

24 March 2025

PROPOSED RESIDENTIAL SUBDIVISION
MILLDALE STAGES 10 TO 13, WAINUI EAST

GEOTECHNICAL INVESTIGATION REPORT

Fulton Hogan Land Development Limited AKL2024-0257AB Rev 3





AKL2024-0257AB						
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	Name	Signature	Position
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For and on behalf of CMW Geosciences







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STATEMENTS OF QUALIFICATIONS AND EXPERIENCE

Melissa Campbell

I am a Senior Engineering Geologist at CMW Geotechnical NZ Limited, trading as CMW Geosciences. CMW Geosciences is a specialist geotechnical engineering and geological sciences services consultancy with offices in New Zealand and Australia. I have been employed at CMW Geosciences since March 2017.

I hold the qualification of Bachelor of Science (Geology) from The University of Auckland, which I completed in 1999.

I have 16 years of professional experience in engineering geology and geotechnical engineering, primarily in the North Auckland region, frequently in the Northland Allochthon geology. My experience has been primarily in land development, including as CMW's project manager for the wider Milldale project since 2017.

I confirm that, in my capacity as author of this report, I have read and abide by the Environment Court of New Zealand's Code of Conduct for Expert Witnesses Practice Note 2023.

Chris Ritchie

I am a Principal Engineering Geologist at CMW Geotechnical NZ Limited, trading as CMW Geosciences. CMW Geosciences is a specialist geotechnical engineering and geological sciences services consultancy with offices in New Zealand and Australia. I have been employed at CMW Geosciences since July 2019.

I hold the qualifications of MSc (Engineering Geology) from The University of Auckland, which I completed in 2010. I am a Chartered Professional Engineering Geologist and Chartered Member of Engineering New Zealand.

I have 15 years of professional experience in engineering geology and geotechnical engineering in the Auckland region. My experience has been primarily in land and building development and linear infrastructure, the last 12 years has been focussed in the North Auckland area. Large portions of my work in this time have been focussed on development of land and the investigation and assessment of roading corridors in Northland Allochthon terrain.

I confirm that, in my capacity as CMW's internal reviewer of this report, I have read and abide by the Environment Court of New Zealand's Code of Conduct for Expert Witnesses Practice Note 2023.

Richard Knowles

I am a Principal Geotechnical Engineer at CMW Geotechnical NZ Limited, trading as CMW Geosciences. CMW Geosciences is a specialist geotechnical engineering and geological sciences services consultancy with offices in New Zealand and Australia. I have been employed at CMW Geosciences since March 2014.

I hold the qualifications of BE (civil) from the University of Auckland, which I completed in 1992. I am a Chartered Professional Engineer (Geotechnical) and Chartered Member of Engineering New Zealand.

I have 32 years of professional experience in geotechnical engineering in the Auckland region. My experience has primarily been in land and building development and for the last 20 years has been focussed in the North Auckland area while I have been based in offices in Orewa, Silverdale or Albany. Large portions of my work in this time have been focussed on development of land in Northland Allochthon terrain in Red Beach and Silverdale.

I confirm that, in my capacity as CMW's internal reviewer of this report, I have read and abide by the Environment Court of New Zealand's Code of Conduct for Expert Witnesses Practice Note 2023.



1 INTRODUCTION

CMW Geosciences (CMW) was engaged by Fulton Hogan Land Development Limited (FHLDL) to carry out a geotechnical investigation of a site located between Cemetery and Lysnar Roads, Wainui East, referred to as Milldale Stages 10 to 13, which is being considered for the construction of a residential subdivision.

The scope of work and associated terms and conditions of our engagement were detailed in our services proposal letter referenced AKL2024-0257AA, Rev 0 dated 30 October 2024. It provides for an investigation sufficient to identify and quantify geo-hazards and assess potential solutions based on experience in previous stages of the Milldale development in a similar geological setting, but further geotechnical investigations will be required to refine the ground models for final design.

This report has been prepared in support of the application by FHLDL for a resource consent to the Environmental Protection Authority (EPA) under the Fast-Track Approvals Act 2024 (FTAA).

Resource Consent is required for bulk earthworks, subdivision, streamworks, water permits and discharge consents for the development of 606 residential lots, 27 residential super lots, jointly owned access lots (JOALS) and roads to vest, reserves to vest, and all associated works, landscaping and infrastructure.

The purpose of this report is to describe the investigation completed, the ground conditions encountered, identify and quantify geotechnical risks to the development and to provide recommendations with respect to geotechnical aspects of the proposed subdivision development including site preparation, temporary works, foundation construction and site / subsoil classification.

2 SITE DETAILS

The site subject to this application is located within the Milldale development and referred to as the Milldale Stages 10 to 13 subdivision areas (the Site). Stages 10 to 13 are located within the northern and western extents of the Milldale development and comprise the remaining undeveloped greenfield stages of Milldale.

Overall, the Site covers a total area of approximately 71 ha. It is bordered by Wainui Road to the north, Lysnar Road to the north-east, and undeveloped land to the west, as shown on *Figure 1 & 2*. Previously consented Milldale stages are located to the south of the Site including Stages 5 to 8 and the Milldale Local Centre.

A full description of the Site and surrounds is provided in the application Assessment of Environmental Effects (AEE).

Details of the site are as follows:

- The site is legally described as Lot 9006 DP 602895; Lot 9007 DP 602895; Lot 3 DP 151229; Lot 1 DP 147739; Lot 1 DP 488814; Lot 2 DP 488814; Lot 3 DP 488814; and Lot 2 DP 147739.
- The site comprises two main parts; Stages 10 & 11 occupy the gently sloping southern flank of the Wainui Road ridge, between Lysnar Road and Argent Lane. Stages 12 & 13 occupy the moderate slopes to the east of Cemetery Road, extending as far as Argent Lane in the north, but excluding the low-lying parcel of land at 48 Argent Lane. See *Figure 2*.
- A tributary to Waterloo Creek lies near the southern boundary of Stages 10 & 11. Stages 12 & 13 share their south-eastern boundary with Stage 7, as well as a parcel of grazing land at 48 Argent Lane which is excluded from the development.
- Current land use is predominantly pasture, with a scattering of trees. Stand-alone rural-residential dwellings are dotted across the Site, together with assorted farm buildings. Due to the historical farming land use, rubbish fills, offal pits and uncontrolled fills may exist within the site. Where these were observed during our site walkover, they have been noted on the *Geomorphology Plans (Figures 14 & 15)*.

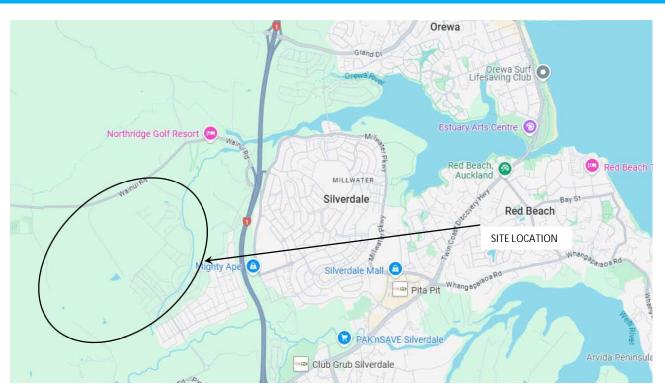


Figure 1: Site Location Plan (Reference: Google Maps)

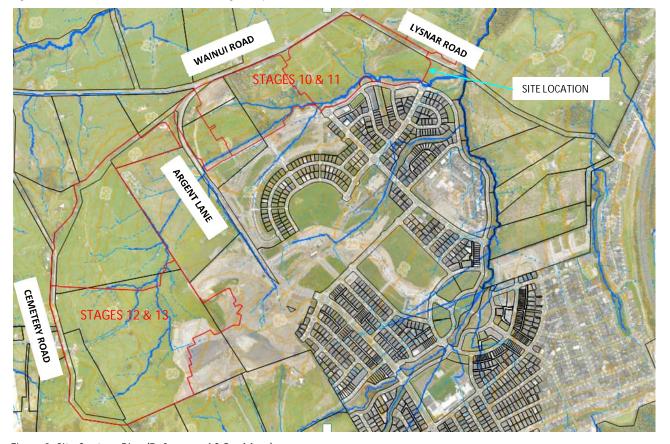


Figure 2: Site Contour Plan (Reference: AC GeoMaps)



3 PROPOSED DEVELOPMENT

FHLDL are proposing the subdivision and development of the site into a medium density residential development. The proposal will result in the development of the site into 606 residential lots, 27 residential super lots, jointly owned access lots (JOALS) and roads to vest, reserves to vest, and all associated works, landscaping and infrastructure.

The development will require land modification works to facilitate Stages 10 to 13 of the Milldale Fast Track application. This includes bulk earthworks across the site to refine the site to the required finished levels.

A full description of the project is provided in the application AEE.

Brief details for the development are as follows:

- Original landform to be modified with cuts and fills of up to 11m and 9m respectively, equating to approximately 735,000m³ of cut and 950,000m³ of fill.
- A series of cut batter slopes and retaining walls are proposed to form terraces of gently sloping lots. Existing watercourses are enhanced into stormwater reserve areas.

4 DESKTOP STUDY

4.1 Related Documents

The following documents were reviewed during preparation of this report:

- CMW Geosciences Milldale Stage 7 Geotechnical Investigation Report, Ref AKL2022-0138AB Rev 2, 9 August 2023.
- CMW Geosciences Milldale Earthworks Precincts 2 & 3 Geotechnical Assessment Report, Ref AKL2018-0102AB Rev 4, 25 June 2020.
- CMW Geosciences Milldale Stages 2 & 3, Wainui East Geotechnical Investigation Report, Ref AKL2017_0069AC Rev.3, 18 September 2017.

4.2 Site History

Historic aerial photographs were reviewed from the website Retrolens and Auckland Council GeoMaps, as well as the most recent imagery available from Google Earth.

Changes and observations are summarised below and highlighted on Figures 3 to 10.

- Earliest aerial photos from *April 1940 (Figure 3)* show the site largely undeveloped or used as grazing farmland, with occasional farm buildings or sheds. The Stage 10/11 portion of site was largely covered in scrub and trees, whilst the Stage 12/13 portion appears to be grazing farmland, with several clusters of trees remaining in the northern part of this area. Two buildings can be seen which are interpreted to be the earliest residential dwellings on the site. To the north of Wainui Road, a fan-shaped feature observed on the slopes may be indicative of a change in geology in this area.
- By September 1961 (Figure 4), further residential dwellings had been constructed to the north of the site along Wainui Road. The residential dwelling in Stage 10/11 is no longer visible, and vegetation around that area has become more mature. Little further development is evident.
- The aerial photo from *April 1973 (Figure 5)* shows the site had by this time undergone major development. Argent Lane and Lysnar Road are now visible as unsealed tracks. The majority of the Stage 10/11 area had been cleared with two relatively small areas of mature trees remaining. New buildings are visible in the area to the south of the site, together with a pond at the end of Argent Lane. This photograph shows a textural change in the land in Stage 12/13, possibly related to a change in geology.
- By March 1981 the Stage 10/11 area had been almost entirely cleared of vegetation. By March 1988 (Figure 6) the creek at the southern boundary of Stage 10/11 had been dammed to form a pond near Lysnar Road, and another pond had been formed near the southern end of Cemetery Road.

- By 1999 (Figure 7) further residential and farm buildings had been constructed within and around the site. Two additional ponds had been formed mid-slope as indicated.
- The 2010 and 2011 photograph (Figure 8) shows several new dwellings and ancillary buildings constructed within the site. Little further change is evident in the 2017 photograph (Figure 9), however commencement of construction of the first stage of Milldale can be seen to the east of the site.
- By 2024 (Figure 10), extensive earthworks of the Milldale development are evident to the south and east of the site. New residential development is visible to the south.

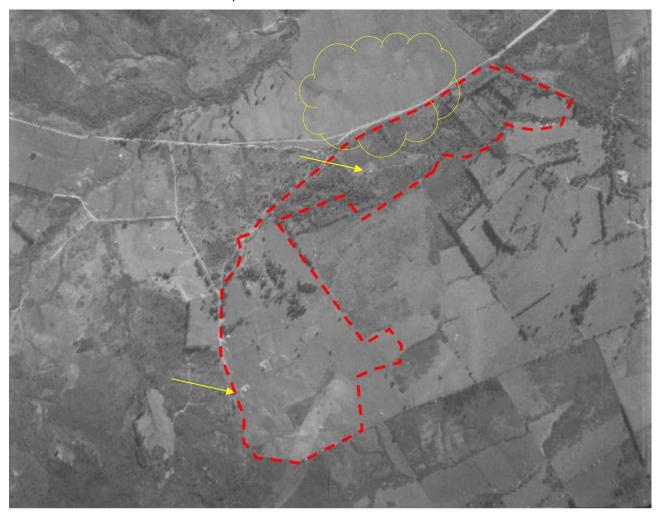


Figure 3: 1940 Aerial Imagery from Retrolens.



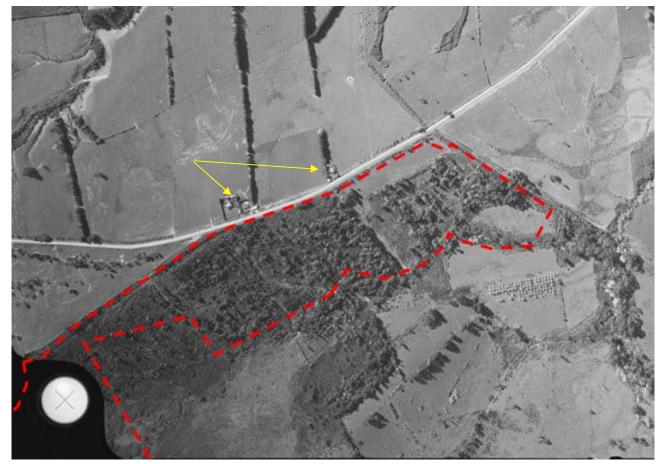


Figure 4: 1961 Aerial Imagery from Retrolens



Figure 5: 1973 Aerial Imagery from Retrolens

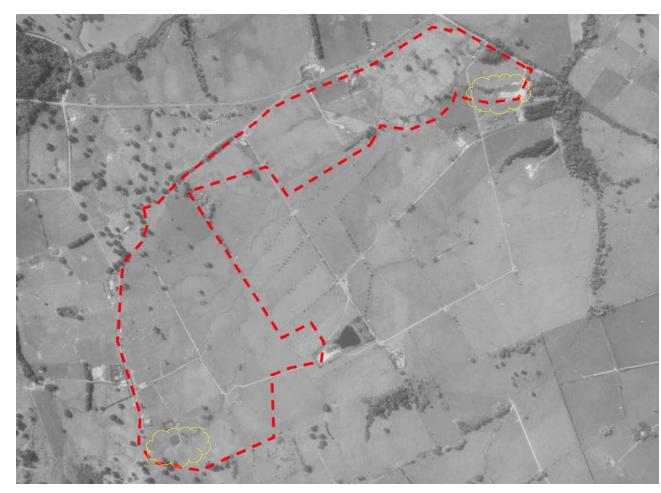


Figure 6: 1988 Aerial Imagery from Retrolens



Figure 7: 1999 Aerial Imagery from Auckland Council GeoMaps





Figure 8: 2010 & 2011 Aerial Imagery from Auckland Council GeoMaps



Figure 9: 2017 Aerial Imagery from Auckland Council GeoMaps



Figure 10: 2024 Aerial Imagery from Google Earth



5 INVESTIGATIONS AND RESULTS

5.1 Field Investigation

Following a dial before you dig search, the site walkover and field investigation was carried out between late October 2024 and January 2025 during fine weather conditions. The scope of fieldwork completed is shown below:

	Investigation Summary							
Test ID	Test Type	Depth (m)						
MH01-24 to MH14-24; MH01-25 to MH04-25	Machine Borehole	10m to 24m						
TP01-24 to TP32-24	Test Pit	1.9m to 5.0m						
CPT01-24 to CPT17-24	Cone Penetrometer Test	1.7m to 20.3m (refusal)						

Engineering logs of the relevant investigations are presented in *Appendix C*.

The approximate locations of the respective investigation sites referred to above are shown on the Site Investigation Plans (*Drawings 01 & 02*) and at right as *Figures 11 & 12*.

5.2 Laboratory Testing

Testing has been scheduled by CMW and at the time of writing is being carried out by Babbage Geotechnical Laboratory, an IANZ registered Testing Authority. The extent of testing currently scheduled is presented below. Certificates for the test results will be presented in *Appendix D* once received.

Laboratory Testing	boratory Testing									
Test ID/ Location	Type of Test	Test Method	Depth (m bgl)	Results						
MH04-24	Direct Shear Test (Shear Box) 3-Point Peak	BGL In-House Test Method #1	3.7 – 3.85							
MH04-24	Direct Shear Test (Shear Box) 3-Point Peak	BGL In-House Test Method #1	10.75 – 10.9							
MH04-24	Direct Shear Test (Shear Box) 3-Point Peak	BGL In-House Test Method #1	17.85 – 18.0							
MH05-24	Direct Shear Test (Shear Box) 3-Point Peak	BGL In-House Test Method #1	10.25 – 10.5							
MH10-24	Direct Shear Test (Shear Box) 3-Point Peak	BGL In-House Test Method #1	6.45 – 6.7							
MH11-24	Direct Shear Test (Shear Box) 3-Point Peak	BGL In-House Test Method #1	5.4 – 5.65							
MH13-24	Direct Shear Test (Shear Box) 3-Point Peak	BGL In-House Test Method #1	11.8 – 12.0							
MH13-24	Direct Shear Test (Shear Box) 3-Point Peak	BGL In-House Test Method #1	14.6 – 14.85							
MH14-24	Direct Shear Test (Shear Box) 3-Point Peak	BGL In-House Test Method #1	14.1 – 14.3							

5.3 Groundwater

During the investigation, completed in spring and summer conditions (November - December 2024), groundwater was not encountered in the test pit excavations.

Groundwater monitoring piezometers were installed in MH06-24 and MH10-24 to 15m and 19.5m respectively below existing ground level using 32mm uPVC, gravel and bentonite plug fitted with a toby cover. Results of groundwater monitoring undertaken following the investigation is presented below.

	Piezometer Details											
Test ID	Screen Depth	Screened Soil	31/01/25									
	(mbgl)	Formation	Depth (mbgl)	Elevation (mRL)								
MH06-24	12 – 15	Undifferentiated Mangakahia Complex	2.4	42.6								
MH10-24	16.5 – 19.5	Hukerenui Mudstone	2.3	70.8								



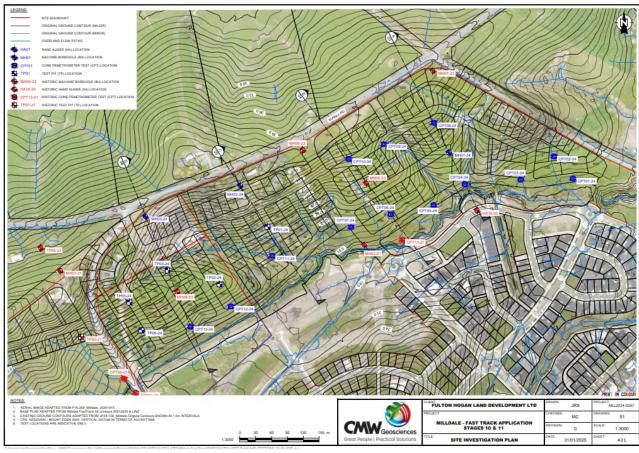


Figure 11: Site Investigation Plan – Stages 10 &11

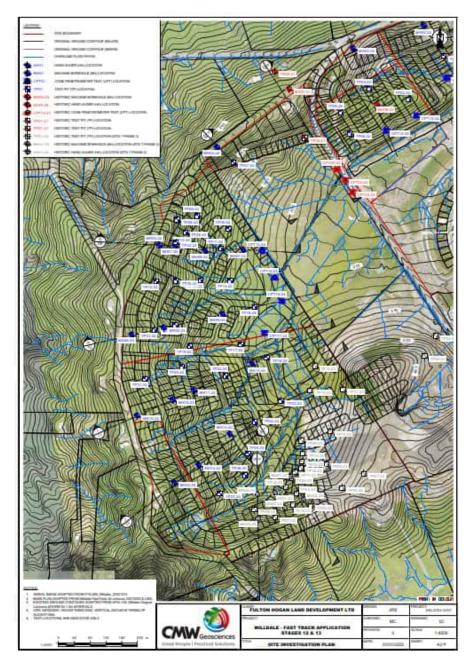


Figure 12: Site Investigation Plan – Stages 12 &13



6 GEOLOGY

6.1 Published and Interpreted Geology

Published geological maps¹ for the area depict the regional geology as comprising Hukerenui Mudstone of the Mangakahia Complex of the Northland Allochthon and Tauranga Group Alluvium as illustrated in *Figure 13*.

The Northland Allochthon strata are part of an allochthonous (meaning removed from its formation location) mass of continental crust that was peeled from the subduction zone north of New Zealand and emplaced through low angle thrust faulting onto areas of Northland and the Silverdale area. Due to the nature of emplacement, materials are typically highly fractured or even shattered and variably weathered.

Our investigations have also encountered Undifferentiated Mangakahia Complex and Mahurangi Limestone of the Motatau Complex of the Northland Allochthon. Subtle changes in the site topography suggest the Hukerenui Mudstone lies predominantly in the ridgelines, with Mahurangi Limestone in the low-lying areas. Undifferentiated Mangakahia Complex was typically either beneath or interfingered with the Hukerenui Mudstone.

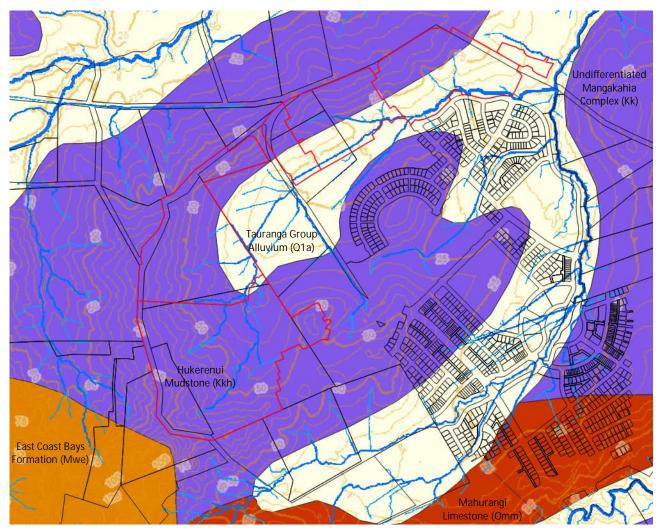


Figure 13: Regional Geology (GNS Science Web Geology Map)

¹ Edbrooke, S.W. (compiler) 2001: Geology of the Auckland area. Institute of Geological and Nuclear Sciences 1:250 000 geological map 3. 1 sheet + 74 p. Lower Hutt, New Zealand. GNS Science.



	Summary of Typical Conditions of Mapped Geologies											
Geological Unit	Location	Formation	Typical Composition, Weathering / Layering and Variability	Behaviour, Instability Mechanism(s) and Principal Potential Geohazards								
Tauranga Group Alluvium/ Colluvium	Mapped in low-lying areas adjacent to streams	The most recent deposits which overlie other geologies. Pleistocene aged river and stream deposits, including landslide debris and erosion deposits	Comparatively high variability in layering of particle sizes and locations of deposits. Predominantly mixtures of clays, silts and sands. Some gravels. Can contain pockets or layers of organic soils and peats or reworked and highly sensitive volcanic pumice silts. Groundwater is typically shallow.	Poorly consolidated deposits, particularly organics, will usually settle / subside if unsupported or overloaded. Liquefaction (if sandy lenses are present) Lateral Spread if liquefiable near a free face High shrink/ swell/ expansivity of clay deposits Prone to comparatively poor bearing capacity characteristics								
Hukerenui Mudstone of the Mangakahia Complex of the Northland Allochthon	Predominant geology as per published maps. Predominantly in the Stage 12/13 ridge, and also found in the Stage 10/11 slopes, underlying Alluvium.	Moderate slopes and ridges characterised by hummocky debris lobes, often without clearly identifiable head scarps. Geomorphology reflects deep soil creep of the most weathered deposits.	Hard clays in red, brown, green, black, and purple. Commonly highly sheared and may contain small serpentinite bodies. Weathered transitional zone difficult to distinguish from underlying, less weathered rock mass.	High plasticity clays prone to debris sliding and deep-seated creep, even on gentle slopes. Soil creep typically at a consistent weathering depth resulting in a predominantly planar movement morphology. Groundwater seepages are common from mid-slope. Swampy ground regularly observed in elevated areas. High shrink/ swell/ expansivity								
Undifferentiated Mangakahia Complex of the Northland Allochthon	Encountered in boreholes and test pits in the Stage 12 & 13 slopes, either underlying or interfingered with the Hukerenui Mudstone	Typically observed as more muted, gentle slopes.	Extremely weak to very weak grey siltstone. Highly shattered but tightly interlocking Typically weathers to dark grey clay, initially on the surfaces of defects. Groundwater surface is commonly between 3 and 5 metres depth, at the transition zone between soil and rock.	With removal of confining pressures such as during excavation or drilling, these siltstones disintegrate into their composite angular gravels and cobbles. The sheared and weak nature of most of the rock mass leads to rapid expansion and degradation of these deposits towards complexly weathered soils over relatively short periods of time when they are unloaded and left exposed to the elements. Soil creep typically at a consistent weathering depth resulting in a predominantly planar movement morphology. High shrink/ swell/ expansivity								
Mahurangi Limestone of Motatau Complex of the Northland Allochthon	Low lying areas west of Argent Lane	Muddy, commonly shattered, rarely crystalline limestone.	Typically forms a low-permeability residual soil mantle that is soft and wet near the base of the layer and immediately above a broken rock (weathering transition) zone overlying the unweathered and typically high strength, commonly shattered, muddy lime rock. Observed depth to rock is comparatively low, typically 1-2m.	Unstable on moderate gradients as the soil mantle slides across the slope-parallel broken zone on the softened, wet layer. High shrink/ swell/ expansivity Rock deposits subject to tunnelling erosion and variability. Parent rock can be significantly stronger than other rock of Northland Allochthon origin and depending on fracturing, may require ripping with a bulldozer to excavate. High shrink/ swell/ expansivity of near-surface clays Shallow circular instability and soil creep in moderately graded slopes Deep seated block failures governed by unfavourable rock defects and bedding orientations and inclinations and trapped groundwater deposits								



6.2 Geomorphology

Geomorphology of the site was mapped during site walkovers and in conjunction with examination of aerial photographs and topographical contours. Geomorphology plans are presented in *Figures 14 & 15* and as *Drawings 03 & 04* in *Appendix A*.

Key notes for this site include:

- The distinct change in landform between the low-lying, gently sloping to flat watercourse areas and the moderate slopes is likely the contact between the Tauranga Group alluvial and colluvial deposits and the Northland Allochthon.
- Further west, in the low-lying areas of Stages 12 & 13, the regular, gentle to flat contour suggests this area is underlain by the Mahurangi Limestone.
- A subtle break in slope below both Cemetery and Wainui Roads may indicate a contact between allochthonous units. The hummocky debris mounds and deep-seated creep on the western slopes in particular suggest this is the base of the Hukerenui Mudstone. Swampy ground and groundwater seepages forming shallow gullies are common, regularly originating from the same elevation as this inferred contact.
- In Stages 10 & 11 near the corner of Argent Lane and Wainui Road, a tributary watercourse lies approximately parallel to the ridgeline. This may also indicate a geological contact.
- Drainage patterns typically run south-west to north-east.
- The regional geological map (see *Figure 13*) indicates an area of East Coast Bays Formation to the southwest of the site, however the steep contour at the southern end of Cemetery Road suggests this may occur inside the site boundary also.



Figure 14: Geomorphology Plan (Stages 10 & 11)

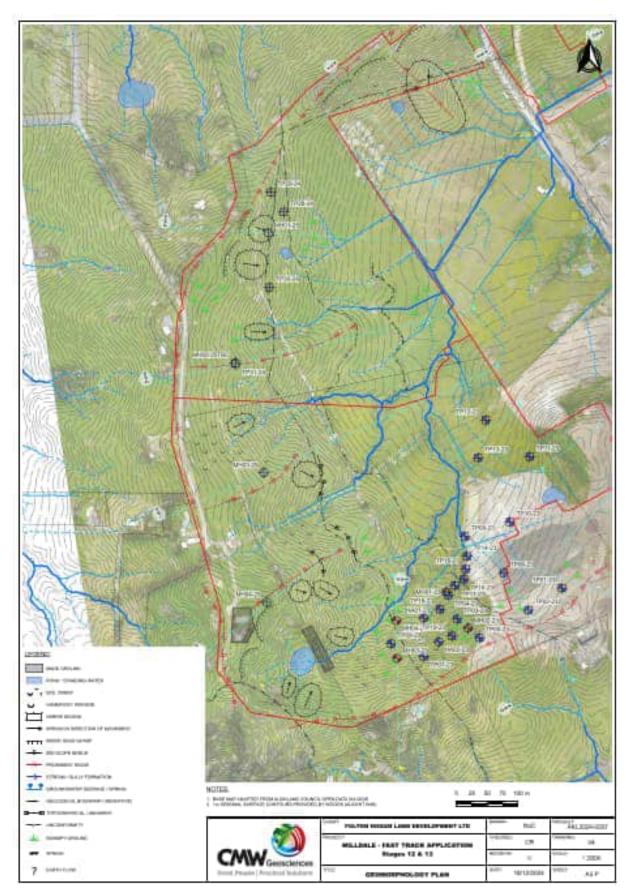


Figure 15: Geomorphology Plan (Stages 12 & 13)



7 GEOTECHNICAL MODEL

7.1 Stratigraphic Units

Our assessment of the distribution of the stratigraphic layers at our specific investigation locations is illustrated on the appended Geological Sections A to L (*Drawings 05 to 16 / Figures 16 to 19*) and are presented below.

The site differentiation of weathering layers within Northland Allochthon deposits is based on a combination of both measured strengths and observation of degree of weathering in the profile.

	Ground Model					
Geological Unit	Description					
Topsoil / Fill	Encountered in all test pits and machine holes. Thicknesses ranged from 0.1m to 0.5m averaging approx. 0.25m. Generally moist to wet across the site.					
Tauranga Group Alluvium (Stream)	Encountered in lower-lying areas in the vicinity of watercourses across the site. CPT testing indicates depths up to 7m below ground level. Described as light grey, green and blue clays and silts with limonite staining and some organic inclusions such as decomposing roots. Typically stiff to very stiff.					
Tauranga Group Alluvium (Ridge)	Encountered in the upper portion of the slopes below Wainui Road, in Stages 10 & 11. Encountered in MH02-24 to 13m below ground level. Described as light grey, green and blue clays and silts, occasionally streaked pink or with limonite staining. Some organic inclusions such as decomposing wood fragments or rootlets. Typically stiff to very stiff.					
Northland Allochthon Residual Soil	Orange-brown to grey clays and silty clays which were firm to very stiff, moist and highly plastic. Typically 1 to 4m thick.					
Undifferentiated Mangakahia Complex	Grey, moderately weathered, highly fractured but interlocking angular siltstone. Extremely weak to very weak. Transitional materials identified by increased clay matrix and weathering of the rock fragments. Rapidly degrades towards complexly weathered soils over relatively short periods of time when unloaded and left exposed to the elements.					
Hukerenui Mudstone	Grey, brown, red and green mudstone in the form of hard, highly plastic clays, occasionally with fine gravel-sized angular inclusions of less weathered mudstone. Sheared surfaces within the clays. Unable to be penetrated with a shear vane. Weathered transitional materials identified by lower shear strengths (firm to very stiff).					
Mahurangi Limestone	Muddy, commonly shattered, tightly interlocking limestone. Grey to white. Transitional materials identified by increased weathering, light brown-grey, more open defects. A softened contact between residual soil and transitional rock mass has been identified where shear strengths are soft to firm.					

7.2 Groundwater

- Overland flow in the area is generally west to east, originating from high on the slopes beneath Cemetery Road
- A full assessment of the groundwater conditions on site has been undertaken by Williamson Water & Land Advisory.

7.3 Recommended Geotechnical Parameters

CMW has undertaken a body of shear box testing on Hukerenui Mudstone and Undifferentiated Mangakahia Complex samples across a range of projects in the Silverdale area. That body of testing is being supplemented as time progresses and has been used to assess lower quartile conservative parameters for design in these units. Cross checking has occurred with back analysis of slope failures and has in some instances led to significant further reductions in parameters, particularly cohesion values. Copies of test results from adjacent Milldale Stage 7 have been provided in *Appendix D*. Further laboratory testing of samples from this investigation is currently underway.

Geotechnical Design Parameters										
Unit Description	Strength Range	γ (kN/m³)	c´ (kPa)	φ´ (deg)	S _u (kPa)					
Proposed Engineered Fill	Vane Shear Strength >110kPa	18	8	28	100					
Tauranga Group Alluvium (Stream)	CPT Qc < 1MPa	17	5	26	60					
Tauranga Group Alluvium (Ridge)	SPT N values 1 to 8	17	8	26	80					
Residual Northland Allochthon Soils	VSS 40 to >200kPa	18	5	28	60					
Transitional Undifferentiated Mangakahia Complex	VSS 70 to >200kPa SPT N values 3 - 39	18	8	21	55*					
Undifferentiated Mangakahia rock mass	SPT N values 40+	21	20	28	150**					
Transitional Hukerenui Mudstone	SPT N values 12 -29	18	8	12	95					
Hukerenui Mudstone	SPT N values 30+	21	20	28	150**					
Mahurangi Limestone - softened base contact	***	18	5	26	50					
Transitional Mahurangi Limestone	VSS >200kPa	19	3	40	-					
Mahurangi Limestone	SPT N values 40+	19	10	40	-					

Notes: γ = soil unit weight (conservative value determined from typical published values for similar soil types)

- c´ = effective cohesion (conservative value developed from previous Milldale stages shear box testing and back analysis). Additional testing within these stages is in progress for Mangakahia and Hukerenui sub-facies.
- ϕ = effective friction angle (conservative value developed from previous Milldale stages shear box testing and back analysis). Additional testing within these stages is in progress for Mangakahia and Hukerenui sub-facies.
- S_u = undrained shear strength (lower bound value determined from vane shear testing and CPT correlations).
- * Lower value than the typical range assumed due to the potential for degradation on unloading and exposure. The adopted value resembles remoulded values and strengths taken from back analysis of pile driving data nearby.
- ** Behaves as a plastic clay despite the high N-values in penetration.
- *** Parameters derived from back analysis in similar terrains.



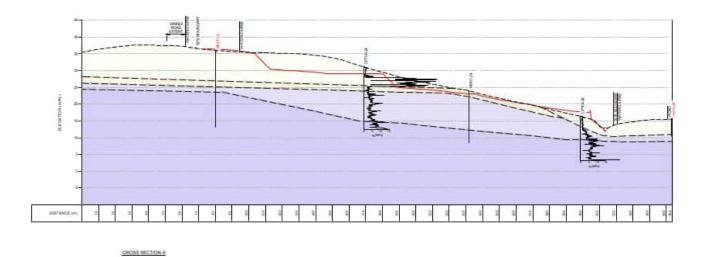


Figure 16: Section A Geological Section

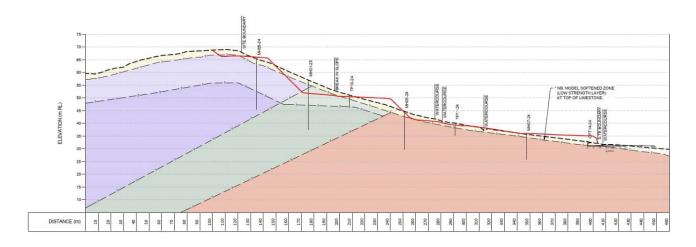


Figure 17: Section G Geological Section

CROSS SECTION G

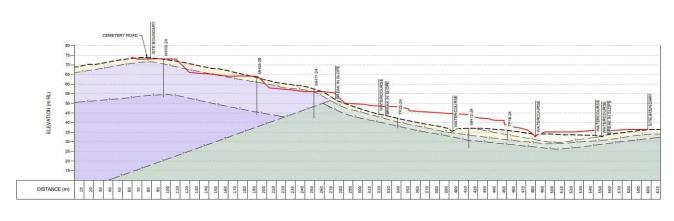


Figure 18: Section I Geological Section

CROSS SECTION I

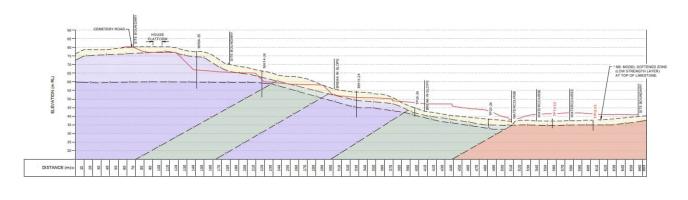


Figure 19: Section J Geological Section

CROSS SECTION J



8 GEOHAZARDS ASSESSMENT

A full Geotechnical Risk Register including geohazards assessment is presented in *Appendix E* and contains references for the assessment methods used. The table below is a summary of critical geohazards to this project and is based on information available to date. The Geotechnical Risk Register is a live document that will be updated as the project progresses. Where relevant, specific assessment details can be found in the respective design calculation packages in the appendices as noted.

	Geohazard Assessment Summary										
Itom	Geotechnical Hazard	Description	Area Assessed	Assessment Outcome	Existing Risk	of Damage to Lan	nd / Structures	Mitigation Maggura	Residual Risk of Damage to Land / Structures		
Item	George Illical Hazaru	Description	Ai ea Assesseu	Assessment Outcome	Likelihood	Consequence	Risk Rating	- Mitigation Measure	Likelihood	Consequence	Risk Rating
		Seismicity	Entire Site	Site subsoil class = Class B or C due to the variance in depth of rock across the site. ULS PGA = 0.19g							
1	Earthquake			Liquefaction analysis carried out for CPTs across the site - refer <i>Appendix G</i> for calculation package including methodology and detailed results.							
·		Liquefaction Entire Site	In respect to the MBIE Module 3 Liquefaction Performance Levels, the site is rated as mild with liquefaction severity numbers ranging from 1-8, with ULS settlements being a maximum of 30mm.	1	5	5	Mitigation not required.	1	5	5	
				Based on our results, the site is expected to experience negligible liquefaction induced settlement.							
		Global Instability Entire site		Target Min. FOS = 1.5, 1.3 and 1.0 for prevailing, worst credible and seismic conditions.							
			Entire site	Results show that the proposed landforms generally achieve the target factors of safety for Stages 10 and 11. The exception is a proposed retaining wall near the stream.	4	5	20	Remediation design includes the use of shear keys and reinforced earth slopes with significant engineered fill buttresses. Refer Appendix F for calculation package	2	5	10
2	Slope Instability / Landslide		Results show that proposed landforms for Stages 12 and 13 do not achieve target factors of safety. Significant remediation is required.				and detailed results. Remediation plans are shown on Drawings 17 and 18 with typical details on Drawing 25.				
				Refer <i>Appendix F</i> for calculation package and detailed results.							
		Soil Creep	Entire Site	Soil creep anticipated on fill slopes steeper than 1V:3H and natural slopes steeper than 1V:5H within upper 1.0m of ground surface.	4	4	16	Use of reinforced earth slopes for slopes greater than 1V:3H. Typical detail shown on Drawing 25 with locations shown on the Woods Retaining Wall Plans.	2	4	8



	Geohazard Assessment Summary										
		December 1			Existing Risk	of Damage to Lan	d / Structures	N 4111 - 11 - N 4	Residual Risk	of Damage to Lar	nd / Structures
Item	Geotechnical Hazard	Description	Area Assessed	Assessment Outcome	Likelihood	Consequence	Risk Rating	Mitigation Measure	Likelihood	Consequence	Risk Rating
		Cut / Fill Batter Stability	Entire site	Cut batters proposed in Stages 12/13 do not achieve target factors of safety as noted in Global Stability above. Refer <i>Appendix F</i> for calculation package and detailed results.	4	5	20	Remediation design includes the use of shear keys and reinforced earth slopes with significant engineered fill buttresses. Refer <i>Appendix F</i> for calculation package and detailed results. Remediation plans are shown on Drawings 17 and 18 with typical details on Drawing 25.	2	5	10
		Stream bank instability and erosion	Slopes adjacent to stream in Stages 10/11	Fill placement above meandering stream on Stages 10/11 requires proposed retaining wall on Stage 10 (Section A). This does not meet factor of safety requirements. Refer to calculation package in <i>Appendix F</i> . Significant fills near the stream need to also consider bearing capacity failure during construction, refer to settlement <i>Appendix H</i> .	3	5	15	Retaining walls along stream banks must consider global stability. If factors of safety aren't met (such as Section A), deeper palisade piles may be used. As noted in Appendix H - bearing capacity failure due to excess pore pressure may occur in underlying alluvium due to fill placement near stream. Construction methodology must consider this, and monitoring / instrumentation may be required.	1	5	5
		Rock mass Exposure	Areas of large cuts.	Earthworks will expose Northland Allochthon weathered rock at design subgrade level. Bedrock units with open defects have high rates of permeability and are susceptible to rapid weathering thereby contributing to land instability.	4	4	16	Earthworks management such as capping materials with a 0.85m thick cohesive engineered fill which is less permeable.	1	4	4
3	Problematic Soils	Expansive Soils	Entire Site	Testing on previous stages of the development in these soils and engineered fills created from these soils indicates that they are typically moderately to highly expansive (AS2870).	4	5	20	Testing to be carried out on final surface prior to submission of the Geotechnical Completion Report. Specific foundation design to be undertaken by structural engineer in accordance with AS2870 or NZBC B1/AS1 (site class to be determined on a lot-by-lot basis).	2	5	10
		Potential for uncontrolled fill to be discovered during earthworks where Uncontrolled Fill Entire Site Potential for uncontrolled fill to be discovered during earthworks where previous stockpiles or historical farm fills, embankments or building platforms are encountered.	3	5	15	Uncontrolled fill is to be excavated and replaced during construction.	1	5	5		
4	Settlement	Compressible Soils	Fills over alluvial soils	Primary (t90) settlements of 10mm to 140mm predicted. Post-construction settlements of 5 to 55mm predicted. Differential settlements likely to be within NZ Building Code limits provided sufficient time is left for construction settlements to occur prior to commencement of lot sign-off and building development. CPT17-24 in Stage 12 shows settlements >50mm, this warrants further investigation. Refer to calculation package in Appendix H.	2	5	10	Mitigation generally not required; however settlement monitoring is recommended during construction to confirm the estimated magnitudes in <i>Appendix H</i> . Preliminary settlement monitoring plans are shown on Drawings 21 and 22. Further investigation required in the area around CPT17-24 in Stage 12.	1	5	5



	Geohazard Assessment Summary										
		5			Existing Risk of Damage to Land / Structures				Residual Risk of Damage to Land / Structures		
It	em Geotechnical Hazard	Description	Area Assessed	Assessment Outcome	Likelihood	Consequence	Risk Rating	Mitigation Measure	Likelihood	Consequence	Risk Rating
				Northland Allochthon materials are considered generally incompressible due to their age and stiffness.							
5	Erosion	Cut Batters	Entire site	Cut batters of up to 1V:2H indicated on Woods plans. Cut batters within Mangakahia and Hukerenui units likely subject to ongoing erosion / frittering.	3	4	12	Addressed as part of the Global Instability mitigation design. Refer Drawing 25. All slopes greater than 1V:2H will be geogrid reinforced. Restrictions will be applied above and below the reinforced earth batters in the Geotechnical Completion Report to protect the geogrid reinforcement.	1	4	4
		Fill Batters	Entire site	Engineered fill batters of up to 1V:2H indicated on Woods plans. Fill batters at these gradients likely to require surface management.	3	4	12	Addressed as part of the Global Instability mitigation design. Refer Drawing 25. Restrictions will be applied above and below the reinforced earth batters in the geotechnical completion report to protect the geogrid reinforcement.	1	4	4
6	Groundwater	Groundwater Impacts		Groundwater	Assessme	ent carried o	out by Wil	liamson Water & Land Advis	ory.		

Construction and Safety in Design (SiD) risks will be completed during detailed design for the final remedial geotechnical design.



9 RECOMMENDATIONS

9.1 Earthworks

All earthwork activities must be carried out in general accordance with the requirements of NZS 4431:2022² and the requirements of the Auckland Council Infrastructure Development Code under the guidance of a Chartered Geotechnical Professional.

A typical Geotechnical Works Specification has been produced in *Appendix I*. Typical detail drawings are provided as *Drawings 17 to 25* to depict the remediation described in the sections below and for cost estimation purposes.

A summary of the key project specific construction risks, as presented in the Geotechnical Risk Register in *Appendix E* are as follows:

	Key Construction Risks
Item	Mitigation Measures
Excavatability	Specialist ripping plant or a rock breaker may be required for limestone units. Provision in contract and budget. Consider additional investigations.
Sediment Retention Ponds	Geotechnical Engineer to have input on pond locations with respect to stability/seepage potential, structural design including key and compaction specifications, observation of subgrade conditions, earthfill and QA testing of embankment materials. Placement of ponds beneath the south-western slopes should be avoided. When decommissioning temporary sediment ponds, all water softened material in the bases and sides of the ponds shall be removed and undercut to the satisfaction of the Geotechnical Engineer. Backfilling of temporary ponds shall be to the compaction standard for general filling unless otherwise specified.
Stockpile Locations	The locations of all temporary stockpiles must be approved by the Geotechnical Engineer prior to placement. Where stockpiles cannot be avoided above sloping ground, they should be placed over a wide area with the height restricted under the direction of the Geotechnical Engineer.
Bearing Capacity Failure of Fills near Streams (in particular Stage 11)	Mitigation of bearing capacity failure risk is primarily undertaken as part of the earthworks planning and execution. The primary considerations are: Placing fill evenly across the site and in planned lifts. Restrictions on the speed of placing fill-in areas with thick, soft alluvium layers. Staging of the fill placement to allow for excess pore pressures to dissipate.
Land Instability During Works	Avoid: - unplanned removal of slope toe support via excavation - over-steepening batters - loading upslope of excavations Ensure: - Critical works follow agreed methodology and construction recommendations Consider: - staging critical excavations to limit areas of exposure - ceasing works during and immediately following significant rainfall

- benching / battering requirements
- control of surface water above excavations
- covering steep batters with polythene
- regular inspections for signs of movement

9.1.1 Rock Mass Exposure / Undercuts

Large areas of Northland Allochthon rock mass will be exposed as part of the earthworks cut operation. Bedrock units with open defects have high rates of permeability and are susceptible to rapid weathering thereby contributing to land instability.

It is recommended to cap these materials by undercutting and replacement with a 0.85m thick cohesive engineered fill which is less permeable. In some instances, ripping and recompacting insitu may have the same effect.

9.2 Slope Stability Management

The following section describes slope stability management requirements to form the proposed landform and meet the Auckland Council Code of Practice for Land Development and Subdivision (ACCOP) slope stability factor of safety requirements. Slope stability is considered the most significant geotechnical risk to the development, due to the inherently unstable nature of the Northland Allochthon Geology. The stability modelling methodology and results can be found in *Appendix F*.

The following recommendations are for the purpose of demonstrating that the land is able to be remediated to ACCOP requirements. Further investigation and detailed design of slope stability remediation should be carried out on a stage-by-stage basis prior to earthworks to provide the contractors with detailed drawings, quantities and input into construction sequencing to manage land instability during the works.

Typical remediation plans are shown on *Drawings 17 and 18*. These show the use of shear keys and engineered fill buttresses, standard details of these are shown on *Drawing 25*. These remediation strategies are based on previous experience at Milldale in these geologies and have been constructed in Stages 2,3 and 7.

It should be noted that together with the less than favourable Northland Allochthon geology and boundary constraints to the development whereby the relatively steep gradients across the site are fixed, the frequent watercourses and wetland features observed across all stages of the site pose significant constraints to the success of the slope stability remediation for the project.

These features are regularly steeply incised and locally comprise water softened soils.

The landform proposed is dependent on the developer's ability to construct a universal, cohesive, large-scale remediation. The removal of a number of streams and wetlands and realignment of others will be essential to achieving this.

Any effort to retain greater stream extent or wetlands within the design of the subdivision would result in the requirement for large and costly palisade walls in order to mitigate the risk of instability, as well as roads, infrastructure, and housing that would need to be significantly set back from water features.

The installation of underfill drainage in the selected reclaimed and realigned watercourses and filling with engineered fill will significantly benefit the global stability of the slopes by providing confining loads with improved shear resistance. Water captured by proposed drainage will be directed into the newly formed watercourses as a form of stream recharge.

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² Standards New Zealand (2022) Engineered fill construction for lightweight structures, NZS 4431:2022



General

- A series of 1V:2H reinforced earth slopes (RE slopes) are proposed across all stages of the proposed development. Due to their steepness these are proposed to be reinforced with geogrids to control creep movement on the face, along with a facing of strataweb/geoweb to hold topsoil /mulch in place to allow for planting, refer to *Drawing 25* for a typical detail. Where Transitional Hukerenui Mudstone is present, these reinforced earth slopes will require an engineered fill buttress beyond the geogrids/drainage to achieve ACCOPS slope stability factors of safety.
- Several inter-lot and boundary retaining walls are proposed and have not been specifically assessed at this stage. These will be designed at building consent phase; slope analysis should be considered for retaining walls greater than 2m in height or on boundaries.
- CMW has found, due to the impermeable nature of the materials encountered and propensity of some
 to rapid slaking, the installation of large-scale counterfort drainage within the transitional or
 unweathered materials needs to be carefully considered. The construction of drainage trenches
 introduces zones of high permeability, resulting in zones of increased weathering/ rapid degradation
 which may be detrimental to the long-term stability.

Stages 10/11

- Generally the proposed landform for these stages meets the ACCOP slope stability factor of safety requirements without significant slope remediation.
- Several RE slopes are proposed, these will need to be geogrid reinforced as per *Drawing 25*, however no additional engineered fill buttresses are modelled at this stage.
- Cross Section A-A' within Stage 10 has a retaining wall above the stream at the boundary of existing Stage 5, slope stability modelling showed that this retaining wall will need to be designed to improve global slope stability factors of safety (i.e. palisade action).
- Bearing capacity failure due to rapid filling during construction must be considered, this is discussed in *Appendix H*.

We envision that several further slope stability cross sections will need to be run along the stream prior to construction for the proposed stormwater ponds near the boundary.

Stages 12/13

- Stages 12/13 will require significant slope remediation due to the amount of gradient from Cemetery Road and the presence of the notoriously unstable Hukerenui Mudstone deposits.
- Three RE slopes (named upper, mid and lower) are proposed to address the steep gradient from Cemetery Road to Argent Lane and create terraces for near level building platforms; the upper two RE slopes are to be formed in cut.
- The uppermost RE slope presents the most significant geotechnical challenge on the project, with the drilling investigation finding the transitional Hukerenui Mudstone, the most unstable unit within the project area to depths >10m, this along with the proposed height of the RE slope (up to 13m) and significant removal of buttress below this proposed slope has created the need for extensive remediation. This is shown on Cross Sections G, H, I and J.
- The remediation consists of shear keys beneath these slopes and significant engineered fill buttresses being required to achieve ACCOP slope stability factor of safety requirements, the extent of these are shown on *Drawing 18* and outputs from the stability modelling in *Appendix F*. Engineered Fill Buttresses will comprise an over excavation of the transitional Hukerenui Mudstone and replacement with engineered fill beyond the typical RE slope detail.

- It should be noted that the interpretation of the thickness of Transitional Hukerenui Mudstone is based on limited machine boreholes. Fill buttresses and shear keys will require detailed mapping of the exposure to determine the final dimensions.
- Alternative remediation designs may include the use of long high strength geogrids in the upper RE slopes
 to limit the extent of over excavation of the transitional Hukerenui Mudstone down slope or the use of
 palisade piles. Final design of the remediation solution will be carried out following further investigation
 prior to earthworks.
- CMW has found, due to the impermeable nature of the materials encountered and propensity of some
 to rapid slaking, the installation of large-scale counterfort drainage within the transitional or
 unweathered materials needs to be carefully considered. The construction of drainage trenches
 introduces zones of high permeability, resulting in zones of increased weathering/ rapid degradation
 which may be detrimental to the long-term stability.
- The scale of proposed remediation reduces further down slope, as the presence of more stable Undifferentiated Mangakahia and Mahurangi Limestone units and the reduction in RE slope heights results in more favourable stability conditions.
- Lower RE slopes on Cross Section G, J, I and K also show the presence of Transitional Hukerenui Mudstone and therefore require shear keys and fill buttresses.

9.3 Liquefaction

Results of the liquefaction assessment are in *Appendix G*. In summary:

- In respect to the MBIE Module 3 Liquefaction Performance Levels, the site is rated insignificant to mild with liquefaction severity numbers (LSN) ranging from 1-8. Two outlier CPTs showed LSN greater than 40, however these were in reserve areas and within Hukerenui Mudstone deposits so therefore very unlikely to liquefy due to their age.
- ULS settlements are a maximum of 35mm, with SLS settlements not expected.
- Based on our results, the site is expected to perform relatively well with negligible liquefaction induced settlement.

9.4 Settlement Mitigation

Results of the settlement assessment can be found in Appendix H. In summary:

- Estimated post construction settlements based on CPT analysis are generally predicted to be between 10 and 40mm for widespread development loads of up to 20kPa, we consider this of low risk for typical NZS3604 structures. One outlier at CPT17-24 in Stage 12A had post construction settlements at 55mm so warrants further investigation.
- Settlement estimates will need to be confirmed by settlement monitoring during earthworks.
- A settlement criteria of post construction settlements <50mm and differentials to be within NZS3604 code limits (angular deflection less than 1:240 or 25mm over 6m) is to be confirmed by settlement monitoring during construction. This should be reported in the Geotechnical Completion Report for each stage.
- If further investigations find that the area around CPT17-24 determines post construction settlements in excess of this settlement criteria, ground improvement options such as preload surcharges could be implemented, these have been used extensively throughout the lower elevations of the development. Other options include undercutting of compressible ground and replacement with engineered fill, the use of lightweight fills or rigid inclusions, or rammed aggregate piers.

Settlement Monitoring Plans have been included as *Drawings 21 and 22*, a typical settlement monitoring marker detail is included as *Drawing 23*.



9.5 Boundary Effects

With reference to the Williamson Water and Land Advisory (WWLA) Report, groundwater drawdown was considered 'less than minor' in all stages, with groundwater drawdown being less than 2m at the boundaries. Therefore, drawdown induced settlement effects on neighbouring properties is considered to be less than minor.

9.6 Civil Works

	Key Civil Inputs	
Item	Value	Comment
Subgrade CBR	2 – 3%	Within natural cut ground
	5 – 6%	Within engineered fills
		Subgrade improvement with lime (if desired) is expected to provide better results than the use of cement due to the clayey nature of the soils.
Typical Topsoil Depths	0.1 – 0.5m, averaging 0.25m	
Uncontrolled Fill Locations	-	Not encountered in this investigation but the possibility cannot be discounted. As a minimum, likely to be encountered as shown on the Geomorphology Plans.
Stormwater Soakage (permeability)	N/A	No soakage to ground available due to clayey soils. The addition of water to the highly fractured rock mass is also highly undesirable from a slope stability perspective.
Retaining Wall Parameters	Refer Section 7.3	Geotechnical design parameters provided in Section 7.3

9.7 Foundations

Anticipated Foundation Details								
Item	Methodology	Value	Comment					
Geotechnical Ultimate Bearing Capacity (GUBC) for shallow foundations	B1/VM4	300kPa	Available within natural cut and engineered fill areas. To be confirmed at GCR stage. Short axis of footing measuring no greater than 1.5m in plan					
Expansive Soil Site Class	ASSE ASSESS ASSE		Anticipated characteristic surface movements of up to 40mm (M) / 60mm (H1)					

Strength reduction factors	B1/VM4 ³	0.8	Load combinations involving earthquake overstrength
		0.5	All other load combinations
Seismic Site Class(es)	NZS1170	B and C	Depth to rock varies across the site. Seismic site class will be determined on a lot-by-lot basis at GCR stage.

9.8 Certification

At the completion of the works, a Geotechnical Completion Report (GCR) will be prepared. The GCR will:

- report on the works undertaken
- confirm foundation design parameters
- describe future building and/ or earthworks limitations
- apply any restrictions that require further engineering investigation and/ or design on individual lots to avoid future building works exacerbating a natural hazard

Restrictions that are expected to be applied in the GCR are outlined in the Geotechnical Risk Register.

9.9 Safety in Design

Safety in Design (SiD) has not been addressed at this stage of design, however design activities must consider the unstable nature of Northland Allochthon materials in particular for shallow and deep excavations and the installation of drainage.

10 FURTHER WORK

The following further work is recommended as the project progresses:

- Further geotechnical investigations for detailed design of remedial works are required for each stage. Particular focus on defining geotechnical parameters in the Hukerenui Mudstone and depth of transition materials.
- Detailed design of remedial works, including issued for construction (IFC) drawings for each stage.
- During construction, regular inspections and testing will be required as outlined in the Geotechnical Works Specifications, to be produced for each stage.
- At the completion of the works, a GCR will be prepared by a Chartered Professional Engineer outlining the works completed and all recommendations and restrictions for future development on each lot.

³ Ministry of Business, Innovation and Employment (2019) *Acceptable Solutions and Verification Methods for NZ Building Code Clause B1 Structure*, B1/VM4, Amendment 19



11 CLOSURE

Additional important information regarding the use of your CMW report is provided in the 'Using your CMW Report' document attached to this report.

This report has been prepared for use by Fulton Hogan Land Development Limited in relation to the Proposed Residential Subdivision, Milldale Stages 10 to 13, Wainui East project in accordance with the scope, proposed uses and limitations described in the report. Should you have further questions relating to the use of your report please do not hesitate to contact us.

Where a party other than Fulton Hogan Land Development Limited seeks to rely upon or otherwise use this report, the consent of CMW should be sought prior to any such use. CMW can then advise whether the report and its contents are suitable for the intended use by the other party.



USING YOUR CMW GEOTECHNICAL REPORT

Geotechnical reporting relies on interpretation of facts and collected information using experience, professional judgement, and opinion. As such it generally has a level of uncertainty attached to it, which is often far less exact than other engineering design disciplines. The notes below provide general advice on what can be reasonably expected from your report and the inherent limitations of a geotechnical report.

Preparation of your report

Your geotechnical report has been written for your use on your project. The contents of your report may not meet the needs of others who may have different objectives or requirements. The report has been prepared using generally accepted Geotechnical Engineering and Engineering Geology practices and procedures. The opinions and conclusions reached in your report are made in accordance with these accepted principles. Specific items of geotechnical or geological importance are highlighted in the report.

In producing your report, we have relied on the information which is referenced or summarised in the report. If further information becomes available or the nature of your project changes, then the findings in this report may no longer be appropriate. In such cases the report must be reviewed, and any necessary changes must be made by us.

Your geotechnical report is based on your project's requirements

Your geotechnical report has been developed based on your specific project requirements and only applies to the site in this report. Project requirements could include the type of works being undertaken; project locality, size and configuration; the location of any structures on or around the site; the presence of underground utilities; proposed design methodology; the duration or design life of the works; and construction method and/or sequencing.

The information or advice in your geotechnical report should not be applied to any other project given the intrinsic differences between different projects and site locations. Similarly geotechnical information, data and conclusions from other sites and projects may not be relevant or appropriate for your project.

Interpretation of geotechnical data

Site investigations identify subsurface conditions at discrete locations. Additional geotechnical information (e.g. literature and external data source review, laboratory testing etc) are interpreted by Geologists or Engineers to provide an opinion about a site specific ground models, their likely impact on the proposed development and recommended actions. Actual conditions may differ from those inferred to exist due to the variability of geological environments. The actual interface between materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions. Interpretation of factual data can be influenced by design and/or construction methods. Where these methods change review of the interpretation in the report may be required.

Subsurface conditions can change

Subsurface conditions are created by natural processes and then can be altered anthropically or over time. For example, groundwater levels can vary with time or activities adjacent to your site, fill may be placed on a site, or the consistency of near surface conditions might be susceptible to seasonal changes. The report is based on conditions which existed at the time of investigation. It is important to confirm whether conditions may have changed, particularly when large periods of time have elapsed since the investigations were performed.

Interpretation and use by other design professionals

Costly problems can occur when other design professionals develop their plans based on misinterpretations of a geotechnical report. To help avoid misinterpretations, it is important to retain the assistance of CMW to work with other project design professionals who are affected by the contents of your report. CMW staff can explain the report implications to design professionals and then review design plans and specifications to see that they have correctly incorporated the findings of this report.

Your report's recommendations require confirmation during construction

Your report is based on site conditions as revealed through selective point sampling. Engineering judgement is then applied to assess how indicative of actual conditions throughout an area the point sampling might be. Any assumptions made cannot be substantiated until construction is complete. For this reason, you should retain geotechnical services throughout the construction stage, to identify variances from previous assumption, conduct additional tests if required and recommend solutions to problems encountered on site.

A Geotechnical Engineer, who is fully familiar with the site and the background information, can assess whether the report's recommendations remain valid and whether changes should be considered as the project develops. An unfamiliar party using this report increases the risk that the report will be misinterpreted.

Environmental Matters Are Not Covered

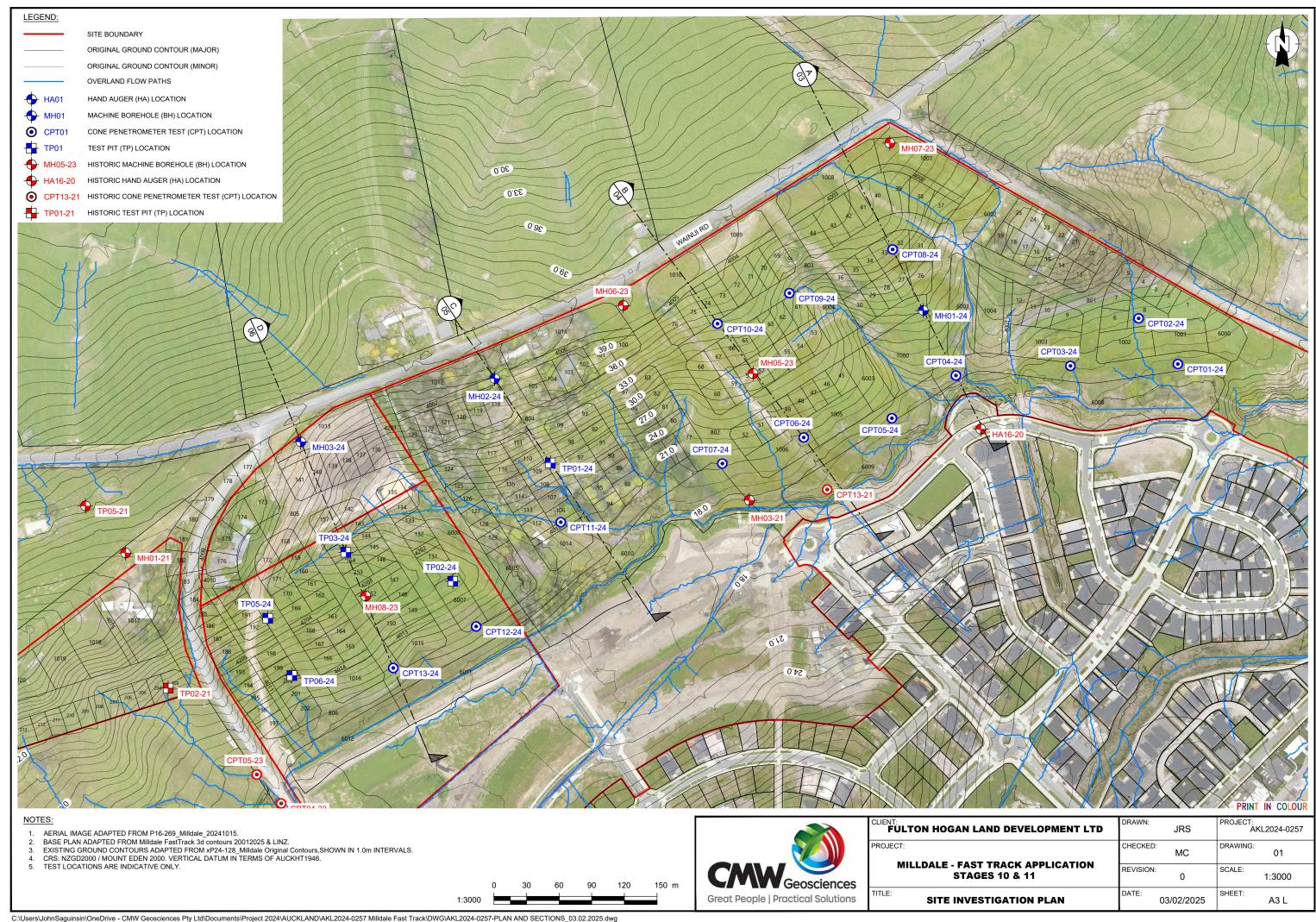
Unless specifically discussed in your report environmental matters are not covered by a CMW Geotechnical Report. Environmental matters might include the level of contaminants present of the site covered by this report, potential uses or treatment of contaminated materials or the disposal of contaminated materials. These matters can be complex and are often governed by specific legislation.

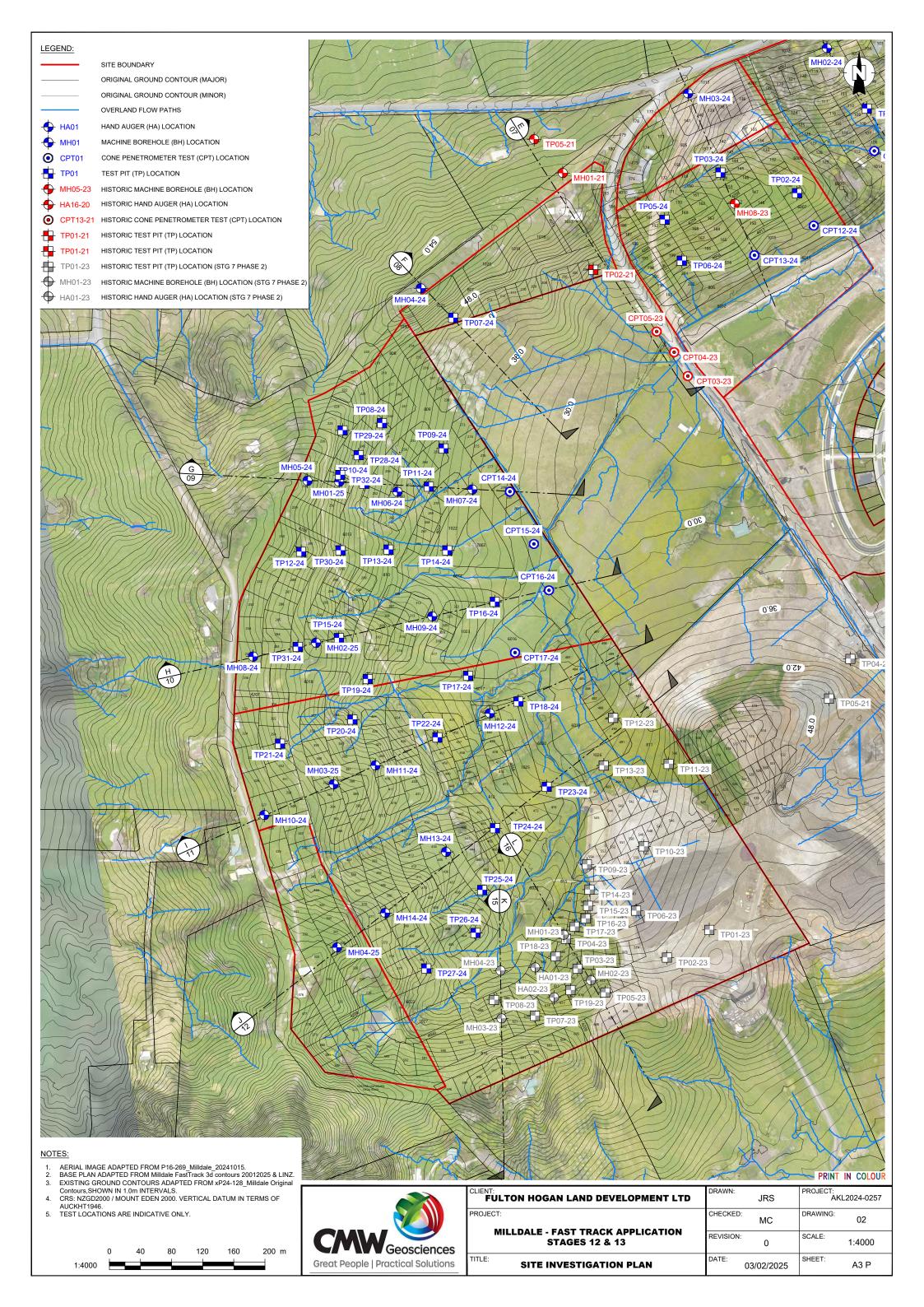
The personnel, equipment, and techniques used to perform an environmental study can differ significantly from those used in this report. For that reason, our report does not provide environmental recommendations. Unanticipated subsurface environmental problems can have large consequences for your site. If you have not obtained your own environmental information about the project site, ask your CMW contact about how to find environmental risk-management guidance.

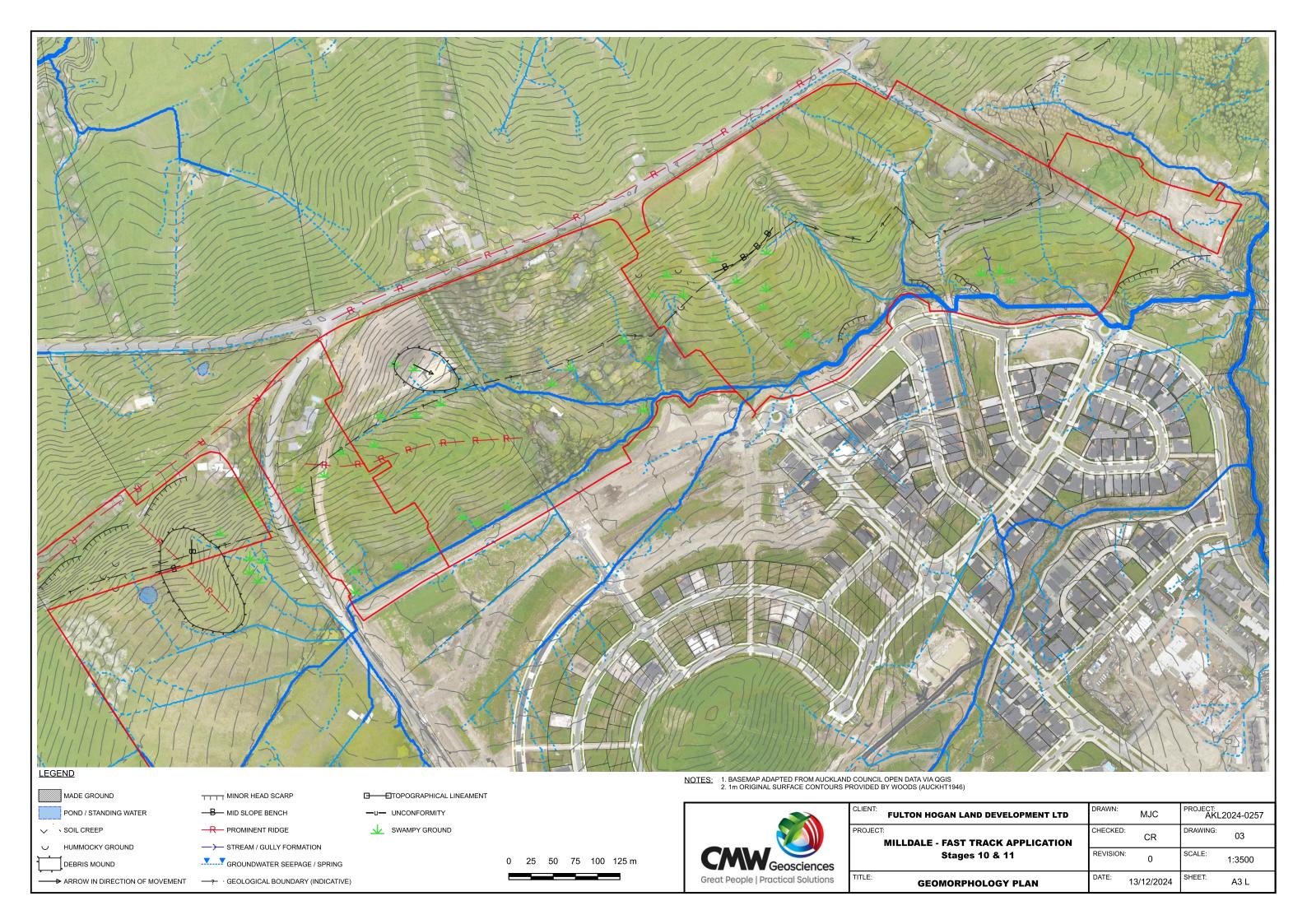


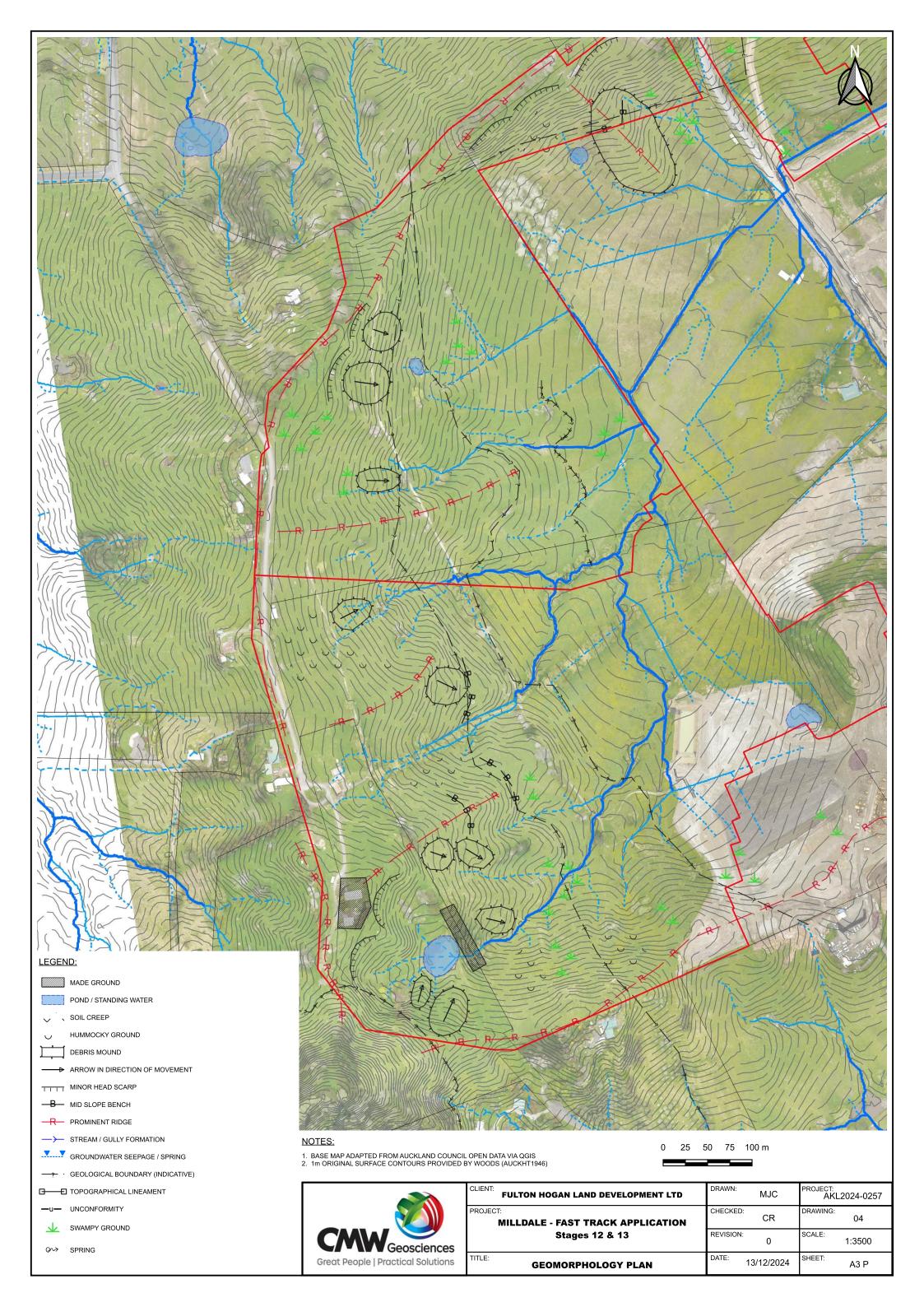
Appendix A: Drawings

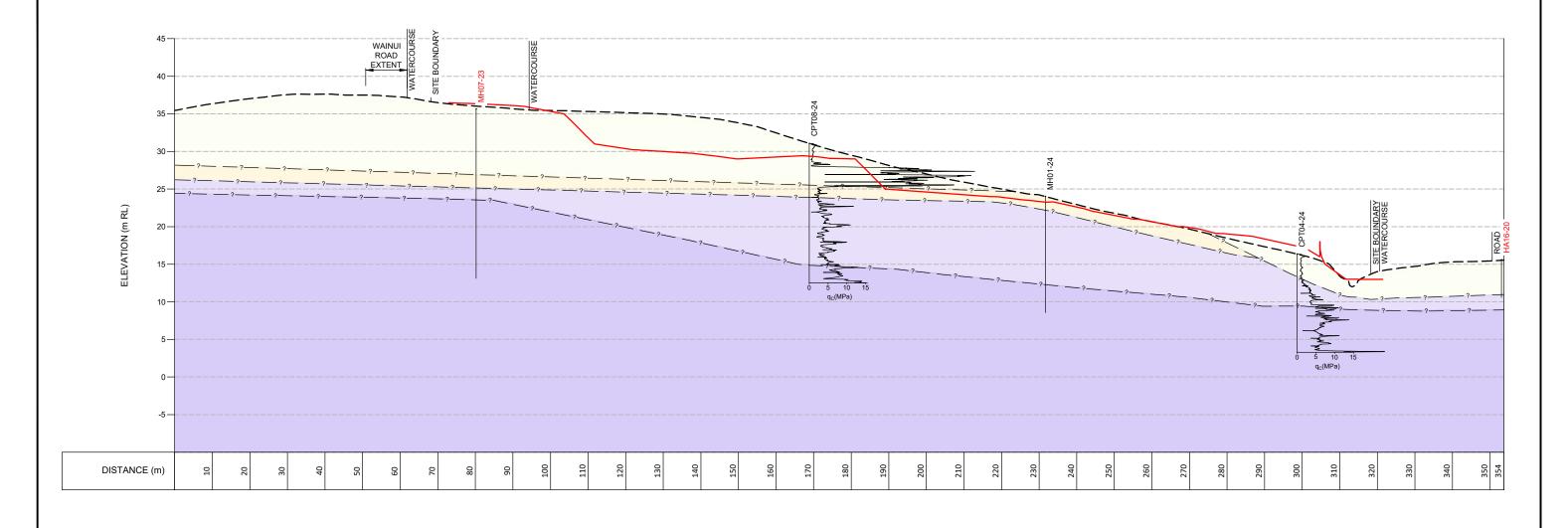
Title	Reference No.	Date	Revision
Site Investigation Plan Stages 10/11	01	03/02/2025	0
Site Investigation Plan Stages 12/13	02	03/02/2025	0
Geomorphology Plan Stages 10/11	03	13/12/2024	0
Geomorphology Plan Stages 12/13	04	13/12/2024	0
Cross Section A	05	03/02/2025	0
Cross Section B	06	03/02/2025	0
Cross Section C	07	03/02/2025	0
Cross Section D	08	03/02/2025	0
Cross Section E	09	03/02/2025	0
Cross Section F	10	03/02/2025	0
Cross Section G	11	03/02/2025	0
Cross Section H	12	03/02/2025	0
Cross Section I	13	03/02/2025	0
Cross Section J	14	03/02/2025	0
Cross Section K	15	03/02/2025	0
Cross Section L	16	03/02/2025	0
Remediation Plan Stage 10/11	17	03/02/2025	0
Remediation Plan Stage 12/13	18	03/02/2025	0
Underfill Drain Plan Stage 10/11	19	03/02/2025	0
Underfill & RE Slope Drains Plan Stage 12/13	20	03/02/2025	0
Settlement Monitoring Plan Stage 10/11	21	03/02/2025	0
Settlement Monitoring Plan Stage 12/13	22	03/02/2025	0
Settlement Marker Typical Detail	23	03/02/2025	0
Underfill Drain Typical Detail	24	03/02/2025	0
Reinforced Earth Slope Typical Detail	25	03/02/2025	0



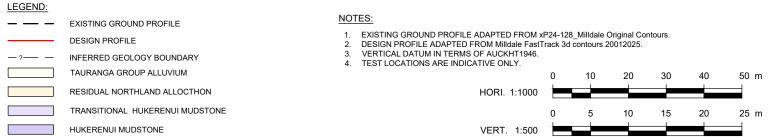






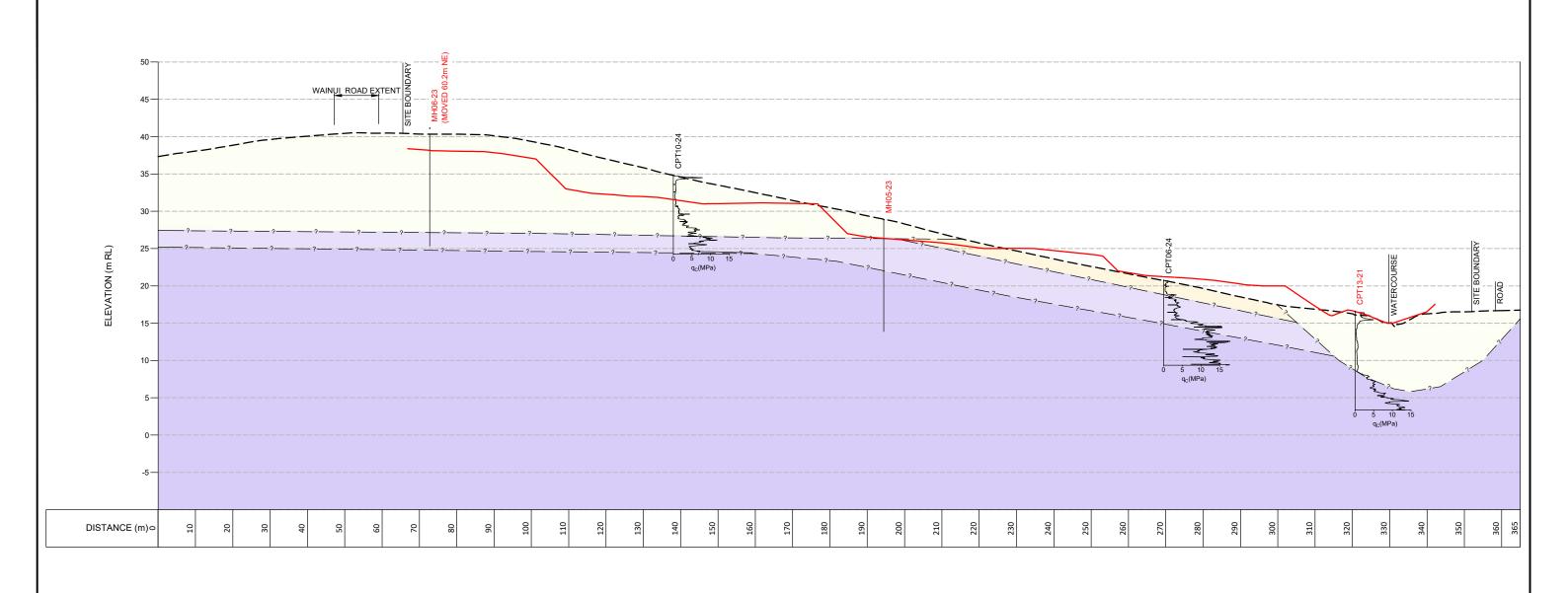


CROSS SECTION A

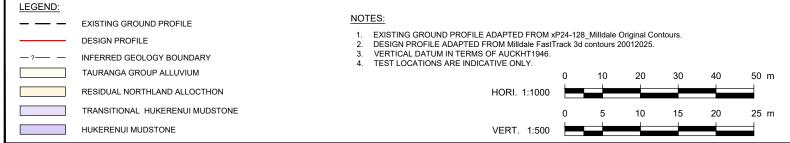




			PRI	NT IN COLOUR
CLIENT: FULTON HOGAN LAND DEVELOPMENT LTD	DRAWN:	JRS	PROJECT	т: AKL2024-0257
PROJECT:	CHECKED	MC	DRAWING	G: 05
MILLDALE - FAST TRACK APPLICATION	REVISION:	0	SCALE:	AS SHOWN
CROSS SECTION A	DATE:	03/02/2025	SHEET:	A3 L

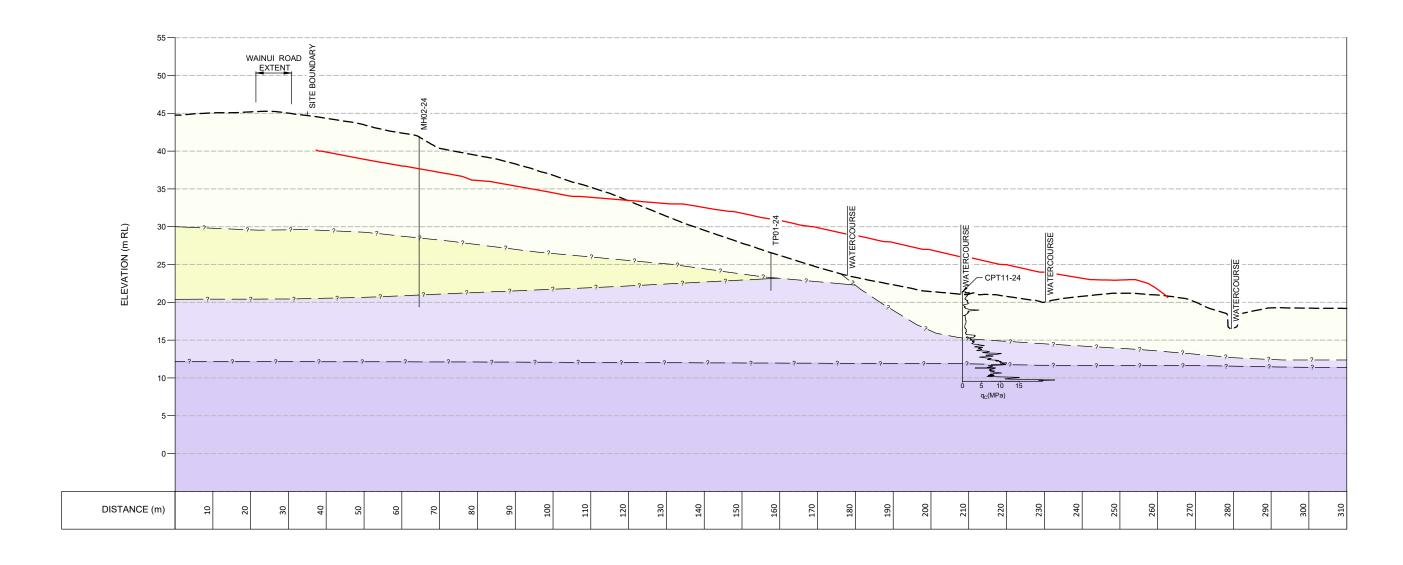


CROSS SECTION B

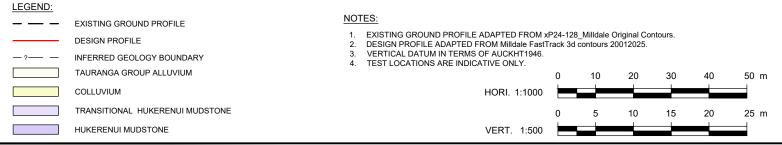


Great People | Practical Solutions

			PKII	NI IN COLOUR
CLIENT: FULTON HOGAN LAND DEVELOPMENT LTD	DRAWN:	JRS	PROJECT	·. AKL2024-0257
PROJECT:	CHECKED:	MC	DRAWING	G: 06
MILLDALE - FAST TRACK APPLICATION	REVISION:	0	SCALE:	AS SHOWN
TITLE: CROSS SECTION B	DATE:	03/02/2025	SHEET:	A3 L

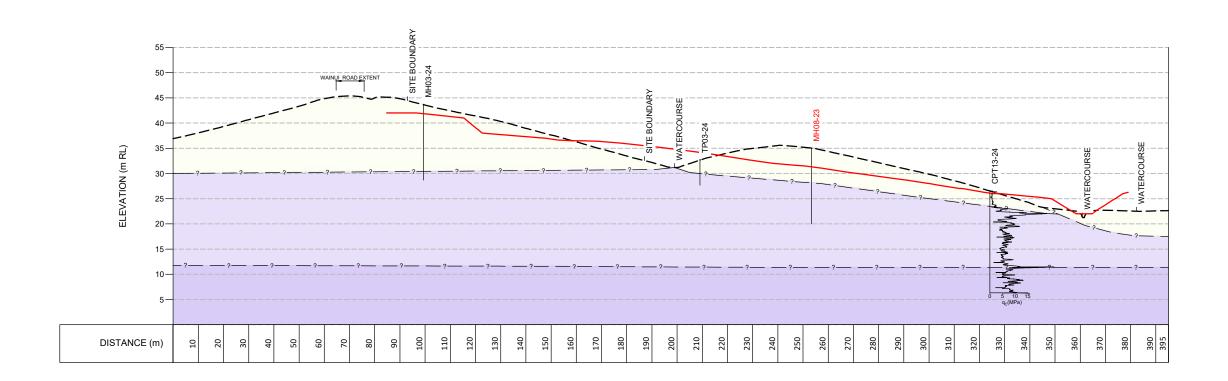


CROSS SECTION C





			PRII	NI IN COLOUR
CLIENT: FULTON HOGAN LAND DEVELOPMENT LTD	DRAWN:	JRS	PROJECT	 AKL2024-0257
PROJECT:	CHECKED:	MC	DRAWING	9: 07
MILLDALE - FAST TRACK APPLICATION	REVISION:	0	SCALE:	AS SHOWN
TITLE: CROSS SECTION C	DATE:	03/02/2025	SHEET:	A3 L



CROSS SECTION D

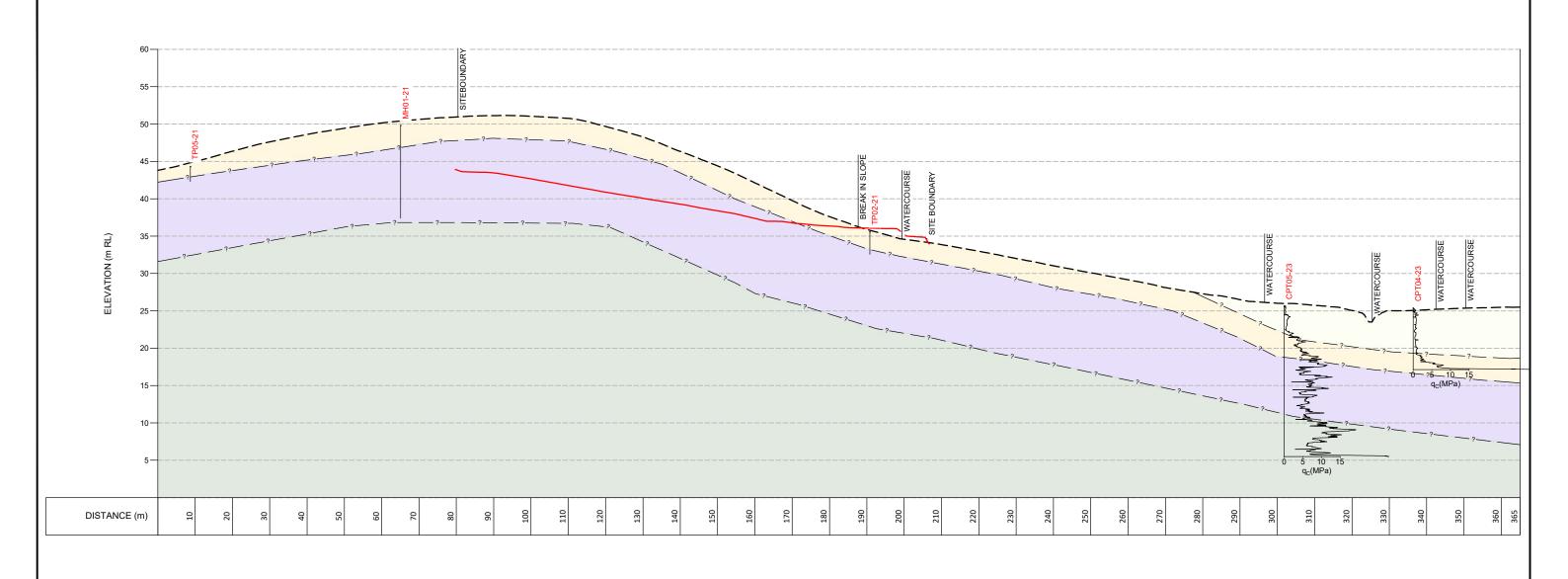
LEGEND: EXISTING GROUND PROFILE DESIGN PROFILE INFERRED GEOLOGY BOUNDARY TAURANGA GROUP ALLUVIUM TRANSITIONAL HUKERENUI MUDSTONE HUKERENUI MUDSTONE

- EXISTING GROUND PROFILE ADAPTED FROM xP24-128_Milldale Original Contours.
 DESIGN PROFILE ADAPTED FROM Milldale FastTrack 3d contours 20012025.
 VERTICAL DATUM IN TERMS OF AUCKHT1946.
 TEST LOCATIONS ARE INDICATIVE ONLY.

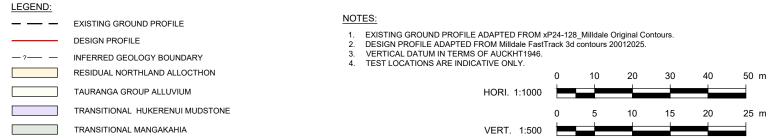
	0	15	30	45	60	75 m
HORI. 1:1500						
	0	7.5	15	22.5	30	37.5 m
VERT. 1:750						



			PRI	NI IN CULUUR
CLIENT: FULTON HOGAN LAND DEVELOPMENT LTD	DRAWN:	JRS	PROJEC1	T: AKL2024-0257
PROJECT:	CHECKED:	MC	DRAWING	G: 08
MILLDALE - FAST TRACK APPLICATION	REVISION:	0	SCALE:	AS SHOWN
TITLE: CROSS SECTION D	DATE:	03/02/2025	SHEET:	A3 L

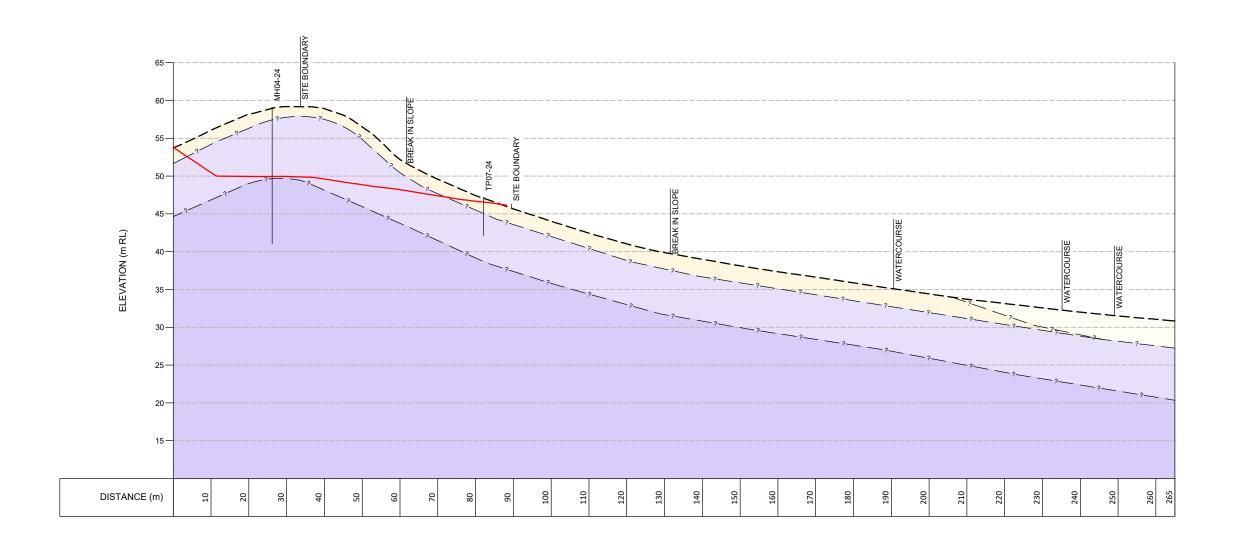


CROSS SECTION E





			PRI	NI IN COLOUR
CLIENT: FULTON HOGAN LAND DEVELOPMENT LTD	DRAWN:	JRS	PROJEC1	r: AKL2024-0257
PROJECT:	CHECKED:	MC	DRAWING	G: 09
MILLDALE - FAST TRACK APPLICATION	REVISION:	0	SCALE:	AS SHOWN
CROSS SECTION E	DATE:	03/02/2025	SHEET:	A3 L

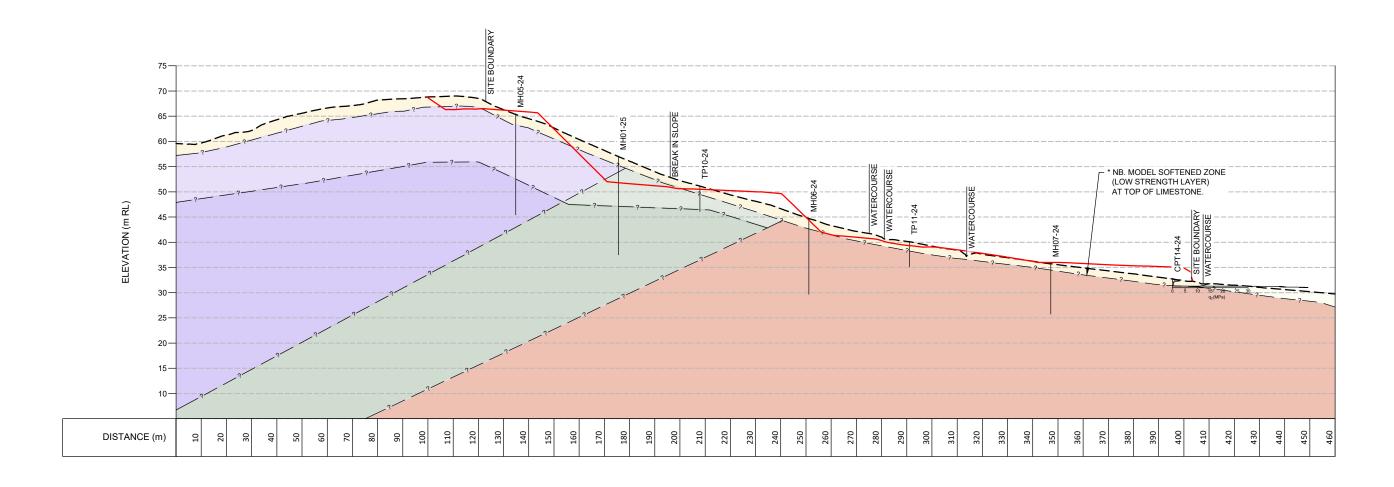


CROSS SECTION F

LEGEND: - - - EXISTING GROUND PROFILE DESIGN PROFILE DESIGN PROFILE 1. EXISTING GROUND PROFILE ADAPTED FROM xP24-128_Milldale Original Contours. DESIGN PROFILE 1. EXISTING GROUND PROFILE ADAPTED FROM Milldale FastTrack 3d contours 20012025. DESIGN PROFILE ADAPTED FROM Milldale FastTrack 3d contours 20012025. VERTICAL DATUM IN TERMS OF AUCKHT1946. 4. TEST LOCATIONS ARE INDICATIVE ONLY. TRANSITIONAL HUKERENUI MUDSTONE D 5 10 15 20 25 m HUKERENUI MUDSTONE VERT. 1:500



			PRI	NT IN COLOUR
CLIENT: FULTON HOGAN LAND DEVELOPMENT LTD	DRAWN:	JRS	PROJECT	г: AKL2024-0257
PROJECT:	CHECKED:	MC	DRAWING	G: 10
MILLDALE - FAST TRACK APPLICATION	REVISION:	0	SCALE:	AS SHOWN
CROSS SECTION F	DATE:	03/02/2025	SHEET:	A3 L

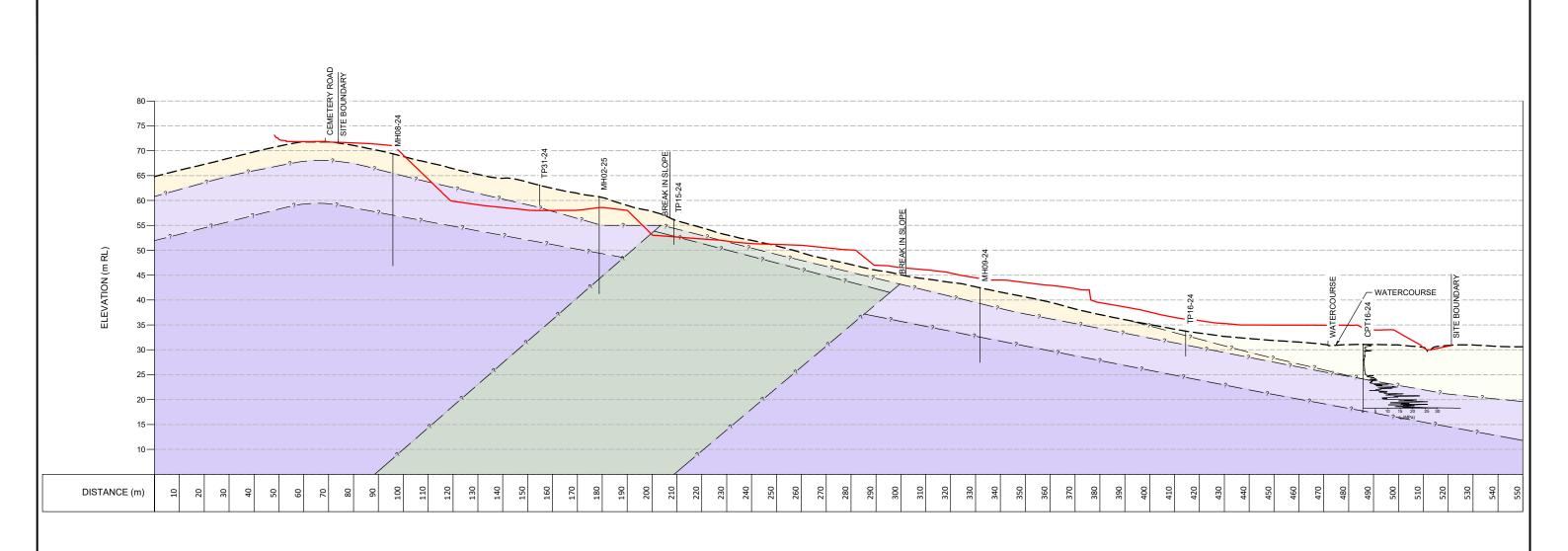


CROSS SECTION G

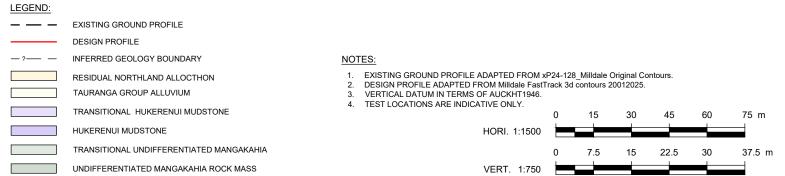
LEGEND: - - EXISTING GROUND PROFILE DESIGN PROFILE - 7 - INFERRED GEOLOGY BOUNDARY RESIDUAL NORTHLAND ALLOCTHON TAURANGA GROUP ALLUVIUM 1. EXISTING GROUND PROFILE ADAPTED FROM xP24-128_Milldale Original Contours. 2. DESIGN PROFILE ADAPTED FROM Milldale FastTrack 3d contours 20012025. TRANSITIONAL HUKERENUI MUDSTONE 1. EXISTING GROUND PROFILE ADAPTED FROM xP24-128_Milldale Original Contours. 2. DESIGN PROFILE ADAPTED FROM Milldale FastTrack 3d contours 20012025. 3. VERTICAL DATUM IN TERMS OF AUCKHT1946. 4. TEST LOCATIONS ARE INDICATIVE ONLY. UNDIFFERENTIATED MANGAKAHIA UNDIFFERENTIATED MANGAKAHIA ROCK MASS 0. 7.5 15 22.5 30 37.5 m MAHURANGI LIMESTONE VERT. 1:750



			PRI	NI IN COLOUR
FULTON HOGAN LAND DEVELOPMENT LTD	DRAWN:	JRS	PROJEC1	г: AKL2024-0257
PROJECT:	CHECKED	MC	DRAWING	G: 11
MILLDALE - FAST TRACK APPLICATION	REVISION:	0	SCALE:	AS SHOWN
CROSS SECTION G	DATE:	03/02/2025	SHEET:	A3 L

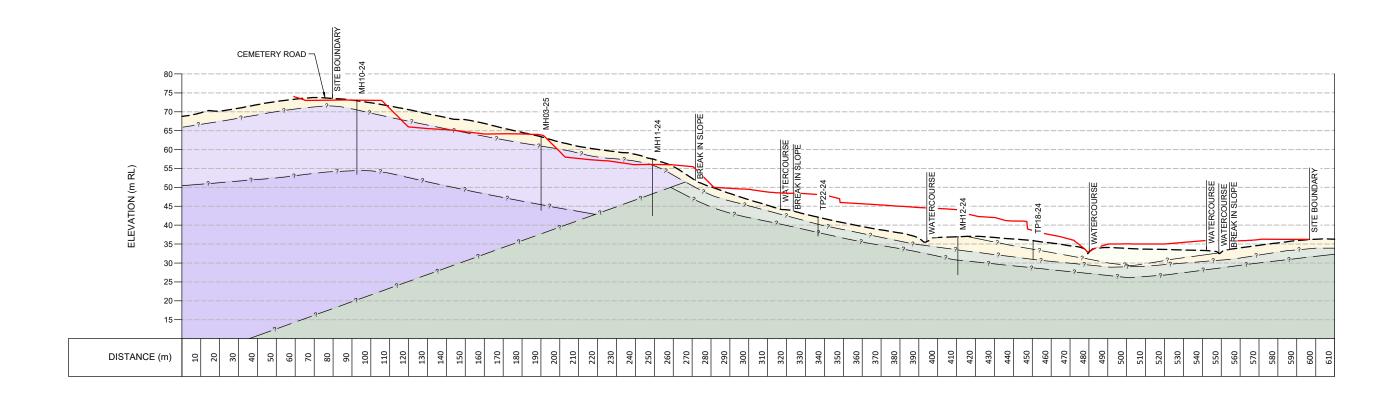


CROSS SECTION H





			PRII	NT IN COLOUR
FULTON HOGAN LAND DEVELOPMENT LTD	DRAWN:	JRS	PROJECT	AKL2024-0257
PROJECT:	CHECKED:	MC	DRAWING	5: 12
MILLDALE - FAST TRACK APPLICATION	REVISION:	0	SCALE:	AS SHOWN
CROSS SECTION H	DATE:	03/02/2025	SHEET:	A3 L



CROSS SECTION I

EXISTING GROUND PROFILE DESIGN PROFILE INFERRED GEOLOGY BOUNDARY RESIDUAL NORTHLAND ALLOCTHON TAURANGA GROUP ALLUVIUM TRANSITIONAL HUKERENUI MUDSTONE HUKERENUI MUDSTONE TRANSITIONAL UNDIFFERENTIATED MANGAKAHIA

UNDIFFERENTIATED MANGAKAHIA ROCK MASS

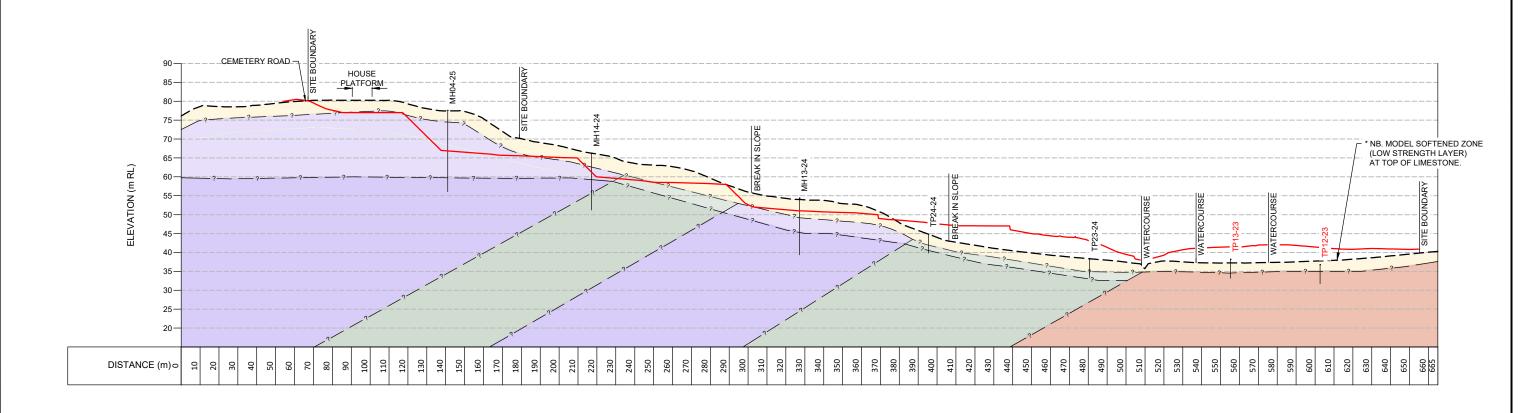
LEGEND:

- EXISTING GROUND PROFILE ADAPTED FROM xP24-128_Milldale Original Contours.
 DESIGN PROFILE ADAPTED FROM Milldale FastTrack 3d contours 20012025.
 VERTICAL DATUM IN TERMS OF AUCKHT1946.
 TEST LOCATIONS ARE INDICATIVE ONLY.





			PRII	NT IN COLOUR
FULTON HOGAN LAND DEVELOPMENT LTD	DRAWN:	JRS	PROJECT	 AKL2024-0257
PROJECT:	CHECKED:	MC	DRAWING	3: 13
MILLDALE - FAST TRACK APPLICATION	REVISION:	0	SCALE:	AS SHOWN
CROSS SECTION I	DATE:	03/02/2025	SHEET:	A3 L



CROSS SECTION J

LEGEND: - - - EXISTING GROUND PROFILE DESIGN PROFILE - - - INFERRED GEOLOGY BOUNDARY RESIDUAL NORTHLAND ALLOCTHON TRANSITIONAL HUKERENUI MUDSTONE HUKERENUI MUDSTONE TRANSITIONAL UNDIFFERENTIATED MANGAKAHIA UNDIFFERENTIATED MANGAKAHIA ROCK MASS MAHURANGI LIMESTONE EXISTING GROUND PROFILE ADAPTED FROM xP24-128 Milldale Original Contours. DESIGN PROFILE ADAPTED FROM Mildale FastTrack 3d contours 20012025. TEST LOCATIONS ARE INDICATIVE ONLY. HORI. 1:2000 VERT. 1:1000



			PRI	NT IN COLOUR
CLIENT: FULTON HOGAN LAND DEVELOPMENT LTD	DRAWN:	JRS	PROJEC1	T: AKL2024-0257
PROJECT:	CHECKED:	MC	DRAWING	3: 14
MILLDALE - FAST TRACK APPLICATION	REVISION:	0	SCALE:	AS SHOWN
TITLE: CROSS SECTION J	DATE:	03/02/2025	SHEET:	A3 L



CROSS SECTION K (F STAGE 7)



NOTES:

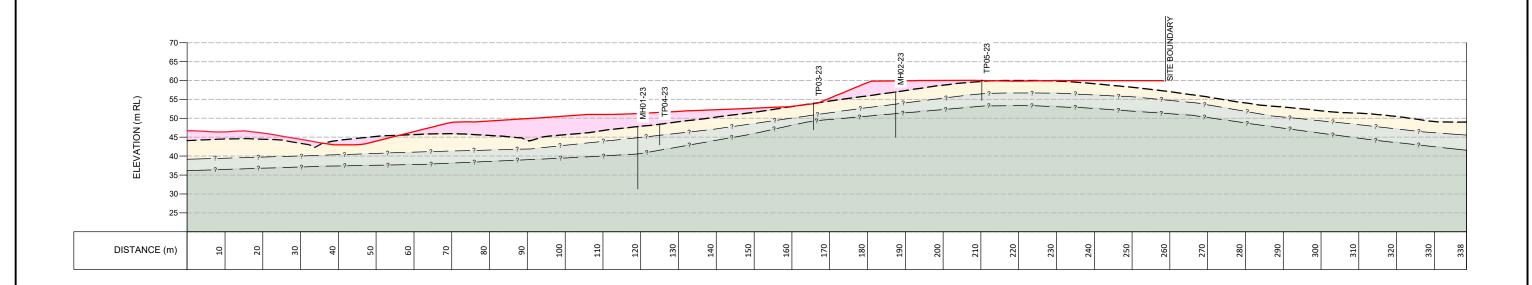
EXISTING GROUND PROFILE ADAPTED FROM xP24-128_Milldale Original Contours.
 DESIGN PROFILE ADAPTED FROM Milldale FastTrack 3d contours 20012025.
 VERTICAL DATUM IN TERMS OF AUCKHT1946.
 TEST LOCATIONS ARE INDICATIVE ONLY.

1:1000

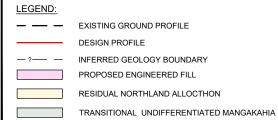


			PRINT	IN COLOUR
FULTON HOGAN LAND DEVELOPMENT LTD	DRAWN:	JRS	PROJECT: AK	L2024-0257
PROJECT:	CHECKED:	MC	DRAWING:	15
MILLDALE - FAST TRACK APPLICATION	REVISION:	0	SCALE:	1:1000
CROSS SECTION K	DATE:	03/02/2025	SHEET:	A3 L

C:\Users\JohnSaguinsin\OneDrive - CMW Geosciences Pty Ltd\Documents\Project 2024\AUCKLAND\AKL2024-0257 Milldale Fast Track\DWG\AKL2024-0257-PLAN AND SECTIONS_03.02.2025.dwg



CROSS SECTION L (D STAGE 7)

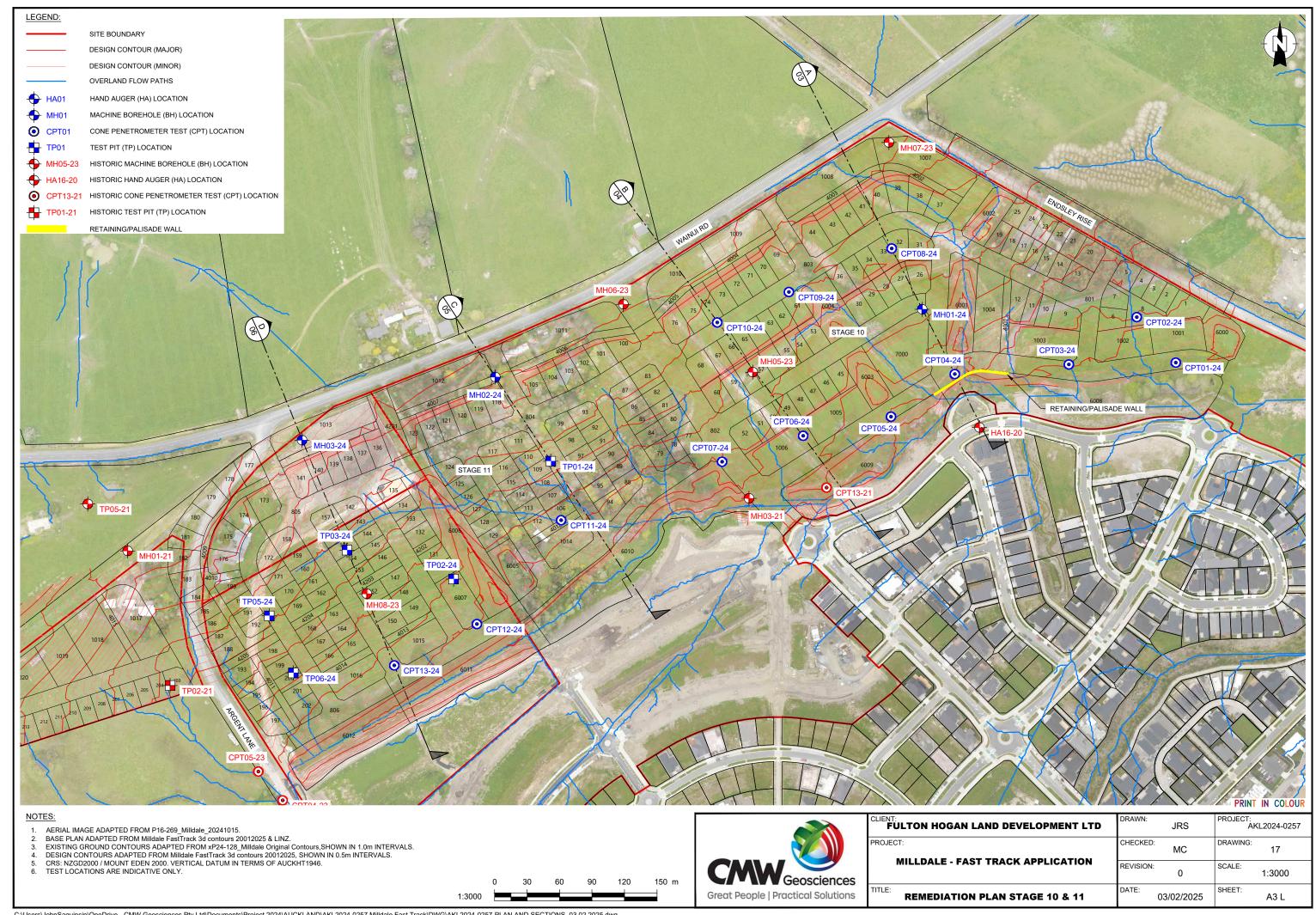


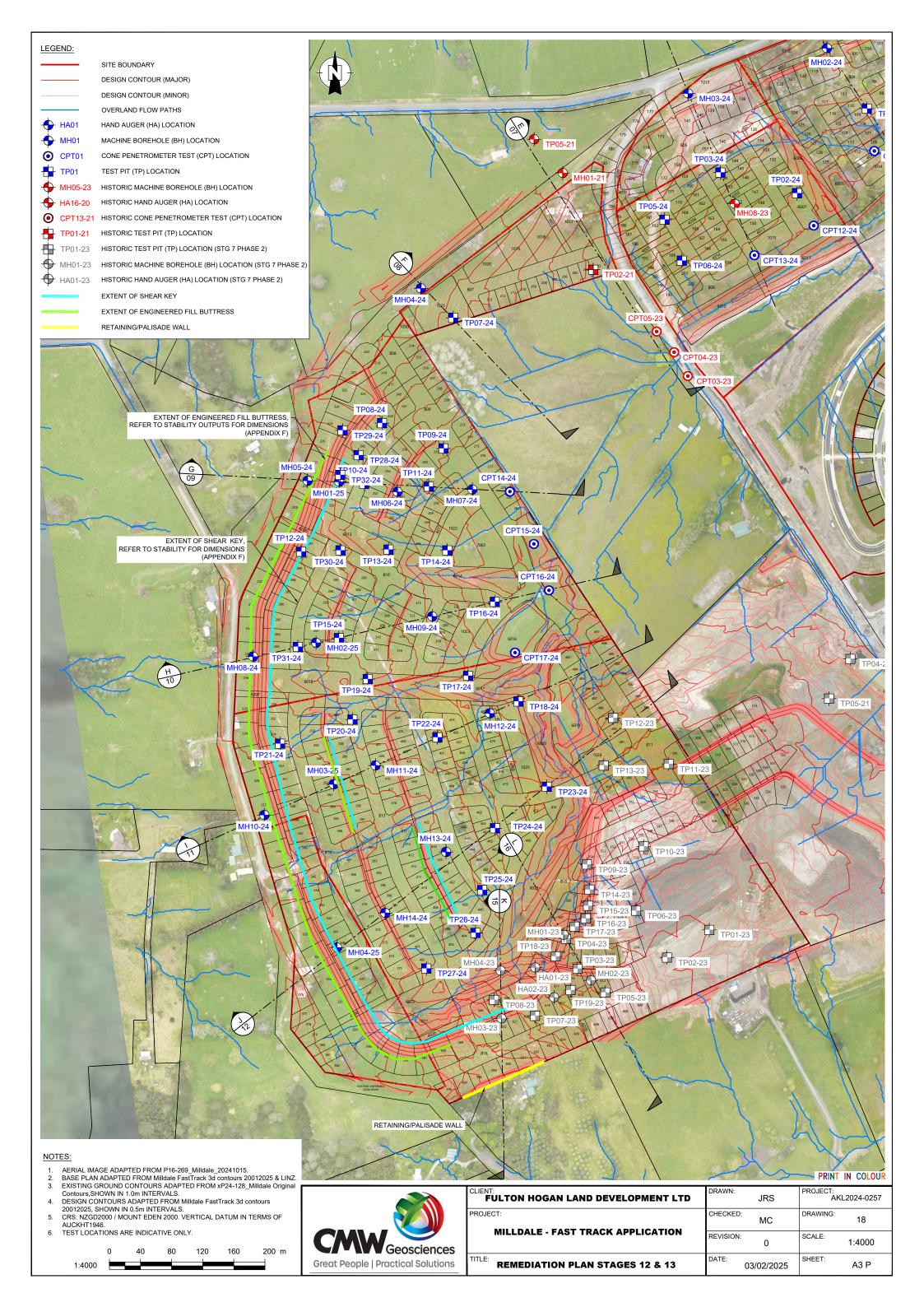
UNDIFFERENTIATED MANGAKAHIA (NORTHLAND ALLOCHTON ROCK)

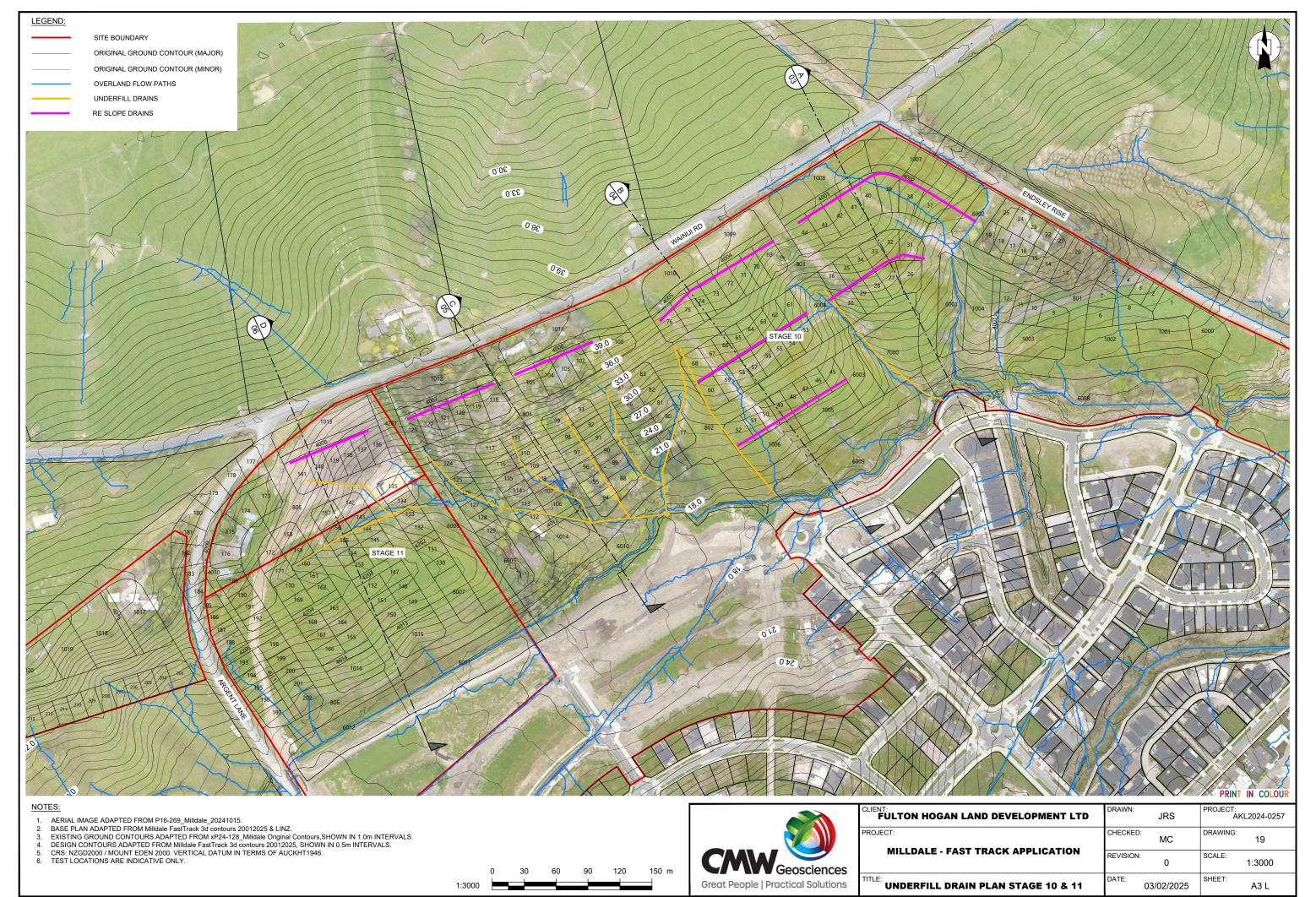
- EXISTING GROUND PROFILE ADAPTED FROM xP24-128_Milldale Original Contours.
 DESIGN PROFILE ADAPTED FROM Milldale FastTrack 3d contours 20012025.
 VERTICAL DATUM IN TERMS OF AUCKHT1946.
 TEST LOCATIONS ARE INDICATIVE ONLY.



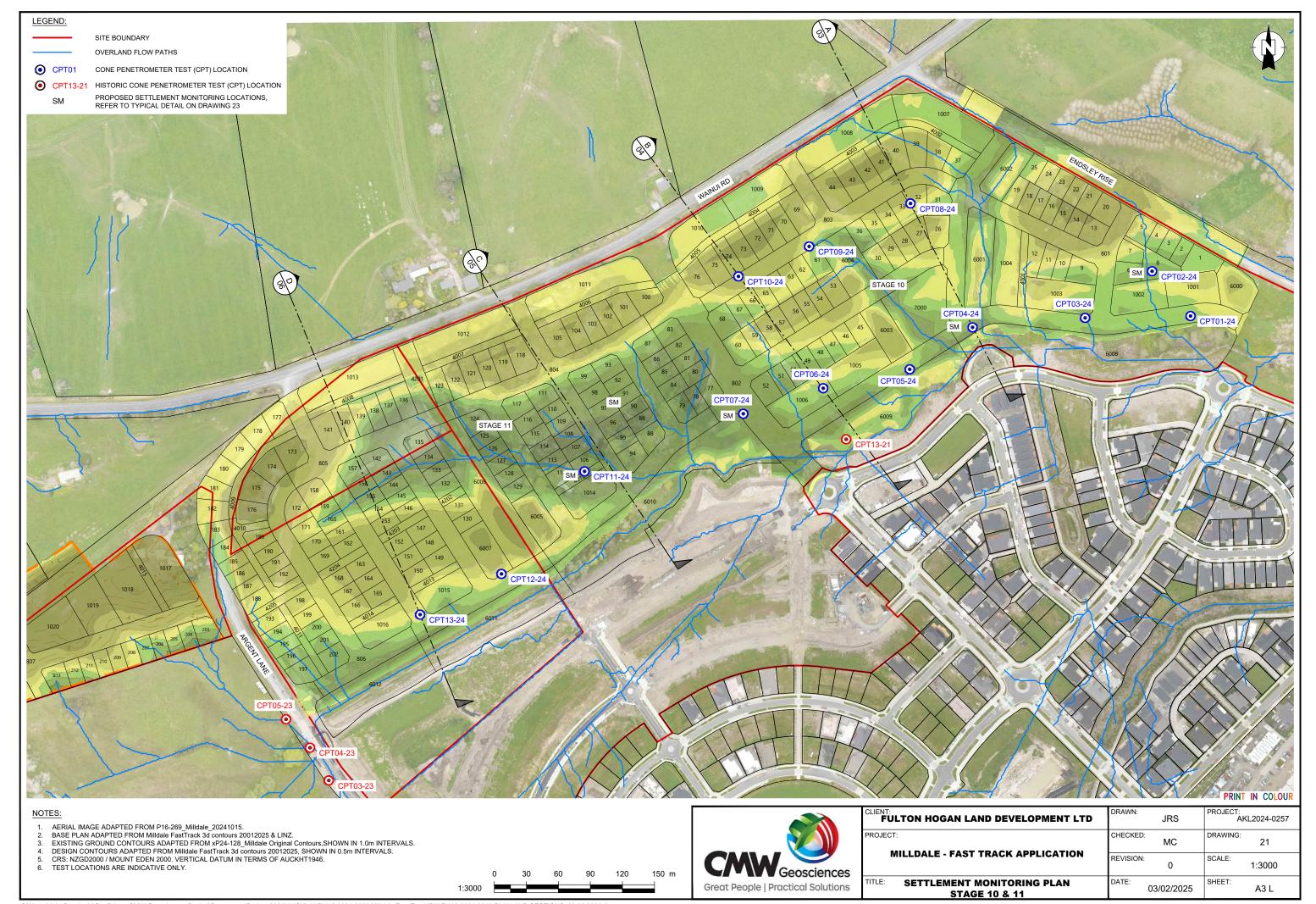
			PRINT	IN COLOUR
CLIENT: FULTON HOGAN LAND DEVELOPMENT LTD	DRAWN:	JRS	PROJECT: AK	L2024-0257
PROJECT: MILLDALE - FAST TRACK APPLICATION	CHECKED:	MC	DRAWING:	16
MILLDALE - FAST TRACK APPLICATION	REVISION:	0	SCALE:	1:1000
TITLE: CROSS SECTION L	DATE:	03/02/2025	SHEET:	A3 L



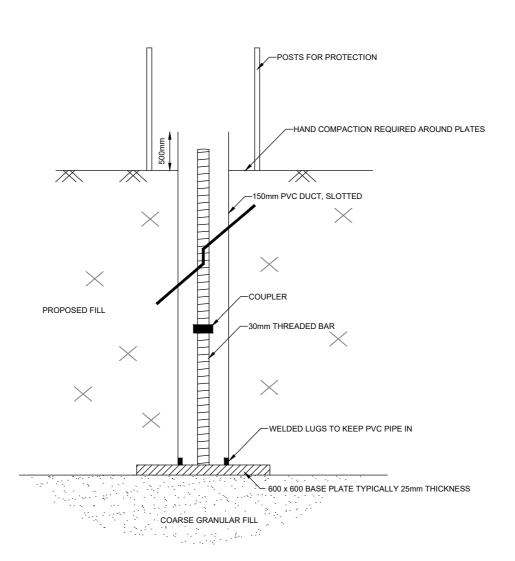






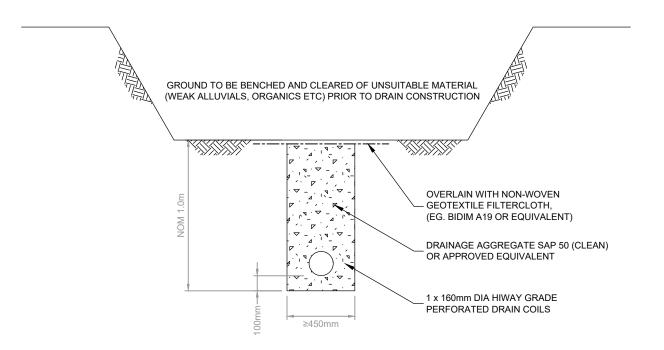






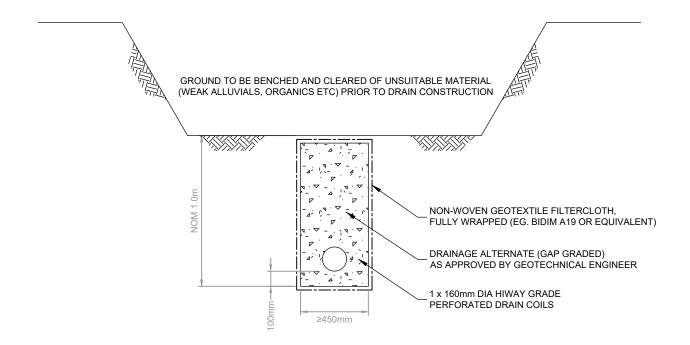


FULTON HOGAN LAND DEVELOPMENT LTD	DRAWN: JRS	PROJECT No: AKL2024-0257
PROJECT:	CHECKED: MC	DRAWING: 23
MILLDALE - FAST TRACK APPLICATION	REVISION: 0	SCALE: NTS
SETTLEMENT PLATE DETAIL	DATE: 03/02/2025	SHEET: A4P



TYPICAL UNDERFILL DRAIN DETAIL

NOT TO SCALE



ALTERNATE UNDERFILL DRAIN DETAIL

NOT TO SCALE



CLIENT: FULTON HOGAN LAND DEVELOPMENT LTD	DRAWN:	JRS	PROJEC1	T: AKL2024-0257
PROJECT: MILLDALE - FAST TRACK APPLICATION	CHECKED:	MC	FIGURE:	24
WILLDALE - FAST TRACK APPLICATION	REVISION:	0	SCALE:	NTS
TITLE: UNDERFILL DRAIN DETAIL	DATE:	03/02/2025	SHEET:	A3

GENERAL NOTES:

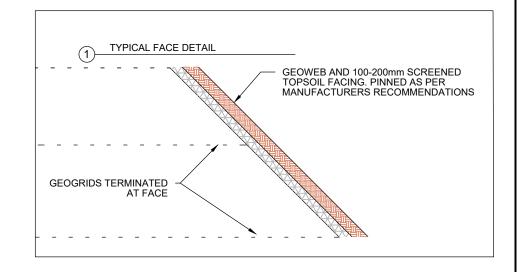
- 1. GEOGRID TO BE PLACED FLAT OR WITH 1% FALL TO REAR OF WALL, GRID SHOULD BE FREE OF WRINKLES AND LIGHTLY TENSIONED PRIOR TO AND DURING PLACEMENT OF FILL.
- 2. CARE MUST BE TAKEN TO ENSURE ADEQUATE TENSIONING OF THE GRID WHERE IT IS WRAPPED UP THE FACE
- 3. WHERE GRIDS OVERLAP MORE THAN 1 METRE ON CURVED WALLS, 100MM OF FILL SHALL BE PLACED BETWEEN THE GRIDS
- 4. RUBBER TIRED VEHICLES MAY PASS OVER THE GRID AT SLOW SPEEDS, A MINIMUM OF150mm OF FILL SHALL BE PLACED ON THE GRID PRIOR TO TRAFFICKING BY TRACKED VEHICLES. EXTRA CARE MUST BE TAKEN WHEN USING SHEEPSFOOT TYPE COMPACTORS TO ENSURE THE GRID IS NOT DAMAGED DURING COMPACTION.
- 5. CONTRACTOR TO ENSURE GRIDS ARE PLACED IN THE CORRECT ORIENTATION. GRID SHOULD BE ROLLED OUT PERPENDICULAR TO THE WALL/ SLOPE FACE.
- 6. GRID LAYERS MUST BE CONTINUOUS OVER THE DESIGN EMBEDMENT LENGTH. NO JOINS ARE PERMITTED PARALLEL TO THE FACE. LAPS PERPENDICULAR TO THE FACE ARE TO OVERLAP BY 100MM.

ENGINEERED FILL BUTTRESS TO BE CONSTRUCTED BY OVER EXCAVATING AND REPLACING WITH ENGINEERED FILL AT 1V:2H (PARALLEL TO SLOPE FACE). LOCATIONS SHOWN ON DG18. PRELIMINARY DESIGN WIDTHS SHOWN ON TABLE

7. ONLY HAND OPERATED EQUIPMENT TO BE OPERATED WITHIN 1 METRE OF THE FACE OF THE WALL.

INSPECTION HOLD POINTS

- BASE OF UNDERCUT
- 2. DRAINAGE INSTALLATION PRIOR TO BACKFILL
- 3. GRID LAYER PLACEMENT PRIOR TO BACKFILL
- 4. COMPACTION TEST ON EACH 1M LIFT PRIOR TO PLACING NEXT GRID LAYER
- 5. OVERALL LENGTH OF EXCAVATION OPEN AT ANY GIVEN TIME, PLUS HEIGHT OF BACKFILL BEFORE NEXT SECTION OF EXCAVATION COMMENCED TO BE DISCUSSED AND AGREED ON SITE BY CLIENT, CONTRACTOR, ENGINEER TO CONTRACT AND GEOTECHNICAL ENGINEER



GRID TYPE EMBEDMENT DEPTH **VERTICAL SPACING** L (m) S (m) PRIMARY 4.0 1.5



PRELIMINARY FILL BUTTRESS WIDTHS (FORMED AT 1V:2H, PARALLEL TO SLOPE FACE)

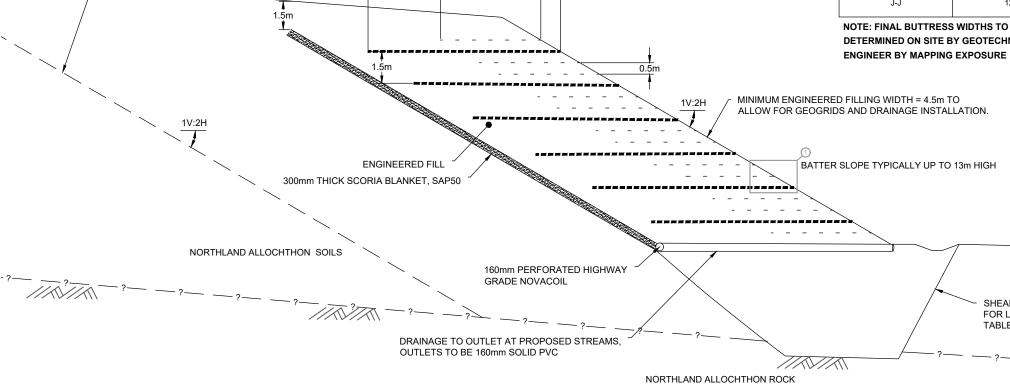
UPPER RE SLOPE			
CROSS SECTION	WIDTH (m)		
G-G	26		
н-н	17		
I-I	13		
J-J	20.5		
MID RE SLOPE			
1-1	8		
LOWER RE SLOPE			
J-J	12		
·			

NOTE: FINAL BUTTRESS WIDTHS TO BE DETERMINED ON SITE BY GEOTECHNICAL

DDEI IMINIADY QUEAD KEY WIDTH AND DEDTHS

PRELIMINARY SHEAR KE	I WIDTH AND DEFTING	
BELOW UPPER RE SLOPE		
CROSS SECTION	BASE WIDTH (m)	DEPTH (m)
G-G	19.5	5
н-н	17	5
1-1	10	6
J-J	14	7
BELOW MID RE SLOPE		
I-I	10	4.5
K-K	12	4.5
BELOW LOWER RE SLOPE		
J-J	12	4.5

NOTE: FINAL SHEAR KEY DEPTHS TO BE DETERMINED ON SITE BY GEOTECHNICAL ENGINEER, MINIMUM EMBEDMENT INTO NORTHLAND ALLOCHTHON ROCK = 0.5m



SHEAR KEYS AS REQUIRED, REFER TO DRAWING 18 FOR LOCATIONS AND PRELIMINARY DIMENSIONS ON

NOTE:

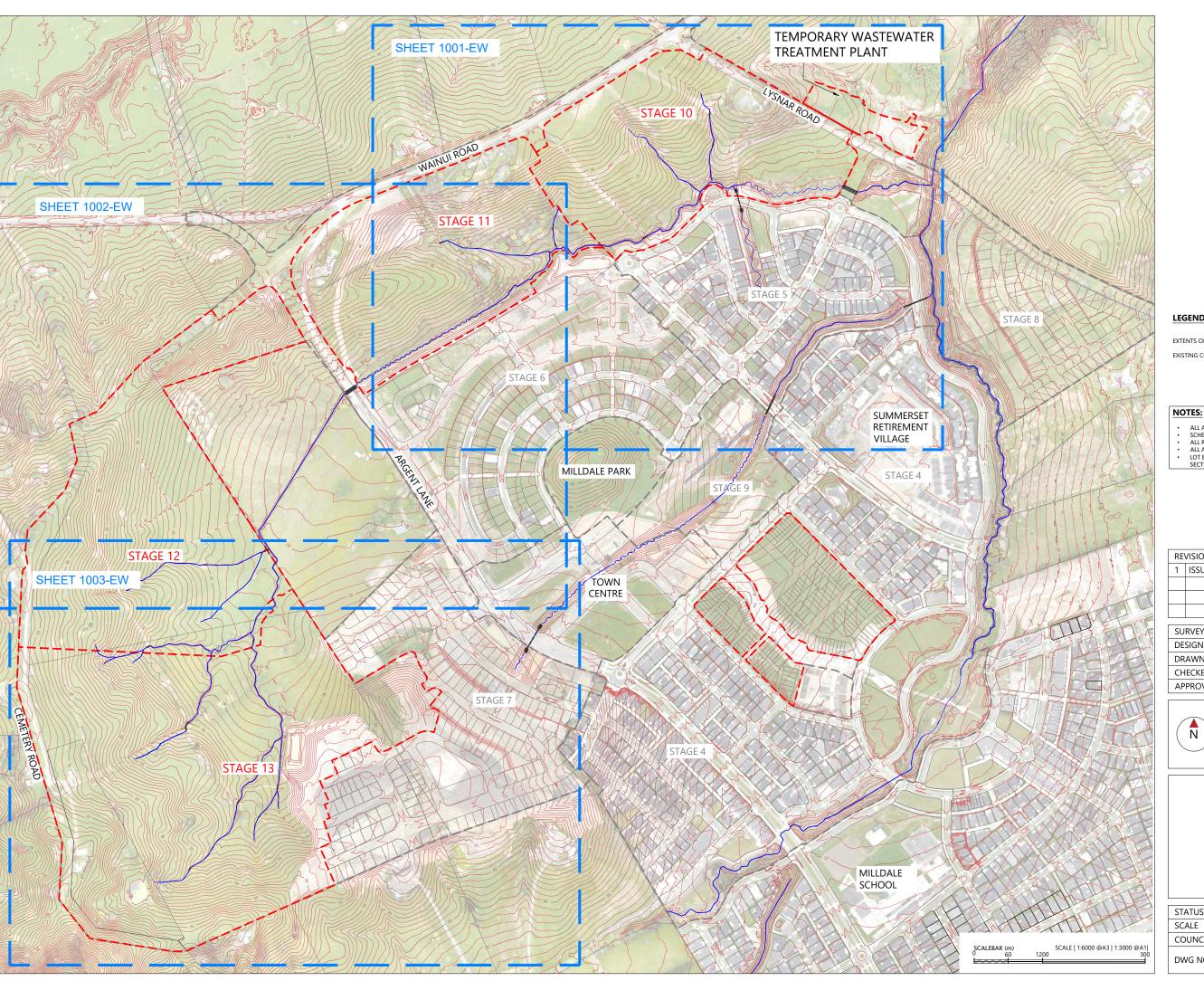
ALL DIMENSIONS ARE IN METRES UNLESS NOTED OTHERWISE



CLIENT: FULTON HOGAN LAND DEVELOPMENT LTD	DRAWN:	JRS	PROJECT: AK	L2024-0257
PROJECT:	CHECKED:	CR	DRAWING:	25
MILLDALE - FAST TRACK APPLICATION	REVISION:	0	SCALE:	NTS
TITLE: TYPICAL REINFORCED EARTH BATTER SLOPE	DATE:	03/02/2025	SHEET:	А3



Appendix B: Woods Limited Development Plans





EXTENTS OF FAST TRACK APPLICATION

EXISTING CONTOUR (1m)

- ALL AREAS AND DIMENSIONS ARE SUBJECT TO FINAL SURVEY SCHEME PLAN IS SUBJECT TO COUNCIL APPROVAL ALL ROADS TO VEST IN AUCKLAND COUNCIL ALL ACCESSWAYS TO VEST IN AUCKLAND COUNCIL LOT 8 DP 136559 COMPRISED IN CT NA80C/106 IS SUBJECT TO SECTION 206 LAND ACT 1924

	RE'	VISION DETAILS	BY	DATE	70 UR
	1	ISSUED FOR INFORMATION	JW	OCT 2024	O
					STING
					EXIS
					-EW-

SURVEYED	WOODS	SIDWELL ROAD
DESIGNED	WOODS	WAINUI
DRAWN	FA	AUCKLAND
CHECKED	JW	
APPROVED	JW	WOODS.CO.NZ

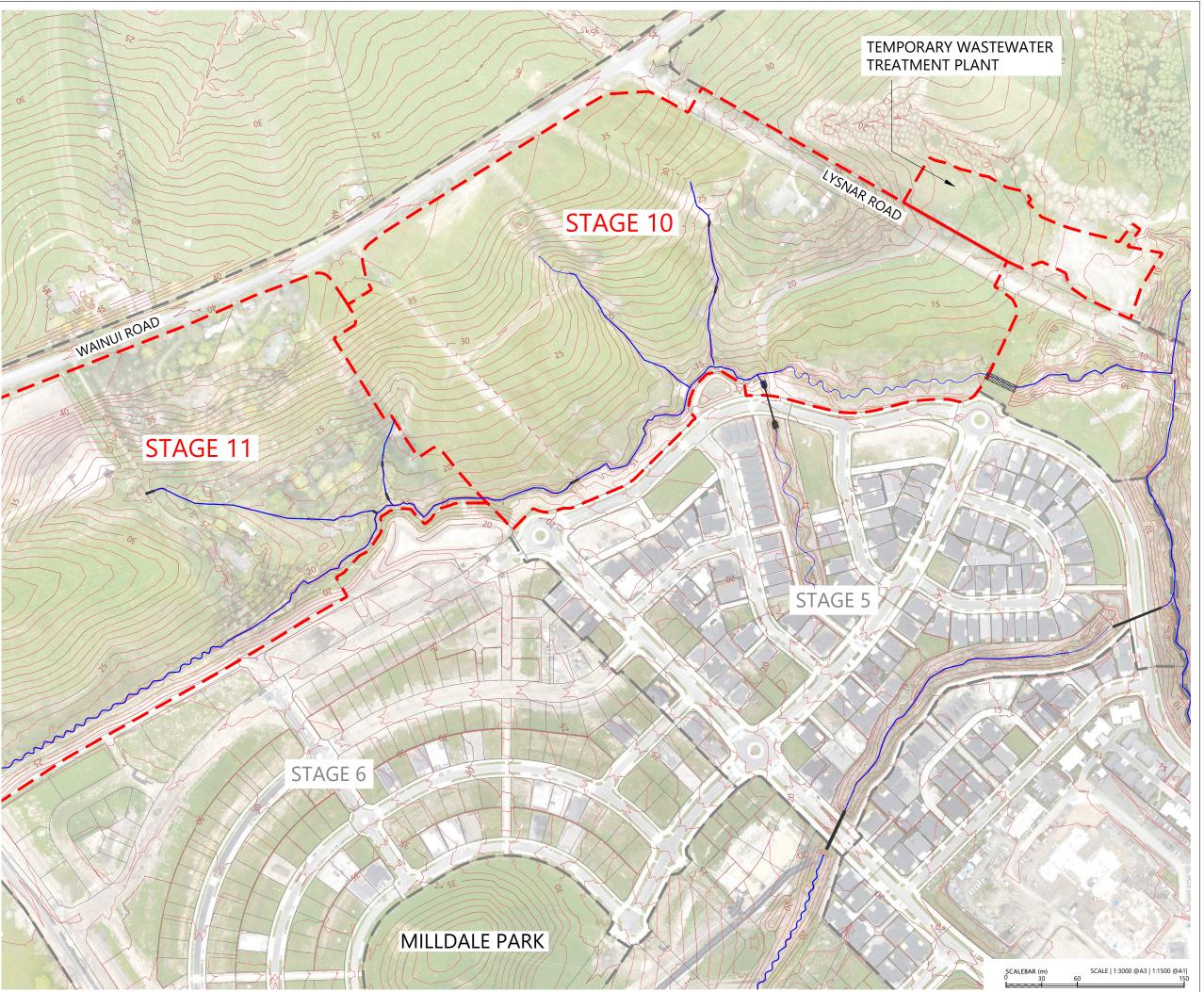




MILLDALE FAST TRACK STAGES 10 - 13

EXISTING CONTOUR LAYOUT OVERALL PLAN

STATUS	ISSUED FOR INFORMATION	REV	DAT/
SCALE	1:6000 @ A3	1	RGY
COUNCIL	AUCKLAND COUNCIL	'	SYNE
DWG NO	P24-128-00-1000-EW	/	File: C:\12D







LOCALITY PLAN N.T.S





- ALL AREAS AND DIMENSIONS ARE SUBJECT TO FINAL SURVEY
 SCHEME PLAN IS SUBJECT TO COUNCIL APPROVAL
 ALL ROADS TO VEST IN AUCKLAND COUNCIL
 ALL ACCESSWAYS TO VEST IN AUCKLAND COUNCIL
 LOT 8 DP 136559 COMPRISED IN CT NA80C/106 IS SUBJECT TO SECTION 206 LAND ACT 1924

RE	VISION DETAILS	BY	DATE
1	ISSUED FOR INFORMATION	JW	OCT 2024

SURVEYED	WOODS	SIDWELL ROAD
DESIGNED	WOODS	WAINUI
DRAWN	FA	AUCKLAND
CHECKED	JW	
APPROVED	JW	WOODS.CO.NZ





MILLDALE FAST TRACK STAGES 10 - 13

EXISTING CONTOUR LAYOUT PLAN SHEET 1

_			
	STATUS	ISSUED FOR INFORMATION	REV
	SCALE	1:3000 @ A3	1
	COUNCIL	AUCKLAND COUNCIL	ı
	DWG NO	P24-128-00-1001-EW	/

BV DATE €





LOCALITY PLAN N.T.S



EXISTING CONTOUR (1m)



- ALL AREAS AND DIMENSIONS ARE SUBJECT TO FINAL SURVEY SCHEME PLAN IS SUBJECT TO COUNCIL APPROVAL ALL ROADS TO VEST IN AUCKLAND COUNCIL ALL ACCESSWAYS TO VEST IN AUCKLAND COUNCIL LOT 8 DP 136559 COMPRISED IN CT NA80C/106 IS SUBJECT TO SECTION 206 LAND ACT 1924

					. =
	RE'	VISION DETAILS	BY	DATE	TOLIR
	1	ISSUED FOR INFORMATION	JW	OCT 2024	NC
					ING
					-EXIST
I					່∣≥່

SURVEYED	WOODS	SIDWELL ROAD
DESIGNED	WOODS	WAINUI
DRAWN	FA	AUCKLAND
CHECKED	JW	
APPROVED	JW	WOODS.CO.NZ





MILLDALE FAST TRACK STAGES 10 - 13

EXISTING CONTOUR LAYOUT PLAN SHEET 2

STATUS	ISSUED FOR INFORMATION	REV
SCALE	1:3000 @ A3	1
COUNCIL	AUCKLAND COUNCIL	I
DWG NO	P24-128-00-1002-EW	1





LOCALITY PLAN N.T.S

EXTENTS OF FAST TRACK APPLICATION

EXISTING CONTOUR (1m)

NOTES:

- ALL AREAS AND DIMENSIONS ARE SUBJECT TO FINAL SURVEY
 SCHEME PLAN IS SUBJECT TO COUNCIL APPROVAL
 ALL ROADS TO VEST IN AUCKLAND COUNCIL
 ALL ACCESSWAYS TO VEST IN AUCKLAND COUNCIL
 LOT 8 DP 136559 COMPRISED IN CT NA80C/106 IS SUBJECT TO SECTION 206 LAND ACT 1924

				. =
RE'	VISION DETAILS	BY	DATE	TOUR
1	ISSUED FOR INFORMATION	JW	OCT 2024	.N
				ING.
				EXIST
				1≥

SURVEYED	WOODS	SIDWELL ROAD
DESIGNED	WOODS	WAINUI
DRAWN	FA	AUCKLAND
CHECKED	JW	
APPROVED	JW	WOODS.CO.NZ

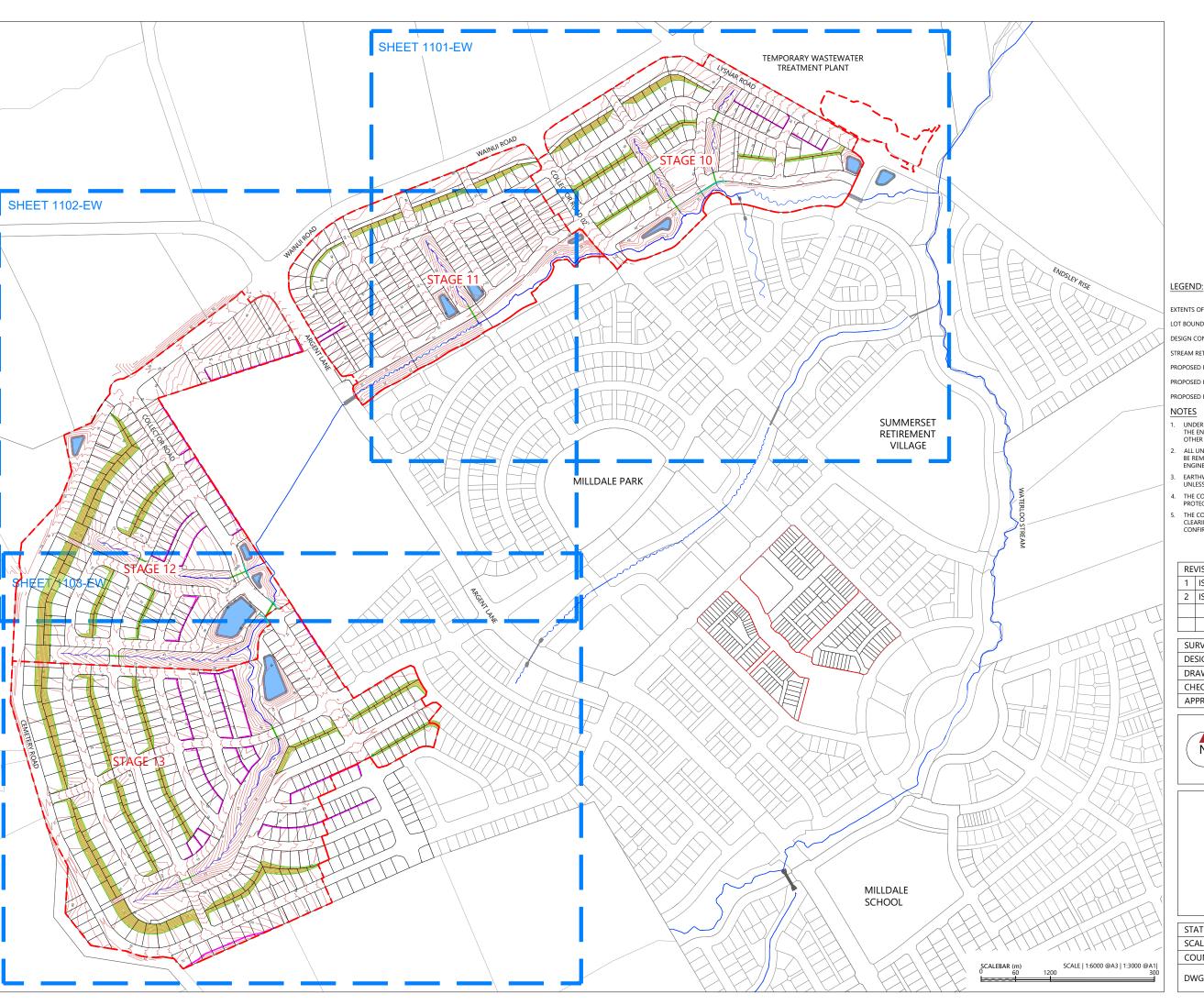




MILLDALE FAST TRACK STAGES 10 - 13

EXISTING CONTOUR LAYOUT PLAN SHEET 3

STATUS	ISSUED FOR INFORMATION	REV
SCALE	1:3000 @ A3	1
COUNCIL	AUCKLAND COUNCIL	ı
DWG NO	P24-128-00-1003-EW	I





LOT BOUNDARIES OF FAST TRACK APPLICATION

DESIGN CONTOUR (1m)

STREAM RETAINED AND ENHANCED

PROPOSED RETAINING WALL

PROPOSED HEADWALL

PROPOSED RE SLOPES

- UNDERFILL DRAINAGE IS TO BE INSTALLED AT THE DIRECTION OF THE ENGINEER. IF THE CONTRACTOR ENCOUNTERS SPRINGS OR OTHER SOURCES OF WATER HE IS TO NOTIFY THE ENGINEER.
- ALL UNSUITABLE MATERIAL AS DEFINED IN THE SPECIFICATION IS TO BE REMOVED AND THE STRIPPED AREAS INSPECTED BY THE ENGINEER BEFORE COMMENCES.
- EARTHWORKS ARE NOT TO BE EXTENDED INTO ADJOINING SITES UNLESS THE ENGINEER HAS ISSUED SPECIFIC INSTRUCTIONS.
- 4. THE CONTRACTOR IS RESPONSIBLE FOR IDENTIFYING AND PROTECTING EXISTING SERVICES AND DRAINAGE ON SITE.
- THE CONTRACTOR SHALL CLARIFY THE AREAS AND EXTENT OF CLEARING WITH THE ENGINEER BEFORE COMMENCEMENT AND CONFIRM THAT ALL NECESSARY CONSENTS ARE IN PLACE.

RE	VISION DETAILS	BY	DATE	I R
1	ISSUED FOR INFORMATION	TGB	DEC 2024	DNT
2	ISSUED FOR INFORMATION	TGB	JAN 2025	ONS
				-DESIGN
				1 ≥

SURVEYED	WOODS	SIDWELL ROAD	5
DESIGNED	WOODS	WAINUI	130
DRAWN	FA	AUCKLAND	00 00 00 00
CHECKED	JW		
APPROVED	JW	WOODS.CO.NZ	500





MILLDALE FAST TRACK STAGES 10 - 13

DESIGN CONTOUR LAYOUT OVERALL PLAN

STATUS	ISSUED FOR INFORMATION	REV
SCALE	1:6000 @ A3	2
COUNCIL	AUCKLAND COUNCIL	
DWG NO	P24-128-00-1100-EW	1







LOCALITY PLAN N.T.S

LOT BOUNDARIES OF FAST TRACK APPLICATION

DESIGN CONTOUR (1m)

STREAM RETAINED AND ENHANCED

PROPOSED RETAINING WALL

PROPOSED HEADWALL

PROPOSED RE SLOPES

NOTES

- UNDERFILL DRAINAGE IS TO BE INSTALLED AT THE DIRECTION OF THE ENGINEER. IF THE CONTRACTOR ENCOUNTERS SPRINGS OR OTHER SOURCES OF WATER HE IS TO NOTIFY THE ENGINEER.
- ALL UNSUITABLE MATERIAL AS DEFINED IN THE SPECIFICATION IS TO BE REMOVED AND THE STRIPPED AREAS INSPECTED BY THE ENGINEER BEFORE COMMENCES.
- 3. EARTHWORKS ARE NOT TO BE EXTENDED INTO ADJOINING SITES UNLESS THE ENGINEER HAS ISSUED SPECIFIC INSTRUCTIONS.
- 4. THE CONTRACTOR IS RESPONSIBLE FOR IDENTIFYING AND PROTECTING EXISTING SERVICES AND DRAINAGE ON SITE.
- THE CONTRACTOR SHALL CLARIFY THE AREAS AND EXTENT OF CLEARING WITH THE ENGINEER BEFORE COMMENCEMENT AND CONFIRM THAT ALL NECESSARY CONSENTS ARE IN PLACE.

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REVISION DETAILS			DATE	J.R.
1	ISSUED FOR INFORMATION	TGB	DEC 2024	ONTC
2	ISSUED FOR INFORMATION	TGB	JAN 2025	GNC
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SURVEYED	WOODS	SIDWELL ROAD	.00-1
DESIGNED	WOODS	WAINUI	-128
DRAWN	FA	AUCKLAND	ENG\P24-
CHECKED	JW		
APPROVED	JW	WOODS.CO.NZ	GS\01

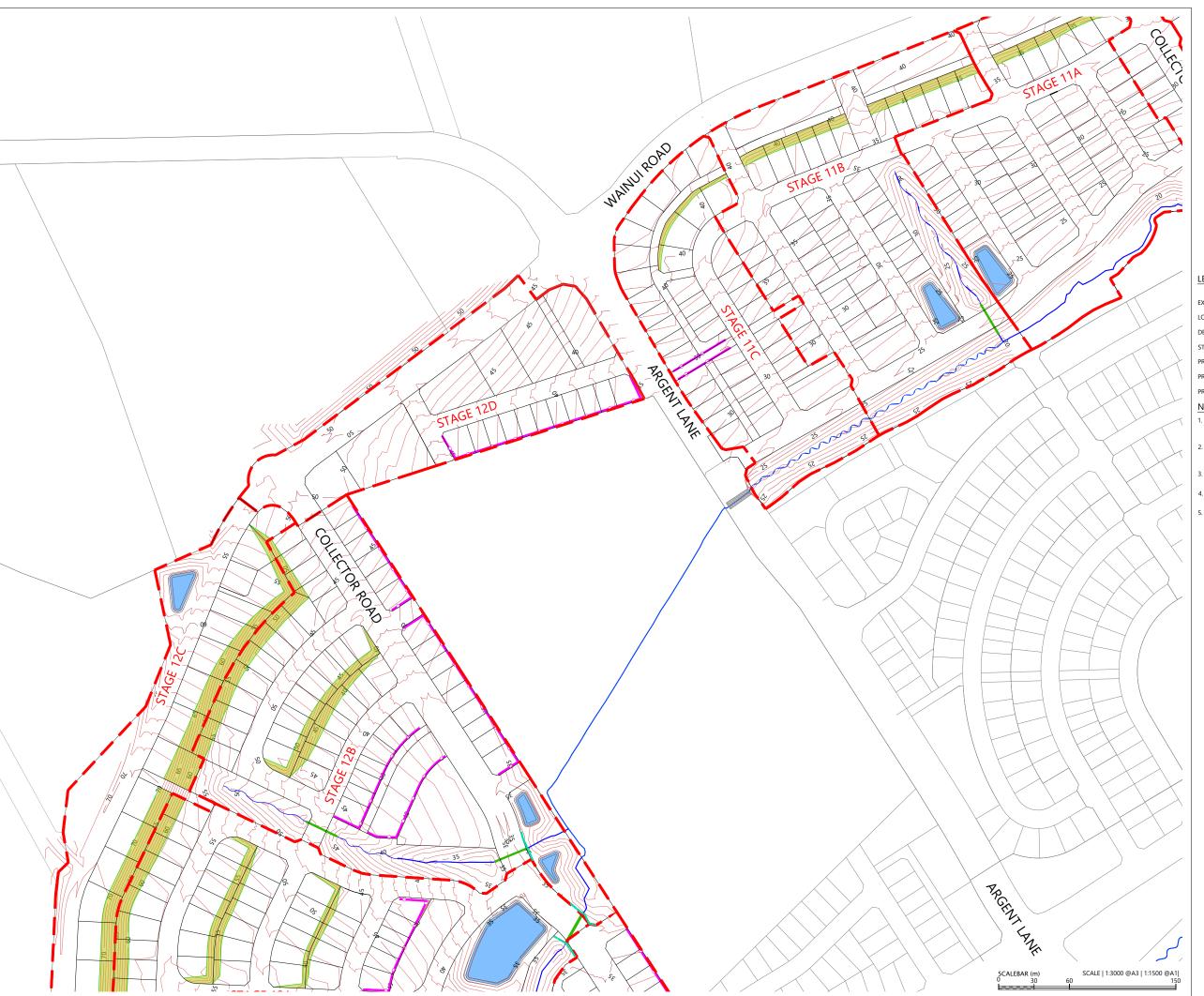




MILLDALE FAST TRACK STAGES 10 - 13

DESIGN CONTOUR LAYOUT PLAN SHEET 1

STATUS	ISSUED FOR INFORMATION	REV
SCALE	1:3000 @ A3	2
COUNCIL	AUCKLAND COUNCIL	۷
DWG NO	P24-128-00-1101-EW	







LOCALITY PLAN N.T.S

EXTENTS OF FAST TRACK APPLICATION

LOT BOUNDARIES OF FAST TRACK APPLICATION

DESIGN CONTOUR (1m)

STREAM RETAINED AND ENHANCED

PROPOSED RETAINING WALL

PROPOSED HEADWALL

PROPOSED RE SLOPES

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SURVEYED	WOODS	SIDWELL ROAD	-00-1
DESIGNED	WOODS	WAINUI	128
DRAWN	FA	AUCKLAND	FNG\P24-128-00-
CHECKED	JW		_
APPROVED	JW	WOODS.CO.NZ	165\01





MILLDALE FAST TRACK STAGES 10 - 13

DESIGN CONTOUR LAYOUT PLAN SHEET 2

STATUS	ISSUED FOR INFORMATION	REV
SCALE	1:3000 @ A3	2
COUNCIL	AUCKLAND COUNCIL	۷
DWG NO	P24-128-00-1102-EW	

-1100-EW-DESIGN CONTOUR LAYOUT PLAN .DWG







LOCALITY PLAN N.T.S

EXTENTS OF FAST TRACK APPLICATION

LOT BOUNDARIES OF FAST TRACK APPLICATION

DESIGN CONTOUR (1m)

STREAM RETAINED AND ENHANCED

PROPOSED RETAINING WALL

PROPOSED RE SLOPES

NOTES

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SURVEYED	WOODS	SIDWELL ROAD
DESIGNED	WOODS	WAINUI
DRAWN	FA	AUCKLAND
CHECKED	JW	
APPROVED	JW	WOODS.CO.NZ

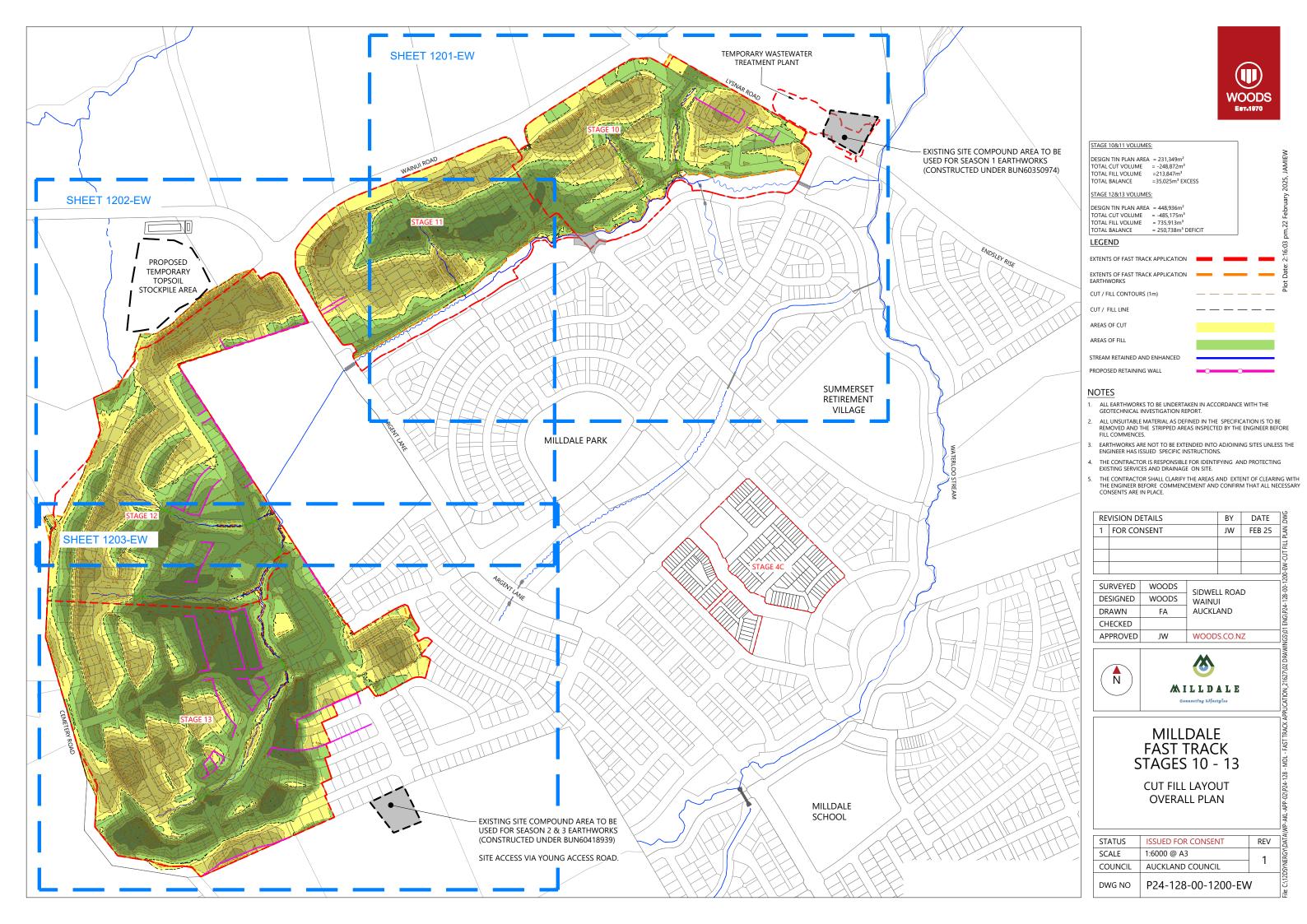


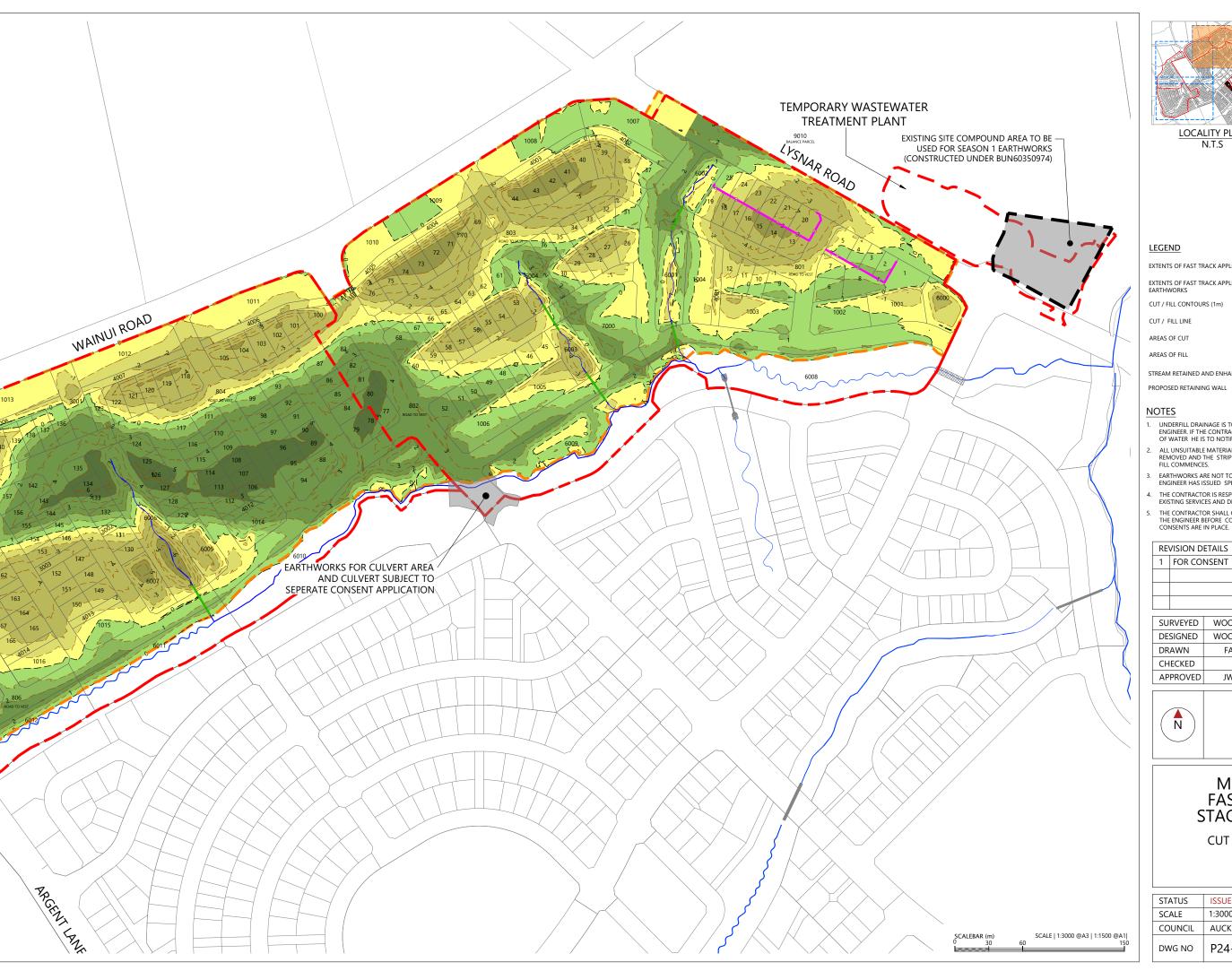


MILLDALE FAST TRACK STAGES 10 - 13

DESIGN CONTOUR LAYOUT PLAN SHEET 3

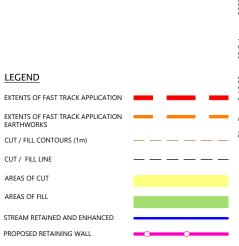
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STATUS	ISSUED FOR INFORMATION	REV
SCALE	1:3000 @ A3	2
COUNCIL	AUCKLAND COUNCIL	
DWG NO P24-128-00-1103-EW		/











- 1. UNDEFILL DRAINAGE IS TO BE INSTALLED AT THE DIRECTION OF THE ENGINEER. IF THE CONTRACTOR ENCOUNTERS SPRINGS OR OTHER SOURCES OF WATER HE IS TO NOTIFY THE ENGINEER.
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REVISION DETAILS			DATE	DWG
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SURVEYED	WOODS	SIDWELL ROAD	Ė
DESIGNED	WOODS	WAINUI	138
DRAWN	FA	AUCKLAND	VCQ\:
CHECKED			FNG
APPROVED	JW	WOODS.CO.NZ	טאט

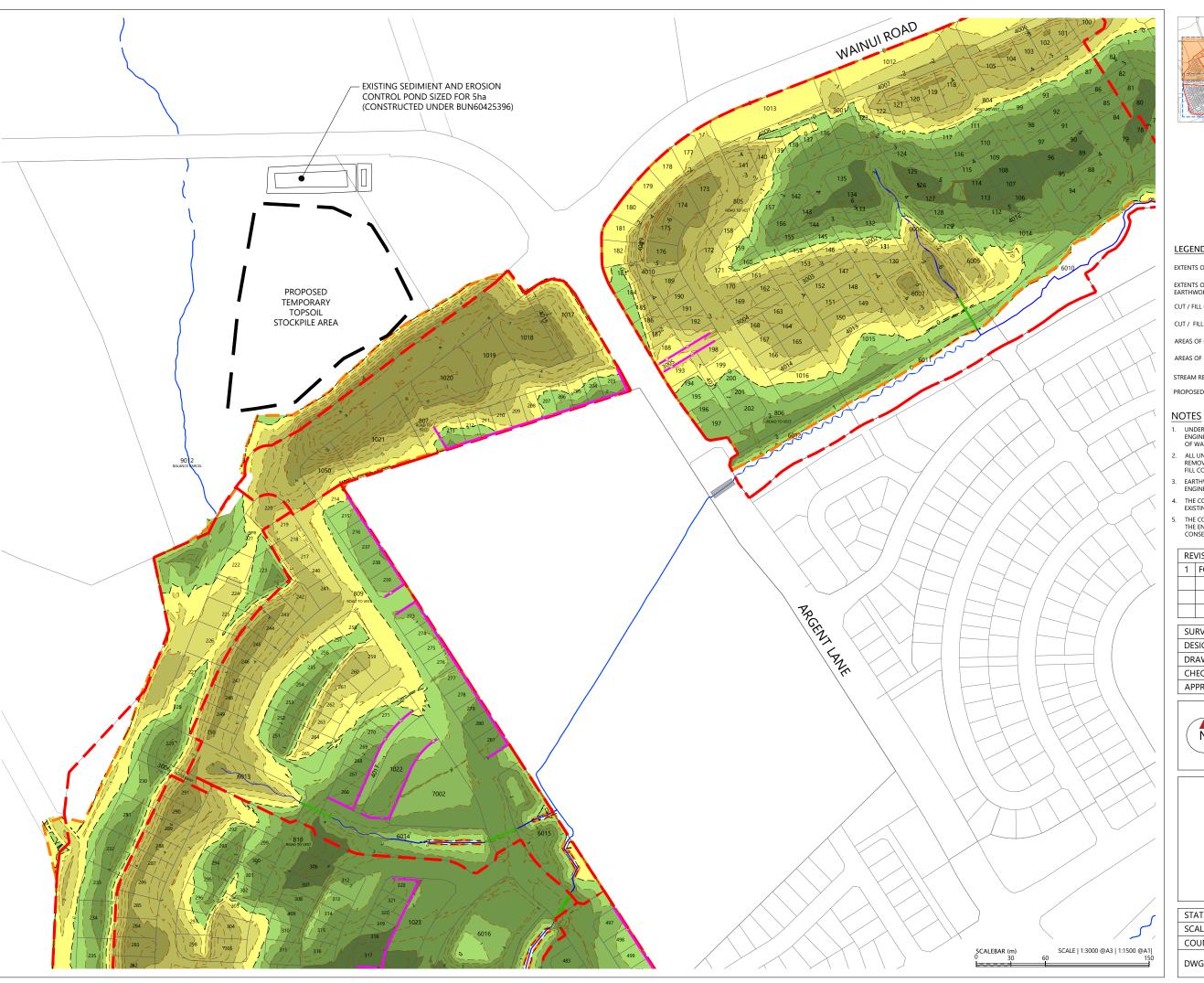




MILLDALE FAST TRACK STAGES 10 - 13

CUT FILL LAYOUT SHEET 1

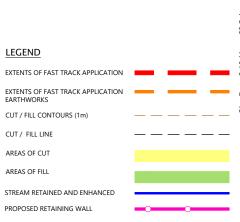
STATUS	ISSUED FOR CONSENT	REV
SCALE	1:3000 @ A3	1
COUNCIL	AUCKLAND COUNCIL	ı
DWG NO	P24-128-00-1201-EW	







LOCALITY PLAN N.T.S



- I. UNDEFILL DRAINAGE IS TO BE INSTALLED AT THE DIRECTION OF THE ENGINEER. IF THE CONTRACTOR ENCOUNTERS SPRINGS OR OTHER SOURCES OF WATER HE IS TO NOTIFY THE ENGINEER.
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REVISION DETAILS			DATE	DWG
1 FOR CONSENT		JW	FEB 25	PLAN
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SURVEYED	WOODS	SIDWELL ROAD	8
DESIGNED	WOODS	WAINUI	-128-
DRAWN	FA	AUCKLAND	ENG/P24
CHECKED			
APPROVED	JW	WOODS.CO.NZ	NGS/01





MILLDALE FAST TRACK STAGES 10 - 13

CUT FILL LAYOUT SHEET 2

STATUS	ISSUED FOR CONSENT	REV
SCALE	1:3000 @ A3	1
COUNCIL	AUCKLAND COUNCIL	ı
DWG NO	P24-128-00-1202-EW	1







LEGEND EXTENTS OF FAST TRACK APPLICATION EXTENTS OF FAST TRACK APPLICATION EARTHWORKS CUT / FILL CONTOURS (1m) CUT / FILL LINE AREAS OF CUT AREAS OF FILL STREAM RETAINED AND ENHANCED

- UNDERFILL DRAINAGE IS TO BE INSTALLED AT THE DIRECTION OF THE ENGINEER. IF THE CONTRACTOR ENCOUNTERS SPRINGS OR OTHER SOURCES OF WATER HE IS TO NOTIFY THE ENGINEER.
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RE	REVISION DETAILS			BY	DATE
1	FOR COI	NSENT		JW	FEB 25

SURVEYED	WOODS	SIDWELL ROAD	8
DESIGNED	WOODS	WAINUI	-128-
DRAWN	FA	AUCKLAND	ENG\P24
CHECKED			
APPROVED	JW	WOODS.CO.NZ	165/01

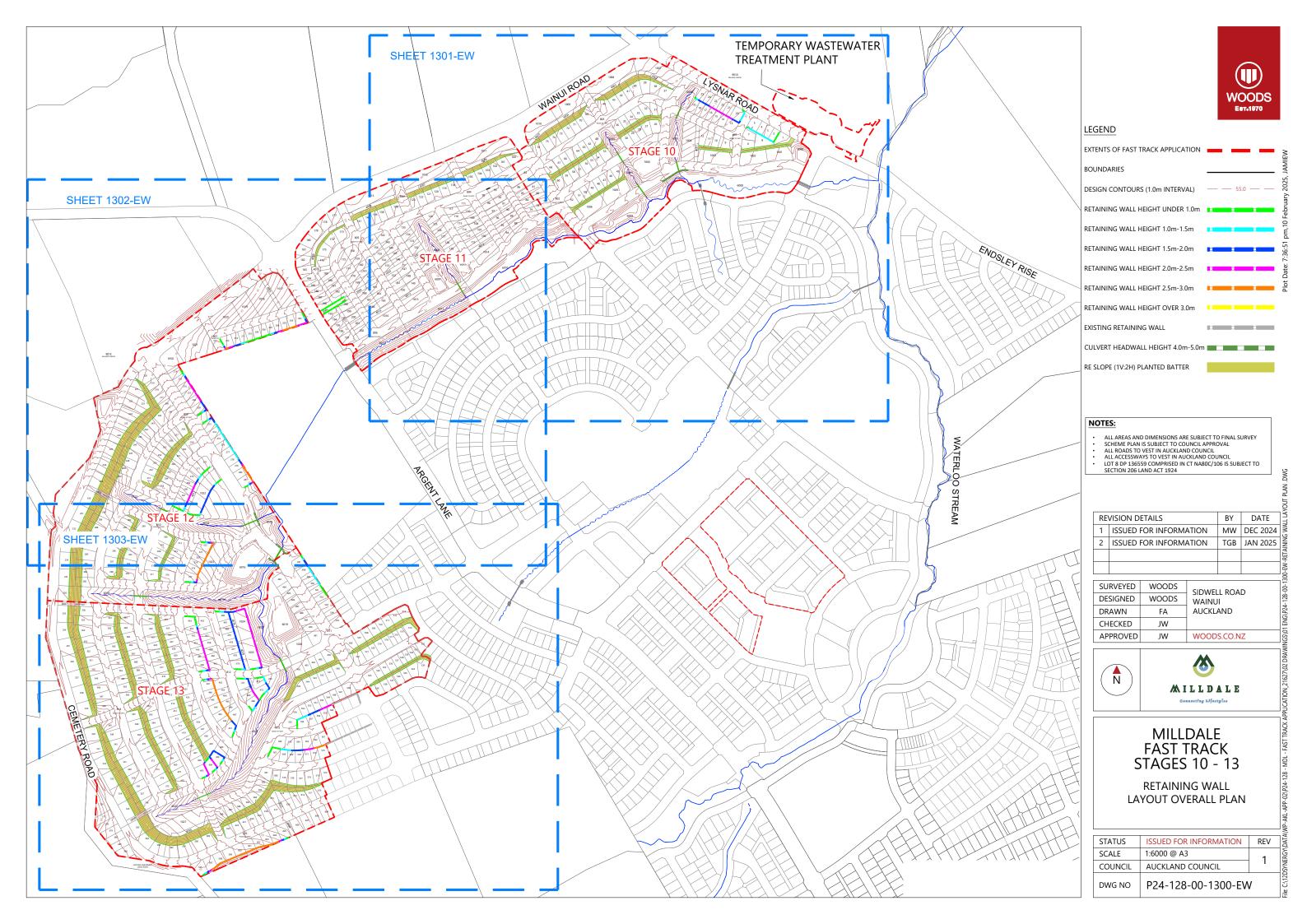


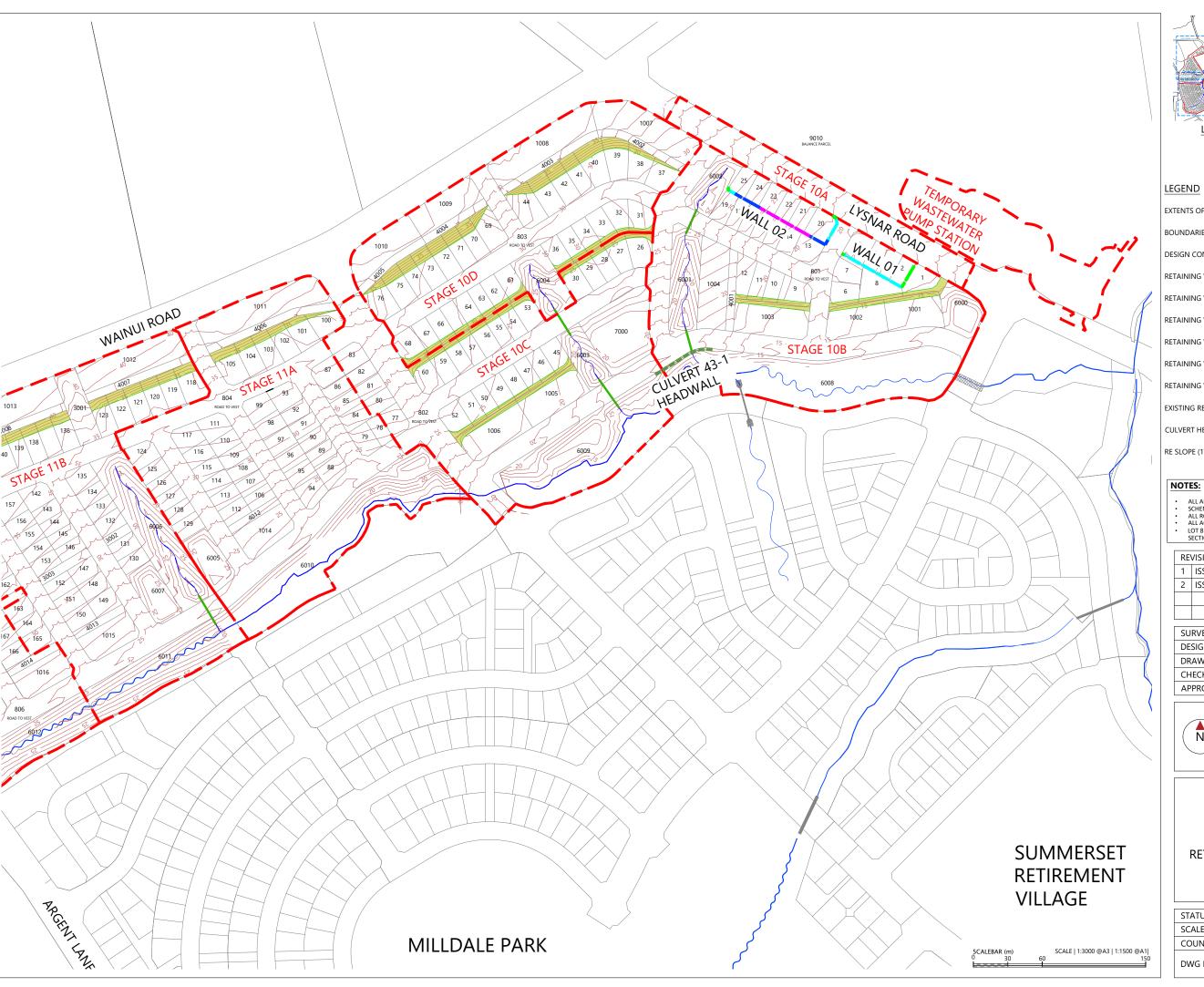


MILLDALE FAST TRACK STAGES 10 - 13

CUT FILL LAYOUT SHEET 3

STATUS	ISSUED FOR CONSENT	REV
SCALE	1:3000 @ A3	1
COUNCIL	AUCKLAND COUNCIL	I
DWG NO	P24-128-00-1203-EW	1









LEGEND	
EXTENTS OF FAST TRACK APPLICATION	
BOUNDARIES	
DESIGN CONTOURS (1.0m INTERVAL)	— — 55.0 — —
RETAINING WALL HEIGHT UNDER 1.0m	<u> </u>
RETAINING WALL HEIGHT 1.0m-1.5m	E
RETAINING WALL HEIGHT 1.5m-2.0m	
RETAINING WALL HEIGHT 2.0m-2.5m	
RETAINING WALL HEIGHT 2.5m-3.0m	
RETAINING WALL HEIGHT OVER 3.0m	
EXISTING RETAINING WALL	0 0
CULVERT HEADWALL HEIGHT 4.0m-5.0m	
RE SLOPE (1V:2H) PLANTED BATTER	

- ALL AREAS AND DIMENSIONS ARE SUBJECT TO FINAL SURVEY
 SCHEME PLAN IS SUBJECT TO COUNCIL APPROVAL
 ALL ROADS TO VEST IN AUCKLAND COUNCIL
 ALL ACCESSWAYS TO VEST IN AUCKLAND COUNCIL
 LOT 8 DP 136559 COMPRISED IN CT NA80C/106 IS SUBJECT TO
 SECTION 206 LAND ACT 1924

	RE'	VISION DETAILS	BY	DATE	II L
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	2	ISSUED FOR INFORMATION	TGB	JAN 2025	AINING
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SURVEYED	WOODS	SIDWELL ROAD	0-1
DESIGNED	WOODS	WAINUI	138
DRAWN	FA	AUCKLAND	FNG/D24.
CHECKED	JW		_
APPROVED	JW	WOODS.CO.NZ	000

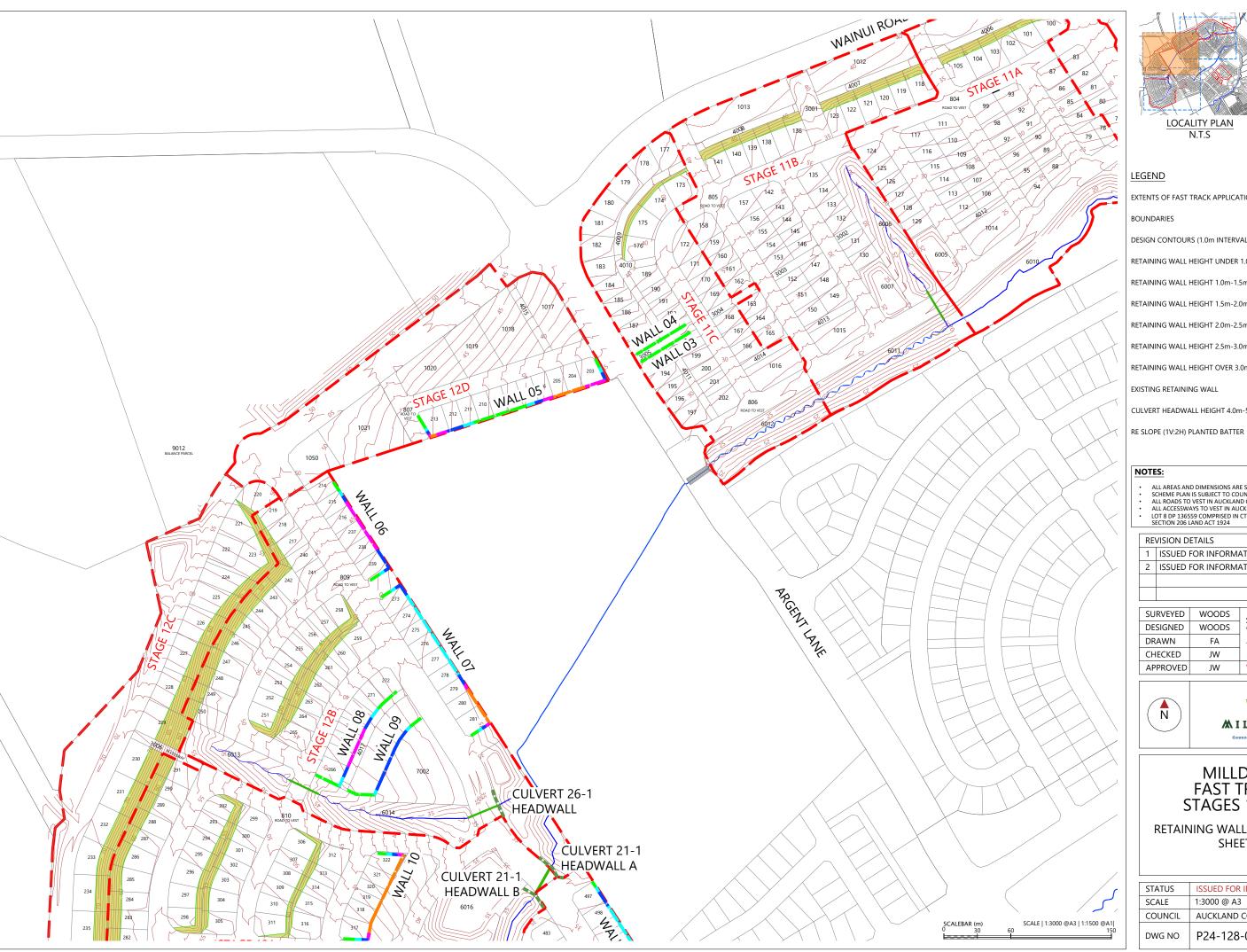




MILLDALE FAST TRACK STAGES 10 - 13

RETAINING WALL LAYOUT PLAN SHEET 1

STATUS	ISSUED FOR INFORMATION	REV
SCALE	1:3000 @ A3	2
COUNCIL	AUCKLAND COUNCIL	۷
DWG NO	P24-128-00-1301-EW	







N.T.S

LEGEND EXTENTS OF FAST TRACK APPLICATION BOUNDARIES DESIGN CONTOURS (1.0m INTERVAL) RETAINING WALL HEIGHT UNDER 1.0m RETAINING WALL HEIGHT 1.0m-1.5m RETAINING WALL HEIGHT 1.5m-2.0m RETAINING WALL HEIGHT 2.0m-2.5m RETAINING WALL HEIGHT 2.5m-3.0m RETAINING WALL HEIGHT OVER 3.0m EXISTING RETAINING WALL CULVERT HEADWALL HEIGHT 4.0m-5.0m

- ALL AREAS AND DIMENSIONS ARE SUBJECT TO FINAL SURVEY SCHEME PLAN IS SUBJECT TO COUNCIL APPROVAL ALL ROADS TO VEST IN AUCKLAND COUNCIL ALL ACCESSWAYS TO VEST IN AUCKLAND COUNCIL LOT 8 DP 136559 COMPRISED IN CT NA80C/106 IS SUBJECT TO SECTION 206 LAND ACT 1924

RE'	REVISION DETAILS		DATE	-
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SURVEYED	WOODS	SIDWELL ROAD	5
DESIGNED	WOODS	WAINUI	128-1
DRAWN	FA	AUCKLAND	ENG/D24.
CHECKED	JW		-
APPROVED	JW	WOODS.CO.NZ	ייטאי

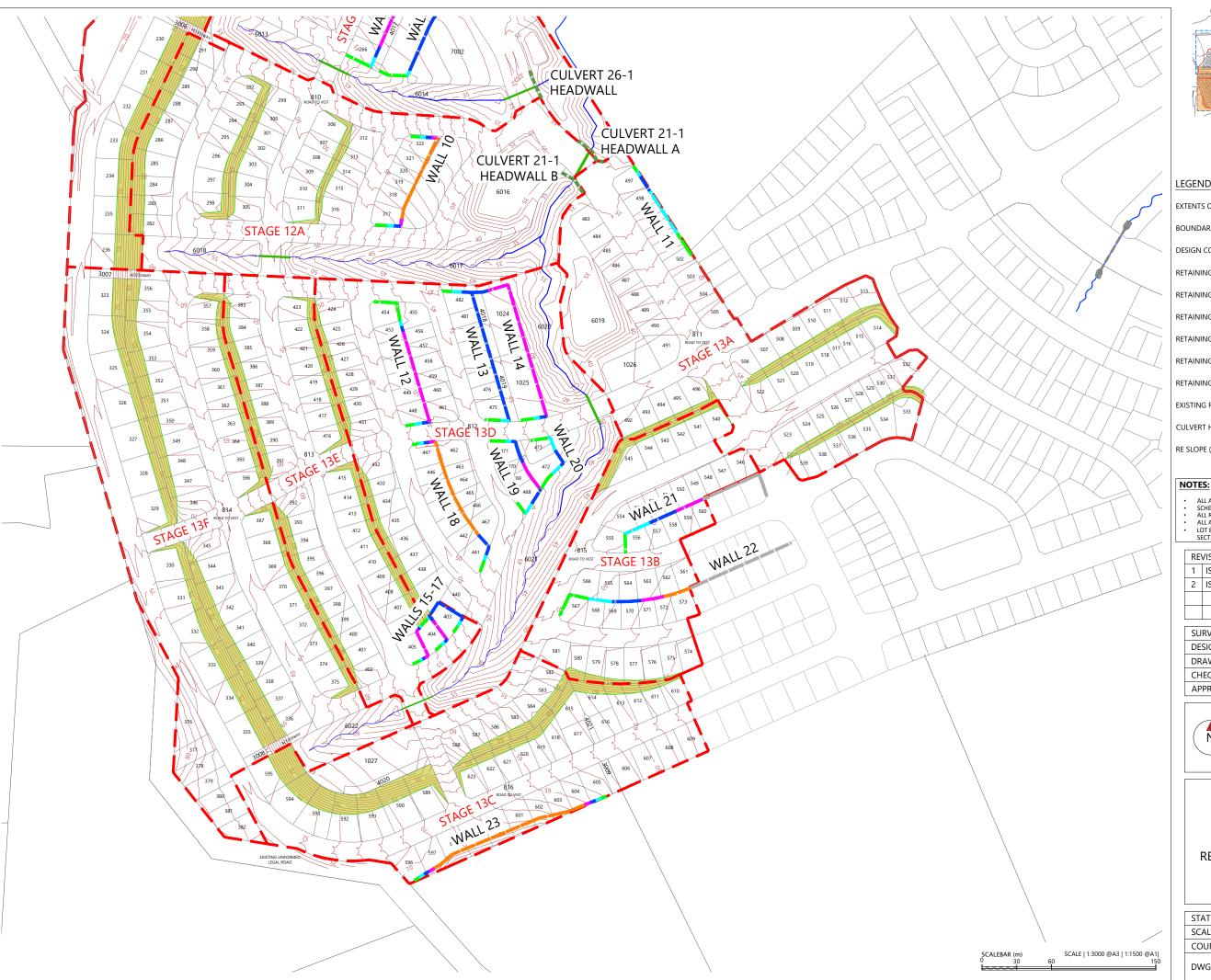




MILLDALE FAST TRACK STAGES 10 - 13

RETAINING WALL LAYOUT PLAN SHEET 2

STATUS	ISSUED FOR INFORMATION	REV
SCALE	1:3000 @ A3	2
COUNCIL	AUCKLAND COUNCIL	۷
DWG NO	P24-128-00-1302-EW	









- ALL AREAS AND DIMENSIONS ARE SUBJECT TO FINAL SURVEY SCHEME PLAN IS SUBJECT TO COUNCIL APPROVAL ALL ROADS TO VEST IN AUCKLAND COUNCIL ALL ACCESSWAYS TO VEST IN AUCKLAND COUNCIL LOT 8 DP 136559 COMPRISED IN CT NA80C/106 IS SUBJECT TO SECTION 206 LAND ACT 1924

	RE'	VISION DETAILS	BY	DATE	11
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SURVEYED	WOODS	SIDWELL ROAD
DESIGNED	WOODS	WAINUI
DRAWN	FA	AUCKLAND
CHECKED	JW	
APPROVED	JW	WOODS.CO.NZ





MILLDALE FAST TRACK STAGES 10 - 13

RETAINING WALL LAYOUT PLAN SHEET 3

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STATUS	ISSUED FOR INFORMATION	REV	DATA
SCALE	1:3000 @ A3	2	RGY
COUNCIL	AUCKLAND COUNCIL	2	2DSYNE
DWG NO	P24-128-00-1303-EW		le: C:\12D