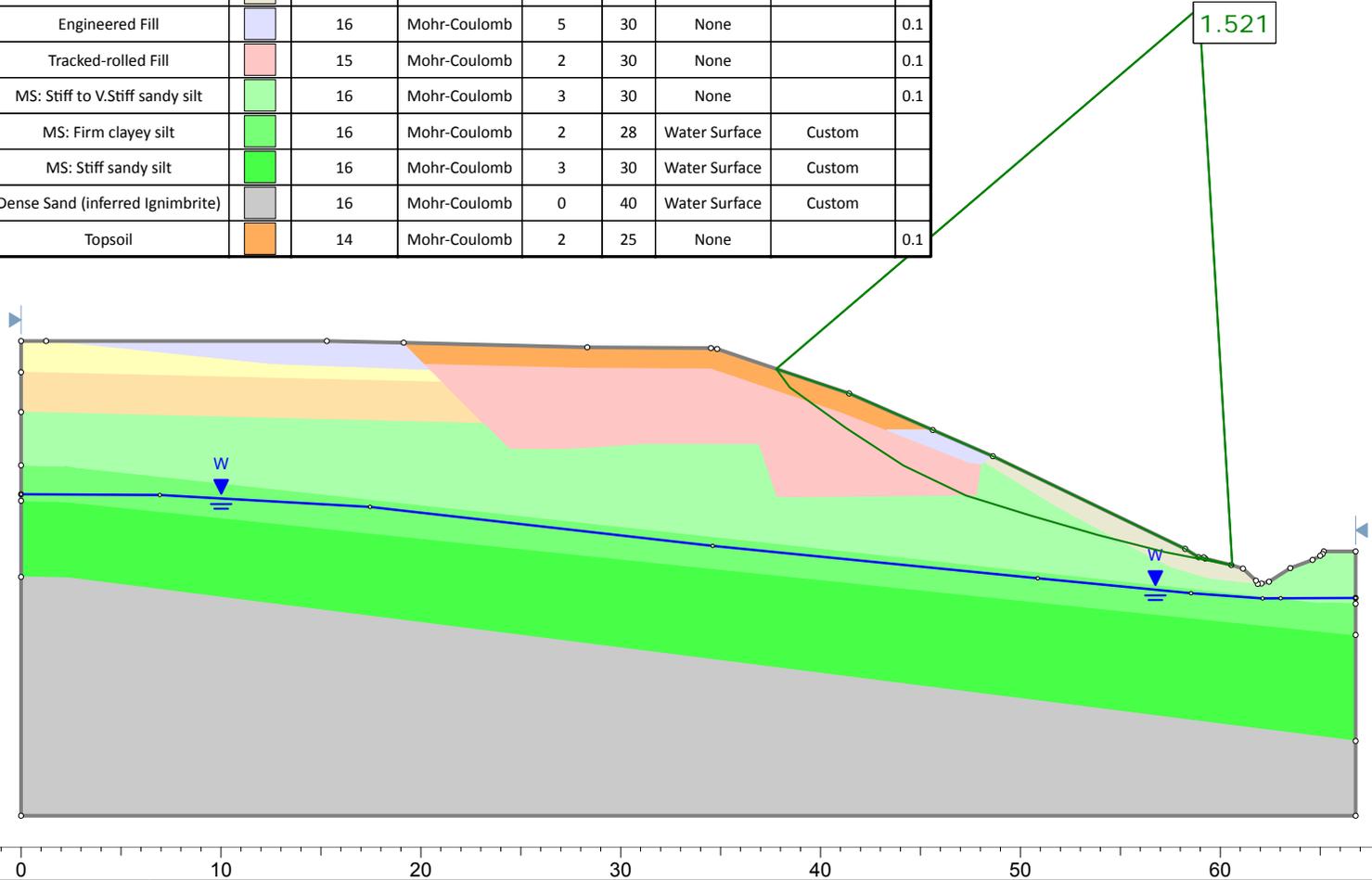
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Rev.	1



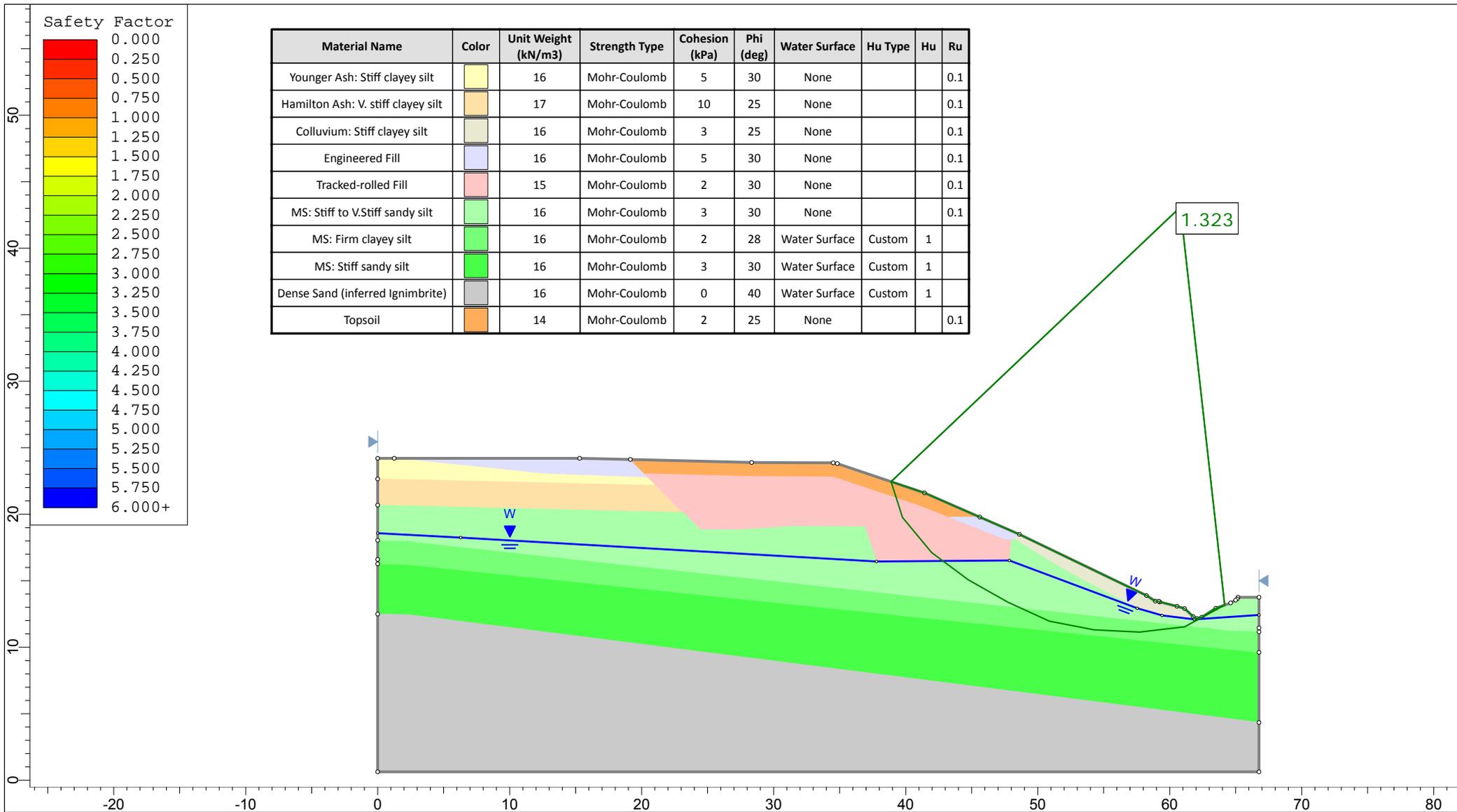




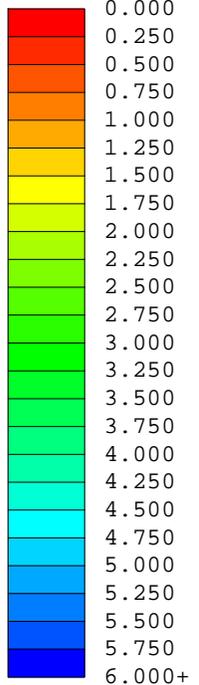
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Topsoil	[Orange]	14	Mohr-Coulomb	2	25	None		0.1



	Project	Kaimai Views Subdivision - Fill Encapsulation	
	Analysis Description	Cross Section 3 - As-built GL - Prevailing GW conditions	
	Drawn By	Company	Classic Developments Omokoroa Ltd
	Date	31/01/2018	File Name



Safety Factor

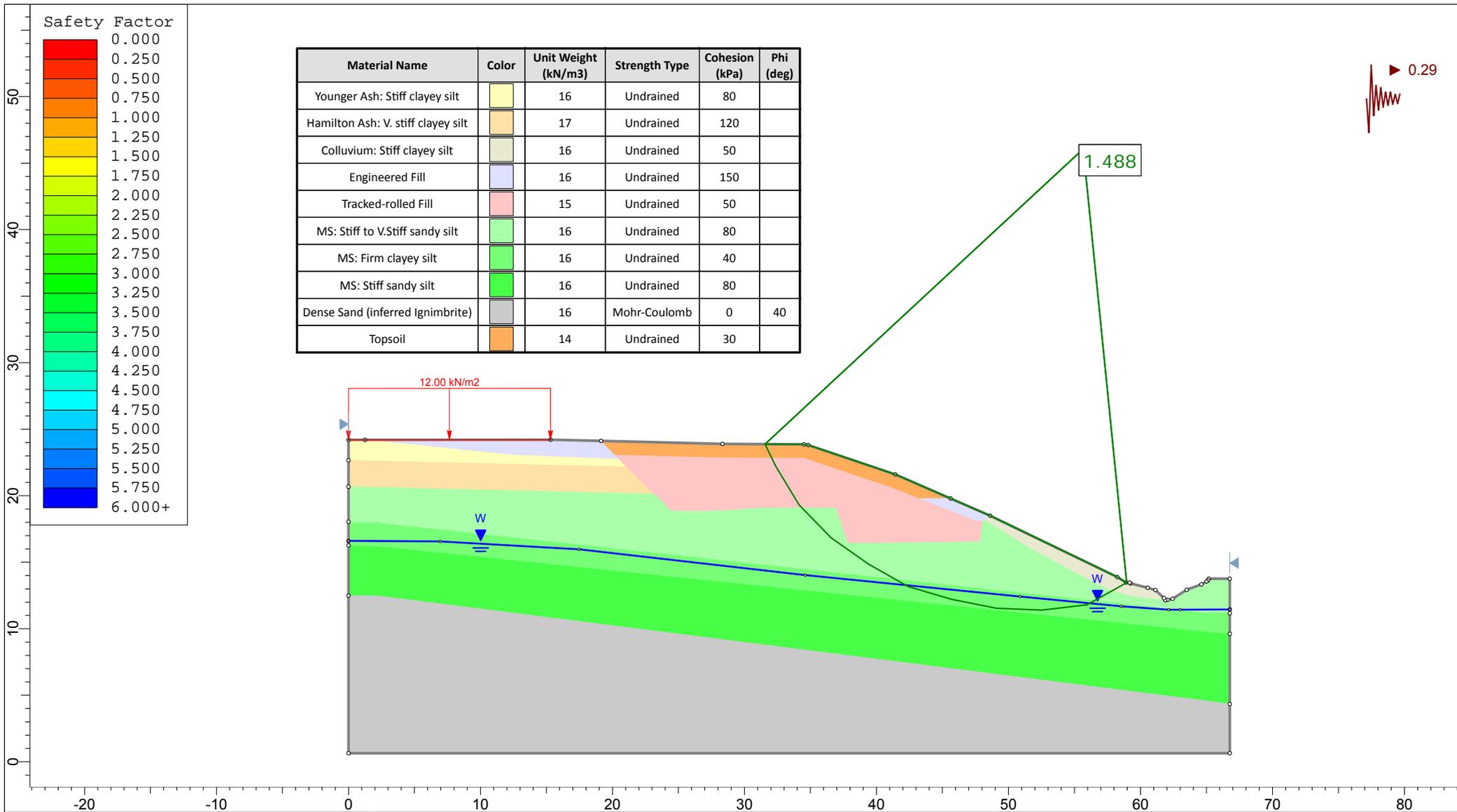


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MS: Stiff sandy silt	[Green]	16	Mohr-Coulomb	3	30	Water Surface	Custom	1	
Dense Sand (inferred Ignimbrite)	[Grey]	16	Mohr-Coulomb	0	40	Water Surface	Custom	1	
Topsoil	[Orange]	14	Mohr-Coulomb	2	25	None			0.1

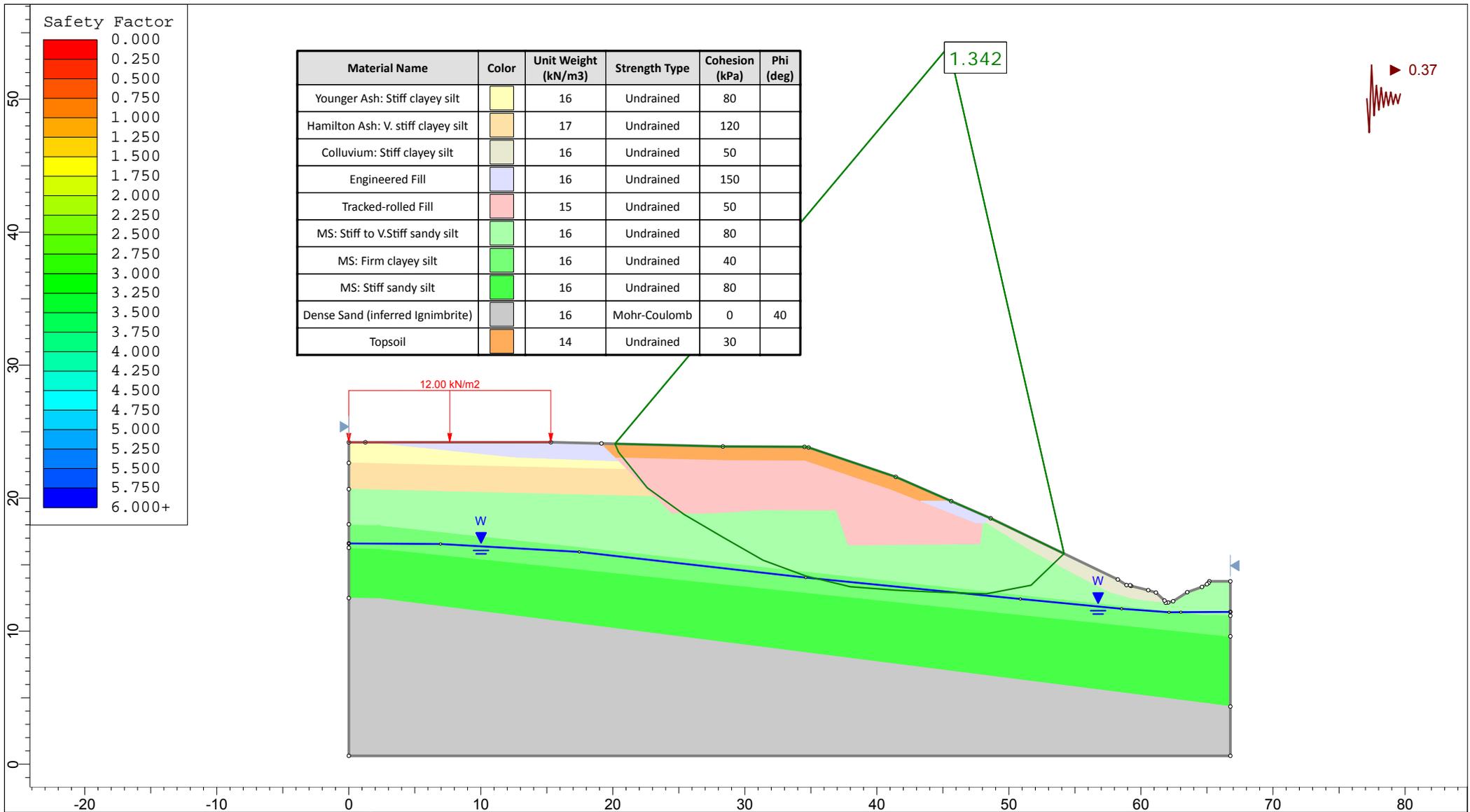
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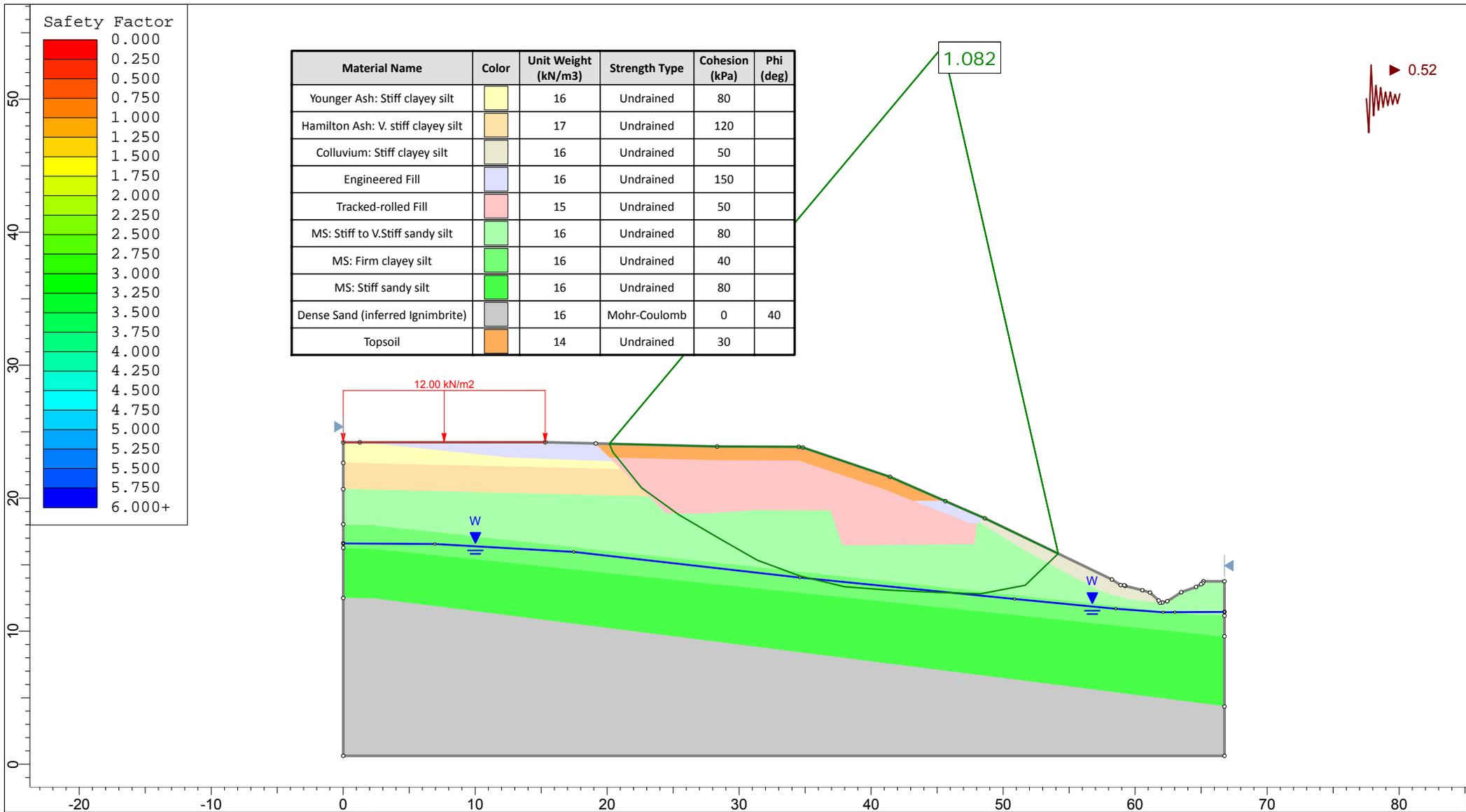
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Drawn By		Company	Classic Developments Omokoroa Ltd
Date	31/01/2018	File Name	ACM Encapsulation - As Built Section 3 - elevated GWL.slim



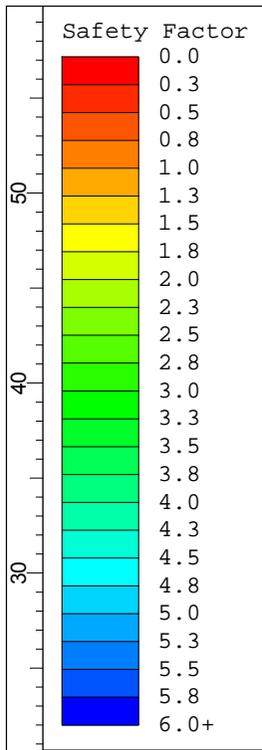
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	<b>Drawn By</b>	<b>Company</b> Classic Developments Omokoroa Ltd
	<b>Date</b> 05/02/2018	<b>File Name</b> ACM Encapsulation - As Built Section 3 - ULS Seismic Case.slim



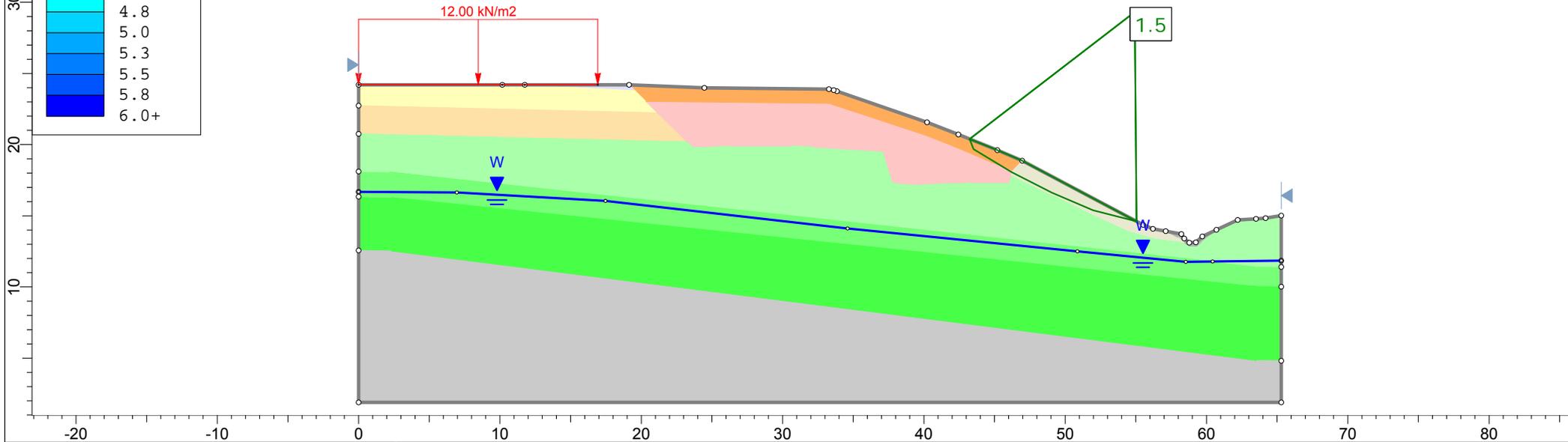
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	<b>Date</b> 05/02/2018	<b>File Name</b> ACM Encapsulation - As Built Section 3 - ULS Seismic Case.slim



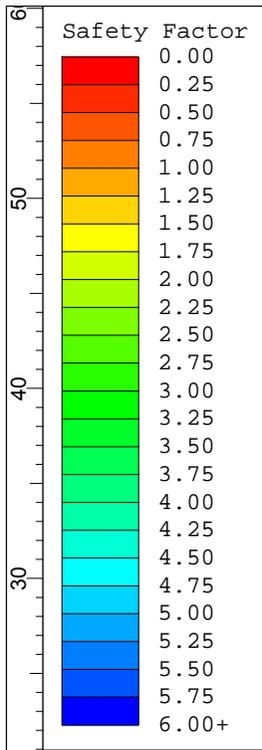
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	<b>Analysis Description</b> Cross Section 3 - As-built GL - IL4 ULS case	
	<b>Drawn By</b>	<b>Company</b> Classic Developments Omokoroa Ltd
	<b>Date</b> 05/02/2018	<b>File Name</b> ACM Encapsulation - As Built Section 3 - ULS Seismic Case.slim



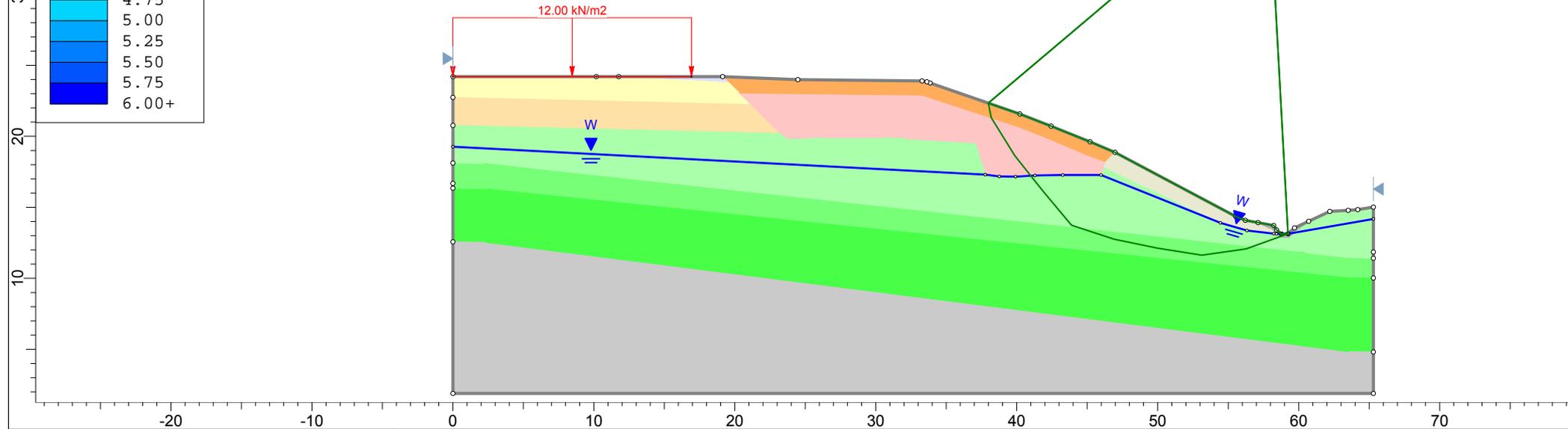
Material Name	Color	Unit Weight (kN/m <sup>3</sup> )	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
Younger Ash: Stiff clayey silt	Yellow	16	Mohr-Coulomb	5	30	None			0.1
Hamilton Ash: V. stiff clayey silt	Orange	17	Mohr-Coulomb	10	25	None			0.1
Colluvium: Stiff clayey silt	Light Green	16	Mohr-Coulomb	3	25	None			0.1
Engineered Fill	Light Blue	16	Mohr-Coulomb	5	30	None			0.1
Tracked-rolled Fill	Light Red	15	Mohr-Coulomb	2	30	None			0.1
MS: Stiff to V. Stiff sandy silt	Light Green	16	Mohr-Coulomb	3	30	None			0.1
MS: Firm clayey silt	Light Green	16	Mohr-Coulomb	2	28	Water Surface	Custom	1	
MS: Stiff sandy silt	Light Green	16	Mohr-Coulomb	3	30	Water Surface	Custom	1	
Dense Sand (inferred Ignimbrite)	Grey	16	Mohr-Coulomb	0	40	Water Surface	Custom	1	
Topsoil	Orange	14	Mohr-Coulomb	2	25	None			0.1
Armour Rock	Grey	20	Mohr-Coulomb	0	45	None			0



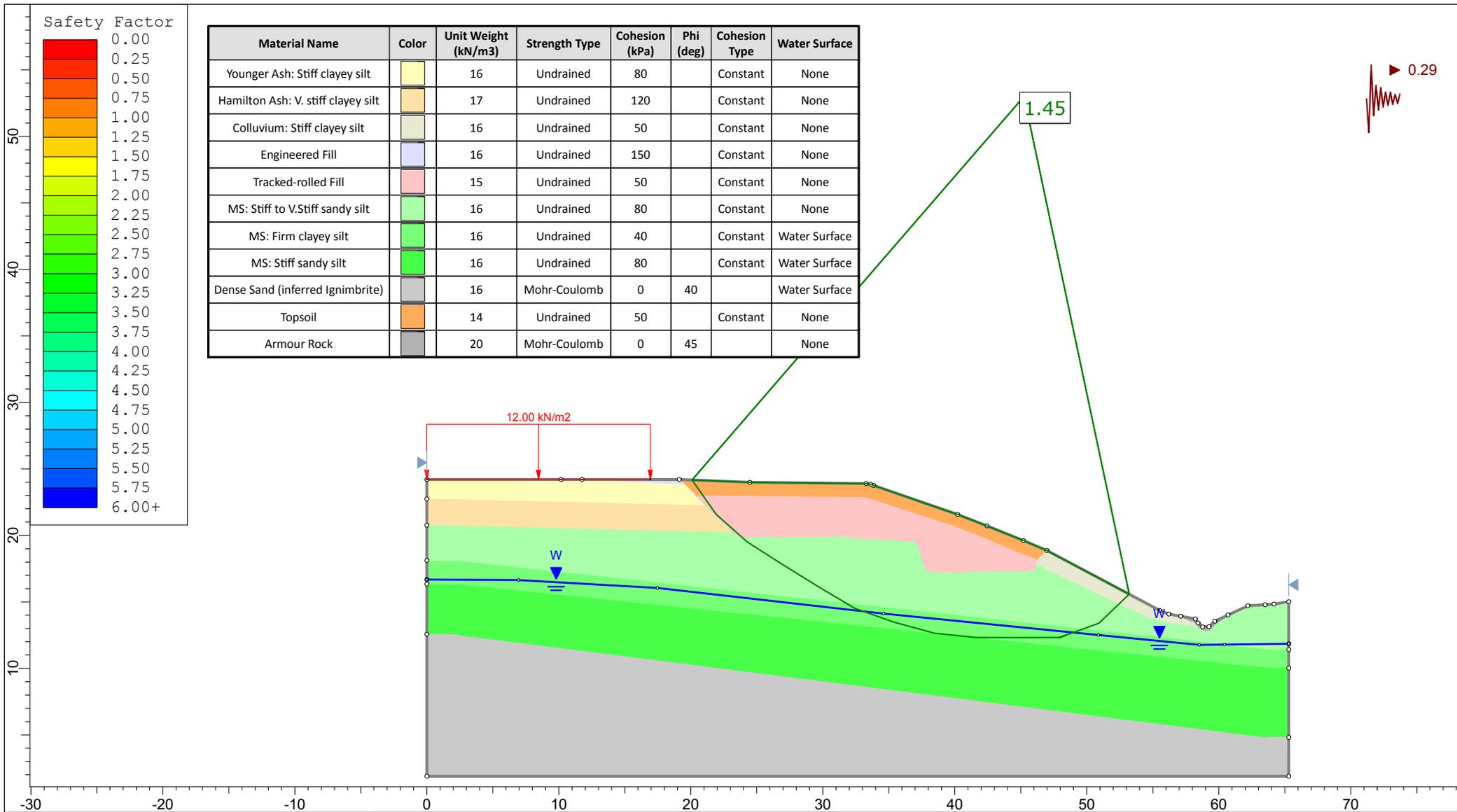
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	Analysis Description	Cross Section 4 - As-built GL - Prevailing GW conditions	
	Drawn By	Company	Classic Developments Omokoroa Ltd
	Date	09/02/2018	File Name



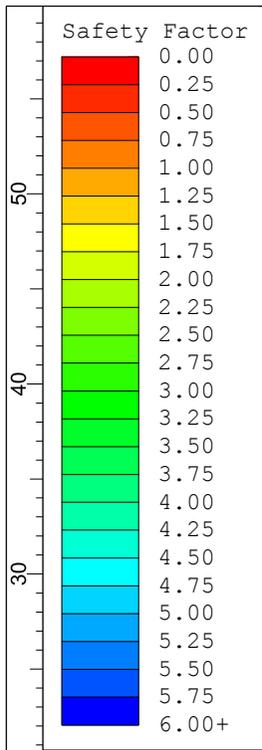
Material Name	Color	Unit Weight (kN/m <sup>3</sup> )	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Hu	Ru
Younger Ash: Stiff clayey silt	[Yellow]	16	Mohr-Coulomb	5	30	None			0.1
Hamilton Ash: V. stiff clayey silt	[Orange]	17	Mohr-Coulomb	10	25	None			0.1
Colluvium: Stiff clayey silt	[Light Green]	16	Mohr-Coulomb	3	25	None			0.1
Engineered Fill	[Light Blue]	16	Mohr-Coulomb	5	30	None			0.1
Tracked-rolled Fill	[Pink]	15	Mohr-Coulomb	2	30	None			0.1
MS: Stiff to V.Stiff sandy silt	[Light Green]	16	Mohr-Coulomb	3	30	Water Surface	Custom	1	
MS: Firm clayey silt	[Light Green]	16	Mohr-Coulomb	2	28	Water Surface	Custom	1	
MS: Stiff sandy silt	[Light Green]	16	Mohr-Coulomb	3	30	Water Surface	Custom	1	
Dense Sand (inferred Ignimbrite)	[Grey]	16	Mohr-Coulomb	0	40	None			0
Topsoil	[Orange]	14	Mohr-Coulomb	2	25	None			0.1
Armour Rock	[Grey]	20	Mohr-Coulomb	0	45	Water Surface	Custom	1	



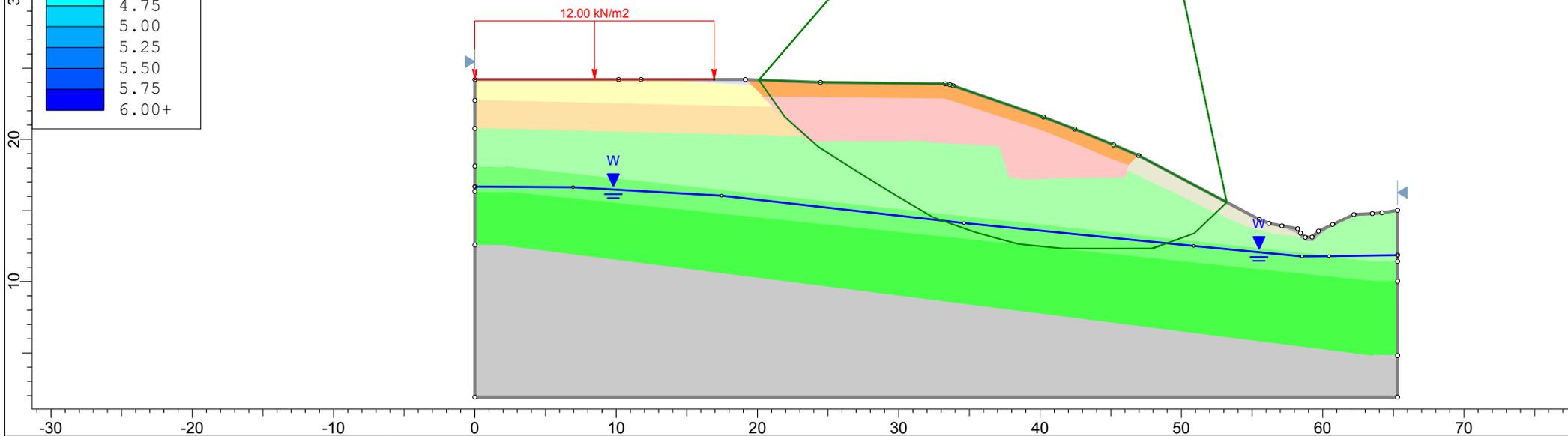
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	Analysis Description	Cross Section 4 - As-built GL - Elevated GW conditions	
	Drawn By	Company	Classic Developments Omokoroa Ltd
	Date	09/02/2018	File Name



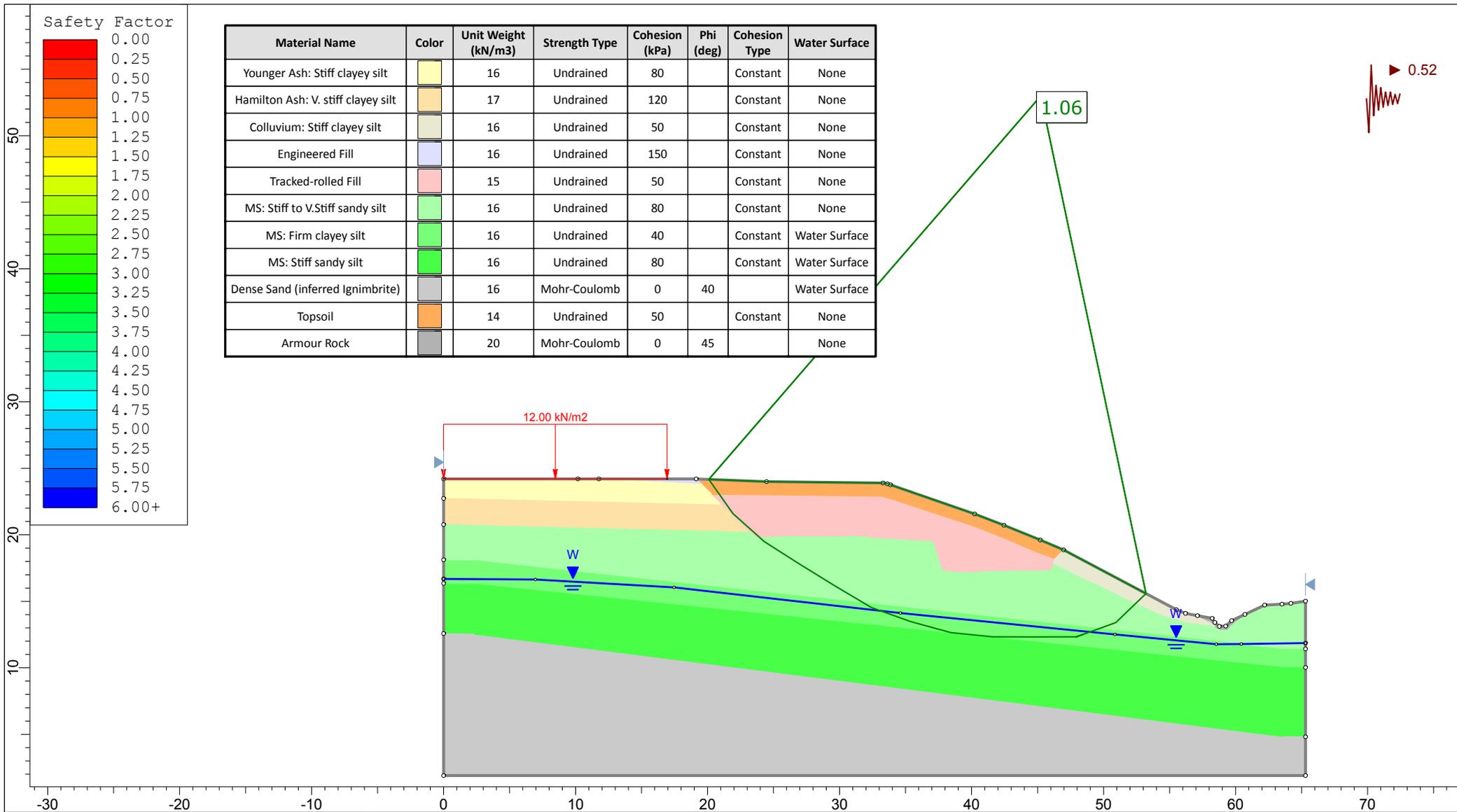
	Project		Kaimai Views Subdivision - Fill Encapsulation	
	Analysis Description		Cross Section 4 - As-built GL - IL2 seismic case	
	Drawn By	Company	Classic Developments Omokoroa Ltd	
	Date	16/02/2018	File Name	ACM - As Built Section 4 - seismic case.slim



Material Name	Color	Unit Weight (kN/m <sup>3</sup> )	Strength Type	Cohesion (kPa)	Phi (deg)	Cohesion Type	Water Surface
Younger Ash: Stiff clayey silt	[Yellow]	16	Undrained	80		Constant	None
Hamilton Ash: V. stiff clayey silt	[Orange]	17	Undrained	120		Constant	None
Colluvium: Stiff clayey silt	[Light Green]	16	Undrained	50		Constant	None
Engineered Fill	[Light Blue]	16	Undrained	150		Constant	None
Tracked-rolled Fill	[Pink]	15	Undrained	50		Constant	None
MS: Stiff to V.Stiff sandy silt	[Light Green]	16	Undrained	80		Constant	None
MS: Firm clayey silt	[Light Green]	16	Undrained	40		Constant	Water Surface
MS: Stiff sandy silt	[Light Green]	16	Undrained	80		Constant	Water Surface
Dense Sand (inferred Ignimbrite)	[Grey]	16	Mohr-Coulomb	0	40		Water Surface
Topsoil	[Orange]	14	Undrained	50		Constant	None
Armour Rock	[Grey]	20	Mohr-Coulomb	0	45		None



	Project	Kaimai Views Subdivision - Fill Encapsulation	
	Analysis Description	Cross Section 4 - As-built GL - IL3 seismic case	
	Drawn By	Company	Classic Developments Omokoroa Ltd
	Date	16/02/2018	File Name



	<b>Project</b> Kaimai Views Subdivision - Fill Encapsulation	
	<b>Analysis Description</b> Cross Section 4 - As-built GL - IL4 seismic case	
	<b>Drawn By</b>	<b>Company</b> Classic Developments Omokoroa Ltd
	<b>Date</b> 16/02/2018	<b>File Name</b> ACM - As Built Section 4 - seismic case.slim



C

Council  
Consents

# Appendix C

## Council Consents

# Resource Consent

## Resource Consent RM16-0346-AP

Following the processing of the Application received on the 31 August 2016, the Bay of Plenty Regional Council has granted the applicant(s):

Classic Developments NZ Limited

Consent(s) to:

RM16-0346-DC.01	Discharge to Land	Expiry 31 October 2021
RM16-0346-LC.01+	Earthworks or Excavation	Expiry 31 October 2021
CH17-00580	Final Approval	23 June 2017

The consent(s) are subject to the conditions specified on the attached schedule(s) for each activity. Advice notes are also provided as supplementary guidance, and to specify additional information to relevant conditions.

**The Resource Consent** hereby authorised is granted under the Resource Management Act 1991 does not constitute an authority under any other Act, Regulation or Bylaw.

DATED at Whakatane this 20th day of October 2016

For and on behalf of The Bay of Plenty Regional Council



**Mary-Anne Macleod**  
Chief Executive



**Thrive together -  
mō te taiao,  
mō ngā tāngata**

The change of the whole of this resource consent was approved under delegated authority of the Bay of Plenty Regional Council dated 23 June 2017

## **Bay of Plenty Regional Council**

### **Resource Consent**

Pursuant to the Resource Management Act 1991, the **Bay of Plenty Regional Council**, by a decision dated 20 October 2016, **hereby grants**:

A resource consent:

- **Under section 15(2)(b) of the Resource Management Act 1991 and Rule 35 of the Bay of Plenty Water and Land Plan being a restricted discretionary activity to discharge contaminants to land.**

subject to the following conditions:

#### **1 Purpose**

- 1.1 The purpose of this resource consent is to authorise and set conditions on the discharge of contaminants associated with the disturbance and remediation of contaminated land at 336, 340 and 344 Omokoroa Road, Omokoroa.

#### **2 Location**

- 2.1 The activity authorised under this consent shall be located at 336, 340, and 344 Omokoroa Road, Omokoroa as shown on the plan referenced as B.O.P.R.C Plan Number RM16-0346/1.

#### **3 Map Reference**

- 3.1 The approximate centre of the activity site is at or about map reference NZTM 1866738,5828267;

#### **4 Legal Description**

- 4.1 PT Lot 1 DPS 65560, PT Lot 2 DPS 65560, Lot 1 DPS 4524 (Western Bay of Plenty District).

#### **5 Temporary Stormwater Discharge**

- 5.1 The consent holder shall ensure that the remediation site is effectively isolated so that all potentially contaminated storm-water from the remediation site is contained within the remediation activity site and discharged to ground soakage at the base of excavations.
- 5.2 Stormwater discharged shall be substantially free of floatable solids, oil and grease.

#### **6 Resource Management Charges**

- 6.1 The consent holder shall pay the Bay of Plenty Regional Council such administrative charges as are fixed from time to time by the Regional Council in accordance with section 36 of the Resource Management Act 1991.

#### **7 Term of Consent**

- 7.1 This consent shall expire on 31 October 2021.

#### **8 The Consent**

8.1 The Consent hereby authorised is granted under the Resource Management Act 1991 and does not constitute an authority under any other Act, Regulation or Bylaw.

## Advice Notes

- 1 Notification and reporting required by this consent should be made in writing to the Manager Pollution Prevention, Bay of Plenty Regional Council, Box 364 or fax 0800 884 882 or email [notify@boprc.govt.nz](mailto:notify@boprc.govt.nz) and should include the consent number RM16-0346.
- 2 The consent holder is responsible for ensuring that all contractors carrying out works under this consent are made aware of the relevant consent conditions, plans and associated documents.
- 3 The consent holder is advised that non-compliance with consent conditions may result in enforcement action against the consent holder and/or their contractors.

## **Bay of Plenty Regional Council**

### **Resource Consent**

Pursuant to the Resource Management Act 1991, the **Bay of Plenty Regional Council**, by a decision dated 20 October 2016, **hereby grants:**

A resource consent:

- **Under section 9(2)(a) of the Resource Management Act 1991 and Rule 35 of the Bay of Plenty Regional Water and Land Plan to undertake a restricted discretionary activity being to disturb and remediate contaminated land.**

subject to the following conditions:

#### **1 Purpose**

- 1.1 The purpose of this resource consent is to authorise and set conditions on the land disturbance and remediation of contaminated land at 336, 340 and 344 Omokoroa Road, Omokoroa.

#### **2 Location**

- 2.1 The activity authorised under this consent shall be located at 336, 340, and 344 Omokoroa Road, Omokoroa as shown on the plan referenced as B.O.P.R.C Plan Number RM16-0346/1.

#### **3 Map Reference**

- 3.1 The approximate centre of the activity site is at or about map reference NZTM 1866738,5828267;

#### **4 Legal Description**

- 4.1 PT Lot 1 DPS 65560, PT Lot 2 DPS 65560, Lot 1 DPS 4524 (Western Bay of Plenty District).

#### **5 Notification of Works - 5 days**

- 5.1 No less than five (5) working days prior to the commencement of works authorised under this consent, the Consent Holder shall request (in writing) a site meeting between the principal site contractor and the Chief Executive of the Bay of Plenty Regional Council (or delegate). Notification at this time shall include details of who is to be responsible for site management and compliance with consent conditions (see Advice Note 3).
- 5.2 The consent holder shall notify (in writing) the Chief Executive of the Bay of Plenty Regional Council or delegate that works have been completed, within five working days of the completion of works under this consent (see Advice Note 3).

#### **6 Contaminated Land Remediation**

- 6.1 The consent holder shall ensure that all remediation operations and installation of erosion and sediment controls are carried out in accordance with the relevant sections of the Resource Consent Application received by Bay of Plenty Regional Council on 31 August 2016, and specific documentation as set out below:
  - The Lysaght Plan titled CLASSIC BUILDERS OMOKOROA SPECIAL HOUSING AREA, OMOKOROA Contaminated Land Remediation Site Validation Soil Sampling Plan, Drawing

- No. 163252-200-RAP Rev. A and referenced as B.O.P.R.C Plan Number RM16-0346/1; and,
    - The Lysaght Plan titled CLASSIC BUILDERS OMOKOROA SPECIAL HOUSING AREA, OMOKOROA Contaminated Land Remediation Site Validation Soil Sampling Plan, Drawing No. 163252-201-RAP Rev. A and referenced as B.O.P.R.C Plan Number RM16-0346/2; and,
    - The Lysaght Plan titled CLASSIC BUILDERS OMOKOROA SPECIAL HOUSING AREA, OMOKOROA Contaminated Land Remediation Site Validation Soil Sampling Plan, Drawing No. 163252-202-RAP Rev. A and referenced as B.O.P.R.C Plan Number RM16-0346/3; or
    - Any subsequent plan that has received written approval from the Chief Executive of the Regional Council or delegate
- 6.2 The consent holder shall undertake the requirements set out in the Remedial Action Plan attached as appendix 1 of this consent, to the satisfaction of the Chief Executive of the Bay of Plenty Regional Council or delegate. In particular, sections 6.0 (Construction Staging), 8.0 (Remedial Action Plan), 9.0 (RAP/SMP Implementation), 10.0 (Disposal Locations), 11.0 (Imported Fill Material), 12.0 (Validation and Monitoring Requirements), 13.0 (RAP/SMP Review) and 14.0 (Contingency Measures) of the document.
  - 6.3 Should any changes to the approved Remediation Action Plan occur to the proposed methodologies following review/revision of the RAP as specified in section 13.0 (RAP/SMP Review) of the RAP document, the consent holder shall forward the revised document to the Chief Executive of the Regional Council or delegate for written approval.
  - 6.4 The consent holder shall undertake the works specified in the most up to date approved Remediation Action Plan (under conditions 6.2 and 6.3 of this consent) to the satisfaction of the Chief Executive of the Bay of Plenty Regional Council or delegate.
  - 6.5 The consent holder shall install all sediment controls within the catchment of the remediation site(s) prior to the commencement of the excavation of the contaminated soils, to the satisfaction of the Chief Executive of the Bay of Plenty Regional Council or delegate.
  - 6.6 Prior to any disposal of contaminated material, the consent holder shall provide confirmation of the appropriately consented disposal location to be used for contaminated material Chief Executive of the Bay of Plenty Regional Council or delegate.
  - 6.7 All contaminated material removed from the site shall be disposed of at a landfill facility legally consented to accept the relevant level of contamination (this includes all sediment controls, covers and other items that have contacted the contaminated soil).
  - 6.8 Where it can be demonstrated that the soil has been fully characterised in accordance with the Ministry for the Environment's 'A Guide to the Management of Cleanfills (2002)' and meets the definition of 'cleanfill', the removal to a consented disposal site is not required.
  - 6.9 Remediation works authorised by this consent shall not be undertaken during the period 1 May to 15 September (inclusive) of any year within the consent term.
  - 6.10 The consent holder shall ensure that contaminated land remediation is completed within three (3) months from commencement unless written approval to complete the remediation works is provided by the Chief Executive of the Regional Council or delegate.
  - 6.11 The consent holder shall ensure that the excavation of the contaminated soils is undertaken in a period with a 72 hour clear weather forecast.
  - 6.12 The consent holder shall ensure that any stockpiles of excavated contaminated soils are plastic lined so as to prevent contaminants leaching into previously uncontaminated ground, effectively bunded to contain all contaminants and imperviously covered.
  - 6.13 There shall be no tracking of contaminated material off site or outside of the remediation area(s).
  - 6.14 The consent holder shall ensure that, at all times, the soil moisture level of exposed areas is sufficient to prevent dust generated by normal earthmoving operations from remaining airborne beyond the boundary of the work site.
  - 6.15 The consent holder shall ensure that any fill material brought into the activity site from off site, for deposition as fill material, is classified as 'cleanfill' in accordance with the Ministry for Environments Guide to the Management of Cleanfills (2002), and the Bay of Plenty Regional Water and Land Plan definition of cleanfill as specified in advice note 6.

- 6.16 The immediate management of the Asbestos Containing Material identified in March 2017 is to be carried out in accordance with the following information:
- The Aurecon NZ Limited "Contaminated Site Management Plan", Revision 2, May 8 2017, attached as Appendix 2 to the consent conditions; and
  - Aurecon NZ Limited "Earthworks Stage 1 Erosion and Sediment Control Plan", Drawing Number 163252-240-EW, Rev 1, and referenced as B.O.P.R.C Plan Number CH17-00580/01.
- 6.17 The remediation and validation of the asbestos contaminated site will be completed in accordance with any subsequent Remediation Action Plan (RAP) completed by Aurecon NZ Limited and as approved by the Bay of Plenty Regional Council. Remediation works are not to occur until the RAP has been approved by the Bay of Plenty Regional Council.
- 6.18 The consent holder shall ensure that a buffer zone, of a minimum of 10 metres, is applied around the affected areas identified as the SP, Stockpile A and Stockpile B on B.O.P.R.C Plan Number CH17-00580/01 and in the Contaminated Site Management Plan attached as Appendix 2 to the consent conditions.

## 7 Investigation and Site Validation

- 7.1 The site shall be remediated to have a soil heavy metal concentration equal to or less than the guideline levels for residential land use as stipulated in the National Environmental Standard for Assessing and Managing the Contaminants in Soils to Protect of Human Health.
- 7.2 The consent holder shall submit a Site Validation Report (SVR) to the Chief Executive of the Bay of Plenty Regional Council (or delegate) within three (3) months of completion of the remediation works. The SVR shall be prepared by a suitably qualified and experienced contaminated land professional in accordance with the Ministry for the Environment (MfE) 'Contaminated Land Management Guideline 1: Reporting on Contaminated Site in New Zealand (2011)' and shall, as a minimum, include:
- a) A summary of the works undertaken, including additional remediation (if required), a statement confirming whether the remediation of the works areas has been completed in accordance with the approved Remediation Action Plan/ Contaminated Sites Management Plan;
  - b) The locations and dimensions of the excavations carried out, including a relevant site plan;
  - c) Records of any unexpected contamination encountered during the works, if applicable;
  - d) A summary of additional soil sampling (if required) and validation sampling undertaken, tabulated analytical results, and interpretation of those results in the context of the Contaminated Land Rules of the Bay of Plenty Regional Council Water and Land Plan;
  - e) Volume of soil disposed off-site and the disposal location;
  - f) Documentation relating to the transportation of soil disposed off-site;
  - g) Volume of cleanfill disposed of on-site including certification documentation (if any); and
  - h) Details regarding any complaints and/or breaches of the procedures set out in the Remedial Action Plan and the conditions of this consent; and
  - i) Details of any asbestos air monitoring programme and results from sampling carried out in accordance with section 5.7 of the Contaminated Site Management Plan, attached as Appendix 2 to the consent conditions.
- 7.3 Any soil analysis shall be undertaken by an IANZ accredited laboratory.

## 8 Signage

- 8.1 Prior to the commencement of works under this consent, the consent holder shall erect a prominent sign adjacent to the entrance of site works, and maintain it throughout the period of the works. The sign shall clearly display, as a minimum, the following information:
- The consent holder
  - The main site contractor;
  - A 24 hour contact telephone number for the consent holder or appointed agent;
  - A clear explanation that the contact telephone number is for the purpose of receiving complaints and information from the public about dust nuisance or any other problem resulting from the exercise of this consent.

## 9 Monitoring and Reporting

- 9.1 The consent holder shall ensure that the erosion and sediment controls are inspected:
- At least weekly during the duration of this consent; and
  - Within 12 hours of each rainstorm event which is likely to impair the function or performance of the erosion and sediment controls.
- 9.2 The consent holder shall maintain records of:
- The date and time of every inspection of erosion and sediment controls on the site;
  - The date, time and description of any maintenance work carried out.
- 9.3 The consent holder shall forward a copy of records required by conditions of this consent to the Regional Council within 48 hours of its request.

## 10 Maintenance

- 10.1 The consent holder shall ensure that the erosion and sediment controls and associated erosion protection devices and dust controls are maintained in an effective capacity at all times during works and until the site is stabilised.

## 11 Resource Management Charges

- 11.1 The consent holder shall pay the Bay of Plenty Regional Council such administrative charges as are fixed from time to time by the Regional Council in accordance with section 36 of the Resource Management Act 1991.

## 12 Term of Consent

- 12.1 This consent shall expire on 31 October 2021.

## 13 The Consent

- 13.1 The Consent hereby authorised is granted under the Resource Management Act 1991 and does not constitute an authority under any other Act, Regulation or Bylaw.

## Advice Notes

- 1 All archaeological sites whether recorded or unrecorded under Subpart 2 of the Heritage New Zealand Pouhere Taonga Act 2014 cannot be destroyed, damaged, or modified without the consent of Heritage New Zealand. In the event that an archaeological site(s) and/or koiwi are unearthed, the consent holder is advised to immediately stop work on the part of the site that the archaeological site(s) is located, and contact Heritage New Zealand and all relevant iwi/hapū for advice. Heritage New Zealand Contact Details: email - [info@lowernorthern@heritage.org.nz](mailto:info@lowernorthern@heritage.org.nz) phone - 07 577 4530. The Bay of Plenty Regional Council is able to advise of the contact details for the relevant iwi/ hapū in this area.
- 2 The consent holder shall obtain all other necessary consents and permits, including those under the Building Act 2004, and the Heritage New Zealand Pouhere Taonga Act 2014. This consent does not remove the need to comply with all other applicable Acts, regulations, relevant Bylaws, and rules of law.
- 3 Reporting, notification and submission of plans on regional council matters required by conditions of this consent be directed (in writing) to the Pollution Prevention Manager, Bay of Plenty Regional Council, PO Box 364, Whakatane or fax 0800 884 882 or email [notify@boprc.govt.nz](mailto:notify@boprc.govt.nz) this notification shall include the consent number RM16-0346.
- 4 The consent holder is responsible for ensuring that all contractors carrying out works under this consent are made aware of the relevant consent conditions, plans and associated documents.
- 5 The consent holder is advised that non-compliance with consent conditions may result in enforcement action against the consent holder and/or their contractors.

- 6 For the purposes of this consent, the definition of clean-fill shall include only natural materials such as clay, soil, rock and such other materials as concrete, brick or demolition products that are free of:
- (a) Combustible or putrescible components (including green waste) apart from up to 10 percent by volume untreated timber in each load;
  - (b) Hazardous substances or materials (such as municipal waste) likely to create leachate by means of biological or chemical breakdown;
  - (c) Any products or materials derived from hazardous waste treatment, stabilisation or disposal processes; or Any other material that has received written approval from the Chief Executive of the Regional Council or delegate.





**D**

**Roles &  
Responsibilities**

# Appendix D

## Roles and Responsibilities

This table summarises the recommended roles and assumed responsibilities for the management of contaminated or potentially contaminated soil during future earthworks. The appointed contractor may wish to appoint sub-consultants or contractors to assume certain responsibilities on their behalf. The roles and responsibilities are suggested only but shall be finalised once earthworks have been confirmed within the area of asbestos encapsulation. All identified roles should include clear lines of communication between all key project stakeholders.

**Table C.1: Roles and Responsibilities**

Role	Responsibility
The Owner	The Owner is the principal for all works and for the purposes of the <i>Health and Safety at Work Act 2015</i> is the person conducting a business or undertaking (PCBU). The Client is responsible for appointing the Principal Contractor and the Principal Consultant. The Client may elect to appoint a project manager to represent their interests in addition to these parties.
Principal Consultant	The Principal Consultant is responsible for observing the works to provide reassurance that they are being carried out in accordance with the proposed design and that any variations to the design are documented and fit for purpose. The Principal Consultant is responsible for advising on the need for and reasonableness of any changes to the contract for the works. The Principal Consultant recommends an Environmental Consultant to deliver specialist services related to contaminated land within the OSMP.
Environmental Consultant (Suitably Qualified Environmental Practitioner)	<p>The Environmental Consultant and their nominated Suitably Qualified Experienced Practitioner (SQEP) will be responsible for activities associated with inspection and/or sampling of soil, such as:</p> <ul style="list-style-type: none"> <li>■ Identifying areas of potential soil contamination; and</li> <li>■ Review of soil data and provision of advice with respect to appropriate management and/or off-site disposal of material.</li> </ul> <p>The SQEP will be available to provide on-going environmental advice and support to the Earthworks Contractor as needed. Where necessary, the SQEP (with the Site Manager) will be responsible for on-going liaison with regulatory authorities and the community in relation to environmental issues.</p> <p>The role of SQEP is determined by the Ministry for the Environment (MfE) but limits responsibility about the definition of this role. The determination as to who may qualify as a SQEP has more recently been defined by WasteMINZ<sup>2</sup>. The minimum requirements of a SQEP suitable for performing this role as interpreted by WasteMINZ is the following:</p> <ul style="list-style-type: none"> <li>■ Tertiary science or engineering qualification relevant to environmental assessment that required the equivalent of at least three years' full-time study;</li> <li>■ Three years contaminated land assessment experience in the last five years;</li> <li>■ Ten years' relevant post graduate environmental experience;</li> <li>■ Continuing professional development 40 hours per year contaminated site related;</li> <li>■ Peer recognition: three SQEP references as to suitability and relevance of qualification and experience; and</li> <li>■ Committed to operate in accordance with a code of ethics for environmental practitioners.</li> </ul>
TCC Category 1 Geoprofessional	<p>The TCC Category 1 Geoprofessional will be responsible for activities associated with geotechnical works and assessment regarding the project, including:</p> <ul style="list-style-type: none"> <li>■ Slope stability</li> <li>■ Settlement</li> <li>■ Seismic ground hazards</li> <li>■ Other Geohazard Risk Assessment and Mitigation listed in TCC DS-10 – APX B.5 Table 1, as administered by WBOPDC.</li> </ul>

<sup>2</sup> <http://www.wasteminz.org.nz/wp-content/uploads/SQEP-Accreditation-Draft-Table-May-2013.pdf>

Principal Contractor	The Principal Contractor for the project is ultimately responsible for the overall compliance with prescribed legislation and guidelines relevant to the project. This is the company who hold the contract to complete the physical works.
Site Manager	<p>The Site Manager will ensure that the appointed Earthworks Contractor (Principal) is prepared to implement environmental protection programmes, appropriate to their activities, and to cooperate in any environmental management plans implemented on the Project.</p> <p>The Site Manager will be the main contact and conduit for ongoing liaison between regulatory authorities. Advice from the Earthworks Contractor may be sought as required. The Site Manager is responsible for ensuring that the works are completed in accordance with the contract.</p>
Earthworks Contractor	The Earthworks Contractor will report directly to the Site Manager and will be responsible for implementing the plan with assistance and direction from the Site Manager or the Principal Consultant. The Earthworks Contractor nominates an Earthworks Environmental Manager. The Earthworks Contractor has responsibility to ensure activities under their direct control are completed in compliance with this plan and related Work Procedures, Inspection Plans, Procedural Checklists, and Environmental Management Plans, as applicable.
Earthworks Environmental Manager	<p>The responsibility for day-to-day site management lies with the Earthworks Environmental Manager. The manager will be assisted by the nominated SQEP as necessary.</p> <p>The Earthworks Environmental Manager is responsible for ensuring that all employees and earthworks subcontractors are fully cognisant of, and abide by, this plan.</p> <p>The Earthworks Environmental Manager will ensure all employees and subcontractors put into practice this plan and shall ensure that the factors that may compromise the achievement of overall project or environmental objectives are brought to the attention of the Site Manager and the SQEP. The Earthworks Environmental Manager will:</p> <ul style="list-style-type: none"> <li>■ Be responsible for ensuring employee and Earthworks Contractor adherence to this plan;</li> <li>■ Maintain the content and implementation of induction training and tool box sessions;</li> <li>■ Keep records of who has been inducted;</li> <li>■ Be responsible for reporting all incidents in breach of this plan to the Site Manager and SQEP;</li> <li>■ Maintain a log of earthworks operations and associated management and/or off-site disposal of material;</li> <li>■ Periodically inspect pollution management features and equipment to confirm availability and completeness; and</li> </ul> <p>The Earthworks Environmental Manager and SQEP shall, in conjunction, be responsible for the following:</p> <ul style="list-style-type: none"> <li>■ Inspection of excavations to determine extent of earthworks;</li> <li>■ Identification of access-controlled work areas; and</li> <li>■ Review and management of imported materials and/or waste materials.</li> </ul>

Licensed Asbestos Removalist	<p>An asbestos specialist will be present on site at all times works involving disturbing or removal of asbestos. The specialist may be the principal contractor or a subcontractor. The asbestos specialist will be responsible for:</p> <ul style="list-style-type: none"><li>■ Preparation of asbestos removal control plans (ARCP) and liaison with Worksafe</li><li>■ Ensuring all works completed on site in compliance with HSW Asbestos Regulations, the Code of Practice and BRANZ guidelines</li><li>■ Provision of inductions and organisation of training, where required</li><li>■ Ensuring that the works area separated from the rest of the site, and that all people within the works area have appropriate training and personal protective equipment, with appropriate signage</li><li>■ Ensuring that all fencing and decontamination areas set up and operational at all times of day</li><li>■ Ensuring all plant and vehicles remain within works area, and not leaving the works area without appropriate decontamination</li><li>■ Ensuring appropriate air monitoring requirements are being undertaken</li><li>■ Material is being handled and placed into appropriate containers or lined trucks for off-site removal and disposal</li></ul>
------------------------------------	--



E

Inspection  
Records

# Appendix E

## Inspection Records

**Kaimai Views Asbestos Containment Cell Monitoring Form**

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Organisation: \_\_\_\_\_

Weather: \_\_\_\_\_

**Previous weather events:**

--

**Evidence of slope instability (cracks, steps, slips etc):**

--

**Evidence of burrowing animals:**

--

**Evidence of vegetation distress:**

--

**Evidence of water ponding:**

--

**Evidence of scour/erosion/earthworks:**

--

**Geotextile cloth visible? Y/N**

**Remedial works required:**

--

**Photographs taken:**

--

**Document prepared by**

**Aurecon New Zealand Limited**  
Ground Level 247 Cameron Road  
Tauranga 3110  
PO Box 2292  
Tauranga 3140  
New Zealand

**T** +64 7 578 6183  
**F** +64 7 578 6143  
**E** [tauranga@aurecongroup.com](mailto:tauranga@aurecongroup.com)  
**W** [aurecongroup.com](http://aurecongroup.com)

**aurecon**

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to life*

**Aurecon offices are located in:**  
Angola, Australia, Botswana, China,  
Ghana, Hong Kong, Indonesia, Kenya,  
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# **Kaimai Views Subdivision Development, Omokoroa**

Remediation Options Appraisal  
and Remedial Action Plan

**Classic Developments Limited**

Reference: 255791

Revision: 0

20 June 2017

**aurecon**

*Bringing ideas  
to life*

# Document control record

Document prepared by:

**Aurecon New Zealand Limited**  
 Ground Level 247 Cameron Road  
 Tauranga 3110  
 PO Box 2292  
 Tauranga 3140  
 New Zealand

**T** +64 7 578 6183  
**F** +64 7 578 6143  
**E** tauranga@aurecongroup.com  
**W** aurecongroup.com

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<b>Name</b>		Luke Beirne	<b>Name</b>		Aaron Collier
<b>Title</b>		Environmental Geologist	<b>Title</b>		Technical Director

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Table 1	Summary of Identified remediation areas
Table 2	Site, project and programme considerations
Table 3	Encapsulation Design Considerations

# 1 Introduction

## 1.1 Overview and project background

Aurecon have been engaged by Classic Developments Limited (the “Client”) to provide environmental consultancy services to design an encapsulation system to assist with the risk of asbestos exposure to current site users and future residents at the Kaimai Views residential subdivision being developed at 336, 340, and 344 Omokoroa Road, Omokoroa, (the “Site”). The site is currently being developed as part of the Omokoroa Special Housing Area – a development completed by a joint venture partnership between the client and Western Bay of Plenty District Council (WBOPDC) creating circa. 250 new residential lots, as shown on Lysaghts drawing No. 163252-230-EW, A copy of which is included in Appendix B.

During earthworks to construct the design landform at Kaimai Views, asbestos containing materials (ACM) were discovered by site personnel within two stockpiles of topsoil and non-engineered fill formed by site contractors during undercut for earthworks. Further inspection following this discovery identified, an additional area of in-situ non-engineered fill also suspected to contain ACM. The source of the ACM is suspected, to be the result of historic gully infilling activities by the previous landowner utilising fill material imported to site containing demolition waste.

A detailed site investigation (DSI) for the Site prepared by Lysaghts (Report Ref. “Detailed Contaminated Site Investigation – for 336, 340 and 344 Omokoroa Road, Omokoroa Reference: 163252”) confirms the previous site use as an orchard, and hotspots of arsenic and hydrocarbon (TPH) contamination with reported concentrations in exceedance of adopted ‘tier 1’ human health soil contaminant standards. Works by Lysaghts to manage, remediate and validate these hotspots are being undertaken and will be reported by Lysaghts separately.

In response to the initial discovery of asbestos, Aurecon have prepared a Contaminated Site Management Plan (CSMP, Ref: 255791-0000-REP-NN-0001-Rev1) to facilitate the removal of ACM impacted topsoil from areas of urgent works within the site by stockpiling the affected material away from works areas to allow completion of a stormwater retention pond. The CSMP represents the first stage of controls to mitigate risk to site construction personnel and adjacent receptors during the earthworks.

This Remedial Action Plan provides a strategy for management of asbestos in soil risk only. The RAP comprises a summary of site conditions and an appraisal of potential remedial options (principally evaluation of off-site disposal or onsite encapsulation activities) and provides methodology for encapsulation and post-works validation to demonstrate the risk has been successfully mitigated. The RAP has been prepared in general accordance with our scoping document dated 27 March 2017, and in agreement with discussions held with BOPRC and WBOPDC.

The CSMP, which details the practical aspects of managing asbestos contaminated soils on the Site, should be read in conjunction with this Remediation Options Appraisal and Remedial Action Plan.

## 1.2 Objectives

The objective of the RAP is to assess the principal options for management of asbestos contaminated material, and to outline the design and methodology of the chosen outcome.

## 1.3 Legislative guidelines

The following legislation and guidelines have been considered for the preparation of this CSMP:

- MfE Contaminated Land Management Guidelines (CLMG), Volumes 1 to 5 (October 2011)
- National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health Regulations (October 2011)
- MfE A Guide to the Management of Cleanfills (January 2002)
- MfE Module 2 – Hazardous Waste Guidelines: Landfill waste acceptance criteria and landfill classification (May 2004)

- Worksafe NZ – Approved Code of Practice: Management and Removal of Asbestos (November 2016)<sup>1</sup>
- Health and Safety at Work Act (2015)
- Health and Safety at Work Asbestos Regulations (2016)
- Western Australian Department of Health (WA DoH) 2009 *Guidelines for the Assessment, Remediation and Management of Asbestos Contaminated Sites in Western Australia*
- CIRIA C733, Asbestos in soil and made ground: a guide to understanding and managing risks (March 2014)
- CIRIA C765, Asbestos in soil and made ground good practice site guide (February 2017).

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<sup>1</sup> <http://construction.worksafe.govt.nz/guides/acop-management-and-removal-of-asbestos/>

## 2 Site Description

### 2.1 Site location

The site is located at 336, 340 and 344 Omokoroa Road, Omokoroa, approximately 16 km west of Tauranga central business district. The site is legally described at Section 2 SO 503077, PT Lot 2 65560 and Lot 1 DPS 4524 and covers approximately 17 hectares (ha). The land is bounded in the north by the East Coast Main Trunk railway line and includes an area adjacent to the Omokoroa sewerage pump station and Omokoroa Settlers Hall. The land is currently owned by WBOPDC. The site currently zoned as 'commercial' and 'industrial' in accordance with the Western Bay of Plenty District Plan. A site location plan is presented in Figure 1 Appendix A.

At present the site is being earthworked in preparation for lot development, though the works are on hold through winter. For a more detailed description of pre-development site conditions please refer to Lysaght's DSI report.

### 2.2 Topographic setting

The current landform is comprised of two plateaus bisected by an east-west aligned gully, and bounded to the south and west by further gullies. The northern boundary of site is delineated partly by the east coast main trunk (ECMT) rail line and partly by a WBOPDC green waste facility and sewage reticulation plant. The ECMT is constructed in a cutting 1-5m below the level of site. The east of site is bounded partly by Omokoroa road, and partly by a minor vegetated gully.

The southern plateau slopes from the eastern boundary with Omokoroa Road, down to the west and north-west, from 33m RL to 18m RL. At its steepest this slope is at  $\sim 9.5^\circ$ , and  $\sim 3^\circ$  at its shallowest. The northern plateau generally slopes gently northwards, with minor areas levelled for existing structures, and a mound at its northern tip. The highest points on the plateau, at its southern end, are 28m RL, with the crest of the gullies bounding the plateau at  $\sim 20$ m RL. Due to the presence of the plateaus it is likely that the site has previously undergone some earthworking prior to being planted as orchard.

A land bridge is being created between the two plateaus which will support a new road, with a spring culverted to a pipe underneath. Up to 4 m is being cut on the southern plateau, with small areas of minor (<1m) fill, which will result in level building platforms stepping down to generally follow current topography. The northern plateau will be of generally similar design, with level building platforms following topography in steps. The mound at the northern end will be removed (up to 5m cut), and the gully on the eastern boundary will receive up to 9m of fill, creating a level platform above a bank down to a stream. A stormwater pond is being created where the east west gully meets the gullies bounding the south and west of site.

At the point of ACM identification, earthworks for the stormwater pond were being undertaken, and bulk earthworks for the southern mound were almost complete. A pre-development landform, design landform, and design cut to fill plan are presented in Appendix B.

### 2.3 Geological and hydrogeological setting

#### 2.3.1 Geological setting

The mapped geology in the Tauranga basin is a Pleistocene, predominantly fluvial/estuarine basin (570 km<sup>2</sup>) which was partially infilled during a period of rapid subsidence after the eruption of the Waiteariki Ignimbrite (approximately 2 million years old). The infill in the basin is comprised of terrestrial and estuarine volcanoclastic sediments and non-welded or partially welded distal ignimbrites and airfall tephra. The site geology is presented on the Institute of Geological and Nuclear Sciences (IGNS) 1:250,000 scale map sheet 5 'Geology of the Rotorua Area'. The map indicates that the site is underlain by Pleistocene age deposits of the Matua Subgroup. The Matua Subgroup is described as 'pumice, crystal and ash rich sediments reworked from middle Quaternary ignimbrites in the northwest, and greywacke gravels in the east'.

The Matua Subgroup is typically overlain by a thick mantle of Taupo Volcanic Zone tephra comprising (from youngest to oldest) the Younger Ash, Rotoehu Ash and Hamilton Ash beds. The Younger Ash deposits comprise inter-layered zones of silt ash interspersed with layers of pumice rich sandy silts. The Rotoehu Ash

usually consists of a thin sand layer which overlies the Hamilton Ash deposits, which typically comprise older silt and clayey silt horizons. At the top of the Hamilton Ash there is often a distinctive palaeosol layer.

A review of the Bay of Plenty Regional Council soil mapping database indicates that the site is underlain by 'Katikati sandy loam'. The sandy loam is described as an allophanic soil made up of thin rhyolitic tephra overlying weathered tephra and loess colluvial soil. The soil is well drained, and is noted to be moderately to strongly leached.

### **2.3.2 Hydrogeological setting**

An unnamed stream is located onsite, to the north of 340 Omokoroa Road and within 30 m north of works is currently being undertaken. The stream flows west into another unnamed stream which exits into the Tauranga Harbour approximately 2 km northeast of the site.

Wells No. 2027 and No. 100113 located onsite record standing water levels of 23.4 m and 24 m below ground level (bgl) respectively. The ground water level is therefore expected to be consistent with nearby stream levels and at depths of approximately 20-25 m bgl.

## **2.4 Current site use**

The site is currently an incomplete residential subdivision undergoing earthworks to create the development landform. A stormwater pond is being created at the base of a gully in the centre of site.

## **2.5 Previous site use**

The DSI report for the site states that it has previously been used for avocado and kiwifruit orchard purposes, and was listed on the Bay of Plenty Regional Council database as HAIL, for "*A10 Persistent pesticide bulk storage or use including sport turfs, market gardens, orchards, glass houses or spray sheds.*" Prior to this it was identified that the site was used for agricultural grazing, with some associated buildings visible on historical aerial photographs. Anecdotal information from the previous landowner, upon the commencement of works, suggested that minor volumes of construction waste has historically been disposed of in a gully at the site.

## **2.6 Adjacent site uses**

To the north of site is a WBOPDC green waste facility and sewerage reticulation plant, and the ECMT rail line. On the other side of the rail line, a new subdivision is being formed on a previous orchard. To the west and immediately south of the site the land remains in use as orchard, and across Omokoroa Road, to the east, further residential subdivisions are being developed.

## 3 Previous Investigation

A DSI report was prepared by Lysaght for the site (Report Ref. "Detailed Contaminated Site Investigation – for 336, 340 and 344 Omokoroa Road, Omokoroa Reference: 163252"), dated 9 August 2016 and subsequently a RAP and CSMP (Ref. 163252) was completed on 12 August 2016. The DSI identified a general site wide elevation of cadmium above predicted background concentrations and one copper elevation above predicted background concentrations. Five distinct hotspots of elevated arsenic, and one area of total petroleum hydrocarbons were delineated for requiring remediation totalling 16m<sup>3</sup> of primarily topsoil material. None of these identified areas are within the areas of asbestos contamination.

The six areas of heavy metal and TPH contamination identified in Lysaght's DSI have been remediated via excavation and disposal to landfill, and validation testing completed by Lysaght. The soil validation report is being completed by Lysaght (REF. "Site Remediation and Validation Report, for Kaimai Views Development, Omokoroa, Reference: 163252") and is currently in draft status. These areas were outside of the area of asbestos contamination.

### 3.1 Additional Lysaghts testing

Possible ACM fragments were identified on site on 8 March 2017 by Lysaghts engineer, from within a stockpile of material which had been excavated from the permanent stormwater pond. Further suspected ACM fragments were identified in unworked areas of the site as well as some more minor evidence of general construction waste in a smaller stockpile. Three samples of suspected ACM fragments taken by Lysaght were analysed by Hill Laboratories with the results confirming the presence of asbestos fibre cement fragments.

### 3.2 Summary of additional work completed by Aurecon

#### 3.2.1 Initial inspections and stockpile sampling, 14 March 2017

Aurecon undertook an inspection of the site on 14 March 2017, after ACM was uncovered by Lysaghts. This inspection was undertaken following a period of heavy rainfall. During heavy rainfall the wall of a temporary stormwater pond became unstable, exposing non-engineered and uncontrolled fill in failure scarps near to where which the pond had been constructed.

At the time of the initial inspection, topsoil from the former orchard had been stripped and placed in two stockpiles (for the purpose of this RAP, identified as 'Stockpile A' and 'Stockpile B'). Stockpile A (3,600 m<sup>3</sup>) was located adjacent to the pond near the centre of the site. Stockpile B (550 m<sup>3</sup>) was located approximately 250 m to the south of Stockpile A. A plan showing the approximate location of these stockpiles is presented on Figure 1, Appendix A. Photographs taken during the initial inspection are presented in Appendix D.

Aurecon identified suspected ACM fragments throughout Stockpile A, construction waste but no suspected ACM in Stockpile B. Suspected ACM fragments were also identified within exposed fill that had partially collapsed into the pond, this area is identified as 'Area SP'. It was advised by JMC, the appointed earthworks contractor, that uncontrolled fill from the base and sides of the original gully had been added to Stockpile A.

As part of Aurecon's inspection five soil samples (A1 to A5) were collected from Stockpile A; four soil samples (B1 to B4) from Stockpile B and three soil samples (SP1 to SP3) collected from an additional Area SP.

An additional selection of tile fragments was collected from Area SP (SP-T) to confirm that waste construction debris comprised asbestos.

Laboratory results confirm the presence of ACM in two soil samples from stockpile A, one soil sample from stockpile B, and the three soil samples and the fragments collected from Area SP. ACM was reported as being present both as fibre cement, debris and loose fibres showing evidence of degraded condition and friable fibres. A copy of the test results is presented in Appendix C.

#### 3.2.2 Further characterisation, 28 March 2017

The former land owner was contacted to establish whether they were aware of buried and/or filled in gullies in other parts of the development, which they stated they were not. Following advice from the previous site owner, and discussions held with JMC and Classic it was advised that some of the topsoil won from the site had been pushed over the edge of the gully (and possibly buried) as part of early development activities.

Aurecon carried out further testing on 28 March 2017 around Area SP, and along an embankment in the south eastern corner of site. The purpose of this investigation was:

- a) To confirm that topsoil material pushed over the side of the gully did not contain ACM
- b) To further characterise the volume and extent of ACM impacted fill material in Area SP.

The investigations within Area SP were undertaken in collaboration with CMW, the appointed geotechnical engineer to inform extent of uncontrolled fill placed over the embankment. Work undertaken by CMW is reported separately. The following scope of works was completed as part of this additional investigation:

- 5 machine excavated test pits (TP1 to TP5) to maximum depth of 2 m in Area SP. The base of fill was not reached due to testpit instability
- 6 hand dug test pits (TP6-TP11) collected from the south facing embankment. The pits were excavated to confirm depth to natural soils.

A plan showing the location of these test positions is presented on Figure 1, Appendix A.

Five soil samples (TP1-TP5) were collected from four machine excavated test pits at the top of the southern slope of Area SP, and one hand excavated test pit further down this slope. The material was predominantly topsoil, with evidence of construction waste present throughout the fill profile. Test pits were excavated to a maximum depth of 2.0m bgl, however the unstable nature of the fill material caused collapse, and excavations were terminated without determining the full depth of the fill. No asbestos was identified in these five fill samples, however based on visual inspections, anecdotal evidence and constraints imparted by topography limiting ability to appropriately delineate this material fully to the uncontrolled fill it was recommended that all fill within Area SP should be considered contaminated.

Six soil samples (TP6-TP11) were collected from hand excavated test pits along the embankment above the gully bounding the western edge of site. This embankment has been recontoured using topsoil from site and as such samples were collected to confirm the presence or absence of asbestos in this material. The maximum thickness of topsoil encountered in test pits was 400mm, however it is assumed to be deeper than this in areas. The results of the investigation indicated that this material did not contain ACM, however a small pile of construction waste was identified near an old shed in the vicinity of TP6.

A tile sample suspected to comprise ACM was collected within this waste material and sent for testing which confirmed asbestos. JMC were instructed to cover and fence off the area to prevent further dissipation and risk to human health. A copy of the test results, prepared by Analytica Laboratories, is presented in Appendix C.

## 4 Conceptual site model

### 4.1 Sources

Based on the results of our investigation accompanied by collation of desktop and anecdotal data provided by the Client, previous site owners and current contractors, we have identified to date four key areas within the current development site with confirmed ACM. These are summarised as follows:

- Area SP1
- Area TP6
- Stockpile A
- Stockpile B.

These areas are shown on Figure 1, Appendix A and are described in the following subsections.

#### 4.1.1 Area SP1

An area of fill material on the eastern boundary of site, forming a promontory at the conflux of two gullies, comprising topsoil and construction waste. Multiple large fragments of asbestos containing cementitious sheeting are present on the surface, and throughout the soil profile. The previous collapse, and subsequent investigation show fill in this area to be up to 2m thick.

#### 4.1.2 Area TP6

The western boundary of site has been recontoured, now gently sloping to the gully marking the boundary of site. Area TP6 is at the northern end of this slope. A small decrepit shed is present at the top of the slope, and a sample of asbestos tile was collected from the ground surface surrounding the shed, with more observed to be present. A soil sample was collected 10m downslope of the shed, and found not to contain asbestos.

#### 4.1.3 Stockpile A

Stockpile A is on the southern side of the east-west aligned gully escarpment through the centre of site. Measuring 5-6m high in places, and approximately 80m in length, this represents the bulk of the known contaminated material on site. The pile includes ash, construction waste, and topsoil, and had been created during earthworks, before asbestos was recognised within it.

#### 4.1.4 Stockpile B

Stockpile B is located at the top of the recontoured slope, on the western boundary, with a soil bund preventing run-off downslope. Comprised predominantly of topsoil, the pile contains the remains of burn pits, with construction waste present. The stockpile measures 2-2.5m high, and approximately 20m in length, and whilst no asbestos was identified visually, laboratory testing confirmed its presence.

### 4.2 Pathways

The only pathway for asbestos exposure is inhalation. Where asbestos is present at surface it may be transported by surface water flows and as such secondary sources may form which again pose risk via inhalation.

### 4.3 Receptors

Asbestos primarily poses risk to human health. No significant risks to environmental receptors or built environment are posed by asbestos. The specific receptors identified if controls are not implemented at the site include:

- Construction workers and current site users
- Future site users
- Adjacent site users.

## 5 Human health risk assessment

The MfE recommends a two tiered screening assessment for contamination in soils, taking into account site specific conditions to determine appropriate soil guideline values. BRANZ are also due to release more specific guidelines on quantitative Tier 2 analyses for asbestos in soils within New Zealand.

Due to the sensitive nature of the end use of the development, for residential purposes, Tier 1 assessment of Asbestos risk to human health is, in this case, regarded as confirming the presence or absence of asbestos within soils. In this example, samples from Stockpile A, Stockpile B, Area SP and Area TP6 have all confirmed ACM in loose fibre or fragmented state.

Visual assessment of materials later identified by laboratory analysis to be fragments of ACM indicates ACM to be in degraded condition, and that earthworks activities have resulted in further disturbance and transported this material across site. The degraded state of the material and subsequent disturbance suggests that the transfer of fibres to soil is very likely to have occurred. For these reasons we consider that a Tier 2 assessment and development of a screening value would be inappropriate for this site, as quantitative testing would not give results representative of the heterogeneous nature of the material.

Further time and expense invested into the segregation, delineation, and quantitative screening of the material would delay the programme of works and raise costs. As the material is likely geotechnically unsuitable for re-use on site disposal would still be required, and as the material would not be acceptable as cleanfill, there would be no cost or sustainability benefits by undertaking a second stage of human health risk assessment in the context of this project.

### 5.1 Summary of risk

A brief qualitative discussion of risks associated with asbestos contamination to ongoing development works is summarised as follows:

- The immediate risks associated with anticipated works to human health apply to site personnel involved in excavation works. These may result in relatively high exposure, albeit over a low duration period, however asbestos is typically recognised as a non-threshold carcinogen. Appropriate controls to manage asbestos risk will be required during earthworks to comply with Health and Safety at Work (Asbestos) Regulations 2016
- The long term risk to future site users (residents) would be significant if the ACM remained exposed in surface soils. In addition, commercial risks become significant as new lots become less appealing to prospective buyers where even trace amounts of fibres exist, and thus they become devalued. Remedial action is designed to eliminate these risks. Material presenting a human health risk will have its source-pathway-receptor linkage removed during remediation, and this would need to be validated following completion of works
- Adjacent site users will be exposed to both risks although to a lesser degree as the asbestos fibre will mix further with air before exposure. In that context it is unlikely that adjacent site users would be exposed to asbestos fibre in excess of the 0.1 respirable asbestos fibres per millilitre of air mandated by the Asbestos Regulations.

These risks can be best managed through implementation of a site specific management plan to mitigate exposure hazards from contaminated soil for the duration of earthworks that may be expected. Due to the presence of asbestos, excavation, handling, transport and disposal of soils must be supervised by a Class A specialist trained and qualified to handle asbestos containing materials.

**Table 1 Summary of Identified remediation areas**

Location		In-situ / Ex-situ	Estimated volume (m <sup>3</sup> )	Visual/physical characteristics
Stockpile A		Ex-Situ	3600	Topsoil and ash mixture with cementitious ACM fragments.
Stockpile B		Ex-Situ	550	Topsoil and ash with evidence of burning.
SP1		In-Situ	500	Topsoil with building rubble and ACM fragments.
TP6		In-Situ	100	In-situ shed with ACM fragments visible adjacent.

# 6 Remedial options appraisal

## 6.1 Introduction

The results of our risk assessment confirmed the presence of ACM on site, which presented unacceptable risk to the proposed development, from both the perspective of human health and corporate liabilities. As such, it was agreed with Classic and Western Bay of Plenty District Council that remedial work was required to remove ACM from areas of proposed residential lots, and to make further earthworks activities safe for future construction personnel.

To inform the most appropriate methodology an appraisal was recommended to be undertaken to assess the best option taking into consideration health and safety risk, environmental risk, and time and cost factors, amongst others.

As part of this process, three potential remedial options were considered for this project, a summary of the evaluation of which is presented in this section. These options were considered as follows:

- i) On-site remediation of impacted soil (sieving and picking)
- ii) Off-site disposal of contaminated soil (elimination); and
- iii) On site encapsulation of affected materials.

The assessment of the most appropriate method for the site was undertaken using a rigorous and systematic approach based on the process outlined in the UK Environment Agency Contaminated Land Report 11; Model procedures for the management of land contamination.

## 6.2 Design brief

Following discovery of the ACM, a series of meetings held with Classic and Western Bay, summary of discussions includes:

- The site is an active residential subdivision with road/civil infrastructure, stormwater pond and reserve area. Residential lots created for special housing, reserve land to be vested into WBOPDC ownership as a reserve
- Classic Developments Ltd do not want any ACM to retain on Lots, and want it out of the working areas to ensure the risk to health of site workers is minimised, and to ensure ongoing saleability of lots without registration on the BOPRC contaminated sites database
- WBOPDC have indicated they would prefer a minimum soil cap of 1 m to give best possible landscaping options and to mitigate risk to site workers if they install benches, playground etc. Some future works may require founding within natural ash
- As the discovery of asbestos was unexpected, the cost of remediation or management were not allowed for, and potentially could not be kept within any prescribed contingency. Also, any future work will result in a delay to programme. As such, time and economic factors (i.e. cost of remedial work) are also significant for both Classic and Western Bay.

## 6.3 Site specific factors and constraints

A summary of site specific factors and constraints considered in our appraisal is presented in Table 2.

Table 2 Site, project and programme considerations

Factor	Comment
Programme	<ul style="list-style-type: none"><li>■ The site development has commenced at Kaimai Views and the time taken to assess and remove identified contamination is likely to result in delays to programme and have a significant cost overruns.</li><li>■ It has been identified by the Client they wish to get Section 224 certification as soon as practicable.</li></ul>

Factor	Comment
Consent and notification requirements	<ul style="list-style-type: none"> <li>Notification of asbestos contamination provided to WBOPDC, BOPRC and Worksafe NZ. Consents required from WBOPDC and BOPRC to conduct the remediation exercise. Preliminary discussions held with council indicate consent process would be dealt with as soon as practicably possible, but could feasibly extend to 20 working days as prescribed by the Resource Management Act (1991).</li> </ul>
End use	<ul style="list-style-type: none"> <li>The end use of site will be a residential subdivision, with landscaped areas unsuitable for development and a stormwater pond vested into council reserve. Due to the sensitive nature of the end use it is not considered acceptable to retain material within proposed residential areas of the development.</li> <li>A large reserve is to be constructed and vested into WBOPDC on the southern side of the gully, near what is now Stockpile A. WBOPDC have indicated that they are willing for material to be retained within the reserve, provided it can be made safe for the reserve, that it can be landscaped and that controls can be put in place for any future users of the site.</li> </ul>
Site stability	<ul style="list-style-type: none"> <li>The in-situ uncontrolled fill material identified as asbestos containing at SP1 has partially failed during previous heavy rain. CMW have advised that this material cannot stay in-situ due to the risk of further slope failure affecting lots near this area. In addition, the risk of subsequent collapse of contaminated material into the stormwater pond would be difficult to manage during future maintenance activities.</li> </ul>
Access issues	<ul style="list-style-type: none"> <li>Current site access is from Omokoroa Road, and likely to be difficult for large vehicles to navigate due to the narrow nature of the access, placement of site cabins/ vehicle parking on site, and the need to turn right across Omokoroa Road to get to landfills. Omokoroa road and the access into site will be upgraded during the development of the subdivision however this work will not be completed in the foreseeable future.</li> <li>As of June 3 we understand the nearest Class A landfill consented to accept asbestos, Greenpark (Oropi) has suspended operations indefinitely. This means the next available landfill during the time this project is expected to be completed would be Leach's in Tirohia (near Paeroa) a significant distance from site for cartage, resulting in greater cost and slower turnaround of trucks.</li> </ul>
Operational issues	<ul style="list-style-type: none"> <li>Site personnel during works will include the contractor (JMC), construction personnel, a suitably qualified contractor or hygienist (for management of asbestos) and a suitably qualified contaminated land professional (SQEP) for site validation. The availability of suitably qualified and experienced personnel to oversee the works is unknown.</li> <li>There should be no public access to the site. The Client will need to ensure the site is secure and locked out of operational hours. All remediation areas to be fenced off at all times until remediation has been completed. No sensitive ecological species have been identified in the course of the consenting process.</li> <li>The volumes of material are expected to be in the order of ~5000m<sup>3</sup>. Removal from site of this volume of material would require significant amounts of vehicular movements, and depending upon availability and weather take some time, especially through winter months. On site containment will require construction of a significant containment cell.</li> <li>The contractor may need to re-route a stormwater main around the containment cell, or the cell be designed to accommodate the pipe, considering future maintenance.</li> </ul>
Site Constraints	<ul style="list-style-type: none"> <li>The site is currently a partially completed residential subdivision, with works ongoing away from the asbestos contaminated areas. Removal of material from site would require the establishment of haul roads and wash down facilities for road wagons.</li> <li>Excavation of in-situ contamination within area SP1 will likely require the removal of the temporary stormwater pond in this area.</li> <li>Primary sensitive receptors include: construction personnel, neighbouring residents; and the un-named on site stream.</li> <li>The site has capacity for overnight storage of plant.</li> <li>The site has capacity for temporary soil stockpiles of material whilst a containment cell is being created.</li> </ul>
Relevant stakeholders	<ul style="list-style-type: none"> <li>Classic Developments, WBOPDC, BOPRC, Worksafe NZ, future site users, construction workers.</li> </ul>
Site management, PR	<ul style="list-style-type: none"> <li>Perceived or actual risk to human health during remediation works or transport, and any residual risks once remediation is completed including contamination markers on lot titles.</li> <li>General public antipathy towards asbestos issues, and prevalence in national newspapers.</li> </ul>

Factor	Comment
Sustainable Remediation	<ul style="list-style-type: none"> <li>Excavation and off-site disposal is expensive due to a limited number of disposal sites, and their capacity. Excavation and off-site disposal also has large carbon footprint, and retaining the material on site has potential to make this a good case study for future remediation.</li> </ul>

## 6.4 Remediation objectives

The primary remediation goal is to reduce to an acceptable level the risk posed by the presence of asbestos to future site users and construction and maintenance workers.

- Make site safe for intended land use, residential and public open space
- Limit risk to health of site workers
- Limit risk to health of adjacent site users (residents, orchards, Omokoroa Road etc.).

## 6.5 Remedial options appraisal

### 6.5.1 General

Due to the nature and physical properties of asbestos, the remediation may be achieved in a practicable manner by physical removal of the affected soils, or isolation of the affected soils from potential users. In evaluation the most appropriate option we consider the following factors:

- Site constraints as outlined in S3.3
- Effectiveness of remedial option
- Durability and long term risks
- Ease of validation and accountability
- Adverse health or environmental impacts
- Regulatory and consenting constraints
- Economics
- Time
- Sustainability
- Ability of contractor to deliver.

### 6.5.2 On-site remediation of soils

Where asbestos is identified as non-friable, such as non-degraded cementitious sheeting, case studies suggest on-site screening and hand picking of the soils is considered appropriate. The process involves excavation of the impacted material, thinly spreading onto a conveyor belt and passing past operatives in suitable PPE and RPE whom remove fragments by hand. The following advantages and disadvantages of on-site removal have been identified.

#### Advantages

On site remediation separates the asbestos fragments from the soil, vastly reducing the volume of material for disposal. Material can be repeatedly screened to improve remediation. Subject to further analysis, and tier two assessment the material can often be re-used on less sensitive areas of site such as under road-ways and car parks where exposure time is limited and the exposure levels for maintenance workers is deemed acceptable.

#### Disadvantages

Processing this amount of material on site would take considerable time, and due to the sensitive nature of residential development it is unlikely that the remaining soil would be considered suitable for re-use on site. Instead the best outcome would be acceptance as cleanfill, which would require further discussion with council.

Case studies for asbestos remediation within New Zealand are scarce, due to the immaturity of the industry, and thus the availability of suitable plant and operatives would be questionable within the current timeframe. The asbestos containing material needs to be in good condition, and non-friable for this to be a suitable remediation option. There is also the potential to generate dust through the excavation, processing, and transport. It is unlikely, based on the presence of loose fibres that all ACM could be removed, and while trace amounts may be achieved, it is unlikely processed material would meet cleanfill criteria.

### **6.5.3 Off-site disposal**

Removal from site of contamination would involve the excavation and removal from site of soils from within the delineated remediation areas. For the remediation areas excavated soil is loaded onto lined and covered trucks and transported to an approved landfill for disposal. The following advantages and disadvantages of excavation and removal have been identified.

#### **Advantages**

Off-site disposal physically removes the contamination from site, removing the need for long term management and potential for future disturbance. Removal can be completed relatively quickly and easily as part of a wider earthworks programme, and requires no further design.

#### **Disadvantages**

Off-site disposal of this volume of material would incur substantial costs for disposal and transport. There is also the potential to generate dust through the transport process, and landfill is not considered a sustainable remediation technique. Assuming disposal costs of between \$175 and \$250 per m<sup>3</sup>, a ballpark figure of between \$1 million and \$1.5 million could be assumed as a realistic cost of disposal, not including cartage, management and replacement material costs.

### **6.5.4 On-site encapsulation**

In discussion with WBOPDC it is feasible that a containment cell could be designed and created on site, to encapsulate the material and create an impermeable physical barrier between the material and future site users. Material from the three areas identified would be combined and placed in a lined and covered cell within reserve land on site, before being covered with topsoil, and planted.

#### **Advantages**

On site encapsulation removes the need to transport significant quantities of material from the site to landfill, and removes the cost of transport and disposal. Encapsulation creates a physical barrier, and is a more sustainable remediation solution. The long term stability of the cell can be designed and modelled to ensure safety and resilience in the event of earthquakes and other natural occurrences.

#### **Disadvantages**

The design of the containment cell would require significant work, and expense, as well as extended time to create the cell on site. An ongoing management and monitoring plan (OMMP) would need to be created and agreed with WBOPRC whom would become the long term owners of the reserve.

## **6.6 Recommended remediation option**

Based on the planned earthworks and subsequent development plans, the recommended remediation option is encapsulate of the material onsite within the area of proposed reserve. This removes unnecessary transport, and the costs and risks associated, and allows for a controlled, sustainable, long-term solution to be engineered.

# 7 Remedial action plan

## 7.1 Introduction

The investigations to date have confirmed the presence of asbestos in four areas of the site. These areas require remedial action to make the site suitable for the proposed land use. A remediation location plan is presented in Figure 2 Appendix A.

This Remedial Action Plan (RAP) has been prepared in accordance with the Ministry for the Environment (MfE) Contaminated Land Management Guidelines No. 1 Reporting on Contaminated Sites in New Zealand (Revised 2011) and the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 (NES).

This document must be provided to WBOPDC and BOPRC for approval in advance of further remedial works commencing.

## 7.2 Remediation targets

In all areas outside the encapsulation cell, the remediation is non-detect asbestos.

## 7.3 Encapsulation design philosophy

In discussion with WBOPDC, Classic and engaged civil engineers (Lysaghts) and geotechnical engineers (CMW), it has been determined that an encapsulation cell can be created within the area of the subdivision proposed to be vested as reserve.

The design landform created by Lysaghts for the reserve is proposed to drop from north-east to south-west above the new stormwater pond at a gradient of 1V:3H. To safely contain the expected volume of material, overlain by WBOPDCs requirement for 1 m of clean capping, a benched cut into the underlying natural ashes within the current landform is proposed to a design level of 15 m RL, forming 2 benches of 2.5 m height. A cross section prepared by CMW is presented in appendix B.

CMW have undertaken stability analyses to demonstrate stability of the constructed cell. The stability has been modelled for long term static, short term seismic and assuming an elevated water table following heavy rain fall event. As the proposed cell is storing hazardous materials likely to extend beyond the property boundaries in the event of failure, the short term seismic case was modelled using a 1:2500 year earthquake event (assuming an Importance Level 4 structure in accordance with NZS1170 *Structural Design Actions*). A copy of CMWs geotechnical stability report is presented in Appendix B.

The encapsulation cell should be lined to fully contain the material within. The lining should be a non-woven geo-textile to allow moisture to permeate through, and prevent underside pore pressure in times of high groundwater. A woven geotextile will also have a higher coefficient of friction with the overlying cover than a polyethylene membrane would, thus deterring future erosion and slip.

As requested by WBOPDC, a minimum cover thickness of 1m shall be maintained. To prevent erosion, it is suggested that the cap be composed of a combination of compacted ash, or other suitable material, with a topsoil covering. Planting on the slope should be designed as not to penetrate the cover layer, require minimal maintenance, and to help prevent erosion. It is understood that the top of the cell will be grassed as public reserve.

A marker layer should be included at the base of the cover layer, above the containment cell, as a contingency protection measure to warn future contractors about the underlying risk, should the OMMP and council control of the area not prevent excavation.

Due to the positioning of the proposed cell within the gully escarpment, and the present of springs in the vicinity, sub cell drainage shall be installed at the toe of each cut batter, as per the CMW report (Ref TGA2016\_0258AK).

**Table 3 Encapsulation Design Considerations**

Design element	Discussion
Location	Within land to be vested as WBOPRC reserve.
Expected subgrade	Younger Ash, Hamilton Ash, and Matua Subgroup.
Lining and capping	Woven geotextile lining, and covering. 1m cap of topsoil and ash/suitable subgrade.
Drainage	Sub-cell drainage at the toe of each batter.
Marker layers	Marker layer must be constructed within cap. Barrier mesh and warning tape may be appropriate subject to council confirmation.
Stability	Benched cuts as designed and modelled by CMW. A 0.98 Factor of Safety is achieved in a ULS seismic case, assuming an IL4 importance level.
Landscaping	Small shrubs are envisaged on the slope, with the top of the cell to be grassed, vegetation with a likely root zone extending beyond 0.5m are prohibited.

## 7.4 Safety in design

The Health and Safety at Work Act 2015 and Health and Safety Regulations 2016, require a designer to provide information to ensure design when built is without risk to health and safety, and to eliminate risks where reasonably practical and where not reasonably practical to minimise risks. In consideration of the encapsulation cell, Aurecon has prepared a Safety in Design assessment report representing our opinions for consideration in the overall project safety in design process. The report is provided in Appendix E.

This report considers safety aspects in the design, construction, operation, and ongoing management of the cell. It records the safety related thought processes made around decisions thus far, and make suggestions for considerations during future stages.

## 7.5 Methodology and sequence of operations

The encapsulation cell requires geotechnical design and analysis prior to construction. This design, and associated analysis are presented in CMW report TGA2016\_0258AK (dated 9 June 2017), which is included in appendix B of this report.

Prior to commencement of works a start-up meeting is recommended onsite to confirm contractors proposed methodology, roles and validation requirements. Where further information becomes available the methodology may be subject to alteration in discussion between the SQEP, principal contractor and remediation contractor (if required).

The following remediation works shall be undertaken on ACM impacted soils as identified by this report:

- a) Notification to Worksafe (refer CSMP), BOPRC and WBOPDC
- b) Ensure that the subject work areas have been satisfactorily assessed to establish the extent of the contamination and the appropriate signage and controls to ensure the protection of health, safety and environment
- c) Survey set out of remediation areas
- d) Engage a qualified asbestos removal contractor as determined by Worksafe NZ to supervise all work, control the work area and implement the appropriate control measures
- e) Excavation of the contaminated material from Stockpile A to allow for the construction of the containment cell in this area. Excavated material should be suitably banded, and covered to prevent soil and contaminants remobilising. Excavation should be in line with the methodology set out in the CSMP
- f) Construct containment cell
- g) Filling and compaction of material within containment cell
- h) Validation of areas of excavation and previous stockpile locations. The maximum vertical and horizontal extent of remediation areas (including validation sample locations) is to be recorded by instrument survey

- i) Should validation fail, the failed location will be excavated further and the validation process repeated until validation is achieved
- j) Following completion of works the decontamination of the excavator will involve the removal of gross soil by hand from the bucket over the containment cell as guided by the remediation contractor
- k) If required, the bucket will be washed with water over the containment cell to ensure it is free of ACM fragments
- l) Soil in the tracks will be removed by hand by means of shovel and broom and washed with water over the containment cell as required
- m) Asbestos clearance survey will be provided by the remediation contractor prior to demobilisation of the excavator; and
- n) The containment cell should be capped and covered, with any planting taking into consideration root depth, as not to interfere with the cell cap.

If during further earthworks suspected ACM is observed within parts of the site where it has not yet been identified, then those earthworks should cease immediately and a SQEP should review and assess the material in liaison with the contractor. If the presence of asbestos is confirmed, then the remedial works should be expanded to include these areas.

# 8 Soil validation process

## 8.1 General

To demonstrate to the WBODC and BOPRC the successful completion of remediation, soil validation by a SQEP is required to be undertaken, within the area considered by Aurecon to have been potentially impacted by earthworks activities. This area is shown on Figure 2, Appendix A. No works to validate surrounding site soils will be undertaken until all suspected ACM material has been transferred to the cell.

## 8.2 Remediation targets

The proposed remediation targets are:

- Encapsulation cell must be built to design specification, and covered by at least 1m of clean material (confirmed by testing)
- Soil outside of the encapsulation cell and used as capping for the cell must be visually clear of ACM fragments and have no traces of loose fibres detected. Remaining soils shall be free of construction waste, asbestos containing materials and other unsuitable materials.

## 8.3 Validation sample methodology

Sampling and laboratory testing shall be performed in accordance with the methodology set out within CLMG Vol. 5. The excavation will need to remain open while the validation samples are processed by the laboratory. To protect subsoils during this period a layer of blinding sand or gravel may be placed above subsoils, however it should be noted that if contamination is identified then this layer will be considered to be contaminated. A Site Validation Report (SVR) is required to be prepared in accordance with the MfE Contaminated Land Management Guidelines to demonstrate completion of works and that the site has been satisfactorily remediated to the required standard. The SVR must be presented to WBOPDC and BOPRC within three months of completion of works.

The top 10 cm of surface soils across the excavation are required to be validated as free of ACM as per the requirements of WA DOH (2009), CLMG and the NES. Validation of excavated areas will be undertaken as follows:

- At the completion of the soil surface ACM removals/assessment, the specialist removal contractor will visually assess each grid within the delineated work area
- The visual inspection will be undertaken by walking two sets of 1 m spaced transects set at right angles, to observe the presence of remaining ACM fragments
- If following at least two (2) passes no surface ACM is detected within each grid area, the grid area will be deemed to be have obtained visual clearance
- If remaining ACM fragments are detected the material will be removed from the excavation until no further visible fragments are seen
- Once visual clearance is attained validation sampling will then be undertaken by the SQEP to confirm the absence of asbestos fibres
- Validation samples will be collected in accordance with the recommended sampling density in the WA DOH 2009 guidelines and the proposed BRANZ Guide to Managing Asbestos in Soil (draft 2016)
- All samples collected to be analysed for asbestos will be minimum of 500 mL in size (or in containers certified as clean by the receiving laboratory) and analysed in accordance with the CLMG, and also the Australian Standard 'Method for the Qualitative Identification of asbestos in bulk samples' (AS4964-2004) by an IANZ-accredited laboratory; and
- The final extent of excavation and all validation sample locations shall be recorded by instrument survey.

## 8.4 Documentation

All field observations and measurements will be documented by the site contractor (and SQEP) in field sheets and in photographs. All field records, etc. will be placed on file for future reference. Soil samples will be registered in a central sample register. As a minimum, the table will include:

- Field ID of soil sample
- Date and time of sampling
- Depth of sample
- Observations of the sampled soil (e.g. colour, odour, sheen, etc.).

## 8.5 Sample preservation, packaging and shipping

Procedures for containing and soil samples, as set out within CLMG Vol. 5, are as follows:

- Samples will be immediately placed and stored in laboratory-supplied sample containers/bags
- Samples will be labelled with details including:
  - Date and time sampled
  - Project number
  - Field ID
  - Sample preservatives used (if any).

Soil samples will be collected in the sample jars, bottles and bags supplied by the selected analytical laboratories. The filled containers will be stored in a chilled, insulated container until received by the analysing laboratory. Sample numbers, dates, preservation and analytical requirements will be recorded on Chain of Custody (CoC) documentation, which will also be delivered to the analytical laboratories.

## 8.6 Chain of Custody protocols

Samples collected in the field will be traceable from the time of collection until the analytical laboratory receives them. To maintain and document sample possession CoC procedures shall be followed. CoC records shall include the following information:

- Project number
- Time and date of collection
- Depth of sample (for soils)
- Number and type of containers
- Sample type and identification
- Receiving analytical laboratory
- Required analyses
- Names and signatures documenting relinquishment of the samples to the laboratory.

CoC records will accompany samples at all times once the samples are collected. When transferring possession of the samples, the individuals relinquishing and receiving the samples will sign, date, and note the time of transfer on the CoC record. The SQEP, prior to dispatch to the laboratory, will review all CoC. The laboratory will be contacted to return (by email) appropriately signed CoC records to confirm sample delivery.

## 8.7 QA/QC

No duplicates will be collected for asbestos samples, due to the heterogeneous distribution of asbestos fibres. As such assessment will be on the basis of units and retesting will be required should asbestos be identified.

## 8.8 Validation reporting

A report will need to be produced presenting the results and findings of the remediation works and validation sampling in general accordance with the CLMG Vol 1. The SVR will contain the following sections:

- Introduction, background and objectives
- Site identification
- DQOs
- Scope of works
- Summary of previous investigations, site history, site condition and surrounding environment
- Details of the remediation works conducted
- Adopted assessment criteria
- Quality control and quality assurance by assessment against DQIs, where required
- Results of remediation effort including clearance certificates and validation results
- Conclusions and recommendations.

The report will include summary tables of analytical results and figures showing the sampling locations and exceedances of the adopted assessment criteria.

## 8.9 Contingency scenarios

### 8.9.1 Continued failure of validation samples

Given the nature of identified asbestos impact within the site, there is potential for unidentified bonded ACM to be located within underlying subsurface soils and near surface soils. In the event that the proposed remediation works do not meet the validation criteria due to identification of additional impact and extensive buried waste a reassessment of remedial and validation options may need to be undertaken (alternate design, removal from site of excess material, limit extent of dig out).

### 8.9.2 Cross contamination

Given the work area and nature of the site, measures should be enforced to eliminate the potential for cross contamination:

- Areas that are to be remediated should be delineated and isolated. Plant and vehicle movements from these areas should be restricted to a defined path. Plant and vehicles should be cleaned of loose material and sprayed with water before exiting the site
- Plant and truck movements within areas of active remediation should also be restricted and monitored to ensure vehicles do not pass over previously excavated and/or validated areas.

## 8.10 Ongoing Management and Monitoring Plan (OMMP)

Following completion of cell and validation of works, an OMMP will be required to be prepared by a SQEP for use by site owners (WBOPDC) for future earthworks and management. In line with CLM guideline 1 “the requirements for an ongoing monitoring and management plan for the site should be assessed where... on-site containment of contamination is proposed.” The OMMP will need to include:

- Location Plan
- As built plans showing key extents and depths of cell including any marker layer
- Strategy for future earthworks and management
- Limitations about type of vegetation that can be planted over the cell to limit disturbance of capping layers
- Key contacts and responsibilities
- Requirements of any future sampling or monitoring.

## 9 Limitations of this plan

Information provided in this report and the subsequent findings herein are reliant on a limited selection of information provided by the Client. Aurecon takes no responsibility for the quality / accuracy of information provided by third parties.

The outcome of this report is limited to information supplied for the activities associated with the scope of works only. It is intended that this plan provides a description of the identified soil contamination and recommendations on how to address and manage any contamination issues at the location in question. Remediation advice is limited to surface asbestos impact only.

We note that this report has been prepared for the use by the Client and appointed subcontractors only and is based on information provided by them. Aurecon takes no responsibility and disclaims all liability whatsoever for any loss or damage that the Client may suffer as a result of using or relying on any such information or recommendations contained in this report.

This report does not provide a complete assessment of the environmental status of the site, and it is limited to the scope defined herein. Should further information become available regarding the conditions at the site, including previously unknown likely sources of contamination, Aurecon reserves the right to review this report in the context of the additional information.

The report may contain various remarks about and observations on legal documents and arrangements such as contracts, supply arrangements, leases, licences, permits and authorities. A consulting engineer can make remarks and observations about the technical aspects and implications of those documents and general remarks and observations of a non-legal nature about the context of those documents. However, as a consulting engineer Aurecon is not qualified, cannot express and should not be taken as in any way expressing any opinion or conclusion about the legal status, validity, enforceability, effect, completeness or effectiveness of those arrangements or documents or whether what is provided for is effectively provided for. They are matters for legal advice.

# 10 References

- Ministry for Environment (April 2012) Users Guide: NES for Assessing and Managing Contaminants in Soil to Protect Human Health. Wellington. Ministry for the Environment
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- Worksafe NZ – Approved Code of Practice: Management and Removal of Asbestos (November 2016)
- Health and Safety at Work Act (2015)
- Health and Safety at Work Asbestos Regulations (2016)
- BRANZ The New Zealand Guidelines for Assessing and Managing Asbestos in Soil (Draft 2016)
- Resource Management Act, 1991

A large green polygon with a yellow-orange triangle at the bottom left corner. The green area is a large trapezoid-like shape with a diagonal cut. The yellow-orange triangle is at the bottom left, with its hypotenuse parallel to the diagonal cut of the green shape.

A

Site Plans

# Appendix A

## Site Plans



**Legend**

- SP1
- SP-A
- SP-B
- TP-6
- Test Pits
- Site boundary



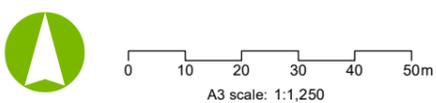
**Notes:**  
 -Background image from Western Bay of Plenty Regional Council mapping  
 -Stockpile and test pit locations are approximate

Date: 18/06/17

Version: 0

P:\Projects\255791 - Classic Ombokoroa Kaimai Views\Project Delivery\GeoGIS

Map by: LAB



Job No: 255791  
 Projection: MNZGD 2000



**Legend**

- Validation Area
- Containment cell
- Contingency Capacity
- Stockpile Locations

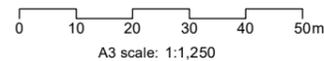


**Notes:**  
 -Background image from Western Bay of Plenty Regional Council mapping  
 -Remediation area is assumed, based on extent of contamination and observations made on site. This plan is for information only and the extent of the validation area is subject to change

Date: 18/06/17

Version: 0

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Map by: LAB



Job No: 255791  
 Projection: MNZGD 2000

**Classic Developments Kaimai Views**  
**Figure 2: Containment cell and Validation Plan**

A large green polygon with a diagonal cutout. The top-left corner is cut off by a diagonal line. The bottom-left corner is cut off by a diagonal line, revealing a yellow/orange section. The text 'B' is located in the upper left area, and 'Third Party Information' is located in the lower right area.

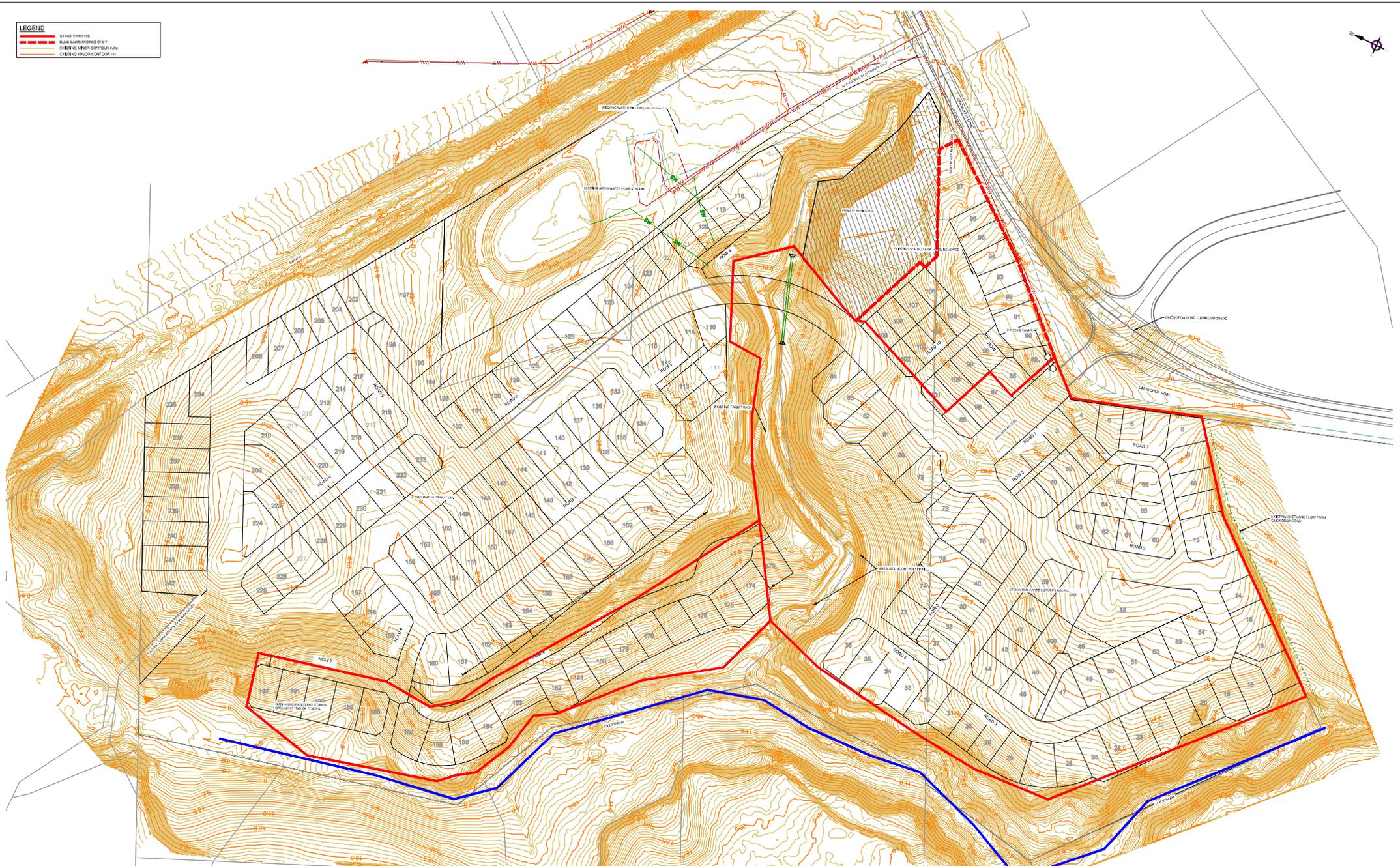
**B**

Third Party Information

# Appendix B

## Third Part Information

LEGEND	
	STAGE EXTENTS
	PLANNED PROPOSED D.I.T
	EXISTING MINOR CONTOUR LINES
	EXISTING MAJOR CONTOUR LINES



CONSTRUCTION

No.	Date	Revision Details	By	Ver.	App.
01	07/02/17	FOR CONSTRUCTION	AV		

Drawn AV	Signed	Date 07/02/17
Designed AV	Signed	Date 07/02/17
Verified PM	Signed	Date 07/02/17
Approved PM	Signed	Date 07/02/17

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**SURVEYING, ENGINEERING & LAND DEVELOPMENT**  
19 Totara St, Mount Maunganui 3116 Ph 07 578 8798 www.lysaght.net.nz

Project:  
**CLASSIC DEVELOPMENTS  
KAIMAI VIEWS  
OMOKOROA**

Drawing Title:  
**EARTHWORKS  
STAGE 1  
EXISTING CONTOUR PLAN**

Project No.	163252
Scale (A1)	1:1000
Drawing No.	163252-200-EW
Rev.	01

**NOTES**

1. CONTOURS SHOWN ARE PROPOSED FINISHED GROUND CONTOURS AT 500MM INTERVALS UNLESS OTHERWISE STATED.
2. FINAL EARTHWORKS LEVELS TO BE 100MM LOWER THAN THE F.G.L. NOTATION ON THE DRAWINGS.
3. RETAINING WALLS TO BE CONSTRUCTED TO FINISHED GROUND LEVELS.
4. REFER TO CIVIL DRAWINGS FOR FINISHED WALL DETAILS.

**LEGEND**

	EARTHWORKS EXTENT
	PROPOSED MINOR CONTOUR
	PROPOSED MAJOR CONTOUR
	PROPOSED RETAINING WALL 0.5m-1.0m
	PROPOSED RETAINING WALL 1.0m-2.0m



CONSTRUCTION

Drawn AV		Signed		Date 07/02/17		 <p>THIS DRAWING REMAINS THE PROPERTY OF LYSAGHT CONSULTANTS LTD. NO LIABILITY SHALL BE ACCEPTED FOR THE UNAUTHORISED USE OF THIS DRAWING</p>	Project: CLASSIC DEVELOPMENTS KAIMAI VIEWS OMOKOROA	Drawing Title: EARTHWORKS STAGE 1 DESIGN CONTOUR PLAN	Project No. 163252	
Designed AV		Signed		Date 07/02/17					Scale (A1) 1:1000	
Verified PM		Signed		Date 07/02/17					Drawing No. 163252-220-EW	
Approved PM		Signed		Date 07/02/17					Rev. 01	
SURVEYING, ENGINEERING & LAND DEVELOPMENT 19 Totara St, Mount Maunganui 3116 Ph 07 578 8798 www.lysaght.net.nz										

**LEGEND**

- 2 — STAGE EXTENTS
- 1 — CUT CONTOUR
- 0 — FILL CONTOUR
- 0 — ZERO CONTOUR
- AREA OF CUT
- AREA OF FILL

**NOTES**

1. CONTOURS SHOWN ARE CUT/FILL CONTOURS TAKEN FROM DATUM TO ADJUSTED GROUND SURFACE LESS ALLOWED TO DETERMINE SURBURGE AT 1M INTERVALS.



CONSTRUCTION

01	07/02/17	FOR CONSTRUCTION	AV		
No.	Date	Revision Details	By	Ver.	App.


**LYSAGHT**  
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Project:  
**CLASSIC DEVELOPMENTS  
 KAIMAI VIEWS  
 OMOKOROA**

Drawing Title:  
**EARTHWORKS  
 STAGE 1  
 CUT FILL PLAN**

Project No.	163252
Scale (A1)	1:1000
Drawing No.	163252-220-EW
Rev.	01

9 June 2017

Document Ref: TGA2016\_0258AK Rev0

Classic Developments Omokoroa Ltd  
PO Box 864  
Tauranga 3140

Attention: Bruce Cuff

Dear Bruce,

**RE: GEOTECHNICAL REPORT FOR FILL CONTAINMENT EMBANKMENT  
KAIMAI VIEW RESIDENTIAL SUBDIVISION – 336-344 OMOKOROA ROAD, OMOKOROA**

## **1 INTRODUCTION**

CMW Geosciences (NZ) Limited (CMW) have been engaged by Classic Developments Omokoroa Ltd to carry out a geotechnical assessment for a proposed fill embankment as part of the development of the Kaimai Views Residential Subdivision at 336-344 Omokoroa Road, Omokoroa (formerly known as Omokoroa Special Housing Area).

CMW has previously carried out a geotechnical investigation for the proposed subdivision development, with the results of the investigation presented in the CMW Geotechnical Investigation Report (GIR) for Omokoroa Road Special Housing Area (referenced TGA2016\_0258AB, dated 18 August 2016).

It is understood that recent earthworks on site has exposed some existing uncontrolled fill adjacent to a gully escarpment within the vicinity of proposed Lot 36. Inspection and testing of this fill by an Environmental Scientist from Aurecon has reported that approximately 5,000m<sup>3</sup> of uncontrolled fill contains various building materials including the presence of Asbestos. To minimise further handling and disturbance of the uncontrolled fill, it is planned to dispose of the fill on-site within a dedicated fill containment area where it is intended to not impose further risk to the proposed residential development. The proposed fill containment area is shown on the attached Figure 70.

This supplementary geotechnical assessment has been requested to evaluate the stability of the proposed fill embankment and to provide geotechnical recommendations with regards to embankment construction. This report is not intended to assess the environmental effects of the fill embankment, which is currently being completed by others.

## **2 LANDFORM**

The site of the proposed fill containment embankment originally contained an avocado orchard which has recently been removed in preparation for subdivision development. The general area comprises a broad elevated terrace at between RL 15.5m to RL 22m which gently grades at approximately 5 degrees to the horizontal towards an incised gully in the northwest. The gully comprises moderately steep escarpments of approximately 20 to 30 degrees to the horizontal which fall across a vertical distance of 5 to 7 metres.

A perennial watercourse is situated in the base of the gully, which feeds into the Kayelene Place stormwater system and Omokoroa Golf Course in the north. A stormwater attenuation pond is currently under construction within the gully immediately downstream (west) of the fill embankment which will operate as a sediment pond during earthworks over the following 12 months, and later a permanent stormwater attenuation pond following subdivision development. The Lysaght design drawings for the embankment dam indicate the crest of the emergency spillway will be at RL 15.4m (Moturiki Datum) (ie toe of fill embankment) and the long-term dead storage level of the pond at RL 13.21m.

The site has recently been cleared of vegetation and topsoil in preparation of bulk earthworks. Some filling has occurred upslope within the vicinity of the proposed allotments while the asbestos contaminated fill has been stockpiled within the fill disposal area. The stockpiles have been observed as part of the walkover assessment by an Engineering Geologist from CMW, which identified the uncontrolled fill as comprising predominantly sandy silt soils with some organic material and building rubble comprising concrete and timber.

### 3 PROPOSED DEVELOPMENT

The proposed fill embankment configuration is presented on the appended Lysaght Design Drawings and reproduced on the attached Figures 70 to 73.

Those drawings show that the proposed earthfill embankment extends across the elevated terrace above the gully escarpment, behind proposed lots 73 to 83, measuring approximately 150m in length and 50m wide. The fill volume of the embankment will be increased by excavating across the natural slope at approximate RL 15.5m (Moturiki Datum) where cuts of up to 5m will be required.

The excavation will be backfilled with the asbestos contaminated soils to RL 23m and a 1m cover of topsoil will be placed across the fill (to meet WBOPDC topsoil cover requirements) with a maximum cumulative fill thickness of 8.5m. The outer batter will be formed to 1:3 (vertical:horizontal) and graded towards the gully escarpment to the west. It is understood the area will become a dedicated council-owned reserve as part of the Kaimai Views Subdivision development.

It is understood a winter earthworks consent is being applied for with the intention to construct the containment as soon as possible to mitigate further environmental hazards associated with stockpiling this material on site. A Remedial Action Plan and Earthworks Construction Methodology is currently being prepared by others to address any contamination or health & safety concerns during construction.

### 4 PREVIOUS INVESTIGATIONS

A number of previous geotechnical investigations associated with the proposed subdivision development have been carried out within close proximity to the proposed fill embankment and are described in the following reports:

- CMW Geotechnical Investigation Report (GIR) for Omokoroa Road Special Housing Area (referenced TGA2016\_0258AB, dated 18 August 2016);
- CMW Geotechnical Design Report for Pond 1 Earthfill Embankment Dam (referenced TGA2016\_0293AB, dated 7 February 2017);
- CMW Technical Memorandum – Assessment of Proposed Borrow Area for Earthfill Dam Construction Materials (referenced TGA2016\_0258AG, dated 22 December 2016); and
- CMW Technical Memorandum – Assessment of Soil Conditions within 1200mm Diameter Stormwater Thrust Pipe (referenced TGA2016\_0258AH, dated 26 January 2017).

The approximate locations of the relevant investigation boreholes and Cone Penetrometer Tests (CPTs) referred to in the above reports are shown on Figure 70 attached.

## 5 GROUND MODEL

Based on the investigation results presented within the above reports and our experience with the site, the following ground model has been established:

- The main geological unit underlying the site comprises stiff to very stiff sandy silts and silty sands of the Matua Subgroup. Undrained shear strengths derived from hand shear vane results ranged from 70kPa to >190kPa, with the average value being approximately 80kPa.
- A layer of firm clayey silt occurs within the Matua Subgroup profile where recorded undrained shear strengths were noticeably lower, at around 40 to 60kPa. The firm clayey silts were encountered at a depth of approximately 7m below the upper terrace and also near the base of the gully.
- Beneath the Matua Subgroup, at approximately 10 to 15m below existing ground level, dense sands were encountered in the machine borehole drilled near the invert of the gully (MBH02) which coincide with an abrupt increase in the CPT cone resistance ( $q_c$ ) at this level, and is inferred to be weathered ignimbrite.
- Across the gently sloping upper terrace, the typical sequence of volcanic ash deposits were encountered beneath the topsoil layer, to collective depths of approximately 2.5m. The sequence comprised stiff to very stiff clayey silts of the Younger (Post-Rotoehu) ash underlain by fine grained sands of the Rotoehu ash, which was in turn underlain by Hamilton ash, comprising very stiff to hard clayey silts. Undrained shear strengths within the Younger ash ranged from 80kPa to 130kPa whilst undrained shear strengths in the Hamilton ash were >196kPa.
- Within the lower slopes of the gully escarpment, colluvium comprising stiff to very stiff clayey silt was encountered to a maximum depth of 1.8m. Undrained shear strengths within the colluvium ranged from 56kPa to 154kPa.
- Groundwater was not encountered in the investigation holes across the upper terrace, however was encountered in the majority of the hand auger boreholes located near the base of the gully and was encountered at a similar level to the stream water level.
- Some minor springs and groundwater seepage has been observed within the gully escarpments within the vicinity of the disposal site. Additionally, given the presence of the layered soil profile with contrasting permeability, it is considered there is the potential for perched groundwater levels to develop within the more permeable sandy soils during and following periods of intense or prolonged rainfall.

Representative ground profiles were generated from the Lysaght survey data provided and geological cross sections A-A to C-C were developed as shown on Figures 71 to 73.

## 6 ENGINEERING EVALUATION AND RECOMMENDATIONS

### 6.1 Slope Stability

#### 6.1.1 Assessment Criteria

Specific slope stability analyses were completed for the critical proposed ground profile across the site, represented by Cross Sections B-B, to assess the stability of the proposed fill embankment under a range of conditions and with respect to the following criteria:

<b>Slope Stability Case</b>	<b>Required Factor of Safety (FoS)</b>
Prevailing groundwater conditions	1.5
Elevated groundwater conditions	1.2
ULS seismic case	1.0

The analyses included an assessment of the Peak Ground Acceleration (PGA) for the Ultimate Limit State (ULS) design seismic event in accordance with the NZTA Bridge Manual (2014) and NZGS Earthquake Geotechnical Engineering Practice: Module 1 (2016). No information has been provided with regards to the Importance Level (IL) of the fill embankment, therefore analyses have considered a range of IL's between IL2 and IL4.

Calculations of the PGA adopted the conservative Class C site subsoil condition and assumed a 50 year design working life, and are summarised in Table 2 below:

<b>Importance Level (IL)</b>	<b>Subsoil Site Classification</b>	<b>PGA</b>
Importance Level 2 (1/500 Annual Probability of Exceedance)	Class C	0.29
Importance Level 3 (1/1000 Annual Probability of Exceedance)	Class C	0.37
Importance Level 4 (1/2500 Annual Probability of Exceedance)	Class C	0.52

### 6.1.2 Design Parameters

Shear strength parameters for the Matua Subgroup subsoils were calibrated by completing a back analysis of the pre-development ground profile under elevated groundwater conditions to achieve a factor of safety of close to 1. Effective stress soil parameters for the remaining units were based on the results of the investigation and past experience in modelling these materials. These parameters are summarised in Table 3 below:

<b>Soil Unit Name</b>	<b>Unit Weight (kN/m<sup>3</sup>)</b>	<b>Effective Stress Soil Cohesion (kPa)</b>	<b>Effective Stress Friction Angle (degrees)</b>	<b>Undrained Shear Strength (kPa)</b>
Engineer certified fill	16	5	30	150
Topsoil	14	2	28	50
Track-rolled Fill	15	2	30	50
Colluvium	16	5	30	50

Younger Ash	16	5	30	80
Hamilton Ash	17	10	25	120
Stiff to v.stiff sandy silt (Upper Matua Subgroup)	16	3	30	80
Firm clayey silt (Upper Matua Subgroup)	16	2	28	40
Stiff sandy silt (Lower Matua Subgroup)	16	3	30	80
Dense sand (Inferred Ignimbrite)	16	5	40	NA

A 12kPa uniformly distributed load has been applied to the area above the fill embankment to account for additional building loads imposed within the residential subdivision properties.

A sensitivity analyses has been completed for the track-rolled fill material to assess the suitability of the design batter gradient and the significance that the properties of the contained fill has on the overall embankment stability.

### 6.1.3 Analyses Results

Analyses were undertaken using the software package Slide Version 6, adopting the general Limit Equilibrium-Morgenstern Price method for the critical Cross Section B-B, with the results summarised in Table 4 below. Selected stability printouts are appended.

<b>Slope Stability Case</b>	<b>Min. Required Factor of Safety (FoS)</b>	<b>FoS Achieved</b>
Prevailing groundwater conditions	1.5	1.50
Elevated groundwater conditions	1.2	1.24
ULS seismic case – IL2	1.0	1.35
ULS seismic case – IL3	1.0	1.19
ULS seismic case – IL4	1.0	0.98

Results of the analyses indicate that the design fill embankment depicted by Cross Section B-B provides acceptable factors of safety (FoS) against slope instability under prevailing and elevated groundwater conditions. Furthermore, adopting a conservative subsoil Class C site and a 50 year design working life, the design fill embankment achieves the minimum global FoS requirement using the undrained shear strengths presented in Table 3 for an Importance Level 2 and 3 structure, however marginally falls outside the FoS requirement for an IL4 structure.

For the seismic case, the “yield” acceleration (ie the PGA to achieve a FoS = 1.0) is around 0.50g. Therefore, using the Ambraseys & Menu (1988)<sup>1</sup> the estimated displacement from the IL4 ULS design earthquake event is insignificant (ie <1mm). This indicates the magnitude of displacement of the fill embankment is likely to be relatively minor, and the release of release of any contained fill material as a result of an IL4 ULS seismic event is considered very low.

#### 6.1.4 Sensitivity Analyses

A sensitivity analyses was completed for the track-rolled fill material to assess the geological parameters for both the prevailing groundwater (typical long-term operating conditions) and elevated porewater pressure (ru) case and a design embankment gradient of 1:3 (vertical:horizontal). The results of the sensitivity analyses are summarised in Table 5 below and indicate the design fill embankment gradient of 1:3 is considered appropriate in maintaining internal stability of the contained uncontrolled fill:

<b>Stability Case</b>	<b>Unit</b>	<b>Unit Weight (t/m<sup>3</sup>)</b>	<b>Effective Stress Soil Cohesion, c' (kPa)</b>	<b>Effective Stress Friction Angle, <math>\phi</math> (degrees)</b>	<b>FoS Achieved</b>
Prevailing groundwater (ru=0.1)	Track-rolled fill	15	0	25	1.43
Elevated porewater pressure (ru=0.3)	Track-rolled fill	15	0	25	1.05

## 6.2 Earthworks Recommendations

### 6.2.1 General

All earthworks must be carried out in general accordance with the requirements of NZS 4431 and the requirements of the WBOPDC 2009 Development Code under the guidance of a suitably qualified and experienced Geotechnical Engineer.

Earthworks must also be carried out in accordance with the recommendations provided in the following documents:

- GIR for the proposed subdivision development supplemented by the recommendations provided in this report; and
- The Remedial Action Plan and Earthworks Construction Methodology (currently being prepared by others).

### 6.2.2 Excavations

To provide adequate volumes for fill containment, excavation to approximate RL 15.5m (Moturiki Datum) are proposed. Beneath the topsoil layer, excavations are expected to encounter initially friable silts of the Younger ash, as outlined in the CMW subdivision GIR, dated 18 August 2016. These materials, together with the underlying Hamilton ash and intermediate lense of Rotoehu ash have been successfully earthworked around the region and typically require minimal moisture conditioning during the summer months to be suitable for use as engineered fill.

<sup>1</sup> N. N. Ambraseys & J. M. Menu, Earthquake-Induced Ground Displacements, *Earthquake engineering and Structural Dynamics*, Vol 16, pg 985-1006, 1998

Within deeper cuts beneath 2 to 2.5m, soils of the underlying Matua Subgroup are likely to be encountered, which typically contain much higher moisture contents, sometimes approaching the soil liquid limit and are highly sensitive, which can make them particularly challenging to earthwork. These materials can be used within engineered fills although the amount of drying, blending and compaction effort required should not be underestimated. Additionally, the non-plasticity fine-grained silt of the Matua Subgroup soils can make them susceptible to piping erosion, therefore these soils should be avoided where they may become exposed to surface or groundwater flows.

### 6.2.3 Cut and Fill Batters

To maintain adequate factors of safety against slope instability, permanent fill batters for the embankment comprising track-rolled variable fills and min. 1m thick topsoil cover should be formed to no steeper than 1:3 (V:H). Following topsoiling, surface protection against erosion shall be implemented, and may include mulching until vegetation is established or the use of geofabrics.

Temporary cut batters shall be formed no steeper than 1:1 (vertical:horizontal) where no signs of groundwater seepage is observed. Benches shall be provided at maximum 2.5m vertical heights to maintain an overall cut gradient (bench plus batter) of 1(V):2.5(H), as shown of Figures 71 to 73. Where temporary cut batters are proposed to exceed this grade during earthworks, further advice should be obtained from the project geotechnical engineer.

### 6.2.4 Subsoil Drains

Several springs have previously been identified in the general area, therefore, the likelihood of encountering springs/seepage during excavations is considered likely. Subsoil drainage must be installed at the toe of each cut batter and shall comprise 100mm diameter perforated drainage coil with filter sock along the toe with a cover of coarse sand or drainage aggregate wrapped in geotextile (ie Bidim A19 or similar). Each drain will terminate into a central subsoil drain that runs towards and discharges near the toe of the gully via a solid wall pipe. A 200mm thick drainage blanket comprising granular sand or pumice shall be applied across the base of the excavation with the excavation profiled to fall towards a central subsoil drain. Indicative subsoil drain locations have been shown on Figure 70, however shall be confirmed by the project geotechnical engineer on site.

All installed subsoil drains shall be surveyed by the project surveyor and included on the earthworks as-built plans.

### 6.2.5 Earthfill Construction

The prepared base and benched excavation should be inspected by the project geotechnical engineer. The uncontrolled fill may then be placed, spread and compacted within the excavation in controlled 200mm (loose) lifts under the supervision of a geotechnical engineer and environmental engineer in accordance with the requirements of the Asbestos Management Plan and construction specification.

Each lift should be compacted by track-rolling with at least 4 passes with a min. 20-tonne excavator. The moisture condition of the uncontrolled fill shall be controlled to maintain within a plastic state (for cohesive soils) and should be within  $\pm 2\%$  of Optimum Moisture Content. This may require wetting down during compaction and protecting stockpiles from infiltration of rain and stormwater runoff.

Each layer of fill shall be proof-rolled to confirm the construction methodology is suitable, fill conditions and an adequate level of uniform compaction is achieved, under the regular supervision of the project geotechnical engineer.

The topsoil cover should also be compacted using a similar methodology in 200mm layers with each layer compacted by either track-rolling with the excavator or the use of specific compaction plant.

## 7 LIMITATIONS

This report has been prepared for use by our client Classic Developments Omokoroa Ltd, their consultants and the Western Bay of Plenty District Council. Liability for its use is limited to these parties and to the scope of work for which it was prepared as it may not contain sufficient information for other parties or for other purposes.

It should be noted that factual data for this report has been obtained from discrete locations using normal geotechnical investigation techniques. As such investigation methods by their nature only provide information about a relatively small volume of subsoils, 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 the report. If variations in the subsoils occur from those described or assumed to exist then the matter should be referred back to CMW immediately.

**For and on behalf of  
CMW Geosciences (NZ) Ltd**

Prepared by:



**Robert Taylor**  
Senior Geotechnical Engineer

Reviewed by:



**Matt Packard**  
Senior Geotechnical Engineer  
MIPENZ, CPEng  
TCC Category 1 Geotechnical Engineer

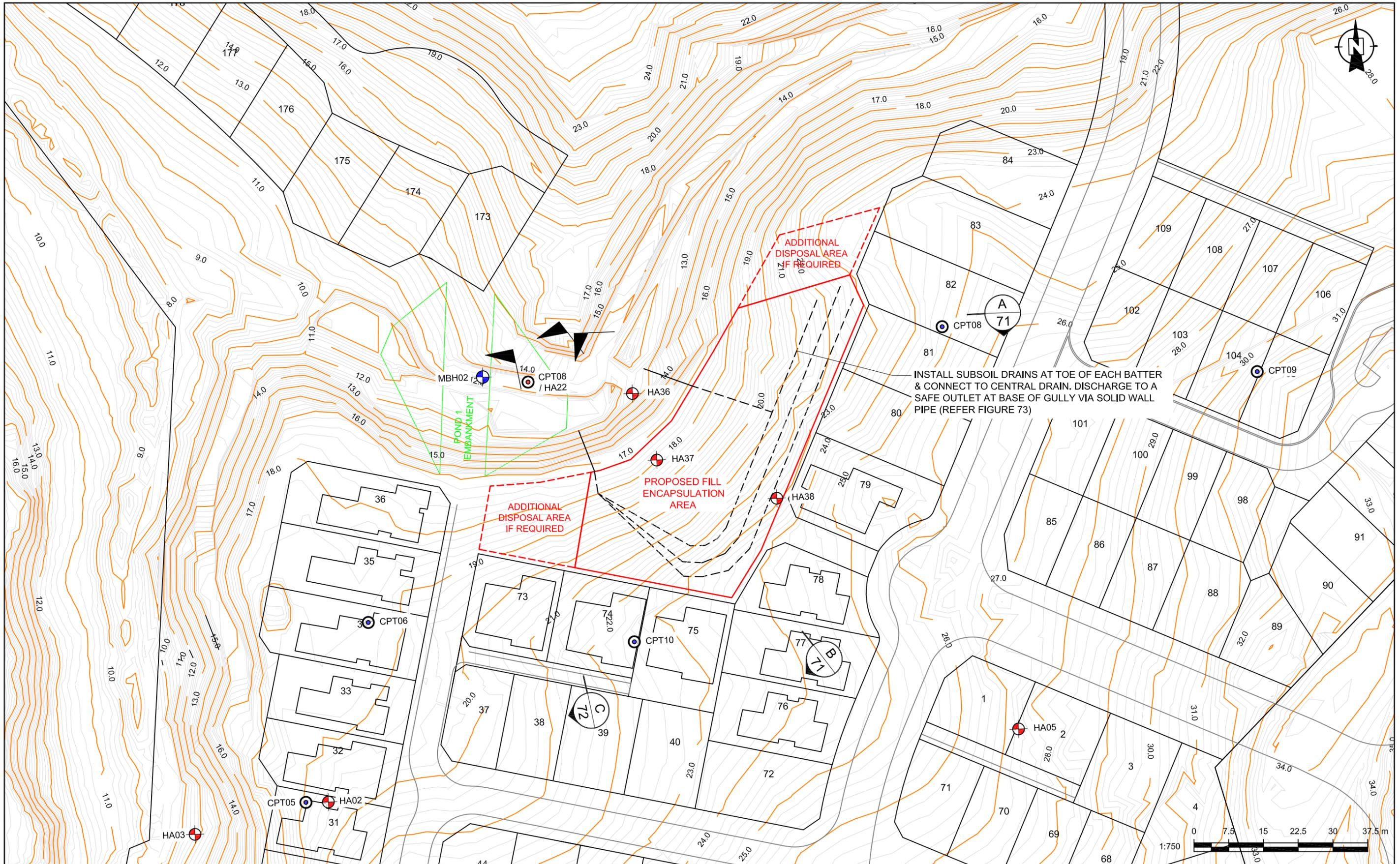
Reviewed and approved by:



**Dave Morton**  
Principal Geotechnical Engineer  
MIPENZ, CPEng  
TCC Category 1 Geotechnical Engineer

Attachments: *Figure 70 - Geotechnical Investigation Plan*  
*Figure 71 – Cross Section A-A*  
*Figure 72 – Cross Section B-B*  
*Figure 73 – Cross Section C-C*  
*Lysaght Consultant Limited Contaminated Material Disposal Plans, Drawings No's 163252-SKT-31 & -32 dated 10/03/2017*  
*Engineering Borehole Logs*  
*Cone Penetrometer Test (CPT) Results*  
*Select Slope Stability Outputs*

Distribution: 1 copy Classic Developments Omokoroa Limited (electronic)  
1 copy Lysaght Consultants Limited (electronic)  
Original held by CMW Geosciences Ltd



**LEGEND:**

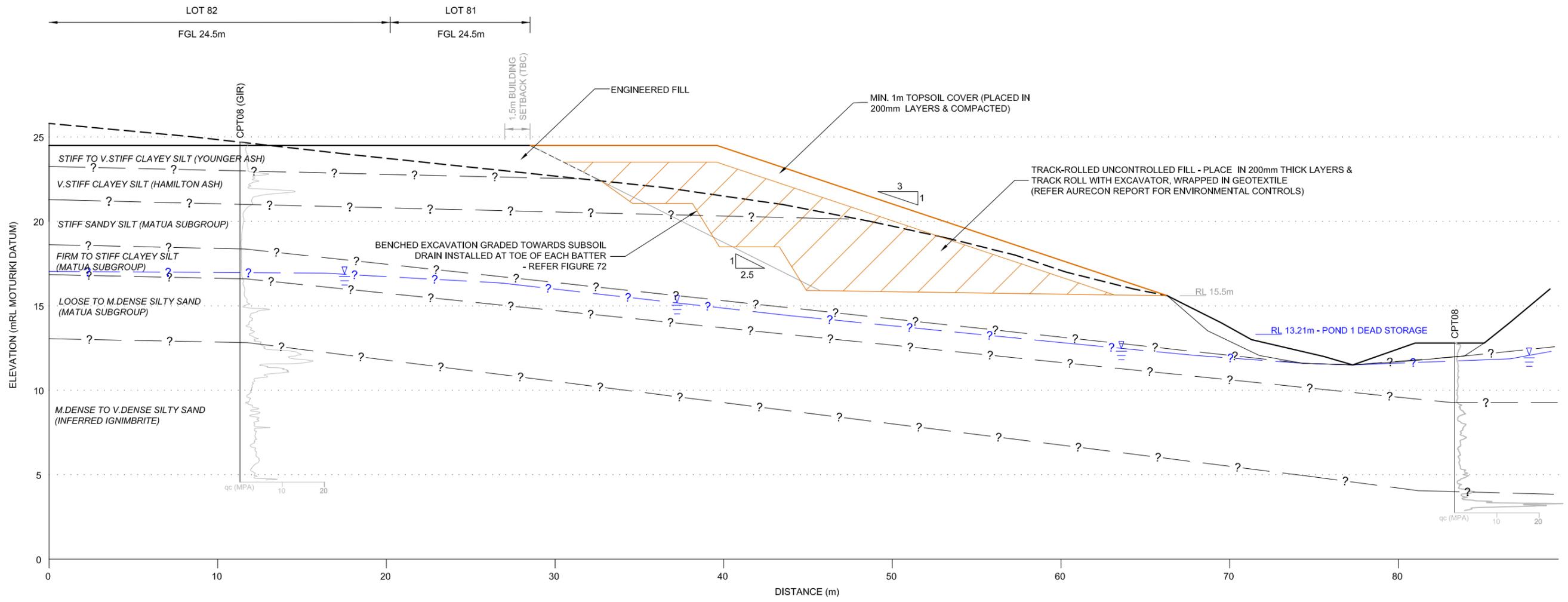
-  DENOTES APPROXIMATE EXTENT OF FILL DISPOSAL AREA
-  DENOTES HAND AUGER (HA) BOREHOLE (CMW GIR - NOV 2016)
-  DENOTES CONE PENETROMETER TEST (CPT) (CMW GIR - NOV 2016)
-  DENOTES MACHINE BOREHOLE (MBH) (CMW POND 1 DAM - FEB 2017)
-  DENOTES CONE PENETROMETER TEST (CPT) (CMW POND 1 DAM - FEB 2017)

**NOTES:**

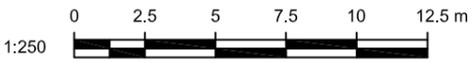
1. CONTOURS ARE PRE-DEVELOPMENT CONTOURS SHOWN AT 0.2 METRE INTERVALS (MOTURIKI DATUM)
2. DEVELOPMENT LAYOUT OBTAINED FROM LYSAGHT CONTOUR PLANS PROVIDED



CLIENT: <b>CLASSIC DEVELOPMENTS OMOKOROA LTD</b>	DRAWN: RT	PROJECT: TGA2016-0258
PROJECT: <b>KAIMAI VIEWS - STAGE 1 336-344 OMOKOROA ROAD, OMOKOROA</b>	CHECKED: MP	FIGURE: 70
TITLE: <b>SITE PLAN - ASBESTOS FILL DISPOSAL</b>	REVISION: 0	SCALE: 1:750
	DATE: 25/05/2017	SHEET: A3 L



CROSS SECTION A-A



**LEGEND:**

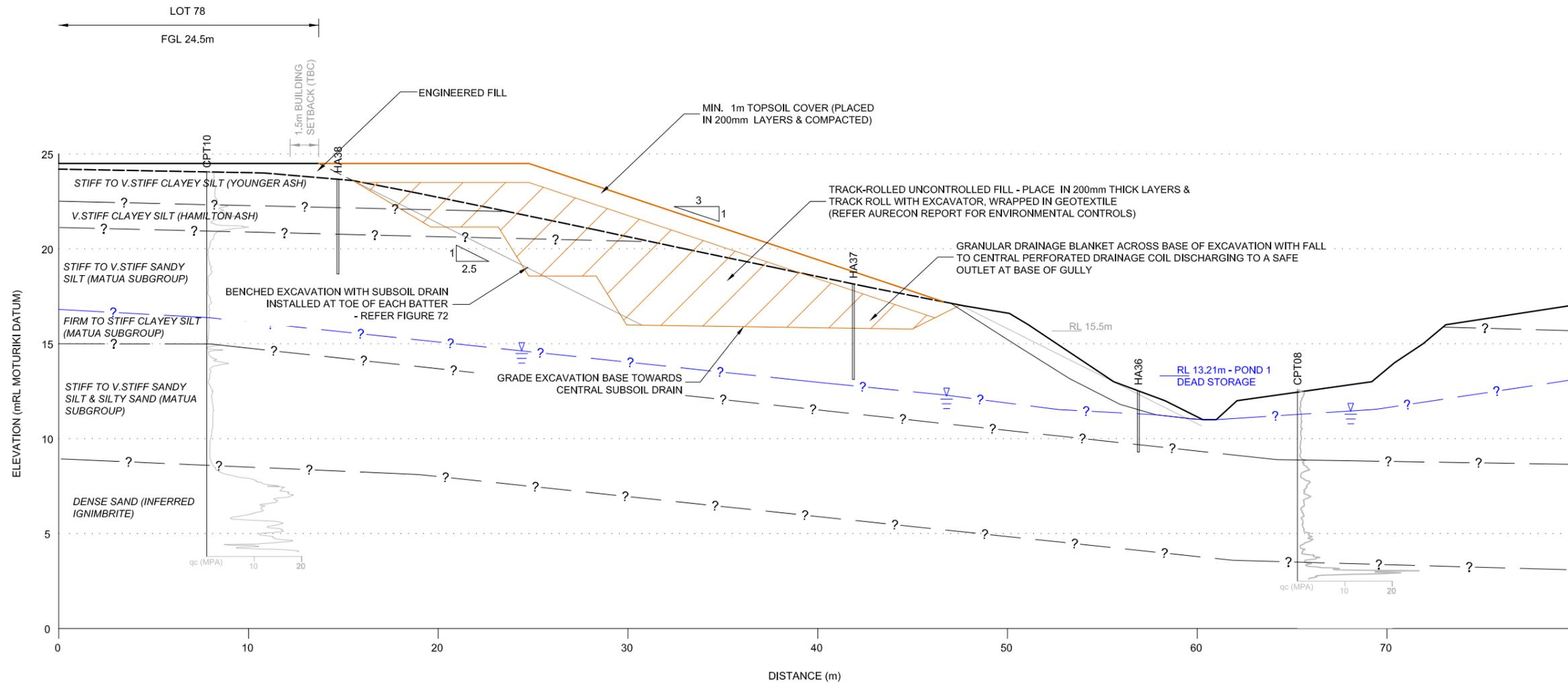
---	PRE-DEVELOPMENT GROUND SURFACE
—	PROPOSED GROUND SURFACE (POST DEVELOPMENT)
—	PROPOSED UNCONTROLLED FILL ENCAPSULATION

**NOTES:**

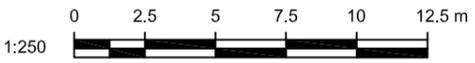
- CROSS SECTIONS DERIVED FROM LYSAGHT CONSULTANTS LTD CONTOUR PLANS REFERENCING BOTH SURVEY AND LIDAR DATA



CLIENT: <b>CLASSIC DEVELOPMENTS OMOKOROA LTD</b>	DRAWN: RT	PROJECT: TGA2016-0258
PROJECT: <b>KAIMAI VIEWS - FILL ENCAPSULATION</b> 336-344 OMOKOROA ROAD, OMOKOROA	CHECKED: MP	FIGURE: 71
TITLE: <b>CROSS SECTION A-A</b>	REVISION: 0	SCALE: 1:250
	DATE: 25/05/2017	SHEET: A3 L



CROSS SECTION B-B



**LEGEND:**

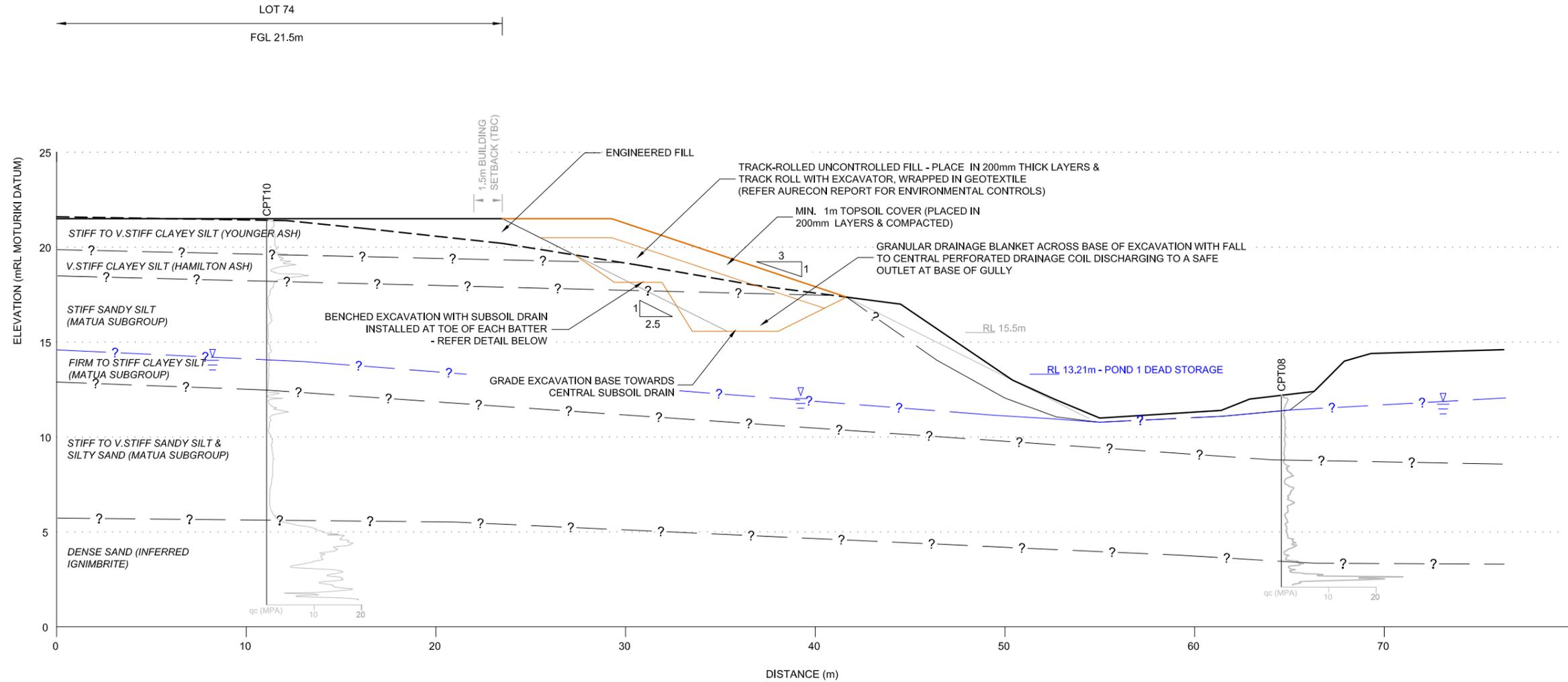
---	PRE-DEVELOPMENT GROUND SURFACE
—	PROPOSED GROUND SURFACE (POST DEVELOPMENT)
—	PROPOSED UNCONTROLLED FILL ENCAPSULATION

**NOTES:**

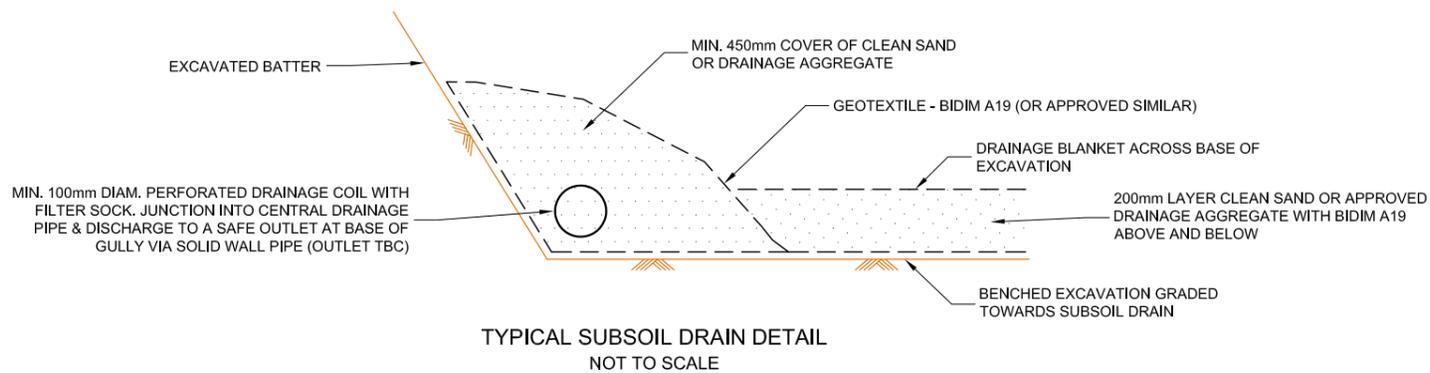
- CROSS SECTIONS DERIVED FROM LYSAGHT CONSULTANTS LTD CONTOUR PLANS REFERENCING BOTH SURVEY AND LIDAR DATA



CLIENT: <b>CLASSIC DEVELOPMENTS OMOKOROA LTD</b>	DRAWN: RT	PROJECT: TGA2016-0258
PROJECT: <b>KAIMAI VIEWS - FILL ENCAPSULATION</b> 336-344 OMOKOROA ROAD, OMOKOROA	CHECKED: MP	FIGURE: 72
TITLE: <b>CROSS SECTION B-B</b>	REVISION: 0	SCALE: 1:250
	DATE: 25/05/2017	SHEET: A3 L



CROSS SECTION C-C



**LEGEND:**

---	PRE-DEVELOPMENT GROUND SURFACE
—	PROPOSED GROUND SURFACE (POST DEVELOPMENT)
—	PROPOSED UNCONTROLLED FILL ENCAPSULATION

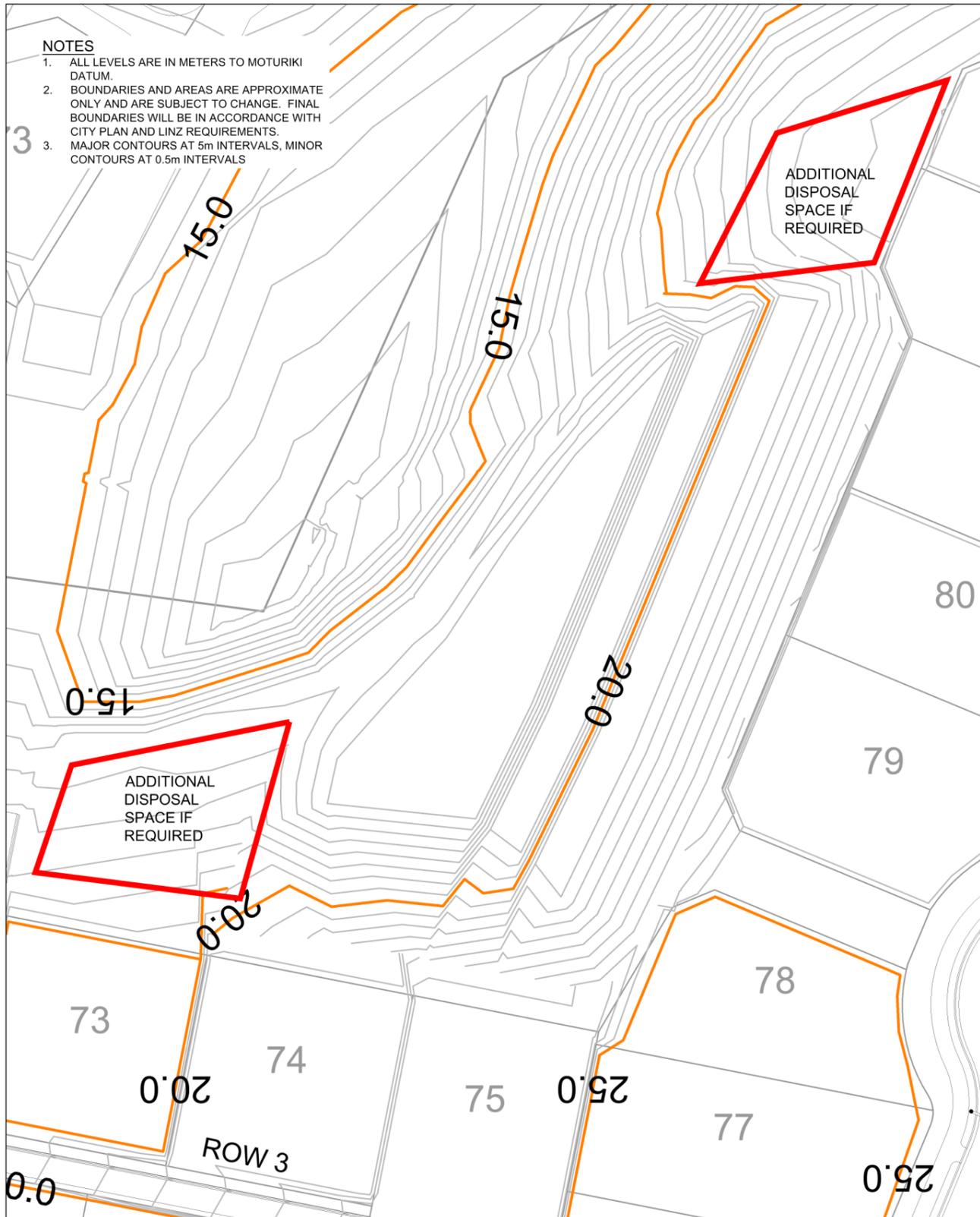
**NOTES:**

- CROSS SECTIONS DERIVED FROM LYSAGHT CONSULTANTS LTD CONTOUR PLANS REFERENCING BOTH SURVEY AND LIDAR DATA

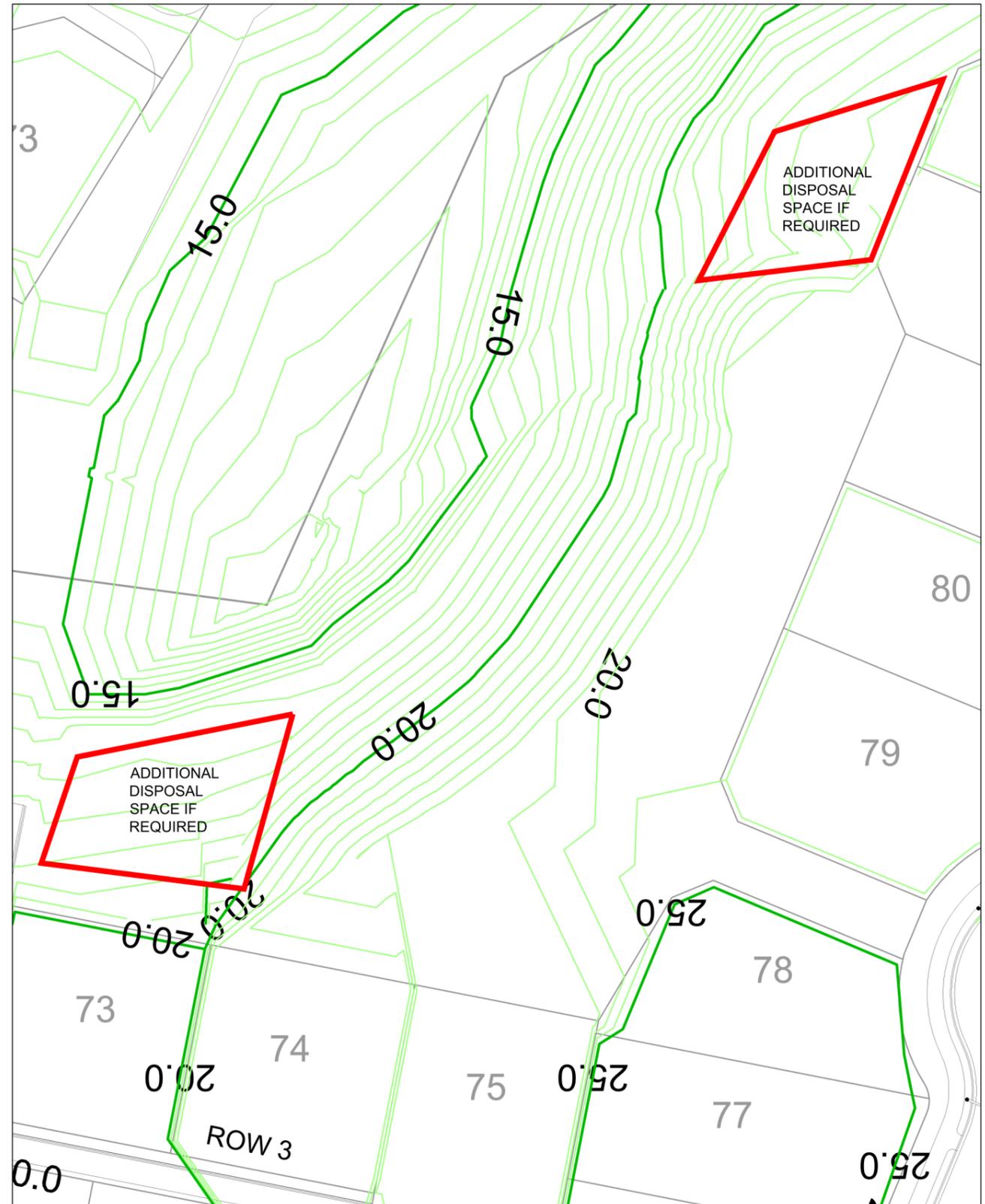


CLIENT: <b>CLASSIC DEVELOPMENTS OMOKOROA LTD</b>	DRAWN: RT	PROJECT: TGA2016-0258
PROJECT: <b>KAIMAI VIEWS - FILL ENCAPSULATION</b> 336-344 OMOKOROA ROAD, OMOKOROA	CHECKED: MP	FIGURE: 73
TITLE: <b>CROSS SECTION C-C</b>	REVISION: 0	SCALE: 1:250
	DATE: 25/05/2017	SHEET: A3 L

- NOTES**
1. ALL LEVELS ARE IN METERS TO MOTURIKI DATUM.
  2. BOUNDARIES AND AREAS ARE APPROXIMATE ONLY AND ARE SUBJECT TO CHANGE. FINAL BOUNDARIES WILL BE IN ACCORDANCE WITH CITY PLAN AND LINZ REQUIREMENTS.
  3. MAJOR CONTOURS AT 5m INTERVALS, MINOR CONTOURS AT 0.5m INTERVALS



EXCAVATION  
SCALE 1:500



FINISHED SURFACE  
SCALE 1:500



Drawn	Signed	Date			
AV		10/03/17			
Designed	Signed	Date			
AV		10/03/17			
Verified	Signed	Date			
PM		10/03/17			
Approved	Signed	Date			
PM		10/03/17			
No.	Date	Revision Details	By	Ver.	App.
A	10/03/17	FOR APPROVAL	AV		

**LYSAGHT**

THIS DRAWING REMAINS THE PROPERTY OF LYSAGHT CONSULTANTS LTD. NO LIABILITY SHALL BE ACCEPTED FOR THE UNAUTHORISED USE OF THIS DRAWING

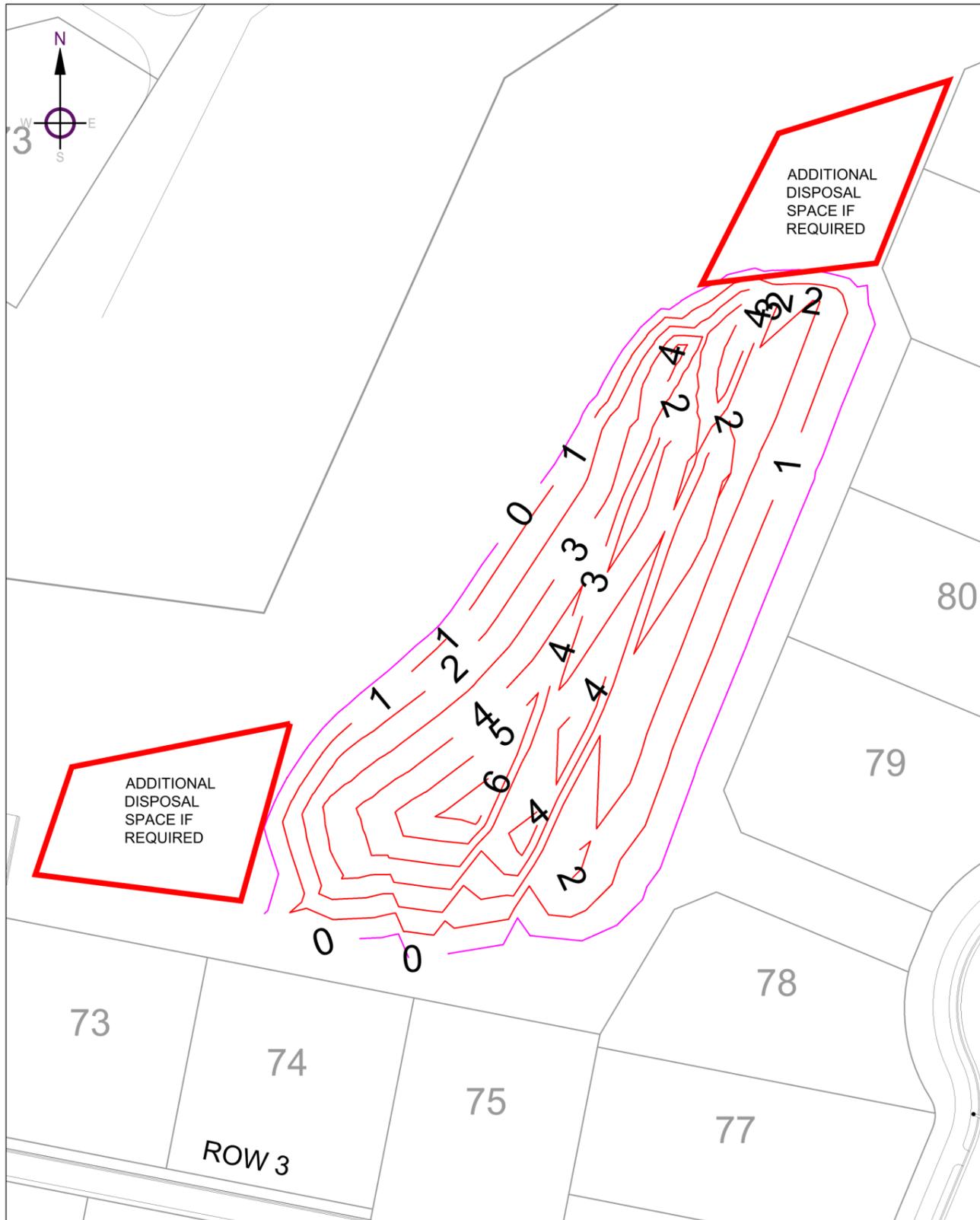
**SURVEYING, ENGINEERING & LAND DEVELOPMENT**  
19 Totara St, Mount Maunganui 3116 Ph 07 578 8798 www.lysaght.net.nz

Project:  
CLASSIC DEVELOPMENTS  
KAIMAI VIEWS  
OMOKOROA SPECIAL HOUSING AREA  
OMOKOROA

Drawing Title:  
SKETCH  
CONTAMINATED MATERIAL DISPOSAL

FOR INFORMATION

Project No. 163252  
Scale (A3) 1:500  
Drawing No. 163252-SKT-31  
Rev. A



VOLUME CONTAMINATED MATERIAL TO BE DISPOSED OF:  
 MAIN STOCKPILE - 3600m<sup>3</sup>  
 SMALLER STOCKPILE - 550m<sup>3</sup>  
 IN-SITU 1 - 500m<sup>3</sup>  
 IN-SITU 2 - 100m<sup>3</sup>  
 TOTAL = 4750m<sup>3</sup>

ASSUMED COMPACTION FACTOR WITH TRACK ROLLED MACHINERY 1.2

VOLUME TO BE DISPOSED: 3960m<sup>3</sup>

VOLUME AVAILABLE AS PER DESIGN FOR 1m COVER BELOW DESIGN SURFACE: 4070m<sup>3</sup>

FINAL REMEDIATED AREA 2650m<sup>2</sup>  
 VOLUME OF CLEAN FILL @ 800mm THICK = 2120m<sup>3</sup>  
 PLACE TOPSOIL TO A DEPTH OF 200mm

○ DEPTH OF CONTAMINATED FILL  
 SCALE 1:500

FOR INFORMATION

Drawn		Signed		Date		 <p>THIS DRAWING REMAINS THE PROPERTY OF LYSAGHT CONSULTANTS LTD. NO LIABILITY SHALL BE ACCEPTED FOR THE UNAUTHORISED USE OF THIS DRAWING</p>	Project: CLASSIC DEVELOPMENTS KAIMAI VIEWS OMOKOROA SPECIAL HOUSING AREA OMOKOROA	Drawing Title:		Project No.	
Designed		Signed		Date				SKETCH		163252	
Verified		Signed		Date				CONTAMINATED MATERIAL DISPOSAL		Scale (A3)	
Approved		Signed		Date				DEPTH OF MATERIAL		1:500	
A 10/03/17		FOR APPROVAL		AV		SURVEYING, ENGINEERING & LAND DEVELOPMENT		Drawing No.		Rev.	
No.		Date		Revision Details		19 Totara St, Mount Maunganui 3116 Ph 07 578 8798 www.lysaght.net.nz		163252-SKT-32		A	





# HAND AUGER BOREHOLE - HA22

Client: Classics Development Ltd  
 Project: 336, 340, 344 Omokoroa Rd  
 Site Address: Omokoroa, Tauranga  
 Project: TGA2016\_0258  
 Date: 04/11/2016  
 Borehole Location: Refer to Figure



1:25 Sheet 1 of 1

Logged by: LSP Checked by: LPM		Position: E.1875266.5m N.5826656.6m (NZTM) Survey Source: Hand Held GPS		Elevation: Datum:		Hole Diameter: 50mm Angle from horizontal: 90°			
Unit	Groundwater	RL (m)	Depth (m)	Graphic Log	Material Description Soil: USC; Soil type; colour; structure; strength; moisture; bedding; plasticity; sensitivity; additional comments Rock: Weathering; colour; fabric; rock name; strength; additional comments	Moisture Condition Consistency/Relative Density	Shear Strengths (kPa) Peak (Residual)	Dynamic Cone Penetrometer (Blow/100 mm) 5 10 15 20	Comments
Peat					Pt: PEAT: dark brown, mottled light brown, non plastic to low plasticity.		V-124(23)		
Alluvium					ML: Clayey SILT: light orange-brown, low to medium plasticity, sensitive to quick.	St to VSt	V-81(13)		
			1		... minor fine sand. ML: Sandy SILT: green-grey, mottled orange, non plastic, quick, sand is fine grained.	M	V-161(8) V-209(11)		
Matua Subgroup			2		ML: Clayey SILT, minor fine sand: blue-grey, low plasticity, insensitive to sensitive, trace green inclusions.	Vst to H	V-145(26) V-100(13)		
			3			s	V-145(35) V-129(77)		
			3		Borehole terminated at 3.0 m				
			4						
			5						

Termination reason: Target Depth Reached

Remarks: Shear vane number 2017.

# HAND AUGER BOREHOLE - HA36

Client: Classics Development Ltd  
 Project: 336, 340, 344 Omokoroa Rd  
 Site Address: Omokoroa, Tauranga  
 Project: TGA2016\_0258  
 Date: 28/11/2016  
 Borehole Location: SW Pipe Alignment



1:25 Sheet 1 of 1

Logged by: LSP Checked by: KB		Position: E.1866689.8m N.5828302.1m (NZTM) Survey Source: Hand Held GPS		Elevation: Datum:		Hole Diameter: 50mm Angle from horizontal: 90°			
Unit	Groundwater	RL (m)	Depth (m)	Graphic Log	Material Description Soil: USC; Soil type; colour; structure; strength; moisture; bedding; plasticity; sensitivity; additional comments Rock: Weathering; colour; fabric; rock name; strength; additional comments	Moisture Condition Consistency/Relative Density	Shear Strengths (kPa) Peak (Residual)	Dynamic Cone Penetrometer (Blow/100 mm) 5 10 15 20	Comments
TS					OL: Organic SILT, minor rootlets: dark brown.	D to M	VSt		
					ML: SILT, trace fine sand: orange-brown, non plastic, moderately sensitive. ... becoming light brown.				
Colluvium			1		ML: Clayey SILT, trace fine to coarse sand: light brown, speckled/mottled orange and grey, low to medium plasticity, moderately sensitive to sensitive. ... trace black inclusions, mottled dark brown.	M	St to VSt		
					ML: Clayey SILT, trace fine sand: brown, mottled dark brown, grey and orange, low plasticity, insensitive. ... poor recovery.				
					V-151(36)				
					V-81(38) V-56(22) V-154(20)				
Matua Subgroup			2		ML: Clayey SILT: white, mottled orange, medium plasticity, insensitive to moderately sensitive.	S	F to St		
					V-42(10) V-42(22) V-56(28)				
					V-62(42)				
			3		ML: Clayey SILT: white, mottled orange, medium plasticity, insensitive to moderately sensitive. ... becoming blue-grey.				
					ML: SILT, minor clay, trace fine sand: blue-grey, low plasticity.	H			
					Borehole terminated at 3.3 m				
			4						
			5						

3.3m: Refusal.

Termination reason: Refusal.

Remarks: Groundwater not encountered. Shear vane number 1861. TS stratigraphic code denotes Topsoil.

# HAND AUGER BOREHOLE - HA37

Client: Classics Development Ltd  
 Project: 336, 340, 344 Omokoroa Rd  
 Site Address: Omokoroa, Tauranga  
 Project: TGA2016\_0258  
 Date: 28/11/2016  
 Borehole Location: SW Pipe Alignment



1:25 Sheet 1 of 1

Logged by: LSP Checked by: KB		Position: E.1866704.3m N.5828288.4m (NZTM) Survey Source: Hand Held GPS		Elevation: Datum:		Hole Diameter: 50mm Angle from horizontal: 90°					
Unit	Groundwater	RL (m)	Depth (m)	Graphic Log	Material Description Soil: USC; Soil type; colour; structure; strength; moisture; bedding; plasticity; sensitivity; additional comments Rock: Weathering; colour; fabric; rock name; strength; additional comments	Moisture Condition Consistency/Relative Density	Shear Strengths (kPa) Peak (Residual)	Dynamic Cone Penetrometer (Blow/100 mm) 5 10 15 20	Comments		
Matua Subgroup			1	[Cross-hatched pattern]	ML: SILT, trace rootlets: light brown, mottled dark brown, non plastic, sensitive to extra sensitive.	D to M	V-169(34)				
					ML: SILT, minor fine to medium sand: light orange-brown, non plastic, moderately sensitive to sensitive. ... trace rootlets.		V->196(22)				
					... some fine to medium sand.		V-126(20)				
							V-73(31)				
							V->196(56)				
							V-99(28)				
							V-168(56)				
							V-165(56)				
							V-154(62)				
							V-112(64)				
Matua Subgroup			2	[Cross-hatched pattern]	ML: SILT, minor fine sand: light brown, mottled brown, non plastic, moderately sensitive.	St to VSt	V-95(48)				
					ML: Clayey SILT: light orange-brown, non plastic to low plasticity, moderately sensitive.		V-116(56)				
							V-126(84)				
Matua Subgroup			3	[Cross-hatched pattern]	... becoming light brown.	M					
					ML: Clayey SILT, trace fine sand: light brown, non plastic to low plasticity, insensitive to moderately sensitive.						
Matua Subgroup			4	[Cross-hatched pattern]	ML: Clayey SILT: light grey-brown, low plasticity, insensitive. ... mottled orange.						
					ML: Clayey SILT: light orange, medium plasticity, insensitive.						
			5		Borehole terminated at 5.0 m						

Termination reason: Target Depth Reached.

Remarks: Groundwater not encountered. Shear vane number 1861.

# HAND AUGER BOREHOLE - HA38

Client: Classics Development Ltd  
 Project: 336, 340, 344 Omokoroa Rd  
 Site Address: Omokoroa, Tauranga  
 Project: TGA2016\_0258  
 Date: 28/11/2016  
 Borehole Location: SW Pipe Alignment

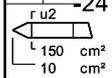
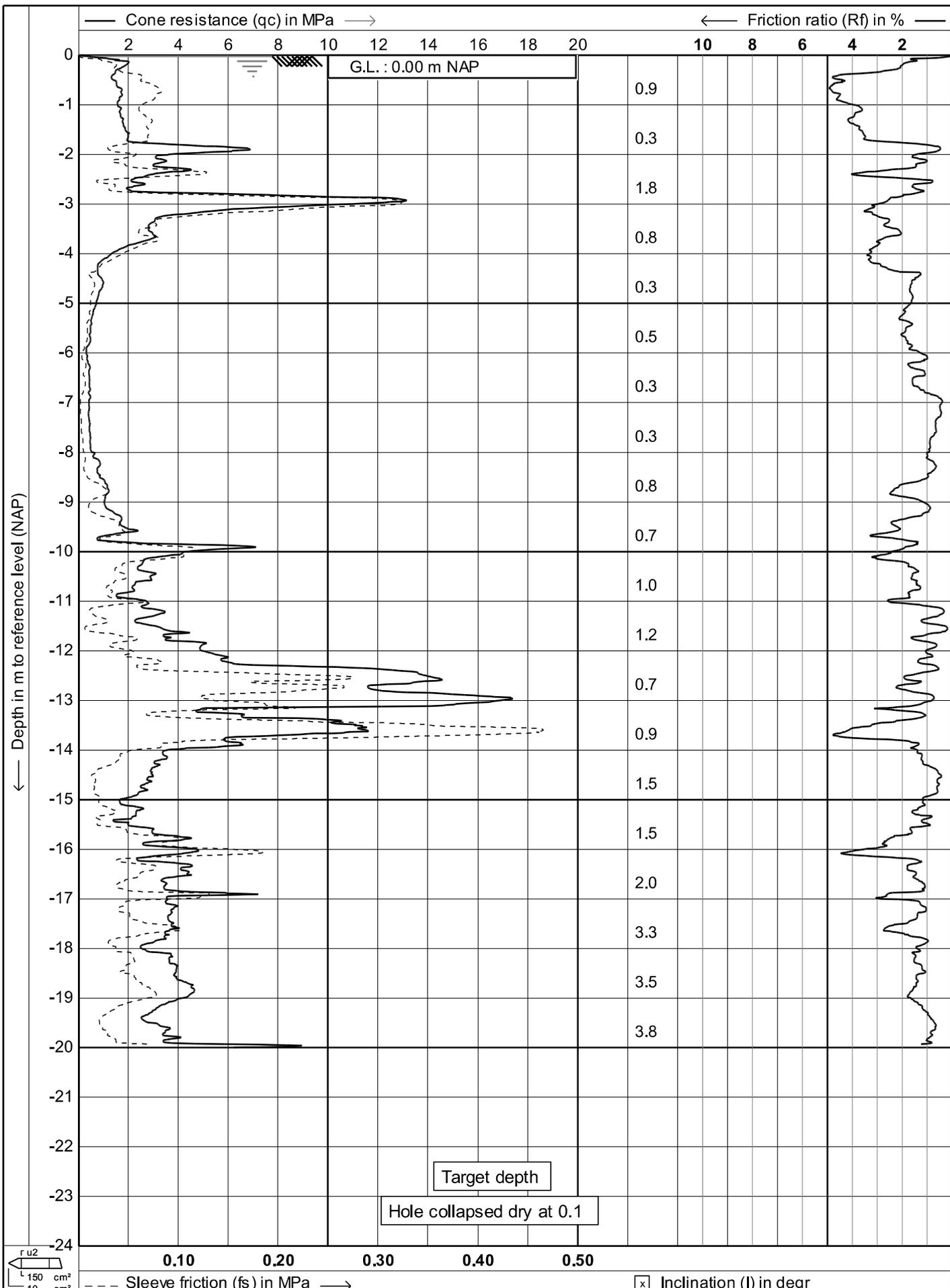


1:25 Sheet 1 of 1

Logged by: LSP Checked by: KB		Position: E.1866719.9m N.5828278.7m (NZTM) Survey Source: Hand Held GPS		Elevation: Datum:		Hole Diameter: 50mm Angle from horizontal: 90°				
Unit	Groundwater	RL (m)	Depth (m)	Graphic Log	Material Description Soil: USC; Soil type; colour; structure; strength; moisture; bedding; plasticity; sensitivity; additional comments Rock: Weathering; colour; fabric; rock name; strength; additional comments	Moisture Condition	Consistency/Relative Density	Shear Strengths (kPa) Peak (Residual)	Dynamic Cone Penetrometer (Blow/100 mm)	Comments
									5 10 15 20	
TS					OL: Organic SILT, minor rootlets: dark brown.					
Younger Ash					ML: SILT, trace fine sand: light orange-brown, mottled brown, non plastic, sensitive.	D to M	St to VSt	V-132(28)		
				ML: SILT, trace fine sand: light orange-brown, non plastic, moderately sensitive.	V-76(17)					
					... some fine sand.					
					SM: Silty fine to medium SAND: light orange-brown, poorly graded.					
RA			1		ML: Clayey SILT, trace fine sand: light creamy brown, non plastic to low plastic, trace black inclusions.	M				
				SP: Fine SAND: light grey, poorly graded.						
Hamilton Ash			2		ML: Clayey SILT: dark brown, low to medium plasticity.	D to M	H	V-UTP		
					ML: SILT: orange-brown, non plastic. ... poor recovery.			V-UTP		
Matua Subgroup			3		ML: Clayey SILT: orange, non plastic to low plasticity, moderately sensitive.	M	St to VSt	V-108(39)		
					ML: Clayey SILT: light brown, low to medium plasticity, insensitive to moderately sensitive.			V-109(32)		
				... trace fine sand and black inclusions.	V-84(39)					
				... mottled orange.	V-155(76)					
			4		Borehole terminated at 4.0 m			V-70(28)		
			5							

Termination reason: Target Depth Reached.

Remarks: Groundwater not encountered. Shear vane number 1861. TS stratigraphic code denotes Topsoil and RA stratigraphic code denotes Rotoehu Ash.



Test according A.S.T.M Standard D 5778-12

Project : **Site Investigations**

Location: **336**

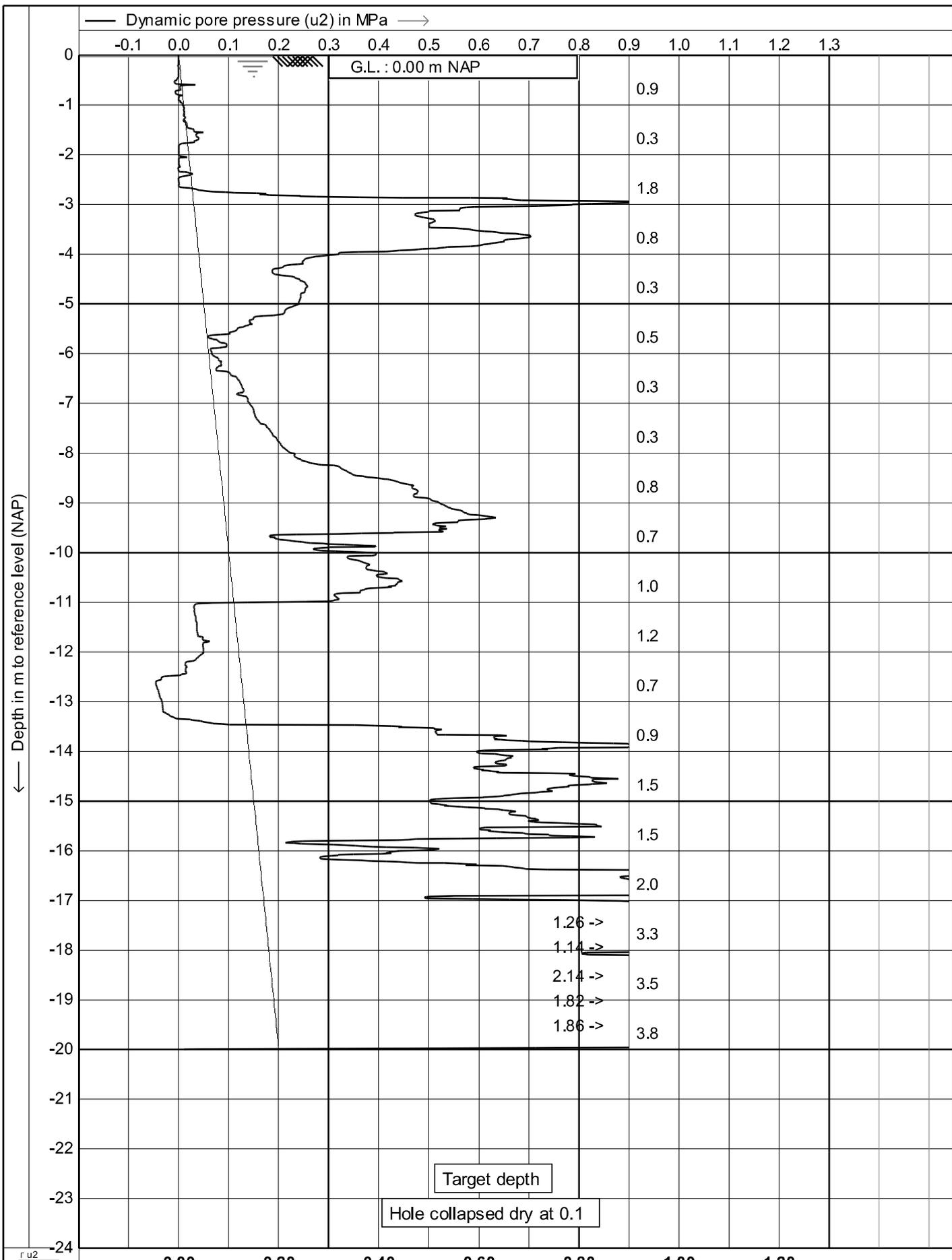
Position: **0, 0 RD**

Date : **20-6-2016**

Cone no. : **C10CFIP.C13082**

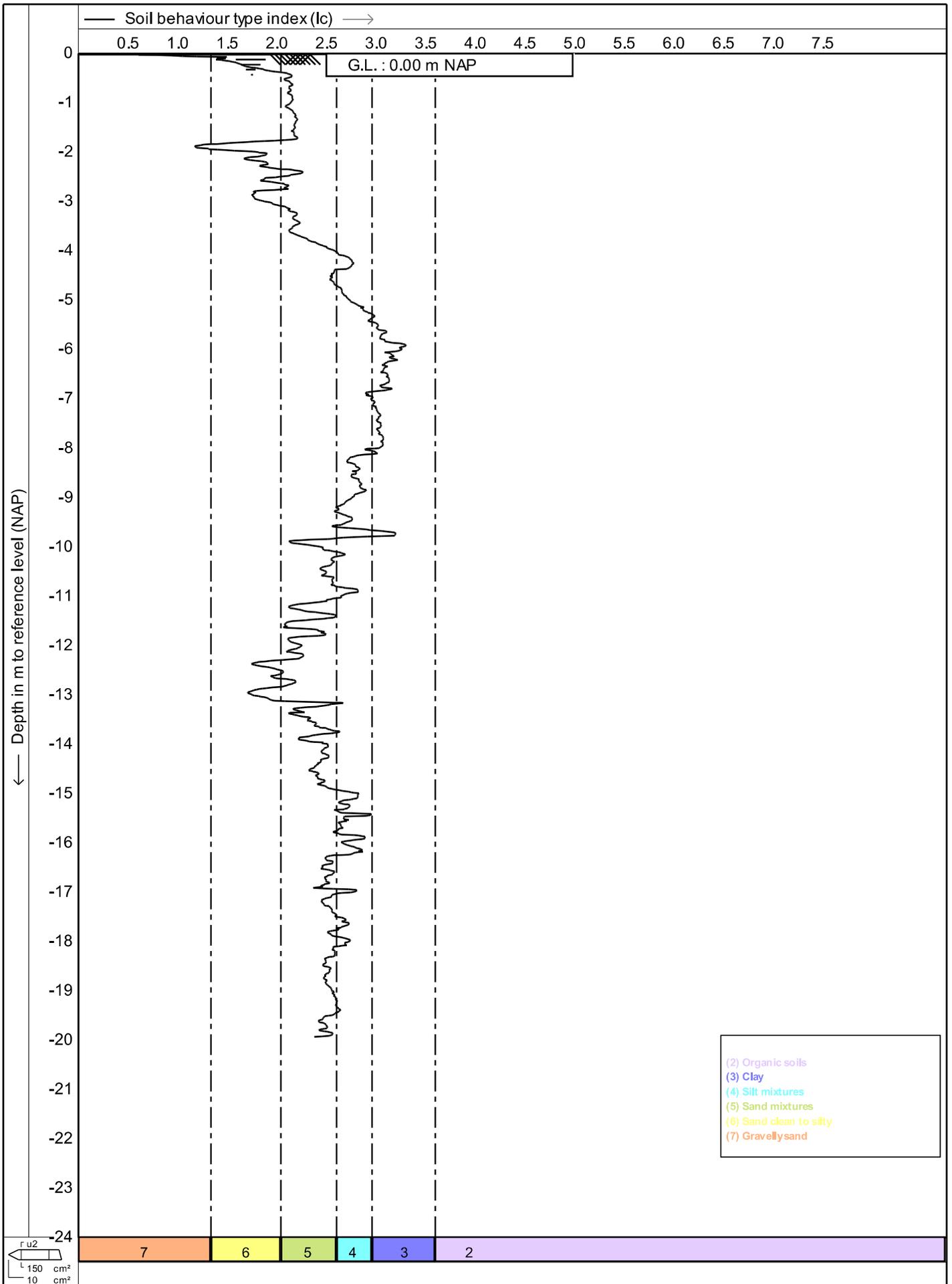
Project no. : **01CMW13**

CPT no. : **08** | 1/14



Equilibrium pore pressure ( $u_0$ ) in MPa  $\rightarrow$   Inclinon (I) in degr

	Test according A.S.T.M Standard D 5778-12	Date : 20-6-2016
	Project : Site Investigations	Cone no. : C10CFIP.C13082
	Location: 336	Project no. : 01CMW13
	Position: 0, 0 RD	CPT no. : 08
		2/14



Test according A.S.T.M Standard D 5778-12

Date : 20-6-2016

Cone no. : C10CFIP.C13082

Project : Site Investigations

Project no. : 01CMW13

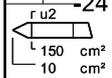
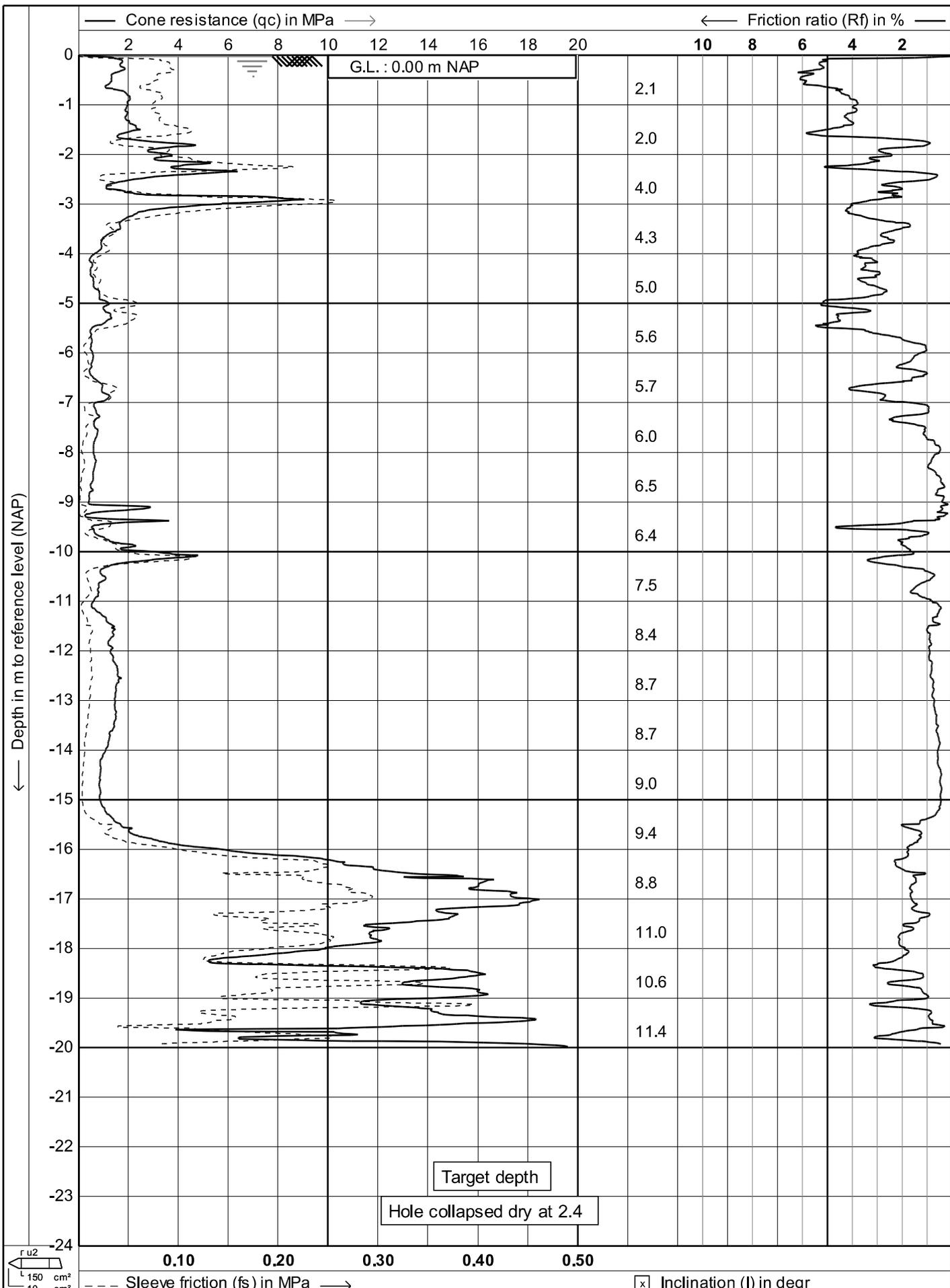
Location: 336

Position: 0, 0 RD

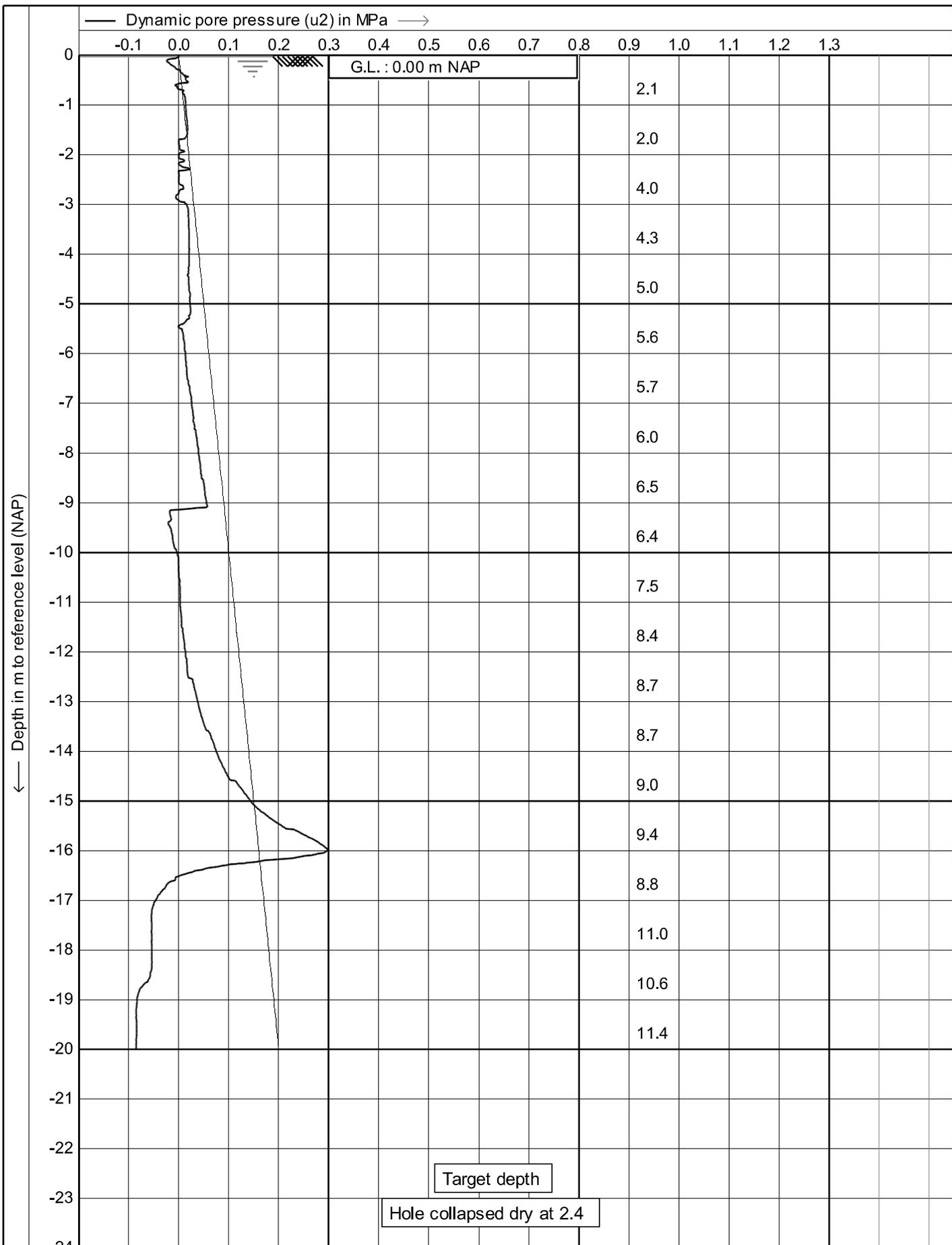
CPT no. : 08

9/14



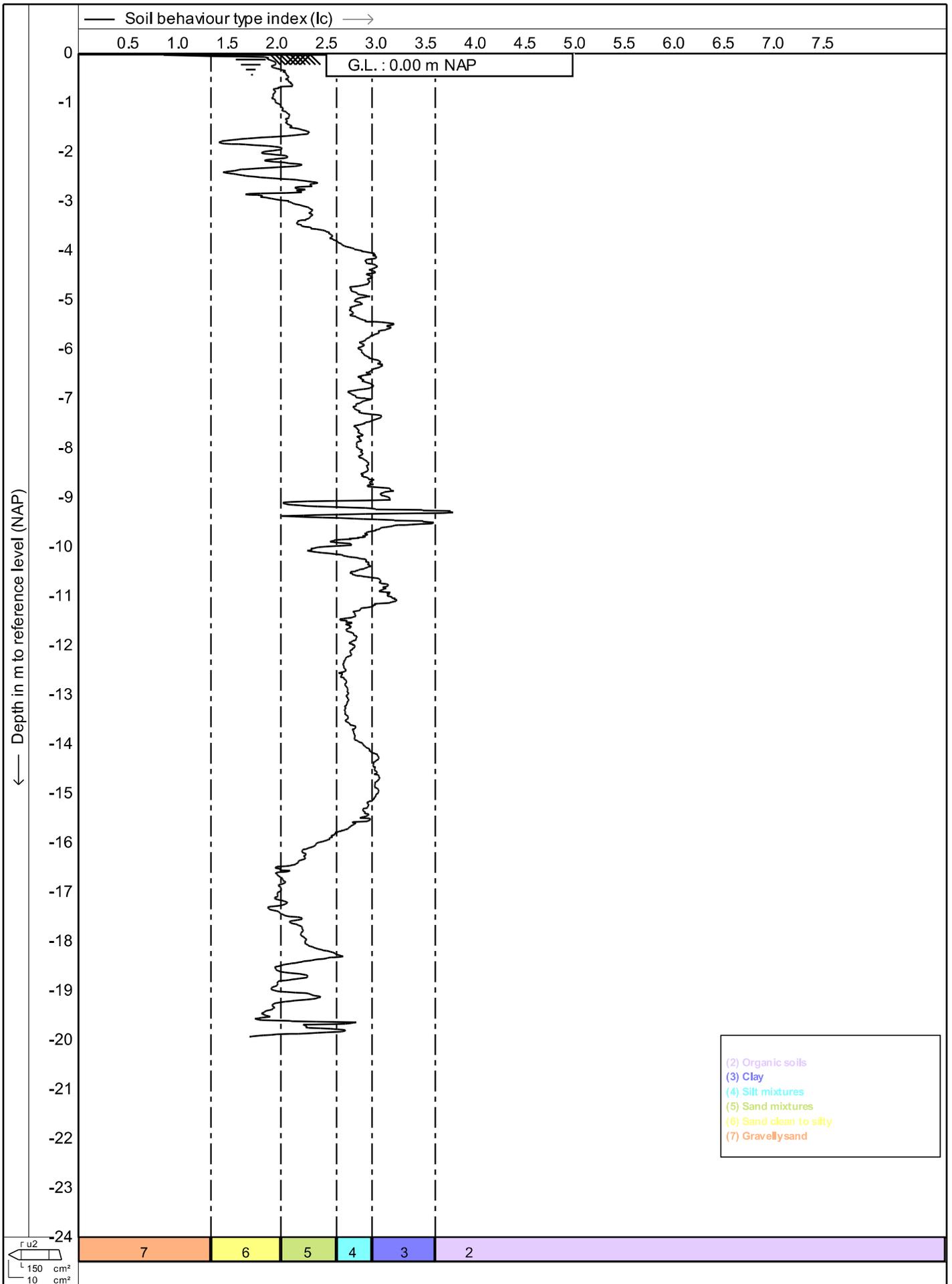


Test according A.S.T.M Standard D 5778-12		Date : 23-6-2016
Project : Site Investigations		Cone no. : C10CFIP.C13082
Location: 336		Project no. : 01CMW14
Position: 0, 0 RD		CPT no. : 10
		1/14



Inclusion (I) in degr  
 --- Equilibrium pore pressure ( $u_0$ ) in MPa

	Test according A.S.T.M Standard D 5778-12	Date : 23-6-2016
	Project : Site Investigations	Cone no. : C10CFIP.C13082
	Location: 336	Project no. : 01CMW14
	Position: 0, 0 RD	CPT no. : 10
		2/14



Test according A.S.T.M Standard D 5778-12

Date : 23-6-2016

Cone no. : C10CFIP.C13082

Project : Site Investigations

Project no. : 01CMW14

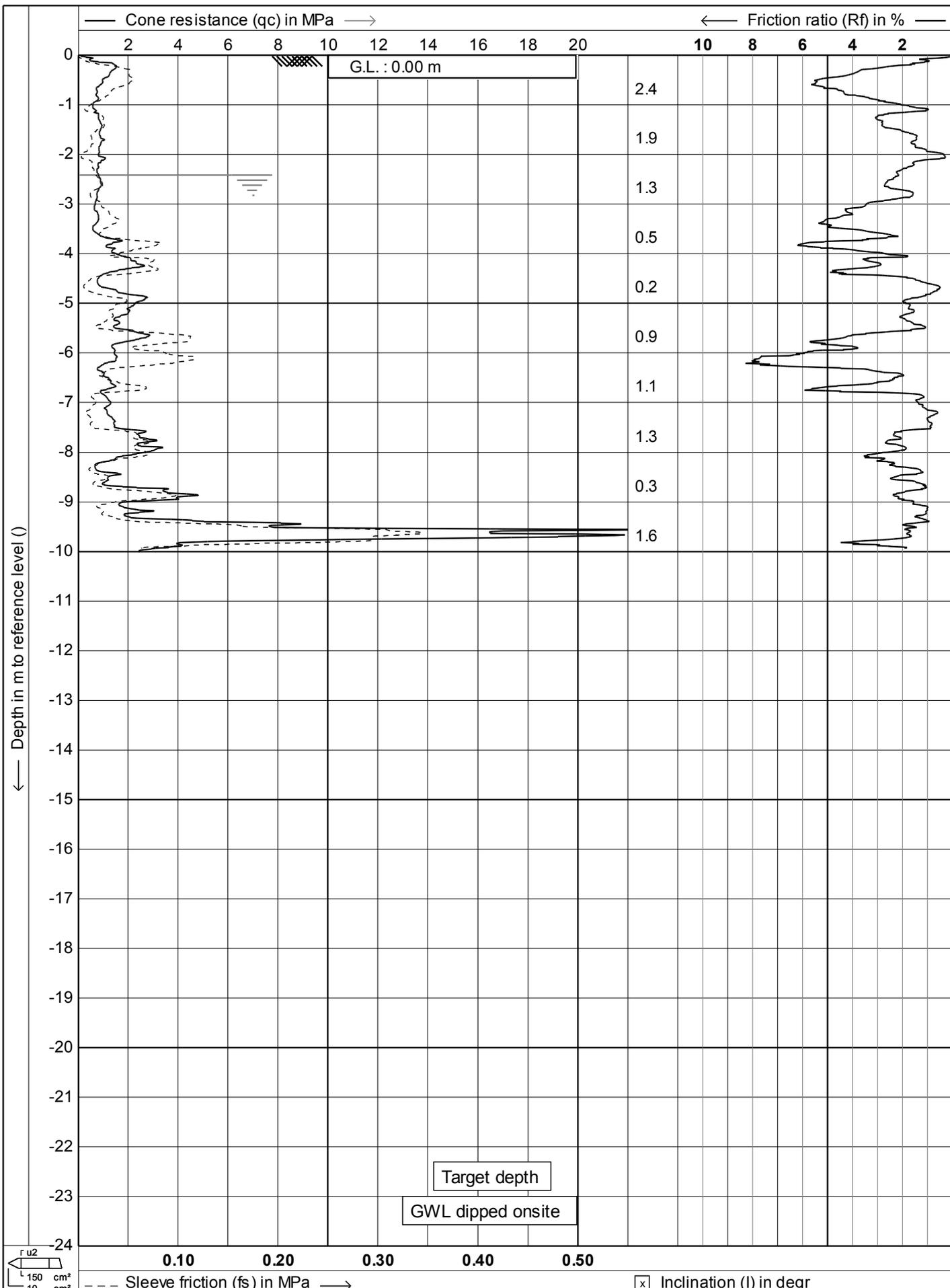
Location: 336

Position: 0, 0 RD

CPT no. : 10

9/14



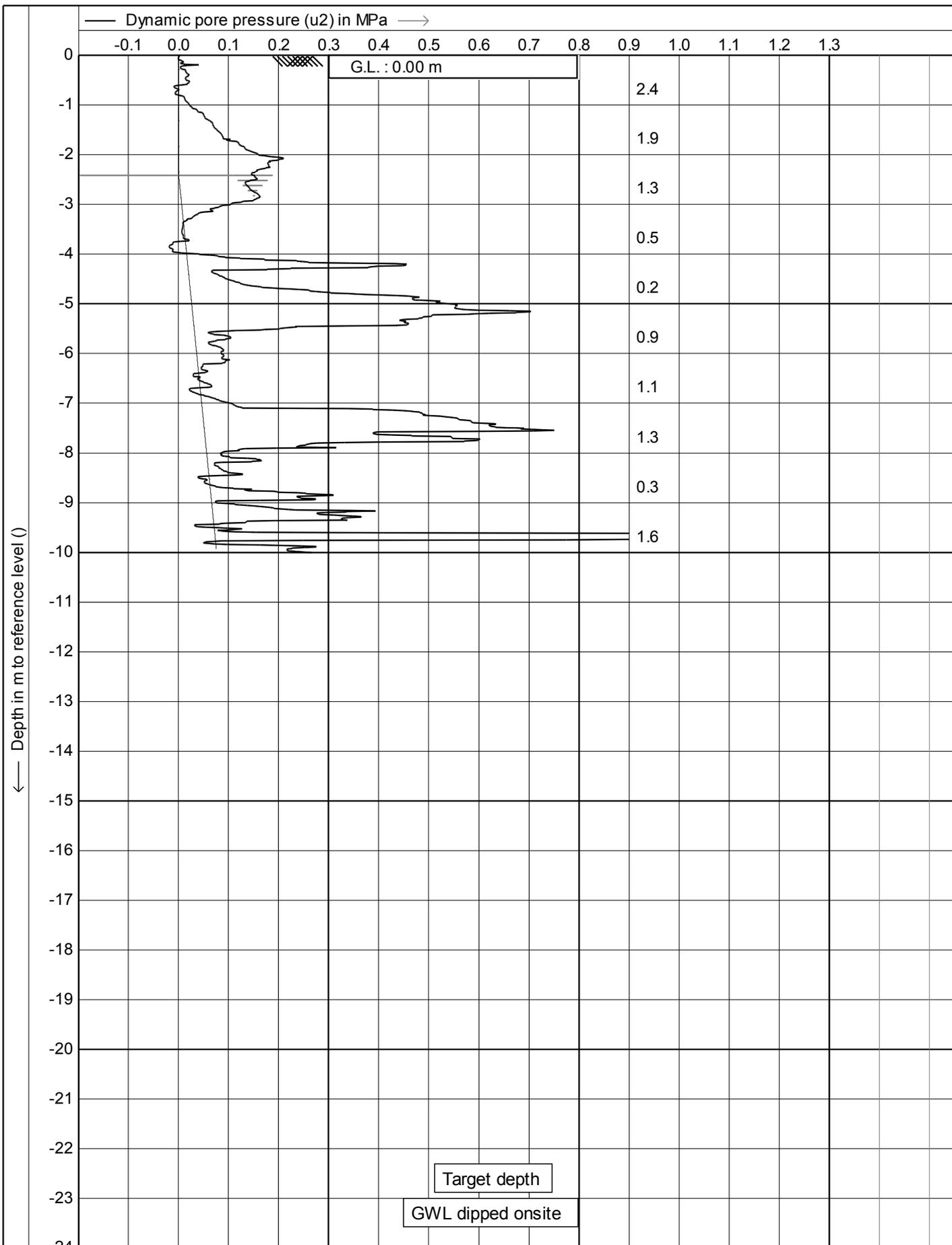


CPTlogk V1.33



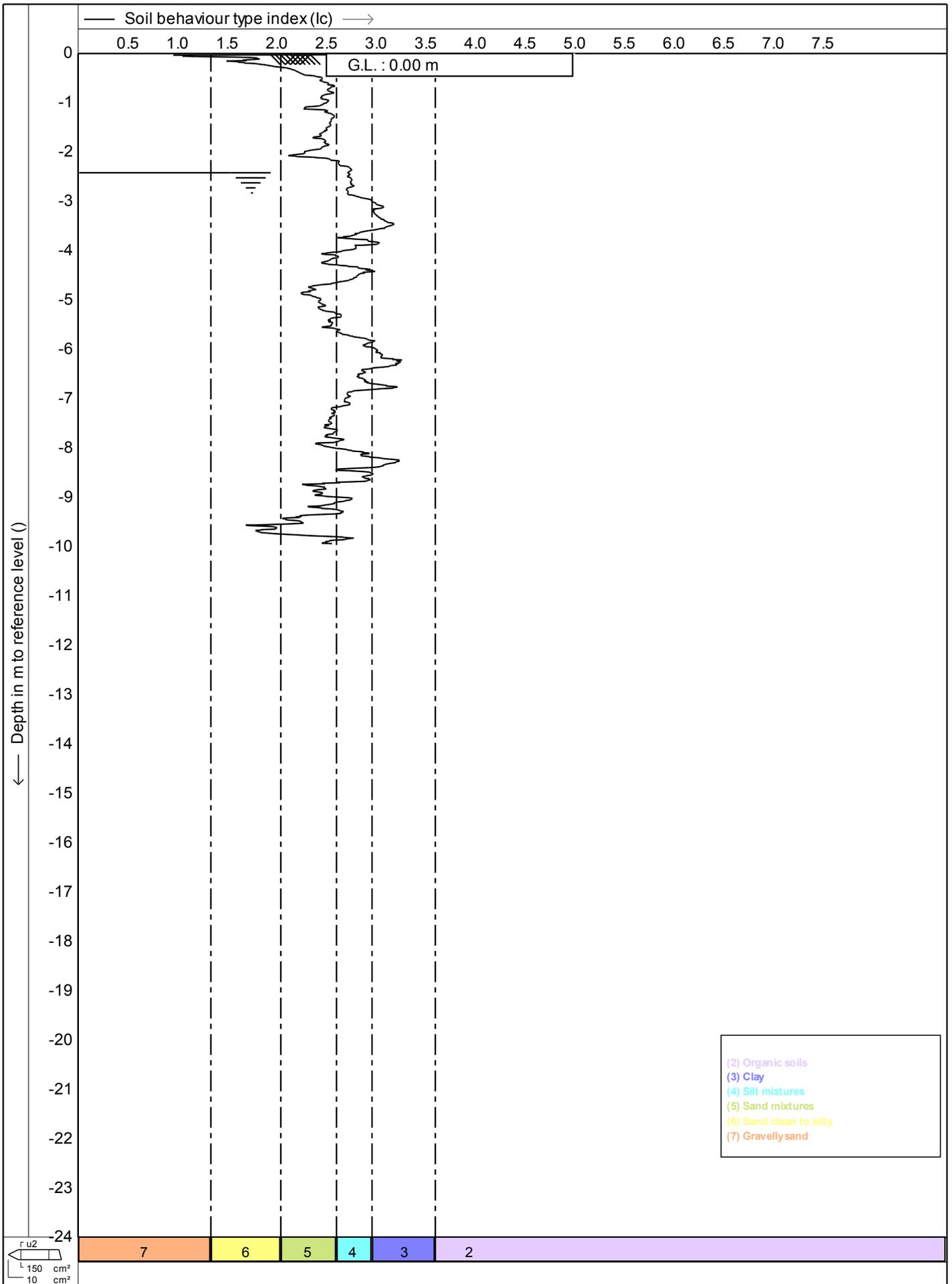
Test according A.S.T.M. Standard D 5778-12  
 Project : **Site Investigation**  
 Location: **Settlers hall - Omokoroa**

Date : **26-8-2016**  
 Cone no. : **C10CFIIP.C14123**  
 Project no. : **02CMW7**  
 CPT no. : **08**      1/14

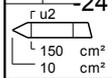


$\gamma_{u2}$   
 150 cm<sup>2</sup>  
 10 cm<sup>2</sup>

	Test according A.S.T.M. Standard D 5778-12	Date : 26-8-2016
	Project : Site Investigation	Cone no. : C10CFIP.C14123
	Location: Settlers hall - Omokoroa	Project no. : 02CMW7
		CPT no. : 08
		2/14



- (2) Organic soils
- (3) Clay
- (4) Silt mixtures
- (5) Sand mixtures
- (6) Sand clean to silty
- (7) Gravelly sand



Test according A.S.T.M. Standard D 5778-12

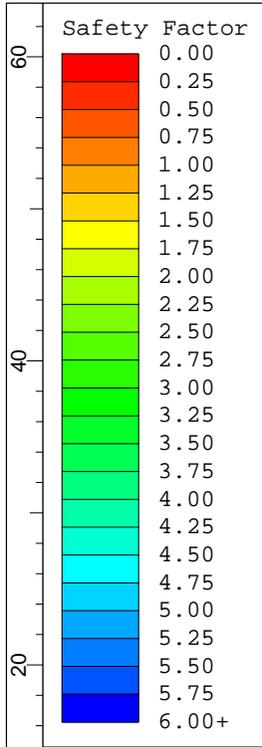
Date : **26-8-2016**  
 Cone no. : **C10CFIP.C14123**  
 Project no. : **02CMW7**  
 CPT no. : **08**      **9/14**

Project : **Site Investigation**

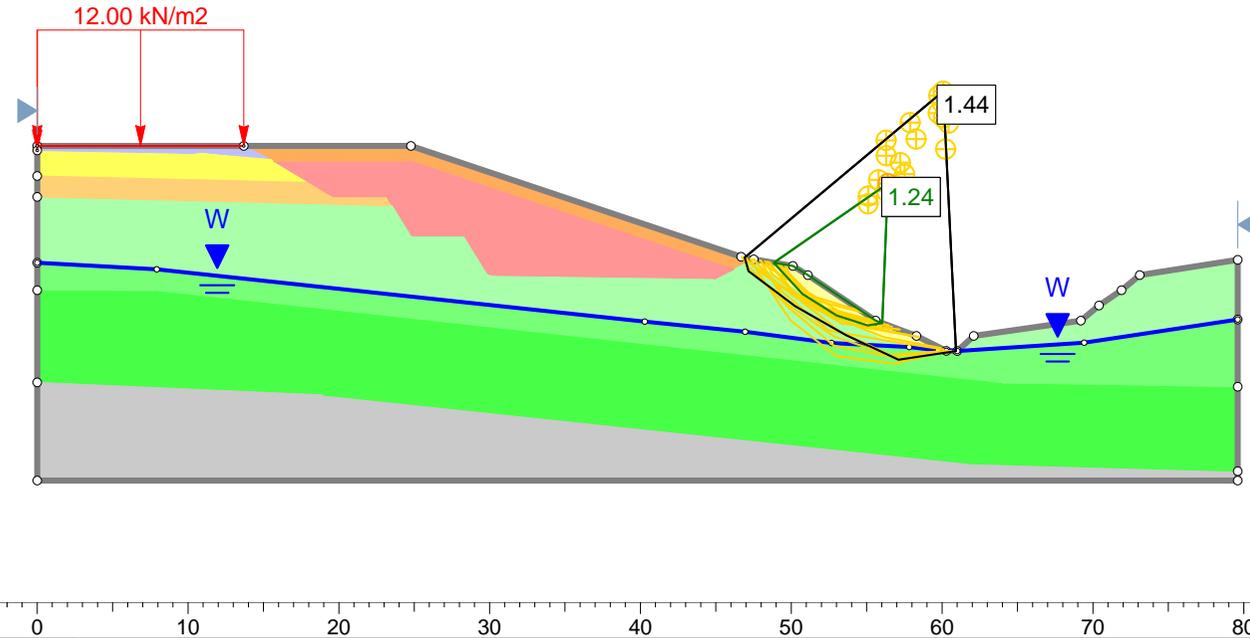
Location: **Settlers hall - Omokoroa**



FACTORS OF SAFETY <1.5 SHOWN

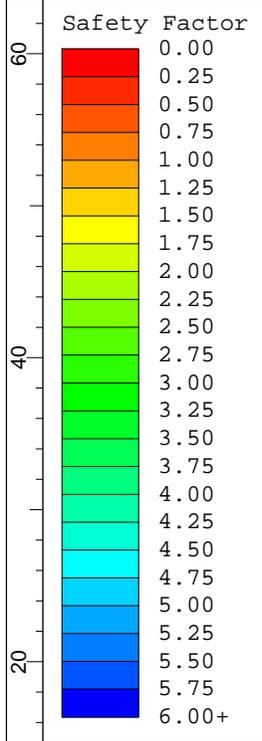


Material Name	Color	Unit Weight (kN/m <sup>3</sup> )	Strength Type	Cohesion (kPa)	Phi (deg)	Hu Type	Ru
Younger Ash: Stiff clayey silt	[Yellow]	16	Mohr-Coulomb	5	30		0.1
Hamilton Ash: V. stiff clayey silt	[Orange]	17	Mohr-Coulomb	10	25		0.1
Colluvium: Stiff clayey silt	[Light Yellow]	16	Mohr-Coulomb	3	25		0.1
Engineered Fill	[Light Blue]	16	Mohr-Coulomb	5	30		0.1
Tracked-rolled Fill	[Light Red]	15	Mohr-Coulomb	2	30		0.1
MS: Stiff to V.Stiff sandy silt	[Light Green]	16	Mohr-Coulomb	3	30		0.1
MS: Firm clayey silt	[Light Green]	16	Mohr-Coulomb	2	28	Automatically Calculated	
MS: Stiff sandy silt	[Light Green]	16	Mohr-Coulomb	3	30	Automatically Calculated	

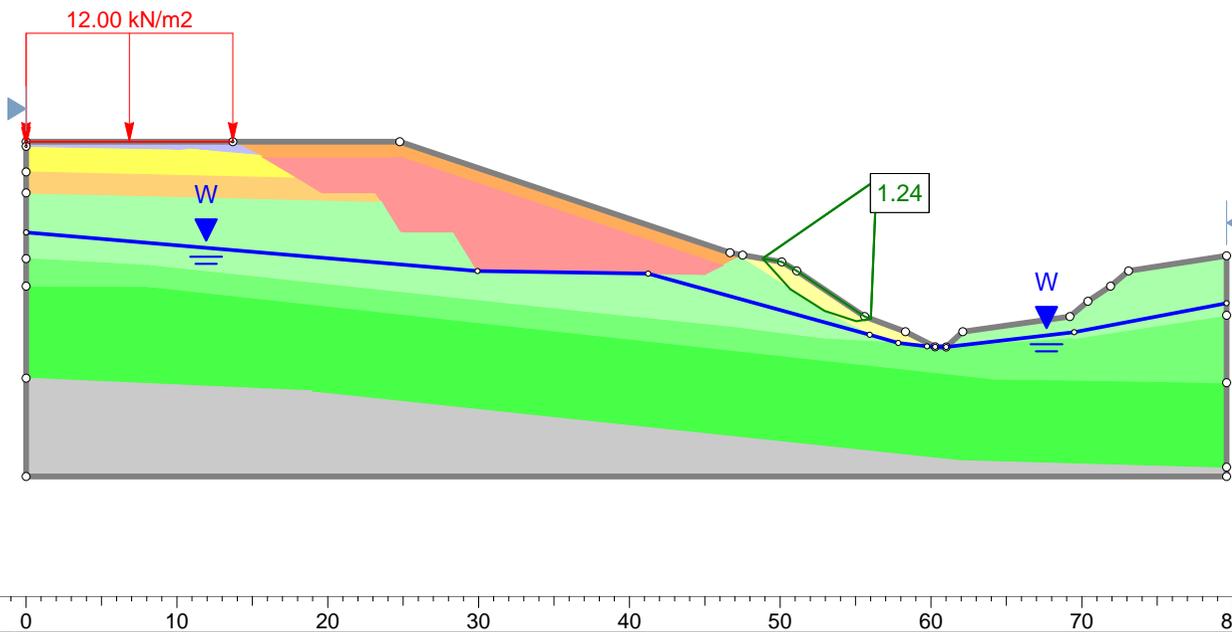


	Project		
	Kaimai Views Subdivision - Fill Encapsulation		
	Analysis Description		
	Cross Section B-B - Proposed GL - Prevailing GW conditions		
Drawn By	Scale	Company	
	1:500	Classic Developments Omokoroa Ltd	
Date	File Name		
23/05/2017	Fill Encapsulation - Section B - Proposed profile prevailing GWL.slim		

LOWEST FACTOR OF SAFETY SHOWN



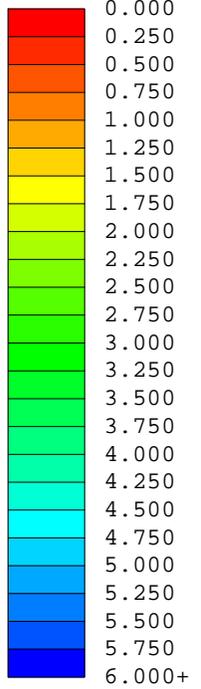
Material Name	Color	Unit Weight (kN/m <sup>3</sup> )	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type	Ru
Younger Ash: Stiff clayey silt	Yellow	16	Mohr-Coulomb	5	30	None		0.1
Hamilton Ash: V. stiff clayey silt	Orange	17	Mohr-Coulomb	10	25	None		0.1
Colluvium: Stiff clayey silt	Light Yellow	16	Mohr-Coulomb	3	25	None		0.1
Engineered Fill	Light Blue	16	Mohr-Coulomb	5	30	None		0.1
Tracked-rolled Fill	Red	15	Mohr-Coulomb	2	30	None		0.1
MS: Stiff to V.Stiff sandy silt	Light Green	16	Mohr-Coulomb	3	30	Water Surface	Automatically Calculated	
MS: Firm clayey silt	Green	16	Mohr-Coulomb	2	28	Water Surface	Automatically Calculated	
MS: Stiff sandy silt	Light Green	16	Mohr-Coulomb	3	30	Water Surface	Automatically Calculated	
Dense Sand (inferred Ignimbrite)	Grey	16	Mohr-Coulomb	0	40	Water Surface	Automatically Calculated	
Topsoil	Orange	14	Mohr-Coulomb	2	25	None		0.1



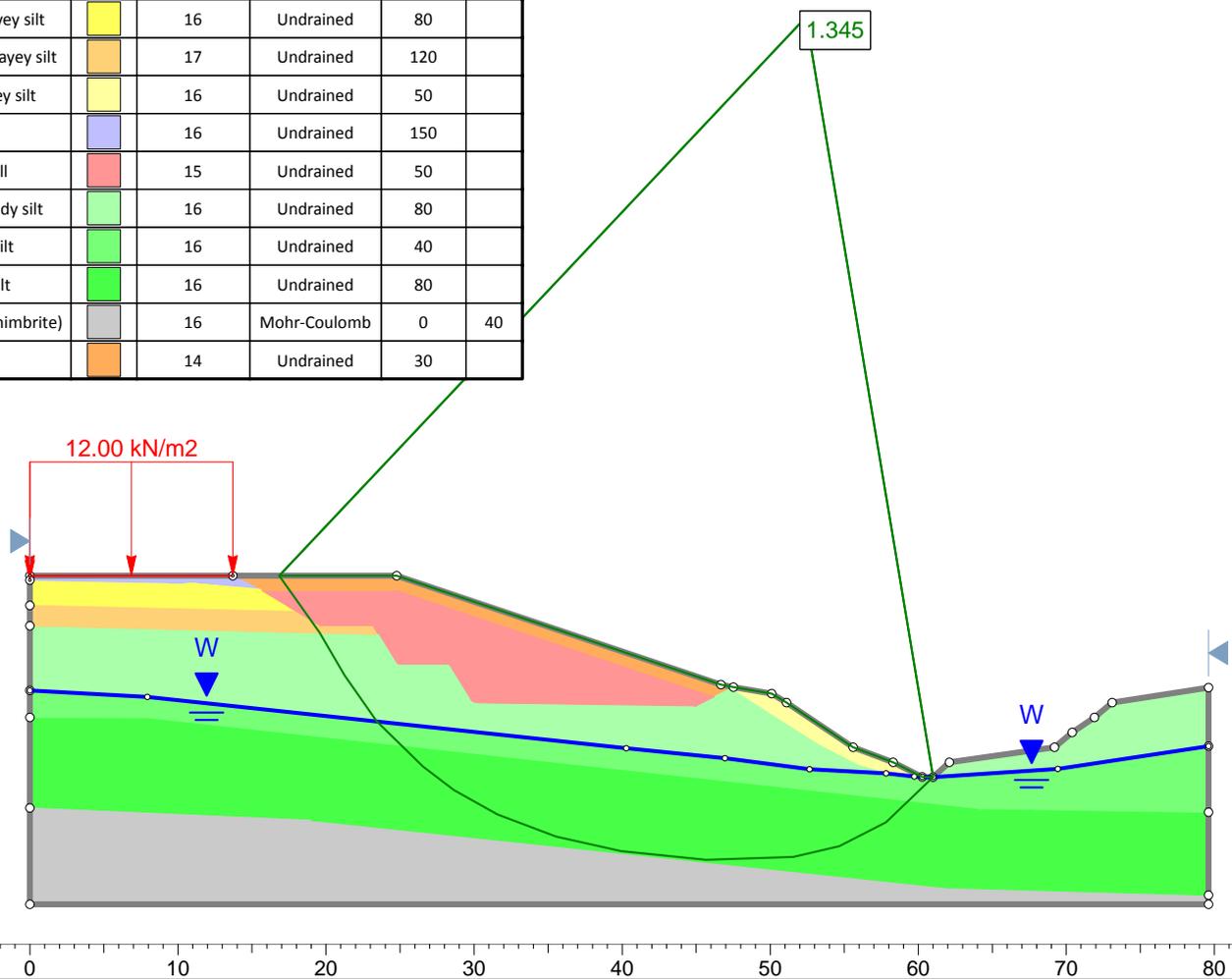
	Project			Kaimai Views Subdivision - Fill Encapsulation		
	Analysis Description			Cross Section B-B - Proposed GL - Elevated GW conditions		
	Drawn By	Scale	Company	1:500	Classic Developments Omokoroa Ltd	
	Date	23/05/2017		File Name Fill Encapsulation - Section B - Proposed profile elevated GWL.slim		

LOWEST FACTOR OF SAFETY SHOWN

Safety Factor

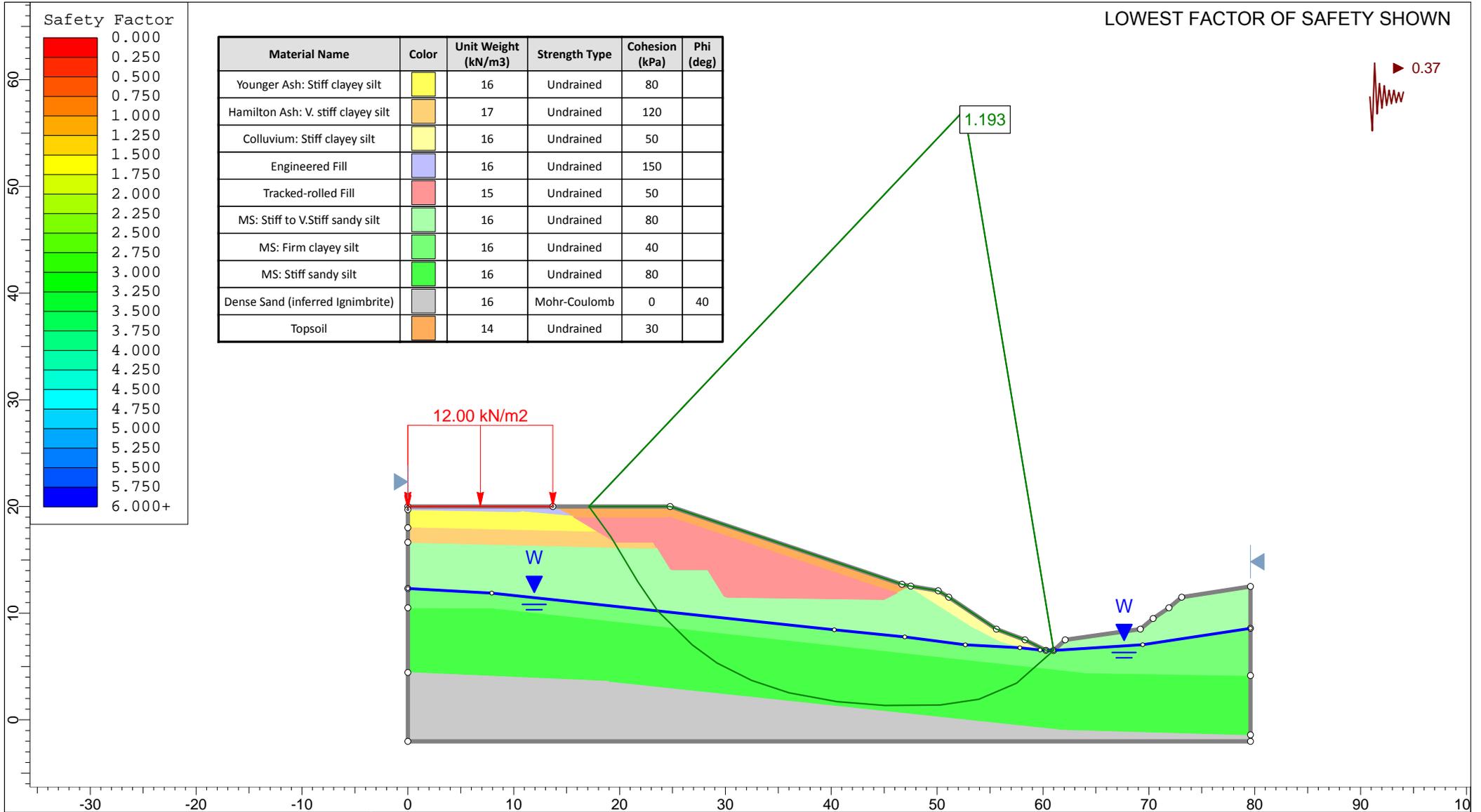


Material Name	Color	Unit Weight (kN/m <sup>3</sup> )	Strength Type	Cohesion (kPa)	Phi (deg)
Younger Ash: Stiff clayey silt	Yellow	16	Undrained	80	
Hamilton Ash: V. stiff clayey silt	Orange	17	Undrained	120	
Colluvium: Stiff clayey silt	Light Yellow	16	Undrained	50	
Engineered Fill	Light Blue	16	Undrained	150	
Tracked-rolled Fill	Red	15	Undrained	50	
MS: Stiff to V.Stiff sandy silt	Light Green	16	Undrained	80	
MS: Firm clayey silt	Green	16	Undrained	40	
MS: Stiff sandy silt	Light Green	16	Undrained	80	
Dense Sand (inferred Ignimbrite)	Grey	16	Mohr-Coulomb	0	40
Topsoil	Orange	14	Undrained	30	

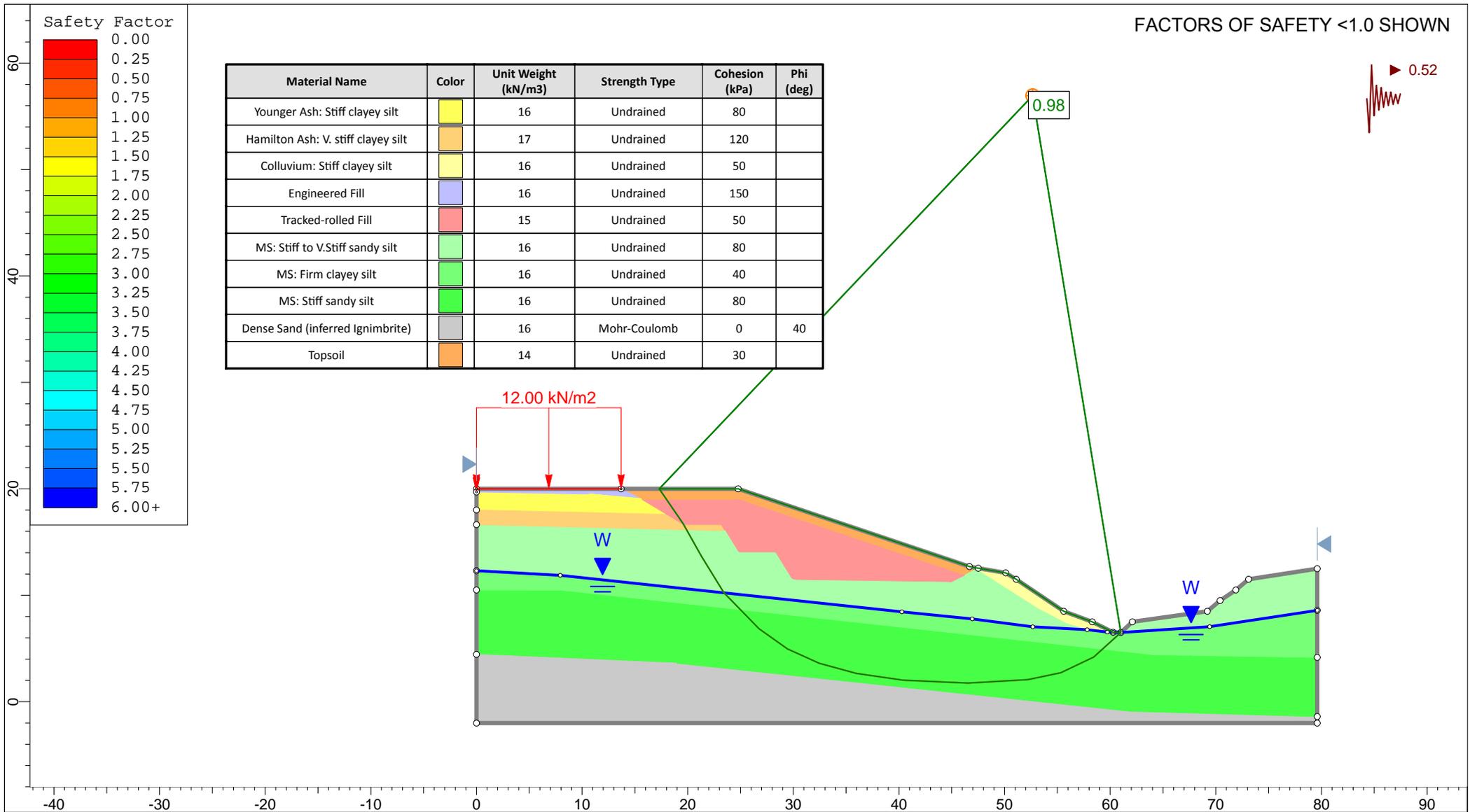


	Project		
	Kaimai Views Subdivision - Fill Encapsulation		
	Analysis Description		
	Cross Section B-B - IL2 ULS Seismic Case		
Drawn By	Scale	Company	
	1:500	Classic Developments Omokoroa Ltd	
Date	File Name		
23/05/2017	Fill Encapsulation - Section B - IL2 ULS Seismic Case.slim		

LOWEST FACTOR OF SAFETY SHOWN



	Project		
	Kaimai Views Subdivision - Fill Encapsulation		
	Analysis Description		
	Cross Section B-B - IL3 ULS Seismic Case		
Drawn By	Scale	Company	
	1:500	Classic Developments Omokoroa Ltd	
Date	File Name		
23/05/2017	Fill Encapsulation - Section B - IL3 ULS Seismic Case.slim		



	<b>Project</b> Kaimai Views Subdivision - Fill Encapsulation		
	<b>Analysis Description</b> Cross Section B-B - IL4 ULS Seismic Case		
	<b>Drawn By</b>	<b>Scale</b> 1:500	<b>Company</b> Classic Developments Omokoroa Ltd
	<b>Date</b> 23/05/2017	<b>File Name</b> Fill Encapsulation - Section B - IL4 ULS Seismic Case.slim	

A large green polygon with a diagonal line running from the bottom-left towards the top-right. The top-right corner is cut off by a horizontal line. At the bottom-left corner, there is a small yellow triangle pointing outwards.

C

Laboratory Results

# Appendix C

## Laboratory Results



## Certificate of Analysis

Aurecon New Zealand Ltd  
 ANZ Centre, Ground Floor, 247 Cameron Road  
 Tauranga 3110  
 Attention: Luke Beirne  
 Phone: 021 526031  
 Email: luke.beirne@aurecongroup.com

Lab Reference: 17-11060  
 Submitted by: Luke Beirne  
 Date Received: 5/05/2017  
 Date Completed: 11/05/2017  
 Order Number:  
 Reference: 255791

Sampling Site: Kamai Views

### Heavy Metals in Soil

Client Sample ID			E1	E2	E3	E4	E5
Date Sampled			4/05/2017	4/05/2018	4/05/2019	4/05/2020	4/05/2021
Analyte	Unit	Reporting Limit	17-11060-1	17-11060-2	17-11060-3	17-11060-4	17-11060-5
Arsenic	mg/kg dry wt	0.125	10.4	8.01	6.90	8.22	5.61
Beryllium	mg/kg dry wt	0.013	0.82	0.82	0.84	0.92	0.74
Boron	mg/kg dry wt	1.25	3.22	2.19	2.94	2.77	1.98
Cadmium	mg/kg dry wt	0.005	0.32	0.15	0.27	0.27	0.24
Chromium	mg/kg dry wt	0.125	11.4	6.22	5.17	6.58	4.42
Copper	mg/kg dry wt	0.075	30.4	15.6	20.8	20.7	14.8
Lead	mg/kg dry wt	0.05	32.5	14.5	13.8	19.3	16.0
Mercury	mg/kg dry wt	0.025	0.17	0.098	0.10	0.13	0.12
Nickel	mg/kg dry wt	0.05	4.68	2.56	1.76	2.88	2.11
Zinc	mg/kg dry wt	0.05	92.8	59.1	61.1	92.6	61.6

### Total Petroleum Hydrocarbons - Soil

Client Sample ID			E1	E2	E3	E4	E5
Date Sampled			4/05/2017	4/05/2018	4/05/2019	4/05/2020	4/05/2021
Analyte	Unit	Reporting Limit	17-11060-1	17-11060-2	17-11060-3	17-11060-4	17-11060-5
C7-C9	mg/kg dry wt	10	<10	<10	<10	<10	<10
C10-C14	mg/kg dry wt	15	<15	<15	<15	<15	<15
C15-C36	mg/kg dry wt	25	<25	<25	<25	<25	<25
C7-C36 (Total)	mg/kg dry wt	50	<50	<50	<50	<50	<50

### Polycyclic Aromatic Hydrocarbons - Soil

Client Sample ID			E1	E2	E3	E4	E5
Date Sampled			4/05/2017	4/05/2018	4/05/2019	4/05/2020	4/05/2021
Analyte	Unit	Reporting Limit	17-11060-1	17-11060-2	17-11060-3	17-11060-4	17-11060-5
1-Methylnaphthalene	mg/kg	0.01	<0.01	<0.01	<0.01	<0.01	<0.01

## Polycyclic Aromatic Hydrocarbons - Soil

Client Sample ID			E1	E2	E3	E4	E5
Date Sampled			4/05/2017	4/05/2018	4/05/2019	4/05/2020	4/05/2021
2-Methylnaphthalene	mg/kg	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthene	mg/kg	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthylene	mg/kg	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Anthracene	mg/kg	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benz[a]anthracene	mg/kg	0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo[a]pyrene	mg/kg	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo[b] & [j] fluoranthene	mg/kg	0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo[g,h,i]perylene	mg/kg	0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo[k]fluoranthene	mg/kg	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chrysene	mg/kg	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Dibenz(a,h)anthracene	mg/kg	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluoranthene	mg/kg	0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Fluorene	mg/kg	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Indeno(1,2,3-cd)pyrene	mg/kg	0.01	0.01	<0.01	<0.01	<0.01	<0.01
Naphthalene	mg/kg	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phenanthrene	mg/kg	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Pyrene	mg/kg	0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Benzo[a]pyrene TEQ (LOR)	mg/kg	0.01	0.03	0.03	0.03	0.03	0.03
Benzo[a]pyrene TEQ (Zero)	mg/kg	0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Anthracene-d10 (Surrogate)	%	1	87.9	89.0	88.3	88.0	87.2

## Moisture Content

Client Sample ID			E1	E2	E3	E4	E5
Date Sampled			4/05/2017	4/05/2018	4/05/2019	4/05/2020	4/05/2021
Analyte	Unit	Reporting Limit	17-11060-1	17-11060-2	17-11060-3	17-11060-4	17-11060-5
Moisture Content	%	1	28	27	31	31	29

## Method Summary

**Elements in Soil** Acid digestion followed by ICP-MS analysis. US EPA method 200.8.

**TPH in Soil** Solvent extraction, silica cleanup, followed by GC-FID analysis. (C7-C36)

**PAH in Soil** Solvent extraction, silica cleanup, followed by GC-MS analysis.

**Benzo[a]pyrene TEQ (LOR):** The most conservative TEQ estimate, where a result is reported as less than the limit of reporting (LOR) the LOR value is used to calculate the TEQ for that PAH.

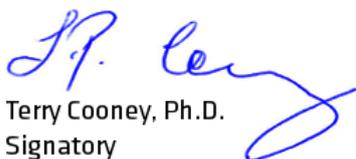
**Benzo[a]pyrene TEQ (Zero):** The least conservative TEQ estimate, PAHs reported as less than the limit of reporting (LOR) are not included in the TEQ calculation.

Benzo[a]pyrene toxic equivalence (TEQ) is calculated according to 'Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health'. Ministry for the Environment. 2011.

**Moisture** Moisture content is determined gravimetrically by drying at 103 °C.

## Report Comments

Samples were received by Analytica Laboratories in acceptable condition unless otherwise noted on this report.

  
Terry Cooney, Ph.D.  
Signatory



## ANALYSIS REPORT

<b>Client:</b>	Aurecon New Zealand Limited	<b>Lab No:</b>	1740927	A2Pv1
<b>Contact:</b>	R Griffiths C/- Aurecon New Zealand Limited PO Box 2292 Tauranga 3140	<b>Date Received:</b>	15-Mar-2017	
		<b>Date Reported:</b>	22-Mar-2017	
		<b>Quote No:</b>	82714	
		<b>Order No:</b>		
		<b>Client Reference:</b>	Classic Omokoroa	
		<b>Submitted By:</b>	R Griffiths	

### Sample Type: Soil

Sample Name:	A1 14-Mar-2017	A2 14-Mar-2017	A3 14-Mar-2017	A4 14-Mar-2017	A5 14-Mar-2017
Lab Number:	1740927.1	1740927.2	1740927.3	1740927.4	1740927.5
Asbestos Presence / Absence	Amosite (Brown Asbestos) and Chrysotile (White Asbestos) detected.	Asbestos NOT detected.	Asbestos NOT detected.	Asbestos NOT detected.	Amosite (Brown Asbestos) detected.
Description of Asbestos Form	Fibre Cement and Loose Fibres	-	-	-	Loose Fibres
As Received Weight g	447.4	461.4	399.4	302.1	417.4
Dry Weight g	337.0	322.1	301.1	209.5	326.1
Dry Sample Fraction >10mm g ashed wt	97.5	< 0.1	7.1	2.6	27.0
Sample Fraction <10mm to >2mm g ashed wt	78.3	32.6	71.5	26.2	98.5
Sample Fraction <2mm g ashed wt	143.4	256.5	206.1	161.9	185.9
<2mm Subsample Weight g ashed wt	57.8	57.9	56.9	53.8	58.6
Weight of Asbestos in >10mm Sample Fraction g ashed wt	12.093	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Weight of Asbestos in <10mm to >2mm Sample Fraction g ashed wt	0.00013	< 0.00001	< 0.00001	< 0.00001	0.00034
Weight of Asbestos in <2mm Sample Fraction g ashed wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001

Sample Name:	B1 14-Mar-2017	B2 14-Mar-2017	B3 14-Mar-2017	B4 14-Mar-2017	SP-A 14-Mar-2017
Lab Number:	1740927.6	1740927.7	1740927.8	1740927.9	1740927.10
Asbestos Presence / Absence	Asbestos NOT detected.	Asbestos NOT detected.	Chrysotile (White Asbestos) detected.	Asbestos NOT detected.	Amosite (Brown Asbestos), Chrysotile (White Asbestos) and Crocidolite (Blue Asbestos) detected.
Description of Asbestos Form	-	-	ACM Debris	-	Fibre Cement
As Received Weight g	311.5	403.2	249.7	331.1	432.2
Dry Weight g	238.4	300.0	182.5	143.2	307.3
Dry Sample Fraction >10mm g ashed wt	7.6	14.4	13.8	2.4	41.6
Sample Fraction <10mm to >2mm g ashed wt	79.2	78.0	18.3	15.2	35.7
Sample Fraction <2mm g ashed wt	141.5	189.9	137.2	107.3	216.5
<2mm Subsample Weight g ashed wt	51.7	58.4	52.0	54.3	51.4
Weight of Asbestos in >10mm Sample Fraction g ashed wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	6.262
Weight of Asbestos in <10mm to >2mm Sample Fraction g ashed wt	< 0.00001	< 0.00001	0.00005	< 0.00001	< 0.00001
Weight of Asbestos in <2mm Sample Fraction g ashed wt	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001



Sample Type: Soil					
<b>Sample Name:</b>	SP-B	SP-C			
	14-Mar-2017	14-Mar-2017			
<b>Lab Number:</b>	1740927.11	1740927.12			
Asbestos Presence / Absence	Amosite (Brown Asbestos), Chrysotile (White Asbestos) and Crocidolite (Blue Asbestos) detected.	Chrysotile (White Asbestos) and Crocidolite (Blue Asbestos) detected.	-	-	-
Description of Asbestos Form	Fibre Cement and ACM Debris	Fibre Cement and Loose Fibres	-	-	-
As Received Weight	g 374.0	392.2	-	-	-
Dry Weight	g 269.6	286.6	-	-	-
Dry Sample Fraction >10mm	g ashed wt 41.5	37.7	-	-	-
Sample Fraction <10mm to >2mm	g ashed wt 57.7	56.4	-	-	-
Sample Fraction <2mm	g ashed wt 158.3	172.1	-	-	-
<2mm Subsample Weight	g ashed wt 58.3	55.7	-	-	-
Weight of Asbestos in >10mm Sample Fraction	g ashed wt 5.864	3.716	-	-	-
Weight of Asbestos in <10mm to >2mm Sample Fraction	g ashed wt 0.00118	0.00003	-	-	-
Weight of Asbestos in <2mm Sample Fraction	g ashed wt < 0.00001	0.00003	-	-	-

Testing has been carried out under the assumption that the weight of asbestos in the sample is unaffected by the ashing process.

## SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil			
Test	Method Description	Default Detection Limit	Sample No
Individual Tests			
Semi Quantitative Asbestos in Soil	Based on approximately 100g of sample provided.	-	1-12
Semi Quantitative Asbestos in Soil			
As Received Weight	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1-12
Dry Weight	Sample dried at 100 to 105°C, measurement on balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g	1-12
Sample Fraction >10mm	Sample ashed at 400°C, 10mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	1-12
Sample Fraction <10mm and >2mm	Sample ashed at 400°C, 10mm and 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	1-12
Sample Fraction <2mm	Sample ashed at 400°C, 2mm sieve, measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.1 g ashed wt	1-12
Asbestos Presence / Absence	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	-	1-12
Description of Asbestos Form	Description of asbestos form and/or shape if present.	-	1-12
Weight of Asbestos in >10mm Sample Fraction	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.00001 g ashed wt	1-12
Weight of Asbestos in <10mm to >2mm Sample Fraction	Measurement on analytical balance. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.00001 g ashed wt	1-12
Weight of Asbestos in <2mm Sample Fraction	Measurement on analytical balance. Asbestos weight in <2mm subsample, if <2mm subsample weight is not "Entire Fraction". Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.00001 g ashed wt	1-12

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

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A handwritten signature in purple ink, appearing to be 'Dexter Paguirigan', written in a cursive style.

Dexter Paguirigan Dip Chem Engineering Tech  
Laboratory Technician - Asbestos



## ANALYSIS REPORT

<b>Client:</b>	Aurecon New Zealand Limited	<b>Lab No:</b>	1742205	A2Pv1
<b>Contact:</b>	R Griffiths C/- Aurecon New Zealand Limited PO Box 2292 Tauranga 3140	<b>Date Received:</b>	17-Mar-2017	
		<b>Date Reported:</b>	23-Mar-2017	
		<b>Quote No:</b>	82714	
		<b>Order No:</b>		
		<b>Client Reference:</b>	Classic Omokoroa	
		<b>Submitted By:</b>	R Griffiths	

### Sample Type: Building Material

Sample Name	Lab Number	Sample Category	Sample Weight on receipt	Asbestos Presence / Absence
SP-T	1742205.1	Fibre Cement	124.78	Amosite (Brown Asbestos), Chrysotile (White Asbestos) and Crocidolite (Blue Asbestos) detected.

## SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

### Sample Type: Building Material

Test	Method Description	Default Detection Limit	Sample No
Asbestos in Bulk Material			
Sample Category	Assessment of sample type. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	-	1
Sample Weight on receipt	Sample weight. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch.	0.01 g	1
<b>Asbestos Presence / Absence</b>	Examination using Low Powered Stereomicroscopy followed by 'Polarised Light Microscopy' including 'Dispersion Staining Techniques'. Analysed at Hill Laboratories - Asbestos; 101c Waterloo Road, Christchurch. AS 4964 (2004) - Method for the Qualitative Identification of Asbestos in Bulk Samples.	-	1

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

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Dexter Paguirigan Dip Chem Engineering Tech  
Laboratory Technician - Asbestos





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## W1703310904

REPORT DATE: 05 Apr 2017

CLIENT NAME & ADDRESS:

Analytica Laboratories

Ground Level, 247 Cameron Road Tauranga

Client Reference: Classic Kamai views

Dear Luke Beirne,

### **Re: Asbestos Soil Identification Analysis – Kamai Views**

12 sample(s) received on 29 Mar 2017 by Laura Liu.

The results of fibre analysis were performed by Irene Suresh of Precise Consulting and Laboratory Ltd on 05 Apr 2017.

The sample(s) were stated to be from Kamai Views.

Sample analysis was performed using polarised light microscopy with dispersion staining in accordance with the guidelines of *AS4964-2004 Method for the qualitative identification of asbestos in soil samples*.

The results of the fibre analysis are presented in the appended table.

Should you require further information please contact Irene Suresh.

Yours sincerely

Irene Suresh

**PRECISE LABORATORY IDENTIFIER**

Issue Date: Jan 2017 | Version 9

Precise Consulting & Laboratory Ltd Limited

Level 2, 10 Hutt Road, Petone, Lower Hutt Wellington 5012

P: 04 9748356 W: [www.preciseconsulting.co.nz](http://www.preciseconsulting.co.nz)



All tests reported herein have been performed in accordance with the laboratory's scope of accreditation



PRECISE

CONSULTING & LABORATORY

Certificate Number: W1703310904

05 Apr 2017

Note 1: The reporting limit for this analysis is 0.1g/kg (0.01%) by application of polarised light microscopy, dispersion staining and trace analysis techniques.

Note 2: If mineral fibres of unknown type are detected (UMF), by PLM and dispersion staining, these may or may not be asbestos fibres. To confirm the identity of this fibre, another independent analytical technique such as XRD analysis is advised.

Note 3: The samples in this report are "As Received" the laboratory does not take responsibility for the sampling procedure or accuracy of sample location description. This document may not be reproduced except in full.

Identified by:

Approved Identifier: Irene Suresh

Reviewed by:

Key Technical Person: Irene Suresh

Issue Date: Jan 2017 | Version 9

Precise Consulting & Laboratory Ltd Limited

Level 2, 10 Hutt Road, Petone, Lower Hutt Wellington 5012

P: 04 9748356 W: [www.preciseconsulting.co.nz](http://www.preciseconsulting.co.nz)



All tests reported herein have been performed in accordance with the laboratory's scope of accreditation



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## Sample Analysis Results

ID	Sample ID	Sample Location/Description/Dimensions	Asbestos Fibre Type
116	1	TP1 Non-Homogeneous Soil 672.5g	NAD-NFD
117	2	TP2 Non-Homogeneous Soil 490.73g	NAD-ORG
118	3	TP3 Non-Homogeneous Soil 433.01g	NAD-ORG
119	4	TP4 Non-Homogeneous Soil 419.68g	NAD-ORG
120	5	N/A Non-Homogeneous Soil 477.71g	NAD-ORG
121	6	TP6 Non-Homogeneous Soil 507.79g	NAD-ORG-SMF
122	7	TP7 Non-Homogeneous Soil 545.74g	NAD-ORG
123	8	TP8 Non-Homogeneous Soil 574.1g	NAD-ORG-SMF
124	9	TP9 Non-Homogeneous Soil 503.38g	NAD-ORG
125	10	TP10 Non-Homogeneous Soil 496.45g	NAD-ORG
126	11	TP11 Non-Homogeneous Soil 534.5g	NAD-ORG
127	12	TP6 Tile Fibre cement sheets -g	CHR-CRO

Issue Date: Jan 2017 | Version 9

Precise Consulting & Laboratory Ltd Limited

Level 2, 10 Hutt Road, Petone, Lower Hutt Wellington 5012

P: 04 9748356 W: [www.preciseconsulting.co.nz](http://www.preciseconsulting.co.nz)



All tests reported  
herein have been  
performed in accordance  
with the laboratory's  
scope of accreditation



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<b>Acronyms</b>			
<i>CHR</i>	<i>Chrysotile (white asbestos) fibres detected</i>	<i>AMO</i>	<i>Amosite (brown / grey asbestos) fibres detected</i>
<i>CRO</i>	<i>Crocidolite (blue asbestos) fibres detected</i>	<i>ACM</i>	<i>Asbestos containing material</i>
<i>AF</i>	<i>Asbestos fines</i>	<i>NFD</i>	<i>No fibres detected</i>
<i>TAD</i>	<i>Trace asbestos detected</i>	<i>NAD</i>	<i>No Asbestos Detected</i>
<i>FA</i>	<i>Fibrous Asbestos</i>	<i>UMF</i>	<i>Unidentified mineral fibres detected (Please see <b>Note 2</b>)</i>

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Precise Consulting & Laboratory Ltd Limited

Level 2, 10 Hutt Road, Petone, Lower Hutt Wellington 5012

P: 04 9748356 W: [www.preciseconsulting.co.nz](http://www.preciseconsulting.co.nz)



All tests reported herein have been performed in accordance with the laboratory's scope of accreditation



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### Appendix 1: Soil Analysis Raw Data

	Sample ID	Sample Weights						>7mm Asbestos Containing Material (ACM) <sup>1</sup>		Asbestos Fines/Fibrous Asbestos <sup>1</sup>				Trace Asbestos Detected (Y/N)
		Total 10L (Kg)	Total 500mL Sub-Sample (g)	>7mm Fraction (g)	2-7mm Fraction (g)	<2mm Sub Sample (g)	<2mm Excess (g)	>7mm ACM (g)	Form & % <sup>3</sup>	2-7mm ACM (g)	Form & % <sup>3</sup>	<2mm ACM (g)	Form & % <sup>3</sup>	
116	TP1	-	672.5	33.58	100.02	100.57	438.56	-	-	-	-	-	-	N
117	TP2	-	490.73	9.5	55.50	101.28	324.45	-	-	-	-	-	-	N
118	TP3	-	433.01	0	5.13	101.5	326.0	-	-	-	-	-	-	N
119	TP4	-	419.68	17.5	27.0	100.05	275.13	-	-	-	-	-	-	N
120	TP5	-	477.71	4.5	6.28	100.47	366.46	-	-	-	-	-	-	N
121	TP6	-	507.79	66.54	48.69	102.48	290.08	-	-	-	-	-	-	N
122	TP7	-	545.74	8.48	18.53	100.02	418.71	-	-	-	-	-	-	N
123	TP8	-	574.1	33.46	40.08	101.03	399.53	-	-	-	-	-	-	N
124	TP9	-	503.38	5.54	19.48	100.89	377.47	-	-	-	-	-	-	N
125	TP10	-	496.45	13.51	45.49	99.53	337.92	-	-	-	-	-	-	N
126	TP11	-	534.5	8.03	9.85	101.13	415.49	-	-	-	-	-	-	N
127	TP6 Tile	-	-	-	-	-	-	64.31	Fibre cement sheets; 15%	-	-	-	-	N

1 These results are raw weighed data presented as per the Western Australian Guidelines and may be under the reporting limit for guidelines AS4964 of 0.1g/kg

2 Trace asbestos detected is indicative that freely liberated respirable fibres are present and dust control measures should be implemented or increased on site. This is not the sole indicator for the friable nature of the asbestos present.



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3 Asbestos percentage is determined using EPA-600-R-93-116: Method for the Determination of Asbestos in Bulk Building Materials and are outside of IANZ accreditation #1097 and is therefore not endorsed by IANZ

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