Clockhouse Quarry Restoration Environmental Permit Application

Stability Risk Assessment

SUEZ Recycling and Recovery UK Limited

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SLR Project No.: 402.065294.00001

15 December 2025

Revision: V1 Final

Making Sustainability Happen

Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
V1	6 November 2025	MR	AK	MR
V1 Final	15 December 2025	MR	AK	MR
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Basis of Report

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1.0 Introduction

1.1 Report Context

SLR Consulting Limited (SLR) has been appointed by SUEZ Recycling and Recovery UK Ltd (SUEZ) to prepare a Stability Risk Assessment (SRA) as part of a Waste Recovery Environmental Permit (EP) application. The application seeks approval for the use of suitable waste in the restoration of Clockhouse Quarry (the Site), located at Horsham Road, Capel, Surrey, RH5 5JL, as a waste recovery operation under the Environmental Permitting (England and Wales) Regulations 2016. This document describes the manner in which the assessment has been carried out and presents the overall findings of the work.

The Site is situated approximately 950m south of the village of Capel and approximately 10km west of Crawley. The total area of the site to be restored measures approximately 12 hectares.

The methodology adopted for this Stability Risk Assessment largely follows the principles outlined in the Environment Agency R&D Technical Report P-385[1], volumes TR1 and TR2 (and, while not representing official Environment Agency Guidance, from here on referred to as the Guidance). Where additional analytical techniques have been used, these are described within the text.

1.2 Site Description

Clockhouse Quarry is a former clay pit associated with the dormant Clockhouse Brickworks covering approximately 26.4 hectares (ha) and can be subdivided into three distinct areas referred to as Area 1, Area 2 and Area 3. The location of each of these areas is shown on Drawing 02 and a description of each is provided as follows:

- **Area 1:** The south-western area includes a closed landfill the subject of Environmental Permit (EP) reference EPR/CP3994HB (EAWML 19674) operated by SITA (now SUEZ Recycling and Recovery Surrey Ltd) under planning permission MO98/1448. The landfill ceased accepting waste in 2004 with the expiry of the planning permission time limit. Restoration was completed in 2008 in accordance with the requirements of planning permission MO98/1448.
- **Area 2:** The south-eastern area and to the east of Area 1 has been quarried and, although included within the expired planning permission MO98/1448 and its restoration landform design, landfilling operations never progressed into Area 2. It remains unrestored and unable to achieve the intended restoration landform due to expiry of the landfill planning permission. Area 2 has historically been partially infilled with quarry overburden as part of the quarry operations and a lower-level restoration design has recently been agreed with the planning authority under permission MO/2023/0789.
- **Area 3:** The northern area, directly north of Area 2 and east of the brickworks has been quarried and is an unrestored flooded quarry void. Mineral permission MO02/1072 includes an outstanding requirement to restore and the restoration design has recently been agreed with the planning authority under permission MO/2023/0789.

Area 1 is already permitted (EPR/CP3994HB) and has been infilled utilising a landfill environmental permit and is formally closed. Therefore, this EP application relates to Areas 2

[1] Environment Agency R&D Technical Report P1-385/ TR1 and TR2, 'Stability of Landfill Lining Systems', February 2003.

and 3 only. The EP application seeks to allow for deposit for recovery activities to take place in order to restore the quarry in accordance with its granted restoration scheme.

1.3 Waste Types and Volume

The EP application is for the deposit of inert waste for recovery. The site will accept up to 686,000m^3 of waste for restoration purposes, which equates to approximately 1,234,000 tonnes of waste at an assumed density of 1.8 t/m^3. The Site will accept up to 500,000 tonnes per annum (tpa) for the purposes of waste recovery.

The imported material will be used to facilitate the low-level restoration if the base of the workings in Area 3 and the northern part of Area 2.

2.0 Conceptual Stability Site Model

2.1 Topography

The critical geometry within the site is present within Area 3 where slopes extend from approx. 90m AOD to 67m AOD at gradients of 1V:2.4H. A 5m wide bench at an elevation of 80m AOD is present on the steepest and longest portion of the subgrade slopes. Site investigation data indicates the entire void has been excavated within in-situ Weald Clay. Interpretation of the ground investigation data indicates a transition from weathered Weald Clay, comprising predominantly silty clay, to unweathered Weald Clay, comprising very stiff clay, mudstone, and bands of siltstone. The depth of this has been conservatively assumed to be approx. 13m bgl (78m AOD).

2.2 Geology

Published geological mapping by the BGS confirms that the bedrock across the Site comprises:

- **Weald Clay Mudstone** – present across the majority of the Site;
- **Weald Clay Sandstone** – east-west bands along the site's northern boundary and through the central portion of the Site; and
- **Weald Clay Limestone** – present along the southern boundary of the main area of the Site;

BGS borehole TQ13NE40 located with the land ownership boundary of SUEZ indicates clay to a depth of 114.6m, although quarrying only extended down to c.35m deep with the base of the main void at c. 67 m AOD.

Ground investigations[2,3] recorded weathered Weald Clay comprising stiff, becoming very stiff silty clay, to depths of between 10.0m and 15.0m bgl. Weathering reduces with depth with the Weald Clay becoming more friable and fissured with depth. Bands of weak unweathered siltstone were recorded from 10.5m and 16.5m bgl in boreholes where rotary coring was undertaken.

The last ground investigation (GI) at the Site was completed in 2022 and 2023 to confirm the site's geological condition. Eight boreholes were drilled as part of the investigation. The location of the boreholes, geological logs and borehole details are provided in the Hydrogeological Risk Assessment (HRA) (ref. 402.065294.00001).

The borehole logs indicate that the geology is exclusively stiff Weald Clay with rare sandstone and limestone horizons of limited thickness (including a 10cm thick limestone band at BH22/1, a 5cm thick sandstone band at BH22/1 and 12cm thick and 8cm thick sandstone bands at BH22/3).

It is noted that the drilling method used in some boreholes may not have detected all sub horizons; large parts of the borehole logs for boreholes BH22/2, BH22/3, BH22/4, BH22/5, BH22/8, BH22/9 were drilled open hole and have no recovery of drilled material.

2.3 Groundwater

Groundwater measurements during drilling as part of the 2022/23 ground investigation recorded water strikes at between 10.5m bgl and 18.0m bgl (78m - 70m AOD). Monitoring of

[2] Ground Investigation undertaken by SLR Consulting Ltd in 2007 in support of proposed EfW development.

[3] Ground Investigation carried out by Jackson Geo Services in October 2022 and June 2023.

groundwater elevations has been carried out by SUEZ in the installed monitoring wells over the intervening period[4]. The HRA states regional groundwater at the perimeter of the void is at an elevation of 83m AOD and is depressed to an elevation of 77m AOD within the centre of the void. The groundwater contours derived from the HRA have been used to represent the pore pressure conditions applied to stability models.

2.4 Basal Subgrade Model

The basal subgrade model within Area 3 comprises in-situ Weald Clay that has been excavated as part of the former clay workings to a depth of 67m AOD. The subgrade to Area 2 comprises an unknown thickness of back cast quarry overburden, The base of mineral extraction is estimated to be at 63m AOD (based on information used to inform the HRA).

Groundwater is currently present in both voids at an elevation of approx. 77m AOD. Areas 2 and 3 will be dewatered prior to placement of any materials as part of the restoration of the site.

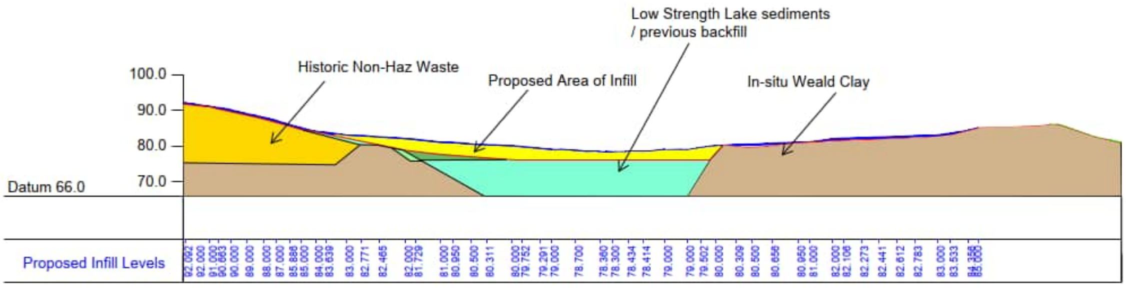
2.5 Side Slope Subgrade Model

Side slopes to Area 3, are formed within in-situ Weald Clay, excavated as part of the former quarry works. The steepest slopes are at a gradient of 1V:2.4H up to 24m high.

Shallower slopes are present within Area 2, adjacent to the existing non-hazardous waste mass in Area 1. Slopes are present at gradients of 1V:3.5H over a height of 9m, with shallower slopes elsewhere. The slopes are formed by the existing waste mass, restoration soils and perimeter bunds to the landfill. Historic instability within the perimeter bunds, attributed to the effects of rapid drawdown of water within the adjacent lagoon, has been considered as part of previous stability assessments. Analyses will include these features as part of this assessment.

Figure SRA2-1 below presents a schematic cross section through the Area 3 where inert soils will be placed.

Figure SRA 2-1 Area 2 Schematic Cross Section



2.6 Basal Geological Barrier System Model

The basal geological barrier system is proposed to be a formed by the low-permeability in-situ Weald Clay. No additional artificial geological barrier is required.

2.7 Side Slope Geological Barrier System Model

The side slope geological barrier system is proposed to be a formed by the low-permeability in-situ Weald Clay. No additional artificial geological barrier is required.

[4] Technical Note – Clockhouse Quarry Proposed Restoration, Review of Groundwater Data to August 2024.

2.8 Waste Mass Model

The site will be restored with imported inert waste, generally comprising clay rich soils excavated from construction sites across the region.

A phasing plan has been prepared for the restoration of the site that splits the site into eight phases each representing either one year (Phases 1, 2 and 5-8) or two years (Phases 3 and 4) of filling.

Critical slopes are anticipated to be formed in Phase 1 where waste will be placed to form a 25m wide platform adjacent to the Clockhouse Brickworks at an elevation of 90m AOD. Waste will be placed to create a temporary slope at a gradient of 1V:3H up to 24m high.

2.8.1 Leachate and Gas Management

The site is to be restored with inert waste typically comprising low permeability soils. No significant quantities of organic or putrescible materials will be present in the waste to produce leachate or gas at concentrations that will require active management.

Notwithstanding this, a nominal 1m head will be assumed on the base of the waste mass in stability models, along with a partial saturation of the waste mass. This is included to account for various factors that may impact on the stability of temporary waste slopes, including surface water ingress, groundwater migration and the inherent variability of the placed waste mass.

2.9 Capping System Model

As the site will only accept inert waste no formal capping system will be required. Restoration will comprise the placement of either:

- 1m of low permeability clay in areas that will form surface water features; or
- 1m of subsoils and topsoil.

Restoration slopes will be constructed to a maximum gradient of 1V:6.6H.

3.0 Stability Risk Assessment

Each of the six principal components of the conceptual stability site model has been considered and the various elements of that component have been assessed with regard to stability.

The principal components considered are:

- The basal subgrade;
- The side slope subgrade;
- The basal geological barrier;
- The side slope geological barrier;
- The waste; and
- The capping system.

3.1 Risk Screening

Issues relating to stability and integrity for each principal component of the proposed development have been subject to a preliminary review to determine the need to undertake further detailed geotechnical analyses. The following sections present the results of this screening exercise.

3.1.1 Basal Subgrade Screening

The key considerations for the side slope sub-grade and the implications for stability/integrity are presented in Table SRA 3-1 below.

Table SRA 3-1 Basal Subgrade Screening

Excessive Deformation	Compressible subgrade	The basal subgrade will be formed by the in-situ Weald Clay. This is considered effectively incompressible under the limited weight imparted by the waste mass. This element does not require further consideration.
	Basal heave	No additional artificial geological barrier will be constructed at the site. Consequently, further analysis is not required.
	Cavities in subgrade	There is no record of cavities occurring in the in-situ Weald Clay. Notwithstanding this the subgrade will be inspected prior to any fill being placed. This element does not require further consideration
Filling on Waste	Compressible waste	Not applicable.
	Cavities in waste	Not applicable.

3.1.2 Side Slope Subgrade Screening

The key considerations for the side slope sub-grade and the implications for stability/integrity are presented in Table SRA 3-2 below.

Table SRA 3-2 Side Slope Subgrade Screening

Cut slope	Rock	Stability	Not applicable.
		Cavities in subgrade	Not applicable.
		Deformability	Not applicable.
	Cohesive soils	Stability	Side slopes will be formed within the in-situ Weald Clay. Analysis will be carried out to confirm side slope subgrade stability This element requires further consideration.
		Deformability	The side slope subgrade will be formed by the in-situ Weald Clay. This is considered effectively incompressible under the limited weight imparted by the waste mass. This element does not require further consideration.
		Time dependent stability	The in-situ Weald Clay slopes have been excavated and untouched for many years. As such the slopes can be considered to be in a drained, effective stress conditions. Analysis of the slopes will be carried out using effective stress parameters, based on site specific laboratory testing.
		Groundwater	The basal areas of Area 2 and Area 3 contain water to an elevation of approx. 79m AOD. Both voids will be dewatered prior to waste placement. Analysis will be carried out to confirm the stability of the subgrade following dewatering. This element requires further consideration.
	Granular soils	Stability	Not applicable
		Deformability	Not applicable
		Groundwater	Not applicable
Fill Slope	Cohesive soils	Stability	A very limited amount of filling against previously buttressed waste slopes will be required at the boundary between Areas 1 and 2. This element requires further consideration.
		Time dependent stability	The buttressed waste slopes have been in place and untouched for many years. As such the slopes can be considered to be in a drained, effective stress conditions. Analysis of the slopes will be carried out using effective stress parameters.
		Groundwater	The basal areas of Area 2 and Area 3 contain water to an elevation of approx. 79m AOD. Both voids will be dewatered prior to waste placement. Analysis will be carried out to confirm the stability of the subgrade following dewatering. This element requires further consideration.
	Granular soils	Stability	Not applicable.
		Deformability	Not applicable.
		Groundwater	Not applicable.

3.1.3 Basal Geological Barrier System Screening

The controlling factors that influence the stability and integrity of the basal geological barrier system are given in Table SRA 3-3, below.

Table SRA 3-3 Basal Geological Barrier System Screening

Geosynthetic / Mineral geological barrier	Stability and Integrity	Not applicable.
	Compressible subgrade	Not applicable.
	Cavities	Not applicable.
	Basal heave	Not applicable.
Mineral Only	Stability and Integrity	In terms of potential for movements along the basal geological barrier system, the development of the void in a series of distinct phases will result in the generation of a number of temporary waste slopes. The presence of temporary slopes may result in instability in the basal geological barrier system. Since this issue is dependent upon the geometry of the waste mass and the geological barrier system, this aspect of the stability review is covered under Section 3.1.5, Waste Mass Screening. In terms of the basal geological barrier system integrity, provided that the stability analysis indicates acceptable factors of safety, then integrity will not be an issue since the waste mass will not induce tensions along the basal geological barrier system.
	Compressible subgrade	The basal geological barrier system to Area 2 will comprise back cast quarry overburden, whilst that in Area 3 will comprise in-situ Weald Clay. Both the quarry overburden (based on the time it has been in-situ) and the in-situ Weald Clay are considered to be effectively incompressible under the stresses imposed by the waste height proposed. This component does not require further consideration.
	Cavities	This issue is discussed as part of the basal subgrade assessment and therefore not considered further here.
	Basal heave	This issue is discussed as part of the basal subgrade assessment and therefore not considered further here.

3.1.4 Side Slope Geological Barrier System Screening

The controlling factors that influence the stability and integrity of the side slope geological barrier system are given in Table SRA 3-4, below.

Table SRA 3-4 Side Slope Geological Barrier System Screening

Unconfined	Mineral only	Stability	No additional artificial geological barrier will be constructed at the site. Unconfined stability of the geological barrier will be considered as part of the side slope subgrade stability analyses and does not require additional analysis. This element does not require further consideration.
		Integrity	No additional artificial geological barrier will be constructed at the site. Unconfined integrity of the geological barrier will be considered as part of the side slope subgrade stability analyses and does not require additional analysis. This element does not require further consideration.
	Geosynthetic / mineral	Stability	Not applicable
		Integrity	Not applicable
Confined	Mineral only	Stability	If the stability in the unconfined condition is satisfactory, it is clear that the stability of the side slope geological barrier system in the confined condition will be greater owing to the buttressing effect of the waste and will therefore be satisfactory. This issue is considered as being separate from the Waste Mass Analysis, which does examine the influence of the confined side slope geological barrier system on the overall stability of the waste mass. The issue of confined side slope geological barrier system stability is therefore considered as part of the Waste Mass Analysis.
		Integrity	The integrity of the side slope geological barrier system will be considered as part of the Waste Mass Analysis.
	Geosynthetic / mineral	Stability	Not applicable
		Integrity	Not applicable

3.1.5 Waste Mass Screening

The controlling factors that influence the stability of the waste mass are presented in Table SRA 3-5 below:

Table SRA 3-5 Waste Mass Screening

Failure wholly in waste	Stability		Inert waste will be placed in phases within the void. Temporary waste slopes will be generated through progressive filling. Temporary waste slopes will require further assessment.
Failure involving geological barrier and waste	Mineral only	Stability	Given that the waste mass will be constructed with a temporary outer slope on top of the basal geological barrier system and against the side slope geological barrier system, the potential for the waste to move along either of these geological barrier systems needs to be considered further within this report.
		Integrity	Settlement of the waste mass is anticipated to be less than 10% of the total waste thickness. This is not considered sufficient to compromise the integrity of the geological barrier, formed by a significant thickness of in-situ Weald Clay.
	Geosynthetic / Mineral	Stability	Not applicable
		Integrity	Not applicable

3.1.6 Capping System Screening

No formal capping system will be constructed as part of the restoration of the site. As such no analysis of the capping system is required.

3.2 Lifecycle Phases

This aspect of the assessment identifies the critical phases during the development of the site.

Given the fact that the site is to be developed in a series of phases across the base of the void, temporary waste slopes will be formed, and waste is placed to achieve the formation levels in each phase. It can be seen that the most critical condition, with respect to waste and geological barrier system stability will occur at the end of filling to the proposed pre-settlement levels in each phase. For this reason, the lifecycle phases assessed within this document are;

- the temporary end-of-construction condition for the side slope sub-grade; and
- the temporary waste filling condition created between phases for the waste mass and confined side slope geological barrier system;

3.3 Data Summary

The following data are required as input for the analyses undertaken for this Stability Risk Assessment:

- Material unit weight;
- Drained shear strength of soils and waste;
- Elastic properties of soils and waste; and,
- Elastic properties of interfaces.

Site-specific data for the Weald Clay has been taken from the Jackson Geo Service ground investigation report[3]. The values reported have been used to establish the relevant design parameters presented in Table SRA 3-6 and Table SRA 3-7.

Other data required for the analyses have been derived from other sources (for example, published data on interface shear strength). This is discussed in more detail in Section 3.5.

3.4 Selection of Appropriate Factors of Safety

The factor of safety is the numerical expression of the degree of confidence that exists, for a given set of conditions, against a particular failure mechanism occurring. It is commonly expressed as the ratio of the load or action which would cause failure against the actual load or actions likely to be applied during service. This is readily determined for some types of analysis (e.g. limit equilibrium slope stability analyses). However, consideration must also be given to analyses which do not report factors of safety directly. For example, a finite difference analysis of shear strains within a steep side slope geological barrier system would not usually indicate overall ‘failure’ of the model even though the strains could be high enough to indicate a failure of the *integrity* of the geological barrier system. In such cases, it is necessary to define an upper limit for tension within the geosynthetics (for example) to express the factor of safety as the ratio of allowable tension to actual tension.

Prior to determining appropriate factors of safety for the various components of the model, it is necessary to identify key ‘receptors’ and evaluate the consequences in the event of a failure (relating to both stability and integrity). Consideration of the following receptors is required:

- Groundwater;
- Property - relating to site infrastructure, third party property; and
- Human beings (i.e. direct risk).

The factor of safety adopted for each component of the model would be related to the consequences of a failure.

3.4.1 Factor of Safety for Basal Subgrade

The determination of a factor of safety is not applicable in this case since this component of the Stability Risk Assessment has been screened out.

3.4.2 Factor of Safety for Side Slope Subgrade

A factor of safety of 1.3 is considered appropriate when using peak shear strength parameters.

3.4.3 Factor of Safety for Basal Geological Barrier System

A factor of safety of 1.3 is considered appropriate when using conservative peak shear strength parameters. Where reduced shear strength parameters are adopted (for example, for very long-term conditions, involving the 'fully-softened' or residual shear strength of the basal geological barrier system), it is considered that the factor of safety could be reduced to 1.0, in accordance with the advice given in the Guidance.

3.4.4 Factor of Safety for Side Slope Geological Barrier System

A factor of safety of 1.3 is considered appropriate when using conservative peak shear strength parameters. Where reduced shear strength parameters are adopted, it is considered that the factor of safety could be reduced to 1.0, in accordance with the advice given in the Guidance.

3.4.5 Factor of Safety for Waste Mass

The waste shear strength parameters presented within the Guidance are considered conservative and can be considered to already include an element of partial factoring. Therefore, it is considered appropriate to adopt a factor of safety of 1.3 if adopting these shear strength parameters in combination with the Traditional Approach (Section 2.2.4 of TR1and TR2[1]).

3.4.6 Factor of Safety for Capping System

The determination of a factor of safety is not applicable in this case since this component of the Stability Risk Assessment has been screened out.

3.5 Justification for Modelling Approach and Software

In order to perform a comprehensive Stability Risk Assessment, the components of the Deposit for Recovery development, as previously described in Section 1.2 of this document, have to be considered not only individually but in conjunction with one another where relevant. Any analytical techniques adopted for such an assessment should adequately represent all of the considered scenarios (i.e. the different modelled phases of the lifecycle) for both confined and unconfined conditions (where appropriate). The methodology and the software should also achieve the desired output parameters for the assessment (e.g. determination of limit equilibrium factor of safety or calculation of strains within geological barrier components).

The analytical methods used in this Stability Risk Assessment include:

- Limit equilibrium stability analyses for the derivation of factors of safety for the side slope sub-grade and the temporary waste slopes.

The limit equilibrium analyses have been undertaken using the package SLOPE/W Version 2024.2.1 (Bentley Systems, 2024). The Bishop Slip Circle and Morgenstern-Price Non-Circular methods of analysis have been used.

3.6 Justification of Geotechnical Parameters selected for Analysis

The following section presents a justification for the various parameters used in the stability analyses based on the following criteria:

- An assessment of the suitability of site specific and non-site-specific data where used; and
- Methods for the derivation of the parameters adopted.

A summary of the geotechnical parameters used in the design and analysis of the development are presented in tabular form for each component of the site's construction in Table SRA 3-6. The interface parameters are presented in Table SRA 3-7.

The parameters used in the analysis have been:

- Derived from site investigation results, including onsite logging of materials and in-situ testing;
- Taken from site specific laboratory test data or other relevant published data; and
- Adapted from similar work undertaken by SLR.

It should be noted that the geotechnical parameters for limit equilibrium analysis include the shear strength and unit weight of each material within the model plus pore water pressure assumptions. Shear strength has been defined using the effective shear strength parameters of cohesion, (c′), and the angle of shearing resistance, (ϕ′).

3.6.1 Parameters Selected for Basal Subgrade

No parameters relating to the basal subgrade are required since this component of the Stability Risk Assessment has been screened out.

3.6.2 Parameters Selected for Side Slope Subgrade

3.6.2.1 Area 2

The western side slope subgrade within Area 2 of the site will be formed by buttressed waste slopes in Area 1. Elsewhere in Area 2 side slopes will be formed by in-situ Weald Clay.

The rationale for the selection of material parameters relating to the Weald Clay is presented in detail in the following section. The parameters of the buttress materials and softened lagoon sediments are based on those used in previous stability assessment of the slopes carried out between 2010 and 2013[5, 6, 7]. A summary of the parameters used in analyses is presented in Table SRA 3-6, below.

3.6.2.2 Area 3

The side slope subgrade to Area will be formed by in-situ Weald Clay. The parameters used in analyses are based on site specific data from the 2022/23 ground investigation[3] and literature sources[8]. The results of consolidated drained triaxial testing on Class 1 samples of Weald Clay recovered during the ground investigation return high cohesion and relatively low angle of shearing resistance parameters. Whilst the testing undertaken is considered to be the most reliable laboratory method for measuring effective stress parameters (as opposed to Consolidated Undrained triaxial tests that do not allow for drainage during the shearing phases of the test), these results are considered to include an element of apparent cohesion, likely due to the samples not being fully drained during the test. Whilst these results can be considered to provide a reasonable portrayal of the behaviour of the soils in their current condition, dissipation of pore pressures over time may lead to a reduction in the apparent cohesion recorded by the tests.

Parameters have been selected to represent the Upper Weald Clay that demonstrates a degree of partial weathering, and the Lower Weald Clay which ground investigation has revealed to behave as a low strength mudstone that has undergone a degree of lithification.

The parameters used in analyses are summarised in Table SRA 3-6.

3.6.3 Parameters Selected for Basal Geological Barrier System

The basal geological barrier system will be formed by in-situ Weald Clay.

The parameters required for the confined basal geological barrier system analysis (undertaken as part of the Waste Mass Analysis) are the typical angle of shearing resistance and cohesion for a theoretical interface between the in-situ Weald Clay and the inert waste

[5] SLR Consulting Limited (2010). Capel Landfill Site Clockhouse, nr. Dorking, Surrey. Perimeter Bund Stability Assessment (Ref: 401.0079.00300). Prepared on behalf of: SITA UK Limited.

[6] SLR Consulting Limited (2011) Capel Landfill Site Clockhouse, nr. Dorking, Surrey. Perimeter Bund Stability Assessment (Ref: 401.0079.00300). Prepared on behalf of: SITA UK Limited.

[7] SLR Consulting Limited (1st July 2013). Capel Stability Review (SLR Ref: 410.00079.00300)

[8] Geological Society Engineering Geology Special Publication No. 21, Clay Materials Used in Construction, G. M. Reeves, I. Sims, J. C. Cripps, 2006.

mass in Area 3, or that between the back cast quarry overburden and the inert waste mass in Area 2. Both interfaces are considered to possess the same, or very similar properties and therefore a single set of interface parameters are considered appropriate for both scenarios. The adopted parameters are presented in Table SRA 3-7.

3.6.4 Parameters Selected for Side Slope Geological Barrier System

The side slope geological barrier is formed by the in-situ Weald Clay. As a result, analysis of the geological barrier in the unconfined condition is covered in the side slope subgrade analysis and no additional analysis is required.

The parameters required for the confined basal geological barrier system analysis (undertaken as part of the Waste Mass Analysis) are the typical angle of shearing resistance and cohesion for a theoretical interface between the in-situ Weald Clay and the inert waste mass. The adopted parameters are presented in Table SRA 3-7.

3.6.5 Parameters Selected for Waste Mass

In terms of the waste strength, SLR has adopted conservative values of effective shear strength parameters for a clay rich inert waste, with the values presented in Table SRA 3-6. These have been adopted based on SLR's recent experience of waste materials deposited in similar operations.

3.6.6 Parameters Selected for Capping System

No analyses have been undertaken for this component since the need to do so has been eliminated in the screening process, as described in Section 3.1.6.

Table SRA 3-6 Geotechnical Design Parameters, Materials

Material	Unit Weight γ (kN/m^3)	Undrained Shear Strength Cu (kPa)	Effective cohesion c' (kPa)	Angle of Shearing Resistance ϕ'(°)	Typical Description
Lower Weald Clay	21.5	-	15	25	Unweathered mudstone and siltstone
Upper Weald Clay	21.5	-	3	22.5	Weathered and partially weathered mudstone and siltstone / clay
Area 2 Historic Non-Haz Waste	11	-	2	25	Historic putrescible non-hazardous waste
Area 2 Original Bund	19	-	1	28	Assumed to be site derived low permeability soils
Area 2 Secondary Bund	19	-	0	35	Assumed to be site derived low permeability soils
Area 2 Lagoon Sediment	16	-	0	18	Normally consolidated silt, sand and clay
Inert Waste	16	-	0.5	28	Selected low permeability inert waste received on site.

Table SRA 3-7 Geotechnical Design Parameters, Interfaces

Strength	Peak		Post Peak	
Interface	c'	ø'	c'	ø’
Basal Geological Barrier: In-situ Weald Clay / Inert Waste	0	24	0	20
Side Slope Geological Barrier: In-situ Weald Clay or Quarry Overburden / Inert Waste	0	24	0	20

3.7 Analyses

3.7.1 Basal Subgrade Analysis

No analyses have been undertaken for this component since the need to do so has been eliminated in the screening process, as described in Section 3.1.1.

3.7.2 Side Slope Subgrade Analysis

3.7.2.1 Area 2

Slopes within Area 2, adjacent to the existing non-hazardous waste mass in Area 1, are present at gradients of 1V:3.5H over a height of 9m, with shallower slopes elsewhere. The slopes are formed by the existing waste mass, restoration soils and perimeter bunds to the landfill. Historic instability within the perimeter bunds, attributed to the effects of rapid drawdown of water within the adjacent lagoon, has been considered as part of previous stability assessments. Analyses will include these features as part of this assessment.

Effective stress parameters have been used in the analyses which consider the effects of dewatering the adjacent lagoon. A slow and rapid drawdown condition have been considered.

Slow drawdown of the water in the adjacent lagoon, allowing pore pressures within the restoration soils to equalise with the reducing water level results in an acceptable factor of safety of 1.76. A rapid drawdown will result in an unacceptable factor of safety of 1.0. Output from the analysis is presented as Figure A-1 and A-2 in Appendix A with a summary of the results included in Table SRA 3-8 below.

Table SRA 3-8 Summary of Side Slope Subgrade Stability Analysis for Area 2

Figure	Method	Dewatering Rate	Factor of Safety Peak	Comments
A-1	Drained Circular	Slow	1.76	Acceptable (FOS >1.3)
A-1	Drained Circular	Rapid	1.00	Unacceptable (FOS <1.3)

3.7.2.2 Area 3

Side slopes in Area 3 will be formed within in-situ Weald Clay, excavated as part of the former quarry works. The steepest slopes are at a gradient of 1V:2.4H up to 24m high.

Effective stress parameters have been used in the analyses which consider the effects of dewatering the quarry void. A slow and rapid drawdown condition have been considered.

Slow drawdown of the water in the void, allowing pore pressures within the restoration soils to equalise with the reducing water level results in an acceptable factor of Safety of 1.89. A rapid drawdown will also result in an acceptable factor of safety of 1.85. Output from the analysis is presented as Figure A-3 and A-4 in Appendix A with a summary of the results included in Table SRA 3-9 below.

Table SRA 3-9 Summary of Side Slope Subgrade Stability Analysis for Area 3

Figure	Method	Dewatering Rate	Factor of Safety Peak	Comments
A-1	Drained Circular	Slow	1.89	Acceptable (FOS >1.3)
A-1	Drained Circular	Rapid	1.85	Acceptable (FOS >1.3)

3.7.3 Basal Geological Barrier System Geological Barrier System Analysis

Analysis of the basal geological barrier stability has been undertaken as part of the waste mass stability analyses, as described in Section 3.1.3.

3.7.4 Side Slope Geological Barrier System Analysis

Analysis of the basal geological barrier stability has been undertaken as part of the waste mass stability analyses, as described in Section 3.1.4.

3.7.5 Waste Mass Analysis

In order to undertake the stability aspect of the waste analysis, three potential modes of failure have been considered, namely:

- **Mode 1** Critical slip surfaces passing solely through the waste
- **Mode 2** Critical slip surfaces passing which passes through the waste and along the basal geological barrier
- **Mode 3** Critical slip surfaces passing which passes solely through the side slope geological barrier and basal geological barriers

All modes of potential failure described above, have been analysed for the case of a temporary waste slope. The analysis has considered the stability of the components in terms of circular and non-circular 2-D limit equilibrium using SLOPE/W.

The future development of the site is split into eight Phases, each representing either one year (Phases 1, 2 and 5-8) or two years (Phases 3 and 4) of filling.

A single cross section of the proposed waste mass has been analysed. This has been identified as the worst case with regards to slope height and gradient for all of the failure modes. This section is located within Phase 1 where waste will be placed to form a 25m wide platform adjacent to the Clockhouse Brickworks at an elevation of 90m AOD. Waste will be placed to create a temporary slope at a gradient of 1V:3H up to 24m high. The waste within Phase 1 will have a basal footprint approx. 17m long.

The existing void will be dewatered prior to waste placement and kept dry throughout the operation of the site. However, it is likely that pore fluid pressures may exist within the body of the waste. The distribution of pore fluid pressure will vary within the waste mass due to a number of factors, including the nature and variability of the waste and the presence of perched water tables.

In order to model the pore fluid pressures in the waste mass a pore water pressure ratio (r_u) of 0.1 will be applied to the waste mass to represent a worst-case condition. This is considered to be a conservative estimate that will adequately represent the variability of the heterogenous waste mass.

3.7.5.1 Mode 1

The results in Table SRA 3-10 below, present a summary of calculated factors of safety for the critical failure that passes solely through the waste in the section considered to represent the worst-case condition. The analysis assumes a circular slip plane and effective stress parameters have been applied to the waste mass. The output plots derived from the analyses are presented in Appendix SRA B.

Table SRA 3-10 Summary of Waste Stability Analysis for Mode 1

Figure	Method	Pore Pressure Ratio (r_u)	Factor of Safety Peak	Comments
B-1	Drained Circular	0	1.57	Acceptable (FOS >1.3)
B-1	Drained Circular	0.1	1.48	Acceptable (FOS >1.3)

Cases B-1 and B-2 demonstrate the reduction in the factor of safety between the anticipated effective stresses for varying pore fluid pressure conditions within the waste mass. The factor of safety exceeds the acceptable level, as determined in Section 3.4.5, for all cases considered.

3.7.5.2 Mode 2

Mode 2 considers a potential failure mechanism that passes through the waste and along the basal geological barrier system. The worst case for this mode of failure is also within Phase 1 where failure within the 24m thick waste has been analysed. Both peak and fully softened shear strength parameters for the interface between the in-situ Weald Clay and the inert waste mass have been considered in the analysis.

A nominal 1m groundwater head in the base of the site has been assumed and the pore fluid pressures in the waste previously assumed for the analysis of Mode 1 have been applied, for the investigation of Mode 2. Effective stresses at the interface between the Weald Clay geological barrier and the waste have been calculated based on this pore pressure condition. Output drawings from the analyses, detailing the slope profiles and the critical slip planes for each scenario are presented in Appendix B.

Table SRA 3-11 Summary of Waste Stability Analysis for Mode 2

Figure	Method	Pore Pressure Ratio (r_u)	Angle of Shearing Resistance (°)	Cohesion c' (kPa)	Factor of Safety	Comments
B-3	Drained Non-circular	0	24	0	1.37	Acceptable (Peak FOS >1.3)
B-4	Drained Non-circular	0.1	24	0	1.32	Acceptable (Peak FOS >1.3)
B-5	Drained Non-circular	0	20	0	1.21	Acceptable (Post Peak FOS >1.00)
B-6	Drained Non-circular	0.1	20	0	1.16	Acceptable (Post Peak FOS >1.00)

Cases B-3 and B-4 assume the interface angle of shearing resistance along the critical interface in the base of the area is at its peak, with an angle of shearing resistance value of 24°. The stability analysis demonstrated that the factor of safety for this scenario is drops from 1.37 to 1.32 as the r_u value rises, which are both considered to be acceptable.

Cases B-5 and B-6 assume that the critical interface on the base of the area is at residual value, with an angle of shearing resistance of 20°. Since residual values have been assumed for the critical interface, the allowable factor of safety has been reduced to 1.0, in line with the recommendations made in the Guidance. The analysis has demonstrated that the calculated factor of safety exceeds the minimum value under both favourable and unfavourable pore pressure conditions.

3.7.5.3 Mode 3

Mode 3 considers a critical slip surface that passes down the critical side slope geological barrier interface and along the critical basal geological barrier interface. The critical condition for a Mode 3 failure occurs where the basal length of the filled waste is at a minimum and this occurs at the end of filling in Phase 1 where the basal width is approx. 17m.

The analysis was undertaken using the peak shear and residual shear strength values for the interface angles of shearing resistance along the base of the cell Both analyses assume a residual condition is present along the side slope interface due to ongoing waste settlement.

The results presented in Table SRA 3-12 below, represent the calculated factors of safety for Mode 3 analyses, assuming a non-circular slip plane and effective stress parameters. Output plots derived from the analyses are presented in Appendix B.

Table SRA 3-12 Summary of Waste Stability Analysis for Mode 3

Figure	Shear Strength of Critical Basal Interface		Basal Length (m)	Factor of Safety	Comments
	Friction Angle (^{0})	Cohesion (kPa)			
B-7	24	0		N/A	No resolvable solution
B-8	24	0	17	1.56	Acceptable (Peak FOS >1.3)
B-9	20	0	17	1.17	Acceptable (Peak FOS >1.0)

No resolvable solution is found for a failure that passes along the full length of the side slope profile. This is considered to be due to the presence of the approx. 5m wide bench across the slope at 80m AOD. However, a failure that passes through the upper portion of the waste mass and along the lower portion of the side slope has been presented and is considered to represent a critical condition in this scenario. An acceptable factor of safety of 1.56 is recorded in Mode 3A conditions, reducing to 1.17 when Mode 3B conditions are considered.

3.7.6 Capping Analysis

No analyses have been undertaken for this component since the need to do so has been eliminated in the screening process, as described in Section 3.1.6.

3.8 Assessment

3.8.1 Basal Subgrade Assessment

Assessment of the basal subgrade is not required since it has been eliminated from consideration by the screening process within Section 3.1.1.

3.8.2 Side Slope Subgrade Assessment

Assessment of the side slope subgrade prior to waste placement and in its existing state, demonstrates slopes in both Area 2 and Area 3 return an acceptable factor of safety of >1.3 where dewatering is carried out at a slow rate that allows pore pressures within the slope to equalise with the water level in the adjacent water body. Dewatering within Area 3 can be carried out at a rapid rate and maintain an acceptable factor of safety.

3.8.3 Basal Geological Barrier Assessment

Assessment of the basal geological barrier is not required since it has been eliminated from consideration by the screening process within Section 3.1.3.

3.8.4 Side Slope Geological Barrier Assessment

Assessment of the side slope geological barrier is not required since it has been eliminated from consideration by the screening process within Section 3.1.4.

3.8.5 Waste Mass Stability

The assessment considers the worst-case scenario which is a slope from the base of the void to surrounding ground level. Modelling considers a 24.0m high waste slope at a gradient of 1V:3H.

Stability analysis considered three potential modes of failure:

- Mode 1 - Critical Slip Surfaces passing solely through the waste
- Mode 2 - Critical Slip Surfaces passing through the waste and the basal interface.
- Mode 3 - Critical Slip Surfaces passing down through the side slope geological barrier and along the basal interface.

Where appropriate, each assessment considers a worst-case scenario with elevated pore pressure within the waste mass. Additionally, Mode 2 and Mode 3 considers both peak and residual (softened) strength parameters along the basal interface and geological barrier.

The stability assessment demonstrated that temporary inert waste slopes at a gradient of 1V:3H up to 24.0m high return an adequate factor of safety in all modelled conditions. As shown in Section 2.7.5 the factor of safety is acceptable under both short (peak) and long-term (post peak / residual) conditions.

1.1.1 Capping Assessment

Assessment of this component is not required as it was eliminated from consideration by the screening process (Section 2.1.6).

4.0 Monitoring

Based upon the foregoing Stability Risk Assessment, a simple risk-based monitoring scheme is considered appropriate for the future development of the site. This should be undertaken as part of normal operations in order to validate assumptions made in the SRA and identify any changes that may require further analysis or assessment.

The following sections outline explicit monitoring requirements for each element of the development, where they are considered necessary.

4.1 The Risk Based Monitoring Scheme

4.2 Basal Subgrade Monitoring

Monitoring during construction will comprise construction quality assurance to ensure compliance with the construction specification.

No additional monitoring is considered necessary.

4.3 Side Slope Subgrade Monitoring

Monitoring during construction will comprise construction quality assurance to ensure compliance with the construction specification.

In addition, it is recommended that groundwater elevations and discharge rates are monitored during the dewatering of Area 2.

4.4 Basal Geological Barrier System Geological Barrier System Monitoring

Monitoring during construction will comprise construction quality assurance to ensure compliance with the construction specification.

No additional monitoring is considered necessary.

4.5 Side Slope Geological Barrier System Monitoring

Monitoring during construction will comprise construction quality assurance to ensure compliance with the construction specification.

No additional monitoring is considered necessary.

4.6 Waste Mass Monitoring

Operation monitoring should comprise topographic monitoring of temporary and permanent waste slopes to ensure compliance with design geometries. Groundwater elevation should also be monitored to identify any changes to the pore pressure regime within the waste mass.

4.7 Capping Monitoring

No additional monitoring is considered necessary.

Visual inspection of restored slopes should be carried out throughout the operation and aftercare period of the site. Any areas of surface sloughing or gullying should be identified and appropriate remedial works undertaken.

Appendix A Stability Analaysis Results, Side Slope Subgrade

Clockhouse Quarry Restoration Environmental Permit Application

Stability Risk Assessment

SUEZ Recycling and Recovery UK Limited

SLR Project No.: 402.065294.00001

15 December 2025

Figure A-1: Side Slope Subgrade Analysis Area 2, Slow Drawdown

Title: Capel Eastern Flank 2021
Name: Dewatered Lagoon Conditions Long Term
Factor of Safety: 1.76

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Surface
	Original Bund	Mohr-Coulomb	19	1	28	0	
	Restoration Soil	Mohr-Coulomb	19	1	28	0	1
	Secondary Bund	Mohr-Coulomb	19	0	35	0	1
	Slip Surface	Mohr-Coulomb	19	1	14	0	
	Soft Lagoon Material	Mohr-Coulomb	18	0	18	0	1
	Waste	Mohr-Coulomb	11	5	25	0	

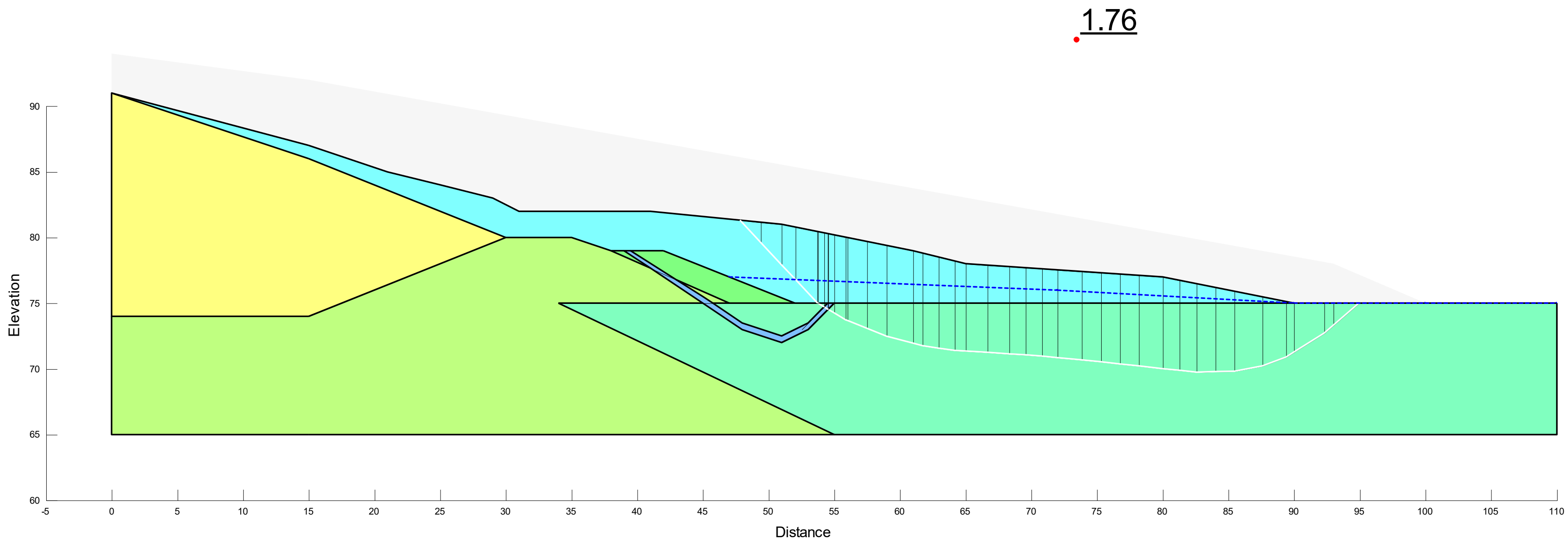


Figure A-2: Side Slope Subgrade Analysis Area 2, Rapid Drawdown

Title: Capel Eastern Flank 2021
Name: Dewatered Lagoon Rapid Drawdown
Factor of Safety: 1.00

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Surface
	Original Bund	Mohr-Coulomb	19	1	28	0	
	Restoration Soil	Mohr-Coulomb	19	1	28	0	1
	Secondary Bund	Mohr-Coulomb	19	0	35	0	1
	Slip Surface	Mohr-Coulomb	19	1	14	0	
	Soft Lagoon Material	Mohr-Coulomb	18	0	18	0	1
	Waste	Mohr-Coulomb	11	5	25	0	

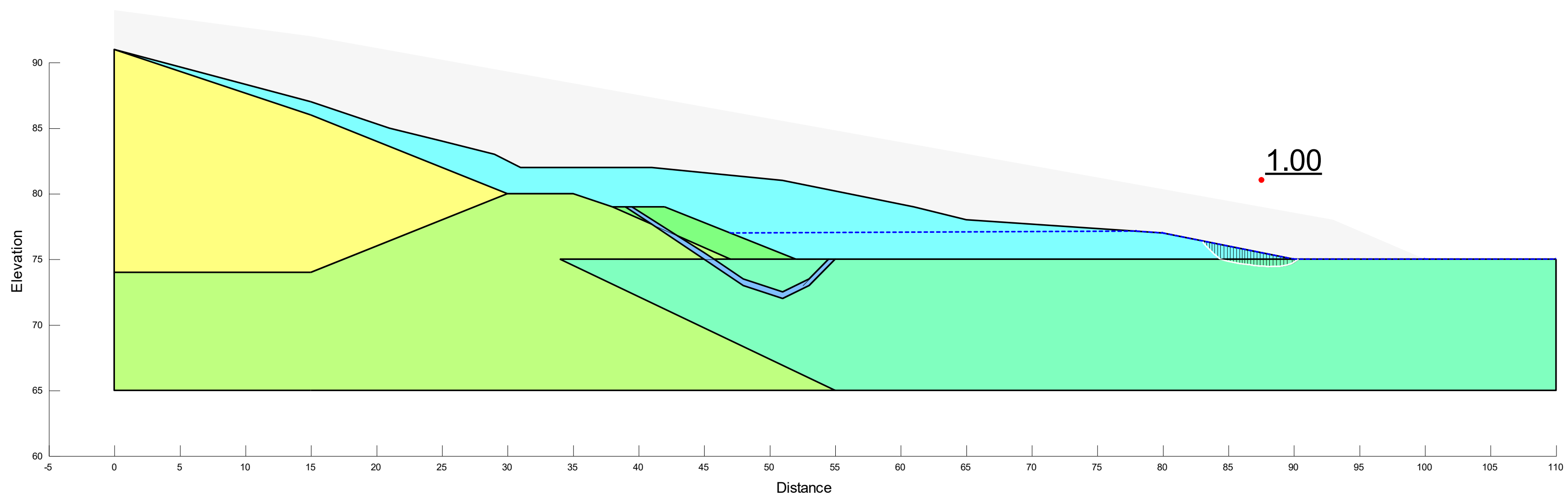


Figure A-3: Side Slope Subgrade Analysis Area 3, Slow Drawdown

Title: Capel Area 3
Name: Area 3 SSG Dewatered quarry slow drawdown
Factor of Safety: 1.82

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Surface
	Lower Weald Clay Alternative	Mohr-Coulomb	21.5	15	25	0	1
	Upper Weald Clay Final	Mohr-Coulomb	21.5	3	22.5	0	1

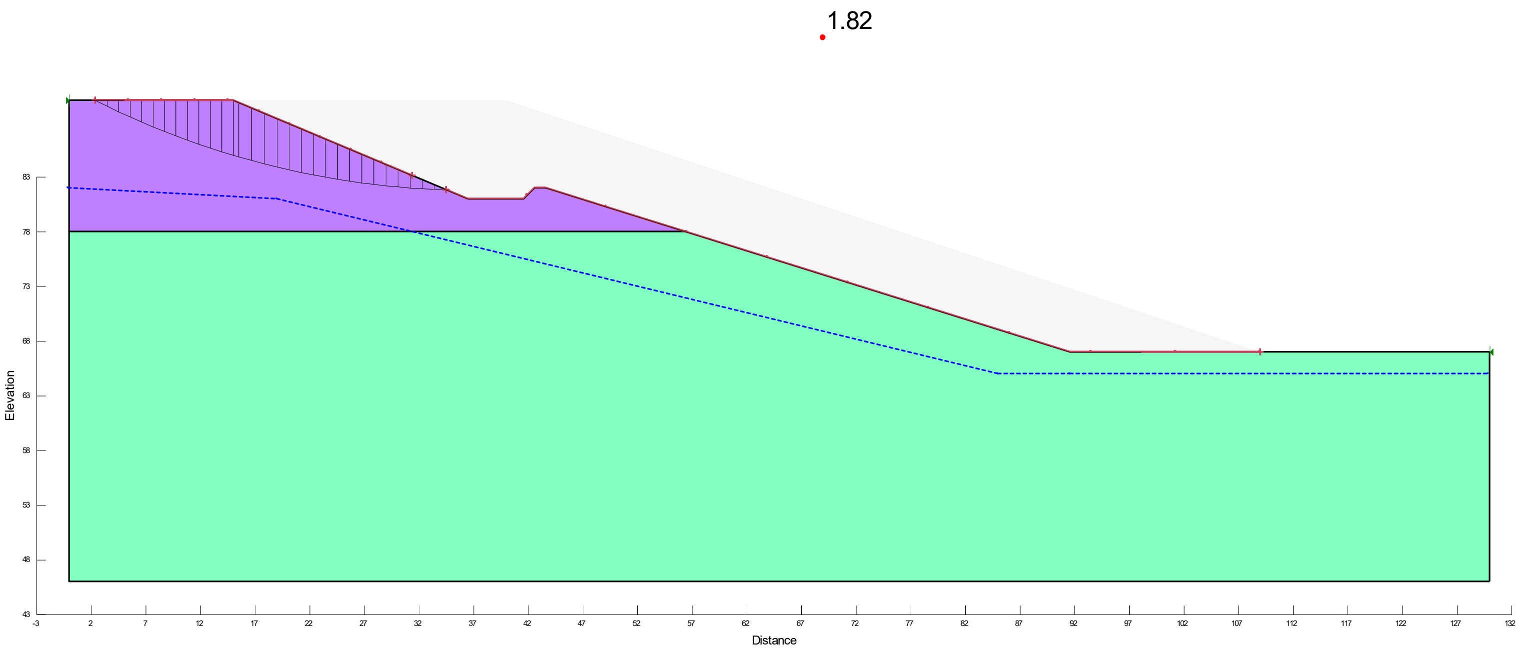
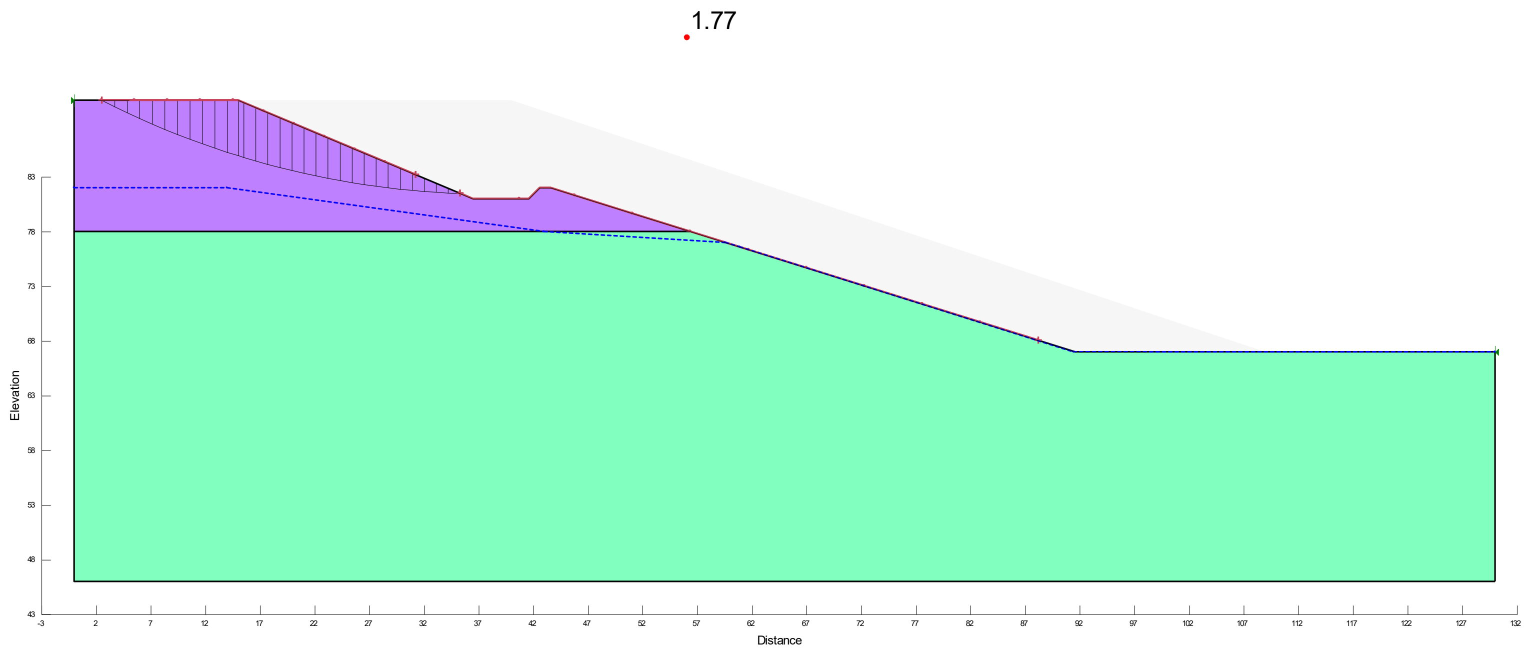


Figure A-4: Side Slope Subgrade Analysis Area 3, Rapid Drawdown

Title: Capel Area 3
Name: Area 3 SSG Dewatered quarry rapid drawdown
Factor of Safety: 1.77

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Surface
	Lower Weald Clay Alternative	Mohr-Coulomb	21.5	15	25	0	1
	Upper Weald Clay Final	Mohr-Coulomb	21.5	3	22.5	0	1



Appendix B Stability Analysis Results, Waste Mass

Clockhouse Quarry Restoration Environmental Permit Application

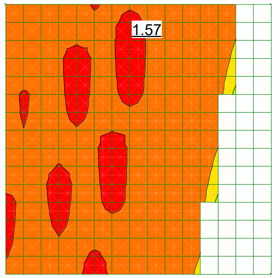
Stability Risk Assessment

SUEZ Recycling and Recovery UK Limited

SLR Project No.: 402.065294.00001

15 December 2025

Figure B-1: Waste Stability Analysis Mode 1A



Title: Capel Area 3
Name: Area 3 Waste Mass 1A
Factor of Safety: 1.57

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Surface
	Basal Interface Peak	Mohr-Coulomb	18	0	24	0	2
	Imported Restoration Material	Mohr-Coulomb	16	0.5	28	0	2
	Lower Weald Clay Alternative	Mohr-Coulomb	21.5	15	25	0	1
	Side Slope Interface Peak	Mohr-Coulomb	18	0	24	0	2
	Upper Weald Clay Final	Mohr-Coulomb	21.5	3	22.5	0	1

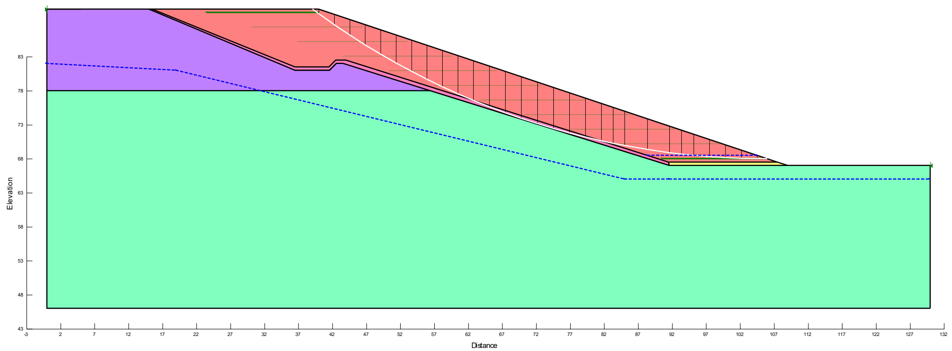
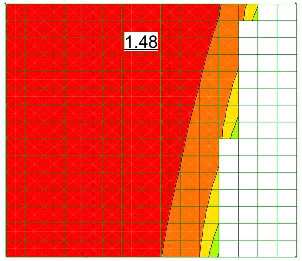


Figure B-2: Waste Stability Analysis Mode 1B



Color	Name	Slope Stability Material Model	Unit Weight (kN/m^3)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Surface	Include Ru	Ru	Exclude if unsaturated
	Basal Interface Peak	Mohr-Coulomb	18	0	24	0	2	No		
	Imported Restoration Material	Mohr-Coulomb	16	0.5	28	0	2	Yes	0.1	Yes
	Lower Weald Clay Alternative	Mohr-Coulomb	21.5	15	25	0	1	No		
	Side Slope Interface Peak	Mohr-Coulomb	18	0	24	0	2	No		
	Upper Weald Clay Final	Mohr-Coulomb	21.5	3	22.5	0	1	No		

Title: Capel Area 3
Name: Area 3 Waste Mass 1B
Factor of Safety: 1.48

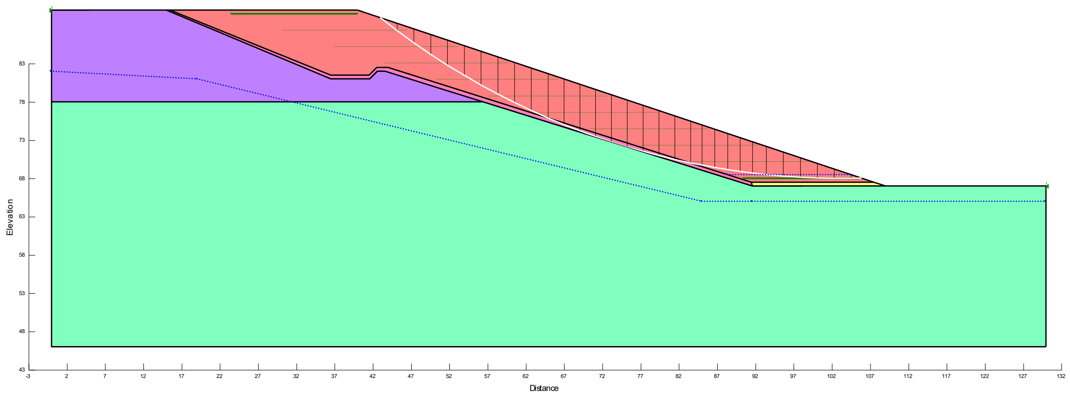


Figure B-3: Waste Stability Analysis Mode 2A

Title: Capel Area 3
Name: Area 3 Waste Mass 2A
Factor of Safety: 1.37

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Surface
	Basal Interface Peak	Mohr-Coulomb	18	0	24	0	2
	Imported Restoration Material	Mohr-Coulomb	16	0.5	28	0	2
	Lower Weald Clay Alternative	Mohr-Coulomb	21.5	15	25	0	1
	Side Slope Interface Peak	Mohr-Coulomb	18	0	24	0	2
	Upper Weald Clay Final	Mohr-Coulomb	21.5	3	22.5	0	1

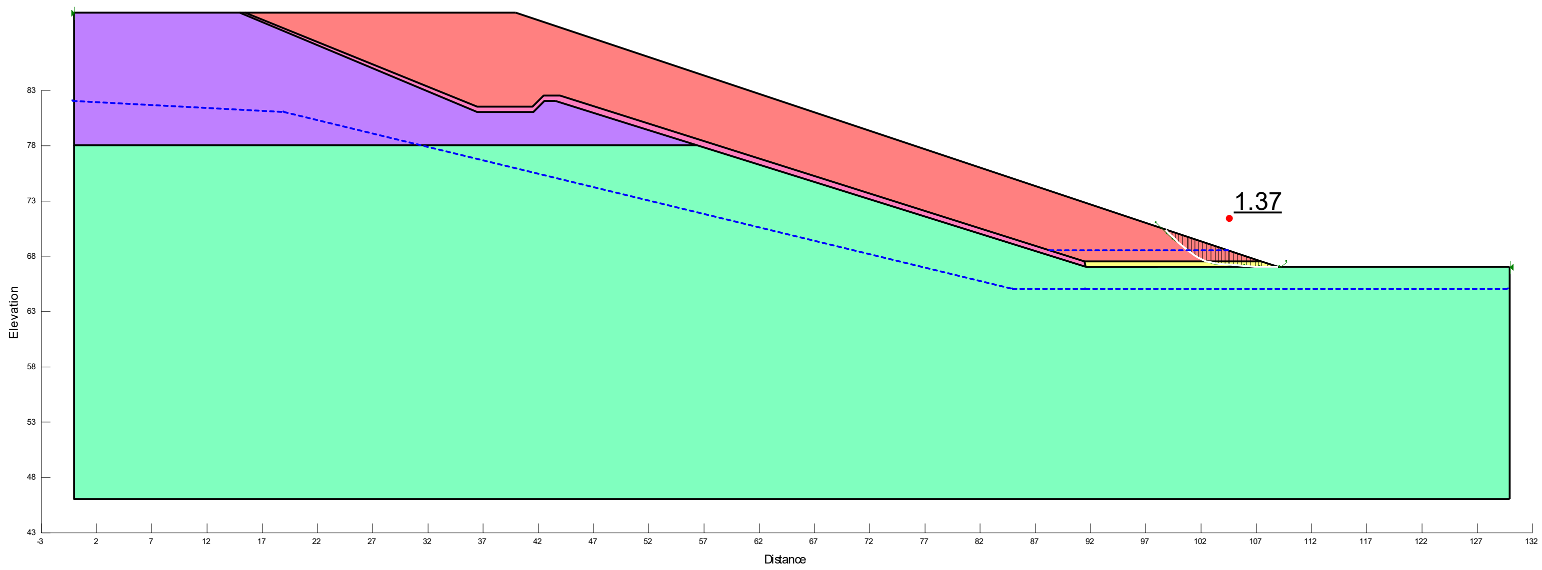


Figure B-4: Waste Stability Analysis Mode 2B

Title: Capel Area 3
Name: Area 3 Waste Mass 2B
Factor of Safety: 1.32

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Surface	Include Ru	Ru	Exclude if unsaturated
	Basal Interface Peak	Mohr-Coulomb	18	0	24	0	2	No		
	Imported Restoration Material	Mohr-Coulomb	16	0.5	28	0	2	Yes	0.1	Yes
	Lower Weald Clay Alternative	Mohr-Coulomb	21.5	15	25	0	1	No		
	Side Slope Interface Peak	Mohr-Coulomb	18	0	24	0	2	No		
	Upper Weald Clay Final	Mohr-Coulomb	21.5	3	22.5	0	1	No		

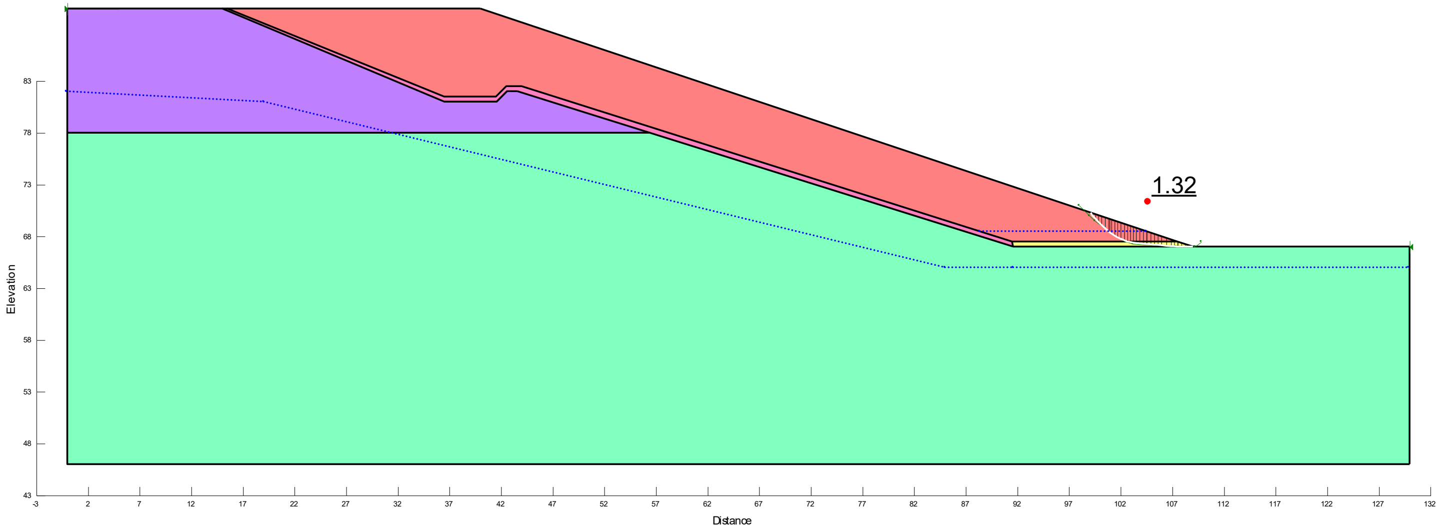


Figure B-5: Waste Stability Analysis Mode 2C

Title: Capel Area 3
Name: Area 3 Waste Mass 2C
Factor of Safety: 1.21

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Surface
	Basal Interface Residual	Mohr-Coulomb	18	0	20	0	2
	Imported Restoration Material	Mohr-Coulomb	16	0.5	28	0	2
	Lower Weald Clay Alternative	Mohr-Coulomb	21.5	15	25	0	1
	Side Slope Interface Peak	Mohr-Coulomb	18	0	24	0	2
	Upper Weald Clay Final	Mohr-Coulomb	21.5	3	22.5	0	1

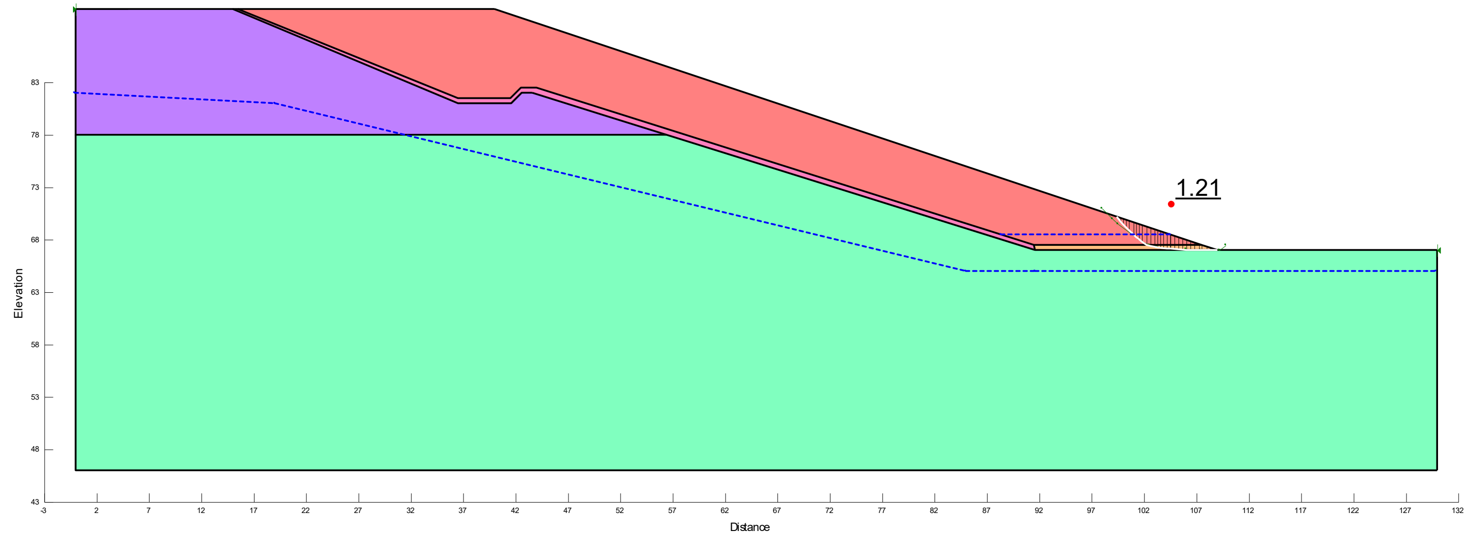


Figure B-6: Waste Stability Analysis Mode 2D

Title: Capel Area 3
Name: Area 3 Waste Mass 2D
Factor of Safety: 1.16

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Surface	Include Ru	Ru	Exclude if unsaturated
	Basal Interface Residual	Mohr-Coulomb	18	0	20	0	2	No		
	Imported Restoration Material	Mohr-Coulomb	16	0.5	28	0	2	Yes	0.1	Yes
	Lower Weald Clay Alternative	Mohr-Coulomb	21.5	15	25	0	1	No		
	Side Slope Interface Peak	Mohr-Coulomb	18	0	24	0	2	No		
	Upper Weald Clay Final	Mohr-Coulomb	21.5	3	22.5	0	1	No		

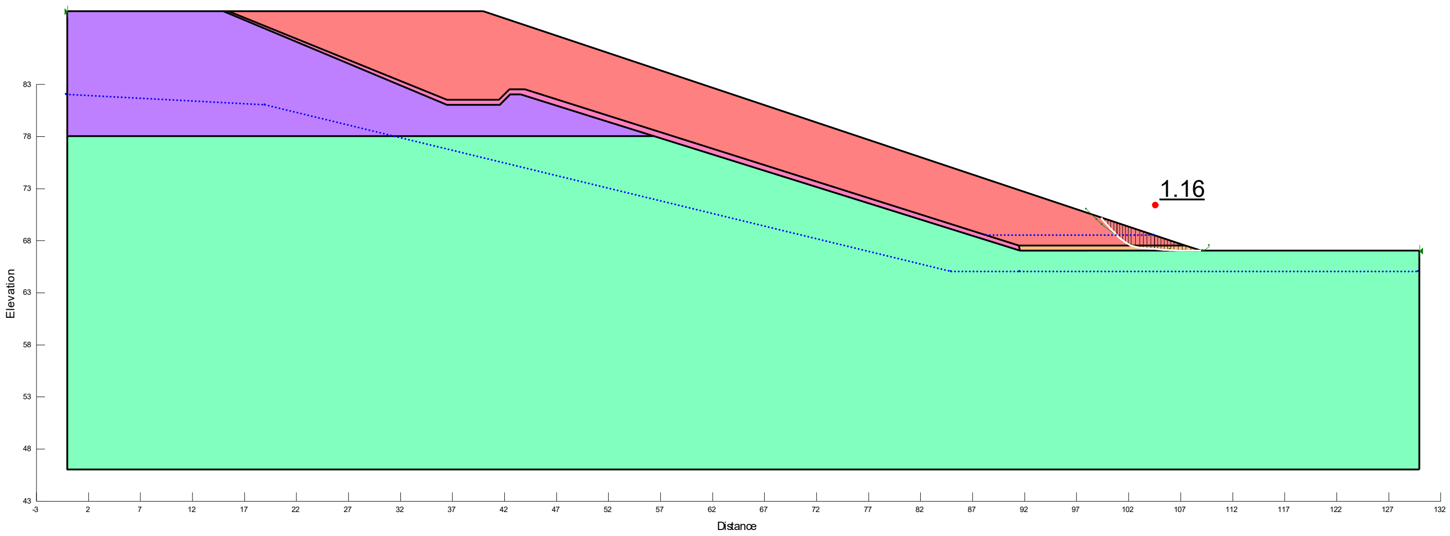


Figure B-7: Waste Stability Analysis Mode 3A No Resolution

Title: Capel Area 3
Name: Area 3 Waste Mass 3A
Factor of Safety: E994

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Include Ru	Piezometric Surface
	Basal Interface Peak	Mohr-Coulomb	18	0	24	0	No	
	Imported Restoration Material	Mohr-Coulomb	16	0.5	28	0	No	
	Lower Weald Clay Alternative	Mohr-Coulomb	21.5	15	25	0	No	1
	Side Slope Interface Residual	Mohr-Coulomb	18	0	20	0	No	
	Upper Weald Clay Final	Mohr-Coulomb	21.5	3	22.5	0	No	1

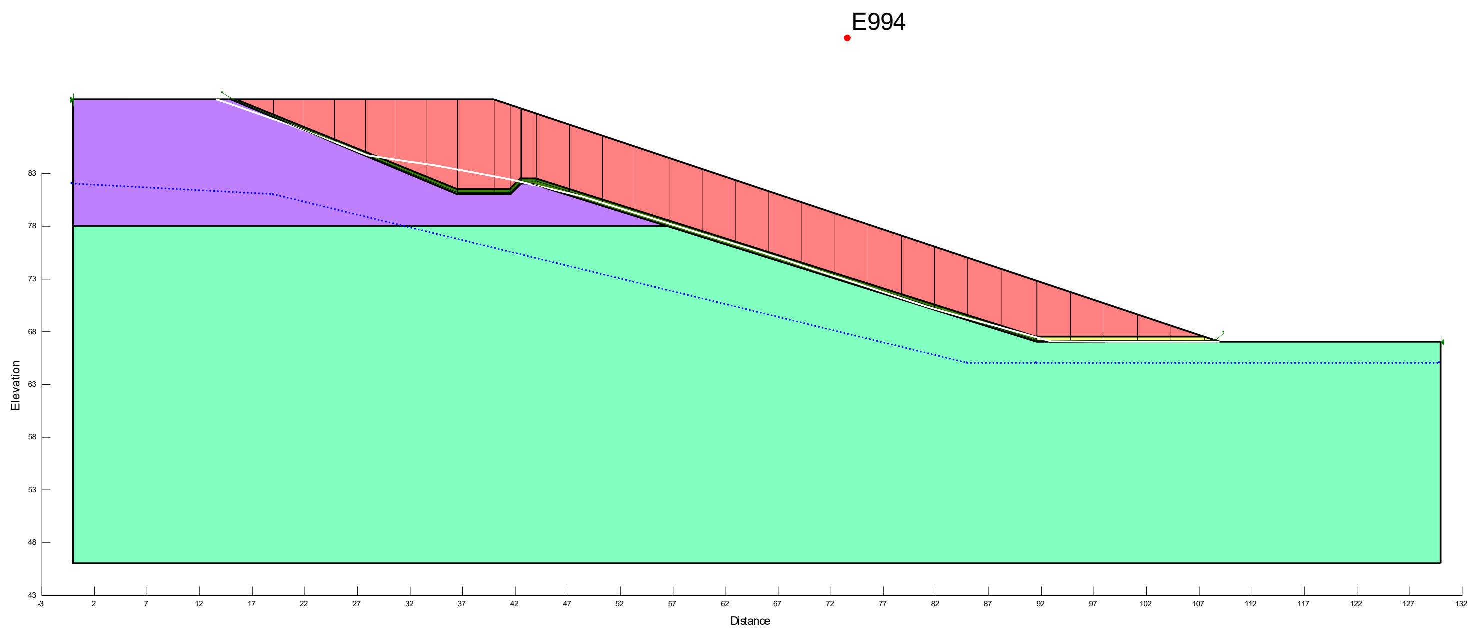


Figure B-8: Waste Stability Analysis Mode 3A Alternative Result

Title: Capel Area 3
Name: Area 3 Waste Mass 3A
Factor of Safety: 1.56

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Include Ru	Piezometric Surface
	Basal Interface Peak	Mohr-Coulomb	18	0	24	0	No	
	Imported Restoration Material	Mohr-Coulomb	16	0.5	28	0	No	
	Lower Weald Clay Alternative	Mohr-Coulomb	21.5	15	25	0	No	1
	Side Slope Interface Residual	Mohr-Coulomb	18	0	20	0	No	
	Upper Weald Clay Final	Mohr-Coulomb	21.5	3	22.5	0	No	1

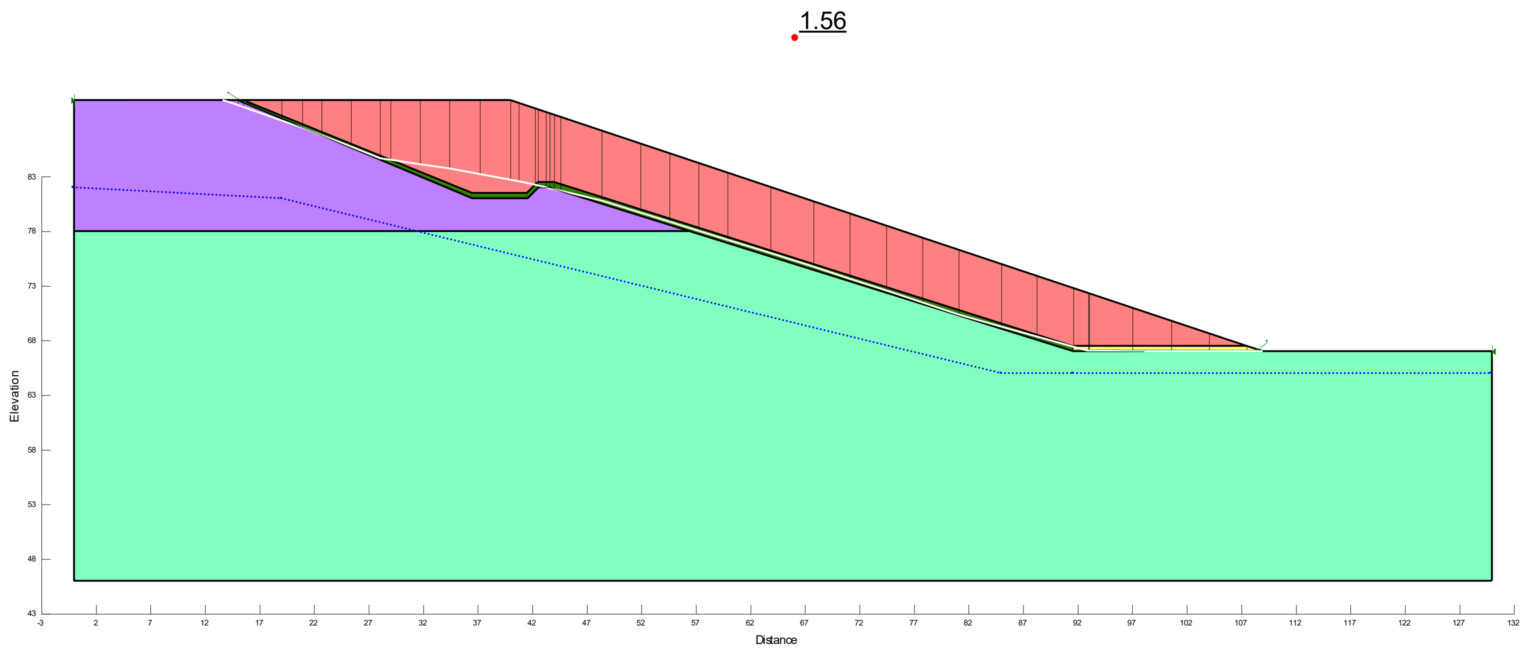
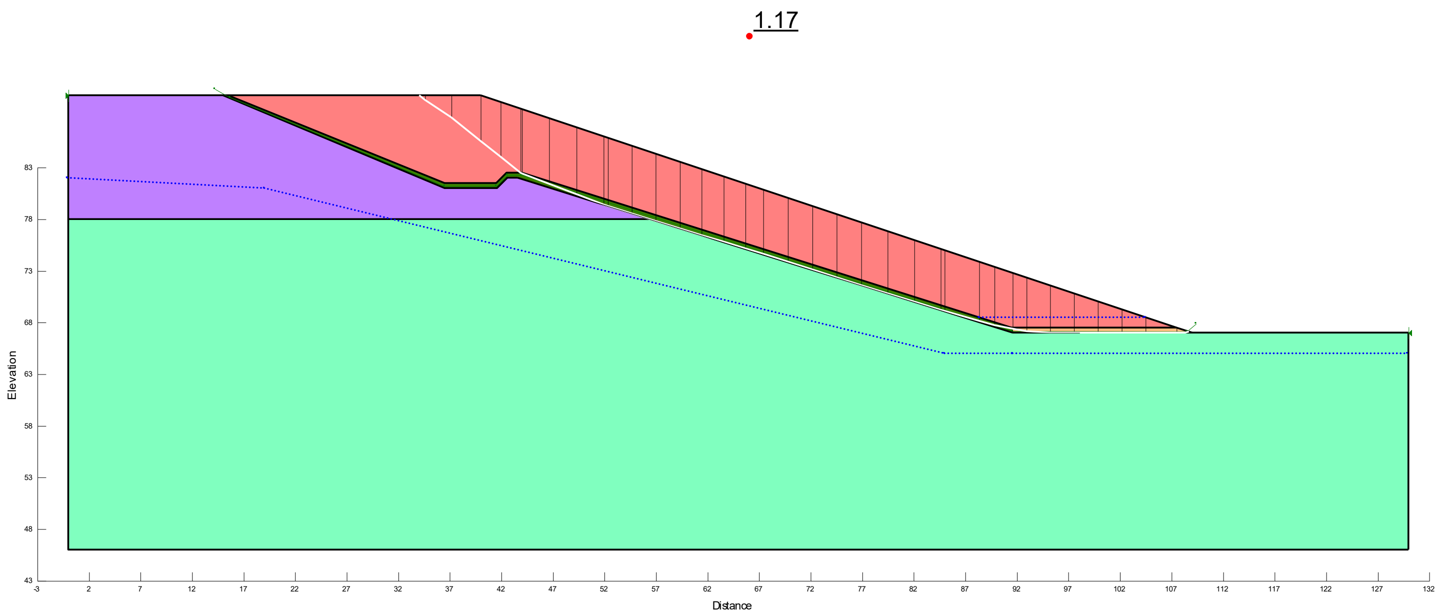


Figure B-9: Waste Stability Analysis Mode 3B

Title: Capel Area 3
Name: Area 3 Waste Mass 3B
Factor of Safety: 1.17

Color	Name	Slope Stability Material Model	Unit Weight (kN/m³)	Effective Cohesion (kPa)	Effective Friction Angle (°)	Phi-B (°)	Piezometric Surface	Include Ru	Ru	Exclude if unsaturated
	Basal Interface Residual	Mohr-Coulomb	18	0	20	0	2	No		
	Imported Restoration Material	Mohr-Coulomb	16	0.5	28	0	2	Yes	0.1	Yes
	Lower Weald Clay Alternative	Mohr-Coulomb	21.5	15	25	0	1	No		
	Side Slope Interface Residual	Mohr-Coulomb	18	0	20	0	2	No		
	Upper Weald Clay Final	Mohr-Coulomb	21.5	3	22.5	0	1	No		



Making Sustainability Happen