



Belmont Quarry Development – Part B

Substantive Application
Appendix B.9 – Geotechnical Assessment
Winstone Aggregates

16 August 2026

Geotechnical Assessment Report

Belmont Quarry Proposed Overburden Disposal Area



Date: 31 July 2026

Job Reference: BGL000252 v2.1

Report prepared for: Winstone Aggregates



Document Control

Title: Geotechnical Assessment Report – Belmont Quarry OBDA				
Date	Version	Description	Prepared by:	Authorised by:
19/01/2026	1.0	Draft issue	ASW	CJL
13/03/2026	1.1	2 nd Draft	ASW	CJL
05/05/2026	1.2	First Issue	ASW	CJL
22/07/2026	2.0	Incorporating peer reviewer’s comments	THL	CJL
31/07/2026	2.1	Final client review and project update	THL	CJL
Distribution				
Client: Winstone Aggregates				

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1 Introduction

Winstone Aggregates [Winstone], a division of Fletcher Concrete and Infrastructure Limited [Fletcher], is proposing a major development to expand its operations at Belmont Quarry, located in Lower Hutt in the Wellington Region. The expansion is critical to securing a reliable supply of high-quality aggregate for infrastructure and construction projects throughout the region.

The Belmont Quarry Development Project is a listed project [Application FTA308 - Belmont Quarry Development] under the Fast Track Approvals Act [2024]. A key component of the project is the creation of a new Overburden Disposal Area [OBDA] adjacent to the existing quarry footprint which will enable the extraction of approximately 33.7 million tonnes of aggregate from the Quarry.

Winstone is proposing a land exchange involving approximately 34.1 hectares of Fletcher-owned land which would be added to the conservation estate, in return for approximately 23.86 hectares of Crown-owned reserve land managed and controlled by Greater Wellington Regional Council as part of Belmont Regional Park.

We have previously provided geotechnical advice relating to the stability of Fletcher-owned land proposed to be used as part of the land exchange¹.

This report provides a geotechnical assessment of the proposed OBDA design. We understand that the report will be provided as a supporting document for the substantive application under the FTAA.

The scope of works was set out in our offer of service dated 24 June 2025.

The author of this report, Cameron Lines, confirms that, in his capacity as author of this report, he has read and agrees to abide by the Environment Court of New Zealand's Code of Conduct for Expert Witnesses Practice Note 2023. Cameron Lines' experience and expertise is set out in his CV at Appendix A.

2 Proposed OBDA

A concept OBDA landform design has been prepared by Terra Mining; this is presented in Appendix B. The design incorporates infilling the two main gullies [eastern and western gullies] as well as smaller sidling gullies in the north of the proposed OBDA footprint.

A schematic of the OBDA footprint is shown in Figure 2-1. The proposed fill depth typically ranges from 10 to 15 m, with a maximum fill depth of 45 m. The highest elevation of the existing topography is approximately RL 210 m, while the crest of the proposed OBDA design is at approximately RL 230m.

¹ Baseline Geotechnical Limited, 2024, Geotechnical Appraisal Report Land Exchange Belmont Quarry Development Project, Wellington, Ref: BGL000252 v1.0 dated 1 December 2025.

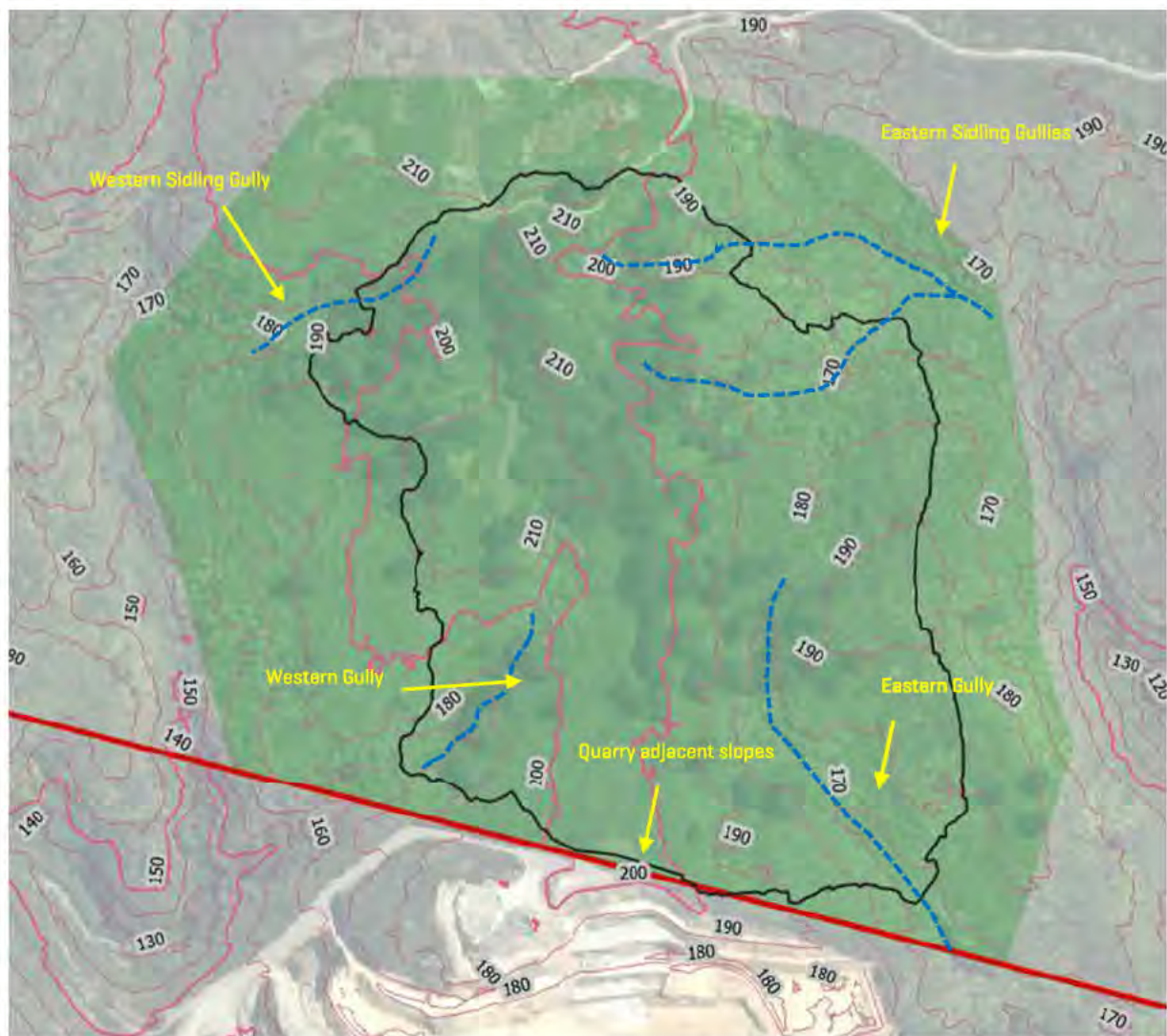


Figure 2-1: Footprint of proposed land exchange area in Belmont Regional Park [green shading] with OBDA footprint [black polygon], contours [GWRC 2020], current Belmont Quarry land parcel [red], observed gullies [blue].

The proposed OBDA will be constructed in stages, and the indicative staging is provided in Appendix C.

3 Historical precedent – Cottle OBDA

The proposed OBDA is similar in scale to the existing Cottle OBDA which was designed by Tonkin & Taylor Limited [T+T] in 2007². The Cottle OBDA covers a similar area [footprint] and has a similar maximum fill height of 50-60 m.

While it needs to be recognised that the Cottle OBDA has yet to be tested against the critical design consideration [being a large magnitude earthquake], it has performed acceptably since construction

² Tonkin + Taylor, 2007. Geotechnical Investigation and design advice for the Proposed Cottle Overburden Disposal Area, Belmont Quarry. Ref: 83504.003 Rev B. Prepared for Winstone Aggregates.

commenced and provides a useful background guide to the expected performance of any future OBDA constructed in a similar fashion.

In general, the design that is set out herein follows the general approach adopted in the Cottle OBDA design, noting the following:

- We have generally adopted more conservative material parameters.
- We have adopted more conservative porewater pressures in the fill materials.
- We have provided a higher level of placement control on overburden materials.
- The seismic design standards have changed since the Cottle OBDA was designed which requires higher seismic loads.
- There is now more robust guidance available with respect to acceptable displacements in seismic events.

This context indicates that the design for the proposed OBDA should result in a lower level of geotechnical risk when compared with the existing Cottle OBDA.

4 Background information

4.1 Site description

Belmont Quarry has been developed on the eastern slopes that abut the Belmont Regional Park and is positioned on the western side of State Highway 2 [northbound], located 24 km northeast of Wellington, and approximately 12 km southwest of Upper Hutt. The ranges to the northeast of the quarry rise to an elevation of approximately RL 210 m³.

The area proposed for the OBDA development is within the Regional Park as set out in Figure 4-1 and is positioned immediately north of Belmont Quarry. The existing topography comprises an eastern and a western gully, both of which flow towards the south, diverting around the active quarry area.

³ Toitū Te Whenua Land Information New Zealand. [2024]. *NZTopo50-BQ32 Lower Hutt, Edition 1.09* [Map]. Toitū Te Whenua LINZ.



Figure 4-1: General location of Belmont Quarry and OBDA footprint [black polygon]. Belmont Quarry land parcel in red.

4.2 Historical aerial imagery

An aerial photograph from 1969 [Figure 4-2] indicates that the proposed OBDA site was historically in pasture on the more gently inclined slopes and ridge crests. By contrast the main east and west gullies and sidling gullies appear to be well vegetated.

An access track beginning from Hebden Crescent is visible in this aerial photograph and this traverses up the ridgeline between the early development of Belmont Quarry to the southeast and another smaller quarry [now the Firth Masonry Plant site].

To the north of the proposed OBDA site an access road used for construction and later maintenance of the electricity transmission lines appears to have been developed, based on large areas of apparent side cast, surplus fill.



Figure 4-2: 1969 aerial photograph of the site [sourced from retrolens.co.nz on 28 July 2025].

4.3 Geology and geomorphology

The published geological map for the area [Figure 4-3] indicates that the OBDA site is underlain by Rakaia Terrane, comprising greywacke sandstone and mudstone with conglomerate, basalt, and chert⁴.

To the southwest of the site is the Wellington Fault which is considered active and is downthrown to the southeast². Other unnamed inactive faults border the northern and western edges of the site, but these do not lie within the footprint of the OBDA.

⁴ Geological information retrieved from GNS <https://data.gns.cri.nz/geology> on 28 July 2025.



Figure 4-3: Site plan illustrating published geology [Retrieved from GNS 28 July 2025].

5 Field observations

BGL has made two visits to the site comprising an initial site walkover in June 2025 to set out the likely requirements for sub-surface investigation and another visit in July 2025 to set out investigation locations and to undertake engineering geological mapping of site areas not previously visited during the initial walkover. Mapping of the upper quarry batters adjacent to the proposed OBDA footprint was completed in July 2026.

Few in-situ rock exposures were observed within the exchanged land package, with the majority of rock exposures observed in cuts along the transmission line access road. Observations were focused on accessible exposures within the gullies and along stream beds.

Photographs of our field observations in Belmont Regional Park are presented in Appendix D.

Weathered greywacke rock, historical backfill and historical process water pond fines were observed in the upper batters of the Quarry adjacent to the proposed OBDA footprint. Annotated photographs for the upper quarry batters are presented in Appendix E.

5.1 Western gully

The western gully was visited in June 2025. It is steeply incised, and flows north to south, eventually turning towards the southwest to flow out of the proposed land exchange area. While there is evidence of some gravel alluvium within the floor of the gully, the southernmost part of the gully floor has been eroded down into the underlying highly to moderately weathered greywacke rock mass, which is exposed in the stream channel [Figure 5-1].



Figure 5-1: Highly weathered greywacke rock exposure in Western Gully floor at Bx06.

5.2 Western sidling gully

The western sidling gully was visited in July 2025. The stream flows to the west in a narrower and more incised gully channel compared to the eastern gullies. The gully is infilled with saturated alluvium. The gully progressively becomes narrower, and the gully floor becomes progressively softer with distance downstream.

Completely weathered rock was observed in the head of this sidling gully, indicating a potentially shallow depth to rock. The exposure was observed near the ridgeline, exposed by a fallen tree [Figure 5-2]. This exposure was an orange-brown silty clay that retained some relict rock fabric, supporting a shallow rock profile.

No rock exposure was observed in the remaining western sidling gully. We have subsequently undertaken sub-surface investigation in this sidling gully to understand the depth to rock near the downstream toe of the OBDA.



Figure 5-2: Fallen tree exposing a residual greywacke soil at Bx11.

5.3 Eastern gully

The eastern gully was visited both in June and July 2025 and is orientated largely north to south and is up to 8 m wide. The wider, more open nature of the gully is reflected in the stream channel, which flows through multiple channels across a flat gully floor which is made up of soft alluvial soils (Figure 5-3). The gully becomes progressively wider and marshier with distance downstream, eventually becoming an extensive wetland (known on site as the 'farm pond').

The 'farm pond' is partially located within the exchange land package and is positioned 10 m southeast of the OBDA design footprint at approximately RL 164 m (Appendix B). The pond is currently located 60 m from the active Belmont Quarry site. Inflows are sourced from the eastern gully, and it appears to outflow southwest, away from the quarry.

No rock exposure was observed in the main eastern gully. We have subsequently undertaken sub-surface investigation to understand the depth to rock.



Figure 5-3: Flat alluvial floor in Eastern Gully at Bx04.

5.4 Eastern sidling gullies

The eastern sidling gullies were visited both in June 2025 and July 2025 and were observed to flow downslope to the east. These sidling gullies have a flat floor infilled with saturated alluvium. The sidling gullies become progressively wider and marshier with distance downstream. Rock was not observed and these were highlighted as an area requiring sub-surface investigation to assess depth to rock.

5.5 Quarry slopes

Mapping of the upper batters of the existing quarry has identified 1-2 m of dry, hard, yellow brown residual greywacke soils overlying weak, light orange brown, highly weathered greywacke rock.

Overlying the natural ground surface is historic quarry backfill. This material comprises an orange brown, tightly packed, gravel with some cobbles and silt. Gravels and cobbles consist of subangular, moderately to highly weathered greywacke. It was observed to be largely stable in quarry batter slopes of 45° up to 10 m high.

Minor groundwater seepage was observed in this material where it had been placed low within the pre-existing gully.

Historic process water pond fines were observed in the upper quarry batters where these had historically infilled a former gully head. These historic process water fines ponds were designed in 1988, and placement occurred from the early 1990's to 2010 when the ponds were capped with quarry backfill.

These materials overlie several metres of gravel quarry backfill and comprise a grey, fine sandy silt of low plasticity. Process pond fines were observed to be wet but not saturated, with no significant groundwater seepages observed. Pocket Penetrometer testing of representative samples indicated a range of undrained shear strengths between 50 and 100kPa.

The historic process water pond fines stand in cut batters up to 60° from horizontal and 5 m high. These batters were developed in 2024 and have been exposed to weathering and surface water flow for 2 years.

There is a clear distinction between slope performance where surface water has been allowed to discharge in an uncontrolled fashion over the crest of batters and where surface water flow has been controlled and discharged away from the pond fines.

Where surface water has been well controlled, slopes largely remain in their originally cut condition, with only localised thin, surficial instability observed. Where surface water discharge is uncontrolled there is evidence of deep scour and rill erosion and associated slumping of the front face, which has degraded to an overall slope angle of 29-30°.

An annotated aerial photograph and associated detailed photographs are presented in Appendix E.

6 Ground investigations

A series of hand-auger boreholes and Scala Penetrometer tests were undertaken by Geotechnics on 24 July 2025. Investigations were conducted to identify the thickness of alluvial material overlying greywacke rock mass. All but one of the tests were dry on completion. HA 25-1 in the eastern sidling gully encountered water inflow at 0.1 m below ground level [m bgl]. A map of investigation locations is provided in Appendix B with geotechnical logs presented in Appendix F.

A summary of investigations is provided in Table 6-1 below.

Table 6-1: Summary of ground investigations.

ID	Depth to refusal (m)	Groundwater encountered (m bgl)
HA 25-1	1.05	0.1 m bgl.
HA 25-2	1.55	No groundwater encountered.
HA 25-3	0.70	No groundwater encountered.
HA 25-4	0.25	No groundwater encountered.

7 Conceptual ground and groundwater model

Regional geology indicates that the site is expected to be underlain by greywacke rock mass. Regional faulting, folding, tilting and uplift of the basement greywacke rock within the Belmont Regional Park has created a series of ridge lines and main gully network systems that drain towards the south and sidling gullies draining towards the east and west.

At the location where the hand-auger boreholes and Scala Penetrometer tests were undertaken, [refer Appendix B] refusal typically occurred between 0.5 m to 1.4 m bgl. Based on our observations

of shallow rock exposure in the western gully, we infer this to be the contact between the alluvium and the underlying completely weathered greywacke rock mass.

Based on similar orientation of the gullies within the site to those observed in the surrounding area, we infer the primary northeast to southwest trending gully alignment and secondary west to east trending gully alignments to be the result of regional scale faulting⁵. The rock structure visible along the forest track west of the exchanged land package supports this.

For the purposes of our geotechnical assessment, we anticipate that the alluvial soils will be able to be completely undercut and removed from the foundation where necessary to provide a OBDA foundation free of soft saturated soils.

Based on seepage observations in each gully, we anticipate that stream flow is primarily sourced from groundwater perched within the soil mantle [regolith].

8 Seismic loadings

A series of different design loads have had to be calculated for the proposed OBDA to account for the temporary nature of some of the quarry activities, the staged development of the OBDA, the expected long term nature of the final landform and the consolidation and dewatering of process water pond fines proposed to be encapsulated into the OBDA.

Three proposed design cases are considered:

1. Long term design case. This considers the majority of the OBDA including the slopes adjacent to the quarry highwall once the current quarry is exhausted (i.e. a design life of >100 years).
2. Short term liquefaction design case. This considers a timeframe within which process water pond fines encapsulated within the OBDA are expected to dewater and consolidate. The process water fines eventually become sufficiently drained so that they are unlikely to liquefy. A design life of 25 years is considered for this case.
3. Quarry adjacent design case: This case considers the OBDA slopes located above the proposed final quarry highwall only while quarry operations are ongoing. The design life for this case is based on the proposed quarry design life (40 years), less the design life of OBDA development stages that do not construct fill above the quarry highwall (Stage 4 – approximately 15 years). Providing an effective design life for this case of 25 years.

We have adopted seismic loadings as set out in Table 8-1, Table 8-2 & Table 8-3 below. We understand that once fill placement is complete, buildings will not be placed on the final surface.

⁵ Begg, J.G.; Johnston, M.R. 2000 Geology of the Wellington area: scale 1:250,000 *Institute of Geological & Nuclear Sciences 1:250,000 geological map 10*

Table 8-1 Derivation of seismic loads for long term case

Parameter	Value Adopted	Comment
Importance Level	IL1	NZS 1170:0 2002 Table 3.2. [consequence limited to within property boundary and does not impact quarry operation and worker safety]
Design Life	>100 years	NZS 1170:0 2002 Table 3.3
Recurrence interval	250 years	
ULS Seismic Load [PGA]	0.66g	NZS TS 1170.5 2025 worst case using default site class and Lower Hutt from Table 3.1
Earthquake Magnitude	7.7	

Table 8-2 Derivation of seismic loads for short term liquefaction case

Parameter	Value Adopted	Comment
Importance Level	IL1	NZS 1170:0 2002 Table 3.2
Design Life	25 years	NZS 1170:0 2002 Table 3.3
Recurrence interval	50 years	
ULS Seismic Load [PGA]	0.25g	NZS TS 1170.5 2025 worse case using default site class and Lower Hutt from Table 3.1
Earthquake Magnitude	7.2	

Table 8-3 Derivation of seismic loads for Quarry adjacent design case

Parameter	Value Adopted	Comment
Importance Level	IL2	NZS 1170:0 2002 Table 3.2 [conservatively considers that slope displacement could endanger quarry workers].
Design Life	25 years	NZS 1170:0 2002 Table 3.3
Recurrence interval	250 years	
ULS Seismic Load [PGA]	0.66g	NZS TS 1170.5 2025 worst case using default site class and Lower Hutt from Table 3.1
Earthquake Magnitude	7.7	

Although the calculation is different, it is evident that the derived long term [Table 8-1] and quarry adjacent [Table 8-3] seismic loads provide the same outcome.

We note that alternative methods of deriving seismic loads are available [MBIE Module 1 & 6]. We have considered this approach but note that it provides similar or lower loads.

9 Slope stability assessment

9.1 General

Our stability assessment has been undertaken using Slide2, a limit equilibrium software package that compares driving forces and resisting forces as a ratio, called a Factor of Safety [FoS]. Where driving forces exceed resisting forces, a factor of safety below 1 is calculated, indicating a slope failure condition.

Cross sections through the existing topography and proposed design have formed the basis of our geological models presented in Appendix B.

Four cross sections have been chosen as they represent different expected gully floor conditions and fill heights and are therefore considered to be illustrative of anticipated OBDA slope performance. These four sections include:

- Section A: Marshiest gully fill and closest to a pre-defined wetland area. The wetland is immediately downslope of the toe of the OBDA section.
- Section B: Greatest gully fill thickness with a recent alluvial soil in the foundation.
- Section C: For ground conditions along the western portion of the site.
- Section D: A section through the OBDA and the quarry highwall

In general, the assessment allows for:

- Undercut and removal of soft alluvium in the foundation of the OBDA, with a platform of rockfill used as a toe buttress, on lower parts of the OBDA.
- A zone of improved clay fill, placed under stricter fill placement guidelines, which will be used to support the front face of the OBDA.
- General mixed overburden fill, placed with less stringent controls.
- An indicative allowance for encapsulated process pond fines up to 3.5 m thick, setback from the outer edge of the OBDA by 30 m for Section A, B and C and 40m for Section D. Ponds are positioned at RL 220 m on the design sections, as illustrated in the indicative stage plans.

9.2 Groundwater conditions for design

For the purposes of the slope stability assessment and based on the information presented in Section 7 we have conservatively adopted a single piezometric surface at the existing ground surface [i.e. conservatively assumed full saturation of natural material].

For the purposes of design, the overburden fill materials have been modelled with an R_u^6 of 0.10 [representing ~20% saturation of any analysed slip circle]. The R_u values adopted are broadly consistent with long term measured pore water pressures in instrumented overburden disposal areas at Winstone's Hunua quarry site in Auckland [Appendix G].

To model elevated groundwater conditions, the overburden fill materials have been modelled with an R_u of 0.25 [representing ~50% saturation of any slip circle]. This is to account for a potential build up in pore pressure during prolonged high intensity rainfall events or partial sub-soil drainage failure.

Separation of groundwater pressures in overburden materials and in-situ soil and rock is considered reasonable, as a sub-soil drainage network is proposed in the former gully system to collect and discharge groundwater seepages.

⁶ R_u is defined as a ratio of normal stress to pore water pressure.

9.3 Anticipated OBDA material types

The OBDA material comprises non-organic material that is not economical to be sold as a product. In Belmont Quarry, this mainly contains weathered greywacke rockfill, residual Greywacke soils and process fines.

These materials are proposed to be separated and used in zoned construction of the OBDA. The nature of each zone and proposed placement controls are set out in Section 10.3 below.

9.4 Liquefaction risks

We have considered potential for liquefaction of the various OBDA materials under seismic loading. Each are considered below:

- From observation the residual Greywacke soils are considered sufficiently clay rich to be non-liquefiable. Additionally, the OBDA is expected to be well drained by sub-soil drains and informal drainage blankets of weathered rock fill. The soils are expected to be moist, not saturated.
- Weathered greywacke rock fill is typically made up of clasts of gravel and cobbles with minor residual greywacke soil, where clast to clast contact dominates behaviour. This material is typically free draining and therefore is expected to have a very high resistance to liquefaction due to its drainage properties that limits excess porewater pressure buildup during a seismic event.
- The process water pond fines are expected to have a moderate to high likelihood of liquefaction shortly after placement and encapsulation when it remains saturated and unconsolidated. This case is considered in the stability analytical work that follows in Section 9.7. In the long term, this material drains and consolidates becoming partially saturated and higher strength. The consolidated state of the process fines has been observed in historic process water pond fines exposed in the current quarry highwall cut. Once this occurs, we consider that there are sufficient air voids to prevent excess porewater pressure generation during a seismic shaking event. The process water pond fines are also proposed to be placed on a drainage blanket (refer Appendix B Figure 10), to support both long term drainage and consolidation, but also to provide a drainage pathway for pore water in the long term during a seismic event.

9.5 Material parameters

We have based the material parameters in this preliminary stability assessment on our observation of the materials exposed during our site visit, in situ testing, comparison with other OBDA fill sites with similar greywacke derived overburden, and back analysis of existing conditions.

The parameters adopted in this assessment are broadly representative of average conditions. Our adopted material parameters are presented in Table 9-1 and Table 9-2.

Table 9-1: Material parameters for design [soil materials]

Material	Type	Density [kN/m ³]	Effective Cohesion [c' – kPa]	Effective Friction Angle [φ' – degrees]
Alluvium	Mohr Coulomb	16	2	26
Zone 1 – Weathered Greywacke Rockfill		18	0	42
Zone 2 – Improved Clay Fill		17	7	34
Zone 3 – Mixed Clay Fill		17	5	30
Zone 4 – Process Fines		16	2	26
Zone 5 – Process Fines [long term]		17	3	30
Zone 4a – Process Fines [liquefied]	Vertical stress ratio	16	-	0.03 vertical effective stress ratio*. Equivalent to friction angle of 1.72°

* Estimates based on conservative value of $q_{cl,ncs}$ of 20 atm using Idriss and Boulanger [2008]⁷, Kramer and Wang [2015]⁸ and Weber [2015]⁹.

Table 9-2: Material parameters for design [in situ rock]

Material	Type	Density [kN/m ³]	UCS [MPa]	GSI	mi	D
HW-CW Rock [Greywacke]	Generalized Hoek Brown	22	25	29	11	0
UW-MW Rock [Greywacke]		22	50	37	11	0

9.6 Design criteria

We have adopted typical stability design criteria for a low importance site that will not support development on completion and that has a low risk of instability extending beyond site boundaries.

Proposed design criteria are:

- Static Case FoS ≥ 1.3
- Elevated Groundwater Case FoS ≥ 1.1
- ULS Seismic Case FoS ≥ 1.0 or displacement analysis <1.0 m.

These criteria are broadly consistent with published regulatory recommendations for parks and bush land, with limited risk of off-site effects¹⁰.

⁷ Idriss, I.M. and Boulanger, R.W. [2008] Soil Liquefaction during Earthquake. EERI Publication, Monograph MNO-12, Earthquake Engineering Research Institute, Oakland. <https://www.eeri.org/>

⁸ Kramer, S. L., & Wang, C.-H. [2015]. Empirical model for estimation of the residual strength of liquefied soil. Journal of Geotechnical and Geoenvironmental Engineering, 141[9], 04015039.

⁹ Weber, J. P. [2015]. Engineering evaluation of post-liquefaction strength. Ph.D. dissertation, Department of Civil and Environmental Engineering, University of California, Berkeley.

¹⁰ The Auckland Code of Practice for Land Development and Subdivision Chapter 2: Earthworks and Geotechnical. July 2022, Version 2.0. Auckland Council.

9.7 Results

We have completed slope stability calculations for the proposed OBDA design on cross sections A, B, C and D. Due to the similar ground conditions and similar fill slope angles and heights, these analysis results are considered representative of the expected performance for the remainder of the OBDA.

Stability analysis results are set out in Table 9-3 and analysis outputs are presented in Appendix H.

Table 9-3: Proposed OBDA design slope stability analysis results.

Section Reference	Design Case	Factor of Safety (FoS)
Section A	Normal Groundwater	1.70
	Elevated Groundwater	1.49
	ULS Seismic – long term [1:250 AEP – PGA 0.66g]	0.63
	Seismic Yield – long term [0.27g for FoS~1.0]	0.99
	Seismic Yield – liquefied process fines [0.07 g for FoS~1.0]	1.08
Section B	Normal Groundwater	1.73
	Elevated Groundwater	1.54
	ULS Seismic – long term [1:250 AEP – PGA 0.66g]	0.61
	Seismic Yield – long term [0.28g for FoS~1.0]	1.00
	Seismic Yield –liquefied process fines [0.07 g for FoS~1.0]	1.09
Section C	Normal Groundwater	1.78
	Elevated Groundwater	1.78
	ULS Seismic– long term [1:250 AEP – PGA 0.66g]	0.65
	Seismic Yield – long term [0.33g for FoS~1.0]	0.99
	Seismic Yield – liquefied process fines [0.06 g for FoS~1.0]	0.97
Section D	Normal Groundwater	1.70
	Elevated Groundwater	1.70
	ULS Seismic [1:250 AEP – PGA 0.66g]	0.68
	Seismic Yield – long term [0.36 g for FoS~1.0]	1.02
	Seismic Yield –liquefied process fines [0.11 g for FoS~1.0]	0.96

The analysis results indicate that the proposed OBDA landform can achieve the adopted design criteria for static and elevated groundwater cases.

Seismic cases for the proposed design indicate that displacements can be expected under the adopted seismic loadings.

We have assessed displacements in accordance with Jibson 2007¹¹ and Macedo et al 2023¹² for the long term (non-liquefaction) seismic cases, which return results of between 90 mm and 400 mm of displacement (depending on the method adopted) with a mean displacement of 200 mm.

For the potential process pond fines liquefaction case, we have adopted Macedo et al 2023 method and 50th percentile displacement as per the recommendations of the NZTA Bridge Manual¹³. The method specified in the Bridge Manual for a liquefied case is Bray and Travarasrou [2007]¹⁴. However, we note that Macedo et al 2023 superseded Bray and Travarasrou 2007 and therefore has been adopted for this assessment.

The seismic load adopted for Sections A, B and C is based on the short term liquefaction case [Table 8-2]. With the process water fines positioned behind a 30 m offset from the OBDA front face, a displacement of approximately 200 mm could be expected under the design seismic loading. This level of displacement is unlikely to exhibit a flow like failure, particularly as the liquefied layer is located well away from the front face, with a front buttress made up of weathered rock fill.

For Section D, the seismic loads adopted are based on the Quarry adjacent design case [Table 8-3]. With the process water fines positioned 40 m offset from the OBDA front face, a displacement of 480 mm could be expected. We anticipate that this level of displacement would be acceptable, however we note that the required 40 m offset from the face of the slope would substantially limit the footprint of the process water pond in this area, making it operationally inefficient.

Our analysis for the liquefied process water fines has been undertaken in a conservative manner due to the low liquefied strength assumed (in absence of CPT investigation results for this material). Additionally, the presence of the proposed drainage blanket below and process water pond would allow excess porewater pressure to dissipate quickly in the event of liquefaction, and our analysis does not account for this effect.

While we are satisfied that the risks associated with process water pond fines located away from the quarry highwall are limited, there are some uncertainties in performance of the process water pond illustrated in Stage 9 of the OBDA development, which is positioned close to the quarry highwall. Additional investigation and detailed design of the Stage 9 process water pond could be undertaken based on information gathered during early-stage construction of the OBDA and other process water ponds. This could be captured as a condition of consent as described in Section 11.3.

10 Conceptual construction recommendations

The following recommendations are conceptual and will need to be finalised prior to construction commencing.

¹¹ Jibson RW. Regression models for estimating coseismic landslide displacement. Eng Geo 2007;91(2-4):209-18.

¹² Macedo J, Bray JD, Liu C. Seismic slope displacement procedure for interface and intraslab subduction zone earthquakes. Journal of Geotechnical and Geoenvironmental Engineering 2023 ASCE

¹³ NZTA [2022]. Bridge manual SP/M/022, Third edition, Amendment 4

¹⁴ Bray JD and Travarasrou T [2007] Simplified procedure for estimating earthquake-induced deviatoric slope displacements. Journal of Geotechnical and Geoenvironmental Engineering, 133(4), 381-392pp

10.1 Foundation preparation

We anticipate that foundation stripping will be required to remove soft and saturated alluvium soils within the gully floor for each stage of placement.

The gullies are narrow, so the depth of soft/wet soils that will need to be undercut is expected to be limited to a thickness of <1.5 m. The area of stripping will be across the full width of the gully.

We recommend stripping of topsoil and vegetation from the entire footprint of each area prior to placing fill materials. Stripped materials may be stockpiled for final rehabilitation of the site.

The historic process water fines positioned at the crest of the quarry highwall should be sub-excavated and replaced with rockfill [Zone 1 fill described in Section 10.4] as part of foundation preparation.

10.2 Sub-surface drainage

10.2.1 Formal sub-soil drains

Formal underfill drainage will be required to manage groundwater pressures at the contact between the current ground surface and the overburden fill. This is expected to include a shallow trench along gully alignments with a filter sock wrapped perforated pipe that is surrounded by drainage aggregate. The drainage aggregate is proposed to be wrapped in a geofabric. This conceptual design is illustrated in Appendix B [Figure 13], where larger Type 1 drains are to be used for the main gully channels and smaller Type 2 drains to be used to pick up localised seepages that may be identified during foundation preparation.

An indicative plan of the length of sub-soil drains is included in Appendix B, Figure 3 along with a detail [Figure 7]. The extent of the sub-soil drainage network will need to be verified during foundation preparation for each construction stage.

10.2.2 Informal drainage blankets

At each bench level we recommend placement of a minimum 0.5 m thick weathered rock fill layer across the footprint of the OBDA to act as an informal drainage blanket which will assist in managing the development of pore water pressure within the fill.

These drainage blankets shall extend through the OBDA, and through any compacted front face to provide relief of excess pore pressures during construction and a drainage pathway for transient flows on completion [refer Appendix B, Figure 8].

The drainage blankets should be constructed from Zone 1 fill as described in Section 10.4.

10.3 Fill placement

10.4 Zone 1 Fill - Weathered greywacke rock fill

A key part of the geotechnical design is achieving an appropriate thickness of Weathered Greywacke Rock Fill buttress, which essentially provides a foundation for the OBDA and buttresses the lower slopes.

Zone 1 fill should be used to replace all unsuitable soils undercut within the gully floors and should be used to construct the entirety of the fill up to the first bench level in these gullies. Zone 1 should also be used to buttress the front face of 1V:2H batters as set out in Table 10-1.

Zone 1 fill should comprise free draining, moderately to highly weathered greywacke rock, with only minor fines. Guidance on placement requirements and compaction control is set out in Table 10-2 below.

10.5 Zone 2 Fill – Improved Greywacke soil fill

The OBDA construction incorporates a structural fill to support the front face of the OBDA for 1V:3H batters. It is also to be used behind the Zone 1 front facing in 1V:2H batters as set out in Table 10-1.

Individual fill layers for Zone 2 shall be bladed out to achieve the maximum loose lift thickness and then be compacted with an 825G Caterpillar compactor or approved equivalent. A D10 dozer may be substituted, provided that initial testing results are acceptable.

No excessive warping or weaving should be observable under trafficking by laden haul trucks post compaction.

Residual greywacke soils should be separated depending on moisture content. If encountered, visibly wet, soft residually weathered Greywacke soils should be separated and placed as Zone 3 mixed clay fill materials. This may include Greywacke soils excavated from close to the contact with an overlying geological unit.

Individual field tests should be undertaken as set out in Table 10-2. Where the soil material is more cohesive, shear vane tests shall be adopted. Where more granular soil material is present, Scala penetrometer testing shall be adopted.

If necessary, excess weathered greywacke rock (Zone 1) may be included into the Zone 2 materials in lifts up to 0.8 m thick. This material shall be placed as per the Zone 1 materials set out in Table 10-2. We anticipate that layers of weathered greywacke rock may also be used to intermittently cap the OBDA if trafficking becomes an issue for the overburden fleet.

10.6 Zone 3 Fill - Mixed clay fill

While a true civil earthworks specification is not appropriate for general overburden disposal some general placement guidance is appropriate so that the material strengths adopted in design can be achieved in practice.

Typical placement is expected to be dependent on moisture content. Drier soils may be bladed out and placed in lift thicknesses up to 1 m, while wetter soils may need to be bladed out in thinner layers [300-400 mm] due to difficulty in working and trafficking this material when placed in thicker lifts. The surfaces should be track rolled by bulldozer.

We consider that the soil placement methodology can be expected to provide a higher than usual level of compaction for the general Mixed Clay Fill. However, a lack of moisture control will mean that this material when placed is likely to be short of maximum dry density and thus is not expected to achieve the material strengths of a soil material compacted under a robust civil specification. However, the methodology is expected [and has been demonstrated through construction of a range of historical OBDA's] to be able to achieve the modelled material strengths used in our stability assessment for this unit.

The mixed clay fill should incorporate no more than 5% organics by volume, without specific geotechnical advice.

10.7 Zone 4 process pond fines

The current procedure is for ponds local to the processing plant to be dredged by excavator and trucked to a disposal cell located within the developing OBDA. This process is expected to be followed for the new OBDA.

Generally, process fines are expected to consolidate over time as demonstrated by historical process fines [15-25 years old] that are now exposed in the crest of the current Belmont Quarry highwall. These can stand in batters up to 5 m high at a slope angle of approximately 45°. We note that our stability analytical results consider both long term and short term seismic behaviour of pond fines.

Process pond fines should be locally supported by a temporary bund, which should not exceed 4 m high [to avoid triggering the need for building consent as a large dam], with a minimum crest width of 3 m and bund side slopes not to exceed 1V:2H. The process fines should be placed over a 1 m thick free draining layer of weathered greywacke rock fill, capped by a geofabric. The underfill drainage blanket should incorporate type 1 sub-soil drains at a minimum horizontal spacing of 10 m, which discharge to the OBDA face. The detail of this underfill drainage blanket and Type 1 subsoil drain is shown in Appendix B, Figure 9.

The temporary detention bund fill should be constructed in accordance with the recommendations for Zone 1 fill.

Process pond fines will need to be routinely encapsulated within the developing OBDA [as illustrated in the indicative stage plans]. The ponds should be encapsulated with a 1 m thick layer of brown rock fill, before later fines cells are developed. No more than two fines cells should be stacked in this fashion without additional geotechnical advice being sought.

10.8 Summary of zoned fill requirements & placement requirements

Table 10-1 sets out the widths of the various fill zones depending on the location within the OBDA. Table 10-2 summarises the recommended fill placement requirements.

We recommend that these Tables be reproduced in any Construction Management Plan [CMP] or Quarry Management Plan [QMP] prepared for the OBDA.

Table 10-1: Summary of zoned fill widths

Area of OBDA	Zone 1 horizontal width	Zone 2 horizontal width	Zone 3
Up to first bench level in all gullies	All fill	Nil	Nil
1V:2H batters	10 m	25 m	Balance of fill
1V:3H batters	Nil	10 m	Balance of fill
Supporting process water ponds	25 m	Nil	Balance of fill
1V:4H or flatter	Nil	Nil	All fill

Table 10-2: Summary of fill placement requirements

Material Type	Loose Layer Thickness [max]	Max Particle Size	Placement requirements	Testing & construction observation
Zone 1 - Weathered Greywacke Rock Fill	0.8 m	400 mm	Bladed out into lifts by Dozer. Track rolling by Dozer, Cycling of laden haul truck fleet	Single Test Minimum Clegg Impact Value [CIV] = 10 Average Clegg Impact Value [CIV] = 12 No warping or weaving evident under passage of laden haul trucks.
Zone 2 - Improved Greywacke Soil Fill	0.3 m	100 mm	Bladed out into lifts by Dozer. Track rolling by Dozer. Rolling with CAT 825 G or CAT D10 dozer [minimum 3 passes]. Cycling of laden haul truck fleet	<u>Cohesive Soil</u> Shear Vane [corrected] = 100 kPa [min]/ >120 kPa [3 test average] <u>Granular Soil</u> Scala Penetrometer 5 blows per 100mm [suite of three tests per location] Minimum 3 test set per 50m ² area. Testing to be carried out for every 0.5 m compacted thickness. No warping or weaving evident under passage of laden haul trucks.
Zone 3 - Mixed Clay Fill	0.3 m to 1.0 m	NA	Bladed out into lifts by Dozer. Track rolling by Dozer.	No specific testing requirements. No more than 5% organics by volume.
Zone 4 - Process Pond Fines	3.5 m	NA	End tipping from haul trucks.	No specific testing requirements.

11 Management of residual geotechnical risks

The analytical work demonstrates that the OBDA can achieve acceptable levels of stability. While the remaining geotechnical risks are considered to be low, we are satisfied that these can be further managed by way of consent conditions and management plans that capture the following uncertainties.

11.1 Early phase soil parameter verification

The stability of the OBDA is dependent on the strength of the materials. We recommend that laboratory testing be undertaken to verify material parameters.

For guidance, laboratory testing in the initial 10,000 m³ of placement of each of Zone 1 and Zone 2 should comprise [at a minimum]:

- Two single point heavy compaction tests.
- Two consolidated undrained triaxial tests on the compacted samples.

The test results should be reviewed against adopted material parameters in Section 9.2.

A condition of consent could be prepared requiring development of a final laboratory testing schedule and geotechnical verification letter summarising the results for Council certification.

11.2 Additional site investigation for Stage 4

We have completed mapping of the crest of the highwall which will provide the foundation for Stages 4-10 and have illustrated acceptable levels of stability for this part of the OBDA. However, we recognise that there are some remaining uncertainties related to the ground conditions away from the current quarry faces.

It should be noted that a range of design contingencies exist that could be incorporated into the design [within the proposed consent landform] to manage these uncertainties. These include:

- Increasing the width of higher strength internal zones [Zone 1 & 2].
- Flattening design slope angles.
- Increasing the offset of the OBDA toe from the quarry highwall.

To manage this residual risk, we recommend a detailed ground investigation and design be completed prior to commencement of Stage 4. The findings of this assessment could be submitted to Council for certification. We consider that a condition of consent would be an appropriate mechanism to manage this uncertainty.

11.3 Detailed design of Stage 9 process water fines pond

Analyses completed for the Stage 9 process water pond suggest that the offset from the front face required to manage liquefaction risk and flow failure is too large to provide an appropriately sized pond that would be operationally useful.

However, the operational need for this process pond and the interaction with the final stages of quarry operations is so far into the future [Year 38 of the schedule provided in Appendix C] that there is a high level of uncertainty in the seismic loading case that would need to be considered.

It is our view that process water pond construction for this stage is not such a significant risk that it should be expressly prohibited but rather be conditional on a detailed design being completed prior to construction of process water ponds at Stage 9.

We consider that a condition of consent would be an appropriate mechanism to manage this uncertainty. The condition should restrict construction of process water ponds at Stage 9 and 10, until a detailed design has been completed and certified by Council.

12 Summary and recommendations

Winstone Aggregates are applying for consent to place overburden within gullies located within Belmont Regional Park, to the northeast of their Belmont Quarry.

We have undertaken field mapping in the main east and west gullies and their associated sidling gullies and limited ground investigation to understand the likely ground conditions and identify geotechnical risks or hazards. Our investigation found that the site is generally underlain by greywacke sandstone that ranges from residual soils to moderately weathered greywacke.

The gully floors are typically soft, wet/saturated mixtures of silt, sands and gravel alluvium, with the exception of the lower reaches of the western gully where highly to moderately weathered greywacke is exposed on the stream. The thickness of the alluvial soils has been confirmed at less than 1.5 m by site investigations at or near to the toe of the proposed OBDA.

Weathered greywacke, historic gravel backfill and historic process water fines are present in the upper quarry batters near the toe of the OBDA where it abuts the quarry. While these materials appear to be performing acceptably in the quarry cut batters, historic process water fines will be sub-excavated from the foundation of the OBDA and replaced with weathered rock fill.

Three separate seismic loading scenarios have been considered. They are long term, short term liquefaction, and quarry adjacent design cases. The long term and quarry adjacent case result in a recurrence interval of 1:250 years, whereas the short term liquefaction case resulted in a recurrence interval of 1:50 years.

The slope stability analytical outputs demonstrate that the proposed OBDA slopes can achieve the adopted design criteria and therefore present a low risk of off-site effects.

The analysis results are based on sub-excavation of all soft alluvial material in the gully floors, placement of sub-soil drainage, replacement of sub-excavated materials with weathered rock fill and a zoned construction of the OBDA itself [as set out in Section 10].

To manage liquefaction risk associated with encapsulated process water ponds, these should be offset 30 m from the front face for the OBDA. This excludes process ponds at stage 9 in slopes abutting the quarry wall which will need to be specifically designed in future.

We have included concept level earthworks guidance for foundation preparation, sub-surface drainage and fill placement. We recommend verification of construction guidance prior to construction commencing for each stage.

Geotechnical verification and detailed design requirements for parts of the proposed OBDA design are set out in Section 11. We note potential adverse outcomes from this geotechnical verification step are manageable by changes to zoned fill placement, OBDA geometry and offset from the quarry highwall and that this could be achieved while remaining within the proposed OBDA landform geometry.

We consider that conditions of consent would be an appropriate mechanism to manage this verification work. We confirm that we have sighted the draft conditions of consent and consider that they appropriately reflect the recommendations made in this report.

Overall, considering the design prepared, the construction recommendations and associated draft conditions of consent we are of the opinion that the proposed OBDA presents a low risk of instability and associated environmental effects.

13 Applicability

This report has been prepared for the exclusive use of our client Winstone Aggregates and the Fast Track Expert Panel in their capacity as decision makers for Application FTA308 - Belmont Quarry Development. The recommendations and opinions in this report are limited to the purpose stated within the report. It may not be relied upon in other contexts or for any other purpose, or by any person other than those nominated above, without our prior written agreement.

We trust that this report meets your present requirements. If you have any queries or wish to discuss any aspect, please contact the undersigned.

For and on behalf of Baseline Geotechnical Limited:

.....


Cameron Lines

Director

Appendix A – Cameron Lines CV

Cameron Lines - Principal Engineering Geologist

Cameron is an Engineering Geologist with 25 years of experience in mining/quarrying, large-scale infrastructure development and land development, specialising in slope instability, natural hazard assessment, materials assessment, cut slope design, overburden disposal and geotechnical risk assessment.

He continues to operate across the full spectrum of the geotechnical sector, from the gathering of field data through to development of engineering geological models, geotechnical design, provision of geotechnical support for construction, and peer review.

Cameron has worked extensively throughout New Zealand, with specific expertise in the geology of the Northland, Auckland, Waikato & Wellington regions. His career to date has also seen him work in Australia, Indonesia, Samoa, Fiji, Sri Lanka and England.

A good understanding of the New Zealand regulatory environment is one of Cameron's strengths including the ability to present often complex geotechnical issues within the framework of environmental effects. He has provided technical support to regulatory authorities when assessing consent applications and has developed and presented geotechnical evidence on behalf of both Applicants and Regional Authorities at consent hearings and at the Environment Court. He is certified as an Independent Resource Management Act hearing commissioner and has acted as an Expert Panel member under the Fast Track Approvals Act (2024).



Expertise

Core competencies include:

- Engineering geology
- Natural hazard assessment
- Slope stability assessment
- Cut and fill slope design
- Geotechnical materials performance and construction observations
- Assessment of geotechnical risk
- Peer review
- Evidence preparation and appearing as an expert witness
- Project management

Experience

Examples of relevant projects:

Waihi North Project – Fast Track Expert Panel

Appointed as a geotechnical and mining specialist to the Fast Track Approvals expert decision making panel for the Waihi North Project.

Belmont Quarry Pit Slope Redesign, Wellington

Rock mass defect mapping, kinematic analysis, slope stability assessment, development of alternative design options for actively deforming 150m high cut slope in greywacke rock.

Horokiwi Quarry – Resource and geotechnical assessment

Structural geology assessment of existing quarry cuts and proposed new areas for extraction to define volumes and quality of the greywacke resource.

Waotu Quarry – Mediation

Review of instability in pit wall affecting a neighbouring Pa site at Waotu Quarry. Review work completed for Waikato Regional Council & South Waikato Regional Council. Briefing Iwi representatives, evidence preparation & appearing as an expert witness at Environment Court mediation.

Plan Change 29 – Nelson City Council

Review of slope instability susceptibility assessments and Fault Hazard assessments prepared by Council's geotechnical consultants. Provision of expert evidence, attending expert witness conferencing and appearing as an Expert Witness at the Plan Change hearing.

Penlink (NZTA)- Geotechnical Peer Review

Engineering geological peer review of Geotechnical Interpretative Report prepared by GHD at pre-tender preliminary design stage.

WFT Finances Limited Appeal – Waikato District Plan Mediation

Review of geotechnical information on behalf of Waikato District Council related to a plan change appeal at Munro Road in Pokeno. Preparation of a position statement and appearing as an expert witness at Environment Court mediation.

Puhoi to Warkworth [NZTA] – Geotechnical Review

Engineering geological peer review related to post construction performance of cut slopes.

Mill Road Project [NZTA] – Geotechnical Review

Engineering geological peer review of Geotechnical Interpretative Report prepared by AECOM at pre-tender preliminary design stage.

Landslide assessments and remedial design for water infrastructure – Watercare

Engineering geological assessment and design of both temporary and permanent remedial solutions for landslides affecting Watercare assets following 2023 natural hazard events in Auckland.

Scenic Drive landslide assessments and remedial design – Auckland Transport

Engineering geological assessment and design of remedial solutions for landslides arising from 2023 natural hazard events in Auckland for Auckland Transport.

Northern Interceptor – Consenting Design

Lead geotechnical consultant for the consenting design for the Northern Interceptor project. Included desk studies, engineering geological models, geotechnical risk assessment, geotechnical guidance for construction feasibility for HDD crossing of the upper Waitemata Harbour, preparation of geotechnical baseline reports.

Remedial slope stability review, Kotata Rise Whangarei.

Engineering Geology assessment of deep-seated landslide mechanism on pre sheared bedding for a large-scale residential development.

Remedial Design Feisst Ridge Slope Instability, Maramarua

Assessment of large scale bi-wedge instability developed in old highwall of K2 Pit during dewatering of K2 lake. Updating of geological models, slope stability assessment and design of remedial toe buttress solution.

Resource Consent, Regulatory Reviews– Waikato Regional Council.

Geotechnical reviews to support Council review of AEE documentation for Quarry sites, clean fill sites and the Peacocke Strategic Wastewater Project.

Geotechnical Peer Review, Highlands Special Housing Area, Nelson.

Geotechnical review of preliminary geotechnical design for a residential sub-division on land subject to historical slope instability.

Mangatangi Mine, Peer Review, Waikato.

Mining, geology and geotechnical peer review of proposed opencast coal mine for regulatory authorities during Consent Application Process. Included liaison with Applicants Experts, review of preliminary design, Section 92 assessment and preparation of Evidence for Consent Hearing.

Technical Support– Wiri South Due Diligence

Assessment of geotechnical risks relating to transfer of ownership of a closed quarry. Included liaison with Iwi groups who had an associated Treaty settlement claim.

Puke Coal Landfill, Peer Review, Waikato.

Geology and geotechnical peer review for regulatory authorities of MSW landfill proposed to backfill an abandoned opencast coal mine. Included review of the AEE, liaison with Applicants Experts, review of preliminary design, and Section 92 assessment on behalf of Council.

Qualifications

MSc (Hons), Engineering Geology, 1999

BSc, Geology, Geography, 1996

Chartered Member of Engineering New Zealand –
Registered Professional Engineering Geologist
CMEngNZ [PEngGeol]

Qualified RMA Hearing Commissioner

Cameron Lines is currently a member of:

International Association for Engineering Geology,
New Zealand Geotechnical Society.

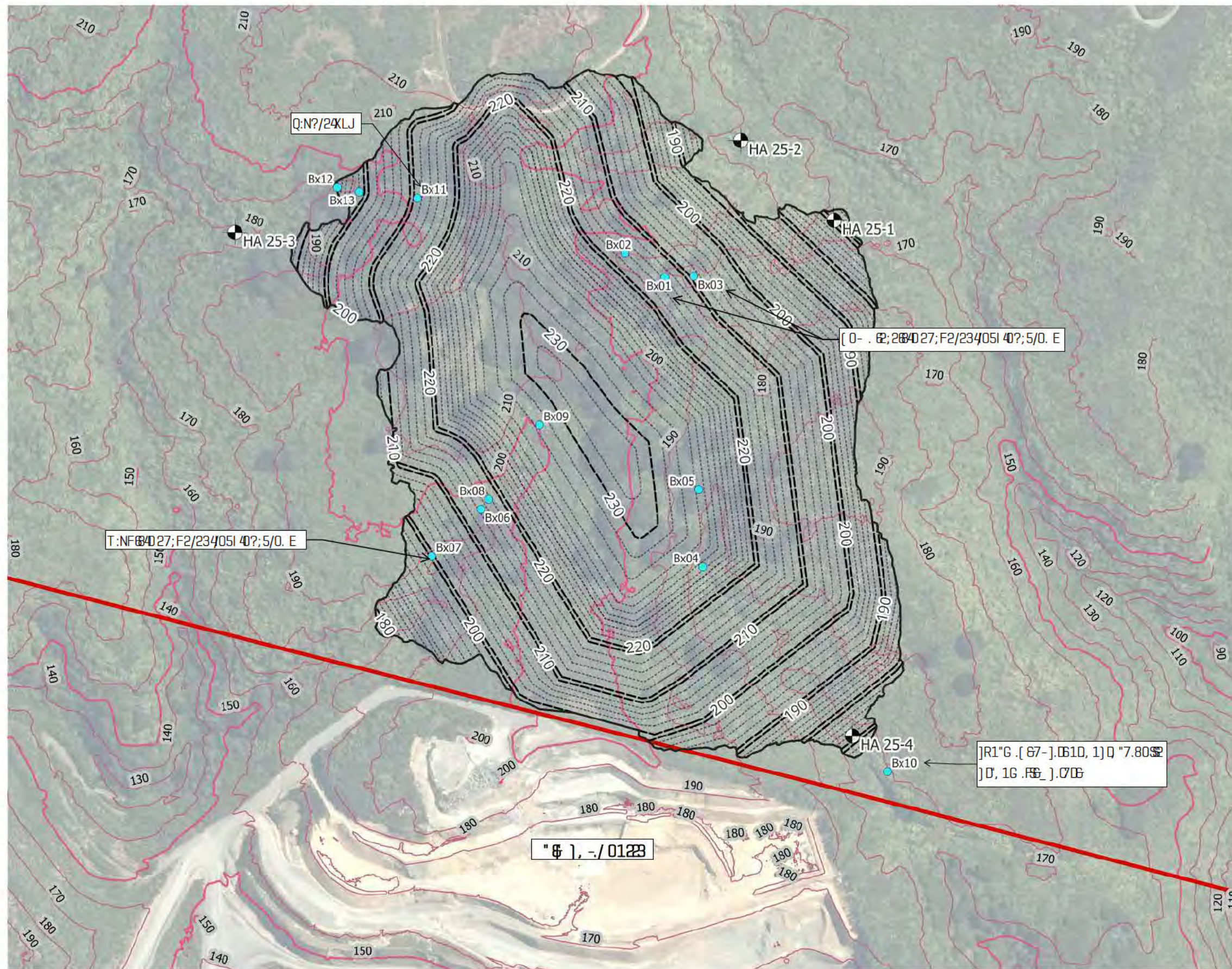
Australian Institute of Mining and Metallurgy.

Contact information

Tel: [REDACTED]

Email: [REDACTED]

Appendix B – BGL figures



Legend

- Belmont quarry boundaries
- BGL Field Observations
- Investigation Locations

OBDA Design

- Design Footprint

Design Contours

- 2m
- 10m

Existing Ground Contours (drone survey)

- 10m
- 50m

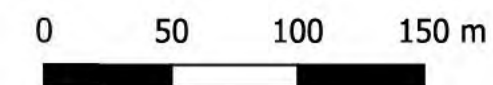


Figure 1: Proposed OBDA Design Footprint and Investigation Locations. The map shows the design footprint (black outline) and existing ground contours (red lines) for the Belmont quarry. Investigation locations are marked with black dots and labeled HA 25-1, HA 25-2, HA 25-3, and HA 25-4. BGL Field Observations are marked with blue dots and labeled Bx01 through Bx13. The map also shows the Belmont quarry boundaries (red line) and the design footprint (black outline). The map is titled "Figure 1: Proposed OBDA Design Footprint and Investigation Locations".

Drawn	19/12/2025
Checked	CJL 19/12/2025
Project No.	BGL000252
Scale:	1:3000
Original Size:	A3

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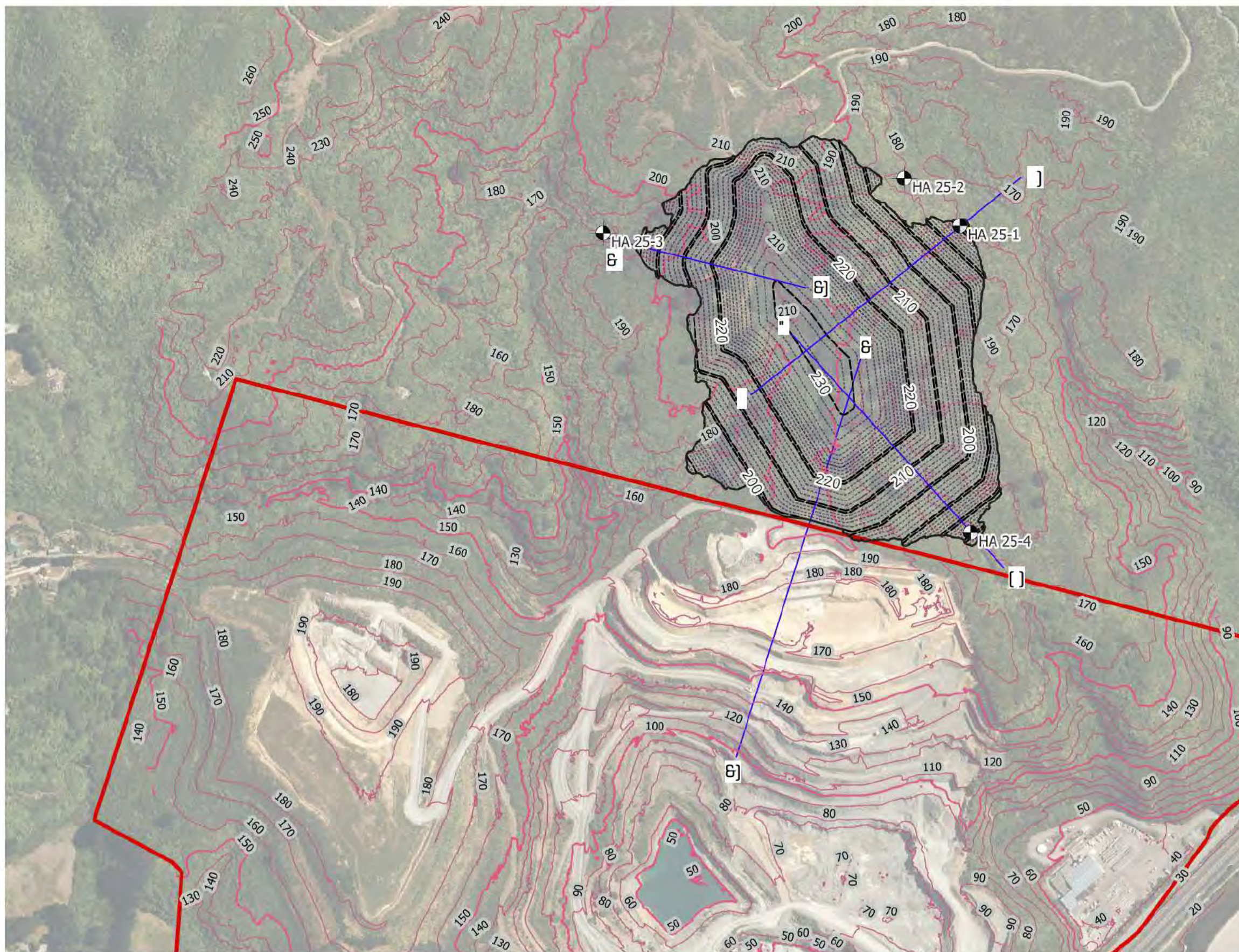
WINSTONE AGGREGATES

Observations and Investigations Location Plan

Proposed OBDA
Belmont Regional Park

Figure Number: Appendix B, Figure 1

Rev A



Legend

OBDA Design

Design Footprint

Design Contours

2m

10m

Belmont quarry boundaries

Cross Section Locations

Existing Ground Contours (drone survey)

10m

50m

Investigation Locations

0 50 100 150 m



Figure 1: Cross Sections Location Plan
E. J. 9/7/2026
P. E. J. 1/8/2026
R. P. A. 2/8/2026

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Checked	CJL	22/07/2026
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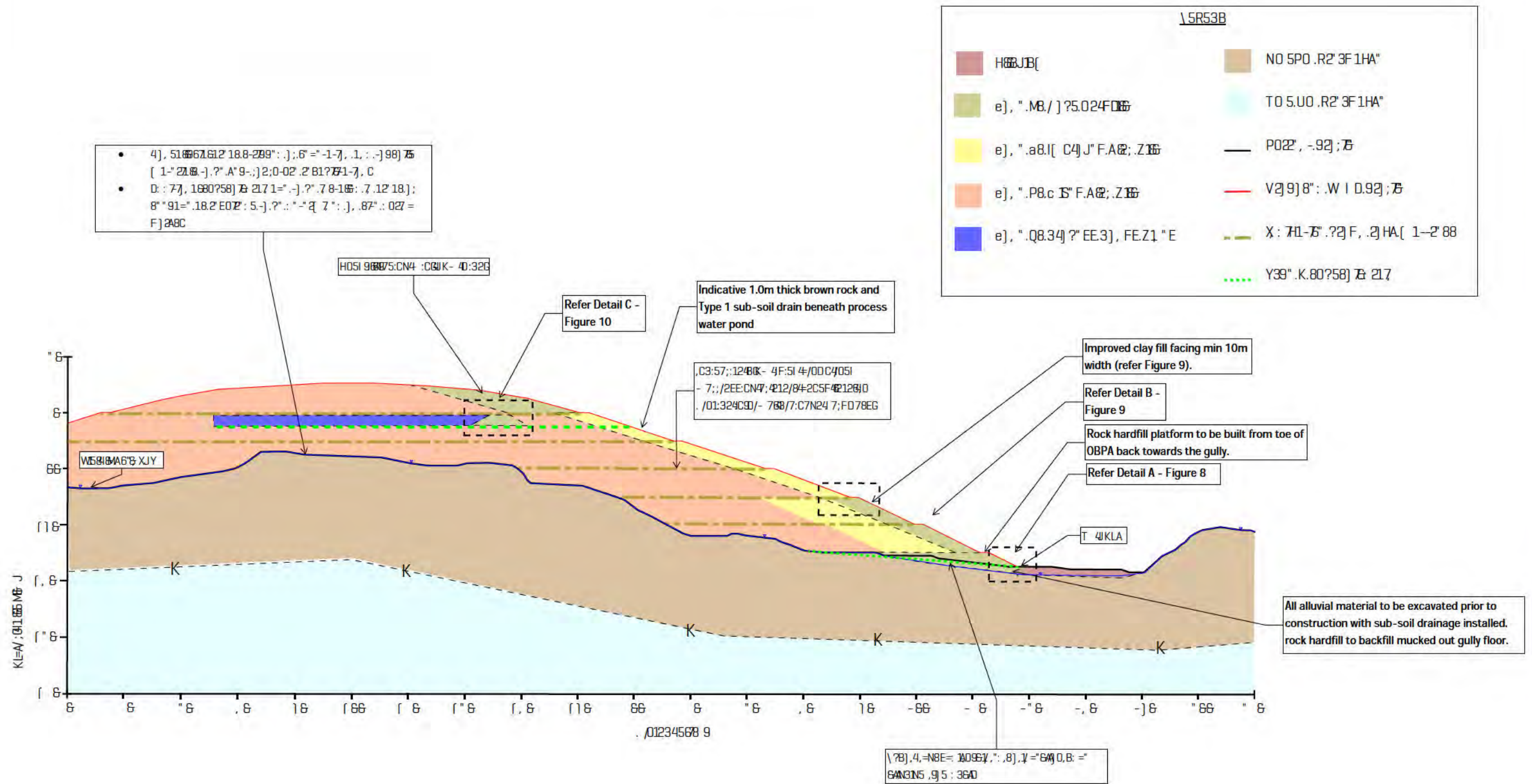
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Cross Sections Location Plan
Proposed OBDA
Belmont Regional Park

Figure Number: 203:MA 14Q:24

Rev A



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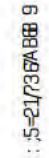
Cross Section A-Eastern Sidling Gully

Proposed OBDA

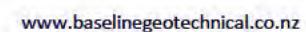
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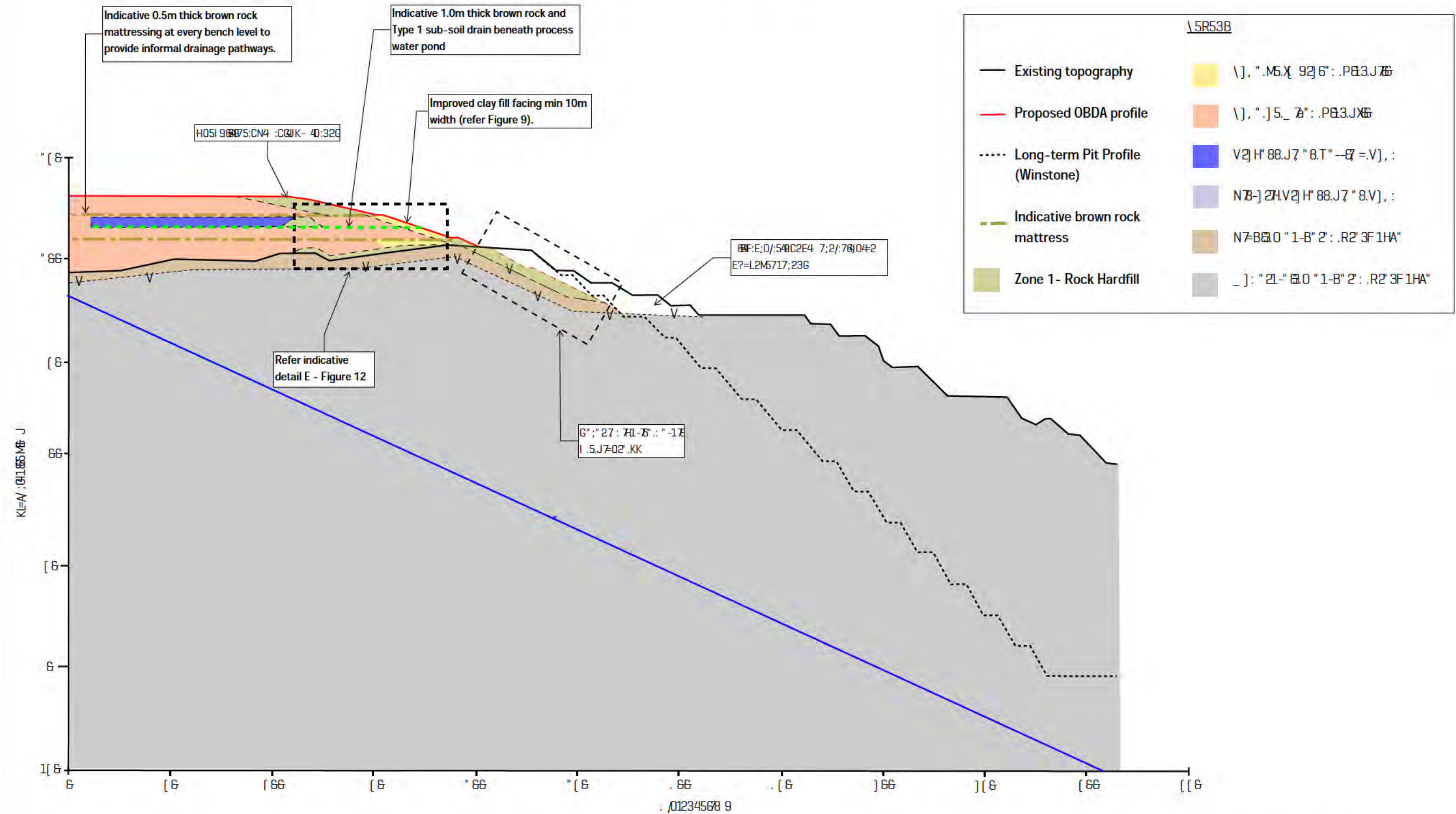
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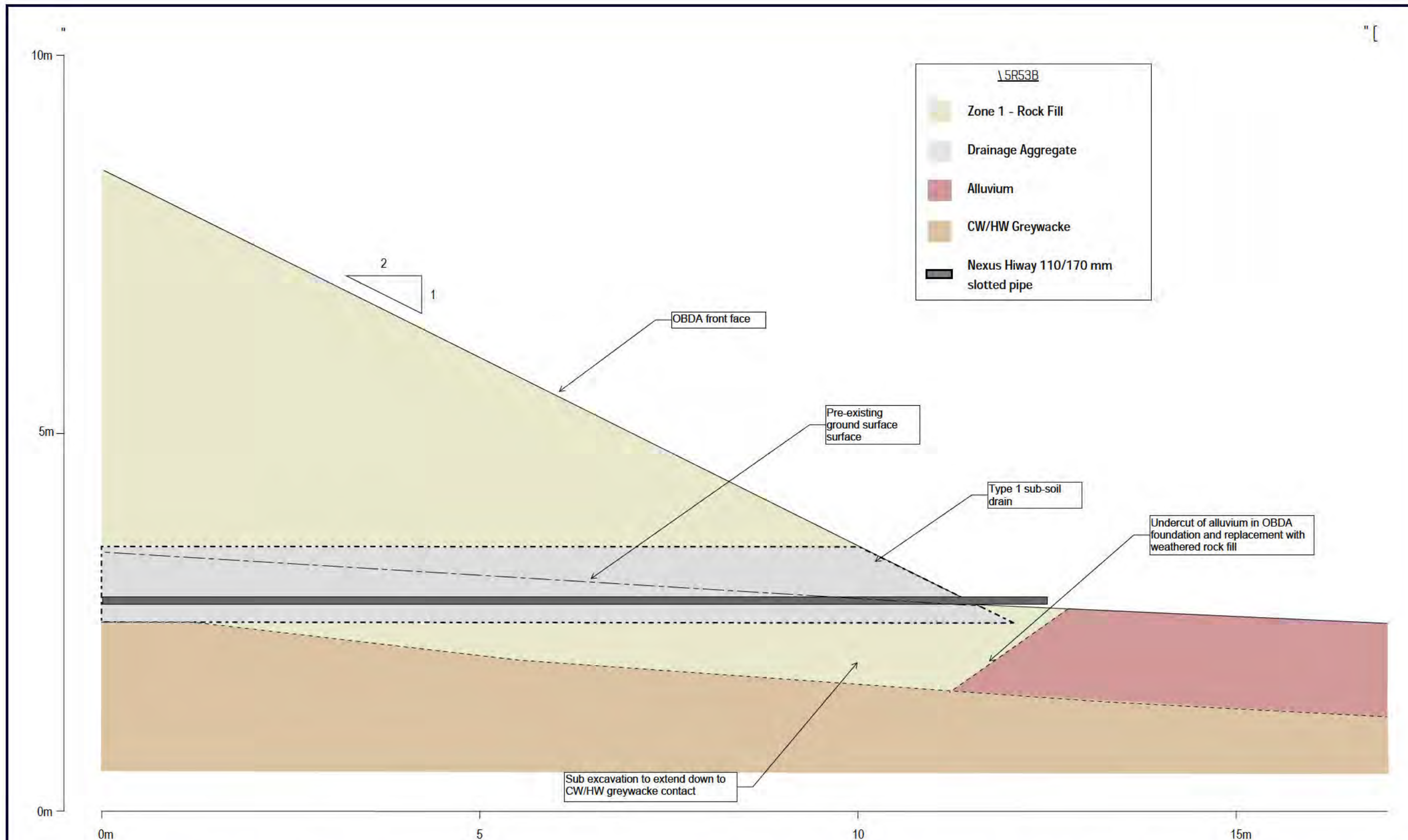
Cross Section D- East Wall

Proposed OBDA

" 26 OC; 4H2N: OC70W/ I

FIG. No. . . 2C3: M4 4Q: N?/ 24

REV. B



1. Proposed OBDA profile based on design "OB-R9J" provided by Mine Design Systems on 19/12/2025.
2. Dashed lines between units represent inferred boundaries that may vary away from investigation locations.



www.baselinegeotechnical.co.nz

DRAWN	CJL	16.03.26
DRAFTING CHECKED	JV5	16.03.26

APPROX. SCALE (AT A3 SIZE)
1:50

PROJECT No. XbM BUB

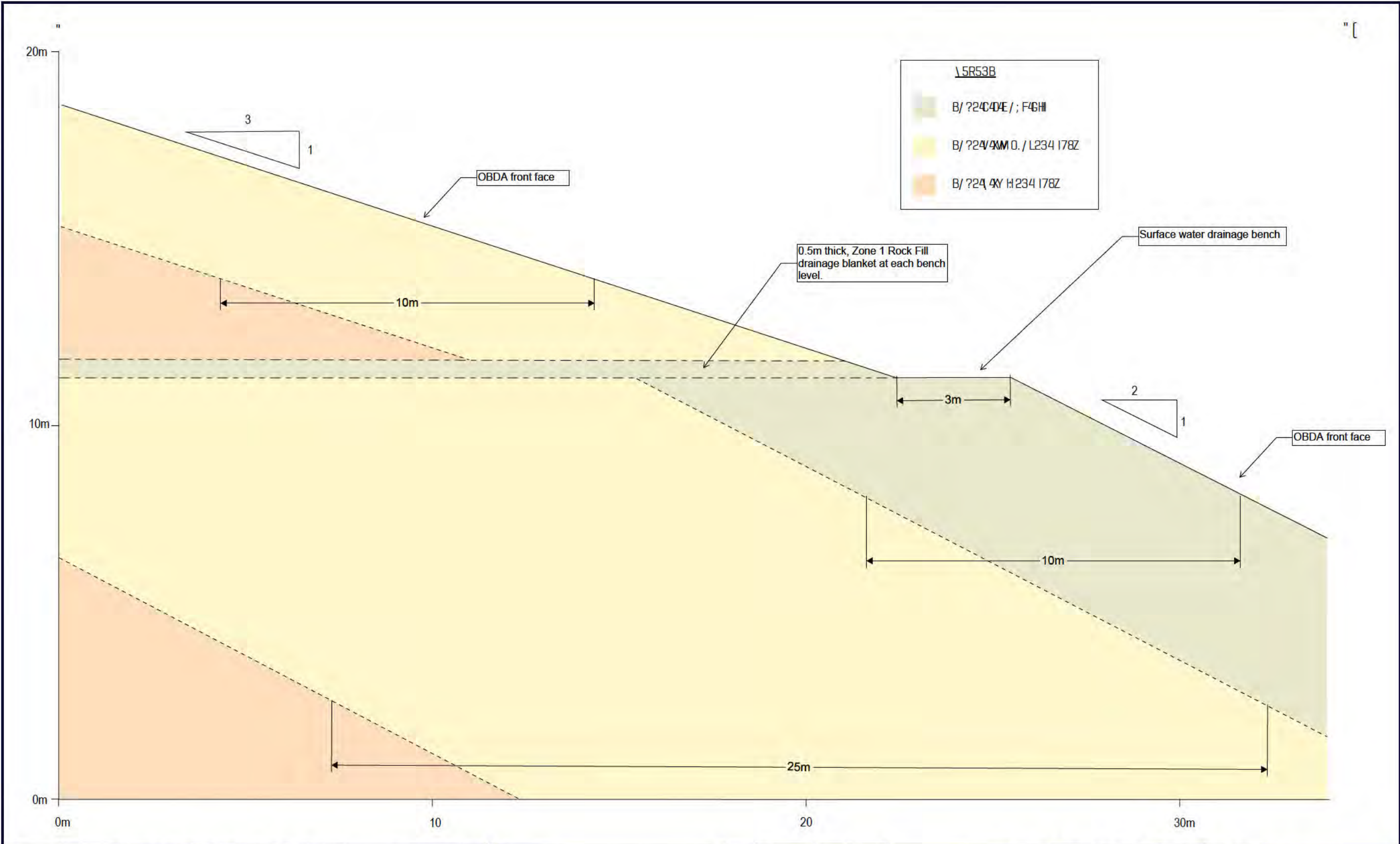
Detail A - Toe Buttress and Drainage

Proposed OBDA

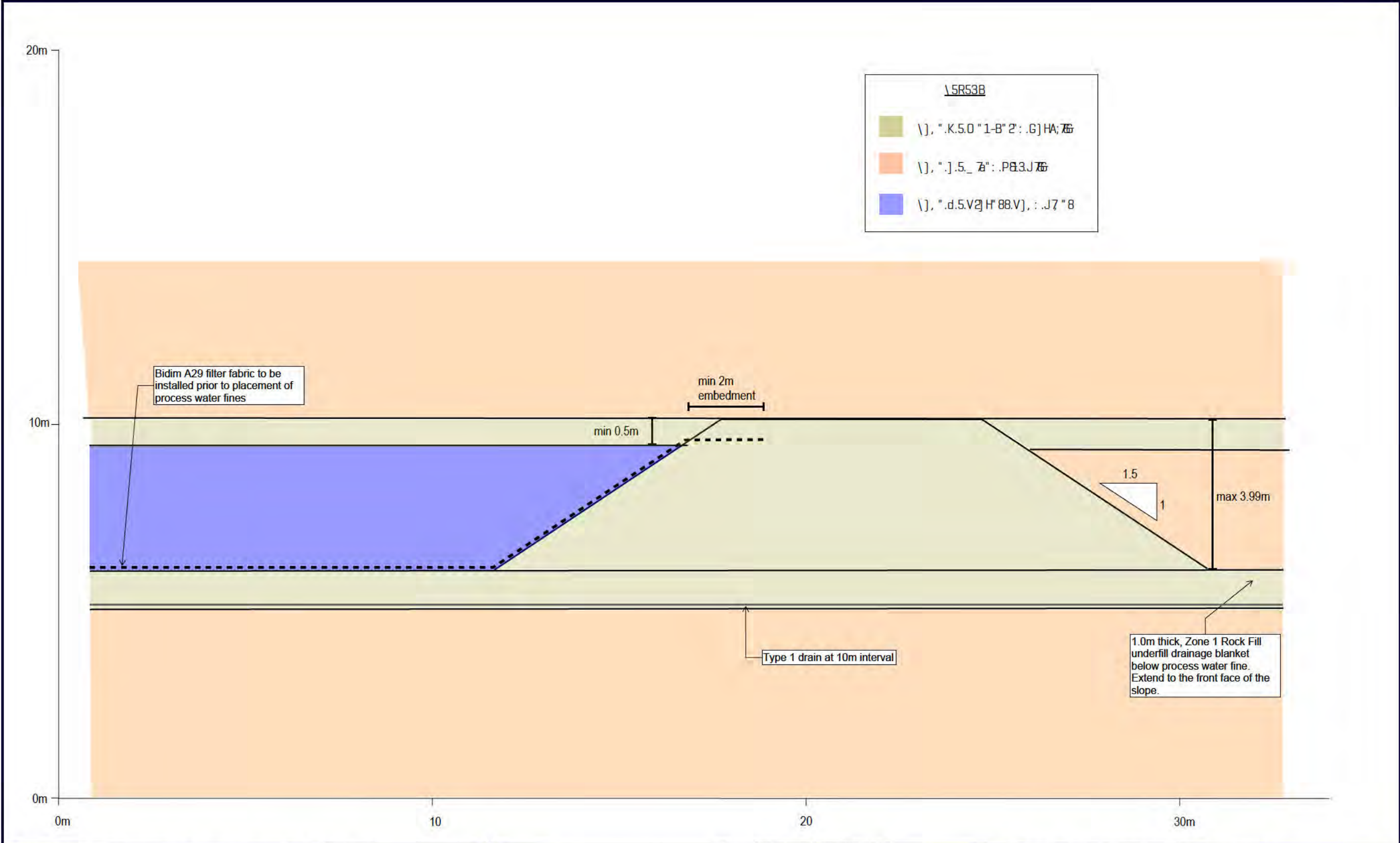
" 26-0C;412N:0C7BW/I

FIG. No. . . 2C3:M 4Q:N?/24

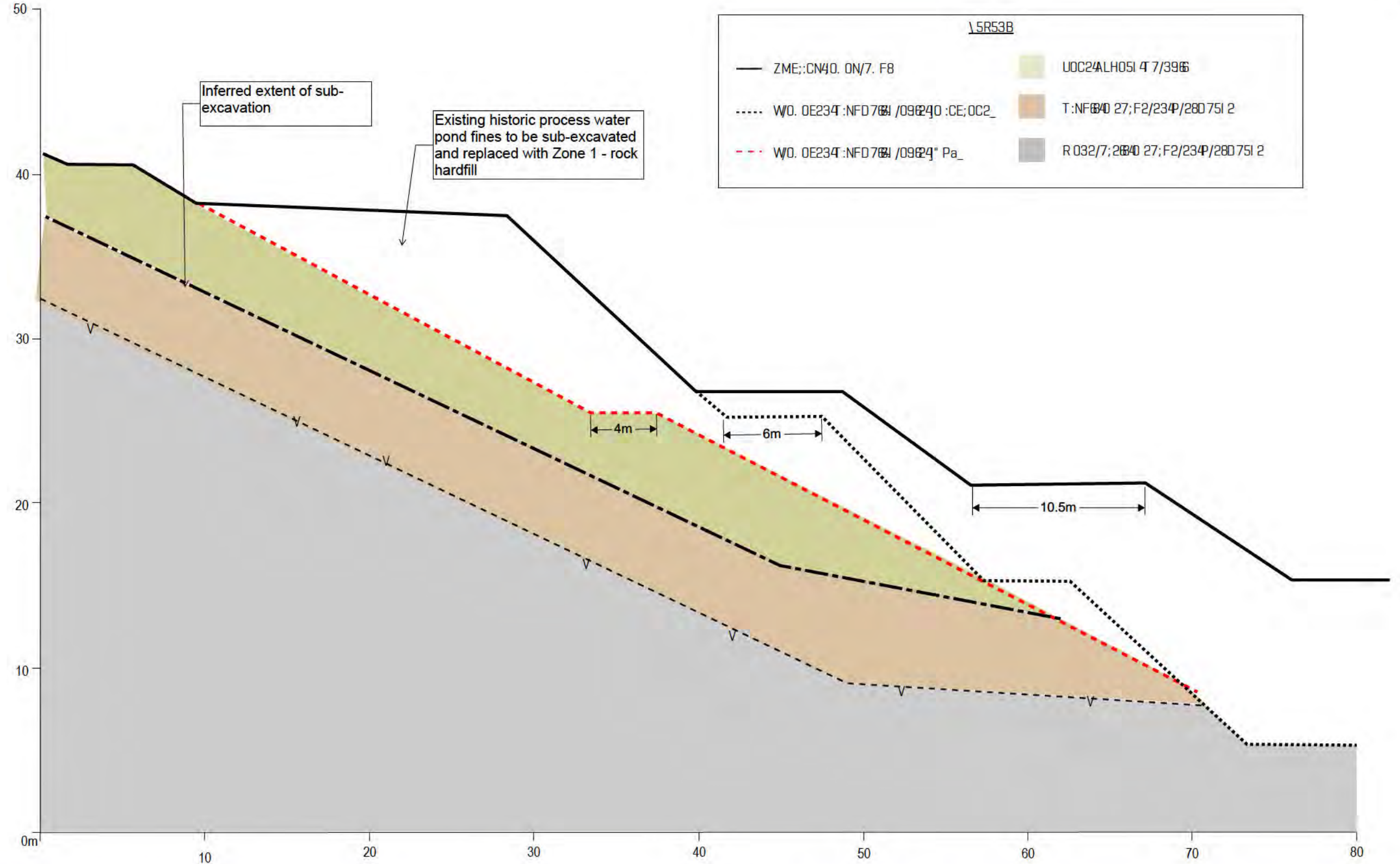
REV. A



1. Proposed OBDA profile based on design "OB-R9J" provided by Mine Design Systems on 19/12/2025. 2. Dashed lines between units represent inferred boundaries that may vary away from investigation locations.	 BASELINE GEOTECHNICAL www.baselinegeotechnical.co.nz	DRAWN [] 16.03.26	Detail B - Inter-Bench Drainage Proposed OBDA " 26- 0C; 412N: 0C78W7/I		REV. A
		DRAFTING CHECKED JV5 16.03.26			
		APPROX. SCALE (AT A3 SIZE) 1:100			
		PROJECT No. XbM BUB	FIG. No. .. 2C3: M4 4Q: N7/24		



1. Detention bund to be maintained below large dam and classifiable dam threshold. 2. Min freeboard of 0.5m should be allowed for.	 www.baselinegeotechnical.co.nz	DRAWN THL 21.07.26	Detail C - Process Water Fines Proposed OBDA " 26- OC; 412N: OC7BW/1	
		DRAFTING CHECKED [j a 21.07.26		
		APPROX. SCALE (AT A3 SIZE) 1:100		
		PROJECT No. XbM BUB	FIG. No. . . 2C3: M4 LQ: N?/24AB	REV. 0



W0 78; 8 =0-BPQ; H0QBCSG0ZLCST0B G\ZC9GH0P; 02 8 9; ?; G0I==EG=C: G90Q0B GE0HC: GH0V]-a)b-baX
bXF0PA?9GH0 FJ0HG9B; 09?Q0B0GH0BPN 02 8 9; ?; G0I==EG=C: G90F0PAGUG0R GZ0A?B C0V0B0ZM0: W-M0 XH7M X
/XF0PA?9GH0P; =MGBN 0HG9B; 09?Q0B0GH0BPN 02 8 9; ?; G0I==EG=C: G90F0PAGUG0R GZ0A?B C0V0B0Z
0I dPef " 63 e4fJP" 0\X
. X0C90GH0B G90ZG:RGG; 0; 890B0B0G; :0 K0B0H0Z?Q; H0B0B0X



**BASELINE
GEOTECHNICAL**

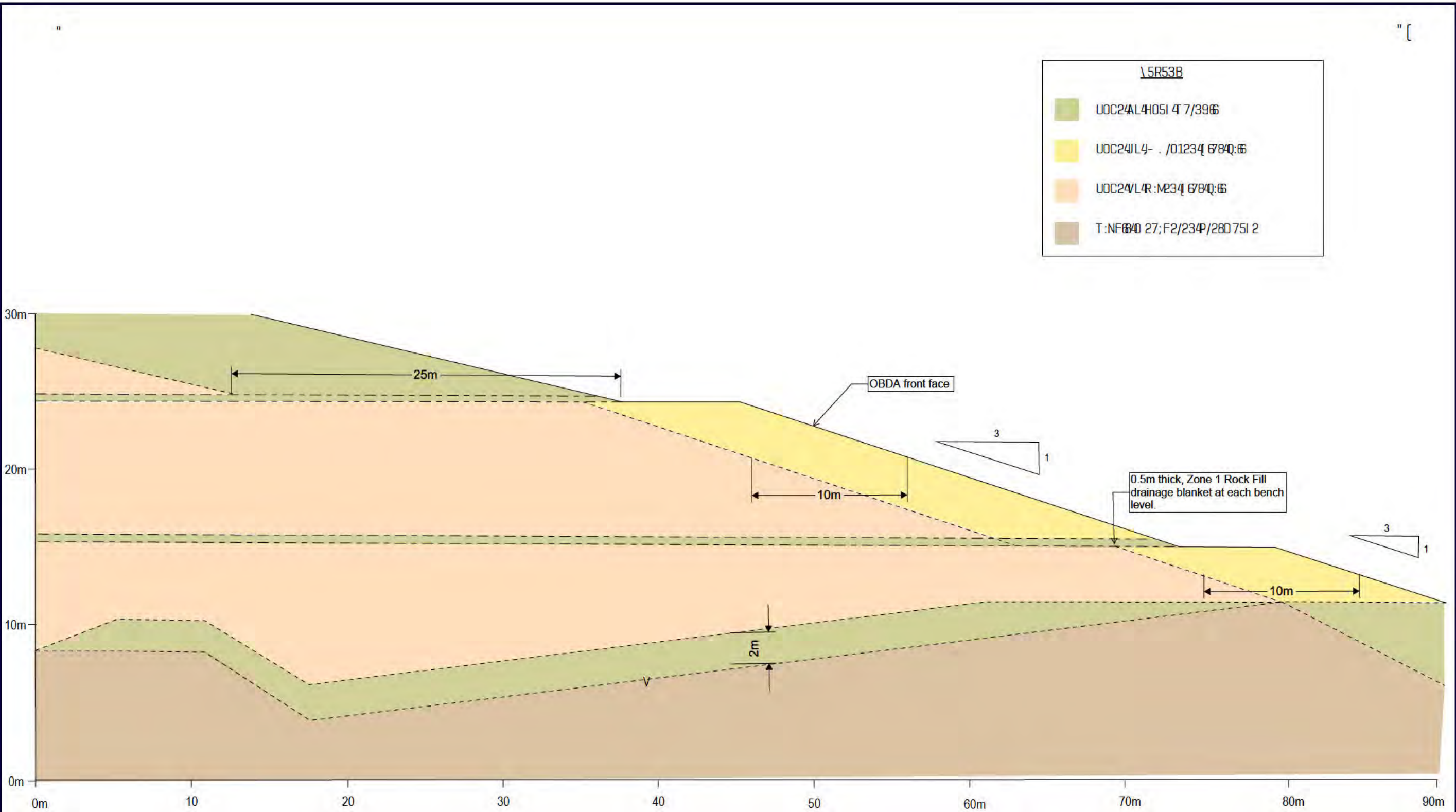
www.baselinegeotechnical.co.nz

DRAWN	[]	MK0f 00
DRAFTING CHECKED	[] a	MK0f 00
APPROX. SCALE (AT A3 SIZE) TUSDV		
PROJECT No.	XbM BUB	

**Detail D - Proposed Belmont Quarry Highwall
Geometries
Proposed OBDA**

" 26- 0C;4H2N:0C70W7/I

FIG. No.	203:M1 4LQ:N?/24A
REV.	0



UOC24/L4:051 47/396
UOC24/L4:01234 67890
UOC24/L4:0234 67890
T:NFB40 27;F2/234/280751 2



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DRAWN	[]	aM] _\ab
DRAFTING CHECKED	[j a	aM] _\ab
APPROX. SCALE (AT A3 SIZE) TUSDV		
PROJECT No.	XbM	BUB

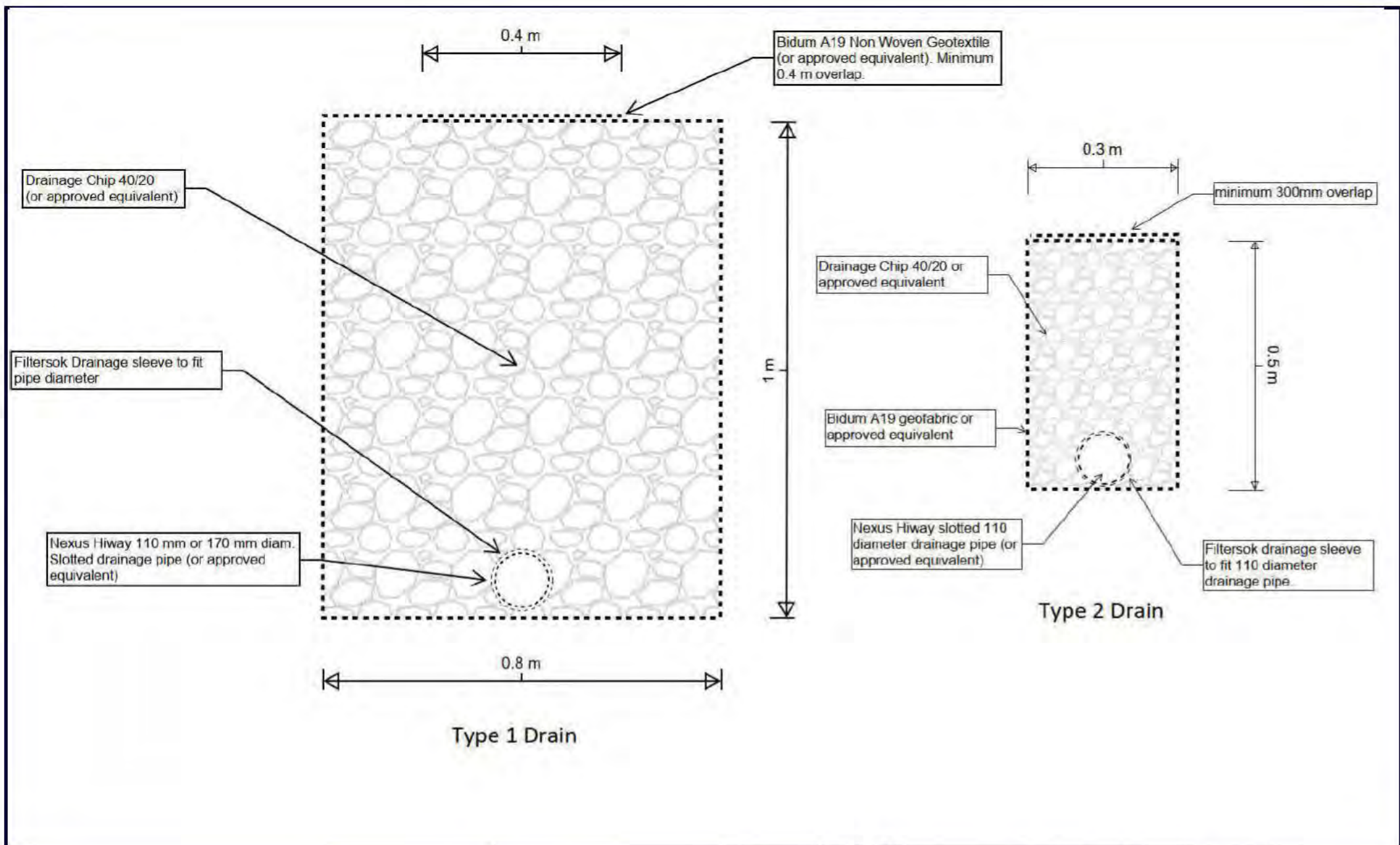
Detail E - Inter-Bench Drainage and Drainage Blanket

Proposed OBDA

26-OC;4H2N:OC76W/I

FIG. No. 203:M4 4Q:N7/24AJ

REV. 0



	 BASELINE GEOTECHNICAL[®] www.baselinegeotechnical.co.nz	DRAWN / 01 "015. DRAFTING CHECKED / 01 "015.	Sub-Soil Drain Detail Proposed OBDA " 26 OC; 4H2N:0C7@W/I	
		APPROX. SCALE (AT A4 SIZE) As Shown		
		PROJECT No. 2A1[[[B	FIG. No. .. 2C3:M 4L4Q:N?/24V	REV. A

Appendix C – OBDA staging plan

OBDA staged volumes and timings

OBDA Stage	Cumulative Volume (m ³)	From commencement	Indicative Year
Stage 1	538,000	Year 11	2037
Stage 2	594,000	Year 12	2038
Stage 3	810,000	Year 14	2040
Stage 4	1,352,000	Year 16	2042
Stage 5	1,425,000	Year 17	2043
Stage 6	1,811,000	Year 19	2045
Stage 7	1,870,000	Year 20	2046
Stage 8	2,448,000	Year 30	2056
Stage 9	2,666,000	Year 38	2064
Stage 10	2,729,000	Year 40	2066

STAGE 1

STAGE 2

STAGE 3

STAGE 4

STAGE 5

STAGES 6 and 7

STAGES 8, 9 and 10

LEGEND

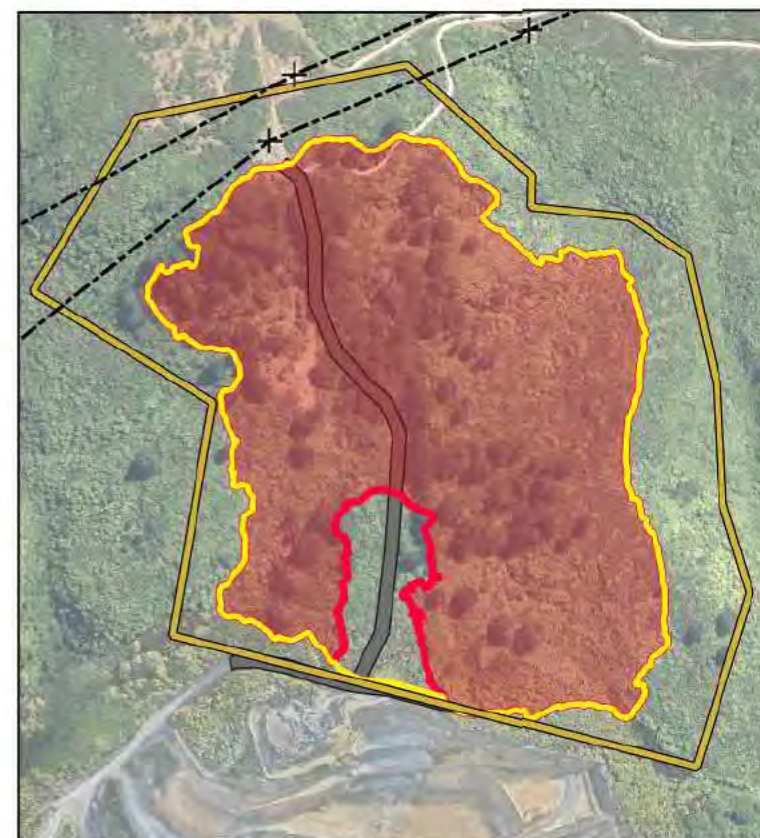
-  Site Boundary
-  Stage Footprint
-  OBDA Extents
-  Central Haul Road

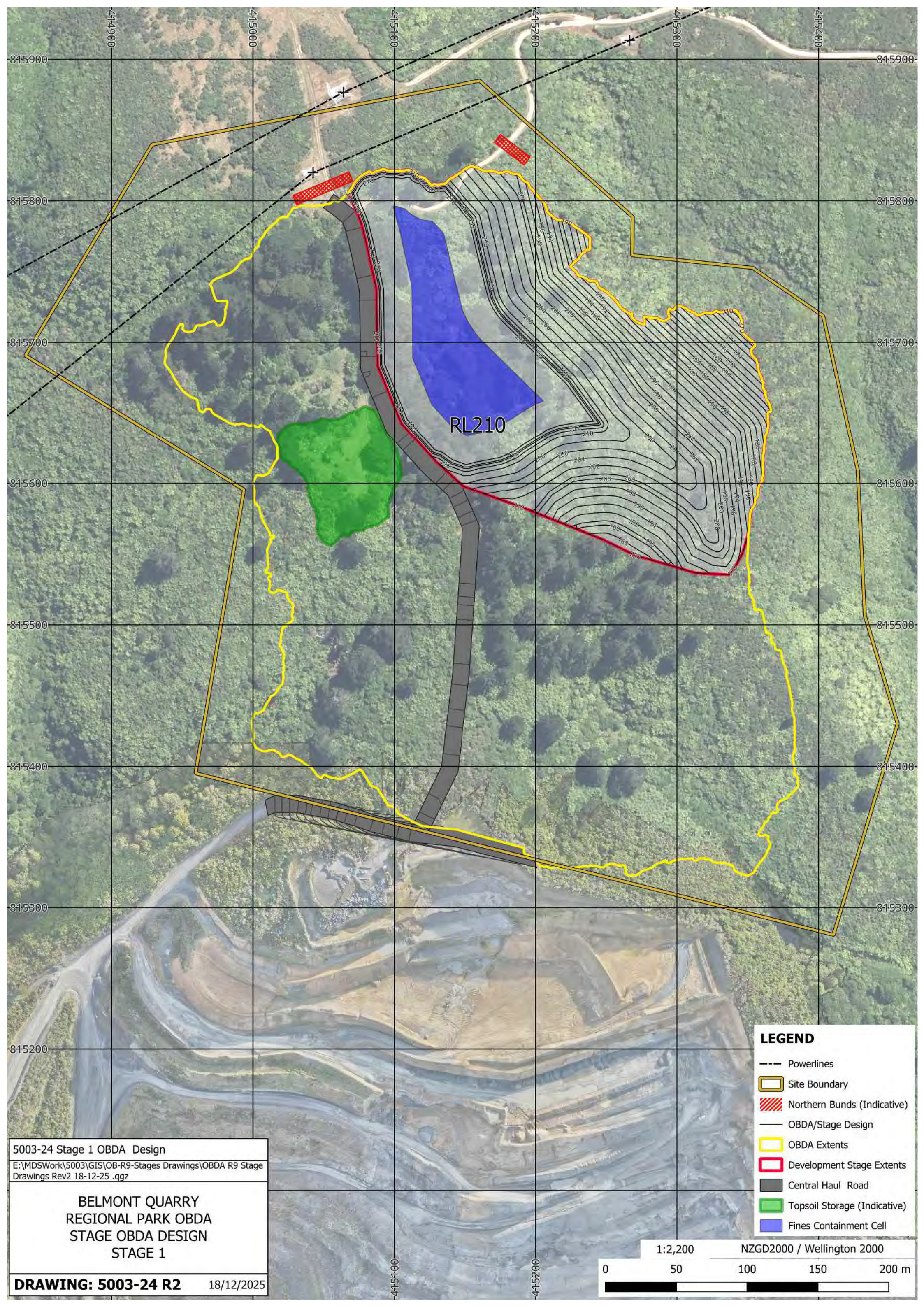
5003-21 Staged Development Footprints
 E:\MDSWork\5003\GIS\OB-R9-Stages Drawings\OBDA R9 Stage Drawings Rev2 18-12-25 .qgz

**BELMONT QUARRY
 REGIONAL PARK OBDA
 STAGED DEVELOPMENT
 FOOTPRINT AREAS**

DRAWING: 5003-21 R2

18/12/2025





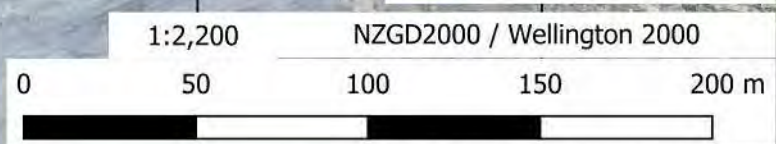
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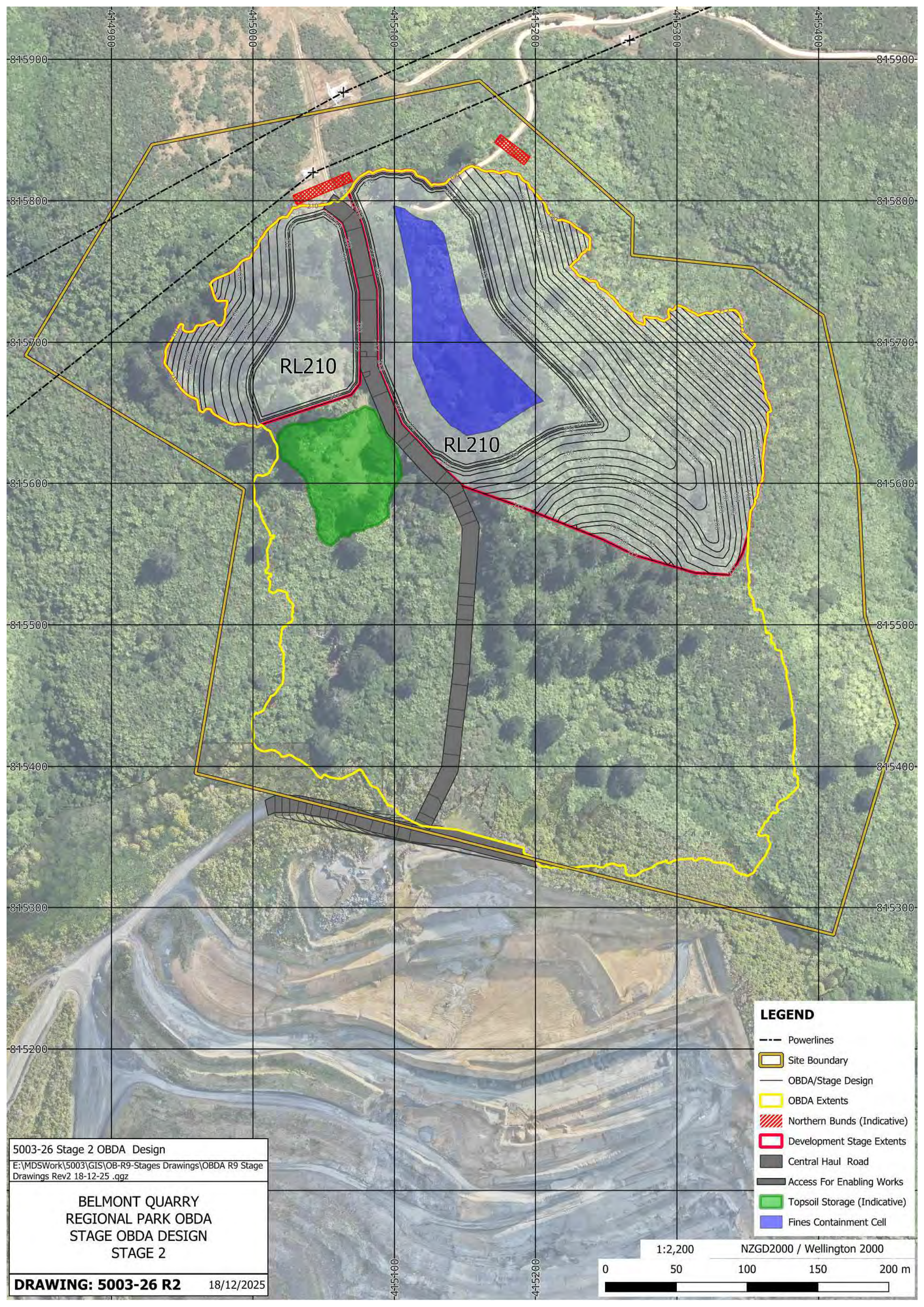
- Powerlines
- Site Boundary
- Northern Bunds (Indicative)
- OBDA/Stage Design
- OBDA Extents
- Development Stage Extents
- Central Haul Road
- Topsoil Storage (Indicative)
- Fines Containment Cell

5003-24 Stage 1 OBDA Design
E:\MDSWork\5003\GIS\OB-R9-Stages Drawings\OBDA R9 Stage Drawings Rev2 18-12-25 .qgz

**BELMONT QUARRY
REGIONAL PARK OBDA
STAGE OBDA DESIGN
STAGE 1**

DRAWING: 5003-24 R2 18/12/2025





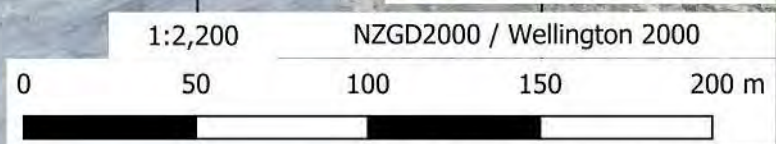
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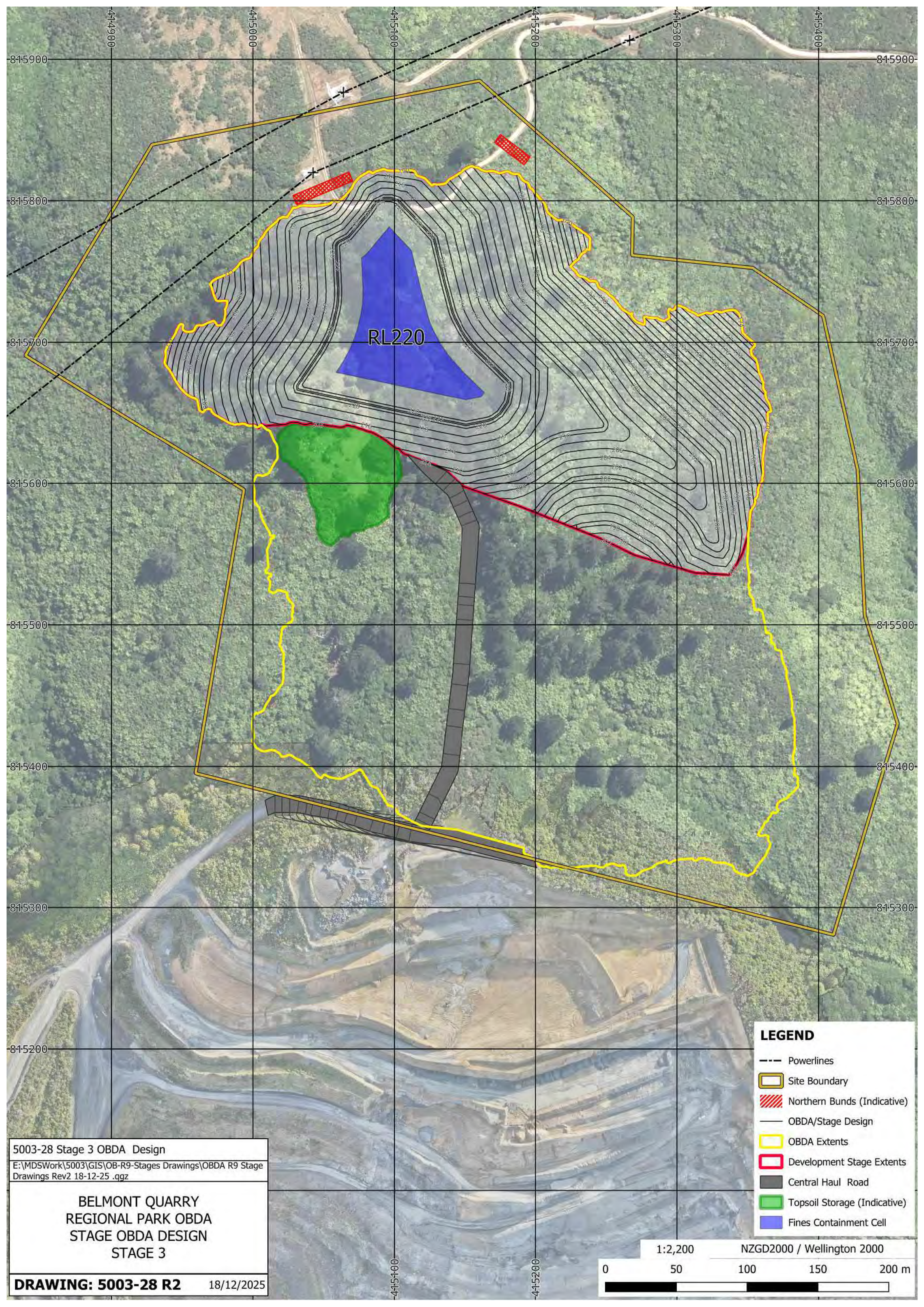
- Powerlines
- Site Boundary
- OBDA/Stage Design
- OBDA Extents
- Northern Bunds (Indicative)
- Development Stage Extents
- Central Haul Road
- Access For Enabling Works
- Topsoil Storage (Indicative)
- Fines Containment Cell

5003-26 Stage 2 OBDA Design
E:\MDSWork\5003\GIS\OB-R9-Stages Drawings\OBDA R9 Stage Drawings Rev2 18-12-25 .qgz

**BELMONT QUARRY
REGIONAL PARK OBDA
STAGE OBDA DESIGN
STAGE 2**

DRAWING: 5003-26 R2 18/12/2025



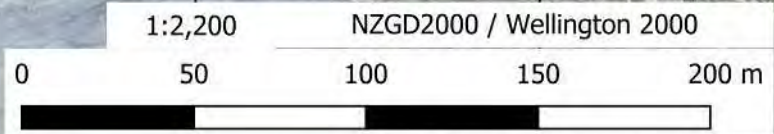


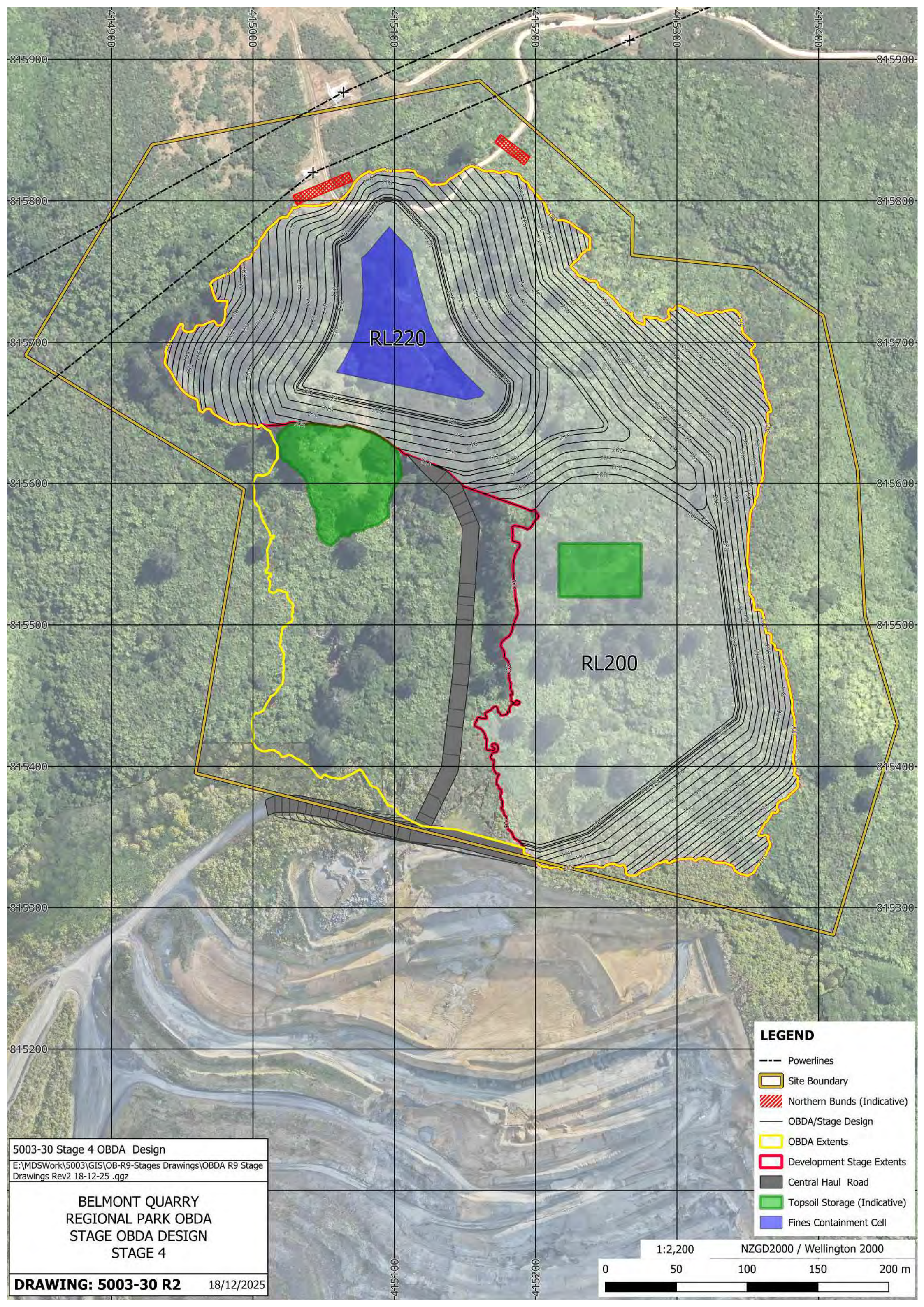
5003-28 Stage 3 OBDA Design
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BELMONT QUARRY
REGIONAL PARK OBDA
STAGE OBDA DESIGN
STAGE 3

DRAWING: 5003-28 R2 18/12/2025

- LEGEND**
- Powerlines
 - Site Boundary
 - Northern Bunds (Indicative)
 - OBDA/Stage Design
 - OBDA Extents
 - Development Stage Extents
 - Central Haul Road
 - Topsoil Storage (Indicative)
 - Fines Containment Cell





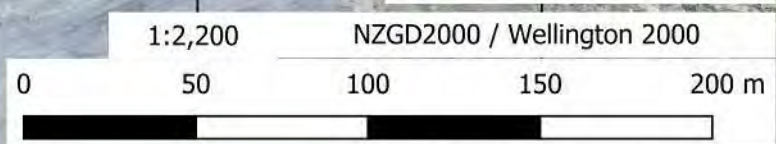
LEGEND

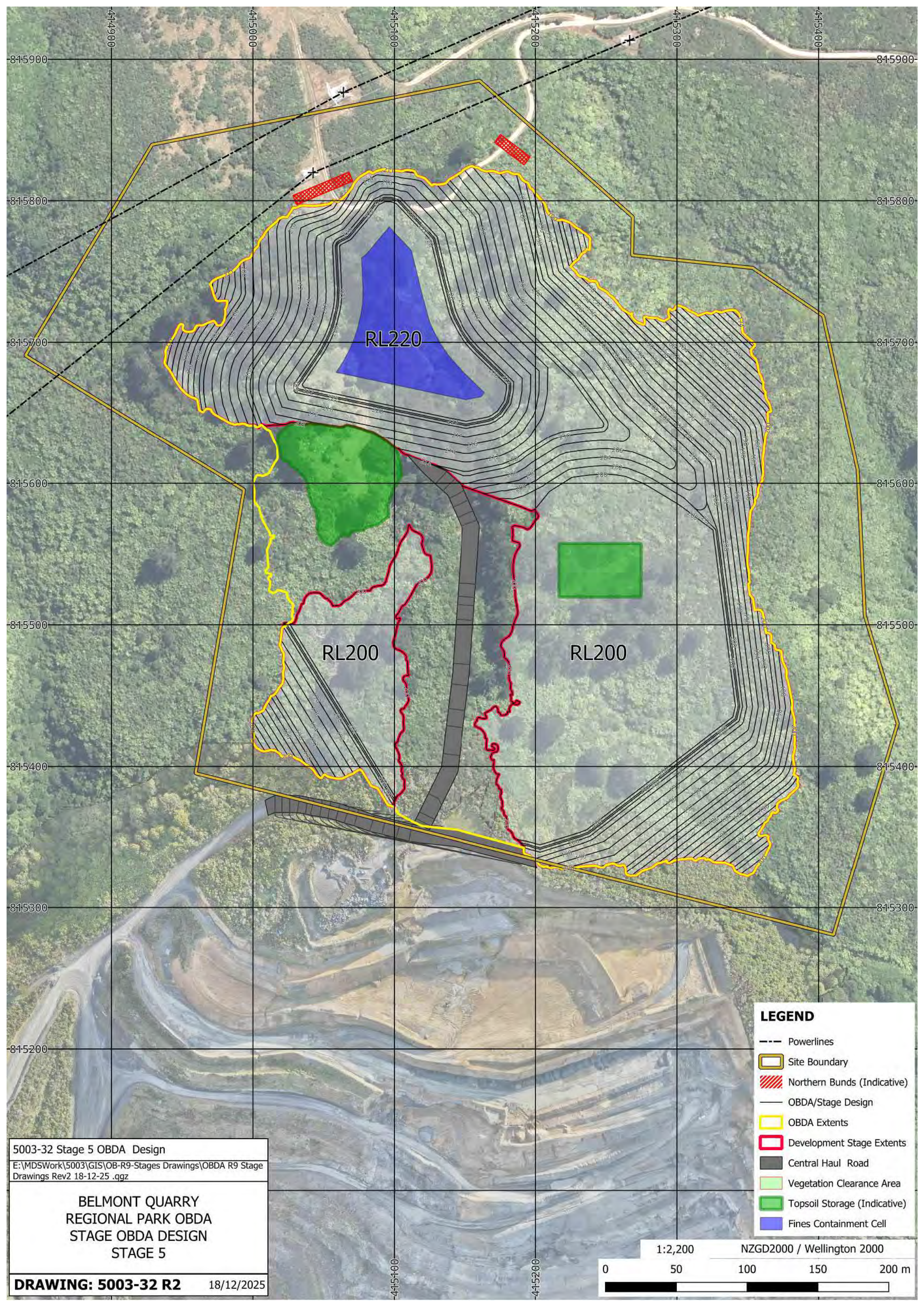
- Powerlines
- Site Boundary
- Northern Bunds (Indicative)
- OBDA/Stage Design
- OBDA Extents
- Development Stage Extents
- Central Haul Road
- Topsoil Storage (Indicative)
- Fines Containment Cell

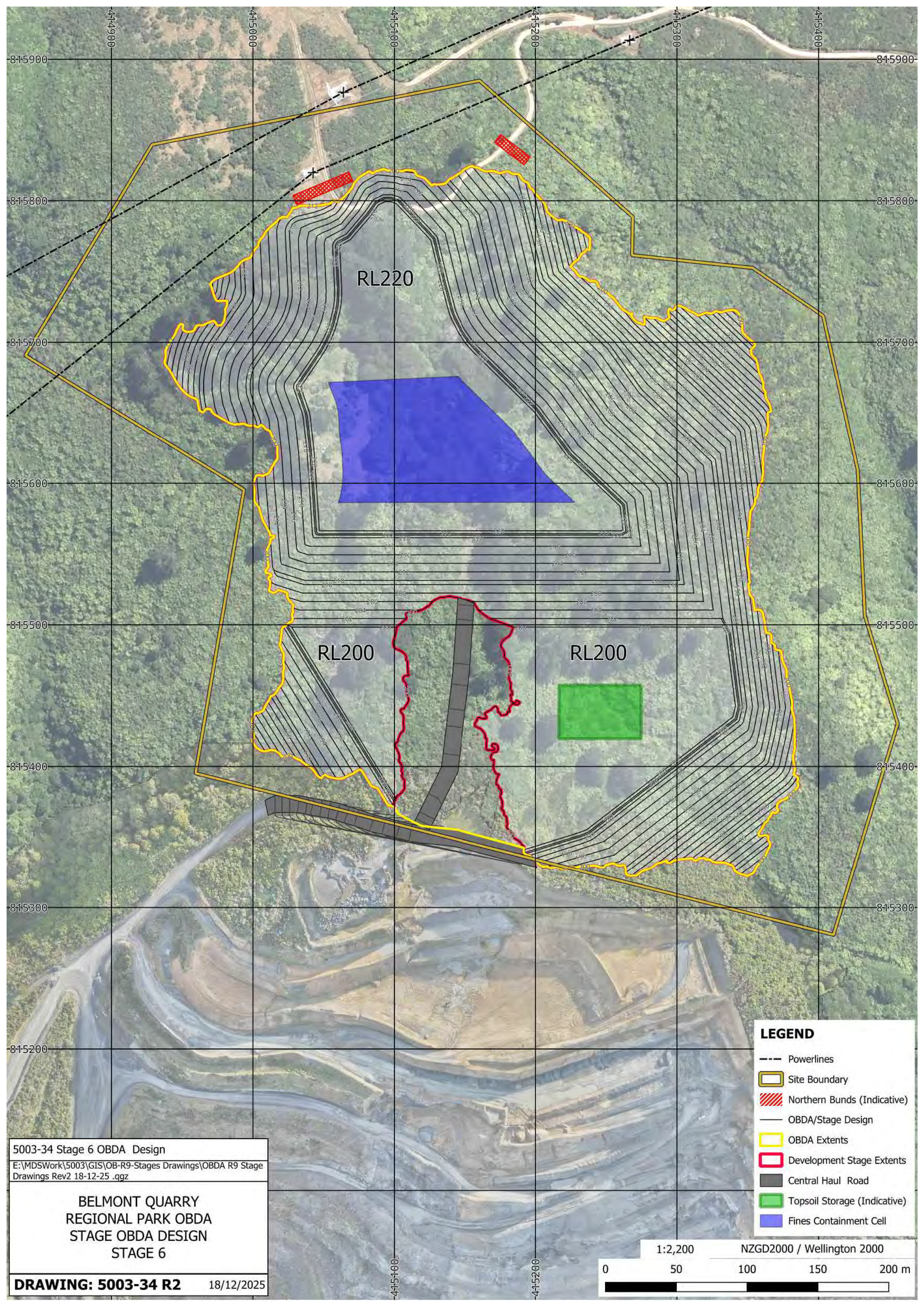
5003-30 Stage 4 OBDA Design
E:\MDSWork\5003\GIS\OB-R9-Stages Drawings\OBDA R9 Stage Drawings Rev2 18-12-25 .qgz

**BELMONT QUARRY
REGIONAL PARK OBDA
STAGE OBDA DESIGN
STAGE 4**

DRAWING: 5003-30 R2 18/12/2025





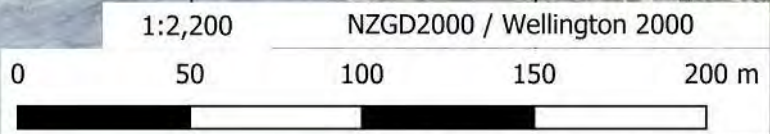


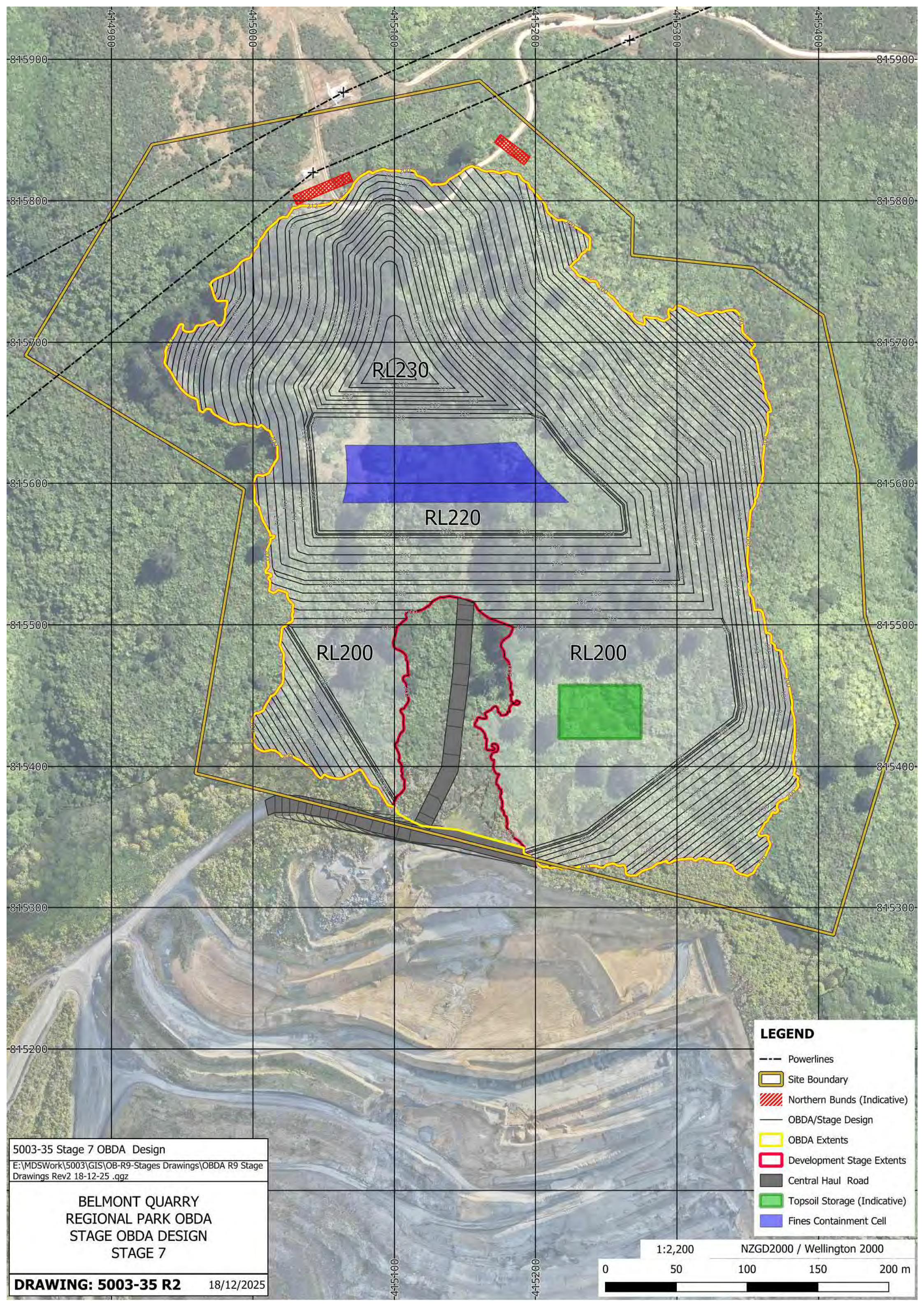
5003-34 Stage 6 OBDA Design
E:\MDSWork\5003\GIS\OB-R9-Stages Drawings\OBDA R9 Stage Drawings Rev2 18-12-25 .qgz

BELMONT QUARRY
REGIONAL PARK OBDA
STAGE OBDA DESIGN
STAGE 6

DRAWING: 5003-34 R2 18/12/2025

- LEGEND**
- Powerlines
 - Site Boundary
 - Northern Bunds (Indicative)
 - OBDA/Stage Design
 - OBDA Extents
 - Development Stage Extents
 - Central Haul Road
 - Topsoil Storage (Indicative)
 - Fines Containment Cell



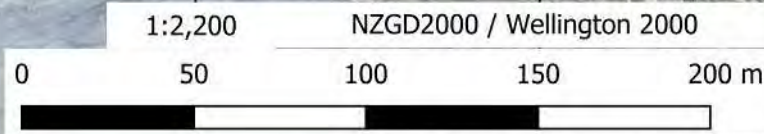


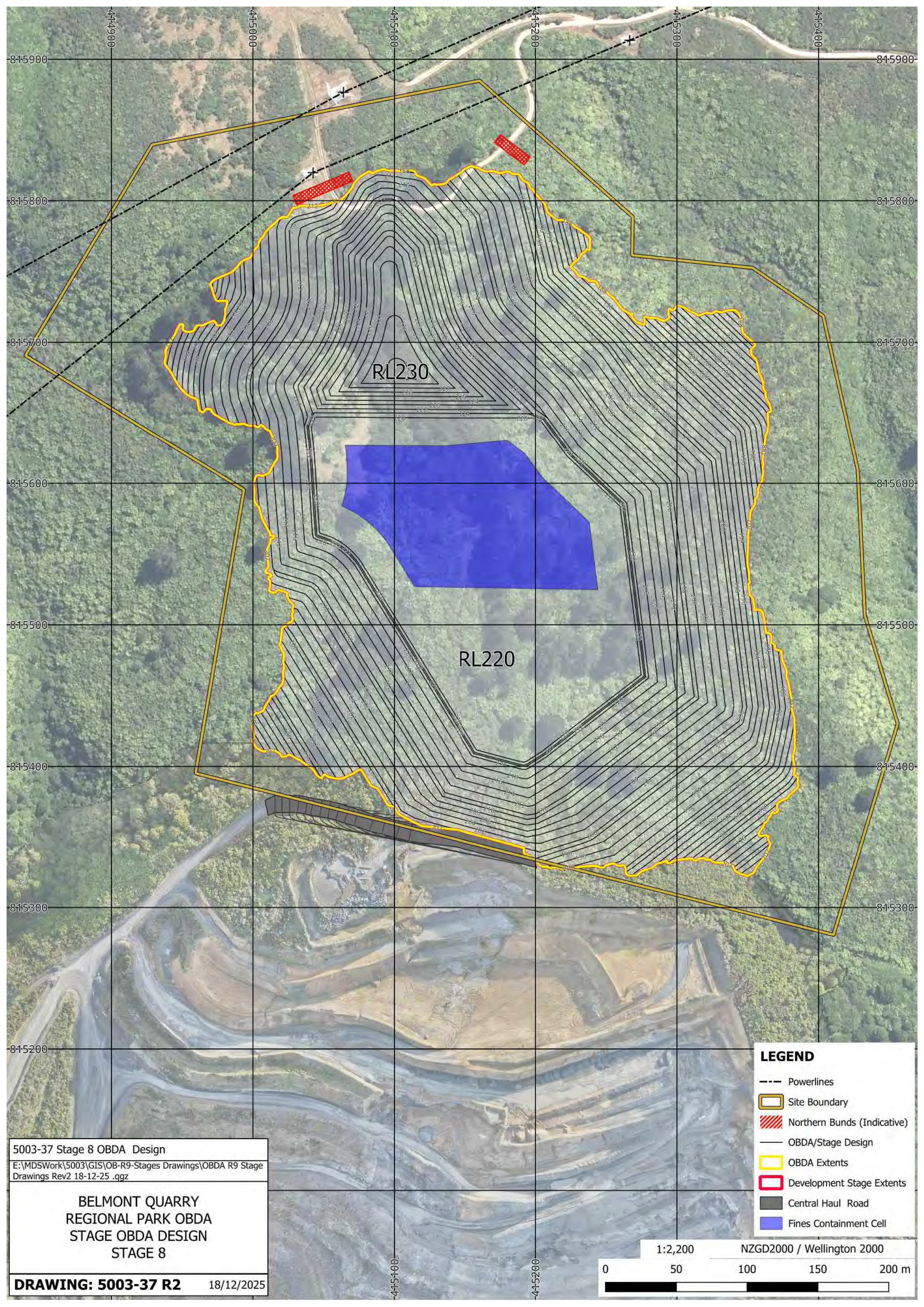
5003-35 Stage 7 OBDA Design
E:\MDSWork\5003\GIS\OB-R9-Stages Drawings\OBDA R9 Stage Drawings Rev2 18-12-25 .qgz

BELMONT QUARRY
REGIONAL PARK OBDA
STAGE OBDA DESIGN
STAGE 7

DRAWING: 5003-35 R2 18/12/2025

- LEGEND**
- Powerlines
 - Site Boundary
 - Northern Bunds (Indicative)
 - OBDA/Stage Design
 - OBDA Extents
 - Development Stage Extents
 - Central Haul Road
 - Topsoil Storage (Indicative)
 - Fines Containment Cell



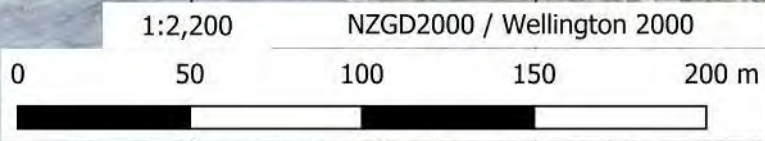


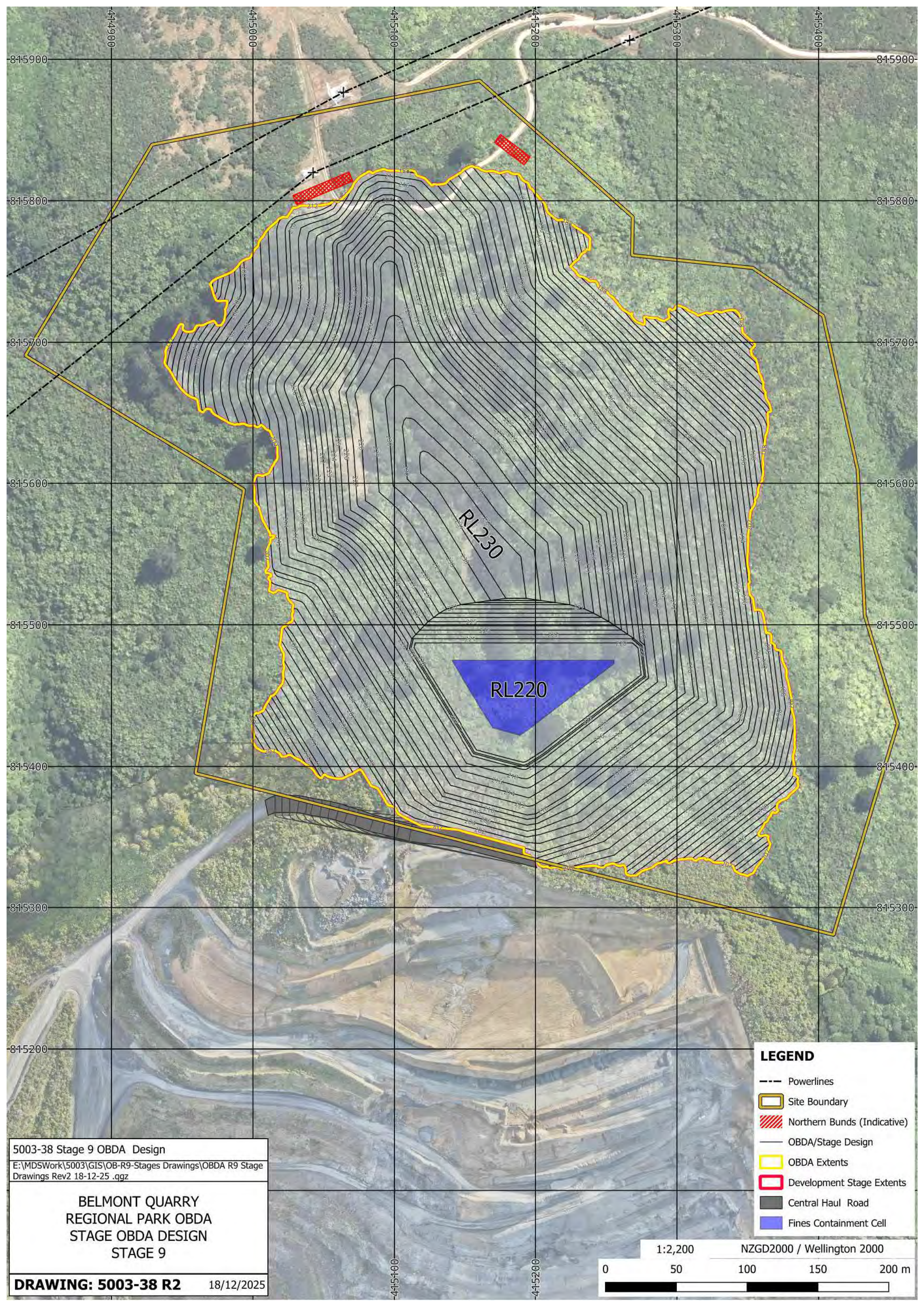
5003-37 Stage 8 OBDA Design
E:\MDSWork\5003\GIS\OB-R9-Stages Drawings\OBDA R9 Stage Drawings Rev2 18-12-25 .qgz

BELMONT QUARRY
REGIONAL PARK OBDA
STAGE OBDA DESIGN
STAGE 8

DRAWING: 5003-37 R2 18/12/2025

- LEGEND**
- Powerlines
 - Site Boundary
 - Northern Bunds (Indicative)
 - OBDA/Stage Design
 - OBDA Extents
 - Development Stage Extents
 - Central Haul Road
 - Fines Containment Cell



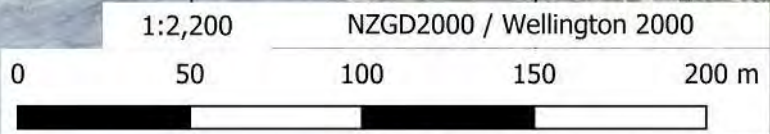


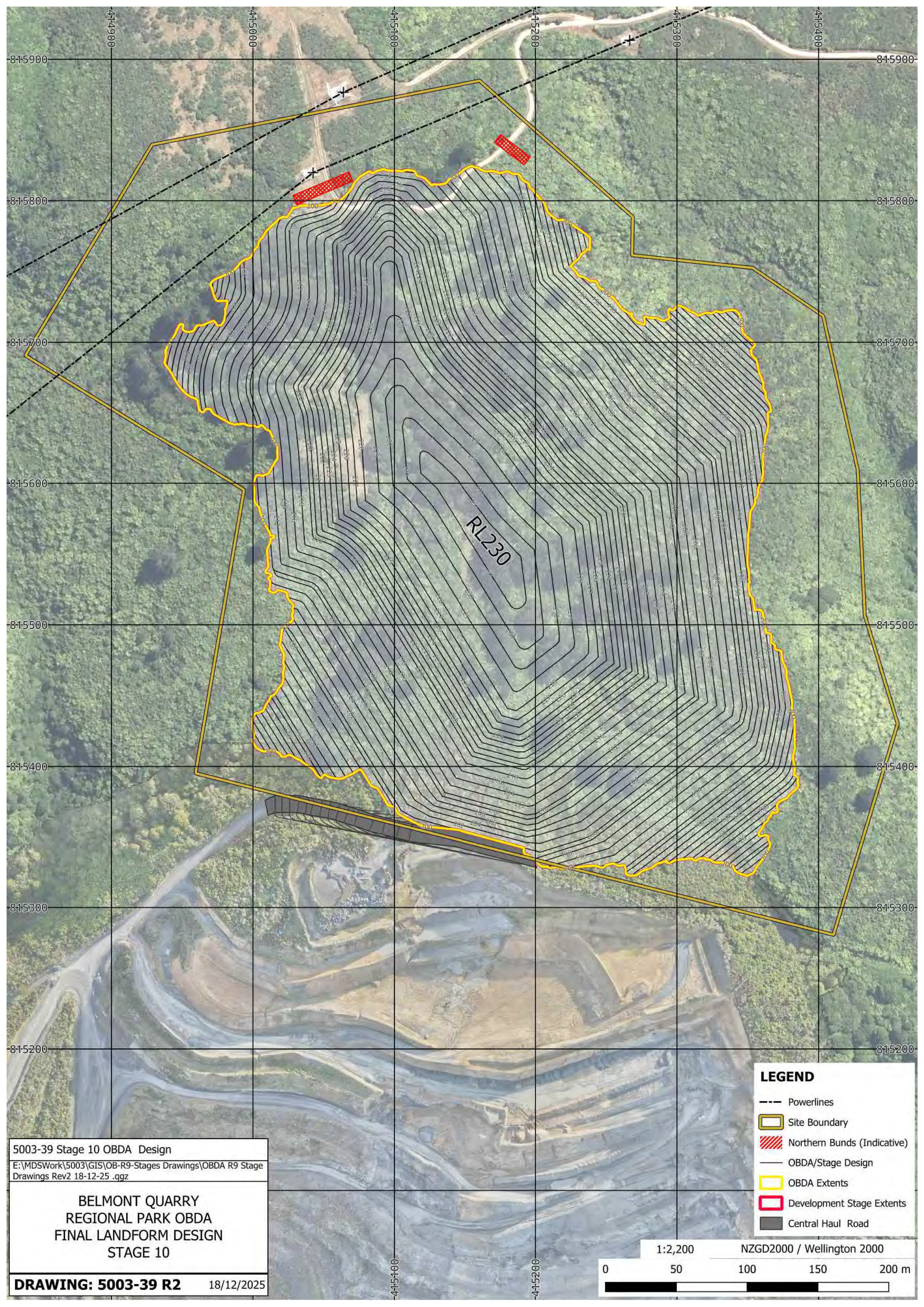
5003-38 Stage 9 OBDA Design
E:\MDSWork\5003\GIS\OB-R9-Stages Drawings\OBDA R9 Stage Drawings Rev2 18-12-25 .qgz

BELMONT QUARRY
REGIONAL PARK OBDA
STAGE OBDA DESIGN
STAGE 9

DRAWING: 5003-38 R2 18/12/2025

- LEGEND**
- Powerlines
 - Site Boundary
 - Northern Bunds (Indicative)
 - OBDA/Stage Design
 - OBDA Extents
 - Development Stage Extents
 - Central Haul Road
 - Fines Containment Cell



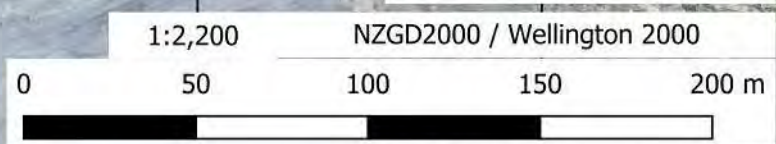


- LEGEND**
- Powerlines
 - Site Boundary
 - Northern Bunds (Indicative)
 - OBDA/Stage Design
 - OBDA Extents
 - Development Stage Extents
 - Central Haul Road

5003-39 Stage 10 OBDA Design
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**BELMONT QUARRY
REGIONAL PARK OBDA
FINAL LANDFORM DESIGN
STAGE 10**

DRAWING: 5003-39 R2 18/12/2025



Appendix D – Annotated photographs (Belmont Regional Park)



Photograph 1: Completely weathered Greywacke in watercourse, start of groundwater seepage at location Bx01 [eastern sidling gully]. Downstream gully remains dry.



Photograph 2: Seepage point, flow in channel at location Bx02 [eastern sidling gully].



Photograph 3: Local alluvial flat at confluence of tributaries, marshy conditions at location Bx03 [eastern sidling gully].



Photograph 4: Typical marshy gully floor conditions in the eastern gully [location Bx04].



Photograph 5: Start of seepage within the eastern gully at location Bx05 [yellow]. The gully above remains dry.



Photograph 6: Highly weathered Greywacke exposed in the stream channel. Gully alluvium was also present in form of gravel and cobbles within a matrix of clay and silt at location Bx06 [western gully].



Photograph 7: Greywacke gravels and cobbles within the main western gully stream channel overlying completely weathered Greywacke [yellow] at location Bx07.



Photograph 8: Highly weathered Greywacke exposed in stream channel at location Bx08 [western gully].



Photograph 9: Seepage observed at the completely weathered Greywacke outcrop at location Bx09 [western gully].

Photographs/ observations made on 24 July



Photograph 10: Pond referred to on site as the 'farm pond', the main eastern gully channel flows into this area. Marshy ground conditions at location Bx10.



Photograph 11: Completely weathered Greywacke exposure with relict structure at location Bx11 [western sidling gully].



Photograph 12: Typical marshy gully floor conditions in the western sidling gully, wider than the eastern gullies [location Bx12]. Watercourse highlighted [yellow].



Photograph 13: Typical stream conditions within the west. Marshy conditions extend a width of 7.9m with an incised channel in the center approximately 1m wide.

Appendix E – Annotated photographs (Upper Quarry Batters)



Photograph E1Annotated Mapping overview. Sourced from Winstone Propeller portal.



BQ13: Batter performance in historic pond fines



BQ14: Lowermost batter in pond fines illustrating localised failure and contact with backfill.



BQ03: Historic backfill overlain by waste concrete and process fines.



BQ04: Degraded process fines batter where surface water is uncontrolled.



BQ01: Contact between process fines and underlying historic quarry backfill.



BQ02: Crest of degraded batter with no surface water control.



BQ05: Localised batter failure in historic process water fines.



BQ11: Process fines overlying residual soils and weathered greywacke rock.

Appendix F – Investigation logs



31 July 2025

Our Ref: 1099653.0000.0.0/Rep1
Customer Reference: BGHL000252

Baseline Geotechnical Limited
PO Box 60 383
Titirangi
Auckland 0642

Attention: Cameron Lines

Belmont Quarry

Geotechnical Investigation

Customer's Instructions

We were instructed to complete:

- 4 x Hand Auger and Dynamic Cone Penetrometer to refusal
- Log and photograph the recovered material

Specifications

None issued.

Date of Procedures

24 July 2025.

Locations

Test locations were determined by Baseline Geotechnical Limited.

The attached plan provides indicative locations only and is not to scale. All other information we provide regarding location should be referenced to the asset owner.

Coordinates are provided in the bore logs.

- a Method used to determine locations: GPS\GNSS (Handheld)
- b Method used to determine RL: Estimated from contours
- c Expected accuracy for location: ± 5 m
- d Expected accuracy for elevation: ± 5 m

Methods

NZS 4402:1988 Test 6.5.2 - Determination of the penetration resistance of a soil (Hand method using a dynamic cone penetrometer) - Scala

Material Description

Material descriptions are provided in the attached results.

Results

The following is attached:

- Test location plan.
- Hand auger boreholes.
- Scala penetrometer results.

Photos can be downloaded from the following link:

[Belmont Quarry Photos](#)

This link will expire on 27 October 2025 after which we can provide the photos upon request. Whilst we provide this information via link for your convenience, please note that once downloaded, we consider the information uncontrolled.

Test Remarks

Material Logging

Material logging and descriptions in the field are in general accordance with the New Zealand Geotechnical Society Inc in 'Guideline for the Field Classification of Soil and Rock for Engineering Purposes' (December 2005), excluding geological information and are based on the observational behaviour of the recovered material.

The logs represent our best assessment of the sub-surface conditions, but due to the subjective nature of material logging, we take no responsibility for any inaccuracies or misinterpretations.

Scala

Our standard test procedure is to over-drill Scala penetrometer tests every 1 m. In this case we have not over-drilled these tests. This variation to the standard test method may increase friction with depth due to skin friction and the protrusion of the rod connectors. The results >1 m deep may therefore not be accurate and are provided for interpretation and inference.

For ease of reference, Scala results have been included in the borehole logs even though they were performed adjacent to the boreholes.

General Remarks

This report has been prepared for the benefit of Baseline Geotechnical Limited, with respect to the particular brief given to us and it cannot be relied upon in other contexts or for any other purpose without our prior review and agreement.

The inherent uncertainties of site investigation work, mean the nature and continuity of subsoil away from the test location could vary from the data logged.

Please reproduce this report in full when transmitting to others or including in internal reports.

If we can be of any further assistance, feel free to get in touch. Contact details are provided at the bottom of the letterhead page.

GEOTECHNICS LTD

Report approved by:

[REDACTED]

.....
Alan Benton
Operations Manager

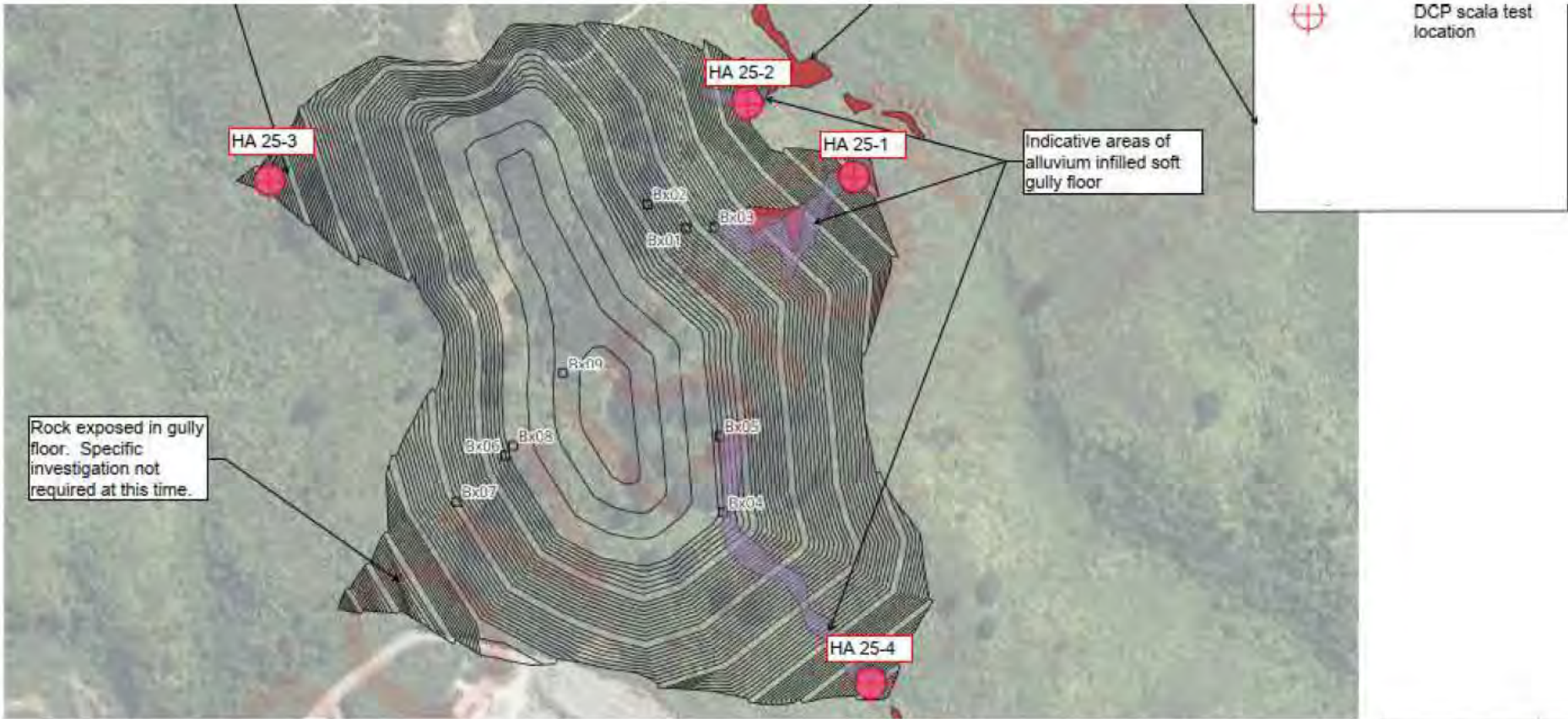
Authorised for Geotechnics by:

[REDACTED]

.....
Corey Papu-Gread
Project Director

31-Jul-25

t:\geotechnicsgroup\projects\1099653\workingmaterial\20250731.ya.1099653.0.0.rep1.docx



LOCATION PLAN

 GEOTECHNICS	LOCATION PLAN								Locations are indicative only	
	Ground Floor, 11-15 Torrens Terrace Mt Cook Wellington 6011	Site	Belmont Quarry, Kelson	Our Ref	1099653.0000.0.0/Rep1	Drawn By	YA	Date	31/07/25	
		Location	Lower Hutt	Customer Ref	BGHL000252	Checked By	ABB	Date	31/07/25	
		Project	Belmont Quarry BG	Lab Ref	N/A	Scale	Not to Scale			

Drawings supplied by Baseline Geotechnical Limited



HAND AUGER LOG

HOLE Id: HA 25-1

Hole Location: See Test Location Plan

SHEET: 1 OF 1

PROJECT: GWN Belmont Quarry BG				LOCATION: Kelson, Lower Hutt				JOB No.: 1099653.0000																					
CO-ORDINATES: 5441690 mN (NZTM2000) 1764369 mE				DRILL TYPE: Hand Auger				HOLE STARTED: 24/07/2025																					
R.L.: 166m				METHOD: Hand Auger and DCP Scala				HOLE FINISHED: 24/07/2025																					
DATUM: NZVD2016								DRILLED BY: GEOTECHNICS																					
								LOGGED BY: SELO CHECKED: ABB																					
GEOLOGICAL		METHOD OBSERVATIONS						ENGINEERING DESCRIPTION																					
STRATIGRAPHY / ENG GEOLOGICAL UNIT / ADDITIONAL OBSERVATIONS		WATER 24/07/2025		CORE RECOVERY (%) 100		METHOD HA50		SCALA PENETROMETER (Blows/50mm)		TESTS		SAMPLES		RL (m)		DEPTH (m)		GRAPHIC LOG		WEATHERING CLASSIFICATION		MOISTURE CLASSIFICATION		CONSISTENCY / DENSITY CLASSIFICATION		ESTIMATED SOIL SHEAR STRENGTH (kPa)		DESCRIPTION	
								0 1 2 3 4 5 6 7 8 9								0.5				W		VS		12 6 3 1.5 0.75 0.375 0.1875 0.09375 0.046875 0.0234375 0.01171875 0.005859375 0.0029296875 0.00146484375 0.000732421875 0.0003662109375 0.00018310546875 0.000091552734375 0.0000457763671875 0.00002288818359375 0.000011444091796875 0.0000057220458984375 0.00000286102294921875 0.000001430511474609375 0.0000007152557373046875 0.00000035762786865234375 0.000000178813934326171875 0.0000000894069671630859375 0.00000004470348358154296875 0.000000022351741790771484375 0.0000000111758708953857421875 0.00000000558793544769287109375 0.000000002793967723846435546875 0.0000000013969838619232177734375 0.00000000069849193096160888671875 0.000000000349245965480804443359375 0.0000000001746229827404022216796875 0.00000000008731149137020111083984375 0.000000000043655745685100555419921875 0.0000000000218278728425502777099609375 0.00000000001091393642127513885498046875 0.000000000005456968210637569427490234375 0.0000000000027284841053187847137451171875 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HAND AUGER LOG

HOLE Id: HA 25-2

Hole Location: See Test Location Plan

SHEET: 1 OF 1

[illegible]



HAND AUGER LOG

HOLE Id: HA 25-3

Hole Location: See Test Location Plan

SHEET: 1 OF 1

[illegible]



HAND AUGER LOG

HOLE Id: HA 25-4

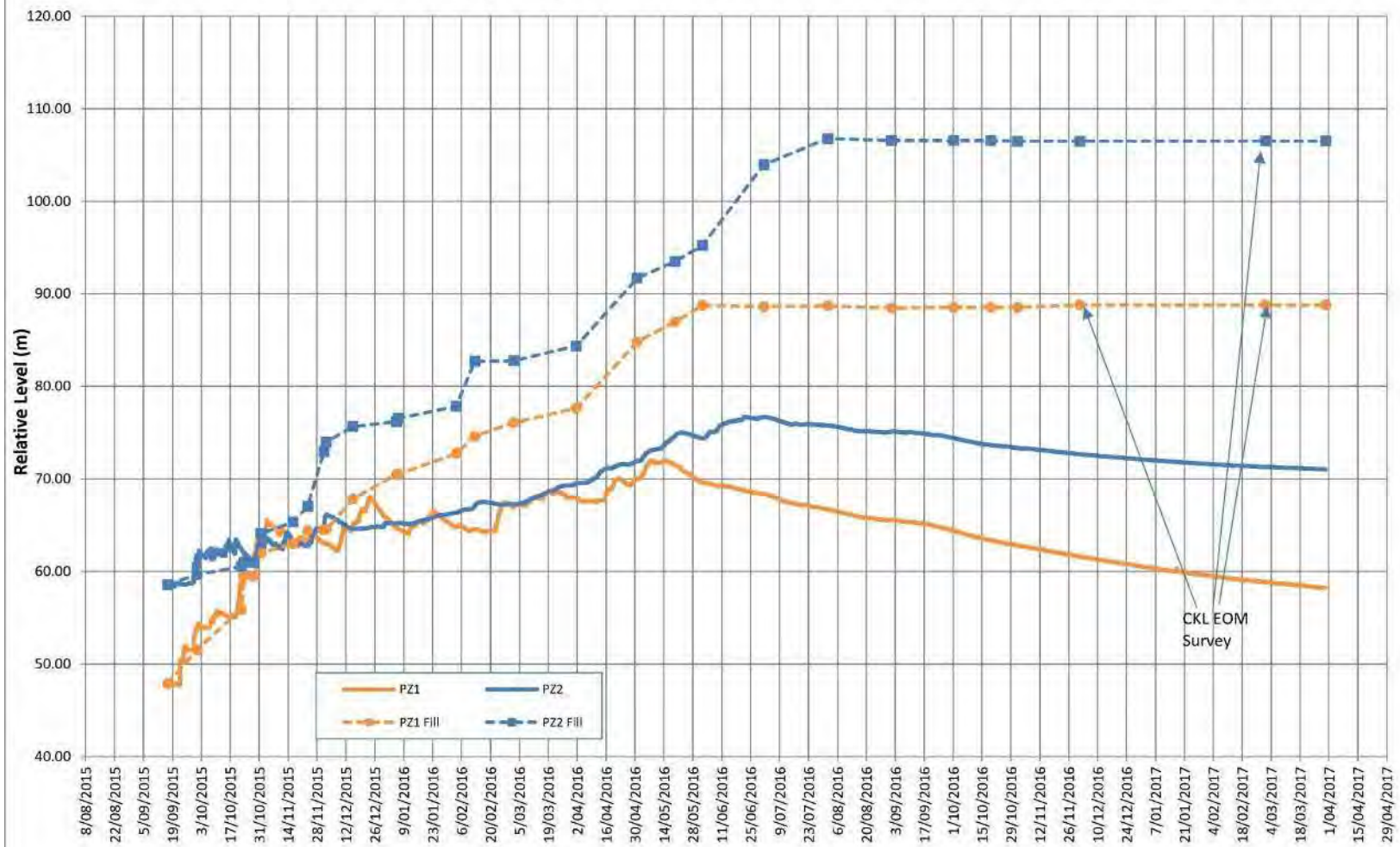
Hole Location: See Test Location Plan

SHEET: 1 OF 1

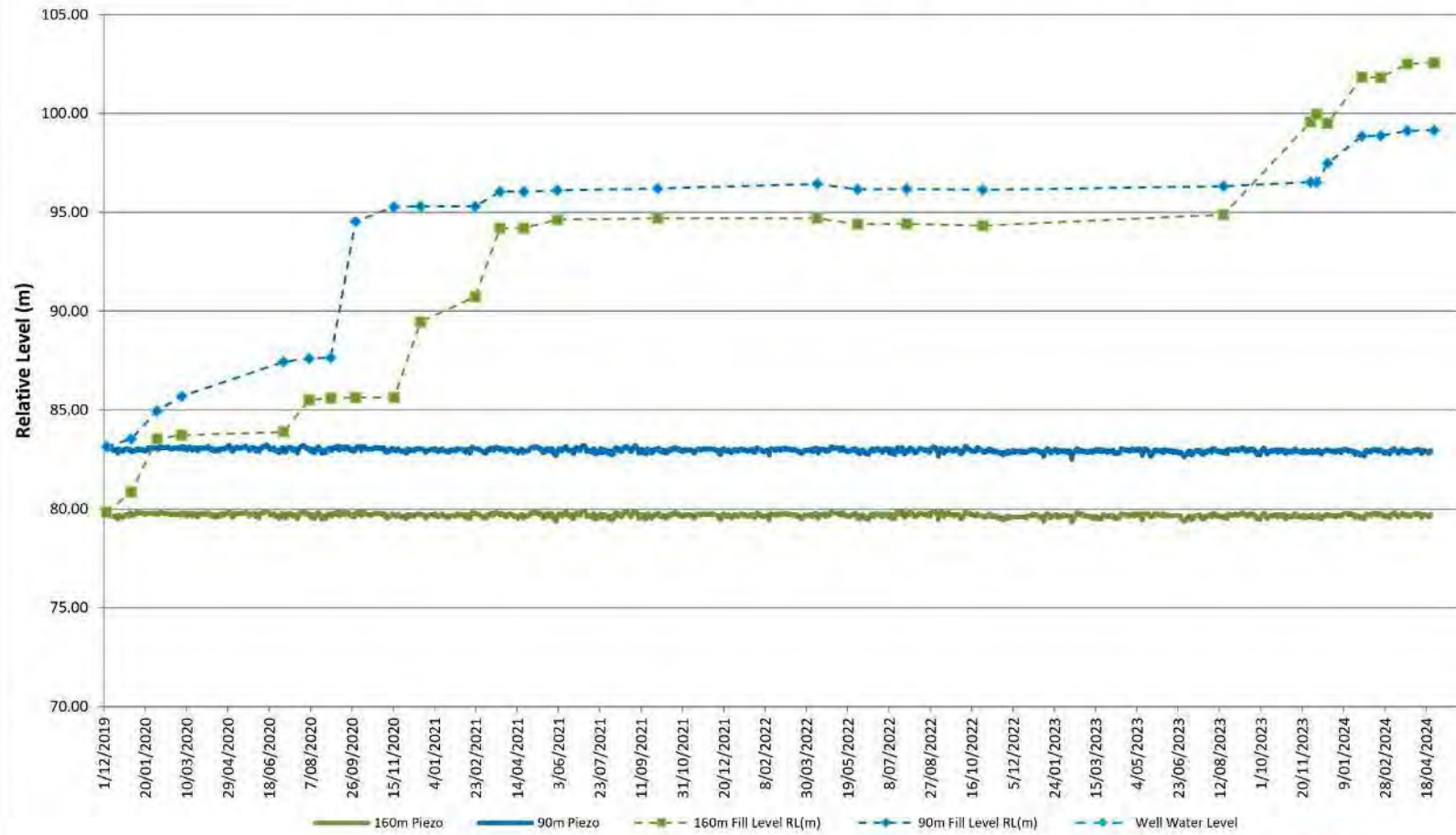
PROJECT: GWN Belmont Quarry BG					LOCATION: Kelson, Lower Hutt					JOB No.: 1099653.0000								
CO-ORDINATES: 5441314 mN (NZTM2000) 1764375 mE					DRILL TYPE: Hand Auger					HOLE STARTED: 24/07/2025								
R.L.: 166m					METHOD: Hand Auger and DCP Scala					HOLE FINISHED: 24/07/2025								
DATUM: NZVD2016										DRILLED BY: GEOTECHNICS								
										LOGGED BY: YA		CHECKED: ABB						
GEOLOGICAL		METHOD OBSERVATIONS							ENGINEERING DESCRIPTION									
STRATIGRAPHY / ENG GEOLOGICAL UNIT / ADDITIONAL OBSERVATIONS		WATER	CORE RECOVERY (%)	METHOD	SCALA PENETROMETER (Blows/50mm)				TESTS	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	WEATHERING CLASSIFICATION	MOISTURE CLASSIFICATION	CONSISTENCY / DENSITY CLASSIFICATION	ESTIMATED SOIL SHEAR STRENGTH (kPa, MPa)	DESCRIPTION
			100	HA50	0	1	2	3	4	5	6	7	8	9			0-5 5-12 12-19 19-27 27-34 34-42 42-49 49-57 57-64 64-71 71-79 79-86 86-93 93-100 100-107 107-114 114-121 121-128 128-135 135-142 142-149 149-156 156-163 163-170 170-177 177-184 184-191 191-198 198-205 205-212 212-219 219-226 226-233 233-240 240-247 247-254 254-261 261-268 268-275 275-282 282-289 289-296 296-303 303-310 310-317 317-324 324-331 331-338 338-345 345-352 352-359 359-366 366-373 373-380 380-387 387-394 394-401 401-408 408-415 415-422 422-429 429-436 436-443 443-450 450-457 457-464 464-471 471-478 478-485 485-492 492-499 499-506 506-513 513-520 520-527 527-534 534-541 541-548 548-555 555-562 562-569 569-576 576-583 583-590 590-597 597-604 604-611 611-618 618-625 625-632 632-639 639-646 646-653 653-660 660-667 667-674 674-681 681-688 688-695 695-702 702-709 709-716 716-723 723-730 730-737 737-744 744-751 751-758 758-765 765-772 772-779 779-786 786-793 793-800 800-807 807-814 814-821 821-828 828-835 835-842 842-849 849-856 856-863 863-870 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1591-1598 1598-1605 1605-1612 1612-1619 1619-1626 1626-1633 1633-1640 1640-1647 1647-1654 1654-1661 1661-1668 1668-1675 1675-1682 1682-1689 1689-1696 1696-1703 1703-1710 1710-1717 1717-1724 1724-1731 1731-1738 1738-1745 1745-1752 1752-1759 1759-1766 1766-1773 1773-1780 1780-1787 1787-1794 1794-1801 1801-1808 1808-1815 1815-1822 1822-1829 1829-1836 1836-1843 1843-1850 1850-1857 1857-1864 1864-1871 1871-1878 1878-1885 1885-1892 1892-1899 1899-1906 1906-1913 1913-1920 1920-1927 1927-1934 1934-1941 1941-1948 1948-1955 1955-1962 1962-1969 1969-1976 1976-1983 1983-1990 1990-1997 1997-2004 2004-2011 2011-2018 2018-2025 2025-2032 2032-2039 2039-2046 2046-2053 2053-2060 2060-2067 2067-2074 2074-2081 2081-2088 2088-2095 2095-2102 2102-2109 2109-2116 2116-2123 2123-2130 2130-2137 2137-2144 2144-2151 2151-2158 2158-2165 2165-2172 2172-2179 2179-2186 2186-2193 2193-2200 2200-2207 2207-2214 2214-2221 2221-2228 2228-2235 2235-2242 2242-2249 2249-2256 2256-2263 2263-2270 2270-2277 2277-2284 2284-2291 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Appendix G - OBDA Groundwater Monitoring Hunua Quarry

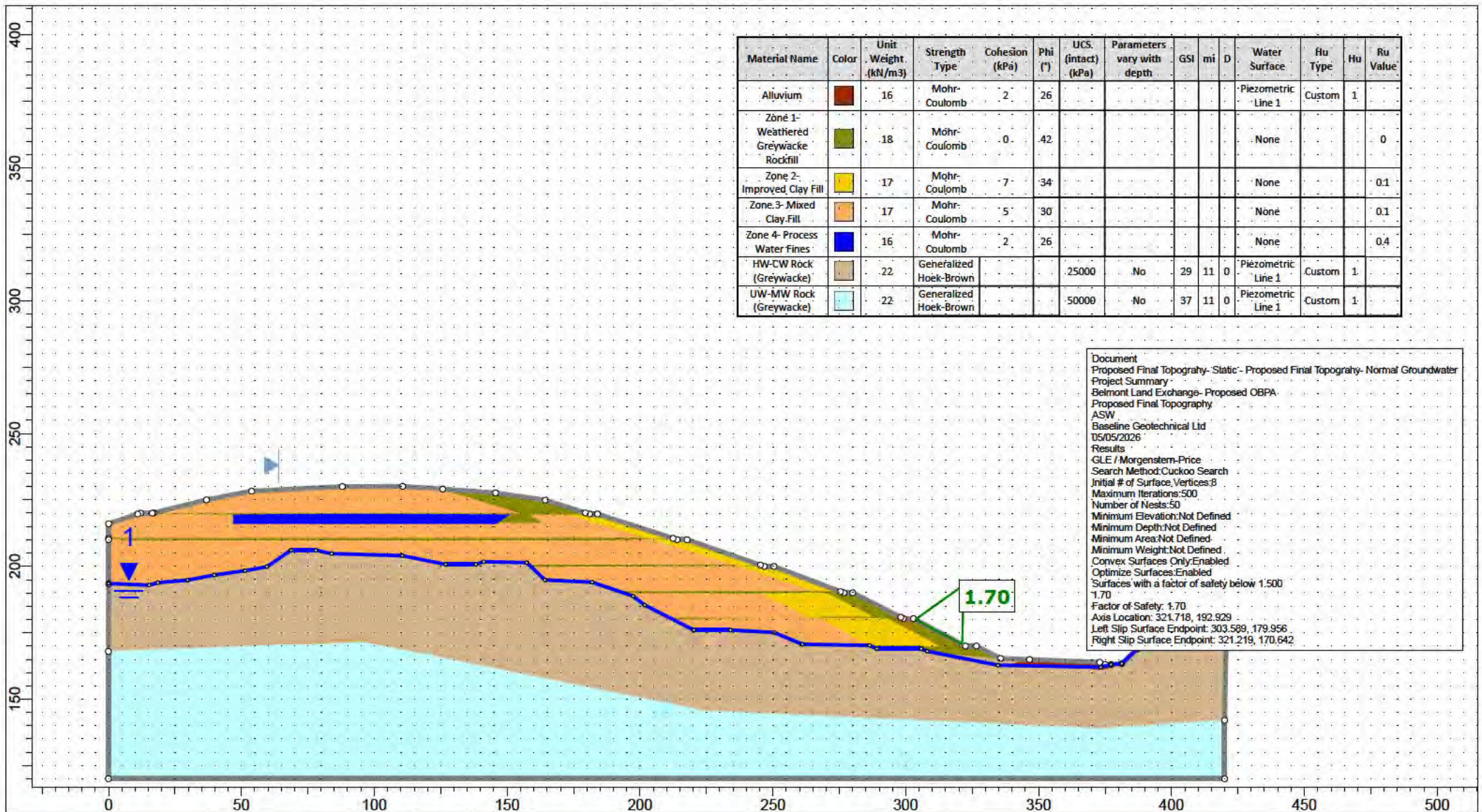
Hunua Quarry Eastern In Pit Fill - VW Piezometers



Hunua Quarry, In Pit Backfill (160m Piezo & 90m Piezo) VWPZ

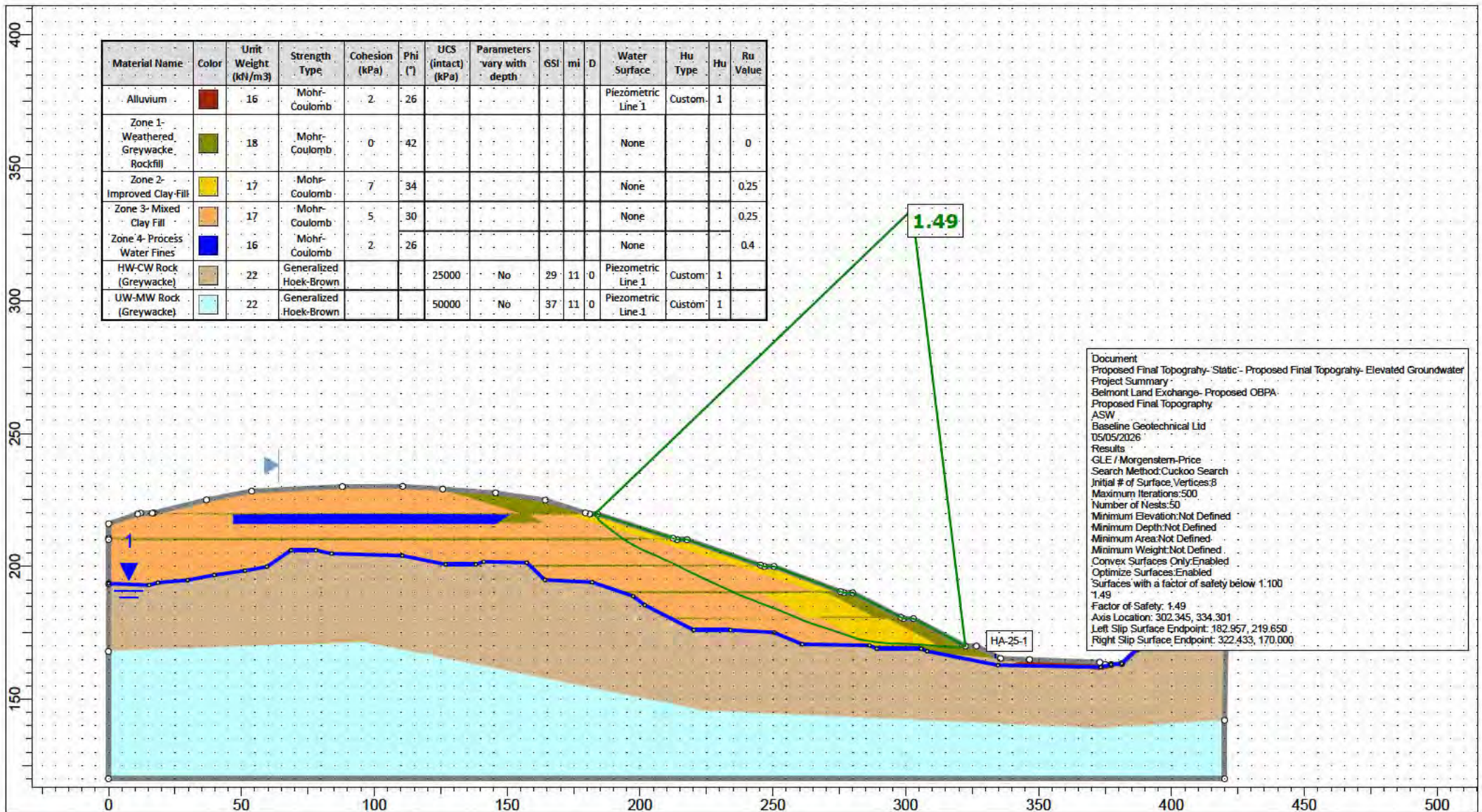


Appendix H - Slope analyses



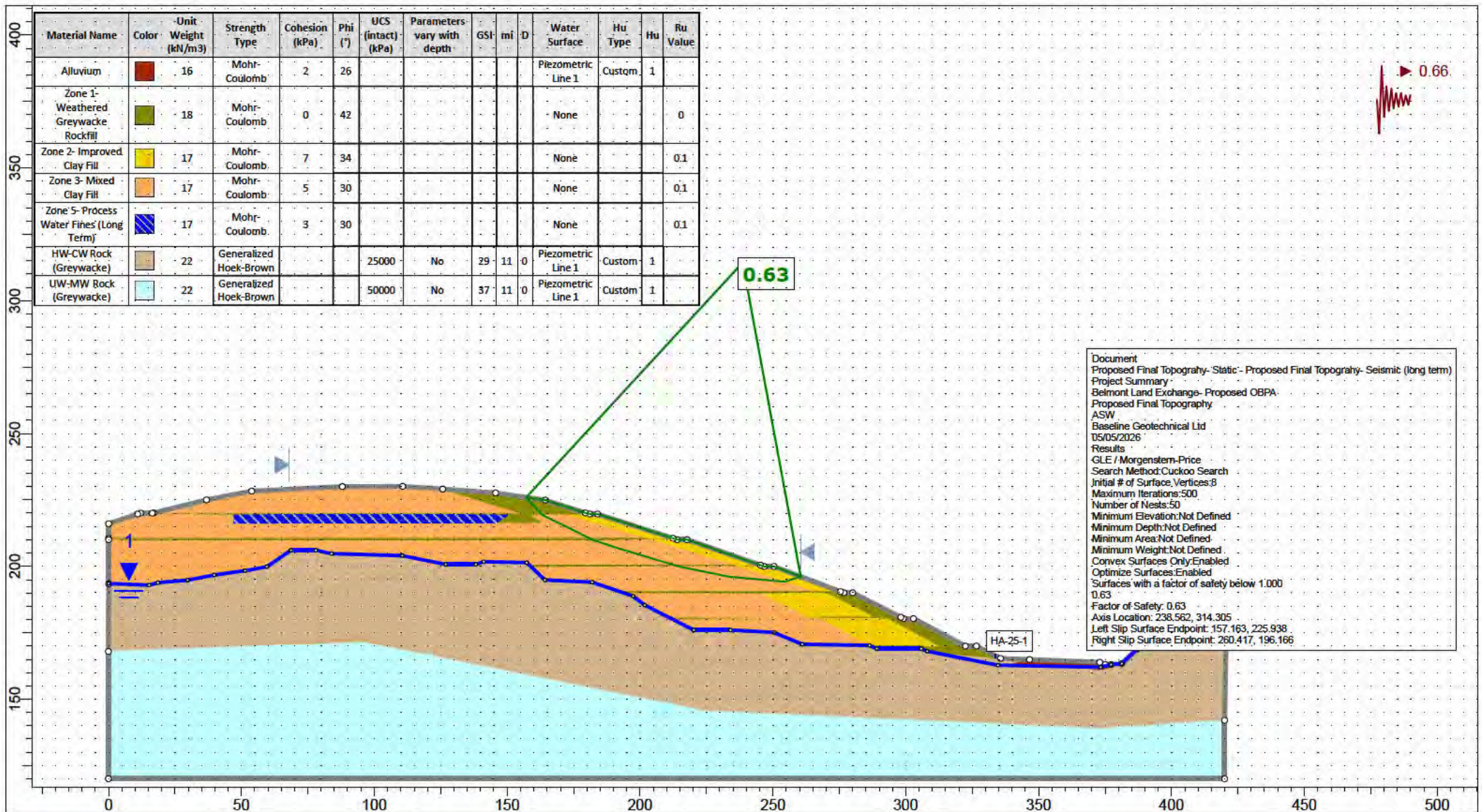
SLIDEINTERPRET 9.043

Project			Belmont Land Exchange- Proposed OBPA		
Analysis Description			Proposed Final Topography , Proposed Final Topography- Normal Groundwater		
Drawn By	THL	Scale	1:2000	Company	Baseline Geotechnical Ltd
Date	22/07/2026	File Name	A- Eastern Sidling Gully v2.1.slm		



SLIDEINTERPRET 9.043

Project			Belmont Land Exchange- Proposed OBPA		
Analysis Description			Proposed Final Topography , Proposed Final Topography- Elevated Groundwater		
Drawn By	THL	Scale	1:2000	Company	Baseline Geotechnical Ltd
Date	22/07/2026	File Name	A- Eastern Sidling Gully v2.1.slmd		



SLIDEINTERPRET 9.043

Project

Belmont Land Exchange- Proposed OBPA

Analysis Description

Proposed Final Topography , Proposed Final Topography- Seismic (long term)

Drawn By

THL

Scale

1:2000

Company

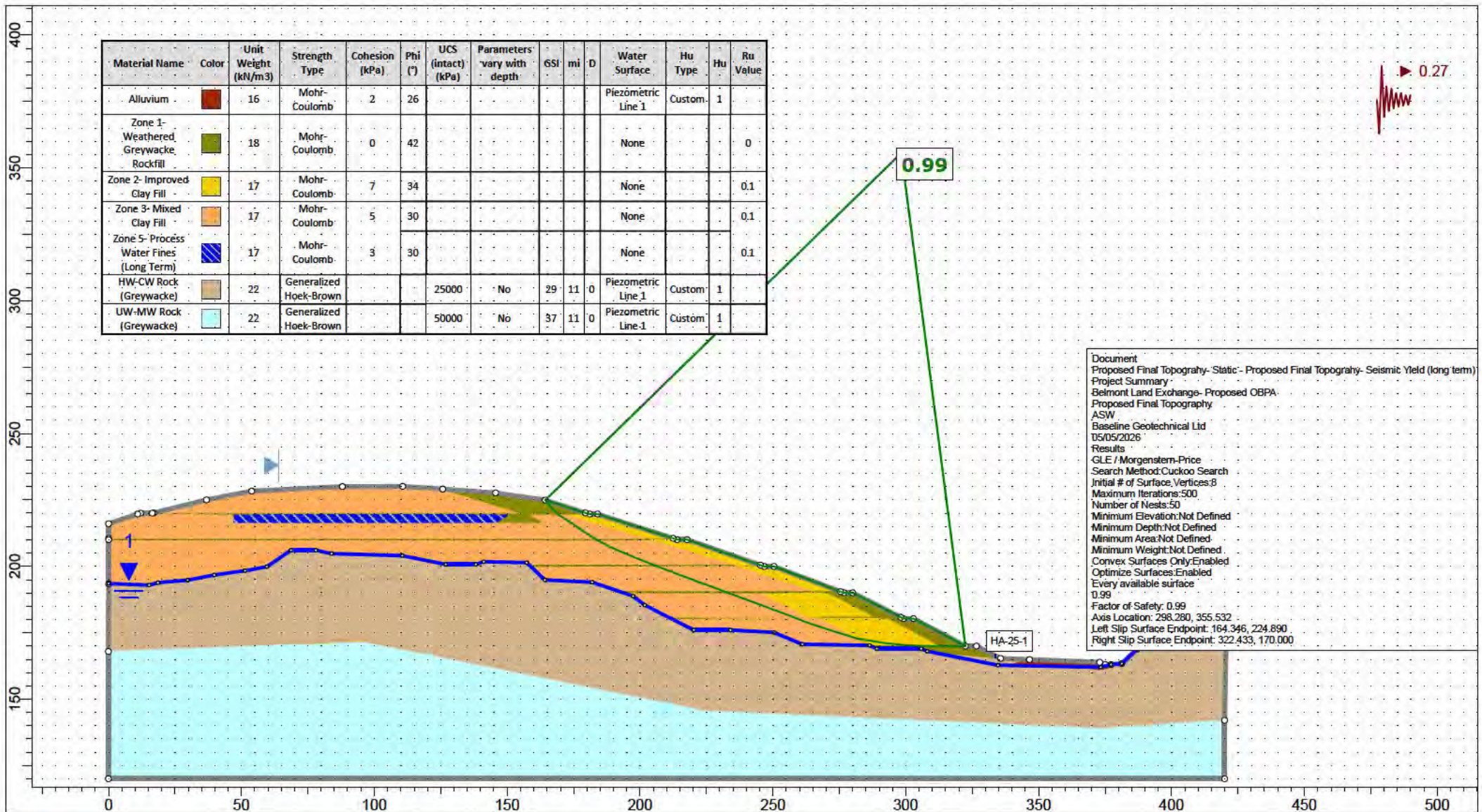
Baseline Geotechnical Ltd

Date

22/07/2026

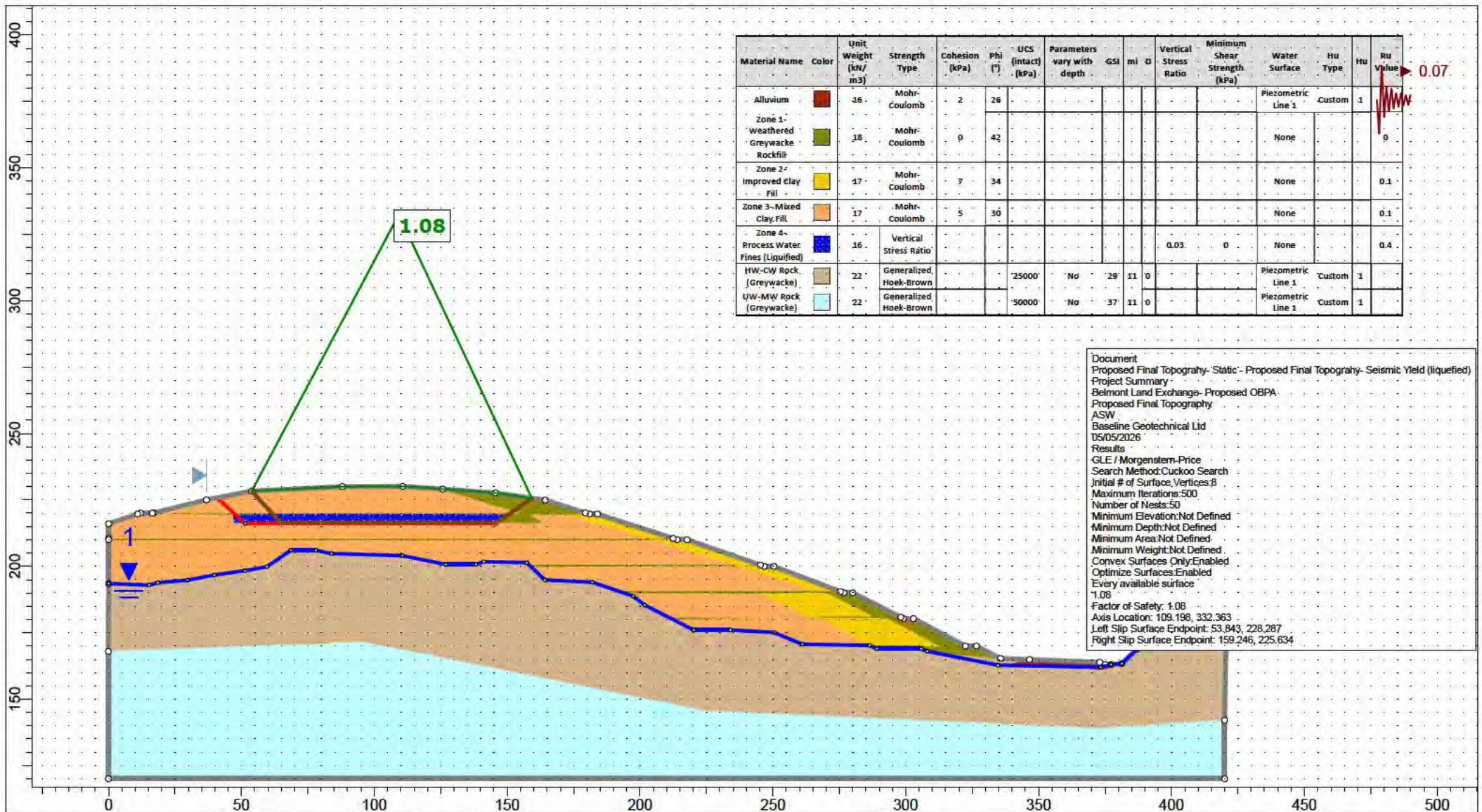
File Name

A- Eastern Sidling Gully v2.1.slm



SLIDEINTERPRET 9.043

Project			Belmont Land Exchange- Proposed OBPA		
Analysis Description			Proposed Final Topography , Proposed Final Topograhy- Seismic Yield (long term)		
Drawn By	THL	Scale	1:2000	Company	Baseline Geotechnical Ltd
Date	22/07/2026	File Name	A- Eastern Sidling Gully v2.1.slmd		

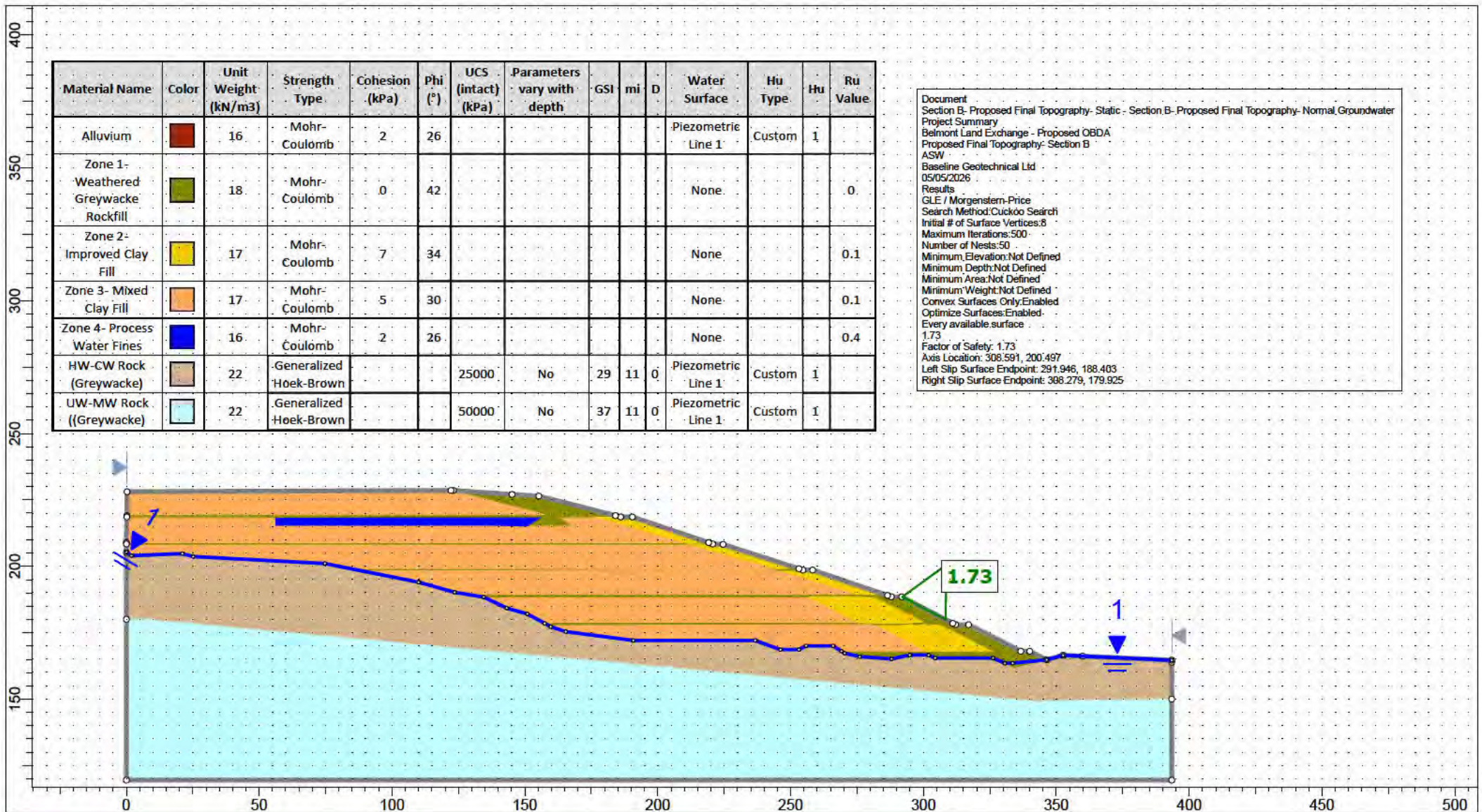


Document
 Proposed Final Topography- Static- Proposed Final Topography- Seismic Yield (liquefied)
 Project Summary
 Belmont Land Exchange- Proposed OBPA
 Proposed Final Topography
 ASW
 Baseline Geotechnical Ltd
 05/05/2026
 Results
 GLE / Morgenstern-Price
 Search Method: Cuckoo Search
 Initial # of Surface Vertices: 8
 Maximum Iterations: 500
 Number of Nests: 50
 Minimum Elevation: Not Defined
 Minimum Depth: Not Defined
 Minimum Area: Not Defined
 Minimum Weight: Not Defined
 Convex Surfaces Only: Enabled
 Optimize Surfaces: Enabled
 Every available surface
 1.08
 Factor of Safety: 1.08
 Axis Location: 109.198, 332.363
 Left Slip Surface Endpoint: 53.843, 228.287
 Right Slip Surface Endpoint: 159.246, 225.634



SLIDEINTERPRET 9.043

Project	Belmont Land Exchange- Proposed OBPA		
Analysis Description	Proposed Final Topography , Proposed Final Topograhy- Seismic Yield (liquefied)		
Drawn By	THL	Scale	1:2000
Date	22/07/2026	Company	Baseline Geotechnical Ltd
		File Name	A- Eastern Sidling Gully v2.1.slm



SLIDEINTERPRET 9.043

Project

Belmont Land Exchange - Proposed OBDA

Analysis Description

Proposed Final Topography- Section B, Section B- Proposed Final Topography- Normal Groundwater

Drawn By

THL

Scale

1:2000

Company

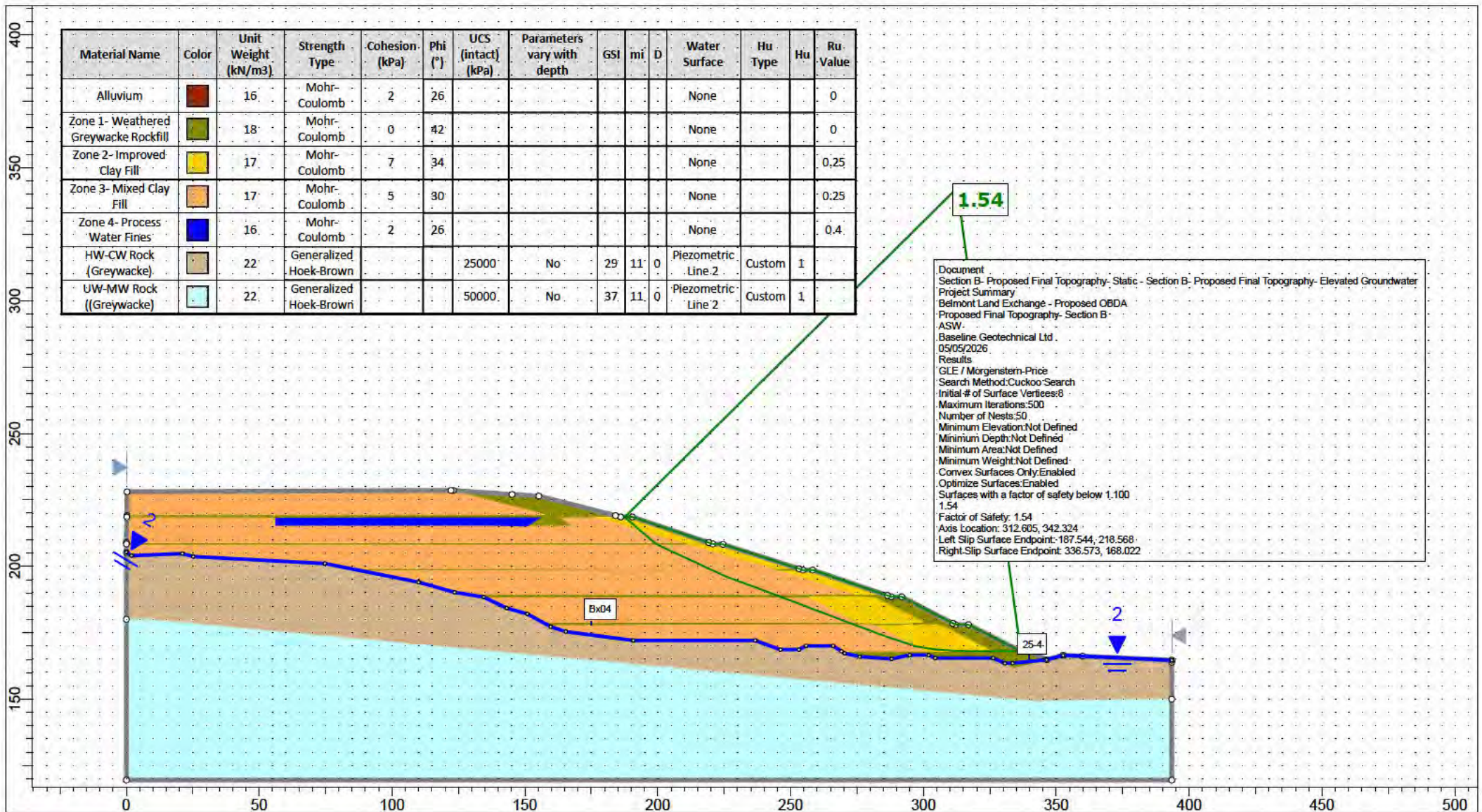
Baseline Geotechnical Ltd

Date

22/07/2026

File Name

B- Eastern Gully v2.1.slm



SLIDEINTERPRET 9.043

Project

Belmont Land Exchange - Proposed OBDA

Analysis Description

Proposed Final Topography- Section B, Section B- Proposed Final Topography- Elevated Groundwater

Drawn By

THL

Scale

1:2000

Company

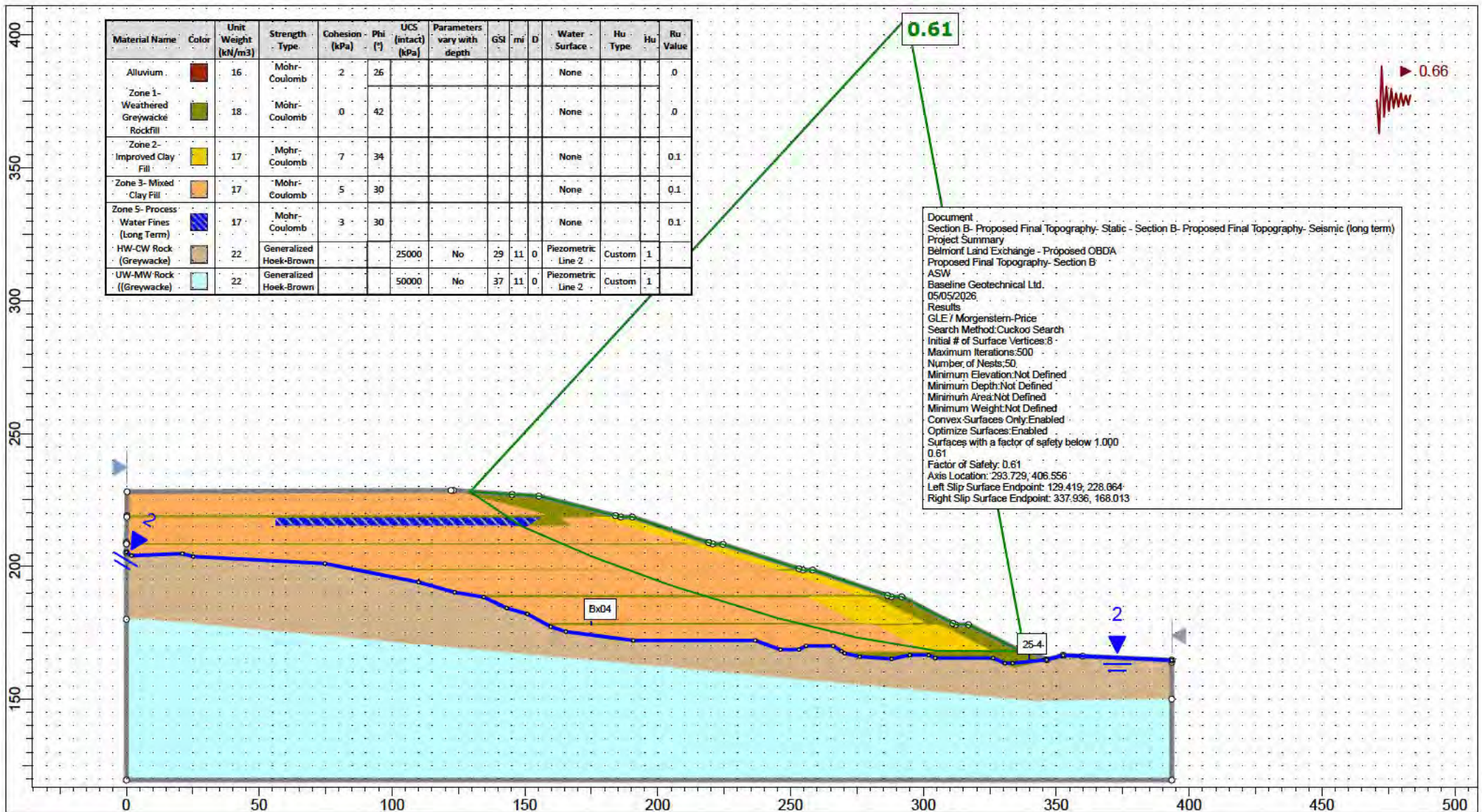
Baseline Geotechnical Ltd

Date

22/07/2026

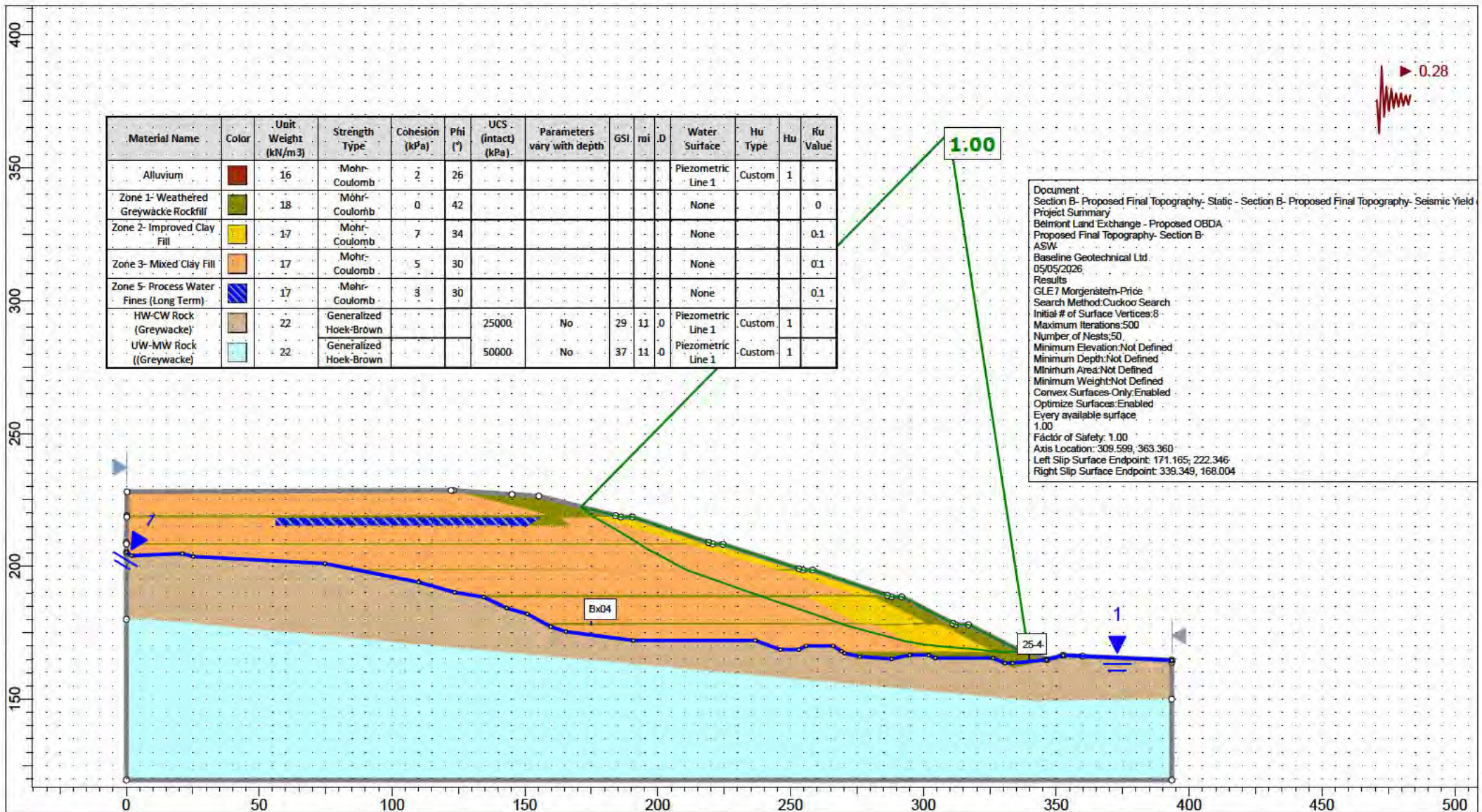
File Name

B- Eastern Gully v2.1.slm



SLIDEINTERPRET 9.043

Project			Belmont Land Exchange - Proposed OBDA		
Analysis Description			Proposed Final Topography- Section B, Section B- Proposed Final Topography- Seismic (long term)		
Drawn By	THL	Scale	1:2000	Company	Baseline Geotechnical Ltd
Date	22/07/2026	File Name	B- Eastern Gully v2.1.slm		



SLIDEINTERPRET 9.043

Project

Belmont Land Exchange - Proposed OBDA

Analysis Description

Proposed Final Topography- Section B, Section B- Proposed Final Topography- Seismic Yield (long term)

Drawn By

THL

Scale

1:2000

Company

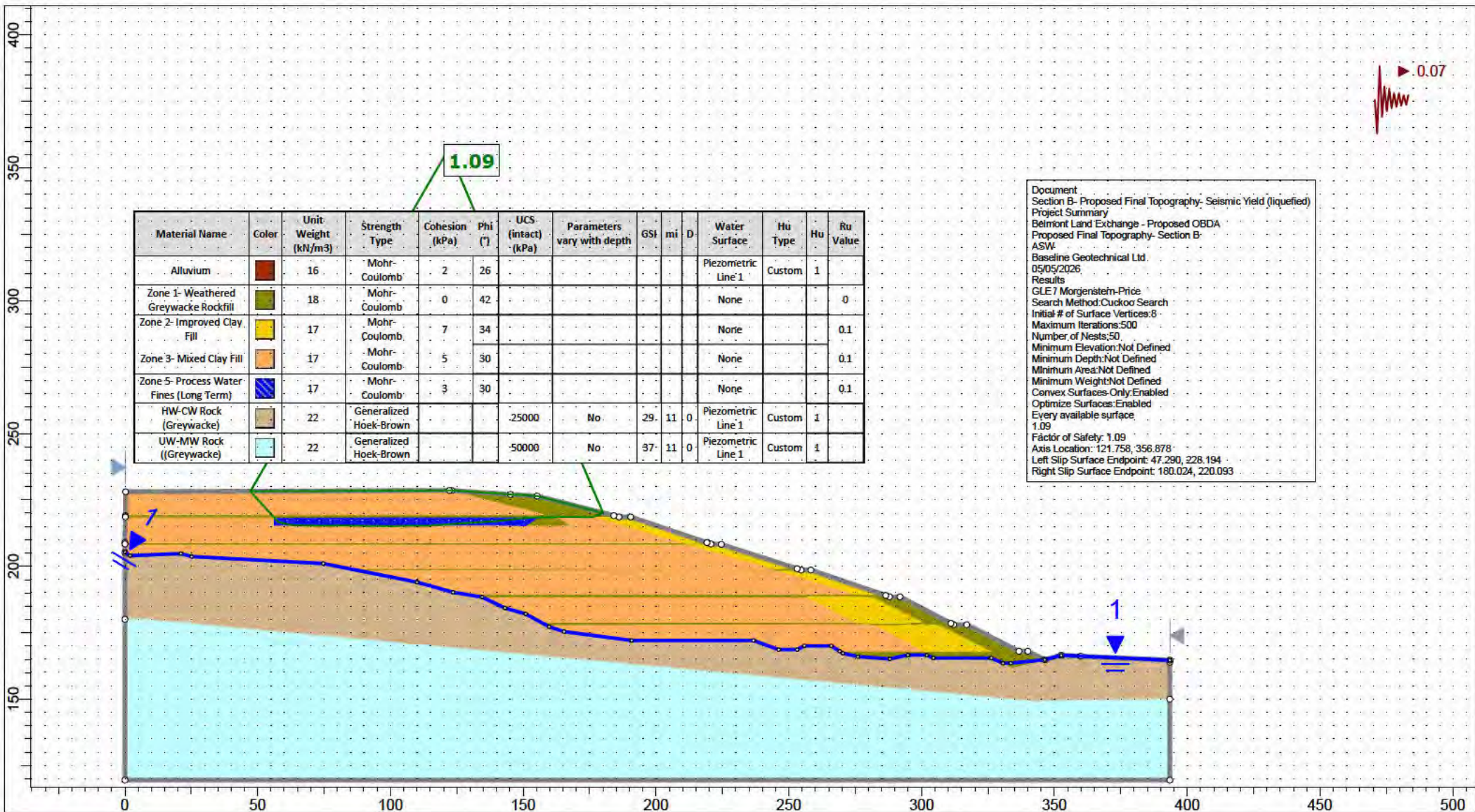
Baseline Geotechnical Ltd

Date

22/07/2026

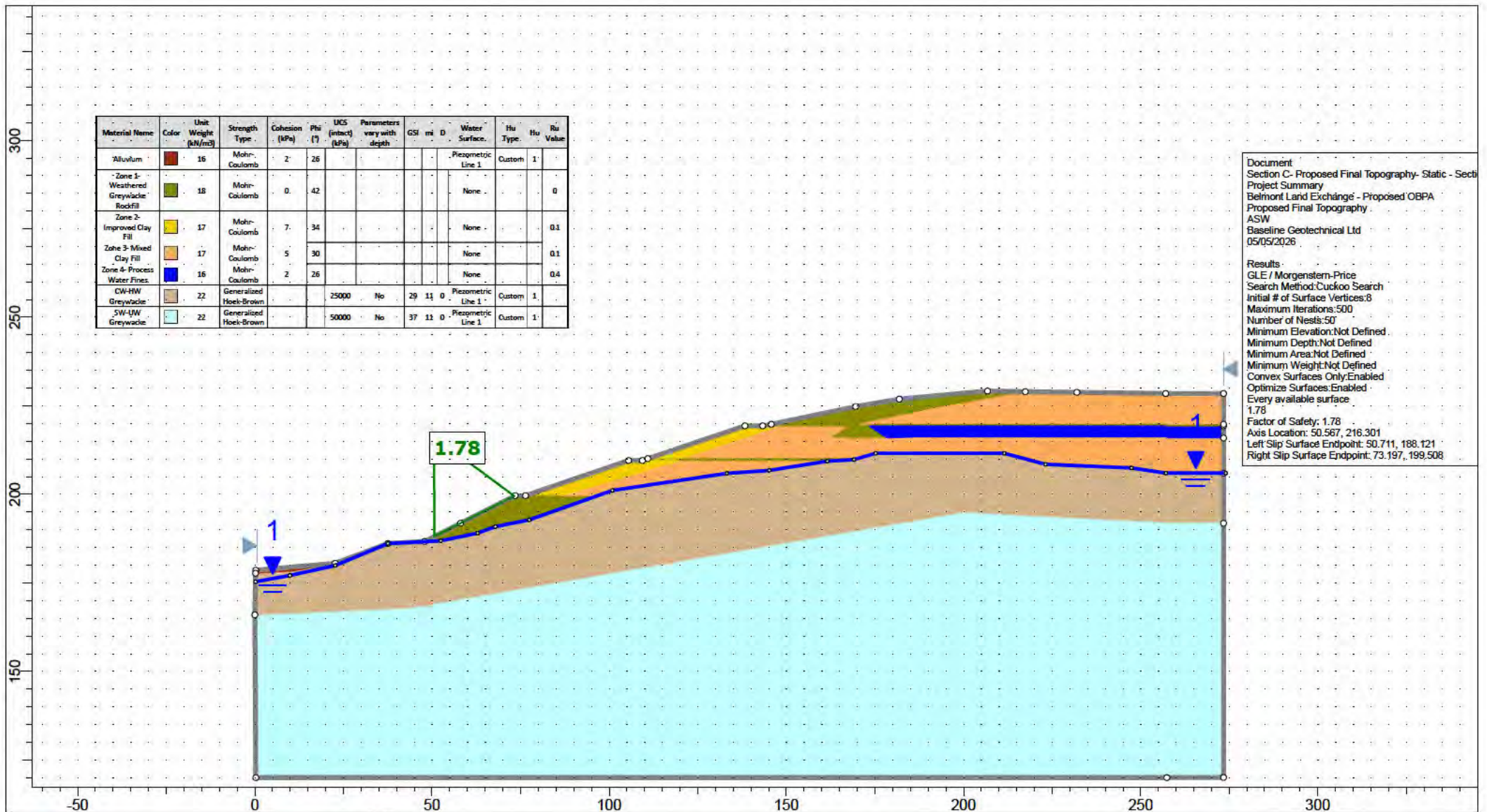
File Name

B- Eastern Gully v2.1.sldm



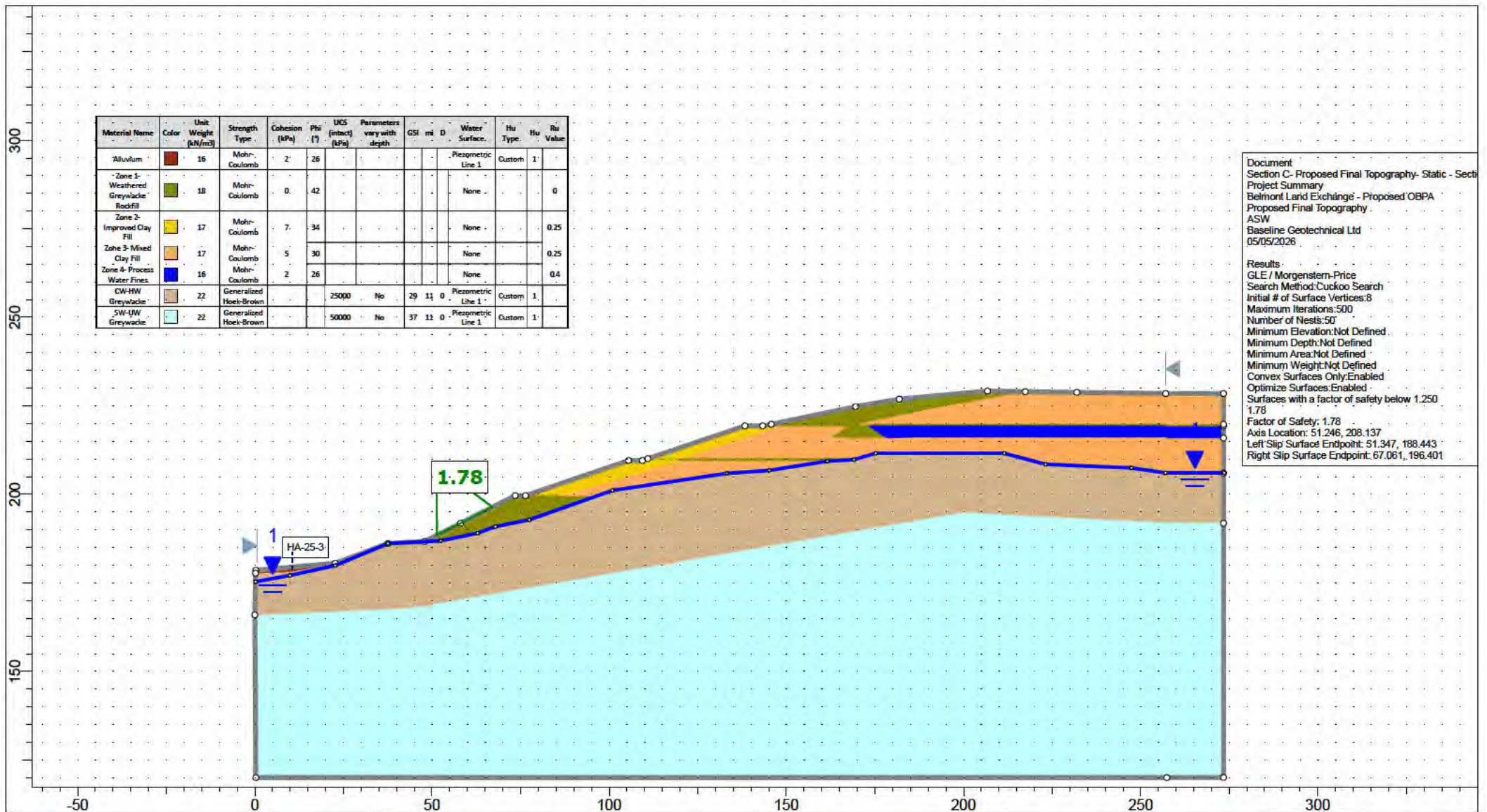
SLIDEINTERPRET 9.043

Project			Belmont Land Exchange - Proposed OBDA		
Analysis Description			Proposed Final Topography- Section B, Section B- Proposed Final Topography- Seismic Yield (liquefied)		
Drawn By	THL	Scale	1:2000	Company	Baseline Geotechnical Ltd
Date	22/07/2026	File Name	B- Eastern Gully v2.1.sldm		



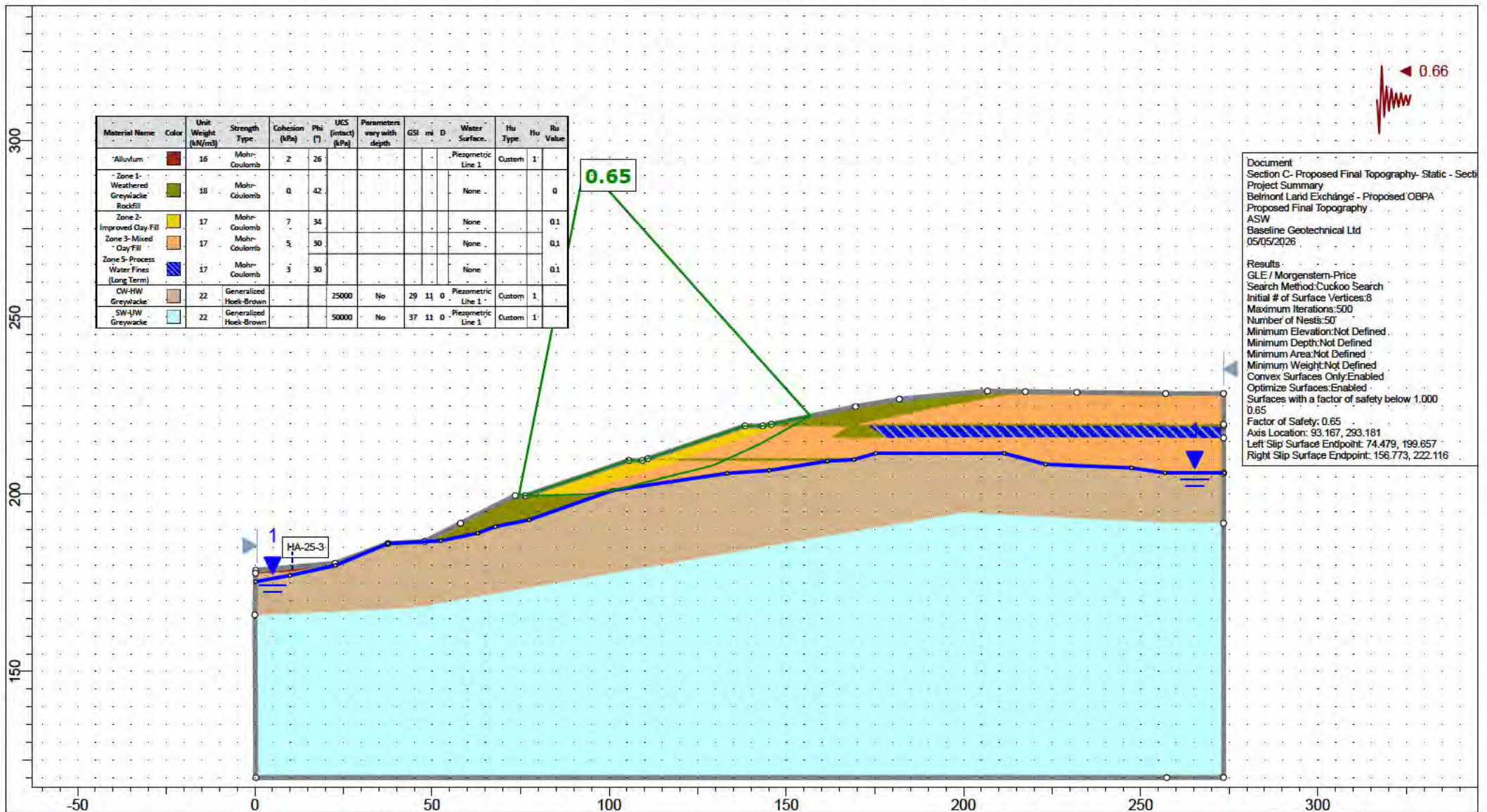
SLIDEINTERPRET 9.043

Project			
Belmont Land Exchange - Proposed OBPA			
Analysis Description			
Proposed Final Topography , Section C- Proposed Final Topography- Normal Groundwater			
Drawn By	THL	Scale	1:1500
Company		Baseline Geotechnical Ltd	
Date	22/07/2026	File Name	C- Western Gully v3.1.slmd



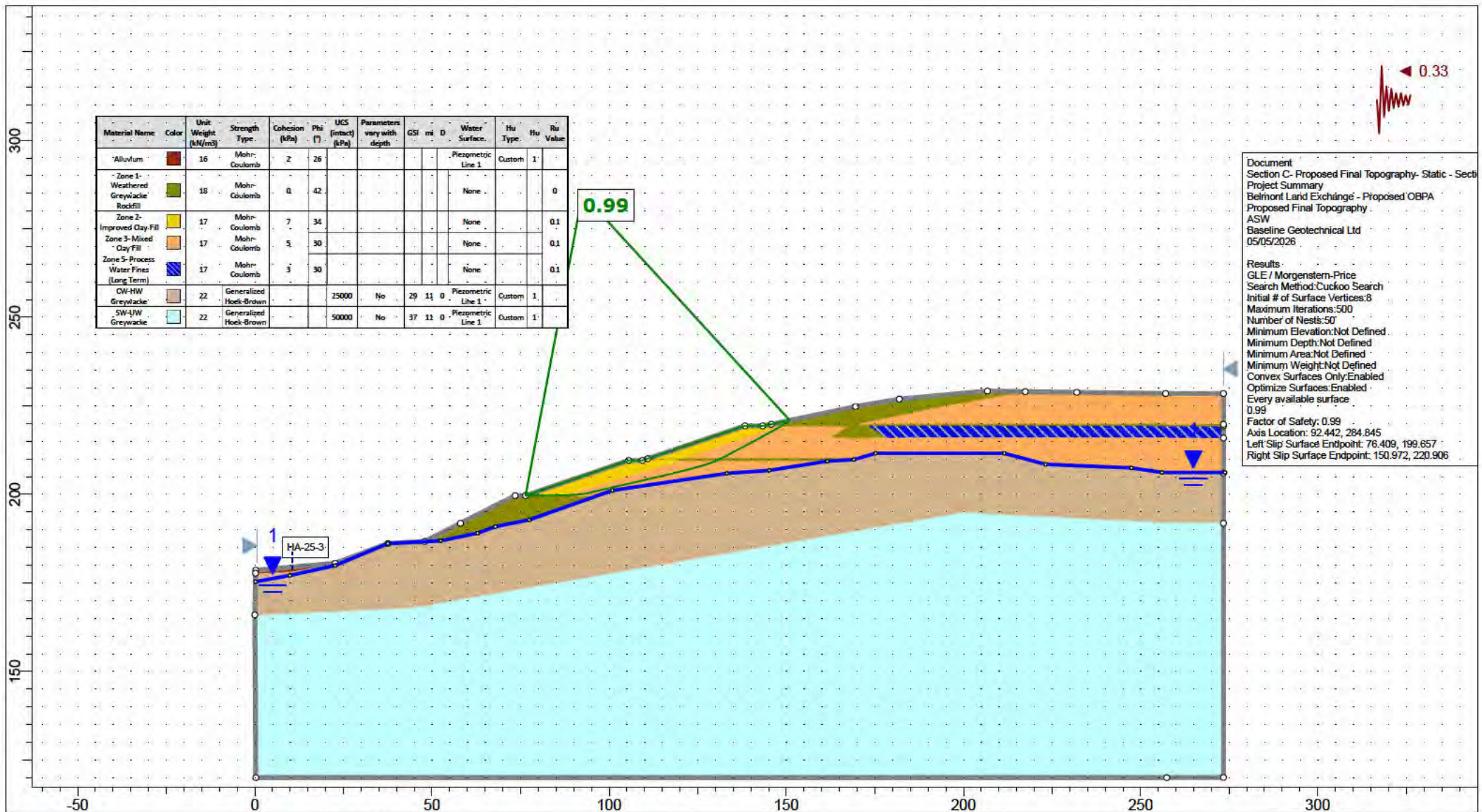
SLIDEINTERPRET 9.043

Project			
Belmont Land Exchange - Proposed OBPA			
Analysis Description			
Proposed Final Topography , Section C- Proposed Final Topography- Elevated Groundwater			
Drawn By	THL	Scale	1:1500
Company		Baseline Geotechnical Ltd	
Date	22/07/2026	File Name	C- Western Gully v3.1.slm



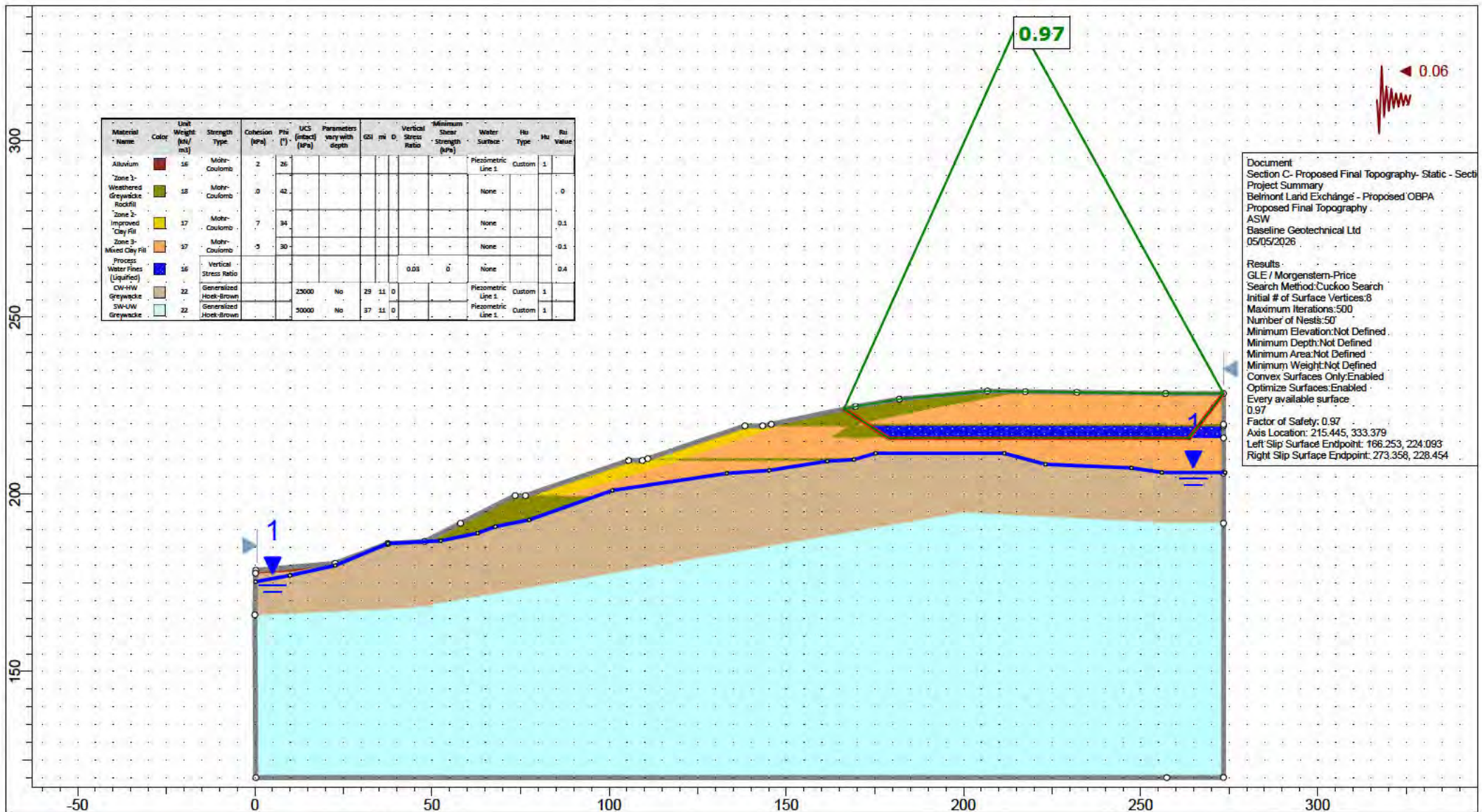
SLIDEINTERPRET 9.043

Project			
Belmont Land Exchange - Proposed OBPA			
Analysis Description			
Proposed Final Topography , Section C- Proposed Final Topography- Seismic (long term)			
Drawn By	THL	Scale	1:1500
Company	Baseline Geotechnical Ltd		
Date	22/07/2026	File Name	C- Western Gully v3.1.slmd



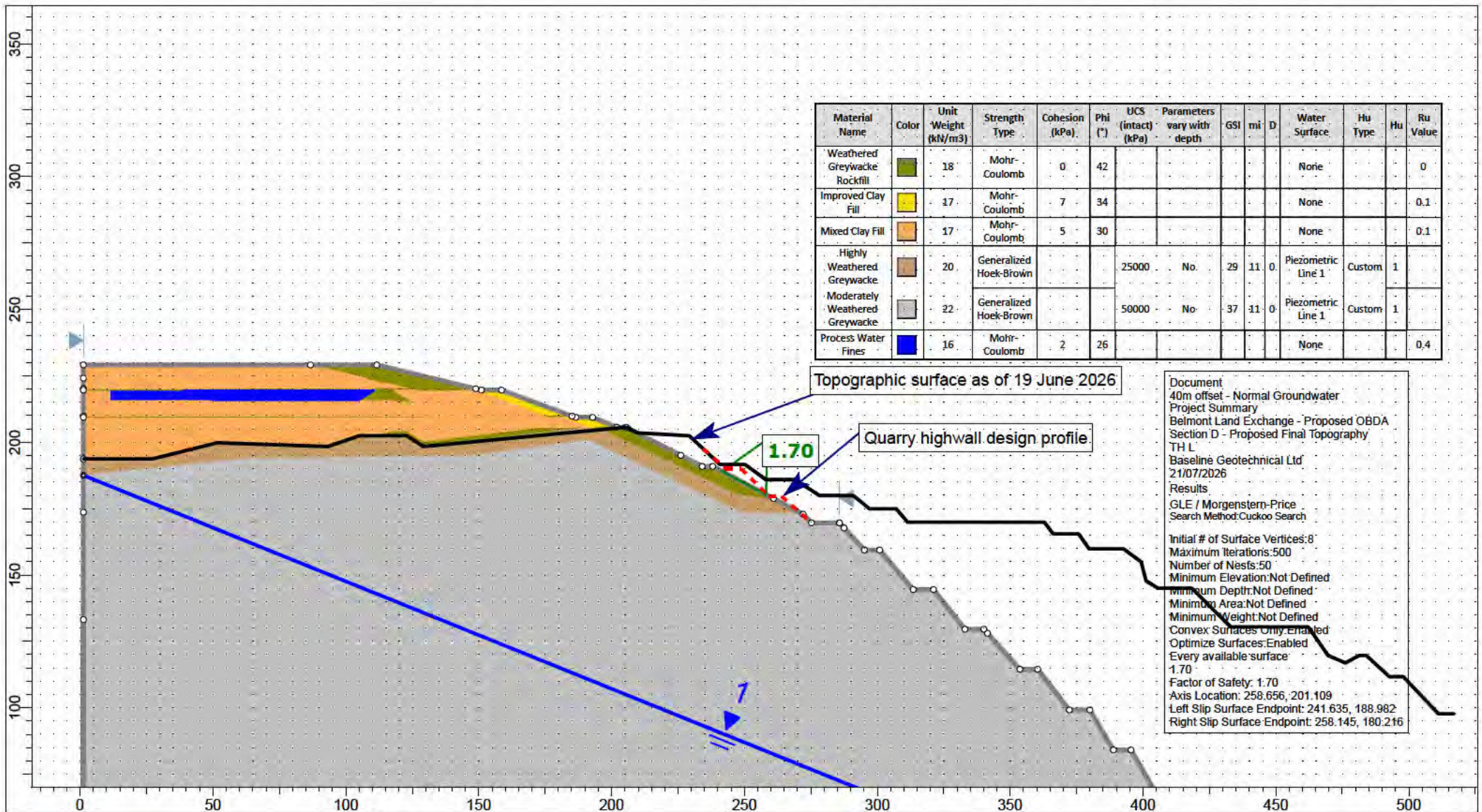
SLIDEINTERPRET 9.043

Project			
Belmont Land Exchange - Proposed OBPA			
Analysis Description			
Proposed Final Topography , Section C- Proposed Final Topography- Seismic Yield (long term)			
Drawn By	THL	Scale	1:1500
Company	Baseline Geotechnical Ltd		
Date	22/07/2026	File Name	C- Western Gully v3.1.slm



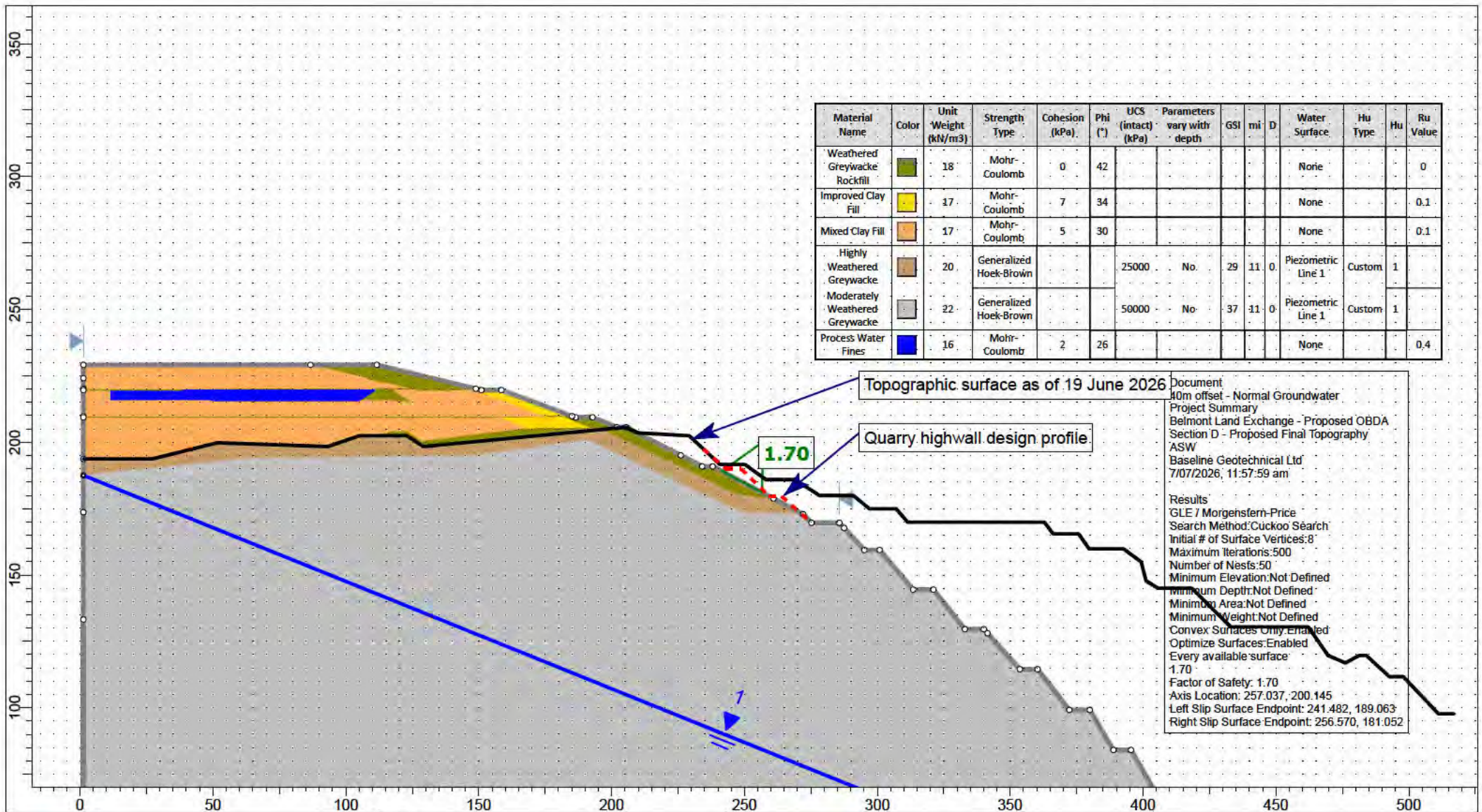
SLIDEINTERPRET 9.043

Project			
Belmont Land Exchange - Proposed OBPA			
Analysis Description			
Proposed Final Topography , Section C- Proposed Final Topography- Seismic Yield (short term, liquefied)			
Drawn By	THL	Scale	1:1500
Company	Baseline Geotechnical Ltd		
Date	22/07/2026	File Name	C- Western Gully v3.1.slmd



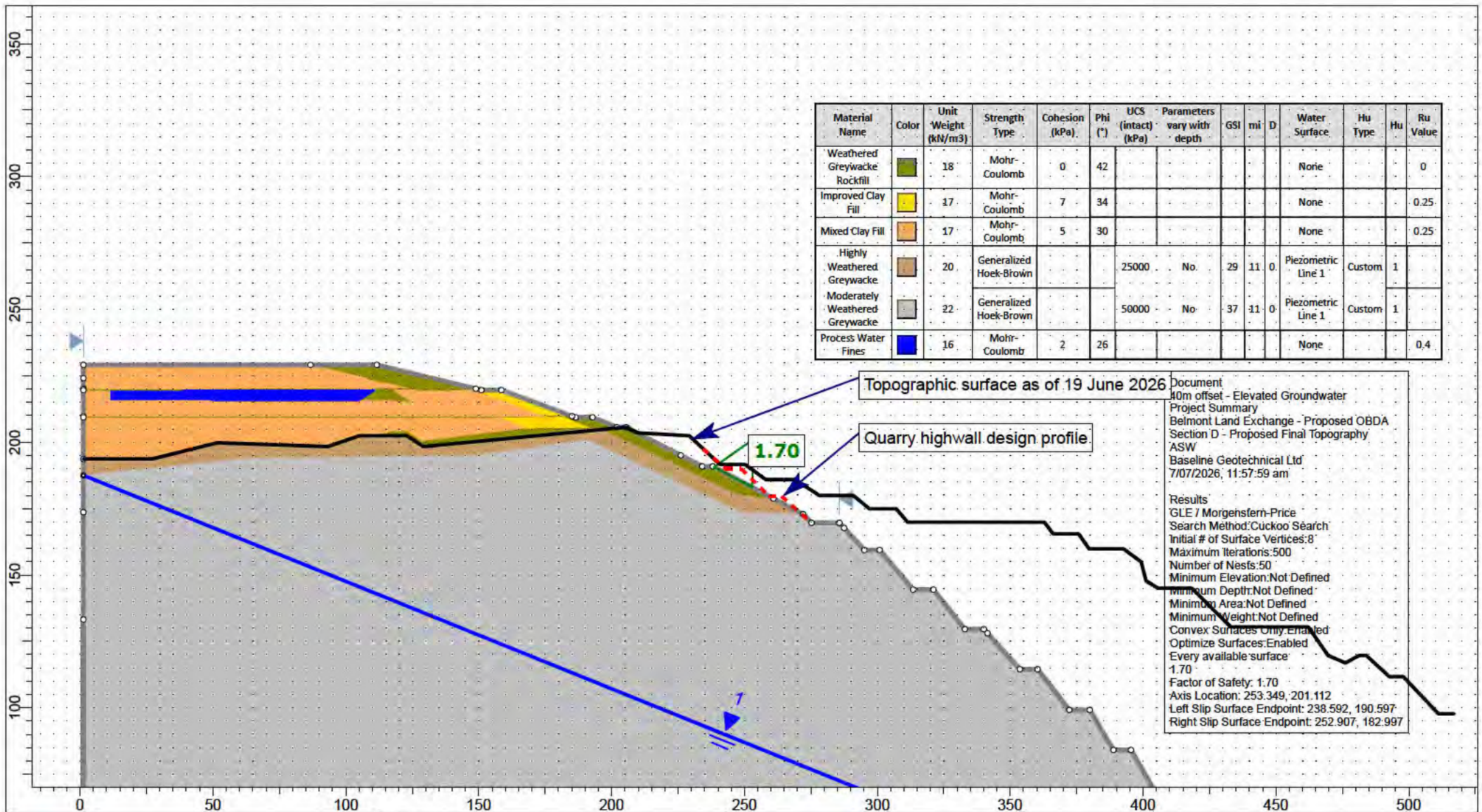
SLIDEINTERPRET 9.043

Project		Belmont Land Exchange - Proposed OBDA	
Analysis Description		Section D - Proposed Final Topography, Normal Groundwater	
Drawn By	THL	Scale	1:2000
Date	22/07/2026	Company	Baseline Geotechnical Ltd
		File Name	Section D v0.3.slmd



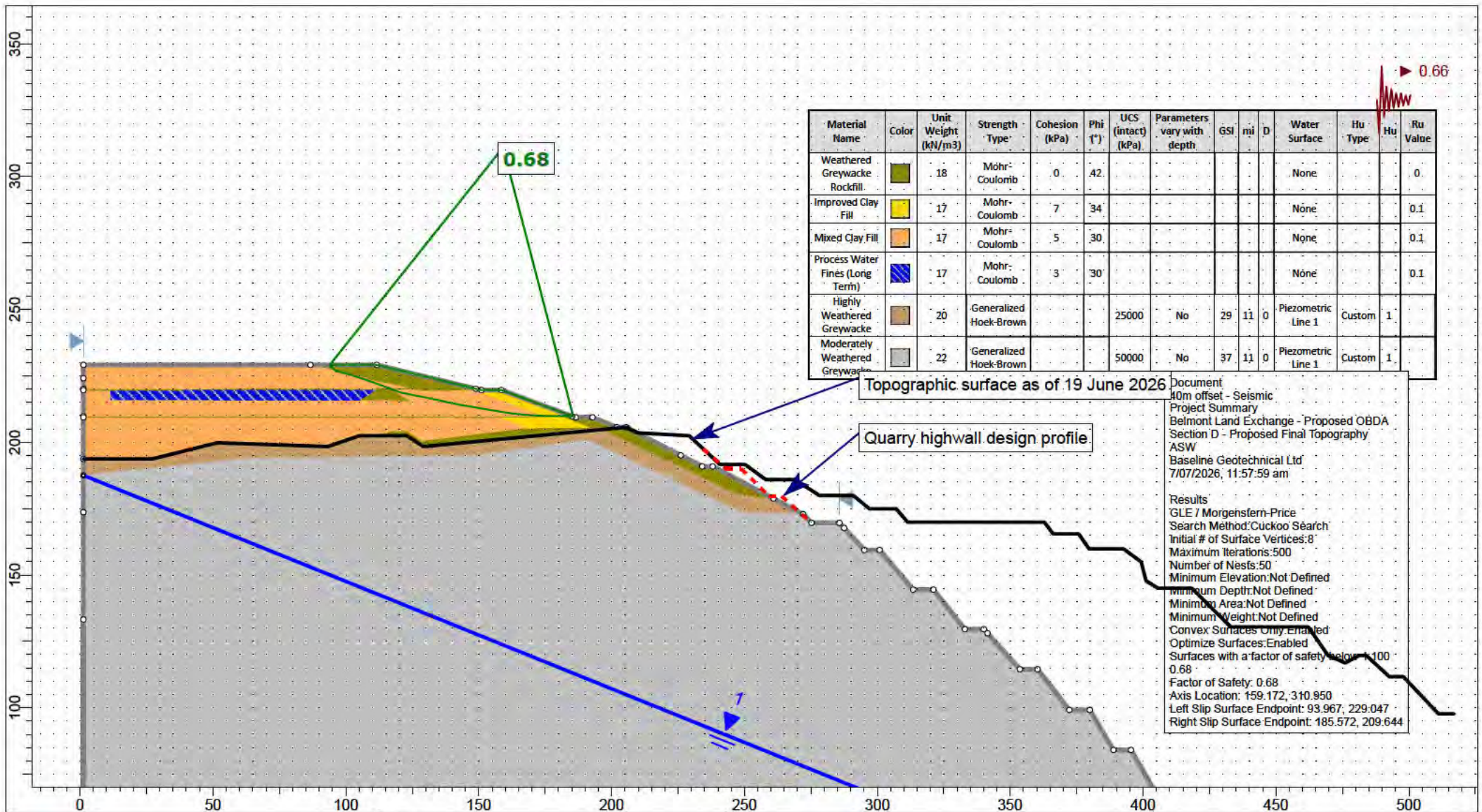
SLIDEINTERPRET 9.043

Project			
Belmont Land Exchange - Proposed OBDA			
Analysis Description			
Section D - Proposed Final Topography, Normal Groundwater			
Drawn By	THL	Scale	1:2000
Date	23/07/2026	Company	Baseline Geotechnical Ltd
		File Name	Section D v0.3.slmd



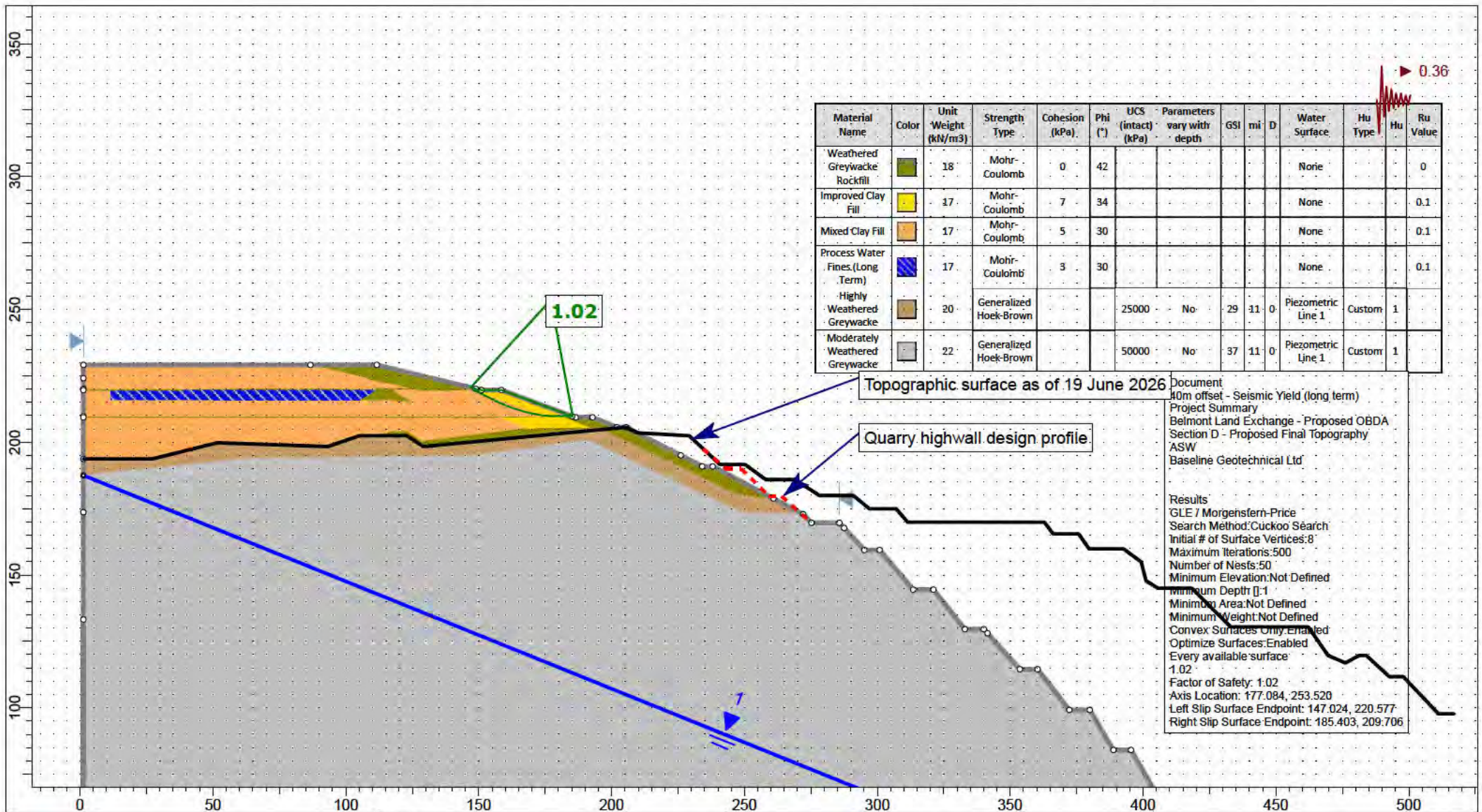
SLIDEINTERPRET 9.043

Project		Belmont Land Exchange - Proposed OBDA	
Analysis Description		Section D - Proposed Final Topography, Elevated Groundwater	
Drawn By	THL	Scale	1:2000
Date	23/07/2026	Company	Baseline Geotechnical Ltd
		File Name	Section D v0.3.slmd



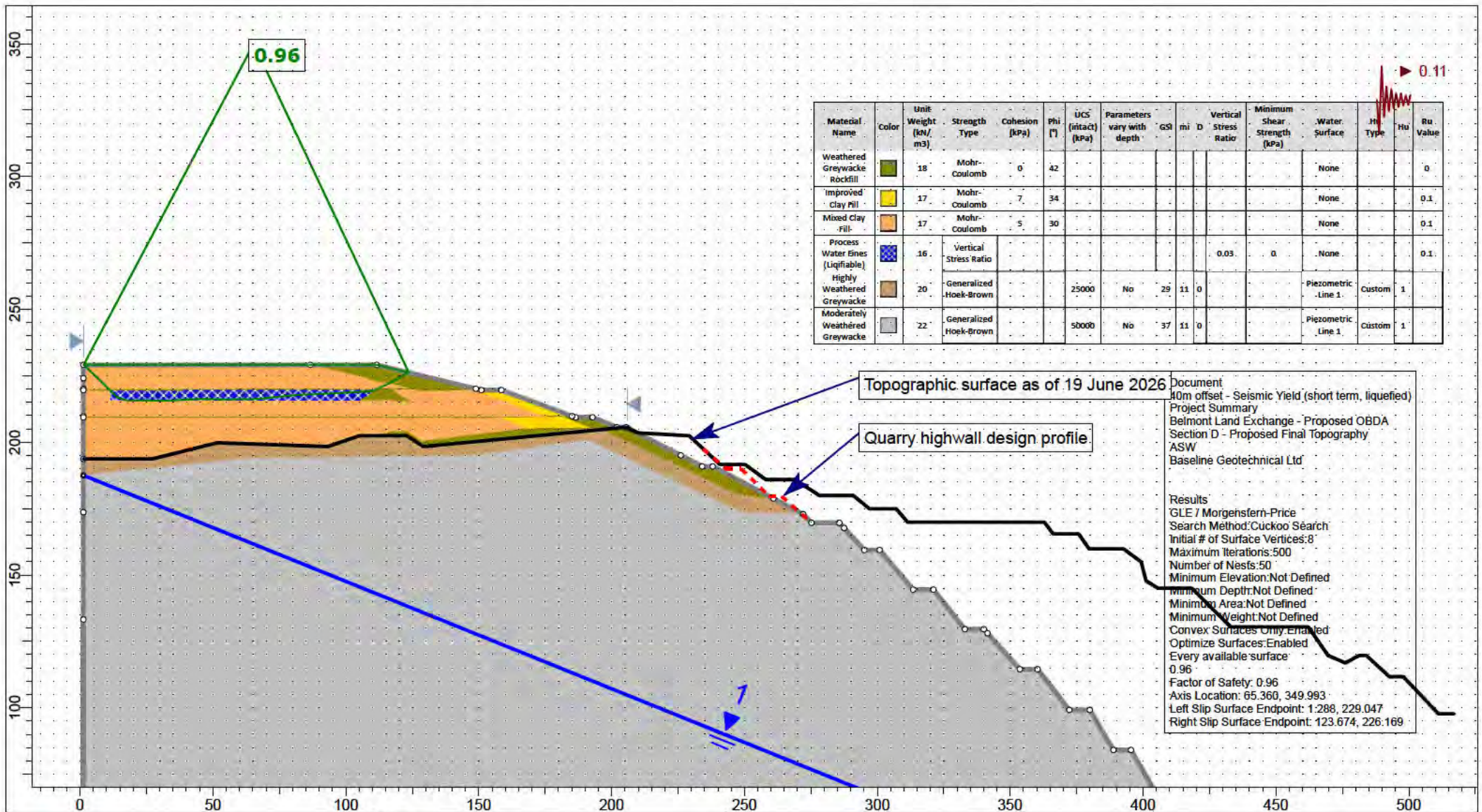
SLIDEINTERPRET 9.043

Project			Belmont Land Exchange - Proposed OBDA		
Analysis Description			Section D - Proposed Final Topography, Seismic		
Drawn By	THL	Scale	1:2000	Company	Baseline Geotechnical Ltd
Date	23/07/2026	File Name	Section D v0.3.slm		



SLIDEINTERPRET 9.043

Project			
Belmont Land Exchange - Proposed OBDA			
Analysis Description			
Section D - Proposed Final Topography, Seismic Yield (long term)			
Drawn By	THL	Scale	1:2000
Date	23/07/2026	Company	Baseline Geotechnical Ltd
		File Name	Section D v0.3.slm



SLIDEINTERPRET 9.043

Project			
Belmont Land Exchange - Proposed OBDA			
Analysis Description			
Section D - Proposed Final Topography, Seismic Yield (short term, liquefied)			
Drawn By	THL	Scale	1:2000
Date	23/07/2026	Company	Baseline Geotechnical Ltd
		File Name	Section D v0.3.slm