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Geological Report and Geotechnical Review
of Proposed Minerals Development at
White Cross Farm, Nr WALLINGFORD,
Oxfordshire

August 2021





Quality Assurance Review

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1. INTRODUCTION

1.1 Background

- 1.1.1 Greenfield Associates have been commissioned by London Rock Supplies Ltd to produce a geological and geotechnical assessment of land at White Cross Farm, near Wallingford, Oxfordshire. This document is intended to supplement the planning application for the proposed development.

1.2 Proposed Scheme

- 1.2.1 The proposed development comprises the extraction of River Terrace Sand & Gravel on land at White Cross Farm, near Wallingford, in phased working scheme with the sand and gravel processed and sold into the local construction market. Following extraction, the void will be backfilled with imported inert materials that will allow the site to be restored back to original ground levels.
- 1.2.2 It is proposed that the in-situ deposits of sand and gravel will be excavated and processed with the near surface clays and soils used to restore the site as part of a phased working and restoration scheme. It is also proposed that the overburden clays will be used as a basal attenuation liner as required by the EA prior to the importation of inert material.

2. SITE DESCRIPTION

2.1 Location

- 2.1.1 The land at White Cross Farm covers an area of some 19 hectares and is located approximately 1km south of the Village centre of Wallingford, 18km to the north of Reading and some 20km south of Oxford. The site is centred at Grid Reference [SU 605 877], as shown in Figure 1.
- 2.1.2 The site is accessed via a farm access off the A329 that forms the western site boundary. The A329 links with the A4130 at the north western corner of the site. The A4130 is the Wallingford bypass and also forms the northern site boundary.

2.2 Topography

- 2.2.1 The site comprises generally flat, low lying, agricultural land used for a mix of arable farming and grazing for livestock that covers an area of some 19 hectares.
- 2.2.2 The site is formed of three areas, a northern area used for livestock grazing and two southern areas. The western of the two southern areas is currently used for arable farming and the eastern is fallow. A drainage ditch runs from north to south down the centre of the site,

splitting the lower lying eastern part of the site from a slightly raised western half of the site. Site levels range from some 44m AOD to 46m AOD in the west of the site and approximately 43.5m AOD in the east of the site (see Figure 2).

- 2.2.3 The River Thames lies adjacent to the eastern site boundary, flowing from north to south. The river bank levels lie at approximately 43.5m AOD, with river water levels at approximately 42.4m AOD. The highest levels on the site are in the north western corner, where the land rises towards the roundabout. The A4130 has been constructed on an embankment that is raised by up to some 5m above the site levels.

2.3 Geology

- 2.3.1 The BGS Geology of Britain viewer indicates that the bedrock of the site comprises the West Melbury Marly Chalk Formation that forms part of the Grey Chalk Subgroup of Upper Cretaceous age. The West Melbury Marly Chalk Formation is described by the BGS as *“Buff, grey and off-white, soft, marly chalk and hard grey limestone arranged in couplets.”* That is generally between 15m and 25m thick. The Glauconitic Marl Member of the West Melbury Marly Chalk Formation is mapped across the majority of the site (see Figure 3). The Glauconitic marl member is generally described by the BGS as *“Calcareous glauconitic sand and glauconitic sandy silty chalk with phosphatic nodules.”* and is general 2m to 4m thick.
- 2.3.2 There is a mineral assessment report published by the British Geological Survey (MAR 64 – Wallingford and Goring) and BGS map sheet 254 for Henley-on-Thames that indicate that the dip of the strata is gently to the south east.
- 2.3.3 Extensive drift deposits are also mapped in this area, comprising continuous deposits of River Terrace Deposits and alluvium in the river valleys. The terrace deposits comprise the Northmoor Sand and Gravel Member that is generally described as *“Sandy limestone gravel”* by the BGS. The general stratigraphy of the area is shown in Table 1.

Table 1 General Stratigraphy of the Wallingford and Oxfordshire area

Drift

Recent and Pleistocene

Alluvium

River Terrace Deposits - Northmoor Sand and Gravel Member

Solid

Upper Cretaceous

Grey Chalk Subgroup

The Glauconitic Marl Member

West Melbury Marly Chalk Formation

Lower Cretaceous

Upper Greensand Group

- 2.3.4 The Mineral Assessment Report published by the British Geological Survey confirms that the river terrace deposits are First Terrace Deposits that generally occur as a narrow outcrop flanking the River Thames, locally overlain by alluvium. The River Terrace Sand and Gravel mapped within the Wallingford area usually comprises mainly fine to coarse gravels with medium and coarse sands present. These deposits have a maximum proven thickness of 9m, but where proved generally range in thickness from 1.6m to 8m in thickness.
- 2.3.5 The gravel fraction is usually described as flint, quartz and limestone with minor amounts of chalk and ironstone in a matrix of quartzitic fine to medium sand which has a pinky brown to yellowish brown colour. Alluvium is mapped across the eastern half of the site overlying the sands and gravels comprising soft dark grey shelly clay and seams of peat.
- 2.3.6 A series of geological site investigations have been carried out on the site that proved the presence of a sand and gravel deposit with a thickness ranging from 0.50m to 5.20m. This deposit comprises brown to orange-brown quartzitic sand and gravel, with sub-angular flint and minor amounts of sandstone and limestone gravels and occasional angular cobbles. All of the boreholes drilled were terminated in the stiff grey/cream clays and soft marls of the Lower Chalk formation, of Cretaceous age.
- 2.3.7 The overburden materials comprise topsoil, subsoil and recent alluvium, ranging in thickness from 0.6m to up to 3.2m, generally thickening to the east. These materials consist of clayey soil with occasional flint and quartzite pebbles with occasional beds of peat. Within the area investigated an extraction area of 15.5ha has been identified. The potential extraction area has been designed using suitable margins to the boundaries of the site, as shown in the construction design plans in Appendix D.

2.5 Footpaths & Rights of Way

- 2.5.1 There is a public footpath (The Thames Way) that runs along the crest of the embankment that forms the western edge of the River Thames. It is proposed that this footpath will not be impacted in any way as part of the development.

2.6 Services & Utilities

- 2.6.1 There are no known overhead or buried cables within the site. There are no gas mains or water mains which lie within or border the site. Information supplied by the landowner suggests that a BT Openreach cable is present along the A329 Reading Road. This will not be affected by the proposed development.

3. SURFACE WATER AND GROUNDWATER

3.1 Surface Water

- 3.1.1 The River Thames lies adjacent to the eastern site boundary, flowing from north to south. The riverbank levels lie at approximately 43.5m AOD, with river water levels at approximately 42.4m AOD. The highest levels on the site are in the north-western corner, where the land rises towards the roundabout. The A4130 has been constructed on an embankment that is raised by up to some 5m above the site levels.
- 3.1.2 Two drains are present onsite. One runs from north to south and one is present flowing from a culvert under the A4130, flowing towards the south-east across the site into the Thames.
- 3.1.3 The flood map for the site published by the Environment Agency indicates that the majority of the site lies within Flood Zones 2 and 3. The western part of the site does not lie within any flood zone and is where all of the proposed infrastructure, processing plant and marina welfare buildings will be located.
- 3.1.4 The proposed minerals development includes a soakaway pond which will be restored into a reedbed has been included as part of the proposed site design in order to manage surface water runoff from the site and may provide additional floodplain water storage. It is proposed that the ditches and watercourses through the site will continue to be linked to the river at the northern end of the site.

3.2 Groundwater

- 3.2.1 A total of 12 borehole monitoring points have been installed on site. Water monitoring standpipes have been installed in 4 boreholes WSA 14/1, WSA 14/2, WSA 14/3 and WSA 14/4. Water and gas monitoring standpipes have been installed in 8 boreholes (GM 16/1 – GM 16/8).
- 3.2.2 Continued monitoring of these boreholes indicates that the groundwater on the site generally lies at around ~43.5mAOD (see **Figure 4**).

4. MINERAL QUALITY AND MINERAL RESOURCES

4.1 Site Investigation

4.1.1 Three phases of drilling have been carried out at the site, the first phase was carried out during 2014 with additional boreholes drilled during 2015 and 2016. A summary of the drilling carried out and mineral thickness proved is given in Table 2 below. The borehole locations are presented on Figure 2 and the borehole logs included as Appendix A.

Table 2 Summary of borehole results

Borehole ID	Easting	Northing	Level (mAOD)	Overburden Thickness(m)	Base of Overburden Level (mAOD)	Mineral Thickness (m)	Base of Mineral Level (mAOD)
WSA 14/1	460539	187981	44.49	1.9	42.6	3.0	39.6
WSA 14/2	460400	187827	45.74	0.9	44.8	4.4	40.4
WSA 14/3	460552	187637	43.63	0.9	42.7	3.3	39.4
WSA 14/4	460629	187488	43.60	3.2	40.4	0.5	39.9
WSA 14/5	460554	187803	43.63	0.8	42.8	2.9	39.9
WSA 14/6	460659	187778	43.47	2.1	41.4	1.9	39.5
WSA 14/7	460418	187698	45.12	0.8	44.3	3.4	40.9
WSA 14/8	460482	187897	45.23	0.8	44.4	3.8	40.6
WSA 14/9	460635	187637	43.45	2.5	41.0	1.2	39.8
WSA 14/10	460554	187548	43.37	0.9	42.5	2.1	40.4
WCF-15/1	460 420	187 521	44.75	0.8	44.0	2.0	42.0
WCF-15/2	460 513	187 586	44.29	1.0	43.3	1.2	42.1
WCF-15/3	460 398	187 627	44.97	1.0	44.0	1.8	42.2
WCF-15/4	460 486	187 688	44.73	0.7	44.0	2.6	41.4
WCF-15/5	460 495	187 845	44.83	0.7	44.1	3.5	40.6
WCF-15/6	460 433	187 916	45.72	1.0	44.7	3.9	40.8
WCF-15/7	460 581	187 701	43.49	0.9	42.6	2.1	40.5
WCF-15/8	460 603	187 595	43.27	1.7	41.6	1.2	40.4
WCF 16/1	460627	187949	43.65	1.6	42.0	2.1	39.9
WCF 16/2	460701	187961	43.59	2.3	41.3	1.3	40.0
WCF 16/3	460603	187875	43.57	1.4	42.2	2.3	39.9
WCF 16/4	460680	187873	43.52	2.3	41.2	1.3	39.9
GM 16/1	460670	188032	43.70	2.0	41.7	2.3	39.4
GM 16/2	460381	187909	46.49	1.7	44.8	4.6	40.2
GM 16/3	460353	187766	46.50	1.5	45.0	5.2	39.8
GM 16/4	460344	187623	45.61	1.7	43.9	1.8	42.1
GM 16/5	460344	187485	45.70	1.5	44.2	1.6	42.6
GM 16/6	460411	187445	44.53	0.6	43.9	1.8	42.1
GM 16/7	460538	187493	44.18	1.8	42.4	Barren	Barren
GM 16/8	460733	187975	43.24	2.1	41.1	0.8	40.3

- 4.1.2 The majority of the boreholes drilled on the site have been in order to prove the thickness of overburden and mineral present on the site. The GM16 series of boreholes were drilled primarily for groundwater and gas monitoring purposes for an environmental permit application. Standpipes have also been installed in boreholes WAL14/1, WAL14/2, WAL14/3 and WAL14/4.

4.2 Mineral Quality

- 4.2.1 A significant sand and gravel deposit has been identified as part of the site investigation for the marina development. In order to assess the viability of this deposit a number of laboratory test have been carried out on the material. These tests include particle size distribution (PSD), Ten Percent Fines Value, Aggregate Crushing Value, Particle Density, Water Absorption and Magnesium Sulphate test. The results of the testing are presented in Appendix B and summaries in Tables 3 and 4 below. The results indicate that the material will be suitable for a range of single size sand and gravel products and for use in concrete.

Table 3: Summary of aggregate test results

Test	Result
10% Fines Value	140kN
Aggregate Crushing Value	22%
Water Absorption	1.9%
Particle Density (Saturated)	2.65 Mg/m ³
Particle Density (Dried)	2.60 Mg/m ³
Apparent Density	2.74 Mg/m ³
Magnesium Sulphate Value	6%

Table 4: Particle Size Distribution

Fines (-63um)	Sand (-63um-4mm)	Gravel (+ 4mm)
4%	50%	46%

4.3 Proven Mineral Resources

- 4.3.1 An assessment has been carried out for the site, which includes an appraisal of the overburden and mineral quantity, together with the mineral quality, and mineral distribution across the site.

4.3.2 This assessment indicates that there is an average of 1.4m of overburden present across the site, ranging from 0.6m to 3.2m and an average of 2.4m of mineral present that ranges in thickness from 0.5m to 5.2m. One borehole (GM16/7), located on the southern site boundary did not prove any mineral.

4.3.3 In order to calculate the potential reserves geological models have been created of the base of overburden and the base of mineral. Volumes of overburden and mineral have been calculated and the reserves are presented in Table 5 below.

Table 5: Potential Mineral Reserves

Extraction Area	Soils & Overburden	Volume of in-situ Mineral	Potential Processing Losses	Estimated Saleable Reserves
(ha)	(m³)	(m³)	(%)	tonnes
15.5	180,000	339,600	10	550,152

5. GEOTECHNICAL REVIEW OF PROPOSALS

5.1 Mineral Excavation

- 5.1.1 The geotechnical aspects of the proposals have been divided into two groups based on the materials that are being assessed. The initial extraction phasing requires the assessment of the in-situ materials (sand, gravel and clay) with the restoration phases requiring the consideration of imported inert materials that are to be used as backfill material and is required to be stable in the long term.
- 5.1.2 In order to design the site so it is stable, especially adjacent to the River Thames and other site boundaries, geotechnical testing of the available material has been carried out. Particle size distribution testing on 15 bulk samples that are considered to be representative of the sand and gravel has been carried out. The clay materials have been tested for Moisture Content, 4 point liquid and plastic limit, Permeability and Dry Density/Moisture Content relationship with hand shear vane tests at each compaction point. The results of testing are presented in Appendix B at the rear of this report.
- 5.1.3 The friction angle and unit weight of the sand and gravel have been estimated using the methodology set out in BS8002:2015. This indicates that the friction angle of the material may be approximately 37° as the sand and gravel is has a uniformity coefficient in excess of 2 and is generally sub angular. The guidance also indicates that a unit weight of 20kN/m^3 is likely to be appropriate for the material.
- 5.1.4 The same guidance has been used to estimate the friction angle and unit weight of the clay and peat on site. The friction angle of the clay has been estimated using the plasticity index/friction angle relationship. The plasticity index of the clay samples indicates a conservative friction angle range of 23° to 25° , therefore an average angle of 24° has been adopted. The guidance also indicates that a unit weight of 18kN/m^3 is likely to be appropriate for the material. The undrained cohesion of the clay material is estimated to be 35kPa. Testing was not carried out on the peat, conservative values have been selected based on the field descriptions which generally described the material as soft silty organic rich clay. The parameters selected are a unit weight of 12.5kN/m^3 , an undrained cohesion of 20kPa, drained cohesion of 0kPa and friction angle of 24° . The basal chalk marl has been assigned geotechnical parameters of a unit weight of 20kN/m^3 , friction angle of 26° based on descriptions of material obtained during the drilling investigations.
- 5.1.5 The proposed extraction design indicates that side slopes will be excavated at a gradient of approximately 1v:2h (27°) and it is proposed that the excavation will be dewatered so the

sand and gravel can be excavated more easily and the geological barrier required for the backfill can be compacted in place.

- 5.1.6 Geotechnical analysis of the initial cut slope at 1v:2h has been carried out to determine the stability of the slope during the extraction phase of the work (see Appendix C). Three sets of analysis have been carried out, these are the undrained short term stability, the drained long term stability and an intermediate scenario that is partially drained. In the undrained (short term) scenario the minimum FoS for full face failure is 1.425, which is considered to be acceptable. There is however the potential for shallow, small scale failures within the sand and gravel deposit at the base of the excavation. The exposed sand and gravel face that will need to be monitored and maintained where necessary.
- 5.1.7 In the medium term the minimum FoS is 1.157, this is considered to be acceptable due to the temporary nature of the excavation. The long term drained analysis of the excavation indicates that there may be some instability in the upper part of the face, where the predominantly clay strata are present. The instability is likely to be small scale shallow failures. The minimum FoS for full face failures is marginally in excess of 1.
- 5.1.8 As there will be no delay in the backfilling operations following mineral extraction the slope remains stable in the long term, with the FoS with this gradient is 1.196 during restoration works. It is recommended that the working faces can be developed at 1v:2h.
- 5.1.9 As the extraction progresses the site will need to be dewatered from a sump in the extraction area. It is proposed that the fines could be mixed with the imported inert materials waste or overburden material for liner works in the long term.
- 5.1.10 Lagoon construction will be carried out under the quarries regulations 1999, thus there is a requirement for all of the lagoons and excavation faces to be designed, constructed and maintained to ensure they are stable throughout the life span of the development.
- 5.1.11 During the works there will be two site accesses, one for HGV's into the site and one for HGV's out of the site. The site entrance will utilise the existing farm access on the western site boundary and the site exit will be on to the A4130 Nosworthy Way on the northern site boundary. At the location of the access onto Nosworthy Way the road lies approximately 3m higher than the site levels. It is proposed that the levels will be raised within the site to allow access onto the road. The ramp up to the road will be constructed in accordance with

the specification for highways works using appropriate overburden materials from within the site and capped off with recycled aggregate to form a firm, clean surface.

5.2 Landscaping and Restoration

- 5.2.1 It is not considered that there is not sufficient overburden clay resource available to suitably landscape and restore the site following mineral extraction, thus it is proposed that imported inert material shall be used to raise the level to ensure restoration to original site contours. It is standard practice for the Environment Agency to require inert fill material to be placed within a "lined void" to prevent any possible contaminants leaching from the material.
- 5.2.2 Testing of the available clay on site indicates that it would be suitable for use as a geological barrier. In some cases the clay was found to be wet of the optimum moisture content and would need to be dried to ensure it can be compacted sufficiently. The clay will be placed along the edges of the area to be filled to ensure the imported material is not in contact with any groundwater. The geological barrier will be built up the sides of the compacted imported fill at a gradient of approximately 1v:3.5h to ensure it remains stable in the long term.
- 5.2.3 It is considered that some degree of erosion control will be required in some sensitive/high traffic areas of the site.
- 5.2.4 A stability assessment has been carried out of the excavated site margins that will be constructed in imported fill. The profile stability has been analysed in the short term (undrained) and long term (drained) scenarios. The geotechnical properties adopted for the natural strata are as stated previously and fill material has been assigned properties of a unit weight of 20kN/m³, undrained cohesion of 45kPa, drained cohesion of 0kPa and friction angle of 26°. The clay comprising the "geological barrier" has been assigned properties of unit weight of 21kN/m³, undrained cohesion of 50kPa, a drained cohesion of 0kPa and friction angle of 24°.
- 5.2.5 Stability analysis of the final cut slope indicates that in the short term (prior to backfilling and restoration) the minimum FoS for the slope is 1.748, rising to 2.054 for full face failures. The long term stability for the slope, once the backfilling has been completed confirms no long-term impacts in relation to stability.

6. CONCLUSIONS AND RECOMMENDATIONS

- 6.1 A series of geological site investigations have been carried out on the site that proved the strata on the site comprise clay, peat and sand and gravel overlying chalk bedrock. The soils will be stored during the works and used in the restoration, with the overburden used as a basal “attenuation material” prior to the importation of inert backfill materials.
- 6.2 The sand and gravel deposit has a thickness ranging from 0.50m to 5.20m. A number of aggregate tests have also been carried out that indicate the material will be suitable for a range of single size sand and gravel products and for use in concrete.
- 6.3 Across the proposed extraction area of 15.5ha it is estimated that approximately 550,000 tonnes of sand and gravel will need to be extracted. The overlying clays (180,000 m³) will be used as part of the restoration.
- 6.4 A stability assessment has been carried out on the proposed excavation slopes and the proposed slopes for the backfill operations. The analysis indicates that during the excavation slopes cut at 1v:2h will be stable in the short to medium term. Analysis of the backfill slopes indicates that the slopes will also be stable in both the short and long term with a slope to ensure long-term restoration stability of the site.

FIGURES



Figure 1

Based upon the 2006 Ordnance Survey 1:25,000 map with the permission of The Controller of Her Majesty's Stationary Office Crown Copyright Greenfield Associates, 1 Commercial Rd, Keyworth, Nottingham Licence No. 100020505

Title	Site Location
Project	Geological & Geotechnical Review
Site	White Cross Farm, Wallingford

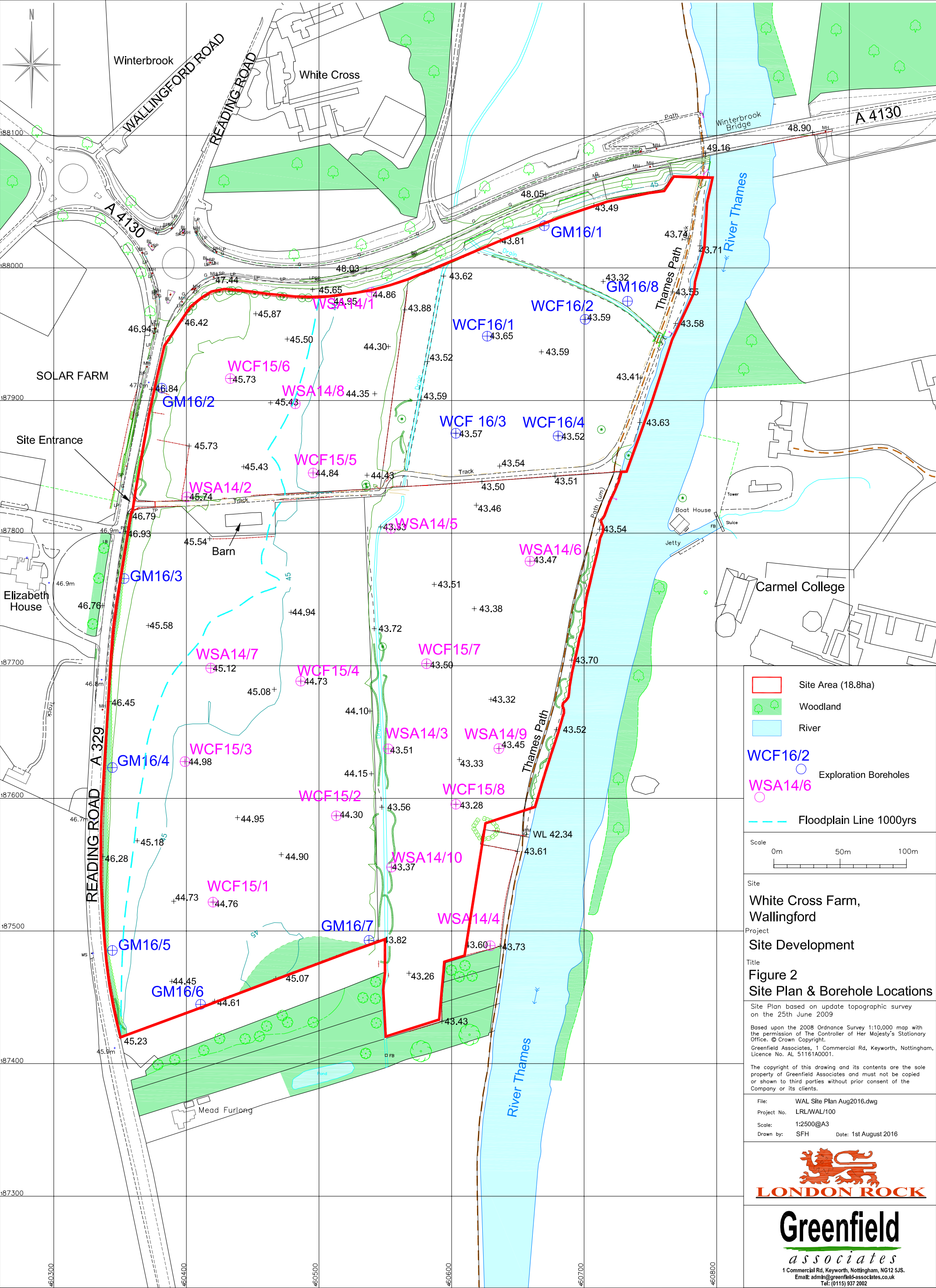
 Application Area

Project No.
LRS/WAL100

Scale
nts



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Site Area (18.8ha)

Woodland

River

WCF16/2

WSA14/6

Exploration Boreholes

Floodplain Line 1000yrs

Scale

0m50m100m

Site

White Cross Farm,
Wallingford

Project

Site Development

Title

Figure 2
Site Plan & Borehole Locations

Site Plan based on update topographic survey on the 25th June 2009

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File:

WAL Site Plan Aug2016.dwg

Project No.

LRL/WAL/100

Scale:


1:2500@A3

Drawn by:

SFH

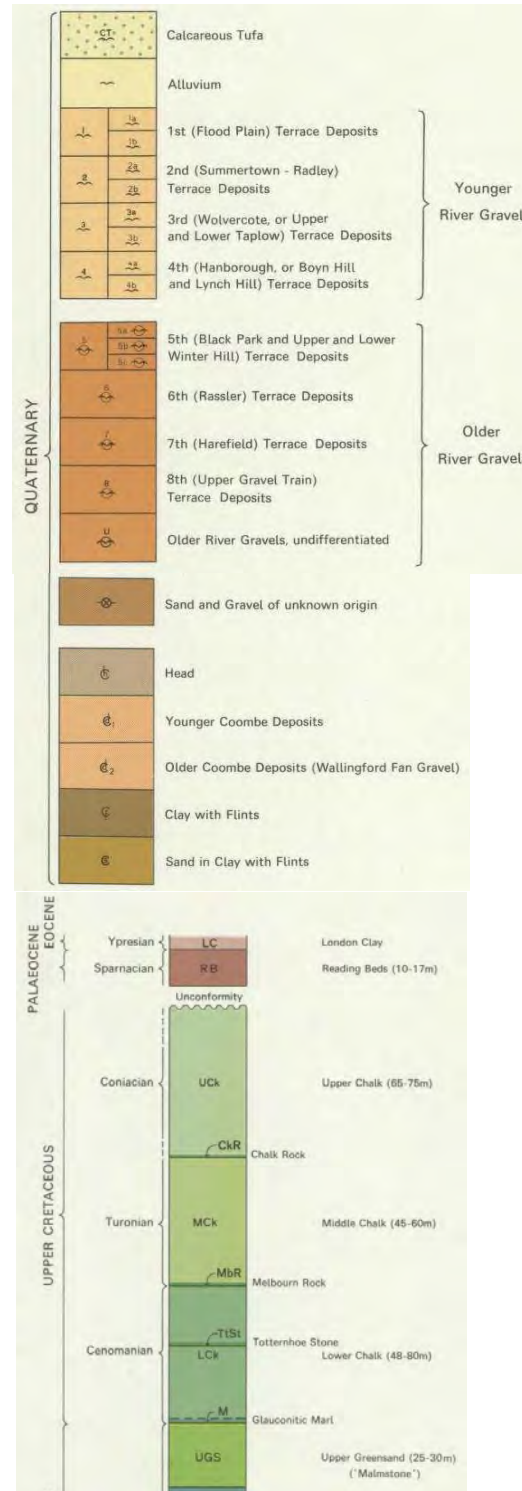
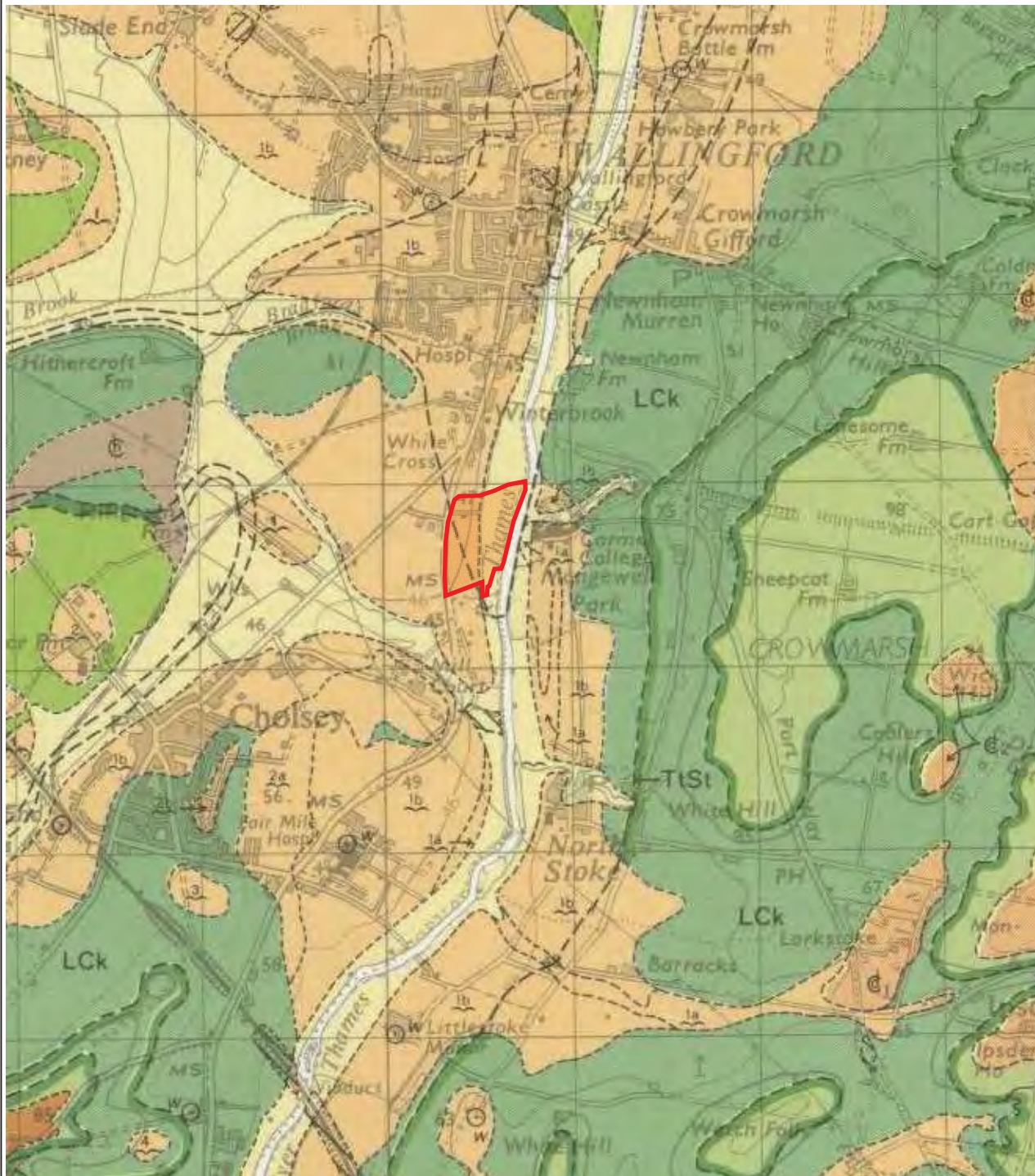
Date:

1st August 2016


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Key

Area of Investigation

Figure 3

Based upon BGS Map 254 Henley-on-Thames
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Title Site Geology

Project Geological & Geotechnical Review

Site Land at White Cross Farm, Wallingford

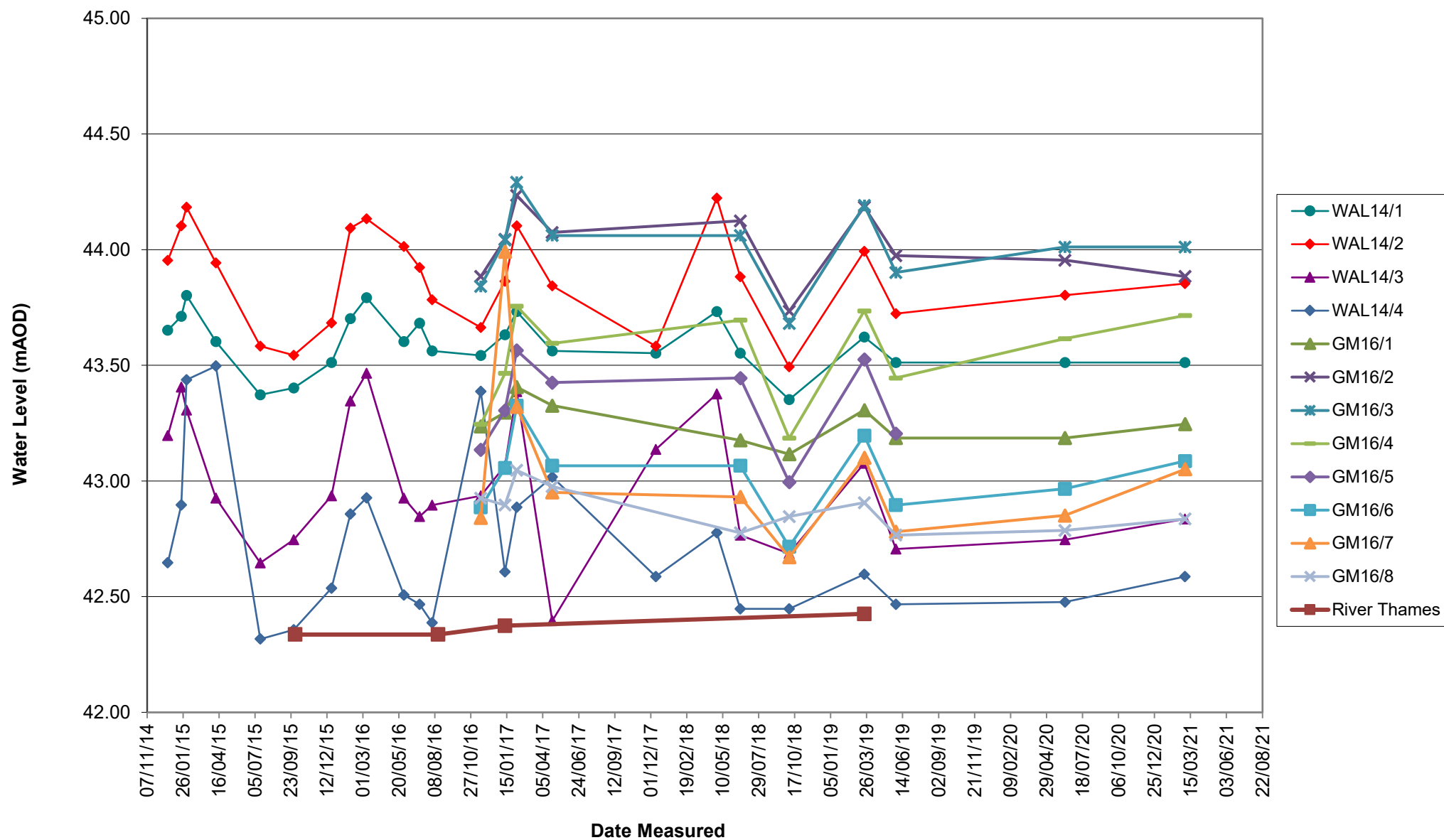
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Project No. LDR/WAL/101 Scale nts

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Figure 4 Groundwater Levels, Wallingford, White Cross Farm



Appendix A Borehole Logs

White Cross Farm, Wallingford

Shell & Auger Borehole Log: Borehole No. WSA 14/1

Depth (m)	Lithological Description	Thickness (m)	Level (m AOD)	Water Depth/ Level (m/ m AOD) Grading (F: S: G)	Installation diagram
0.0	Soil and Subsoil				0.2m above G.L.
0.4	Clayey dark soil	0.4	44.09		Plain pipe
	Clay				Bentonite 0.5m-1m
	Yellowish, stiff clay				
1.0				Water strike at 0.88 m/ 43.61m AOD	
1.9		1.5	42.59		
2.0	Sand				
2.1	Brown, very silty, fine sand.	0.2	42.39		
	Sand and gravel				2.8m
	Yellowish-brown sand and gravel. 60% gravel, 40% sand. G: fine-medium, angular-rounded flint gravel. S: fine-medium, slightly silty. Occasional small cobbles.				Perforated pipe with filter wrapping
3.0					
4.0					
4.9		2.8	39.59		
5.0	Clay				
	Grey clay, stiff, silty, turning to weak shale.				
5.9		1.0	38.59		
6.0	End of Borehole - 5.90m				5.8m
					Spoil sand and gravel used as backfill
7.0					
8.0					
9.0					
10.0					

Borehole No. WSA 14/1	Contractor Metcalf Bros	Client London Rock	Greenfield <i>associates</i> 1 Commercial Rd, Keyworth, Nottingham NG12 5JS E-mail: admin@greenfield-associates.co.uk Tel: 0115 9372002
Date 17/12/14	BH Diameter 150 mm	Project Geological Investigation	
Grid Ref: SU 460539 187981	Surface Level 44.49 m AOD	Site White Cross Farm, Wallingford	

White Cross Farm, Wallingford

Shell & Auger Borehole Log: Borehole No. WSA 14/2

Depth (m)	Lithological Description		Thickness (m)	Level (m AOD)	Water Depth/ Level (m/ m AOD) Grading (F: S: G)	Installation diagram
0.0	Soil and Subsoil Sandy dark soil		0.3	45.44		0.2m above G.L.
0.3	Clay Brown to yellow clay, firm, pebbly					Plain pipe
0.9			0.6	44.84		Bentonite 0.5m-1m
1.0	Sand and Gravel Light orangey brown sand & gravel (50-50 mix). Gravel, fine to medium sand: fine-coarse. Gravel, angular to rounded. Slightly silty. Some clay lumps.				8: 50: 42	
2.0					Water strike at 1.78 m/ 43.96m AOD	
3.0			2.1	42.74	10: 53: 37	2.8m
4.0	Sand and Gravel Brown sand and gravel. 60-70% gravel, with sand. Fine to medium gravel, fine to coarse sand. G: Angular-sub rounded.				5: 66: 29	
4.2			1.2	41.54		
5.0	Pebbly Sand Brown, pebbly sand. Fine to coarse, slightly silty.					
5.3			1.1	40.44		
6.0	Clay Grey clay, stiff. Silty clay, turning to weak grey shale with depth.					
7.0			1.7	38.74		5.8m
7.0	End of Borehole - 7.00m					Spoil sand and gravel used as backfill
8.0						
9.0						
10.0						

Borehole No. WSA 14/2
Date 17/12/14
Grid Ref: SU 460400 187827

Contractor Metcalfe Bros
BH Diameter 150 mm
Surface Level 45.74 m AOD

Client London Rock
Project Geological Investigation
Site White Cross Farm, Wallingford

Greenfield <i>associates</i>
1 Commercial Rd, Keyworth, Nottingham NG12 5JS E-mail: admin@greenfield-associates.co.uk Tel: 0115 9372002

White Cross Farm, Wallingford

Shell & Auger Borehole Log: Borehole No. WSA 14/3

Depth (m)	Lithological Description	Thickness (m)	Level (m AOD)	Water Depth/ Level (m/ mAOD) Grading (F: S: G)	Installation diagram
0.0	<u>Soil and Subsoil</u>				0.2m above G.L. Plain pipe
0.5	Firm peaty soil	0.5	43.01	Water strike at 0.19 m/ 43.32m AOD	Bentonite 0.5m-1m
0.9	Clay Soft yellow clay	0.4	42.61		
1.0	Sand and Gravel Orange-brown sand and gravel. Sand, fine-coarse. Gravel, fine to coarse. Angular-rounded. Mix of 70% gravel, 30% sand. Slightly silty. Larger gravels rounded, small gravels very angular and sharp.				1.2m
2.0					
3.0					
4.0				2: 71: 27	
4.2	Clay Grey clay, stiff, turning to shale.	3.3	39.31		4.2m
5.0					Spoil sand and gravel used as backfill
4.7	End of Borehole - 4.70m	0.5	38.81		
6.0					
7.0					
8.0					
9.0					
10.0					

Borehole No. WSA 14/3
Date 17/12/14
Grid Ref: SU 460552 187637

Contractor Metcalfe Bros
BH Diameter 150 mm
Surface Level 43.51 mAOD


Client London Rock
Project Geological Investigation
Site White Cross Farm, Wallingford

Greenfield <i>associates</i>
1 Commercial Rd, Keyworth, Nottingham NG12 5JS E-mail: admin@greenfield-associates.co.uk Tel: 0115 9372002

White Cross Farm, Wallingford

Shell & Auger Borehole Log: Borehole No. WSA 14/4

Depth (m)	Lithological Description	Thickness (m)	Level (m AOD)	Water Depth/ Level (m/ mAOD) Grading (F: S: G)	Installation diagram
0.0	Soil and Subsoil Firm peaty soil				0.2m above G.L.
0.8		0.8	42.79	Water strike at 0.7m/ 42.89m AOD	Bentonite 0.5m-1m
1.0	Clay Yellowish clay, soft, silty.				Plain pipe
2.0					
2.4		1.6	41.19		
3.0	Peat Dry peat.				
3.2		0.8	40.39		
3.7	Sand and Gravel Brown sand and gravel. Fine to coarse sand, fine to medium gravel.	0.5	39.89		Perforated pipe with filter wrapping
4.0	Clay Grey clay, firm, silty, stiff.				
5.0		1.3	38.59		
5.0	End of Borehole - 5.00m				Spoil sand and gravel used as backfill
6.0					
7.0					
8.0					
9.0					
10.0					

Borehole No. WSA 14/4	Contractor Metcalfe Bros	Client London Rock	 Greenfield <i>associates</i> 1 Commercial Rd, Keyworth, Nottingham NG12 5JS E-mail: admin@greenfield-associates.co.uk Tel: 0115 9372002
Date 17/12/14	BH Diameter 150 mm	Project Geological Investigation	
Grid Ref: SU 460629 187488	Surface Level 43.59 mAOD	Site White Cross Farm, Wallingford	

White Cross Farm, Wallingford

Shell & Auger Borehole Log: Borehole No. WSA 14/5

Depth (m)	Lithological Description		Thickness (m)	Level (m AOD)	Water Depth/ Level (m/ mAOD)	Grading F: S: G
0.0	Soil and Subsoil					
0.4	Peaty soil		0.4	43.23		
0.8	Clay Yellowish clay, soft, silty, turns grey.		0.4	42.83	Water strike at 0.4m/ 43.23m AOD	
1.0	Sand and Gravel Orange-brown sand and gravel. Coarse mix (80% G, 20% S). Gravel, fine to coarse, angular to sub-angular. Sand, fine-coarse. Gravel, hard flint and sandstone.				2: 38: 60	
2.0						
3.0						
3.7			2.9	39.93		
4.0	Clay Grey clay, firm, silty, stiff.					
4.2			0.5	39.43		
	End of Borehole - 4.20m					
5.0						
6.0						
7.0						
8.0						
9.0						
10.0						

Borehole No. WSA 14/5	Contractor Metcalf Bros	Client London Rock	Greenfield <i>a s s o c i a t e s</i> 1 Commercial Rd, Keyworth, Nottingham NG12 5JS E-mail: admin@greenfield-associates.co.uk Tel: 0115 9372002
Date 17/12/14	BH Diameter 150 mm	Project Geological Investigation	
Grid Ref: SU 460554 187803	Surface Level 43.63 mAOD	Site White Cross Farm, Wallingford	

White Cross Farm, Wallingford

Shell & Auger Borehole Log: Borehole No. WSA 14/6

Depth (m)	Lithological Description		Thickness (m)	Level (m AOD)	Water Depth/ Level (m/ mAOD)	Grading F: S: G
0.0	<i>Soll and Subsoil</i> Peaty soil					
0.5			0.5	42.97	Water strike at 0.3m/ 43.17m AOD	
1.0	Clay Yellowish clay, soft.					
1.4			0.9	42.07		
2.0	Clay Dark grey clay, soft, turning to silty peat.					
2.1			0.7	41.37		
3.0	Sand and Gravel Brown-dark brown sand and gravel. 60-70% gravel, 30-40% sand. Sand, coarse. Gravel, fine to medium. Angular-rounded. Occasional small clay bound lumps Gravel is flint and sanstone.					
4.0			1.9	39.47		
4.5	Clay Light grey clay, stiff.		0.5	38.97		
5.0	End of Borehole - 4.50m					
6.0						
7.0						
8.0						
9.0						
10.0						

Borehole No. WSA 14/6	Contractor Metcalf Bros	Client London Rock	Greenfield <i>associates</i> 1 Commercial Rd, Keyworth, Nottingham NG12 5JS E-mail: admin@greenfield-associates.co.uk Tel: 0115 9372002
Date 17/12/14	BH Diameter 150 mm	Project Geological Investigation	
Grid Ref: SU 460659 187778	Surface Level 43.47 mAOD	Site White Cross Farm, Wallingford	

White Cross Farm, Wallingford

Shell & Auger Borehole Log: Borehole No. WSA 14/7

Depth (m)	Lithological Description	Thickness (m)	Level (m AOD)	Water Depth/ Level (m/ mAOD)	Grading F: S: G
0.0	<i>Soll and Subsoil</i>				
0.4		0.4	44.72		
0.8	<i>Clay</i> Brown clay, stiff, pebbly	0.4	44.32		
1.0	<i>Sand and gravel</i> Brown to orange-brown sand and gravel. 60% sand, 40% gravel.			3: 44: 53	
2.0	Sand: Fine-medium, G: Fine-med. Sub-rounded to rounded.	1.5	42.82	Water strike at 1.60m/ 43.52m AOD	
2.3	<i>Sand and gravel</i> Orange-brown sand and gravel. 80% gravel, 20% sand. Gravel, fine-coarse, angular- sub-angular.				
3.0	Occasional cobbles. Sand: Fine to medium.				
4.0		1.9	40.92		
4.2	<i>Shale</i> Light grey shale, stiff.				
5.0		0.8	40.12		
	End of Borehole - 5.00m				
6.0					
7.0					
8.0					
9.0					
10.0					

Borehole No. WSA 14/7	Contractor Metcalf Bros	Client London Rock	Greenfield <i>a s s o c i a t e s</i> 1 Commercial Rd, Keyworth, Nottingham NG12 5JS E-mail: admin@greenfield-associates.co.uk Tel: 0115 9372002
Date 17/12/14	BH Diameter 150 mm	Project Geological Investigation	
Grid Ref: SU 460418 187698	Surface Level 45.12 mAOD	Site White Cross Farm, Wallingford	

White Cross Farm, Wallingford

Shell & Auger Borehole Log: Borehole No. WSA 14/8

Depth (m)	Lithological Description	Thickness (m)	Level (m AOD)	Water Depth/ Level (m/ mAOD)	Grading F: S: G
0.0	Soil and Subsoil				
0.4	Clay Yellow clay, pebbly, firm.	0.4	44.8		
0.8	Sand and Gravel Orange to brown sand and gravel. 80% gravel, 20% sand mix.	0.4	44.4		
1.0	Sand, fine to coarse. Gravel, fine to coarse, angular to sub-angular.			Water strike at 1.4m/ 43.8m AOD	
2.0				4: 46: 50	
3.0					
3.7	Sand and Gravel Brown sand and gravel, 50-50 mix. Sand, fine to medium. Gravel, fine to medium, angular to rounded. Slightly silty. Occasional clay bound lumps. Few rounded cobbles.	2.9	41.5		
4.0	Clay Light grey clay, stiff	0.9	40.6		
4.6		0.5	40.1		
5.0	End of Borehole - 5.10m				
5.1					
6.0					
7.0					
8.0					
9.0					
10.0					

Borehole No. WSA 14/8	Contractor Metcalfe Bros	Client London Rock	Greenfield <i>a s s o c i a t e s</i> 1 Commercial Rd, Keyworth, Nottingham NG12 5JS E-mail: admin@greenfield-associates.co.uk Tel: 0115 9372002
Date 17/12/14	BH Diameter 150 mm	Project Geological Investigation	
Grid Ref: SU 460482 187897	Surface Level 45.2mAOD	Site White Cross Farm, Wallingford	

White Cross Farm, Wallingford

Shell & Auger Borehole Log: Borehole No. WSA 14/9


Depth (m)	Lithological Description	Thickness (m)	Level (m AOD)	Water Depth/ Level (m/ mAOD)	Grading F: S: G
0.0	Soil and Subsoil Firm, peaty soil mix.	0.9	42.55		
0.9	Clay Yellow clay, silty, soft.	0.9	41.65		
1.8				Water strike at 0.5m/ 42.95m AOD	
2.0	Clay and peat Dark grey clay peat, soft mix.	0.7	40.95		
2.5	Sand and Gravel Brown sand and gravel, fine to medium flint and sandstone gravel, fine to coarse sand. Slightly silty.	1.2	39.75		
3.7	Clay Light grey, stiff clay.	0.5	39.25		
4.2	End of Borehole - 4.20m				
5.0					
6.0					
7.0					
8.0					
9.0					
10.0					

Borehole No. WSA 14/9	Contractor Metcalfe Bros	Client London Rock	Greenfield <i>a s s o c i a t e s</i> 1 Commercial Rd, Keyworth, Nottingham NG12 5JS E-mail: admin@greenfield-associates.co.uk Tel: 0115 9372002
Date 17/12/14	BH Diameter 150 mm	Project Geological Investigation	
Grid Ref: SU 460635 187637	Surface Level 43.45 mAOD	Site White Cross Farm, Wallingford	

White Cross Farm, Wallingford

Shell & Auger Borehole Log: Borehole No. WSA 14/10

Depth (m)	Lithological Description	Thickness (m)	Level (m AOD)	Water Depth/ Level (m/ mAOD)	Grading F: S: G
0.0	Soil and Subsoil				
0.6	Peat soil mix	0.4	42.97		
0.9	Clay Yellow clay, firm	0.3	42.67	Water strike at 0.7m/ 42.67m AOD	
1.0	Sand Yellow silty, firm sand	0.1	42.57		
2.0	Sand and gravel Orange-brown sand and gravel. 50-50 mix of sand and gravel. Sand, fine to medium. Gravel, fine to medium, angular to rounded. Slightly silty. Occasional clay bound lumps. Occasional larger rounded pebbles.	2.0	40.57	5: 56: 39	
3.0	Clay Light grey clay, turning to weak shale.	1.0	39.57		
4.0	End of Borehole - 4.00m				
5.0					
6.0					
7.0					
8.0					
9.0					
10.0					

Borehole No. WSA 14/10	Contractor Metcalfe Bros	Client London Rock	 Greenfield <i>associates</i> 1 Commercial Rd, Keyworth, Nottingham NG12 5JS E-mail: admin@greenfield-associates.co.uk Tel: 0115 9372002
Date 17/12/14	BH Diameter 150 mm	Project Geological Investigation	
Grid Ref: SU 460554 187548	Surface Level 43.37 mAOD	Site White Cross Farm, Wallingford	

White Cross Farm, Wallingford

Shell & Auger Borehole Log: Borehole No. WCF 15/1

Depth (m)	Lithological Description	Thickness (m)	Level (m AOD)	Water Depth/ Level (m/ mAOD)	Grading F: S: G
0.0	Soil and Subsoil		44.8		
0.4	Stoney soil	0.4	44.4		
0.8	Clay Yellow-brown firm clay, occasional pebbles.	0.4	44.0		
1.0	Sand and gravel Brown slightly silty sand & gravel, fine-medium sand, fine-medium, angular-rounded flint gravel. Occasional clay bound lumps.				
2.0		1.2	42.8	Water strike at 1.7 m/ 43.1m AOD	
2.8	Sand and gravel Brown sand & gravel, fine-coarse sand fine-medium, angular to rounded flint gravel. Occasional cobbles.	0.8	42.0		2: 27: 72
3.0	Clay Light grey chalky clay.				
4.0		1.2	40.8		
	End of Borehole - 4.00m				
5.0					
6.0					
7.0					
8.0					
9.0					
10.0					

Borehole No. WCF 15/1	Contractor Metcalfe Bros	Client London Rock	Greenfield <i>associates</i> 1 Commercial Rd, Keyworth, Nottingham NG12 5JS E-mail: admin@greenfield-associates.co.uk Tel: 0115 9372002
Date 29/09/2015	BH Diameter 150 mm	Project Geological Investigation	
Grid Ref: SU 460420 187521	Surface Level 44.75 mAOD	Site White Cross Farm, Wallingford	

White Cross Farm, Wallingford

Shell & Auger Borehole Log: Borehole No. WCF 15/2

Depth (m)	Lithological Description		Thickness (m)	Level (m AOD)	Water Depth/ Level (m/ mAOD)	
0.0				44.3		
0.25	Soil Stoney dark clayey soil		0.25	44.1		
	Clay Brown stiff clay with occasional cobbles.					
1.0			0.75	43.4		
	Sand and Gravel Orange-brown sand & gravel, sand fine-coarse, fine-medium sub angular to sub rounded flint gravel.				Water strike at 1.4 m/ 42.9m AOD	3: 57: 40
2.0			1.2	42.2		
2.2	Clay Light grey, firm chalky clay.					
3.0			1.0	41.2		
3.2	End of Borehole - 3.20m					
4.0						
5.0						
6.0						
7.0						
8.0						
9.0						
10.0						

Borehole No. WCF 15/2	Contractor Metcalfe Bros	Client London Rock	Greenfield <i>associates</i> 1 Commercial Rd, Keyworth, Nottingham NG12 5JS E-mail: admin@greenfield-associates.co.uk Tel: 0115 9372002
Date 29/09/2015	BH Diameter 150 mm	Project Geological Investigation	
Grid Ref: SU 460513 187586	Surface Level 44.29 mAOD	Site White Cross Farm, Wallingford	

White Cross Farm, Wallingford

Shell & Auger Borehole Log: Borehole No. WCF 15/3

Depth (m)	Lithological Description	Thickness (m)	Level (m AOD)	Water Depth/ Level (m/ mAOD)	
0.0	Soil and Subsoil Stoney soil		45.0		
0.3	Clay Brown firm clay.	0.3	44.7		
0.9	Clayey Sand	0.6	44.1		
1.0		0.1	44.0		
1.7	Sand and Gravel Brown slightly silty sand & gravel, fine-medium sand, fine-coarse angular to sub angular flint gravels. Occasional clay lumps.	0.7	43.3	Water strike at 1.8 m/ 43.2m AOD	3: 39: 58
2.0	Sand and Gravel Brown- grey brown sand & gravel, fine-coarse sand, fine-medium, sub angular to rounded flint gravels				
2.8		1.1	42.2		
3.0	Clay Light grey firm chalky clay.				
3.8		1.0	41.2		
4.0	End of Borehole - 3.80m				
5.0					
6.0					
7.0					
8.0					
9.0					
10.0					

Borehole No. WCF 15/3	Contractor Metcalf Bros	Client London Rock	Greenfield <i>associates</i> 1 Commercial Rd, Keyworth, Nottingham NG12 5JS E-mail: admin@greenfield-associates.co.uk Tel: 0115 9372002
Date 29/09/15	BH Diameter 150 mm	Project Geological Investigation	
Grid Ref: SU 460398 187627	Surface Level 44.97 mAOD	Site White Cross Farm, Wallingford	

White Cross Farm, Wallingford

Shell & Auger Borehole Log: Borehole No. WCF 15/4

Depth (m)	Lithological Description	Thickness (m)	Level (m AOD)	Water Depth/ Level (m/ m AOD) Grading (F: S: G)
0.0	Soil and Subsoil Clayey dark soil	0.25	44.7	
0.25	Clay Brown stiff clay with odd pebbles	0.35	44.5	
0.6	Sandy Clay	0.1	44.2	
0.7	Sand and Gravel Orange-brown sand & gravel, fine to coarse sand, fine-medium rounded to sub-angular flint gravels. Occasional silt bound lumps.	1.3	44.1	
1.0				
2.0	Sand and Gravel Orange-brown sand & gravel, fine to coarse sand with fine-medium, angular to sub-rounded flint and quartzite gravels. Occasional coarse gravel.	1.3	42.8	Water strike at 1.7m/ 43.0m AOB
3.0				
3.3	Clay Light grey firm chalky clay	0.7	41.5	
4.0	End of Borehole - 4.00m		40.8	
5.0				
6.0				
7.0				
8.0				
9.0				
10.0				

Borehole No. WCF 15/4
Date 29/09/2015
Grid Ref: SU 460486 187688

Contractor Metcalfe Bros
BH Diameter 150 mm
Surface Level 44.73 m AOD

Client London Rock
Project Geological Investigation
Site White Cross Farm, Wallingford

Greenfield <i>associates</i> 1 Commercial Rd, Keyworth, Nottingham NG12 5JS E-mail: admin@greenfield-associates.co.uk Tel: 0115 9372002

White Cross Farm, Wallingford

Shell & Auger Borehole Log: Borehole No. WCF 15/5

Depth (m)	Lithological Description	Thickness (m)	Level (m AOD)	Water Depth/ Level (m/ mAOD)	Grading F: S: G
0.0	Soll and Subsoil		44.8		
0.25	Clay Brown firm-stiff clay.	0.25	44.6		
0.6	Clayey Sand	0.35	44.2		
0.7		0.1	44.1		
1.0	Sand and Gravel Orange-brown sand & gravel, fine to medium sand, slightly silty with fine to medium, sub angular to rounded, flint gravels. Occasional clay lumps.				
2.0		1.3	42.8	Water strike at 1.7m/ 43.1m AOD	
3.0	Sand and Gravel Orange-brown sand & gravel, fine to coarse sand, fine to coarse angular to sub angular flint and quartzite gravels.				2: 56: 42
4.0		2.2	40.6		
4.2	Clay Light grey firm clay.				
5.0	End of Borehole - 5.00m	0.8	39.8		
6.0					
7.0					
8.0					
9.0					
10.0					

Borehole No. WCF 15/5
Date 17/12/14
Grid Ref: SU 460495 187845

Contractor Metcalfe Bros
BH Diameter 150 mm
Surface Level 44.83 mAOD

Client London Rock
Project Geological Investigation
Site White Cross Farm, Wallingford

Greenfield <i>associates</i>
1 Commercial Rd, Keyworth, Nottingham NG12 5JS E-mail: admin@greenfield-associates.co.uk Tel: 0115 9372002

White Cross Farm, Wallingford

Shell & Auger Borehole Log: Borehole No. WCF 15/6

Depth (m)	Lithological Description	Thickness (m)	Level (m AOD)	Water Depth/ Level (m/ mAOD)	Grading F: S: G
0.0			45.7		
0.2	Soil and Subsoil	0.2	45.5		
0.3	Gravel Soil with brick rubble.	0.3	45.2		
0.8	Clay Orange-brown stiff clay.	0.5	44.7		
1.0	Sand and Gravel Brown sand & gravel, fine-medium, silty sand with fine-coarse, angular to sub angular flint and quartzite gravels.				7: 37: 56
2.0				Water strike at 2.0m/ 43.7m AOD	
3.0					
4.0					
4.7		3.9	40.8		
5.0	Clay and Gravel Light grey chalky clay and sandy gravel.	0.4	40.4		
5.1	Weak Rock				
5.2	Light grey-yellow weak rock.	0.1	40.3		
	End of Borehole - 5.20m				
6.0					
7.0					
8.0					
9.0					
10.0					

Borehole No. WCF 15/6	Contractor Metcalf Bros	Client London Rock	Greenfield <i>a s s o c i a t e s</i> 1 Commercial Rd, Keyworth, Nottingham NG12 5JS E-mail: admin@greenfield-associates.co.uk Tel: 0115 9372002
Date 30/09/2015	BH Diameter 150 mm	Project Geological Investigation	
Grid Ref: SU 460433 187916	Surface Level 45.72 mAOD	Site White Cross Farm, Wallingford	

White Cross Farm, Wallingford

Shell & Auger Borehole Log: Borehole No. WCF 15/7

Depth (m)	Lithological Description		Thickness (m)	Level (m AOD)	Water Depth/ Level (m/ mAOD)	Grading F: S: G
0.0	Soll and Subsoil		0.2	43.5		
0.2	Clay Soft yellow clay turning to soft grey clay.			43.3		
0.9	Sand and gravel Brown sand & gravel, fine-coarse sand, fine-medium, sub angular to rounded gravels.		0.7	42.6	Water strike at 0.9m/ 42.6m AOD	
1.0						2: 60: 38
2.0						
3.0			2.1	40.5		1: 49: 50
3.8	Clay Light grey firm chalky clay.					
4.0	End of Borehole - 3.80m		0.8	39.7		
5.0						
6.0						
7.0						
8.0						
9.0						
10.0						

Borehole No. WCF 15/7	Contractor Metcalf Bros	Client London Rock	Greenfield <i>associates</i> 1 Commercial Rd, Keyworth, Nottingham NG12 5JS E-mail: admin@greenfield-associates.co.uk Tel: 0115 9372002
Date 30/09/2015	BH Diameter 150 mm	Project Geological Investigation	
Grid Ref: SU 460581 187701	Surface Level 43.49 mAOD	Site White Cross Farm, Wallingford	

White Cross Farm, Wallingford

Shell & Auger Borehole Log: Borehole No. WCF 15/8

Depth (m)	Lithological Description		Thickness (m)	Level (m AOD)	Water Depth/ Level (m/ mAOD)	Grading F: S: G
0.0				43.3		
0.2	Soil and Subsoil		0.2	43.1		
	Clay Brown firm clay.					
0.8			0.6	42.5		
1.0	Clay Soft grey blue clay.					
1.7			0.9	41.6	Water strike at 1.7m/ 41.6m AOD	
2.0	Sand & Gravel Brown sand & gravel, fine to coarse sand, fine-coarse angular to sub angular flint gravels with occasional cobbles.					
2.9			1.2	40.4		
3.0	Clay Light grey firm chalky clay.					
3.5			0.6	39.8		
	End of Borehole - 3.50m					
4.0						
5.0						
5.1						
6.0						
7.0						
8.0						
9.0						
10.0						

Borehole No. WCF 15/8	Contractor Metcalfe Bros	Client London Rock	Greenfield <i>a s s o c i a t e s</i> 1 Commercial Rd, Keyworth, Nottingham NG12 5JS E-mail: admin@greenfield-associates.co.uk Tel: 0115 9372002
Date 30/09/2015	BH Diameter 150 mm	Project Geological Investigation	
Grid Ref: SU 460603 187595	Surface Level 43.27 mAOD	Site White Cross Farm, Wallingford	

White Cross Farm, Wallingford



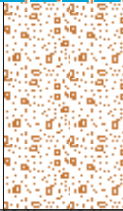

Shell & Auger Borehole Log: WCF 16/1


Depth (m)	Lithological Description		Thickness (m)	Level (m AOD)	Water Depth/ Level (m/ mAOD)	Grading F: S: G
0.0	<i>Soil and Subsoil</i>			43.7		
0.4	Stoney soil		0.4	43.3		
1.0	<i>Clay</i> Yellow to grey soft silty CLAY		1.2			
1.6				42.1	Water strike at 1.6 m/ 42.0m AOD	
2.0	<i>Sand and gravel</i> Brown silty fine to medium sandy GRAVEL, sub-angular to sub-rounded Occasional small ironstone pieces and large flint fragments.		2.1			
3.0						
3.7				40.0		
4.0	<i>Clay</i> Grey stiff CLAY with rocky bands		0.4	39.6		
5.0	End of Borehole - 4.10m					
6.0						
7.0						
8.0						
9.0						
10.0						

Borehole No. WCF 16/1	Contractor Metcalfe Bros Ltd	Client London Rock	Greenfield <i>associates</i> 1 Commercial Rd, Keyworth, Nottingham NG12 5JS E-mail: admin@greenfield-associates.co.uk Tel: 0115 9372002
Date 31/05/2016	BH Diameter 150 mm	Project Geological Investigation	
Grid Ref: SU 46062 18794	Surface Level 43.65 mAOD	Site White Cross Farm, Wallingford	

White Cross Farm, Wallingford




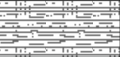
Shell & Auger Borehole Log: WCF 16/2


Depth (m)	Lithological Description		Thickness (m)	Level (m AOD)	Water Depth/ Level (m/ mAOD)
0.0				43.6	
0.2	Soil Peaty clayey soil		0.20	43.4	
1.0	Clay Yellow to grey soft silty CLAY		2.1		
2.3	Sand and Gravel Brown sandy fine to coarse GRAVEL with some small pieces of dark ironstone		1.3	41.3	Water strike at 2.3m/ 41.3m AOD
3.6				40.0	
4.0	Clay Grey stiff flaky CLAY		0.6	39.4	
4.2	End of Borehole - 4.20m				
5.0					
6.0					
7.0					
8.0					
9.0					
10.0					

Borehole No. WCF 16/2	Contractor Metcalfe Bros Ltd	Client London Rock	 Greenfield <i>associates</i> 1 Commercial Rd, Keyworth, Nottingham NG12 5JS E-mail: admin@greenfield-associates.co.uk Tel: 0115 9372002
Date 31/05/2016	BH Diameter 150 mm	Project Geological Investigation	
Grid Ref: SU 46070 18796	Surface Level 43.59 mAOD	Site White Cross Farm, Wallingford	

White Cross Farm, Wallingford

Shell & Auger Borehole Log: WCF 16/3

Depth (m)	Lithological Description		Thickness (m)	Level (m AOD)	Water Depth/ Level (m/ mAOD)
0.0				43.6	
0.3	Soil and Subsoil Peaty soil		0.3	43.3	
1.0	Clay Yellow to grey soft silty CLAY		1.1		
1.4				42.2	Water strike at 1.4m/ 42.2m AOD
2.0	Sand and Gravel Brown silty fine to medium sandy GRAVEL, sub-angular to sub-rounded. With occasional large flint pieces and small ironstone pieces		2.3		
3.7				39.9	
4.0	Clay Grey stiff CLAY with thin rock bands		0.5	39.4	
3.8	End of Borehole - 4.20m				
5.0					
6.0					
7.0					
8.0					
9.0					
10.0					

Borehole No. WCF 16/3	Contractor Metcalfe Bros Ltd	Client London Rock	 Greenfield <i>associates</i> 1 Commercial Rd, Keyworth, Nottingham NG12 5JS E-mail: admin@greenfield-associates.co.uk Tel: 0115 9372002
Date 01/06/2016	BH Diameter 150 mm	Project Geological Investigation	
Grid Ref: SU 46060 18787	Surface Level 43.57 mAOD	Site White Cross Farm, Wallingford	

White Cross Farm, Wallingford




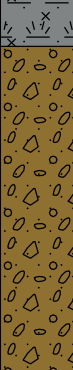

Shell & Auger Borehole Log: WCF 16/4

Depth (m)	Lithological Description	Thickness (m)	Level (m AOD)	Water Depth/ Level (m/ mAOD) Grading (F: S: G)
0.0	Soil and Subsoil Peaty soil		43.5	
0.3	Clay Yellow soft CLAY	0.3	43.2	
0.8		0.5	42.7	
1.0	Grey soft CLAY	0.8		
1.6			41.9	
2.0	Soft Peat	0.7		
2.3	Sand and Gravel Brown silty fine to medium sandy GRAVEL, sub-angular to sub-rounded. Small amount of coarse sand. With occasional large flint pieces and small ironstone pieces		41.2	Water strike at 2.3m/ 41.2m AOD
3.0		1.3		
3.6			39.9	
4.0	Clay Grey stiff flaky CLAY	0.7		
			39.2	
	End of Borehole - 4.30m			
5.0				
6.0				
7.0				
8.0				
9.0				
10.0				

Borehole No. WCF 16/4	Contractor Metcalfe Bros Ltd	Client London Rock	Greenfield <i>associates</i> 1 Commercial Rd, Keyworth, Nottingham NG12 5JS E-mail: admin@greenfield-associates.co.uk Tel: 0115 9372002
Date 31/05/2016	BH Diameter 150 mm	Project Geological Investigation	
Grid Ref: SU 46068 18787	Surface Level 43.52 mAOD	Site White Cross Farm, Wallingford	

BOREHOLE LOG

Project Wallingford			BOREHOLE No GM 16/1	
Job No LR/WF/101	Dates start 18-11-16 finish 18-11-16	Ground Level (m OD)		
Client London Rock		Co-Ordinates ()	Sheet 1 of 1	

STRATA					SAMPLES & TESTS		
Depth	Legend	Reduced Level (Thickness)	DESCRIPTION	Water	Depth	Type No	Test Result
0.20		(0.20)	Topsoil				
		(1.40)	Soft to firm brownish grey becoming grey with occasional brown patches slightly sandy CLAY with occasional rootlets in the top 0.3m		0.20-0.50 0.50-1.60	B1 B2	
1.60		(0.40)	Dark grey with grey patches slightly sandy silty organic CLAY (peat)		1.60-2.00	B3	
2.00		(2.30)	Brown SAND + GRAVEL, fine to coarse sand and fine occasionally medium rounded to sub-angular flint gravel		2.00-4.30	B4	
4.30		(0.20)	Light grey extremely weak to weak silty CHALK		4.30-4.50	B5	
4.50							

Remarks/Chiselling/Water Added etc.

BOREHOLE LOG

Project Wallingford			BOREHOLE No GM 16/2	
Job No LR/WF/101	Dates start 17-11-16 finish 17-11-16	Ground Level (m OD)		
Client London Rock		Co-Ordinates ()	Sheet 1 of 1	

STRATA					SAMPLES & TESTS		
Depth	Legend	Reduced Level (Thickness)	DESCRIPTION	Water	Depth	Type No	Test Result
0.20		(0.20)	Topsoil				
		(1.50)	Brown stiff to very stiff slightly clayey sandy SILT with occasional fine sub-angular flint gravel and rootlets ...with occasional medium to coarse flint gravel in the bottom 0.3m		0.20-1.40	B1	
1.70		(2.00)	Brown SAND + GRAVEL, fine to coarse sand and fine rounded to sub-angular flint gravel		1.40-1.70 1.70-3.70	B2 B3	
3.70		(2.60)	Yellowish brown fine to coarse SAND with much fine occasionally medium rounded to sub-angular flint gravel and occasional coarse se chalk sand		3.70-6.30	B4	
6.30		(0.60)	Creamy grey firm to stiff locally extremely weak weathered CHALK marl		6.30-6.90	B5	
6.90							

Remarks/Chiselling/Water Added etc.

All dimensions in metres
Scale 1:50

Engineer






Method/
Plant Used

Logged By T Shellard

GF MINERAL BH WALLINGFORD BH LOGS.GPJ AGS 3.1.GDT 21/11/16

BOREHOLE LOG

Project Wallingford			BOREHOLE No GM 16/3
Job No LR/WF/101	Dates start 16-11-16 finish 17-11-16	Ground Level (m OD)	
Client London Rock		Co-Ordinates ()	Sheet 1 of 1

STRATA					SAMPLES & TESTS		
Depth	Legend	Reduced Level (Thickness)	DESCRIPTION	Water	Depth	Type No	Test Result
0.30		(0.30)	Topsoil				
1.50		(1.20)	Brown stiff to very stiff slightly sandy SILT with occasional rootlets		0.30-1.50	B1	
3.00		(1.50)	Light brown fine to coarse SAND with much rounded to sub-angular fine to medium flint gravel and occasional coarse chalk sand		1.50-3.00	B2	
6.70		(3.70)	Yellowish brown SAND + GRAVEL, medium to coarse occasionally fine sand and fine to medium rounded to sub-angular flint gravel		3.00-4.50	B3	
7.70		(1.00)	Cream/grey weak to extremely weak slightly weathered silty CHALK ...fractured with drilling in range of coarse sand to coarse gravel		4.50-6.70	B4	
					6.70-7.70	B5	

Remarks/Chiselling/Water Added etc.

Hand dug pit to 1.0m

All dimensions in metres
Scale 1:50

Engineer

Method/
Plant Used

Logged By T Shellard

GF MINERAL BH WALLINGFORD BH LOGS.GPJ AGS 3.1.GDT 21/11/16

BOREHOLE LOG






Project Wallingford			BOREHOLE No GM 16/4
Job No LR/WF/101	Dates start 16-11-16 finish 16-11-16	Ground Level (m OD)	
Client London Rock		Co-Ordinates ()	Sheet 1 of 1

STRATA					SAMPLES & TESTS		
Depth	Legend	Reduced Level (Thickness)	DESCRIPTION	Water	Depth	Type No	Test Result
0.25		(0.25)	Topsoil				
		(0.95)	Brown stiff friable sandy CLAY/SILT with occasional medium to coarse chalk sand		0.25-1.20	B1	
1.20		(0.30)	Light brown with cream patches slightly sandy SILT with occasional rootlets and medium chalk sand		1.20-1.50	B2	
1.50		(0.20)	Brown slightly clayey sandy SILT with occasional fine sub-rounded to rounded flint gravel and coarse chalk sand		1.50-1.70	B3	
1.70		(1.80)	Brown SAND + GRAVEL, fine to coarse sand and fine to medium sub-angular to rounded flint gravel		1.70-3.50	B4	
3.50		(1.00)	Light creamy grey silty weathered CHALK marl with weak to medium fine to medium angular gravel and firm slightly clayey silty sand matrix		3.50-4.50	B5	
4.50							

Remarks/Chiselling/Water Added etc.

BOREHOLE LOG

Project Wallingford		BOREHOLE No GM 16/5	
Job No LR/WF/101	Dates start 16-11-16 finish 16-11-16	Ground Level (m OD)	
Client London Rock		Co-Ordinates ()	Sheet 1 of 1


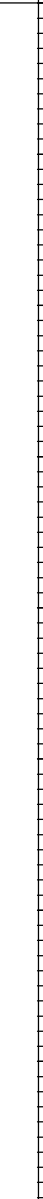

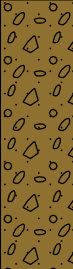

STRATA				SAMPLES & TESTS			
Depth	Legend	Reduced Level (Thickness)	DESCRIPTION	Water	Depth	Type No	Test Result
0.30		(0.30)	Topsoil		0.30-1.20	B1	
1.20		(0.90)	Dark brown firm to stiff sandy CLAY with occasional medium chalk sand				
1.50		(0.30)	Light brown silty fine to medium SAND with some heavily weathered soft silt to coarse sand chalk		1.20-1.50	B2	
3.10		(1.60)	Light Brown slightly silty fine to coarse SAND with much fine to medium sub-rounded to angular flint gravel and occasional coarse chalk sand		1.50-3.10	B3	
4.40		(1.30)	Light grey/cream firm to extremely weak heavily weathered silty CHALK marl with occasional orangish brown iron staining		3.10-4.40	B4	

Remarks/Chiselling/Water Added etc.

All dimensions in metres Scale 1:50	Engineer	Method/ Plant Used	Logged By T Shellard
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BOREHOLE LOG

Project Wallingford		BOREHOLE No GM 16/6	
Job No LR/WF/101	Dates start 15-11-16 finish 15-11-16	Ground Level (m OD)	
Client London Rock		Co-Ordinates ()	Sheet 1 of 1






STRATA				SAMPLES & TESTS			
Depth	Legend	Reduced Level (Thickness)	DESCRIPTION	Water	Depth	Type No	Test Result
0.30		(0.30)	Topsoil				
0.60		(0.30)	Brown to dark brown firm to stiff sandy CLAY with occasional medium chalk sand		0.30-0.60	B1	
2.40		(1.80)	Brown slightly silty SAND + GRAVEL, fine to medium sand and fine occasionally medium sub-angular to rounded flint gravel and occasional medium to coarse chalk sand		0.60-2.40	B2	
3.40		(1.00)	Light grey firm to stiff locally extremely weak silty CHALK marl		2.40-3.40	B3	

Remarks/Chiselling/Water Added etc.

All dimensions in metres Scale 1:50	Engineer	Method/ Plant Used	Logged By T Shellard
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BOREHOLE LOG

Project Wallingford			BOREHOLE No GM 16/7	
Job No LR/WF/101	Dates start 15-11-16 finish 15-11-16	Ground Level (m OD)		
Client London Rock		Co-Ordinates ()	Sheet 1 of 1	

STRATA					SAMPLES & TESTS		
Depth	Legend	Reduced Level (Thickness)	DESCRIPTION	Water	Depth	Type No	Test Result
0.20		(0.20)	Topsoil				
		(1.10)	Light brown to brown slightly sandy CLAY with occasional sub-rounded to rounded fine flint gravel and occasional rootlets		0.20-1.30	B1	
1.30		(0.50)	Soft orangish brown/light grey mottled slightly silty CLAY with occasional medium chalk sand		1.30-1.80	B2	
1.80		(1.20)	Soft grey very sandy CLAY with occasional fine sub-rounded to rounded chalk gravel and occasional orangish brown iron staining from rootlets		1.90-3.00	B3	
3.00		(1.00)	Light brown/cream extremely weak to weak weathered CHALK marl		3.00-4.00	B4	
4.00							




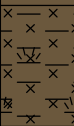


Remarks/Chiselling/Water Added etc.

All dimensions in metres Scale 1:50	Engineer	Method/ Plant Used	Logged By T Shellard
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GF MINERAL BH WALLINGFORD BH LOGS.GPJ AGS 3.1.GDT 21/11/16

BOREHOLE LOG

Project Wallingford		BOREHOLE No GM 16/8	
Job No LR/WF/101	Dates start 18-11-16 finish 18-11-16	Ground Level (m OD)	
Client London Rock		Co-Ordinates ()	Sheet 1 of 1

STRATA					SAMPLES & TESTS		
Depth	Legend	Reduced Level (Thickness)	DESCRIPTION	Water	Depth	Type No	Test Result
0.15			Topsoil		0.15-0.40	B1	
0.40		(0.25)	Grey with occasional brown patches slightly sandy CLAY with occasional medium to coarse chalk sand		0.40-1.30	B2	
1.30		(0.90)	Dark brown slightly sandy silty CLAY with much organic material (peat)		1.30-2.10	B3	
2.10		(0.80)	Brown SAND + GRAVEL, fine to coarse sand and fine to medium rounded to sub-angular flint gravel with occasional fine chalk gravel		2.10-2.90	B4	
2.90		(1.00)	Cream/grey slightly clayey sandy silty heavily weathered CHALK marl		2.90-3.90	B5	
3.90							

Remarks/Chiselling/Water Added etc.

All dimensions in metres Scale 1:50	Engineer	Method/ Plant Used	Logged By T Shellard
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Appendix B
Laboratory Test Results

Table 1 Particle Size Distribution of Borehole Samples - Wallingford

Samples collected: 17/12/2014 & 2015

	Percentage Passing (mm)															Fines (-63u)	Sand	Gravel (+ 4mm)
	0.063	0.125	0.25	0.50	1.0	2.0	4.0	6.3	8.0	10.0	16.0	20.0	31.5	40.0	80.0			
WSA 14-3 (3.4-4.2m)	2.0	3	13	47	56	64	73	78	81	84	93	97	100	100	100	2	71	27
WSA 14-10 (1.0-3.0m)	5.0	6	10	38	47	53	61	68	73	78	90	94	99	100	100	5	56	39
WSA 14-8 (2.0-3.5m)	4.0	5	8	21	28	35	50	60	66	73	85	91	99	100	100	4	46	50
WSA 14-2 (2.0-3.0m)	10.0	12	17	39	46	53	63	71	76	81	92	97	100	100	100	10	53	37
WSA 14-2 (3.0-4.5m)	5.0	7	13	33	43	54	71	81	87	91	97	98	100	100	100	5	66	29
WSA 14-7 (0.8-2.3m)	3.0	4	7	25	29	34	47	57	63	70	87	92	99	100	100	3	44	53
WSA 14-2 (0.9-2.0)	8.0	9	12	30	35	42	58	68	73	79	91	94	99	100	100	8	50	42
WSA 14-5 (0.8-2.3)	2.0	2	4	16	23	29	40	50	56	63	77	84	98	98	100	2	38	60
WCF 15-1 (2-2.8m)	1.5	2	2	9	12	16	28	41	49	60	81	88	97	100	100	2	27	72
WCF 15-2 (1-2.2m)	3.4	4	4	9	15	29	60	80	87	93	97	97	100	100	100	3	57	40
WCF 15-3 (1.7-2.8m)	2.9	3	5	16	19	25	42	59	66	75	89	93	100	100	100	3	39	58
WCF 15-5 (1.7-4.1m)	2.4	3	7	33	42	47	58	64	67	70	77	85	94	96	100	2	56	42
WCF 15-6 (0.8-2m)	6.6	7	10	28	32	36	44	54	61	70	84	91	100	100	100	7	37	56
WCF 15-7 (0.9-2.4m)	2.3	3	6	25	36	47	62	74	80	85	93	95	100	100	100	2	60	38
WCF 15-7 (2.4-3m)	1.0	1	2	24	33	40	50	58	64	70	82	87	97	97	100	1	49	50
Mean	3.9	5	8	26	33	40	54	64	70	76	88	92	99	99	100	4	50	46

Sand Fraction Only (-4mm)							
	0.063	0.125	0.250	0.50	1.0	2.0	4.0
WSA 14-3 (3.4-4.2m)	3	4	18	64	77	88	100
WSA 14-10 (1.0-3.0m)	8	10	16	62	77	87	100
WSA 14-8 (2.0-3.5m)	8	10	16	42	56	70	100
WSA 14-2 (2.0-3.0m)	16	19	27	62	73	84	100
WSA 14-2 (3.0-4.5m)	7	10	18	46	61	76	100
WSA 14-7 (0.8-2.3m)	6	9	15	53	62	72	100
WSA 14-2 (0.9-2.0)	14	16	21	52	60	72	100
WSA 14-5 (0.8-2.3)	5	5	10	40	58	73	100
WCF 15-1 (2-2.8m)	5	7	7	32	43	57	100
WCF 15-2 (1-2.2m)	6	7	7	15	25	48	100
WCF 15-3 (1.7-2.8m)	7	7	12	38	45	60	100
WCF 15-5 (1.7-4.1m)	4	5	12	57	72	81	100
WCF 15-6 (0.8-2m)	15	16	23	64	73	82	100
WCF 15-7 (0.9-2.4m)	4	5	10	40	58	76	100
WCF 15-7 (2.4-3m)	2	2	4	48	66	80	100
Mean	7	9	14	48	60	74	100

Sand Grades

	Fine Sand Fines: (-250u)	Medium Sand (+ 250u)	Coarse Sand (+ 1mm)
3	15	59	23
8	8	61	23
8	8	40	44
16	11	46	27
7	11	42	39
6	9	47	38
14	7	40	40
5	5	48	43
5	2	36	57
6	1	18	75
7	5	33	55
4	8	60	28
15	8	50	27
4	6	48	42
2	2	62	34
7	7	46	40



Laboratory Report



GEO Site & Testing Services Ltd

Contract Number: 33440

Client's Reference:

Report Date: **05-01-2017**

Client **Greenfield Associates**
Bellots House
Bellots Rd
Bath
BA2 3RT

Contract Title: **Wallingford**
For the attention of: **Tom Skailes**

Date Received: **07-12-2016**
Date Commenced: **07-12-2016**
Date Completed: **05-01-2017**

Test Description	Qty
Moisture Content 1377 : 1990 Part 2 : 3.2 - * UKAS	3
4 Point Liquid & Plastic Limit (LL/PL) 1377 : 1990 Part 2 : 4.3 & 5.3 - * UKAS	3
Dry Den/MC (4.5kg Rammer Method 1 Litre Mould) 1377 : 1990 Part 4 : 3.5 - * UKAS	3
Hand Vane at each compaction point (5HV's)	3
Procedure for the Determination of the Permeability of Clayey Soils in a Triaxial Cell Using the Accelerated Permeability Test Environment Agency Method P1-398/TR/2 - * UKAS	3
Disposal of Samples on Project	1

Notes: Observations and Interpretations are outside the UKAS Accreditation
* - denotes test included in laboratory scope of accreditation
- denotes test carried out by approved contractor
@ - denotes non accredited tests

This certificate is issued in accordance with the accreditation requirements of the United Kingdom Accreditation Service. The results reported herein relate only to the material supplied to the laboratory. This certificate shall not be reproduced except in full, without the prior written approval of the laboratory.

Approved Signatories:

Alex Wynn (Associate Director) - Benjamin Sharp (Contracts Manager) - Emma Sharp (Office Manager)
Paul Evans (Quality/Technical Manager) - Vaughan Edwards (Managing Director)

**Test Report: Method of the Determination of the plastic limit and plasticity index
BS 1377 : Part 2 : 1990 Method 5**

Client ref:

Location: Wallingford

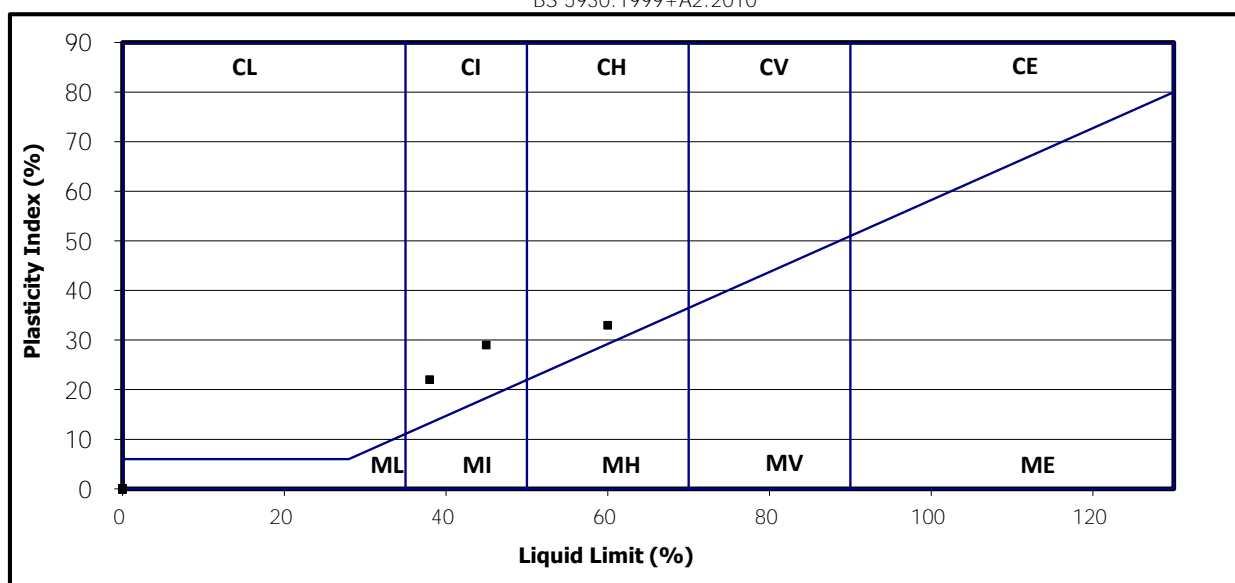
Contract Number: 33440

Hole/ Sample Number	Sample Type	Depth m	Moisture Content % Cl. 3.2	Liquid Limit % Cl. 4.3/4.4	Plastic Limit % Cl. 5.	Plasticity Index % Cl. 6.	% Passing .425mm	Remarks
GM16/N	B	N/A	35	60	27	33	96	CH High Plasticity
GM16/C	B	N/A	11	38	16	22	98	CI Intermediate Plasticity
GM16/S	B	N/A	19	45	16	29	96	CI Intermediate Plasticity

Symbols: NP : Non Plastic # : Liquid Limit and Plastic Limit Wet Sieved

PLASTICITY CHART FOR CASAGRANDE CLASSIFICATION.

BS 5930:1999+A2:2010



For and behalf of GEO Site & Testing Services Ltd

Authorised By:
Emma Sharp (Office Manager)
Date: 4.1.17



Contract Number:

Wallingford

33440

[illegible]

Note: Results on this table are in summary format and may not meet the requirements of the relevant standards, additional information is held by the laboratory



For and behalf of GEO Site & Testing Services Ltd

Authorised By:

Emma Sharp (Office Manager)

Date: 4.1.17

End



SUMMARY OF SHEAR STRENGTH TESTS (TOTAL STRESS)
(BS 1377 : PART 7 : 3 : 1990)

Client ref:

Location:

Wallingford

Contract Number:

33440

[illegible]

SYMBOLS: RM: Remoulded MS: Multistage B: Brittle P: Plastic C: Compound Vane Size : 19mm/33n



B. Sheep

Checked by:

DP Gang

Approved by:

04/01/17

Date of approval:

Dry Density/Moisture Content Relationship

BS 1377:Part 4:1990

Client ref:

Location:

Wallingford

Contract Number:

33440

Hole Number:

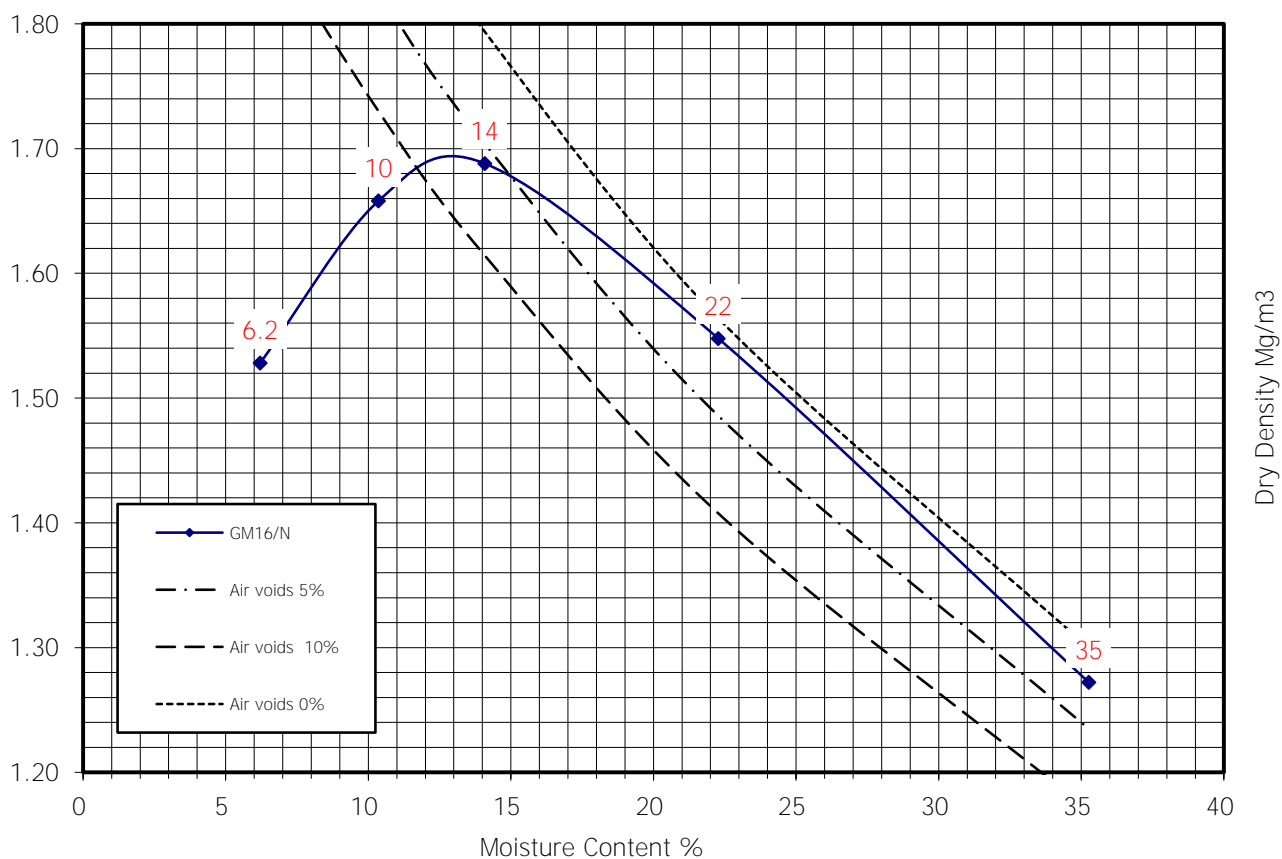
GM16/N

Sample Number:

Depth (m):

Sample Type:

B



Compaction Point:	1	2	3	4	5
Moisture Content:	6.2	10	14	22	35
Bulk Density (Mg/m ³):	1.62	1.83	1.93	1.89	1.72
Dry Density (Mg/m ³):	1.53	1.66	1.69	1.55	1.27

Initial Moisture Content:	35	Method of Compaction:	4.5KG
Particle Density (Mg/m ³):	2.4 Assumed	Material Retained on 37.5 mm Test Sieve (%):	0
Maximum Dry Density (mg/m ³):	1.69	Material Retained on 20.0 mm Test Sieve (%):	0
Optimum Moisture Content (%):	14	Sample Preparation Clause:	3.2.4.1

Remarks:



[Signature]

Checked By

Date Approved:

[Signature]

Approved By:

6.1.11



Permeability in a Triaxial Cell

as per Accelerated test (Environment Agency Report P1-398/TR/2)

Specimen Details

Borehole	GM16/N
Sample No.	
Depth	m
Date	22/12/2016
Disturbed / Undisturbed	4.5kg Recompacted

Description of Specimen

Grey silty CLAY

Initial Specimen Conditions

Height	mm	117.60
Diameter	mm	101.50
Area	mm ²	8091.37
Volume	cm ³	951.54
Mass	g	1815.90
Dry Mass	g	1578.20
Density	Mg/m ³	1.908
Dry Density	Mg/m ³	1.659
Moisture Content	%	15.1
Voids Ratio		
Specific Gravity	kN/m ³	2.65
(assumed/measured)		assumed

Final Specimen Conditions

Moisture Content	%	17.00
Density	Mg/m ³	1.94
Dry Density	Mg/m ³	1.66

Test Setup

Date started	16/12/2016
Date Finished	21/12/2016
Top Drain Used	y
Base Drain Used	y
Pressure System Number	PCell 2
Cell Number	CCell 2

DP Gans

Checked and Approved By

GSTL
Geo Site & Testing Services Limited

Wallingford

22/12/16
Date



Client Ref

Contract No

33440

Permeability in a Triaxial Cell

as per Accelerated test (Environment Agency Report P1-398/TR/2)

Specimen Details

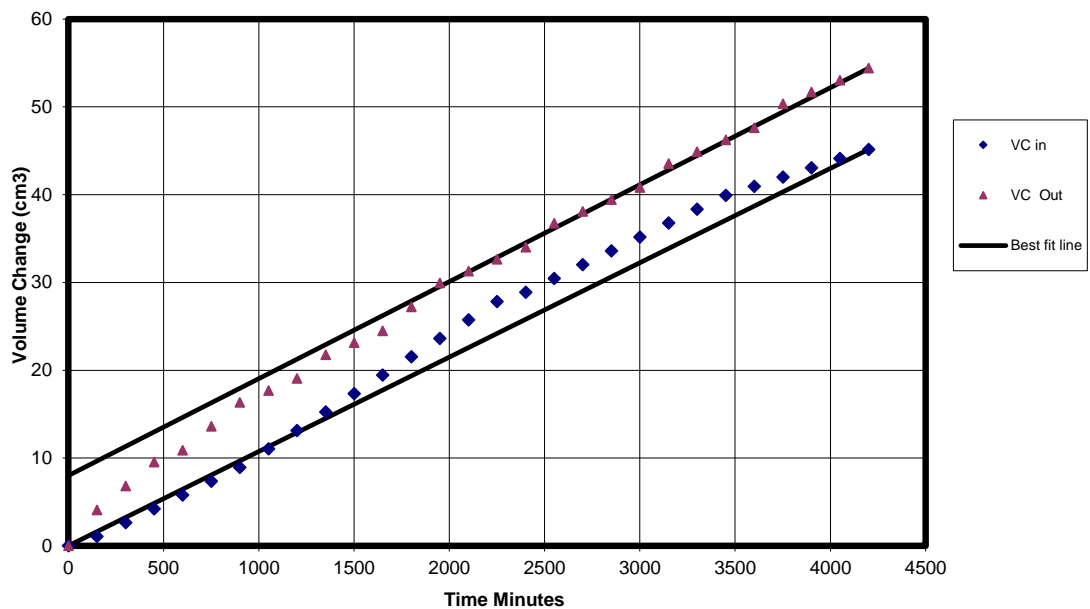
Borehole	GM16/N
Sample No.	
Depth	m
Date	22/12/2016

Permeability

Cell Pressure	kPa	550.00
Inlet Pressure	kPa	425.00
Outlet Pressure	kPa	300.00
Mean Rate of Flow	ml/min	0.01090
Average Temperature	'C	22
Outlet Pressure	kPa	300.00

B Value

Post test	
Final B value	0.94



Corrected

Vertical Permeability 1 m/s

8.6×10^{-11}

D P Gans

Checked and Approved By

22/12/16
Date



Client Ref

GSTL
GEO Site & Testing Services Limited

Wallingford

Contract No

33440

Dry Density/Moisture Content Relationship

BS 1377:Part 4:1990

Client ref:

Location:

Wallingford

Contract Number:

33440

Hole Number:

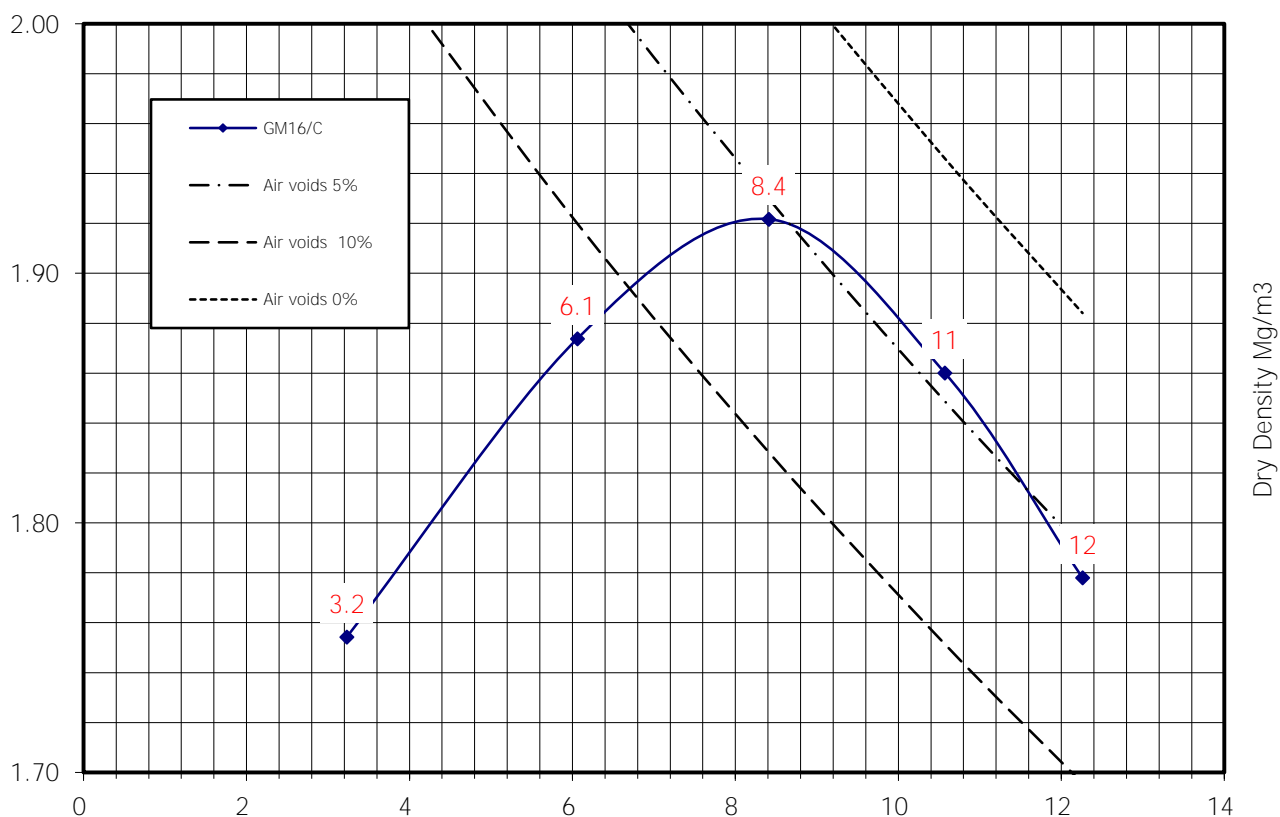
GM16/C

Sample Number:

Depth (m):

Sample Type:

B



Compaction Point:

Moisture Content %

Moisture Content:

Bulk Density (Mg/m³):

Dry Density (Mg/m³):

1	2	3	4	5
3.2	6.1	8.4	11	12
1.81	1.99	2.08	2.06	2.00
1.75	1.87	1.92	1.86	1.78

Initial Moisture Content:

11

Method of Compaction:

4.5KG

Particle Density (Mg/m³): 2.45 Assumed

Material Retained on 37.5 mm Test Sieve (%):

0

Maximum Dry Density (mg/m³):

1.92

Material Retained on 20.0 mm Test Sieve (%):

0

Optimum Moisture Content (%):

8.4

Sample Preparation Clause:

3.2.4.1

Remarks:



[Signature]

Checked By

[Signature]

Approved By:

Date Approved:

6.1.17



Permeability in a Triaxial Cell

as per Accelerated test (Environment Agency Report P1-398/TR/2)

Specimen Details

Borehole	GM16C
Sample No.	
Depth	m
Date	21/12/2016
Disturbed / Undisturbed	4.5kg Recompacted

Description of Specimen

Brown sl sandy silty CLAY

Initial Specimen Conditions

Height	mm	117.00
Diameter	mm	101.30
Area	mm ²	8059.51
Volume	cm ³	942.96
Mass	g	1964.50
Dry Mass	g	1788.50
Density	Mg/m ³	2.083
Dry Density	Mg/m ³	1.897
Moisture Content	%	9.8
Voids Ratio		
Specific Gravity	kN/m ³	2.65
(assumed/measured)		assumed

Final Specimen Conditions

Moisture Content	%	12.53
Density	Mg/m ³	2.13
Dry Density	Mg/m ³	1.90

Test Setup

Date started	16/12/2016
Date Finished	20/12/2016
Top Drain Used	y
Base Drain Used	y
Pressure System Number	PCell 4
Cell Number	CCell 4

DP Gans

Checked and Approved By

GSTL
GEO Site & Testing Services Limited

Wallingford

21/12/16
Date



Client Ref

Contract No

33440

Permeability in a Triaxial Cell

as per Accelerated test (Environment Agency Report P1-398/TR/2)

Specimen Details

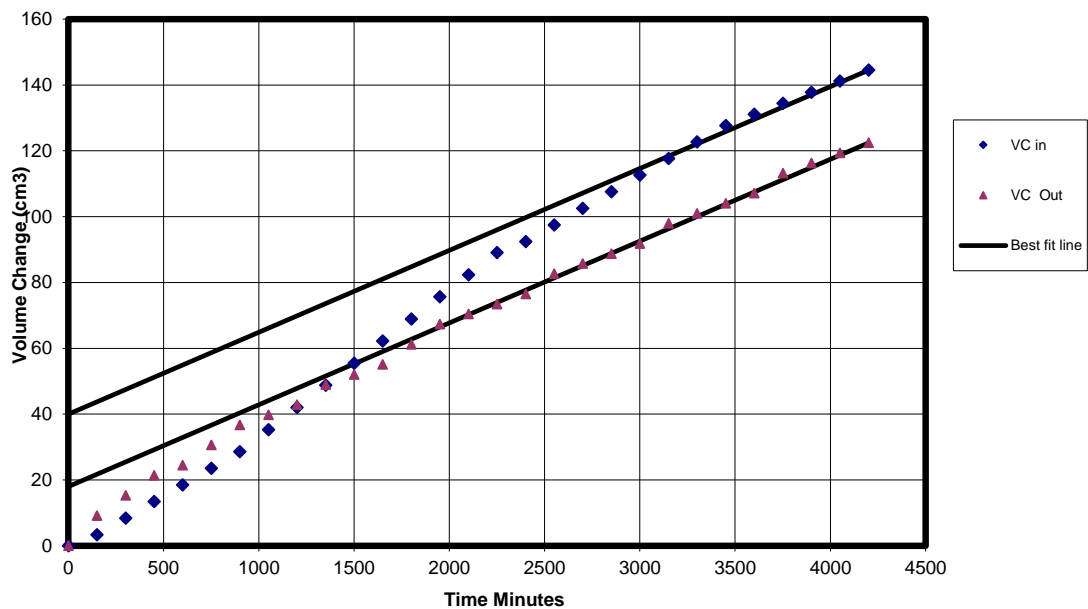
Borehole	GM16C
Sample No.	
Depth	m
Date	21/12/2016

Permeability

Cell Pressure	kPa	550.00
Inlet Pressure	kPa	425.00
Outlet Pressure	kPa	300.00
Mean Rate of Flow	ml/min	0.02487
Average Temperature	'C	22
Outlet Pressure	kPa	300.00

B Value

Post test	
Final B value	0.93



Corrected Vertical Permeability 1 m/s	1.96×10^{-10}
---	------------------------

DP Gans

Checked and Approved By

21/12/16
Date



Client Ref

GSTL
Geo Site & Testing Services Limited

Wallingford

Contract No

33440

Dry Density/Moisture Content Relationship

BS 1377:Part 4:1990

Client ref:

Location:

Wallingford

Contract Number:

33440

Hole Number:

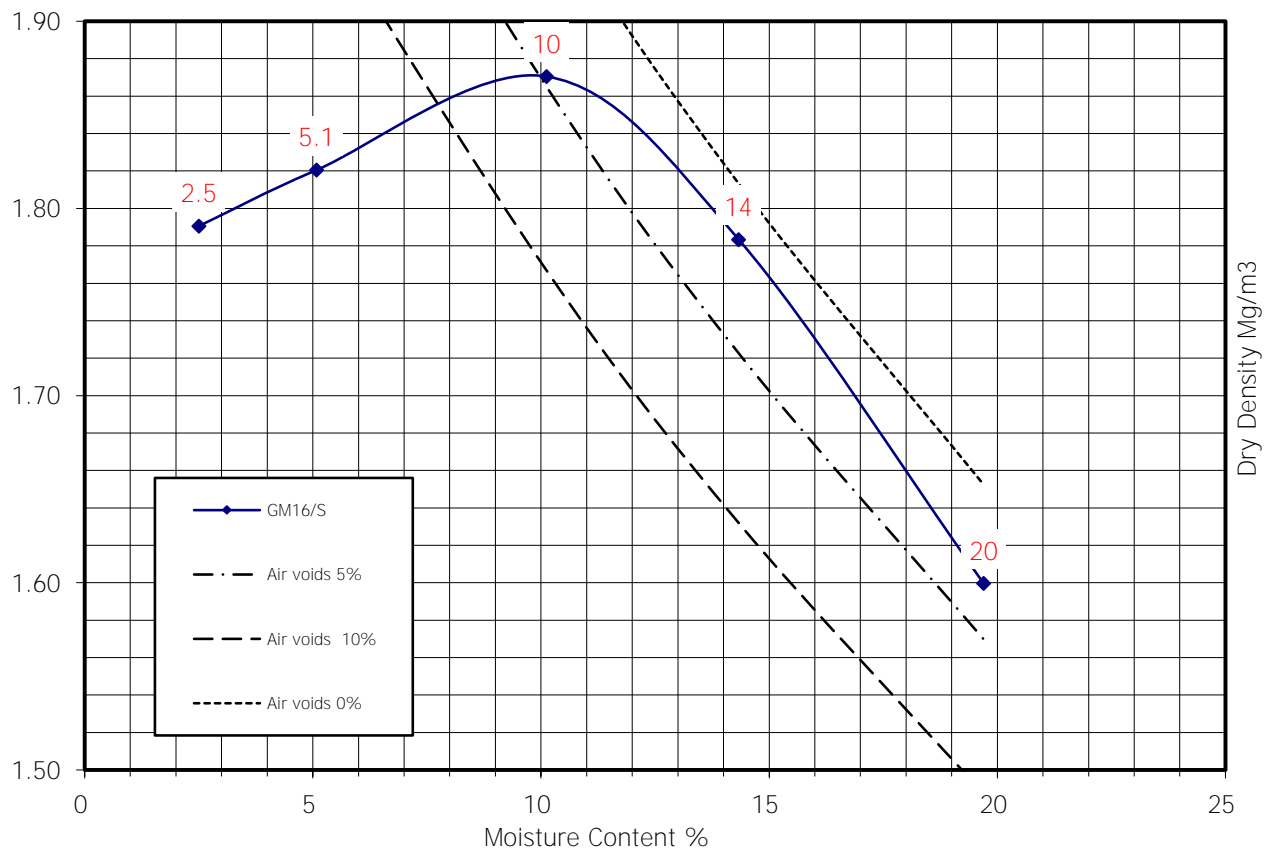
GM16/S

Sample Number:

Depth (m):

Sample Type:

B



Compaction Point:	1	2	3	4	5
Moisture Content:	2.5	5.1	10	14	20
Bulk Density (Mg/m ³):	1.84	1.91	2.06	2.04	1.91
Dry Density (Mg/m ³):	1.79	1.82	1.87	1.78	1.60

Initial Moisture Content:	20	Method of Compaction:	4.5KG
Particle Density (Mg/m ³):	2.45 Assumed	Material Retained on 37.5 mm Test Sieve (%):	0
Maximum Dry Density (mg/m ³):	1.87	Material Retained on 20.0 mm Test Sieve (%):	0
Optimum Moisture Content (%):	10	Sample Preparation Clause:	3.2.4.1

Remarks:



[Signature]

Checked By

Date Approved:

[Signature]

Approved By:

6.1.11



Permeability in a Triaxial Cell

as per Accelerated test (Environment Agency Report P1-398/TR/2)

Specimen Details

Borehole	GMC16/S
Sample No.	
Depth	m
Date	21/12/2016
Disturbed / Undisturbed	4.5kg Recompacted

Description of Specimen

Greyish brown silty CLAY

Initial Specimen Conditions

Height	mm	115.80
Diameter	mm	104.60
Area	mm ²	8593.17
Volume	cm ³	995.09
Mass	g	2049.70
Dry Mass	g	1856.20
Density	Mg/m ³	2.060
Dry Density	Mg/m ³	1.865
Moisture Content	%	10.4
Voids Ratio		
Specific Gravity	kN/m ³	2.65
(assumed/measured)		assumed

Final Specimen Conditions

Moisture Content	%	12.58
Density	Mg/m ³	2.10
Dry Density	Mg/m ³	1.87

Test Setup

Date started	16/12/2016
Date Finished	20/12/2016
Top Drain Used	y
Base Drain Used	y
Pressure System Number	PCell 1
Cell Number	CCell 1

DP Gans

Checked and Approved By

GSTL
Geotechnical & Testing Services Limited

Wallingford

21/12/16
Date



Client Ref

Contract No

33440

Permeability in a Triaxial Cell

as per Accelerated test (Environment Agency Report P1-398/TR/2)

Specimen Details

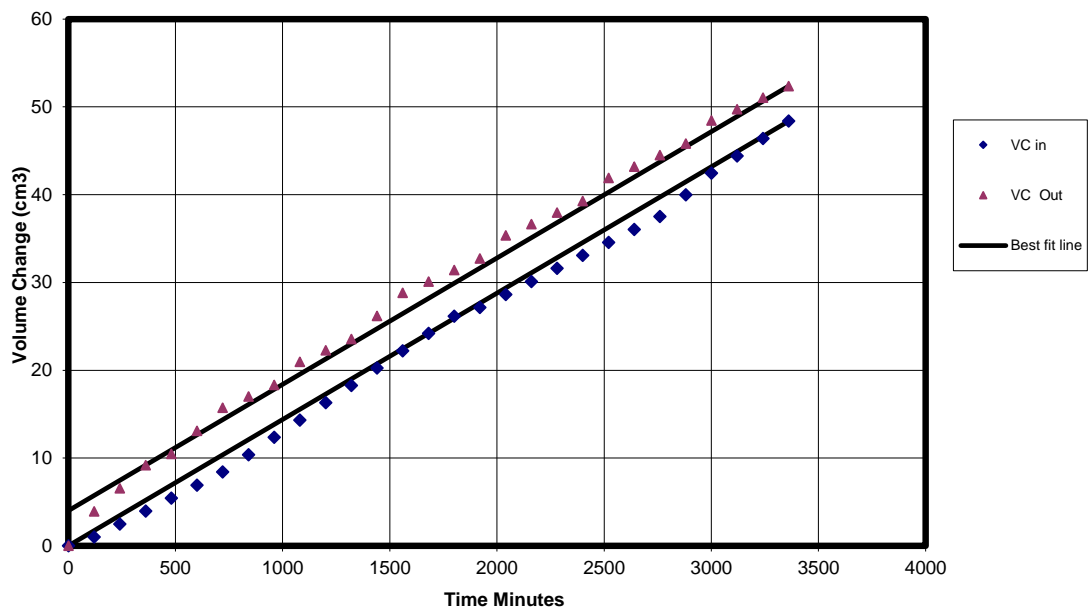
Borehole	GMC16/S
Sample No.	
Depth	m
Date	21/12/2016

Permeability

Cell Pressure	kPa	550.00
Inlet Pressure	kPa	425.00
Outlet Pressure	kPa	300.00
Mean Rate of Flow	ml/min	0.01439
Average Temperature	'C	22
Outlet Pressure	kPa	300.00

B Value

Post test	
Final B value	0.94



Corrected Vertical Permeability 1 m/s	1.05×10^{-10}
---	------------------------

DP Gans

Checked and Approved By

21/12/16
Date



Client Ref

GSTL
Geo Site & Testing Services Limited

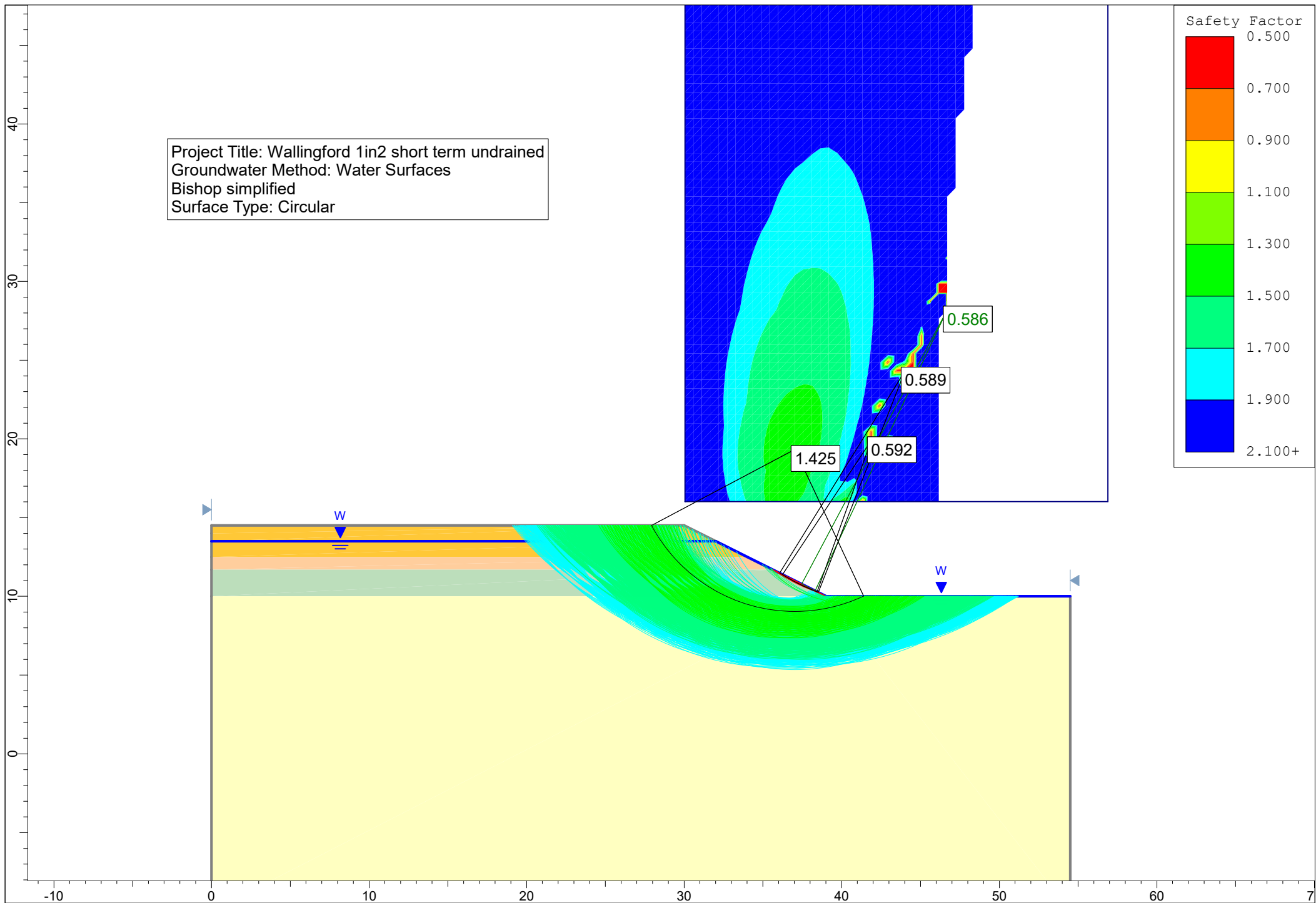
Wallingford

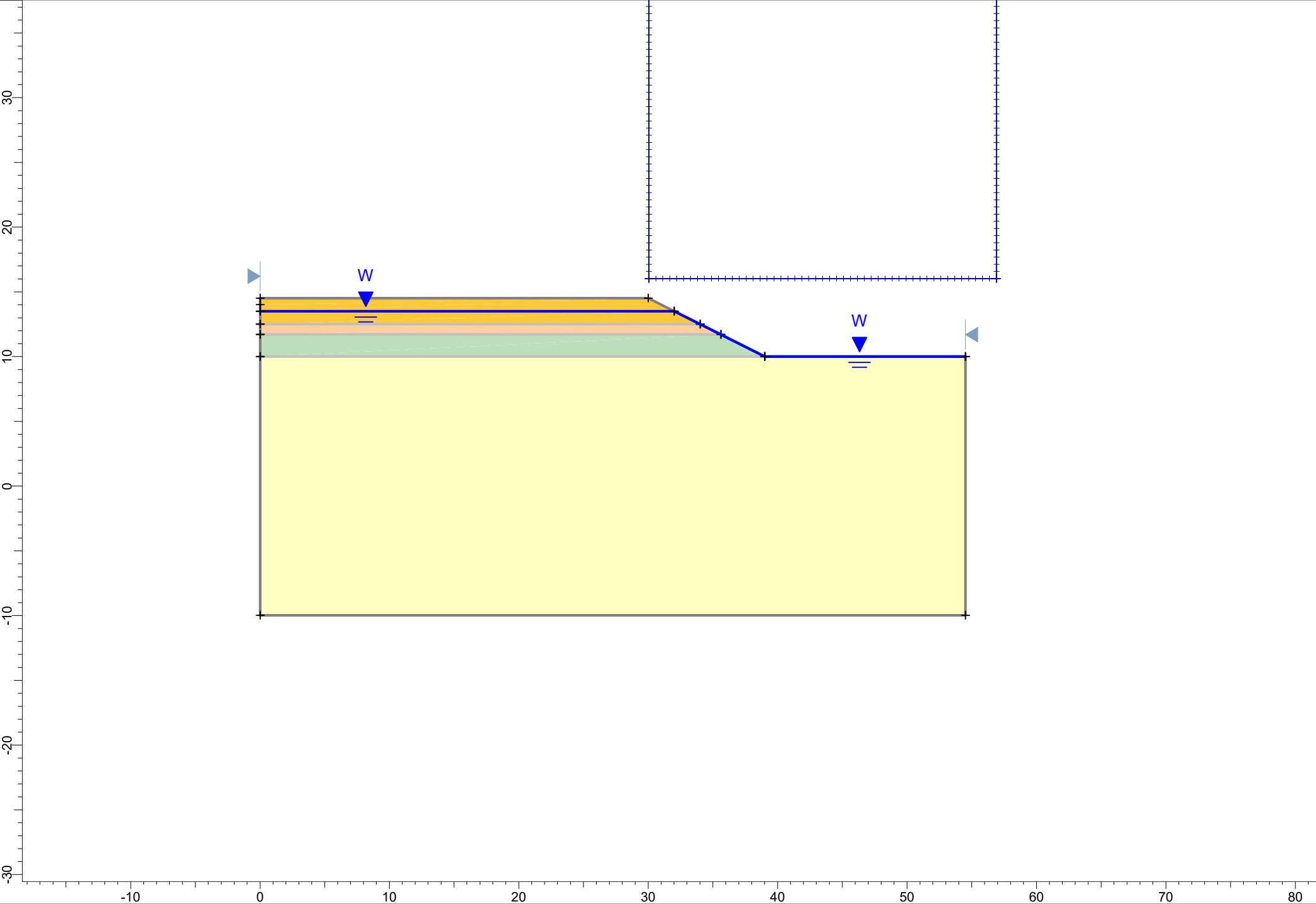
Contract No

33440

Appendix C

Slide Analysis





Slide Analysis Information

Document Name

File Name: WAL cut1in2 ST.sli

Project Settings

Project Title: Wallingford 1in2 short term undrained
Failure Direction: Left to Right
Units of Measurement: SI Units
Pore Fluid Unit Weight: 9.81 kN/m³
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Lower chalk clay
Strength Type: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion: 0 kPa
Friction Angle: 26 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: sand and gravel
Strength Type: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion: 0 kPa
Friction Angle: 37 degrees
Water Surface: Water Table

Custom Hu value: 1

Material: Peat

Strength Type: Undrained

Unit Weight: 12.5 kN/m³

Cohesion Type: Constant

Cohesion: 20 kPa

Water Surface: None

Material: Clay

Strength Type: Undrained

Unit Weight: 18 kN/m³

Cohesion Type: Constant

Cohesion: 35 kPa

Water Surface: None

Global Minimums

Method: bishop simplified

FS: 0.585612

Center: 46.691, 28.187

Radius: 19.712

Left Slip Surface Endpoint: 37.449, 10.775

Right Slip Surface Endpoint: 38.307, 10.346

Resisting Moment=0.384606 kN-m

Driving Moment=0.656758 kN-m

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 20334

Number of Invalid Surfaces: 13887

Error Codes:

Error Code -106 reported for 61 surfaces

Error Code -108 reported for 10257 surfaces

Error Code -112 reported for 214 surfaces

Error Code -1000 reported for 3355 surfaces

Error Codes

The following errors were encountered during the computation:

-106 = Average slice width is less than
 $0.0001 \times (\text{maximum horizontal extent of soil region})$.
This limitation is imposed to avoid numerical errors
which may result from too many slices, or too
small a slip region.

-108 = Total driving moment
or total driving force < 0.1 . This is to
limit the calculation of extremely high safety
factors if the driving force is very small
(0.1 is an arbitrary number).

-112 = The coefficient $M\text{-Alpha} = \cos(\alpha)(1 + \tan(\alpha)\tan(\phi)/F)$
 < 0.2 for the final iteration of the safety factor calculation. This screens out
some slip surfaces which may not be valid in the context of the analysis, in

particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

-1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

List of All Coordinates

Search Grid

30.043	16.015
56.894	16.015
56.894	49.211
30.043	49.211

Material Boundary

0.000	12.500
34.000	12.500

Material Boundary

0.000	11.700
35.600	11.700

Material Boundary

0.000	10.000
39.000	10.000

Material Boundary

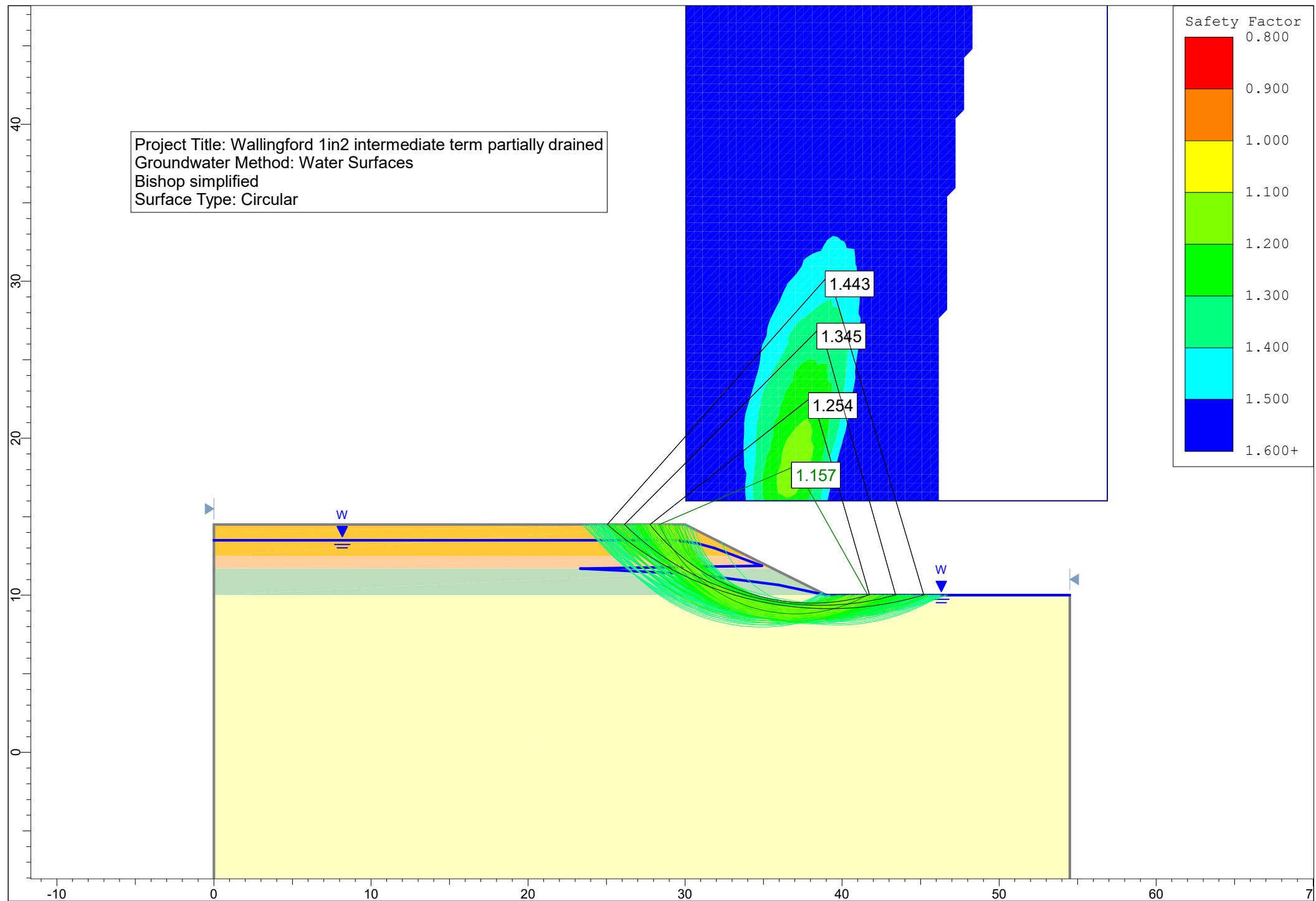
0.000	13.500
32.000	13.500

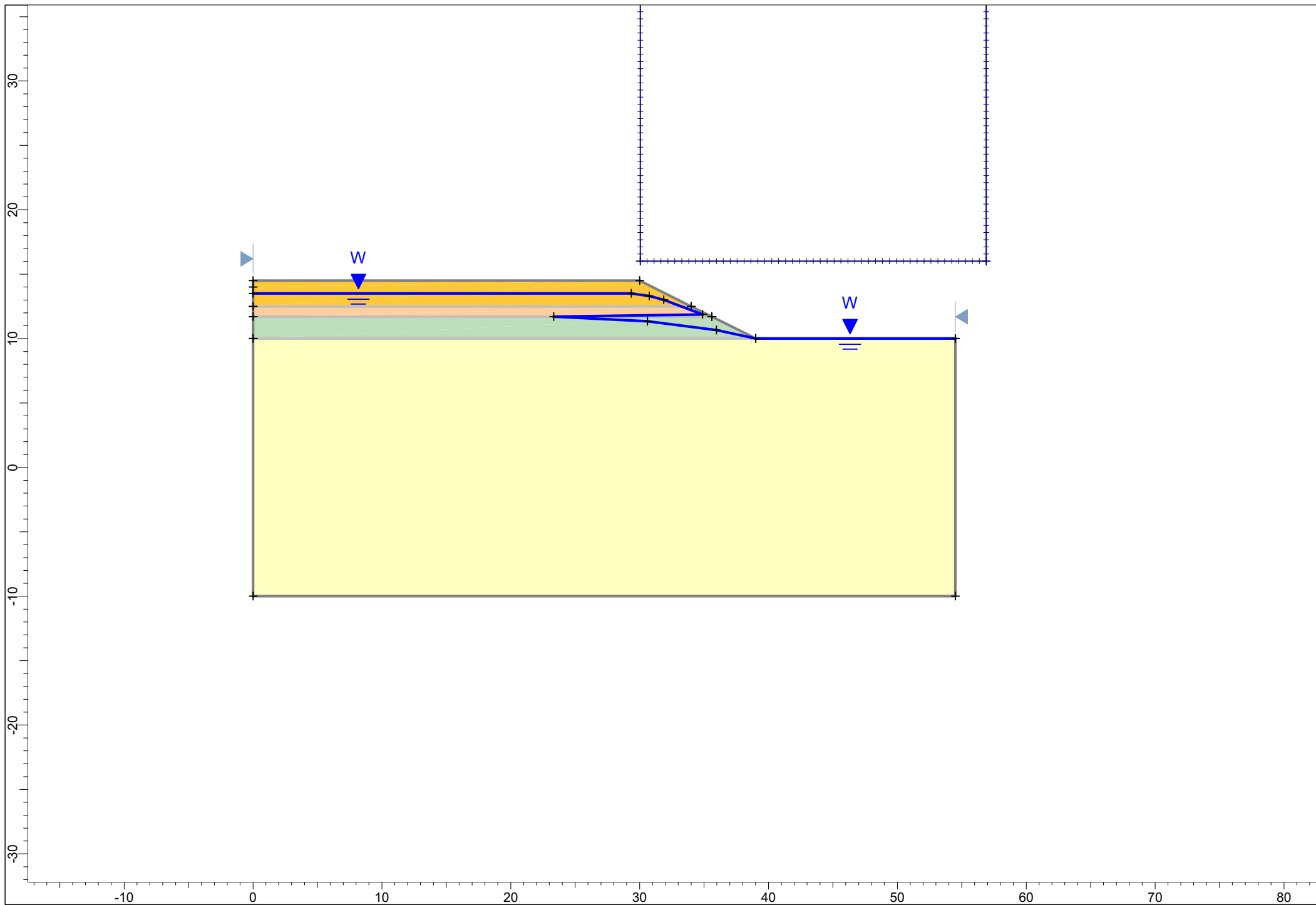
External Boundary

0.000	-9.991
54.500	-9.991
54.500	10.000
39.000	10.000
35.600	11.700
34.000	12.500
32.000	13.500
30.000	14.500
0.000	14.500
0.000	14.000
0.000	13.500
0.000	12.500
0.000	11.700
0.000	10.000

Water Table

0.000	13.500
32.000	13.500
39.000	10.000
54.500	10.000





Slide Analysis Information

Document Name

File Name: WAL cut1in2 MT.sli

Project Settings

Project Title: Wallingford 1in2 intermediate term partially drained
Failure Direction: Left to Right
Units of Measurement: SI Units
Pore Fluid Unit Weight: 9.81 kN/m³
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Lower chalk clay
Strength Type: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion: 0 kPa
Friction Angle: 26 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: sand and gravel
Strength Type: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion: 0 kPa
Friction Angle: 37 degrees
Water Surface: Water Table

Custom Hu value: 1

Material: Peat

Strength Type: Mohr-Coulomb

Unit Weight: 12.5 kN/m³

Cohesion: 10 kPa

Friction Angle: 12 degrees

Water Surface: Water Table

Custom Hu value: 1

Material: Clay

Strength Type: Mohr-Coulomb

Unit Weight: 18 kN/m³

Cohesion: 15 kPa

Friction Angle: 12 degrees

Water Surface: Water Table

Custom Hu value: 1

List of All Coordinates

Material Boundary

0.000	12.500
34.000	12.500

Material Boundary

0.000	11.700
35.600	11.700

Material Boundary

0.000	10.000
39.000	10.000

External Boundary

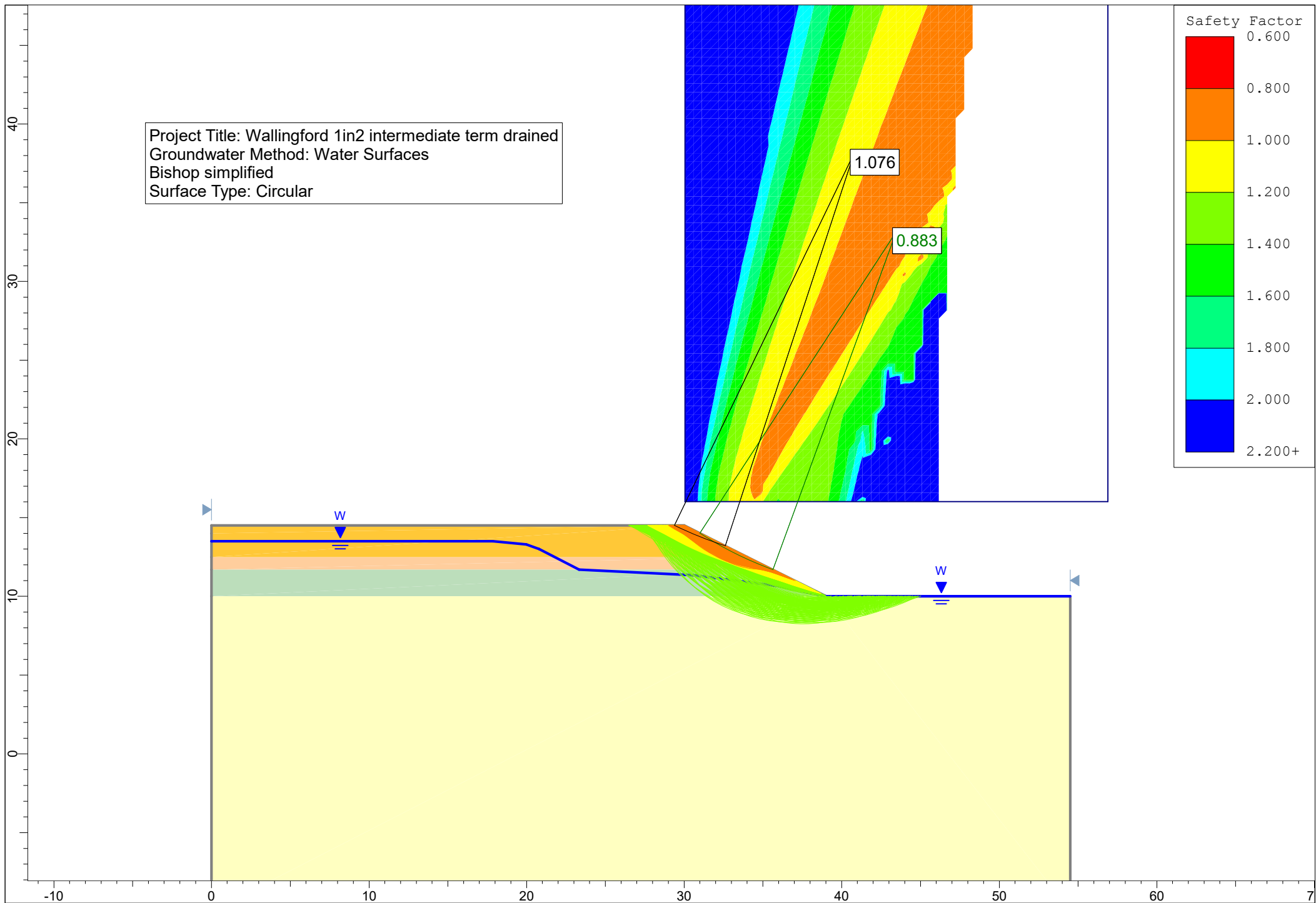
0.000	-9.991
54.500	-9.991
54.500	10.000
39.000	10.000
35.600	11.700
34.000	12.500
30.000	14.500
0.000	14.500
0.000	14.000
0.000	12.500
0.000	11.700
0.000	10.000

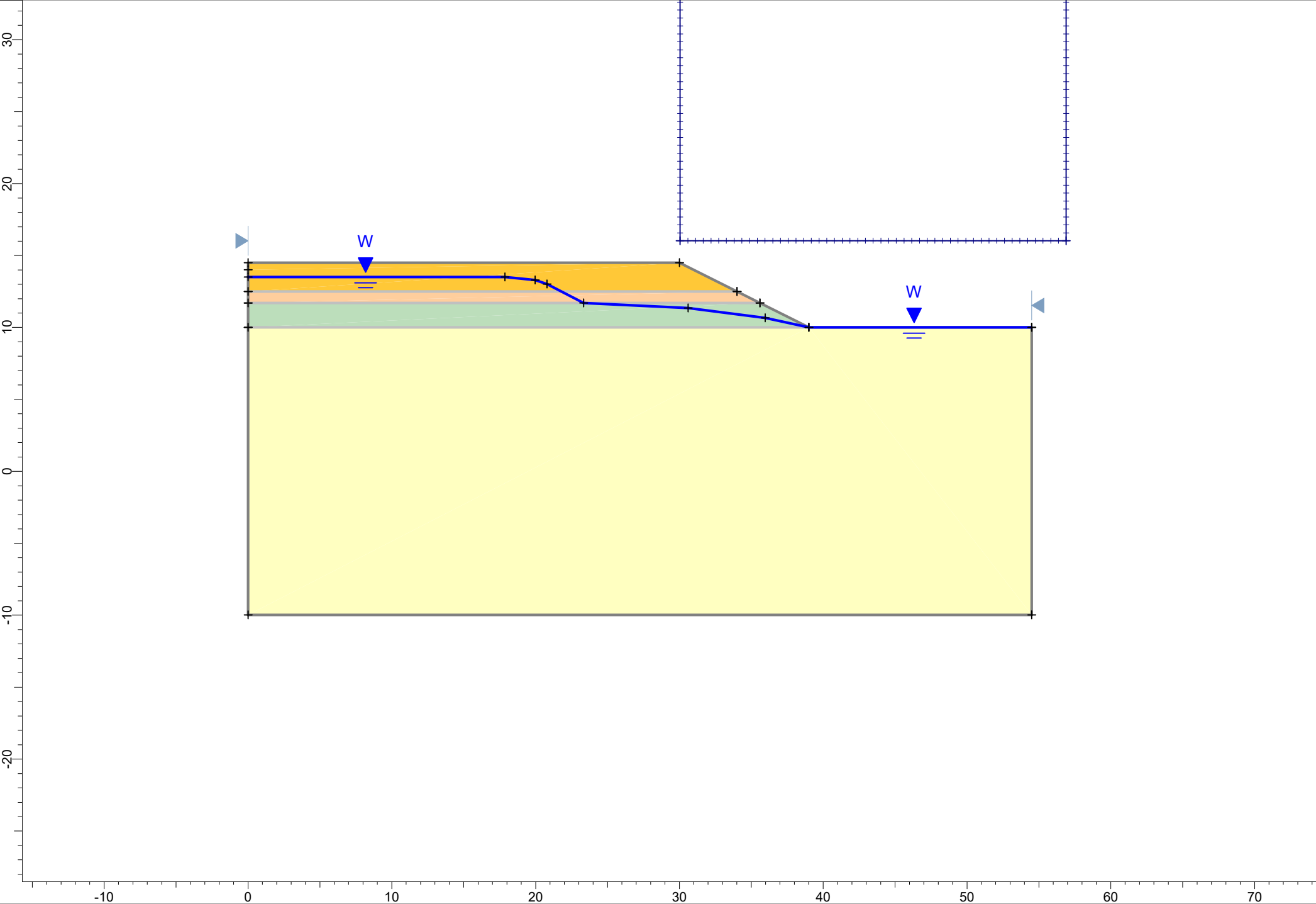
Water Table

0.000	13.500
29.342	13.500
30.743	13.308
31.860	13.008
34.886	11.870
23.334	11.700
30.608	11.344
35.961	10.657
39.000	10.000
54.500	10.000

Search Grid

30.043	16.015
56.894	16.015
56.894	49.211
30.043	49.211





Slide Analysis Information

Document Name

File Name: WAL cut1in2 IT dewatered.sli

Project Settings

Project Title: Wallingford 1in2 intermediate term drained
Failure Direction: Left to Right
Units of Measurement: SI Units
Pore Fluid Unit Weight: 9.81 kN/m³
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Lower chalk clay
Strength Type: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion: 0 kPa
Friction Angle: 26 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: sand and gravel
Strength Type: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion: 0 kPa
Friction Angle: 37 degrees
Water Surface: Water Table

Custom Hu value: 1

Material: Peat

Strength Type: Mohr-Coulomb

Unit Weight: 12.5 kN/m³

Cohesion: 0 kPa

Friction Angle: 24 degrees

Water Surface: Water Table

Custom Hu value: 1

Material: Clay

Strength Type: Mohr-Coulomb

Unit Weight: 18 kN/m³

Cohesion: 0 kPa

Friction Angle: 24 degrees

Water Surface: Water Table

Custom Hu value: 1

List of All Coordinates

Material Boundary

0.000	12.500
34.000	12.500

Material Boundary

0.000	11.700
35.600	11.700

Material Boundary

0.000	10.000
39.000	10.000

External Boundary

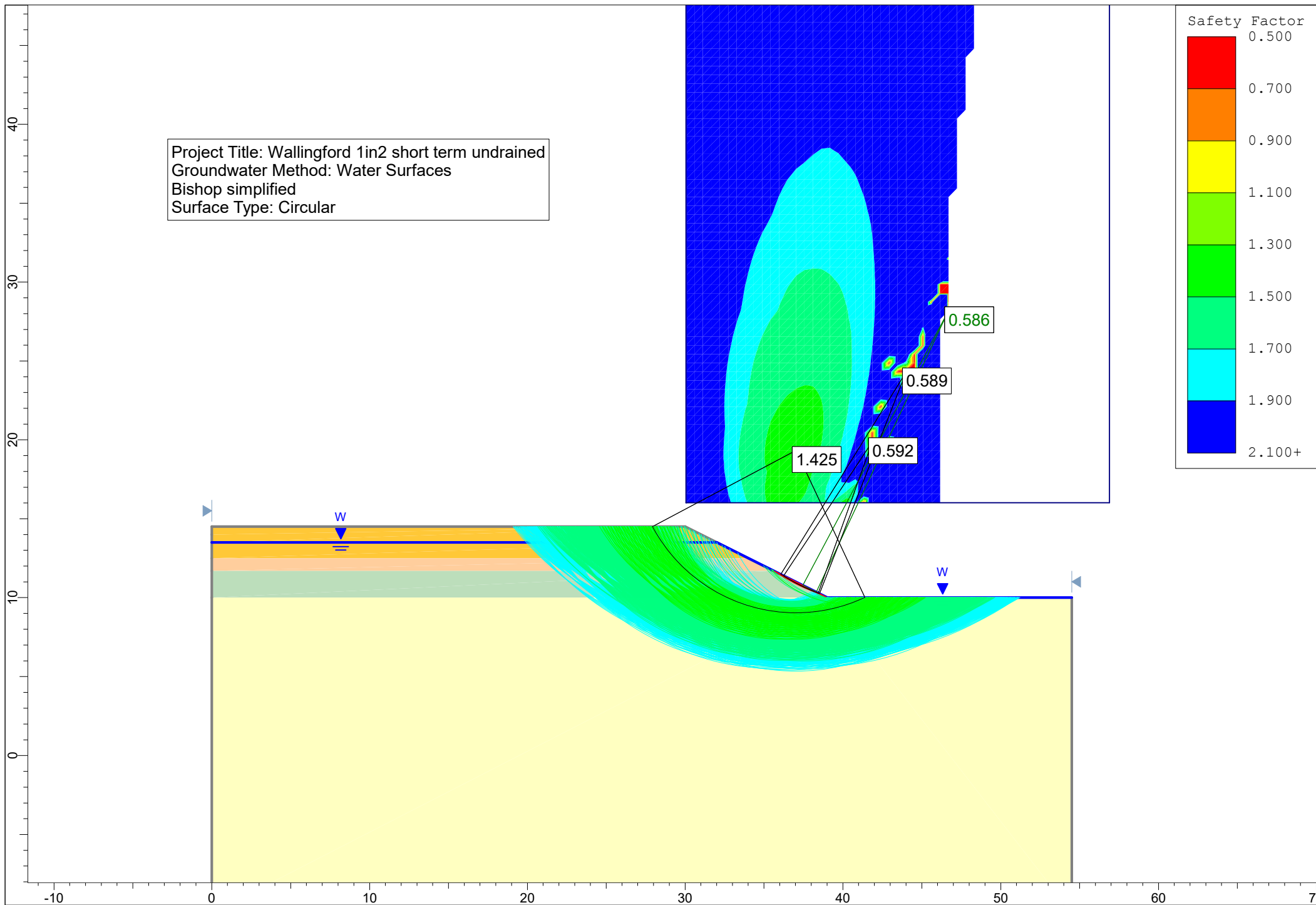
0.000	-9.991
54.500	-9.991
54.500	10.000
39.000	10.000
35.600	11.700
34.000	12.500
30.000	14.500
0.000	14.500
0.000	14.000
0.000	12.500
0.000	11.700
0.000	10.000

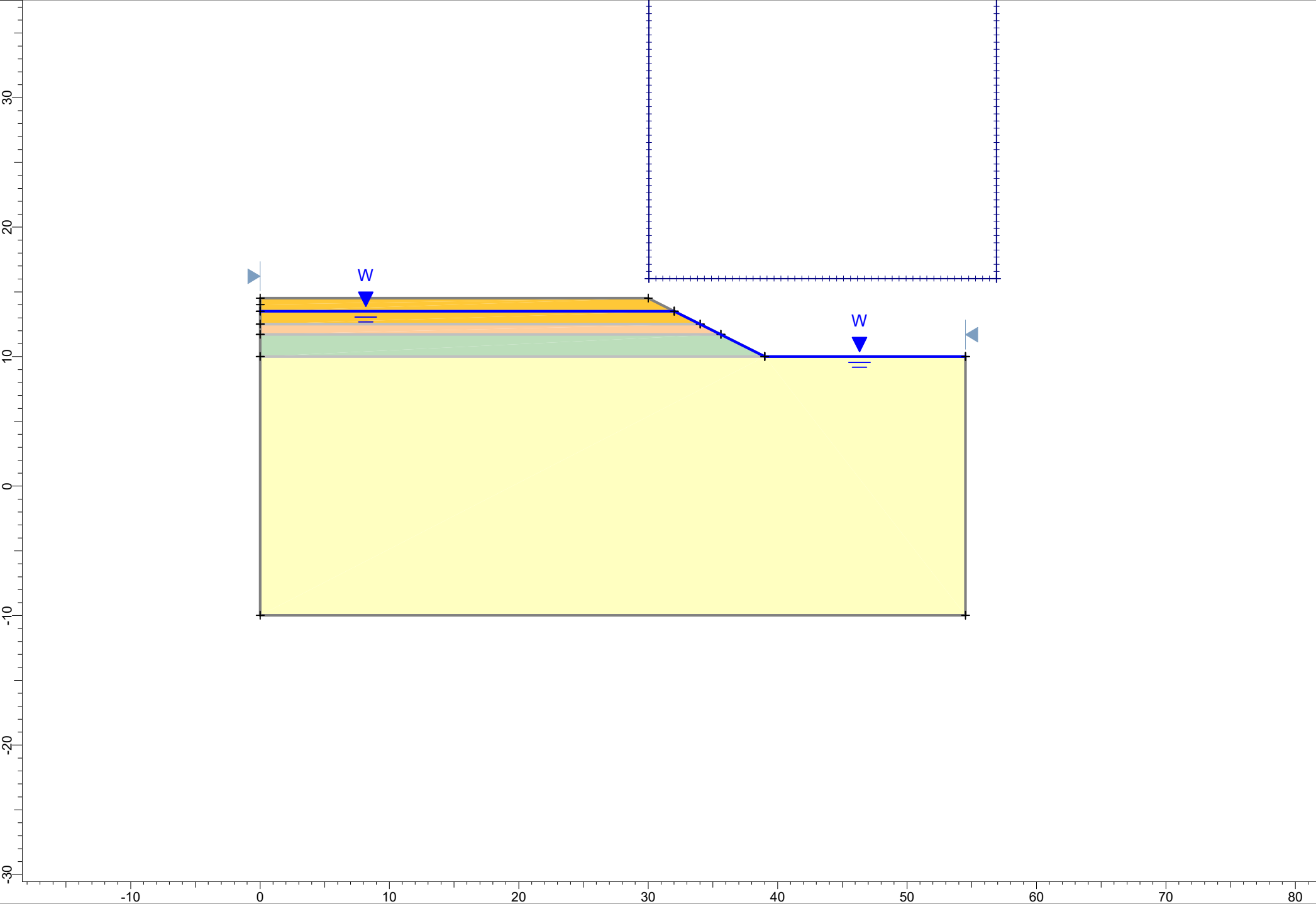
Water Table

0.000	13.500
17.858	13.500
19.970	13.290
20.785	13.008
23.334	11.700
30.608	11.344
35.961	10.657
39.000	10.000
54.500	10.000

Search Grid

30.043	16.015
56.894	16.015
56.894	49.211
30.043	49.211





Slide Analysis Information

Document Name

File Name: WAL cut1in2 ST.sli

Project Settings

Project Title: Wallingford 1in2 short term undrained
Failure Direction: Left to Right
Units of Measurement: SI Units
Pore Fluid Unit Weight: 9.81 kN/m³
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Lower chalk clay
Strength Type: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion: 0 kPa
Friction Angle: 26 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: sand and gravel
Strength Type: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion: 0 kPa
Friction Angle: 37 degrees
Water Surface: Water Table

Custom Hu value: 1

Material: Peat

Strength Type: Undrained

Unit Weight: 12.5 kN/m³

Cohesion Type: Constant

Cohesion: 20 kPa

Water Surface: None

Material: Clay

Strength Type: Undrained

Unit Weight: 18 kN/m³

Cohesion Type: Constant

Cohesion: 35 kPa

Water Surface: None

Global Minimums

Method: bishop simplified

FS: 0.585612

Center: 46.691, 28.187

Radius: 19.712

Left Slip Surface Endpoint: 37.449, 10.775

Right Slip Surface Endpoint: 38.307, 10.346

Resisting Moment=0.384606 kN-m

Driving Moment=0.656758 kN-m

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 20334

Number of Invalid Surfaces: 13887

Error Codes:

Error Code -106 reported for 61 surfaces

Error Code -108 reported for 10257 surfaces

Error Code -112 reported for 214 surfaces

Error Code -1000 reported for 3355 surfaces

Error Codes

The following errors were encountered during the computation:

-106 = Average slice width is less than
 $0.0001 * (\text{maximum horizontal extent of soil region})$.
This limitation is imposed to avoid numerical errors
which may result from too many slices, or too
small a slip region.

-108 = Total driving moment
or total driving force < 0.1 . This is to
limit the calculation of extremely high safety
factors if the driving force is very small
(0.1 is an arbitrary number).

-112 = The coefficient $M\text{-Alpha} = \cos(\alpha)(1 + \tan(\alpha)\tan(\phi)/F)$
 < 0.2 for the final iteration of the safety factor calculation. This screens out
some slip surfaces which may not be valid in the context of the analysis, in

particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

-1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

List of All Coordinates

Search Grid

30.043	16.015
56.894	16.015
56.894	49.211
30.043	49.211

Material Boundary

0.000	12.500
34.000	12.500

Material Boundary

0.000	11.700
35.600	11.700

Material Boundary

0.000	10.000
39.000	10.000

Material Boundary

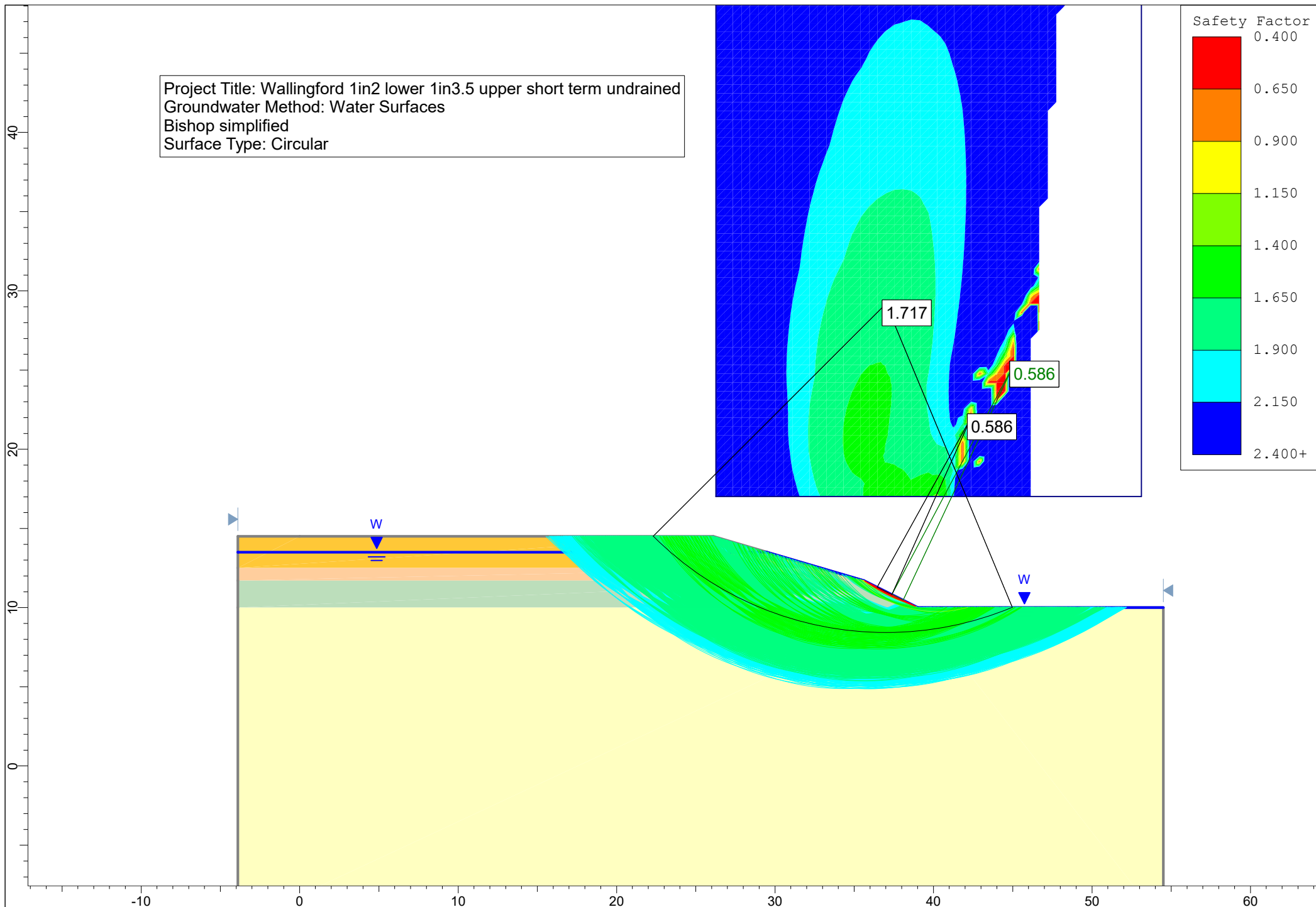
0.000	13.500
32.000	13.500

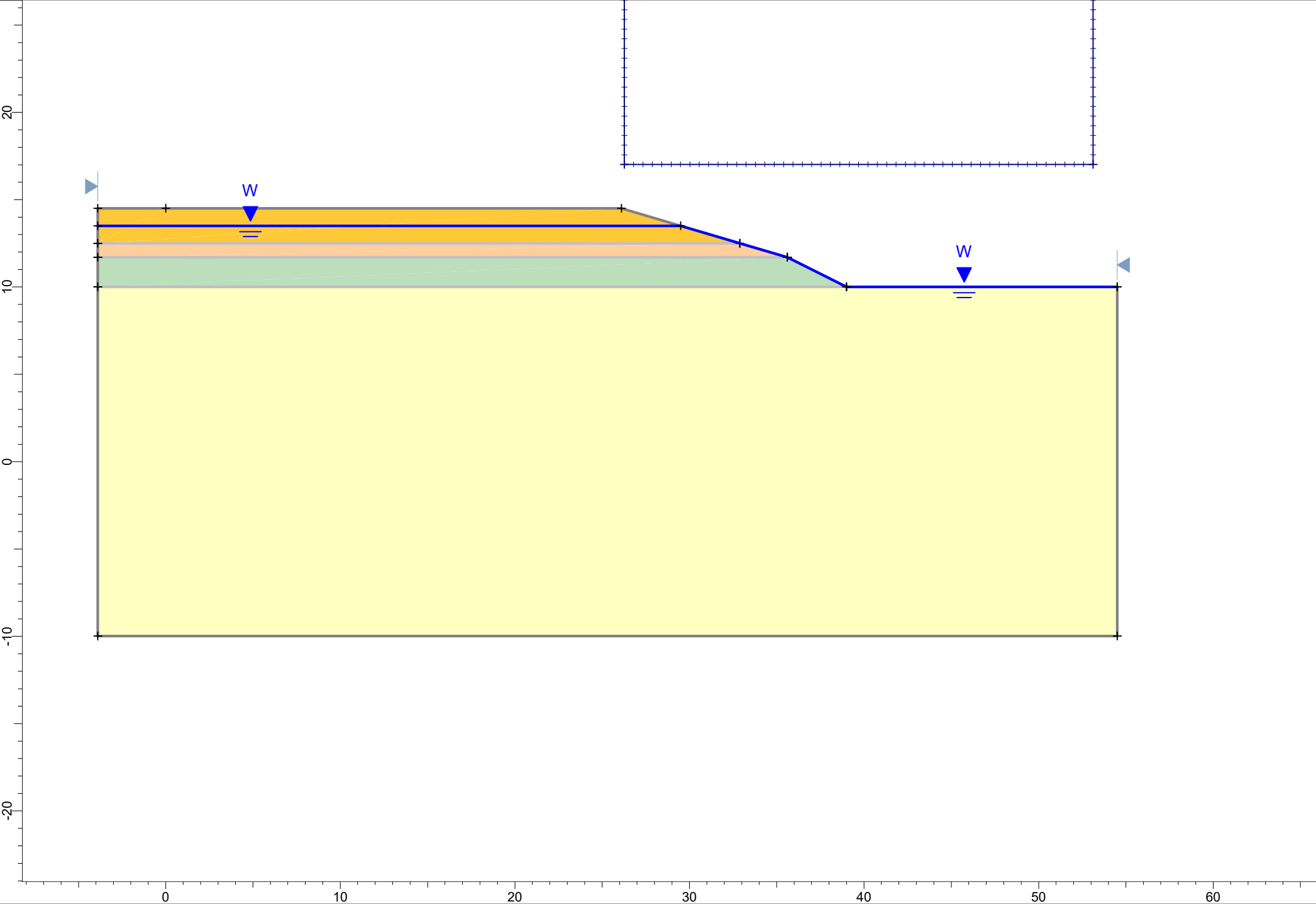
External Boundary

0.000	-9.991
54.500	-9.991
54.500	10.000
39.000	10.000
35.600	11.700
34.000	12.500
32.000	13.500
30.000	14.500
0.000	14.500
0.000	14.000
0.000	13.500
0.000	12.500
0.000	11.700
0.000	10.000

Water Table

0.000	13.500
32.000	13.500
39.000	10.000
54.500	10.000





Slide Analysis Information

Document Name

File Name: WAL cut 1in3.5 upper ST.sli

Project Settings

Project Title: Wallingford 1in2 lower 1in3.5 upper short term undrained
Failure Direction: Left to Right
Units of Measurement: SI Units
Pore Fluid Unit Weight: 9.81 kN/m³
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Lower chalk clay
Strength Type: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion: 0 kPa
Friction Angle: 26 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: sand and gravel
Strength Type: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion: 0 kPa
Friction Angle: 37 degrees
Water Surface: Water Table

Custom Hu value: 1

Material: Peat

Strength Type: Undrained

Unit Weight: 12.5 kN/m³

Cohesion Type: Constant

Cohesion: 20 kPa

Water Surface: None

Material: Clay

Strength Type: Undrained

Unit Weight: 18 kN/m³

Cohesion Type: Constant

Cohesion: 35 kPa

Water Surface: None

Global Minimums

Method: bishop simplified

FS: 0.585616

Center: 45.058, 25.316

Radius: 16.413

Left Slip Surface Endpoint: 37.361, 10.820

Right Slip Surface Endpoint: 38.080, 10.460

Resisting Moment=0.226806 kN-m

Driving Moment=0.387294 kN-m

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 25045

Number of Invalid Surfaces: 9176

Error Codes:

Error Code -103 reported for 3 surfaces

Error Code -106 reported for 11 surfaces

Error Code -108 reported for 9032 surfaces

Error Code -112 reported for 130 surfaces

Error Codes

The following errors were encountered during the computation:

-103 = Two surface / slope intersections, but one or more surface / nonslope external polygon intersections lie between them. This usually occurs when the slip surface extends past the bottom of the soil region, but may also occur on a benched slope model with two sets of Slope Limits.

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.

-108 = Total driving moment or total driving force < 0.1. This is to

limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-112 = The coefficient $M\text{-}\alpha = \cos(\alpha)(1 + \tan(\alpha)\tan(\phi))/F$
< 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

List of All Coordinates

Search Grid

26.263	17.017
53.114	17.017
53.114	50.212
26.263	50.212

Material Boundary

-3.900	12.500
32.886	12.500

Material Boundary

-3.900	11.700
35.600	11.700

Material Boundary

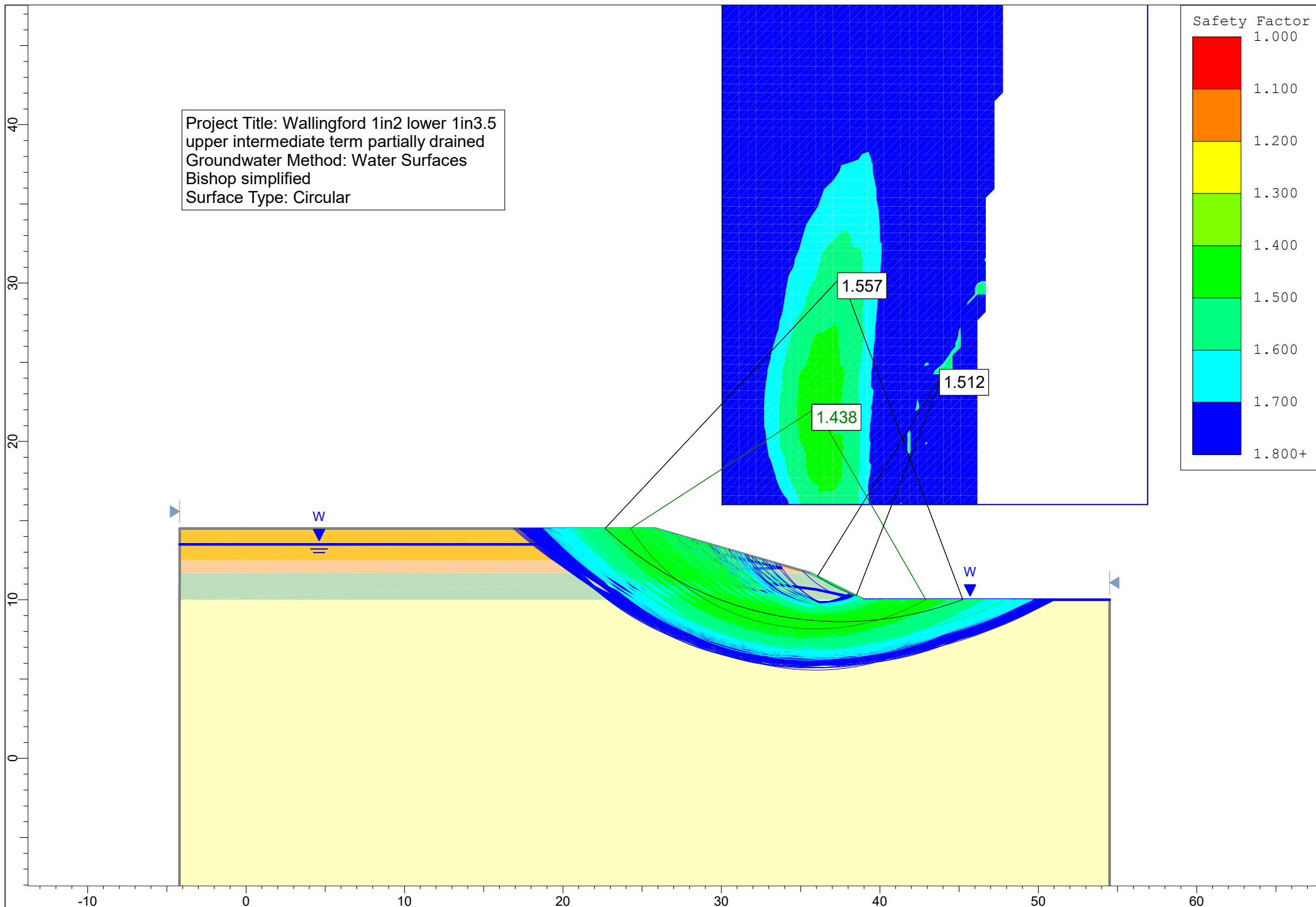
-3.900	10.000
39.000	10.000

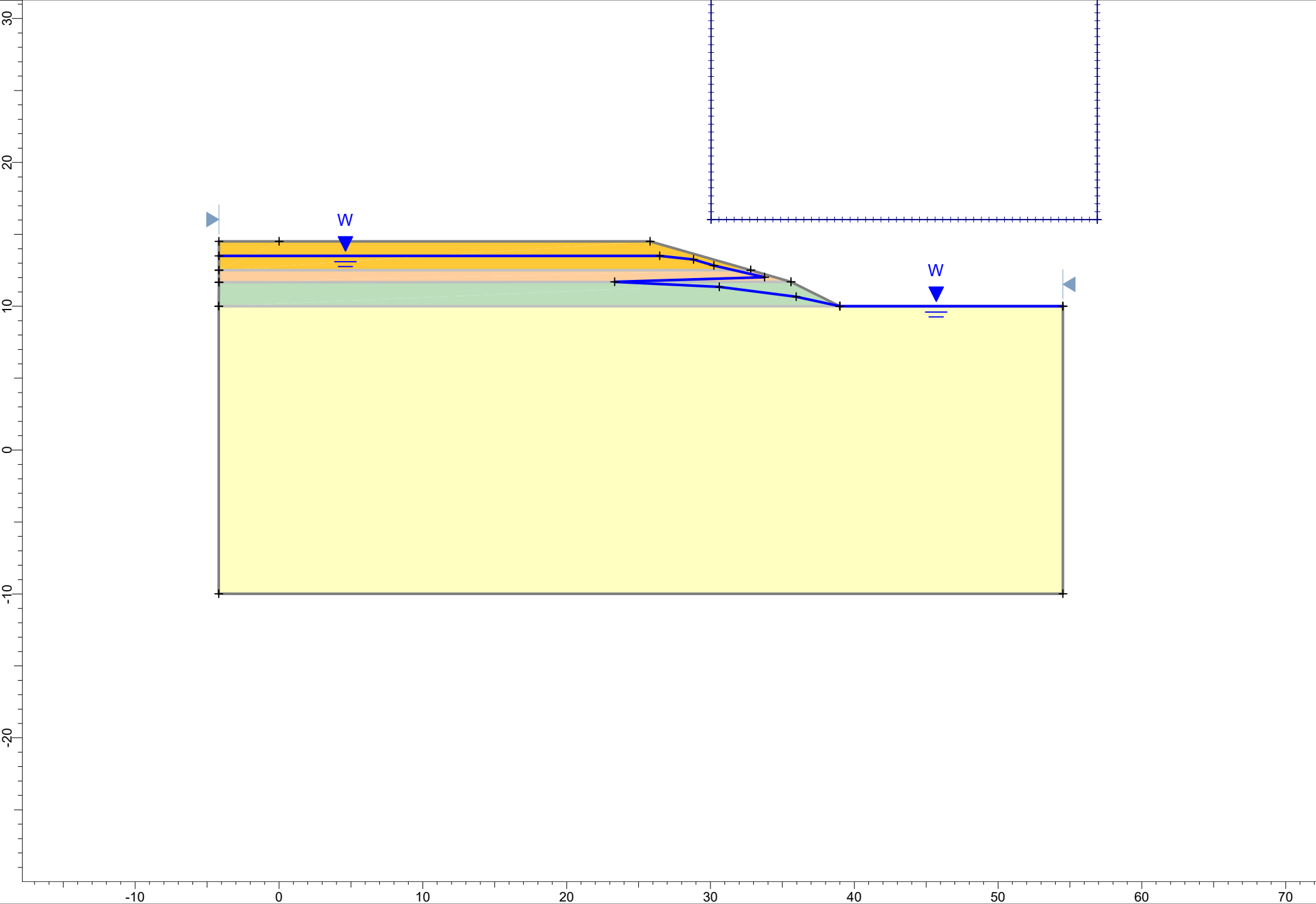
External Boundary

-3.900	-9.991
54.500	-9.991
54.500	10.000
39.000	10.000
35.600	11.700
32.886	12.500
26.100	14.500
0.000	14.500
-3.900	14.500
-3.900	12.500
-3.900	11.700
-3.900	10.000

Water Table

-3.900	13.500
29.493	13.500
35.600	11.700
39.000	10.000
54.500	10.000





Slide Analysis Information

Document Name

File Name: WAL cut1in3.5 MT.sli

Project Settings

Project Title: Wallingford 1in2 lower 1in3.5 upper intermediate term partially drained
Failure Direction: Left to Right
Units of Measurement: SI Units
Pore Fluid Unit Weight: 9.81 kN/m³
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Lower chalk clay
Strength Type: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion: 0 kPa
Friction Angle: 26 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: sand and gravel
Strength Type: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion: 0 kPa
Friction Angle: 37 degrees
Water Surface: Water Table

Custom Hu value: 1

Material: Peat

Strength Type: Mohr-Coulomb

Unit Weight: 12.5 kN/m³

Cohesion: 10 kPa

Friction Angle: 12 degrees

Water Surface: Water Table

Custom Hu value: 1

Material: Clay

Strength Type: Mohr-Coulomb

Unit Weight: 18 kN/m³

Cohesion: 15 kPa

Friction Angle: 12 degrees

Water Surface: Water Table

Custom Hu value: 1

Global Minimums

Method: bishop simplified

FS: 1.438410

Center: 35.951, 22.101

Radius: 13.953

Left Slip Surface Endpoint: 24.249, 14.500

Right Slip Surface Endpoint: 42.898, 10.000

Resisting Moment=4097.21 kN-m

Driving Moment=2848.43 kN-m

Valid / Invalid Surfaces

Method: bishop simplified

Number of Valid Surfaces: 20289

Number of Invalid Surfaces: 13932

Error Codes:

Error Code -105 reported for 1 surface

Error Code -106 reported for 70 surfaces

Error Code -108 reported for 10463 surfaces

Error Code -112 reported for 43 surfaces

Error Code -1000 reported for 3355 surfaces

Error Codes

The following errors were encountered during the computation:

-105 = More than two surface / slope intersections with no valid slip surface.

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety

factors if the driving force is very small
(0.1 is an arbitrary number).

-112 = The coefficient $M\text{-}\alpha = \cos(\alpha)(1 + \tan(\alpha)\tan(\phi))/F$
< 0.2 for the final iteration of the safety factor calculation. This screens out
some slip surfaces which may not be valid in the context of the analysis, in
particular, deep seated slip surfaces with many high negative base angle
slices in the passive zone.

-1000 = No valid slip surfaces are generated
at a grid center. Unable to draw a surface.

List of All Coordinates

Search Grid

30.043	16.015
56.894	16.015
56.894	49.211
30.043	49.211

Material Boundary

-4.184	12.500
32.800	12.500

Material Boundary

-4.184	11.669
35.600	11.700

Material Boundary

-4.200	10.000
39.000	10.000

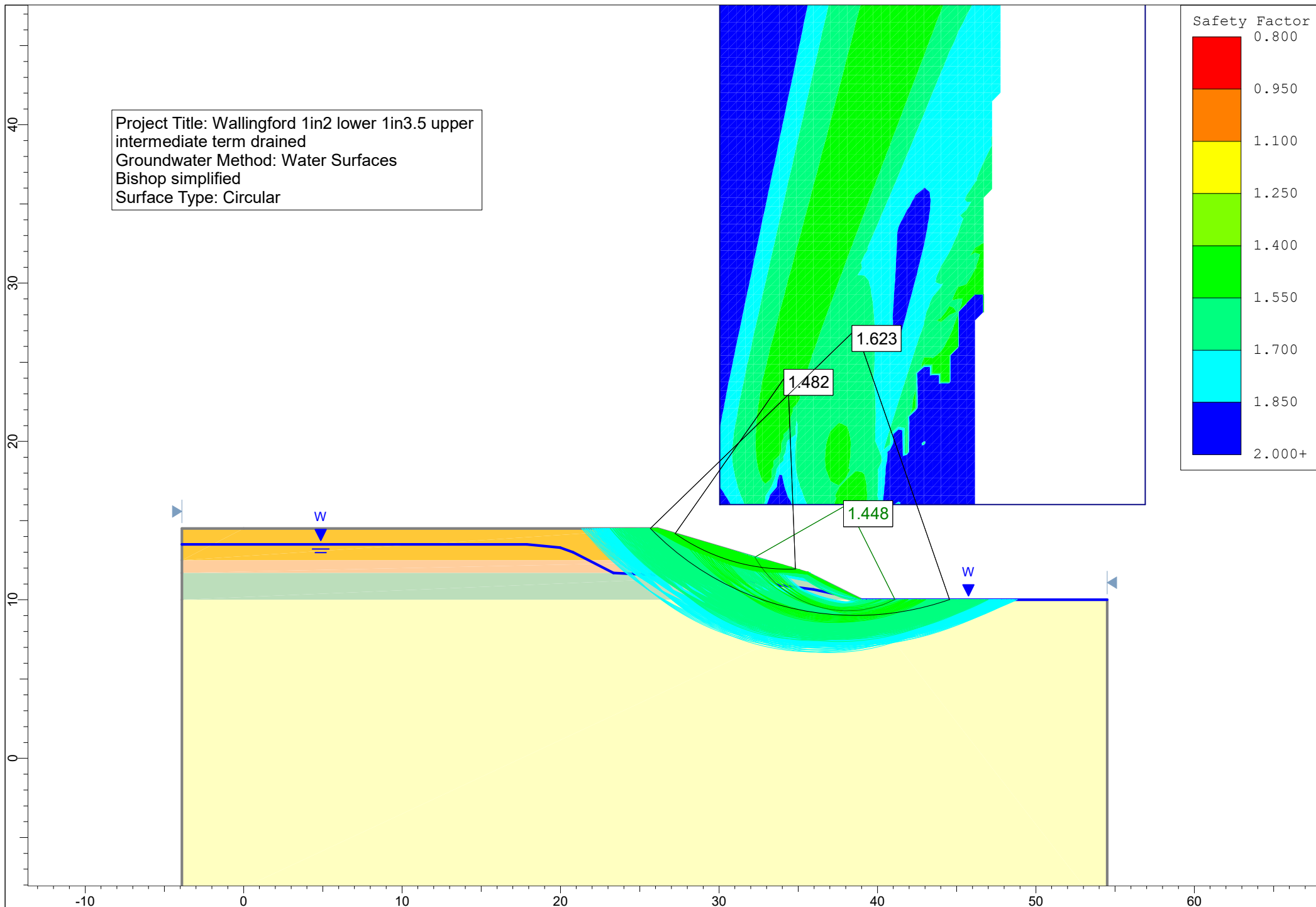
External Boundary

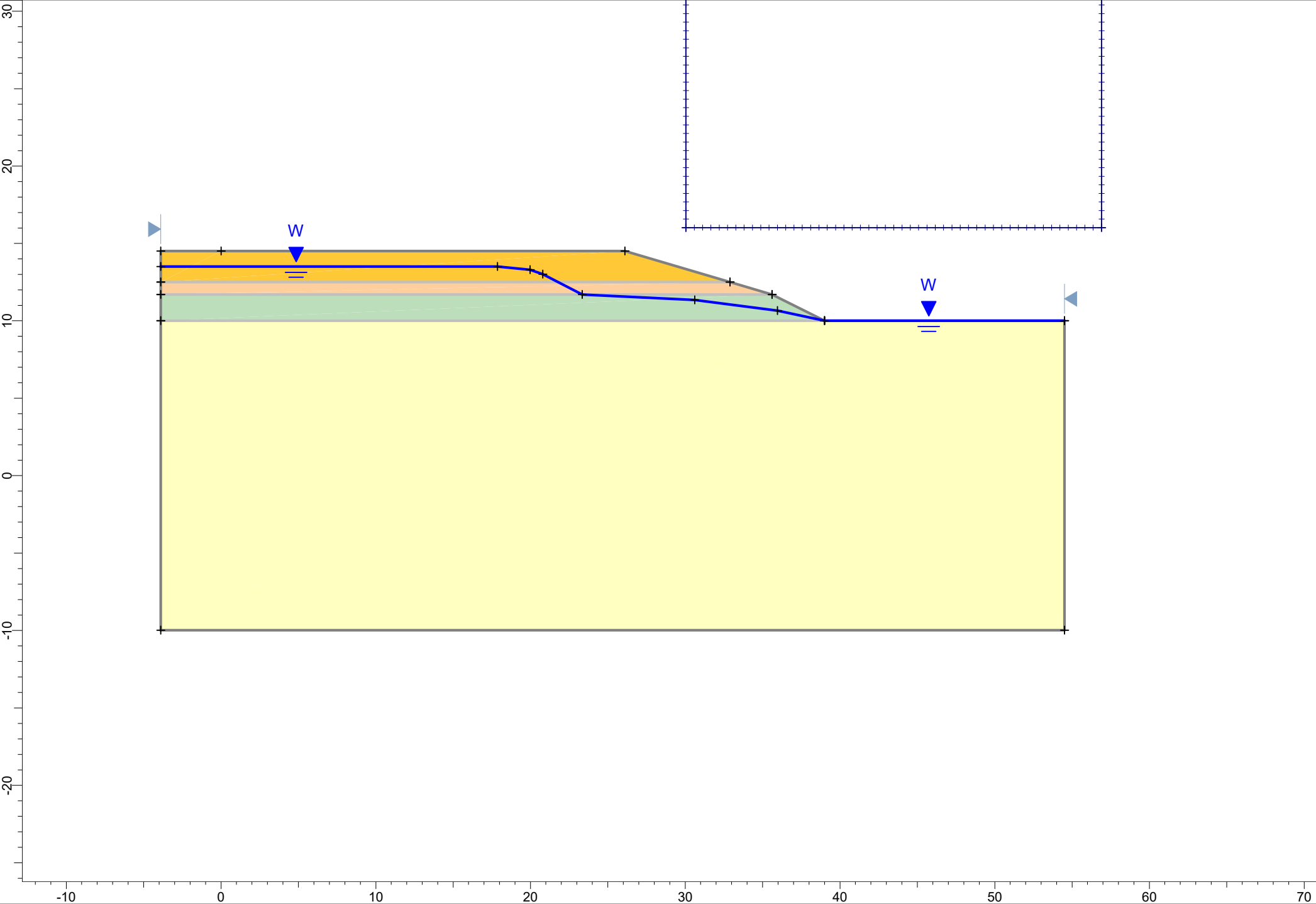
-4.200	-9.991
54.500	-9.991
54.500	10.000
39.000	10.000
35.600	11.700
32.800	12.500
25.800	14.500
0.000	14.500
-4.184	14.500
-4.184	12.500
-4.184	11.669
-4.200	10.000

Water Table

-4.184	13.500
26.476	13.500
28.829	13.249
30.237	12.823
33.766	12.018
23.334	11.700
30.608	11.344
35.961	10.657
39.000	10.000

54.500 10.000





Slide Analysis Information

Document Name

File Name: WAL cut1in3.5 upper LT dewatered.sli

Project Settings

Project Title: Wallingford 1in2 lower 1in3.5 upper intermediate term drained
Failure Direction: Left to Right
Units of Measurement: SI Units
Pore Fluid Unit Weight: 9.81 kN/m³
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Lower chalk clay
Strength Type: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion: 0 kPa
Friction Angle: 26 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: sand and gravel
Strength Type: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion: 0 kPa
Friction Angle: 37 degrees
Water Surface: Water Table

Custom Hu value: 1

Material: Peat

Strength Type: Mohr-Coulomb

Unit Weight: 12.5 kN/m³

Cohesion: 0 kPa

Friction Angle: 24 degrees

Water Surface: Water Table

Custom Hu value: 1

Material: Clay

Strength Type: Mohr-Coulomb

Unit Weight: 18 kN/m³

Cohesion: 0 kPa

Friction Angle: 24 degrees

Water Surface: Water Table

Custom Hu value: 1

List of All Coordinates

Material Boundary

-3.900	12.500
32.886	12.500

Material Boundary

-3.900	11.700
35.600	11.700

Material Boundary

-3.900	10.000
39.000	10.000

External Boundary

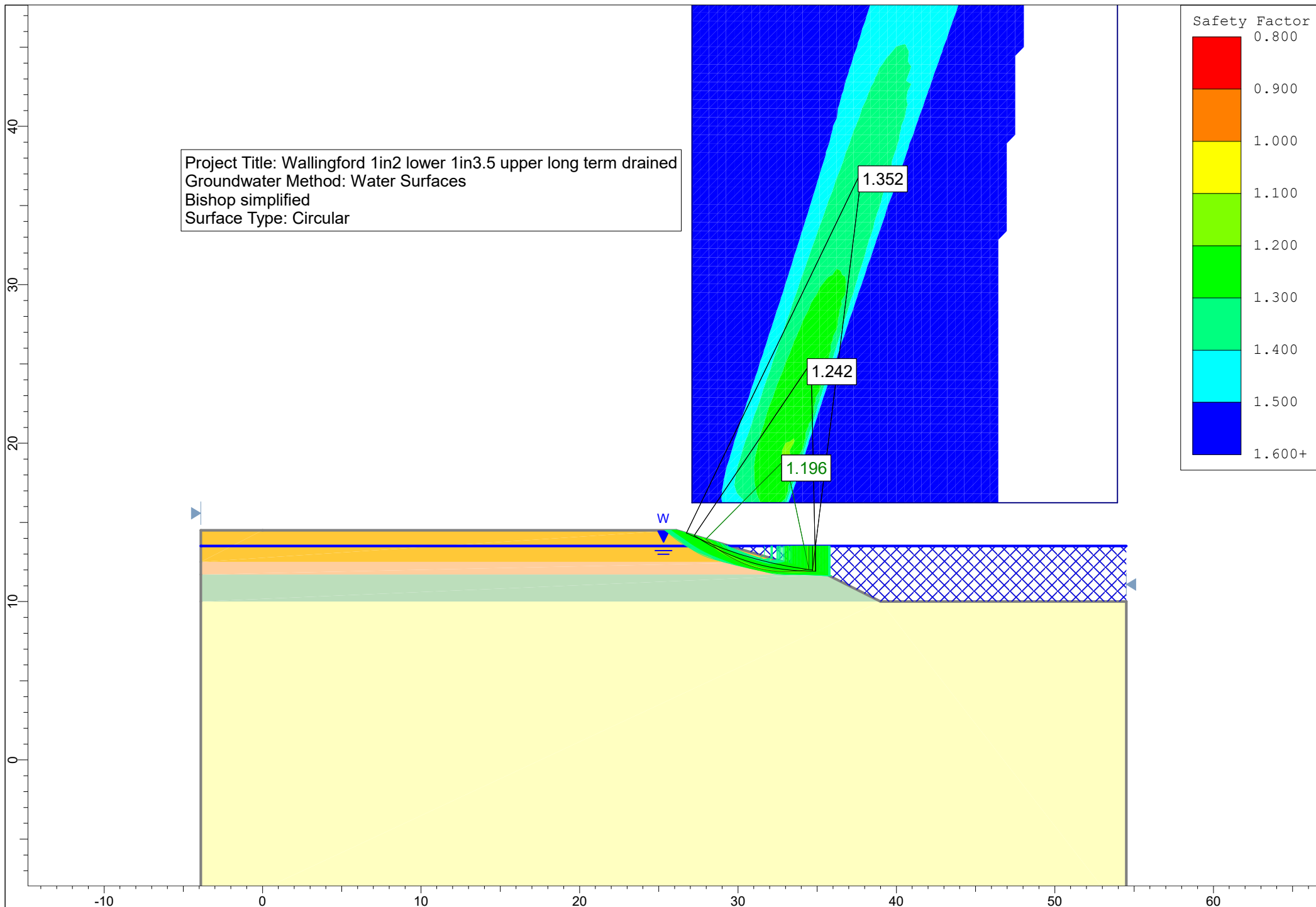
-3.900	-9.991
54.500	-9.991
54.500	10.000
39.000	10.000
35.600	11.700
32.886	12.500
26.100	14.500
0.000	14.500
-3.900	14.500
-3.900	12.500
-3.900	11.700
-3.900	10.000

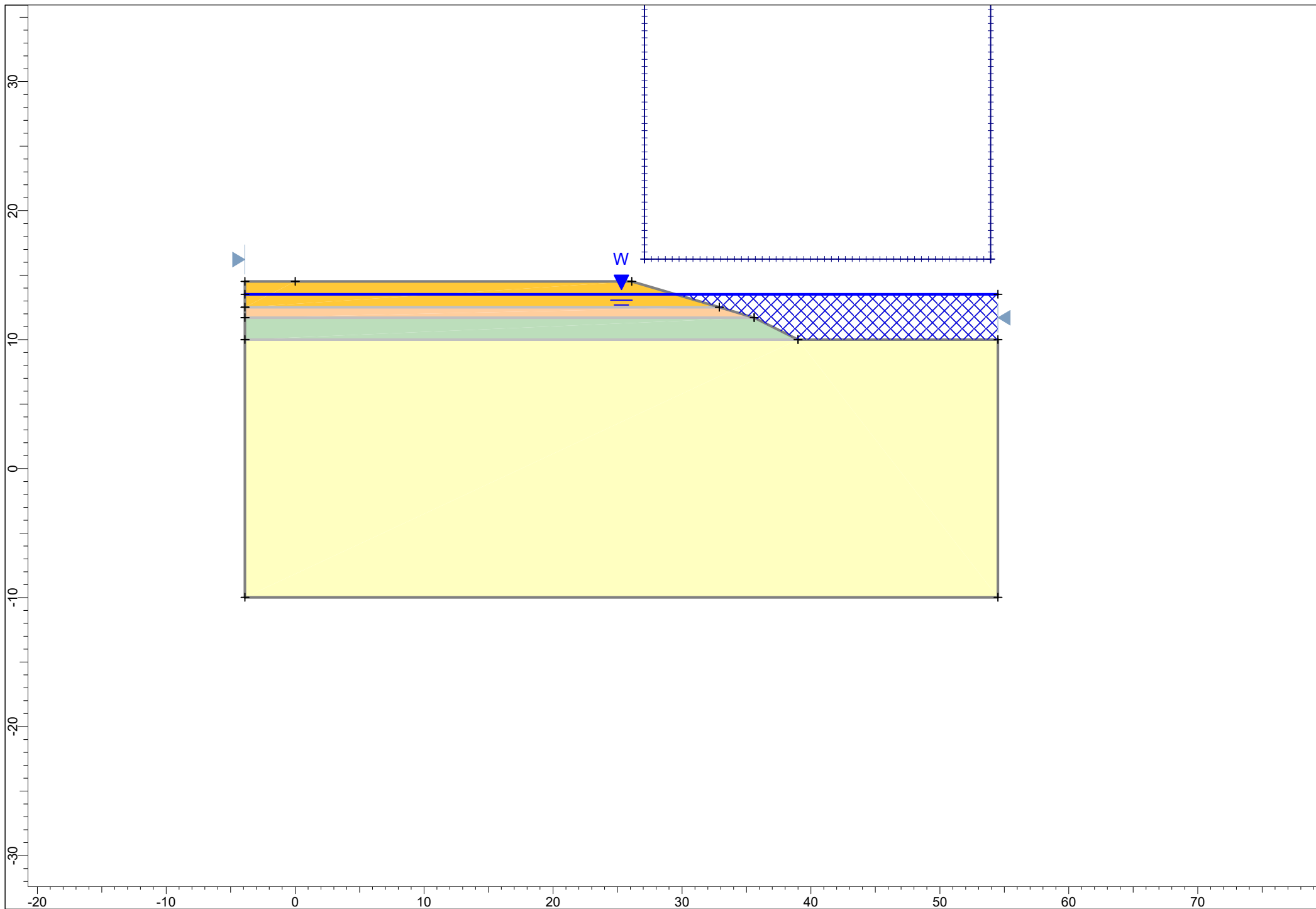
Water Table

-3.900	13.500
17.858	13.500
19.970	13.290
20.785	13.008
23.334	11.700
30.608	11.344
35.961	10.657
39.000	10.000
54.500	10.000

Search Grid

30.043	16.015
56.894	16.015
56.894	49.211
30.043	49.211





Slide Analysis Information

Document Name

File Name: WAL cut 1in3.5 upper.sli

Project Settings

Project Title: Wallingford 1in2 lower 1in3.5 upper long term drained
Failure Direction: Left to Right
Units of Measurement: SI Units
Pore Fluid Unit Weight: 9.81 kN/m³
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Lower chalk clay
Strength Type: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion: 0 kPa
Friction Angle: 26 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: sand and gravel
Strength Type: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion: 0 kPa
Friction Angle: 37 degrees
Water Surface: Water Table

Custom Hu value: 1

Material: Peat

Strength Type: Mohr-Coulomb

Unit Weight: 12.5 kN/m³

Cohesion: 0 kPa

Friction Angle: 24 degrees

Water Surface: Water Table

Custom Hu value: 1

Material: Clay

Strength Type: Mohr-Coulomb

Unit Weight: 18 kN/m³

Cohesion: 0 kPa

Friction Angle: 24 degrees

Water Surface: Water Table

Custom Hu value: 1

List of All Coordinates

Material Boundary

-3.900	12.500
32.886	12.500

Material Boundary

-3.900	11.700
35.600	11.700

Material Boundary

-3.900	10.000
39.000	10.000

External Boundary

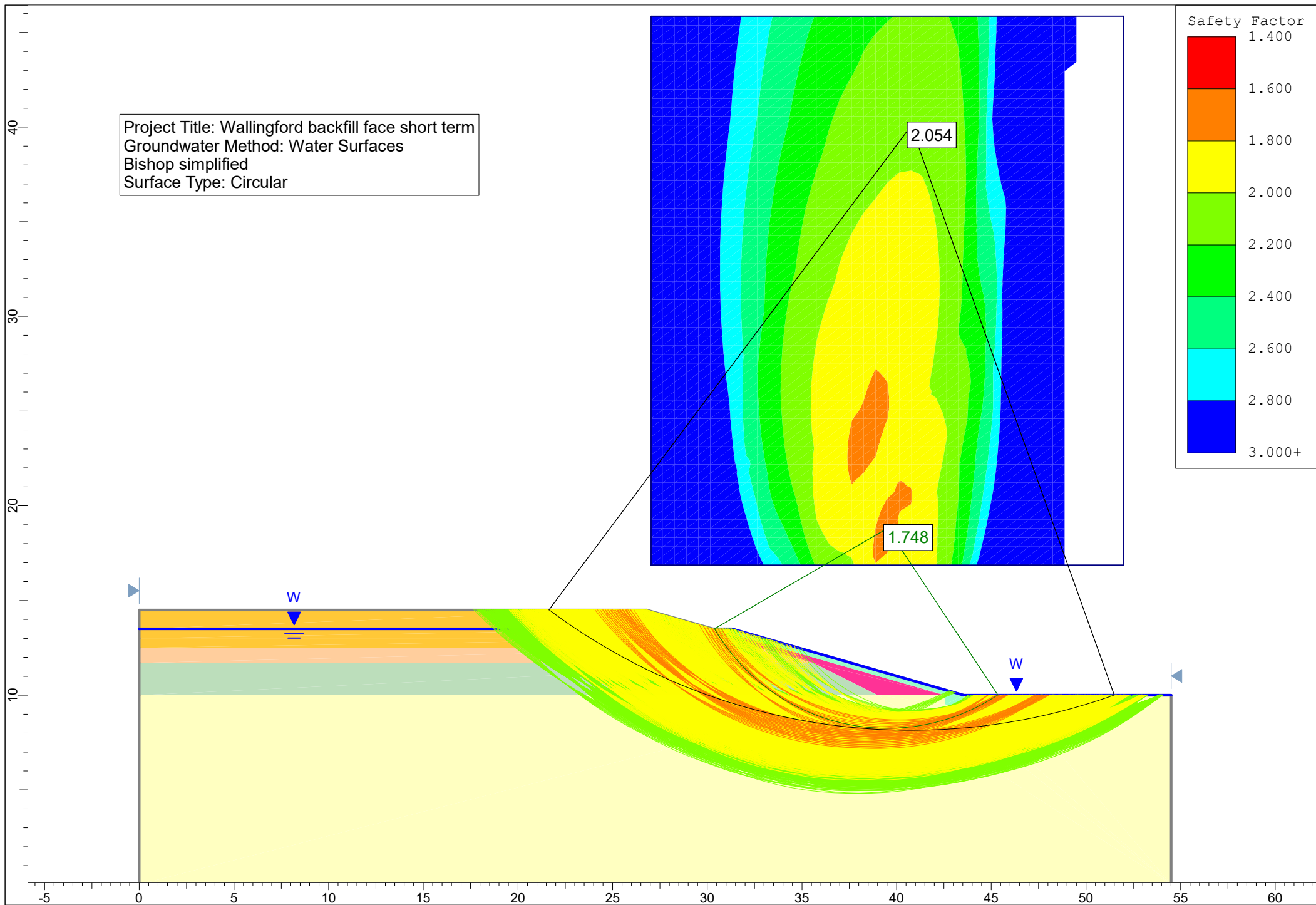
-3.900	-9.991
54.500	-9.991
54.500	10.000
39.000	10.000
35.600	11.700
32.886	12.500
26.100	14.500
0.000	14.500
-3.900	14.500
-3.900	12.500
-3.900	11.700
-3.900	10.000

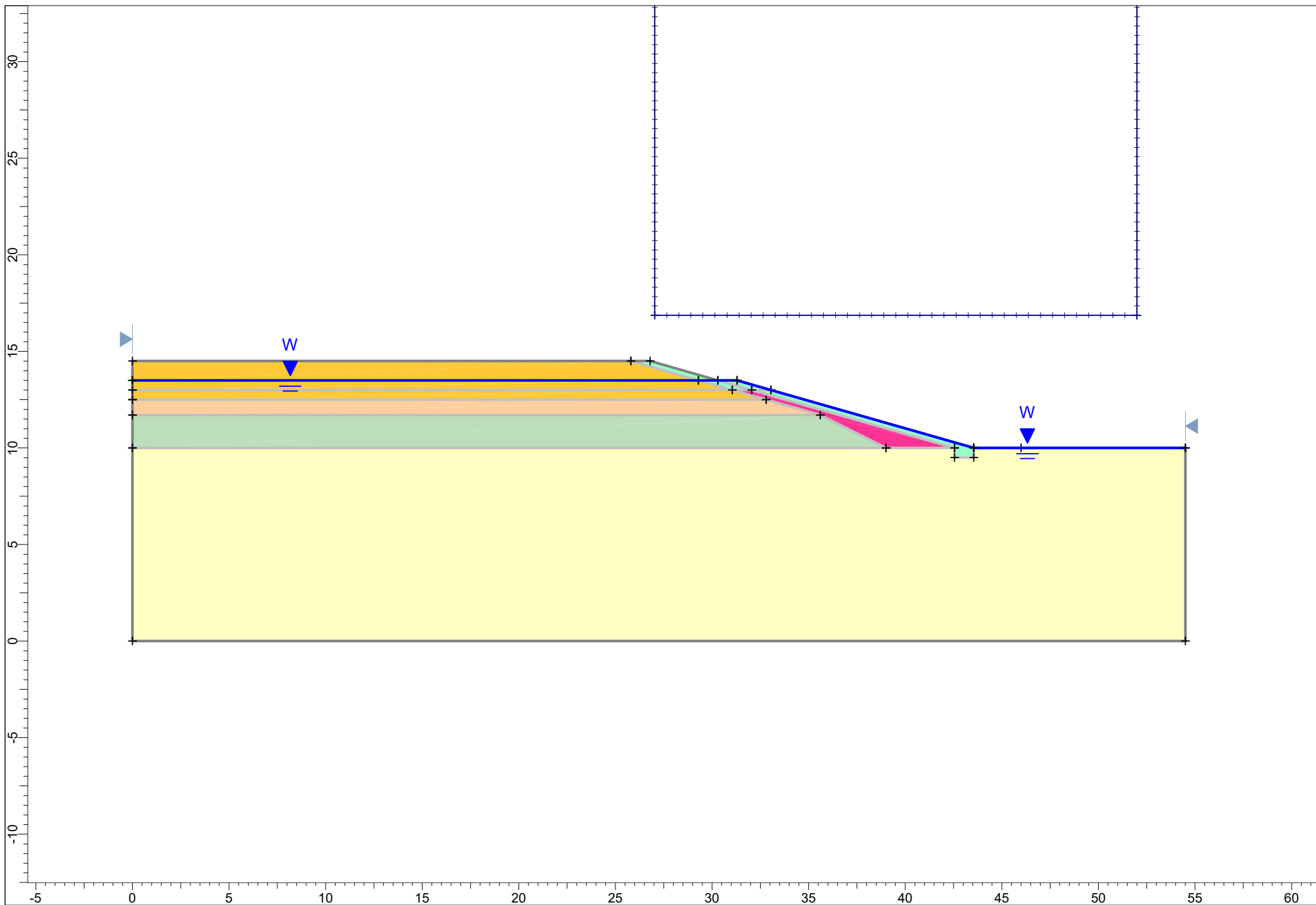
Water Table

-3.900	13.500
54.500	13.500

Search Grid

27.092	16.236
53.943	16.236
53.943	49.431
27.092	49.431





Slide Analysis Information

Document Name

File Name: Fill ST.sli

Project Settings

Project Title: Wallingford backfill face ST
Failure Direction: Left to Right
Units of Measurement: SI Units
Pore Fluid Unit Weight: 9.81 kN/m³
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Lower chalk clay
Strength Type: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion: 0 kPa
Friction Angle: 26 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: sand and gravel
Strength Type: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion: 0 kPa
Friction Angle: 37 degrees
Water Surface: Water Table

Custom Hu value: 1

Material: peat

Strength Type: Undrained

Unit Weight: 12.5 kN/m³

Cohesion Type: Constant

Cohesion: 20 kPa

Water Surface: Water Table

Custom Hu value: 1

Material: clay

Strength Type: Undrained

Unit Weight: 18 kN/m³

Cohesion Type: Constant

Cohesion: 35 kPa

Water Surface: Water Table

Custom Hu value: 1

Material: geo barrier

Strength Type: Undrained

Unit Weight: 21 kN/m³

Cohesion Type: Constant

Cohesion: 50 kPa

Water Surface: None

Material: general fill

Strength Type: Undrained

Unit Weight: 20 kN/m³

Cohesion Type: Constant

Cohesion: 45 kPa

Water Surface: None

List of All Coordinates

Material Boundary

0.000	12.500
32.800	12.500

Material Boundary

0.000	11.700
35.600	11.700

Material Boundary

0.000	10.000
39.000	10.000
42.550	10.000
42.550	9.500
43.550	9.500
43.550	10.000

Material Boundary

25.800	14.500
29.300	13.500
31.050	13.000
32.800	12.500
35.600	11.700
39.000	10.000

Material Boundary

0.000	13.500
29.300	13.500

Material Boundary

30.300	13.500
32.050	13.000
42.550	10.000

Material Boundary

0.000	13.000
31.050	13.000
32.050	13.000
33.050	13.000

External Boundary

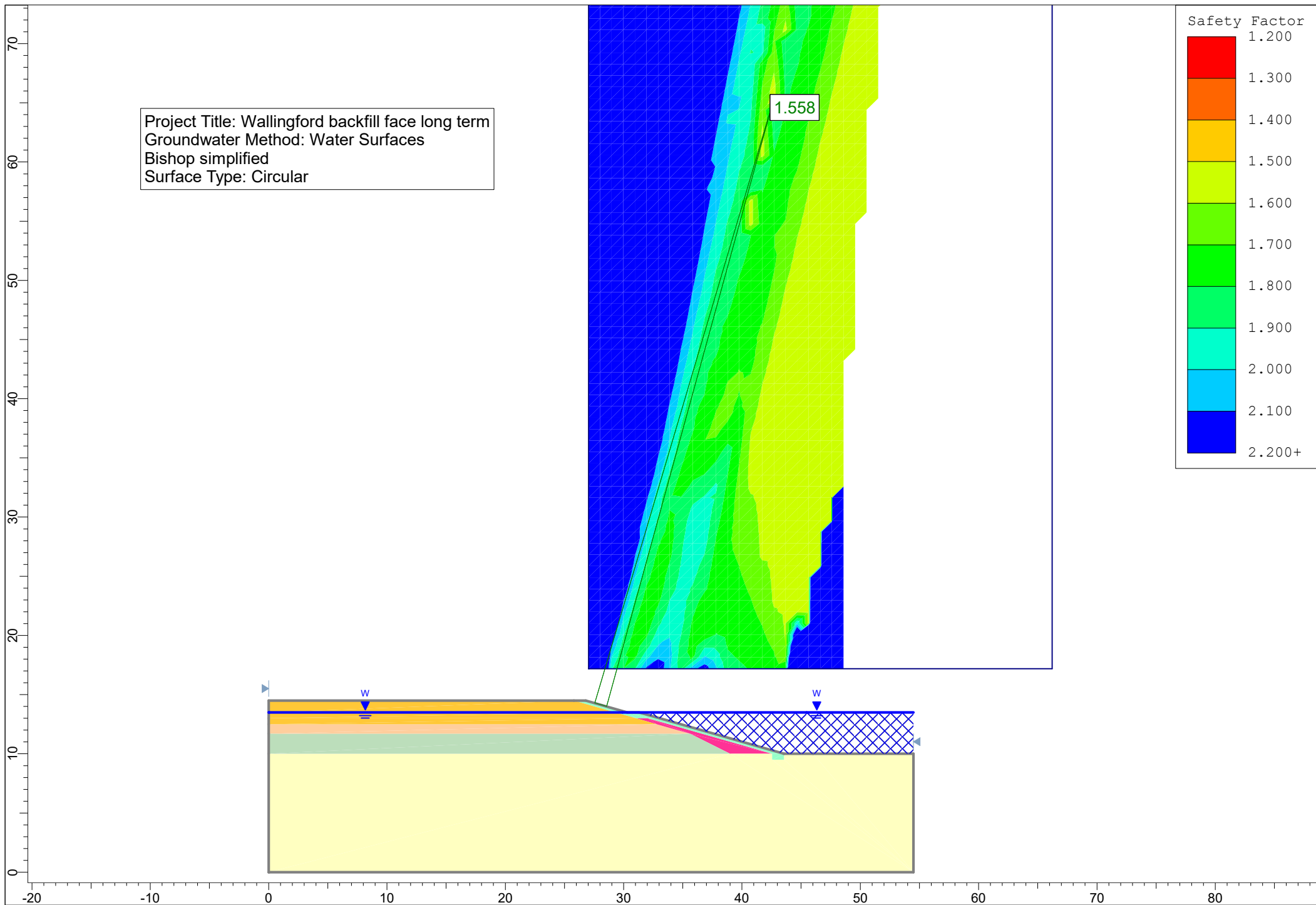
0.000	0.000
54.500	0.000
54.500	10.000
46.000	10.000
43.550	10.000
33.050	13.000
31.300	13.500
30.300	13.500
26.800	14.500
25.800	14.500
0.000	14.500
0.000	13.500
0.000	13.000
0.000	12.500
0.000	11.700
0.000	10.000

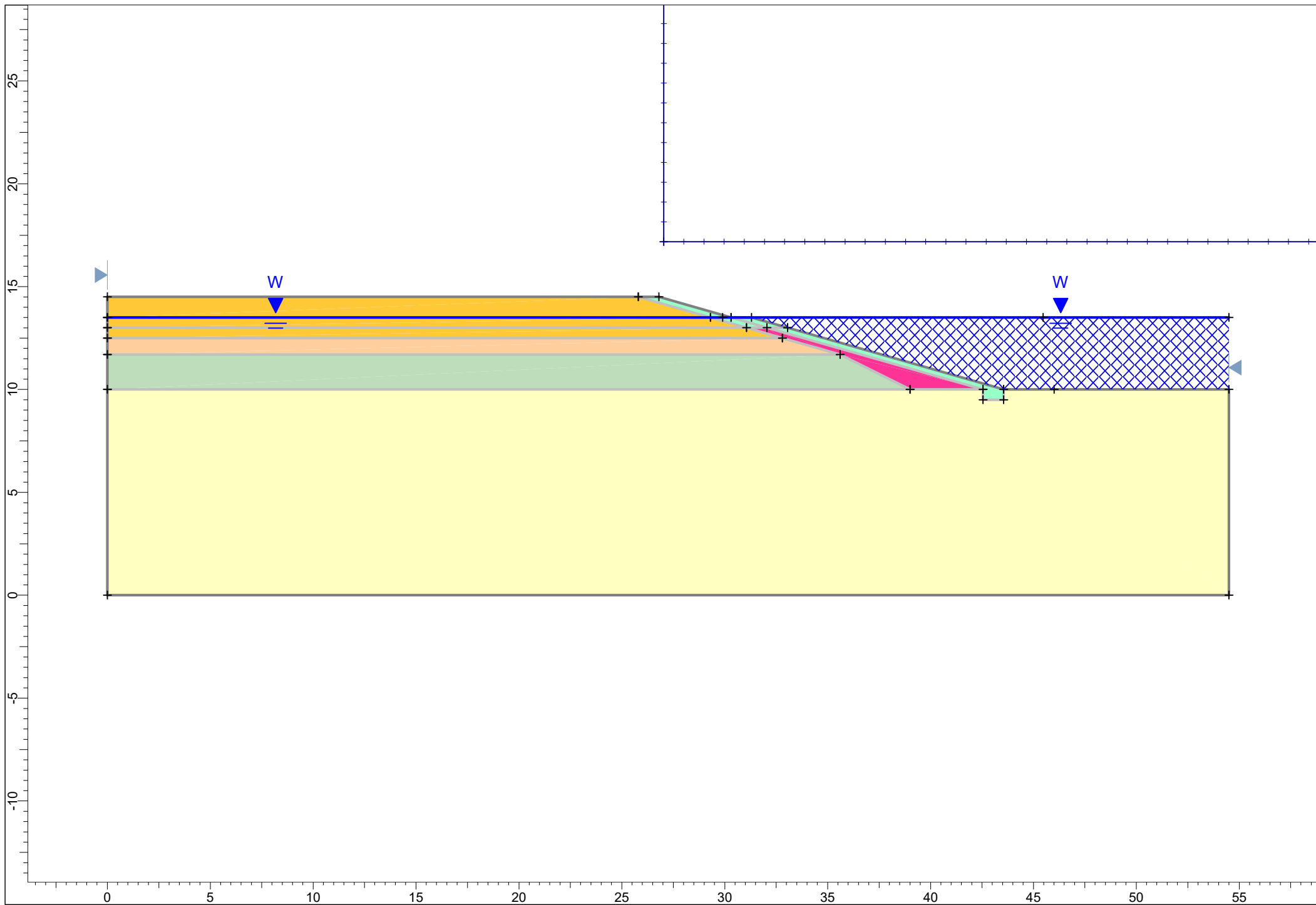
Water Table

0.000	13.500
31.300	13.500
43.550	10.000
54.500	10.000

Search Grid

27.031	16.870
51.991	16.870
51.991	45.851
27.031	45.851





Slide Analysis Information

Document Name

File Name: Slide1.sli

Project Settings

Project Title: Wallingford backfill face LT
Failure Direction: Left to Right
Units of Measurement: SI Units
Pore Fluid Unit Weight: 9.81 kN/m³
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Circular
Search Method: Grid Search
Radius increment: 10
Composite Surfaces: Disabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined

Material Properties

Material: Lower chalk clay
Strength Type: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion: 0 kPa
Friction Angle: 26 degrees
Water Surface: Water Table
Custom Hu value: 1

Material: sand and gravel
Strength Type: Mohr-Coulomb
Unit Weight: 20 kN/m³
Cohesion: 0 kPa
Friction Angle: 37 degrees
Water Surface: Water Table

Custom Hu value: 1

Material: peat

Strength Type: Mohr-Coulomb

Unit Weight: 12.5 kN/m³

Cohesion: 0 kPa

Friction Angle: 24 degrees

Water Surface: Water Table

Custom Hu value: 1

Material: clay

Strength Type: Mohr-Coulomb

Unit Weight: 18 kN/m³

Cohesion: 0 kPa

Friction Angle: 24 degrees

Water Surface: Water Table

Custom Hu value: 1

Material: geo barrier

Strength Type: Mohr-Coulomb

Unit Weight: 21 kN/m³

Cohesion: 0 kPa

Friction Angle: 24 degrees

Water Surface: Water Table

Custom Hu value: 1

Material: general fill

Strength Type: Mohr-Coulomb

Unit Weight: 20 kN/m³

Cohesion: 0 kPa

Friction Angle: 26 degrees

Water Surface: Water Table

Custom Hu value: 1

List of All Coordinates

Material Boundary

0.000 12.500

32.800 12.500

Material Boundary

0.000 11.700

35.600 11.700

Material Boundary

0.000 10.000

39.000 10.000

42.550 10.000

42.550 9.500

43.550 9.500

43.550 10.000

Material Boundary

25.800 14.500

29.300 13.500

31.050 13.000

32.800 12.500

35.600	11.700
39.000	10.000

Material Boundary

0.000	13.500
29.300	13.500

Material Boundary

30.300	13.500
32.050	13.000
42.550	10.000

Material Boundary

0.000	13.000
31.050	13.000
32.050	13.000
33.050	13.000

External Boundary

0.000	0.000
54.500	0.000
54.500	10.000
46.000	10.000
43.550	10.000
33.050	13.000
31.300	13.500
30.300	13.500
26.800	14.500
25.800	14.500
0.000	14.500
0.000	13.500
0.000	13.000
0.000	12.500
0.000	11.700
0.000	10.000

Water Table

0.000	13.500
29.900	13.500
45.468	13.500
54.500	13.500

Search Grid

27.031	17.180
66.205	17.180
66.205	75.015
27.031	75.015