

Appendix J Geotechnical

Technical Memorandum

Subject: ARL Transition Project – Geotechnical Assessment

Reference No: 1092369.2000

Author: Andrew Stiles

Date: 14 November 2025

1 Introduction

Tonkin & Taylor Ltd (T+T) has been engaged by WM New Zealand (WMNZ) to provide technical assessments to understand the effects from a proposal to reconsent Redvale Landfill, north of Auckland.

Redvale Landfill is currently scheduled to cease accepting waste in December 2028 and due to a delay in the authorisation and establishment of the replacement Auckland Regional Landfill (ARL) a transition plan is required. The proposal is to continue sending the current residual waste (around 600,000 tonnes per year) to Redvale Landfill, beyond the existing consent limit of December 2028. This would require new resource consents at Redvale Landfill.

To accommodate the on-going placement of waste at Redvale Landfill beyond 2028, the proposed works will involve the following:

- **Revised final surface profile of the existing landfill:** The current final design landfill ground profile varies but is less than 1V:3H across the footprint. That ground profile will be steepened up to a maximum grade of 1V:3H, to allow placement of additional waste within the existing landfill footprint. Bunds, varying in height between 2 and 6 m, will be constructed along the eastern and southern boundaries to accommodate the required additional waste volumes.
- **Class 2 extension:** The landfill is proposed to be extended to the south-west of the current landfill boundary, within the area currently occupied by the of the now decommissioned Managed Fill and Pond 6. The extension will comprise the excavation and lining of a new landfill cell, allowing the acceptance of waste that meets the Class 2 waste acceptance criteria, which will be constructed in a manner similar to the already constructed cells within the current landfill.
- **Relocation of ancillary activities:** the relocation of ancillary activities to allow for the placement of waste.
- **Sediment Retention Ponds:** The removal and filling in of Sediment Retention Pond 6 and the Office Pond while enlarging Pond 1 to capture and treat the stormwater from these catchments.

This technical memorandum provides an outline of the initial findings of the Geotechnical Assessment and has been prepared for inclusion in an application for Ministerial referral of the project under the Fast-track Approvals Act 2024. Specifically, this technical memorandum responds to the requirements under section 3.4 of the Fast-track Approvals Referral Application Form. A full description of the draft proposal is included in the accompanying information attached to the application form for the referral.

2 Summary of findings

Since the commencement of the original resource consent application process in 1988, a large number of geotechnical and hydrogeological investigations and studies have been carried out for the Redvale Landfill as it has been progressively developed. Recently, four additional boreholes were drilled, with multiple piezometers installed, as part of the investigations for this assessment of the ARL-TP Redvale Landfill (the Project).

In addition, during the Landfill's development the installation and monitoring of an extensive programme of geotechnical instrumentation has been carried out to support design assumptions and to guide construction. The location of the historic and recent investigations, and instrumentation locations, are shown on the Engineering Geological Plans, Figures C1 and C2 in Appendix A. Geotechnical assessment reports were prepared for each of the landfill cells as they were sequentially developed, together with detailed engineering geology mapping and Basegrade Inspections by a Liner Review Team, as required by the consents in accordance with Condition 84.

The geological and geotechnical data gathered at the Redvale Landfill site since the original resource consent process commenced in 1988 has enabled a comprehensive geological and geotechnical model to be developed for the site, see Engineering Geological Plans, Figures C1 and C2 in Appendix A. That model has been reviewed and further updated to incorporate the results of the recent borehole investigations and piezometer monitoring.

The geotechnical model has allowed stability analyses to be carried out with confidence through the revised final surface profile of the existing landfill, and through the proposed Class 2 extension area. The slope stability analyses, carried out along representative cross-sections, satisfied slope stability design safety factor criteria for design groundwater, elevated groundwater and seismic loads for all the cross-sections analysed.

On the basis of the reviews and analyses set out in this assessment we consider that, from a geotechnical perspective, the site is suitable for the construction of the proposed landfill extension works, comprising steepening the current final landfill profile by means of a waste expansion and extending the landfill's area to the south for Class 2 waste. For the Class 2 extension area it is intended that the geotechnical procedures and processes successfully adopted and followed to date will continue to be followed for the extension's design and construction.

3 Assessment methodology

3.1 General

The methodology to inform the assessment to date has comprised both desk-top data review of historic information and records, and fieldwork comprising additional geotechnical investigations.

3.2 Desktop-based tasks

The following desktop-based tasks and assessment have been undertaken to inform the assessment, comprising review of:

- 1 The geotechnical and hydrogeological studies carried out for the Redvale Landfill prior to 1992 to support the original resource consent application.
- 2 The large number of geotechnical and related studies and reports prepared by T+T since 1992, as the landfill has been progressively developed.
- 3 The historic records from the extensive programme of geotechnical instrumentation progressively installed since 1988 at the Redvale Landfill site, principally comprising piezometers, together with inclinometers and survey pins.

- 4 The existing geological and geotechnical model which was also updated to incorporate the results of the recent borehole and groundwater monitoring (piezometer) installation carried out as part of this Project.

3.3 Fieldwork

Comprehensive geotechnical investigations have been carried out at Redvale Landfill since 1990, as the landfill has been progressively developed. The investigations have included numerous machine boreholes and test pits, together with construction observations, engineering geology mapping and Basegrade Inspections of exposed subgrade, and instrumentation installation and monitoring. Laboratory testing, principally triaxial strength tests, has also been carried out to confirm geotechnical design parameters.

For this proposed development 3 additional machine boreholes were carried out along the Landfill's northern boundary and 1 machine borehole within the proposed Class 2 extension area to the south-west of the Landfill, with piezometers installed in each borehole to monitor current groundwater levels for design. Those recent borehole locations have been added to the historic investigation locations shown on the Engineering Geological Plans, Figures C1 and C2 in Appendix A. Groundwater monitoring continues and now includes the additional piezometers recently installed along the Landfill's northern boundary and proposed Class 2 extension area.

3.4 Modelling

Modelling that has been undertaken to inform this assessment comprised slope stability analyses carried out along 7 representative cross-sections through the Northern, Eastern and Southern boundaries of the revised final surface profile of the existing landfill and 3 cross-sections through the proposed Class 2 Waste extension area. The cross-section locations are shown on Figures B1 to B3 in Appendix A, with the cross-section locations shown on the Post Settlement Contour Plan Figure A1.

4 Site and project context

4.1 General

A general description of the site and surrounding locality is included in the accompanying information as part of the referral application. The following elements of the site and project are key to the geotechnical assessment:

4.2 Topography and prior use

Pre-landfill development the original topography sloped down towards the north and north-west. To achieve sufficient airspace volumes, a bund (fill embankment) termed the 'Phase 10 Bund' was constructed along the western half of the northern boundary. That resulted in the lower part of the basegrade along that portion of the landfill boundary being in cut in-situ Northland Allochthon materials, with the upper part formed on a fill embankment. As a result of instability during initial construction, being translational sliding of Fill over Pleistocene Sediments and weathered Northland Allochthon, a substantial shear key was constructed below the bund to meet the required slope stability design criteria.

Redvale Lime operated a lime rock quarry in the Eastern property for many years and the initial phases of the Landfill development included backfilling that existing quarry void.

4.3 Geological and groundwater model

4.3.1 Model development

The extensive and comprehensive database of historic (and recent) geotechnical investigations and monitoring information has allowed ground and groundwater conditions to be well defined. That in turn has allowed the progressive development and updating of the geological and geotechnical models over the many years of the Redvale Landfill's development.

4.3.2 Geological model

The model has identified the Eastern Property and the eastern two-thirds of the Western Property to be underlain by sheared, generally north-northeast to south-southwest trending Northland Allochthon deposits. These are dominated by a prominent central (Mahurangi) Limestone mass aligned approximately along the Properties' common boundary, flanked to the west and east by sheared, often contorted, interbedded Mudstones and Siltstones, see Engineering Geological Plans, Figures C1 and C2 in Appendix A.

Waitemata Group Sandstones and Siltstones form the bedrock geology to the south and west of the Redvale Landfill boundary. The inferred contact between those units and the Northland Allochthon materials is delineated by a steeply WSW dipping thrust fault which runs approximately NW to SE across the south-western edge of the Western Property and then NNE to SSE to the south of the Landfill. Along the thrust fault is a zone of Autoclastic Breccia, formed during the Allochthon emplacement process, with further, irregularly interbedded, sub-parallel bands of Limestone, Autoclastic Breccia and Waitemata Group extending south-westwards towards and beyond (south of) the Landfill boundary and the Waitemata Group country rock.

Pleistocene Sediments and/or residual soils derived from weathering of the Northland Allochthon mudstone/siltstone formed the immediate surface materials over much of the study area, which have mostly been stripped away as part of the Landfill development. Low-angle shear planes have been observed at the base of those Pleistocene Sediments and within the underlying weathered Northland Allochthon mudstones and siltstones.

Variable thicknesses and types, of engineered fill have also been placed over the parts of the development area since 1988 and further fill will be necessary to complete the works. In particular the proposed perimeter bunds will need to be constructed of selected structural fill, keyed at least 0.5 m into weathered Northland Allochthon materials.

4.3.3 Groundwater

The hydrogeological regime and groundwater model for the overall Redvale Landfill site is discussed in the Hydrogeology Memo, which should be referred to for further detail. For the purposes of the Geotechnical Assessment groundwater conditions for the proposed development were assumed as:

- 1 **Northern boundary western half:** For the Design Case groundwater level is generally assumed at the top of the Northland Allochthon mudstone, and for the Elevated case groundwater level is generally assumed at 1 m below existing ground level to the north of the boundary across the Phase 10 bund.
- 2 **Northern boundary eastern half (eastern and southern boundary):** The Design Case and Elevated Case assume groundwater at 3 m below existing ground level and 1 m below existing ground level, respectively.
- 3 **Class 2 waste extension:** The Design case assumes groundwater level based on the piezometric (Pz) data from Pz 44 and Pz 45, installed in Borehole W138, while the Elevated case assumes groundwater levels as varying up to 10 m above the design case.

The assessed Design and Elevated groundwater levels are considered conservative, and likely 'worse-case' conditions.

4.3.4 Discussion

The well-defined ground and groundwater conditions have allowed the landfill void to be excavated with confidence that stability design criteria can be complied with. All cut slopes around the perimeter of the current Landfill void (prior to waste placement) have been formed at 1V:3H, varying to about 1V:4H depending on the slopes' height and ground and groundwater conditions. The great majority of the basegrade cut slopes were formed in in-situ Northland Allochthon, with the exception of the upper portions of the highwall in the south-west corner of the Landfill which was formed in Waitemata Group materials. Fill slopes have also been formed at 1V:3H or flatter.

The underlying Northland Allochthon geology, primarily comprising low permeability mudstones extending to depth, together with the pre-existing quarry void, were key issues in the initial selection of the Redvale Landfill site. In addition, the Northland Allochthon mudstones have been able to be readily placed to form a low permeability liner for the current landfill.

Similarly, the well-developed geological model has also allowed geotechnical design parameters to be assigned with confidence to the various geological units and fill materials.

5 Assessment of potential effects

5.1 General

Based on the proposal and the information available, an assessment of potential effects, and the suitability for construction of the proposed extension works from a geotechnical perspective, has been undertaken and is summarised below.

5.2 Stability of the proposed works

5.2.1 General

Design criteria for the stability of the proposed cuts and fills for the Redvale Landfill have been developed in conjunction with WMNZ, with recommended Factors of Safety for various defined loading cases. For seismic design, a peak ground acceleration (pga) of 0.10 g has been used for the long-term slope stability analyses for the Redvale Landfill. The Class 2 extension development "temporary" slopes are likely to have a design life of between about 1 and 6 years, hence lower pga values could be used. However, stability analyses have conservatively assumed the higher 0.1g value when assessing such temporary slopes.

5.2.2 Slope stability

Slope stability analyses were carried out along:

- 1 7 representative cross-sections through the Northern, Eastern and Southern boundaries of the revised final surface profile of the existing landfill.
- 2 3 through the proposed Class 2 Waste Extension.

The cross-sections are shown on Figures B1 to B3 in Appendix A, with the cross-section locations shown on the Post Settlement Contour Plan Figure A1.

Considering the results of those analyses:

- 1 The analyses satisfied slope stability design criteria for design groundwater, elevated groundwater and seismic loads for all the cross-sections analysed.

- 2 The analyses have assumed that any existing final cap will be removed prior to placing the new waste. It has also been assumed that the new waste is mixed with the immediate underlying old (existing) waste to avoid the potential for an interface layer being inadvertently formed.
- 3 It is intended that any Pleistocene Sediments and/or existing fill will be removed from below the proposed perimeter bunds to the top of the underlying Northland Allochthon, and replaced with engineered fill, and that has been assumed in the analyses.
- 4 Waste has been placed at Redvale Landfill since the mid-1990s and it is likely therefore that strengths of that earlier 'mature' waste have increased from those assumed for previous cell designs. Conservatively, however, the historically assumed strength parameters have been used as the default waste strengths in this assessment.

The stability analyses have been carried out assuming likely 'worst-case' material strength parameters and groundwater conditions. In practice, material strengths could be greater than those assumed 'worst-case' values, over some or all of the development area, and groundwater levels are likely to be generally lower than the levels assumed for the analyses. Stability Factors of Safety will therefore likely further increase beyond the assessed, already acceptable, values.

5.3 Discussion

The above information has allowed comprehensive, detailed and robust geotechnical, geological and groundwater models to be developed for the site. Those models in turn have enabled the design process to develop appropriate cut and fills slopes, and low-permeability liner, with confidence, and which are able to be successfully constructed to meet the agreed and consented design and performance criteria.

The geotechnical investigations, monitoring, design and construction procedures and processes developed since 1991 have allowed the successful, safe and consent-compliant development of the existing completed landfill cells.

From a geotechnical perspective, it is considered that the procedures and processes to date have been appropriate to ensuring that the landfill has been constructed in compliance with the current consents and design criteria and requirements.

It is intended that the geotechnical procedures and processes successfully adopted and followed to date will continue to be used for the design and construction of the proposed landfill extension works, modified as necessary to allow for local variations in geotechnical conditions, landfill cell layout and any other specific design or construction requirements.

On that basis we assess that the site is **suitable** for the construction of the proposed landfill extension works.

6 Conclusions

On the basis of the reviews and analyses carried out for the Geotechnical Assessment, we consider that, from a geotechnical perspective, the site is **suitable** for the construction of the proposed landfill extension works, comprising steepening the current final landfill profile by means of a waste overlay and extending the landfill to the south to form the proposed Class 2 waste area.

7 Applicability

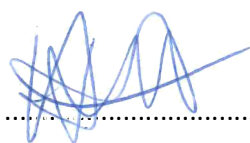
This report has been prepared for the exclusive use of our client WMNZ, with respect to the particular brief given to us, and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

We understand and agree that WMNZ will submit this report to the Environmental Protection Authority in support of a referral application under the Fast-track Approvals Act 2024 for the works described herein, and that the Environmental Protection Authority will rely on this report for the purpose of assessing that application.

Tonkin & Taylor Ltd

Technical memorandum prepared by:

Authorised for Tonkin & Taylor Ltd by:



Andrew Stiles
Senior Principal Geotechnical Engineer



Simonne Eldridge
Project Director

Appendix A Figures

- **Figure A1: Post Settlement Contour Plan**
- **Figure A2: Basegrade Contour Plan**
- **Figures B1 to B3: Cross-sections**
- **Figures C1 and C2: Engineering Geological Plans**



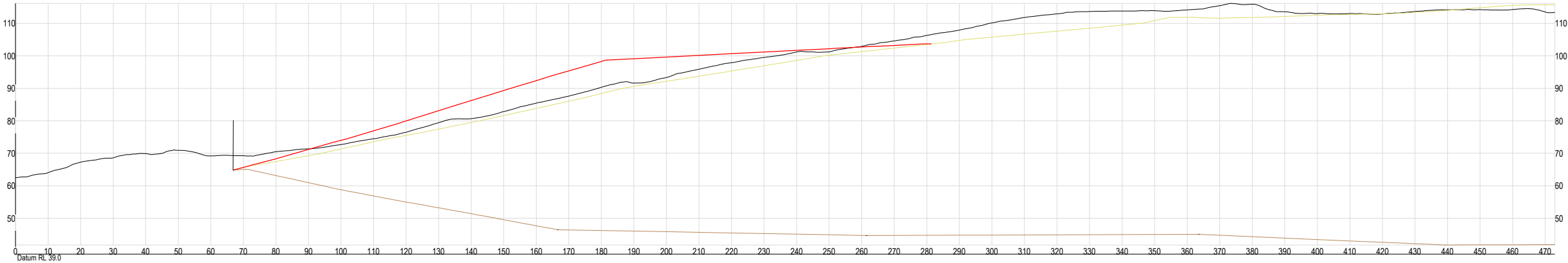
NOTES 1. FOR CROSS-SECTIONS SEE APPENDIX B 2. REFER TO TEXT OF GEOTECHNICAL ASSESSMENT REPORT, JUNE 2025 FOR DISCUSSION		DESIGNED KJUN DRAWN MELP DESIGN CHECKED FIGURE CHECKED	APR.25 MAY.25	FIGURE STATUS PRELIMINARY DRAFT PROJECT PHASE CONSENT DESIGN	CLIENT WM NEW ZEALAND PROJECT ARL TP TITLE POST SETTLEMENT CAP CONTOURS AND CROSS SECTIONS
NOT FOR CONSTRUCTION		THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION PURPOSES UNLESS SIGNED AS APPROVED			SCALE (A1) 1:2000 FIG No. FIGURE A2 REV 1
APPROVED		DATE			



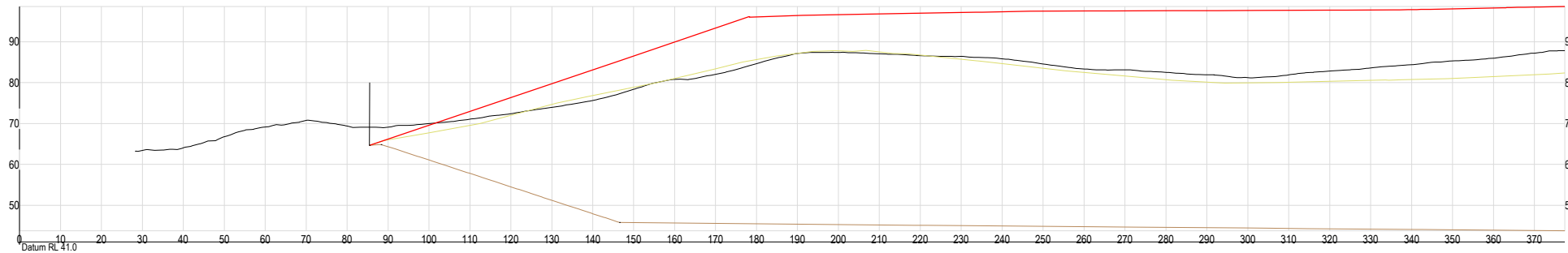
NOTES	
1. FOR CROSS-SECTIONS SEE APPENDIX B	
2. REFER TO TEXT OF GEOTECHNICAL ASSESSMENT REPORT, JUNE 2025 FOR DISCUSSION	

DESIGNED	KJUN	APR.25	FIGURE STATUS PRELIMINARY DRAFT PROJECT PHASE CONSENT DESIGN
DRAWN	MELP	MAY.25	
DESIGN CHECKED			
FIGURE CHECKED			
NOT FOR CONSTRUCTION			THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION PURPOSES UNLESS SIGNED AS APPROVED
APPROVED	DATE		

CLIENT	WM NEW ZEALAND		
PROJECT	ARL TP		
TITLE	BASEGRADE CONTOURS		
SCALE (A1)	1:2000	FIG No.	FIGURE A3
REV	1		

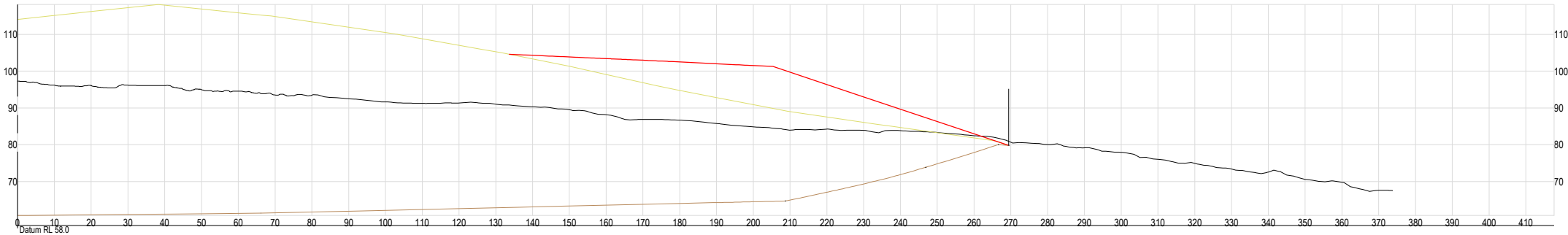


N2a CROSS SECTION
FIG A1
SCALE (A1) 1:750
SCALE (A3) 1:1500



N2 CROSS SECTION
FIG A1
SCALE (A1) 1:750
SCALE (A3) 1:1500

- EXISTING GROUND LEVEL
- PROPOSED CAP DESIGN
- PROPOSED CL2 BASEGRADE DESIGN
- CONSENTED CAP DESIGN
- PROPOSED PERIMETER BUND
- EXISTING BASEGRADE



N1 CROSS SECTION
FIG A1
SCALE (A1) 1:750
SCALE (A3) 1:1500



- NOTES**
- FOR LOCATION OF CROSS-SECTIONS SEE FIGURE A1
 - REFER TO TEXT OF GEOTECHNICAL ASSESSMENT REPORT, JUNE 2025 FOR DISCUSSION

DESIGNED KJUN
DRAWN MELP
DESIGN CHECKED
FIGURE CHECKED

NOT FOR CONSTRUCTION

APPROVED DATE

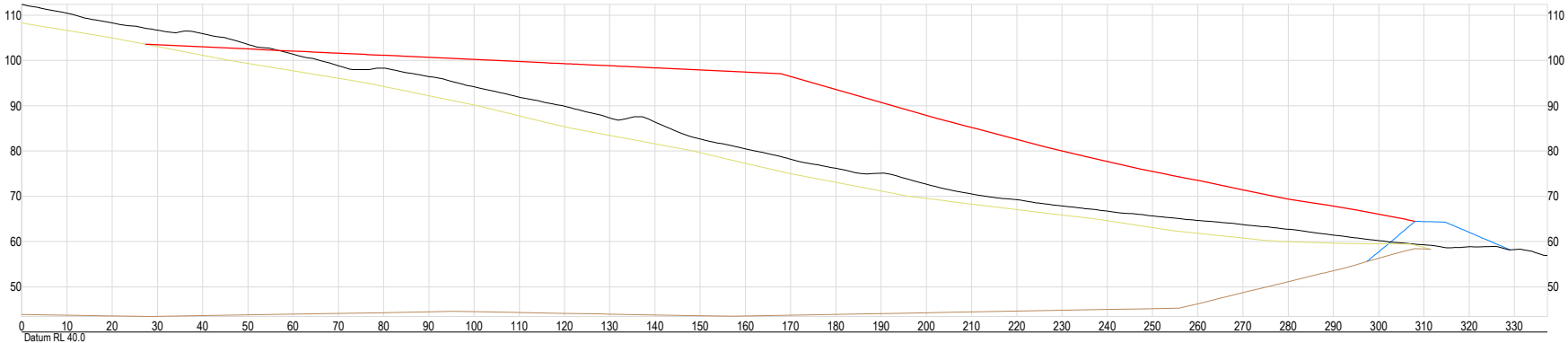
FIGURE STATUS
PRELIMINARY DRAFT
PROJECT PHASE
CONSENT DESIGN

THIS DRAWING IS NOT TO BE USED
FOR CONSTRUCTION PURPOSES
UNLESS SIGNED AS APPROVED

CLIENT **WM NEW ZEALAND**
PROJECT **ARL TP**

TITLE CROSS SECTIONS N1, N2 AND N2a

SCALE (A1) 1:750 FIG No. FIGURE B1 REV 1



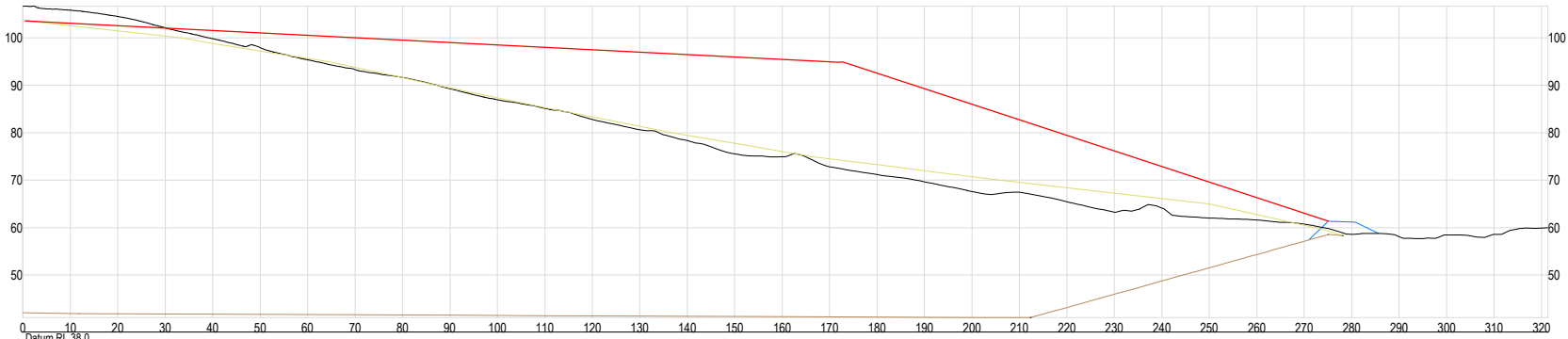
E3

CROSS SECTION

FIG A1

SCALE (A1) 1:750

SCALE (A3) 1:1500



SECTION E2

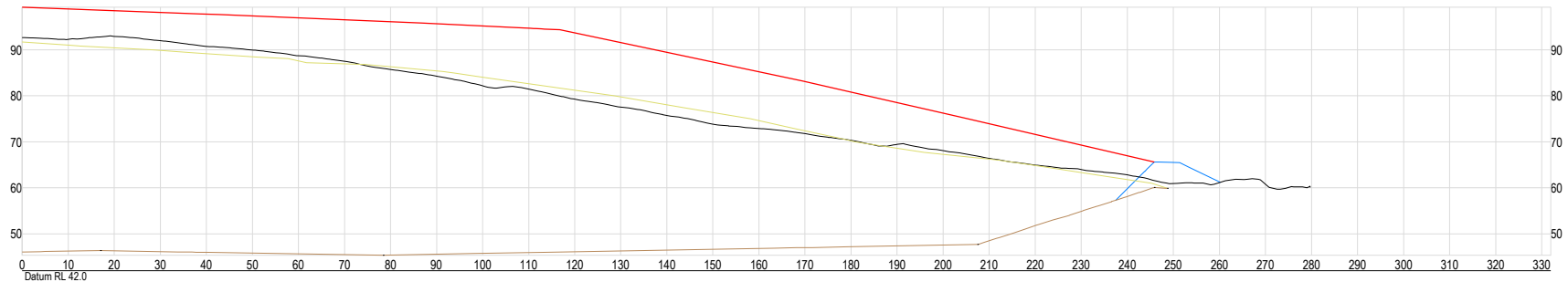
E2

CROSS SECTION

FIG A1

SCALE (A1) 1:750

SCALE (A3) 1:1500



E1

CROSS SECTION

FIG A1

SCALE (A1) 1:750

SCALE (A3) 1:1500



1:750 (A1)
1:1500 (A3)



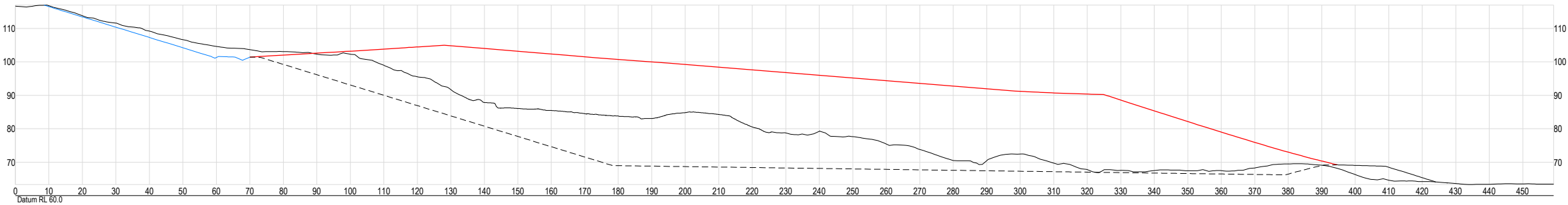
www.tonkintaylor.co.nz

NOTES	
1. FOR LOCATION OF CROSS-SECTIONS SEE FIGURE A1	
2. REFER TO TEXT OF GEOTECHNICAL ASSESSMENT REPORT, JUNE 2025 FOR DISCUSSION	

DESIGNED	KJUN	APR.25	FIGURE STATUS
DRAWN	MELP	MAY.25	PRELIMINARY DRAFT
DESIGN CHECKED	DES.	DATE	PROJECT PHASE
FIGURE CHECKED	CAD	DATE	CONSENT DESIGN
NOT FOR CONSTRUCTION		THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION PURPOSES UNLESS SIGNED AS APPROVED	
APPROVED		DATE	

CLIENT	WM NEW ZEALAND
PROJECT	ARL TP
TITLE	CROSS SECTIONS E1, E2 AND E3
SCALE (A1)	1:750
FIG No.	FIGURE B2
REV	1

DRAFT



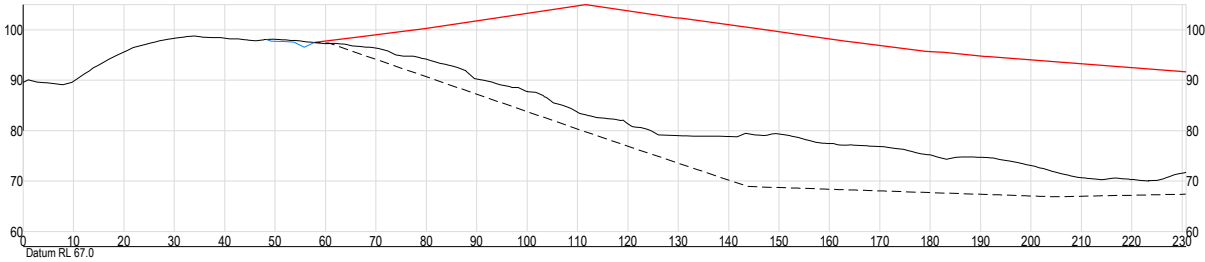
MF3

CROSS SECTION

FIG A1

SCALE (A1) 1:750

SCALE (A3) 1:1500



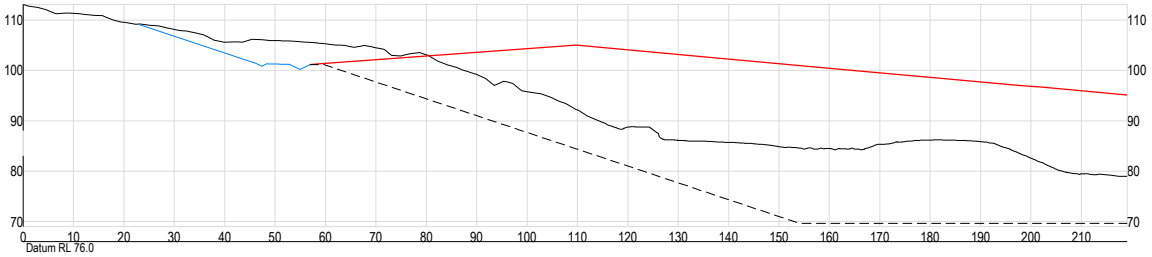
MF2

CROSS SECTION

FIG A1

SCALE (A1) 1:750

SCALE (A3) 1:1500



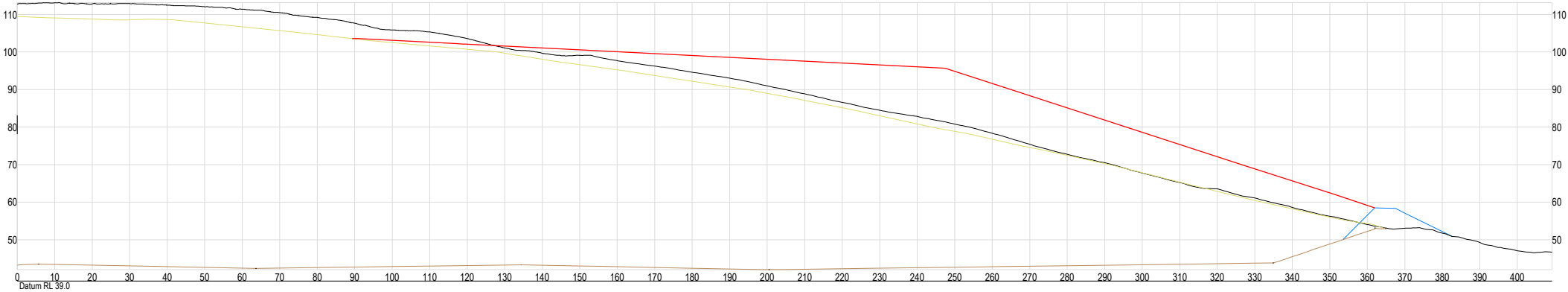
MF1

CROSS SECTION

FIG A1

SCALE (A1) 1:750

SCALE (A3) 1:1500



S1

CROSS SECTION

FIG A1

SCALE (A1) 1:750

SCALE (A3) 1:1500



1:750 (A1)
1:1500 (A3)

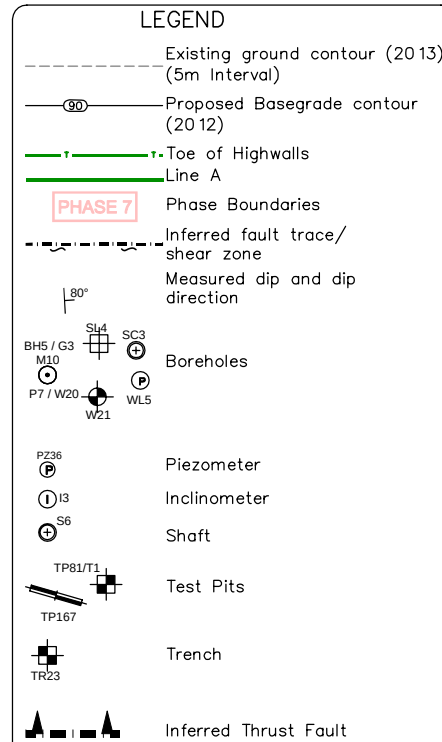
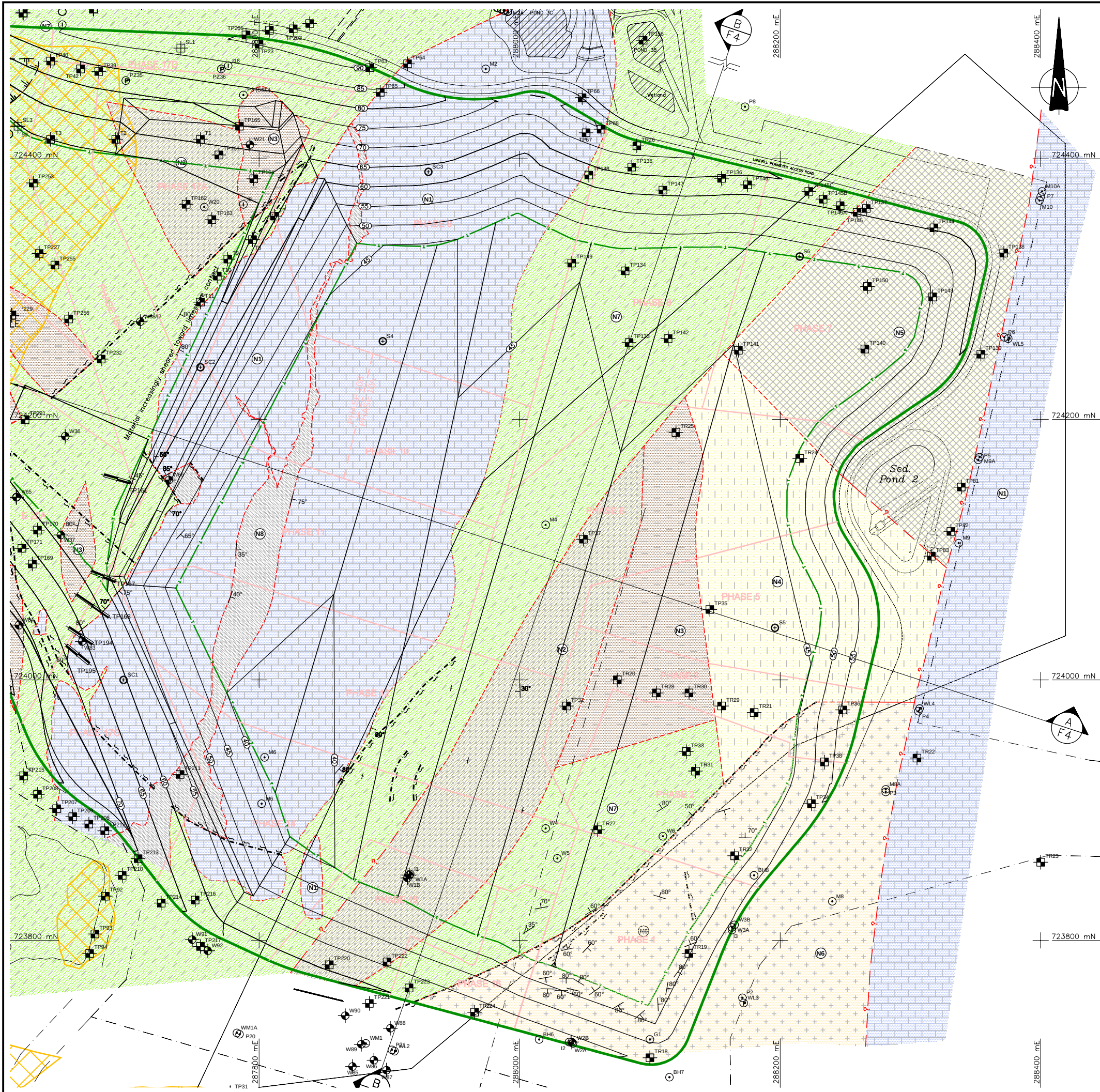


www.tonkintaylor.co.nz

NOTES	
1. FOR LOCATION OF CROSS-SECTIONS SEE FIGURE A1	
2. REFER TO TEXT OF GEOTECHNICAL ASSESSMENT REPORT, JUNE 2025 FOR DISCUSSION	

DESIGNED	KJUN	APR.25	FIGURE STATUS PRELIMINARY DRAFT PROJECT PHASE CONSENT DESIGN
DRAWN	MELP	MAY.25	
DESIGN CHECKED			
FIGURE CHECKED			
NOT FOR CONSTRUCTION			THIS DRAWING IS NOT TO BE USED FOR CONSTRUCTION PURPOSES UNLESS SIGNED AS APPROVED
APPROVED			
DATE			

CLIENT	WM NEW ZEALAND		
PROJECT	ARL TP		
TITLE	CROSS SECTIONS S1, MF1, MF2 AND MF3		
SCALE (A1)	1:750	FIG No.	FIGURE B3
REV	1		



NORTHLAND ALLOCHTHON

- N1 Limestone
- N2 Blocky Mudstone and Siltstone
- N3 Brown carbonaceous Mudstone
- N4 White crushed Mudstone
- N5 Cemented Siltstone, blocky
- N6 Grey blocky Siltstone and Mudstone
- N7 Green to dark grey-green pervasively sheared Mudstone
- N8 Calcareous grey Mudstone

WAITEMATA GROUP

- (Post Emplacement) Grey clayey, silt, fine very weak SANDSTONE and fine sandy SILTSTONE
- (Pre - Emplacement) Light orange, pink, red-purple and grey very weak to weak clayey silty fine SANDSTONE and sandy Siltstone

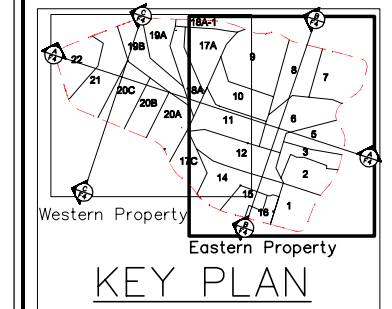
AUTOCLASTIC BRECCIA

- Grey to red-brown to grey green very weak BRECCIA of mudstone /siltstone in a silt/clay matrix.

OTHER

- Stockpiled Fill

- NOTES :**
- N1, N2 etc refer to material types as defined in the Technical Specification.
 - Refer to previous Geotechnical Reports for test pit and borehole logs.
 - Testpits and boreholes are correct in plan position only. Subsequent earthworks are likely to have changed surface elevation.
 - Boundaries and distribution of geological units approximate only and inferred from available information.
 - Basegrade shown is the 2010 Revised Basegrade
 - Cell Phase Layout as currently advised by TPI
 - Drawing to be read in conjunction with text of "Geotechnical Review Report, 29331-300, November 2013"
 - Existing contours as at Aug 2012 (provided by Precision Aerial Surveys Ltd).



2	Revised naming 18A-1 to 17D		
1	Revised issue	APS	Aug.13
0	First Issue	APS	Aug.13
REVISION DESCRIPTION		BY	DATE
DESIGNED :		APS	Aug.13
DRAWN :		JATG	Aug.13
DESIGN CHECKED :			
DRAFTING CHECKED :			
REFERENCE :			

CADFILE : \\29331-GEO-Figure 3_4.dwg

NOT FOR CONSTRUCTION

This drawing is not to be used for construction purposes unless signed as approved
COPYRIGHT ON THIS DRAWING IS RESERVED

Tonkin & Taylor
Environmental and Engineering Consultants
105 Carlton Gore Road, Newmarket, Auckland
Tel. (09) 355 6000 Fax. (09) 307 0265
www.tonkin.co.nz

WM New Zealand

**Redvale Landfill
ARL - TP**

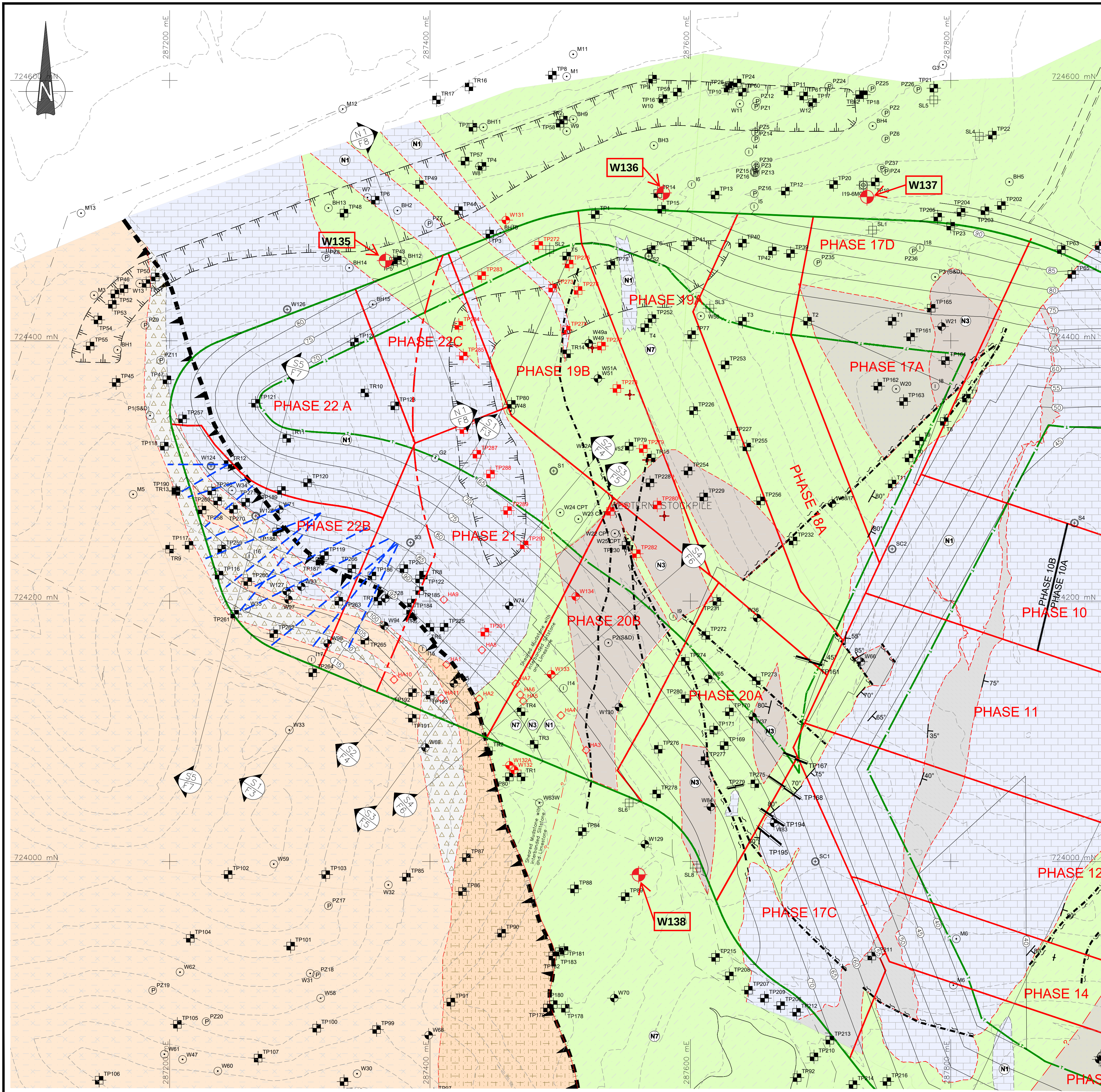
Engineering
Geological Plan
Eastern Property

SCALES (AT A1 SIZE)
AS SHOWN

Figure C1

DRAWING STATUS: PRELIMINARY DRAFT

A3 SCALE 1:3000
A1 SCALE 1:1500
0 20 40 60 80 100 120 140 160



LEGEND

Existing ground contour (2018) (5m Interval)

Proposed Basegrade contour (2010)

Toe of Highwalls

Line A

PHASE 7 Phase Boundaries

Phase 22 Boundary assumed for August 2015 Geotechnical Assessment

Inferred fault trace/ shear zone

Measured dip and dip direction

Boreholes

Piezometer

Inclinometer

Shaft

Test Pits

Trench

(2017) Borehole/Test Pits

(2017) Handauger Boreholes

Drilled Horizontal Drain

Inferred Thrust Fault

Shear Key

NORTHLAND ALLOCHTHON

N1 Limestone

N2 Blocky Mudstone and Siltstone

N3 Brown carbonaceous Mudstone

N4 White crushed Mudstone

N5 Cemented Siltstone, blocky

N6 Grey blocky Siltstone and Mudstone

N7 Green to dark grey-green pervasively sheared Mudstone

N8 Calcareous grey Mudstone

WAITEMATA GROUP

(Post Emplacement)

Grey clayey, silt, fine very weak SANDSTONE and fine sandy SILTSTONE

(Pre - Emplacement)

Light orange, pink, red-purple and grey very weak to weak clayey silty fine SANDSTONE and sandy Siltstone

AUTOCLASTIC BRECCIA

Grey to red-brown to grey green very weak BRECCIA of mudstone /siltstone in a silt/clay matrix.

ORIGINAL IN COLOUR

A3 SCALE 1:3000

A1 SCALE 1:1500

0 20 40 60 80 100 120 140 160

- NOTES :
- N1, N2 etc refer to material types as defined in the Technical Specification.
 - Refer to previous Geotechnical Reports for test pit and borehole logs.
 - Testpits and boreholes are correct in plan position only. Subsequent earthworks are likely to have changed surface elevation.
 - Boundaries and distribution of geological units approximate only and inferred from available information.
 - Cell Phase Layout as currently advised by WMNZ
 - Drawing to be read in conjunction with text of "Phase 21, Phase 22B, and Phase 22C Geotechnical Assessment Report, 1004846.0203, April 2019".
 - Existing contours supplied by Waste Management, June 2018 contours surveyed by Precision Aerial Surveys (PAS) modified as follows:
 - July 2016 contours surveyed by PAS used under western limerock stockpile.
 - June 2003 contours surveyed by Stimpson Surveyors used beneath trees at top of Southern Highwall.

W137

Additional 2024 boreholes

0	First Issue		
REVISION DESCRIPTION	BY	DATE	
DESIGNED :	APS	Mar. 19	
DRAWN :	KAH	Mar. 19	
DESIGN CHECKED :			
DRAFTING CHECKED :			
REFERENCE :			

CADFILE : \\1004846.0203-F2.dwg

APPROVED :

NOT FOR CONSTRUCTION

This drawing is not to be used for construction purposes unless signed as approved

COPYRIGHT ON THIS DRAWING IS RESERVED

Tonkin+Taylor

105 Carlton Gore Road, Newmarket, Auckland

Tel. (09) 355 6000 Fax. (09) 307 0265

www.tonkintaylor.co.nz

WM New Zealand

Redvale Landfill

ARL - TP

Engineering Geology Plan

Western Property

showing Additional Boreholes

SCALES (AT A1 SIZE)

AS SHOWN

Figure C2

REV. 0