69 Redington Road
Basement Impact Assessment
March 2015
108975

FAIRHURST

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CONTROL SHEET

CLIENT: Shakib & Co

PROJECT TITLE: 69 Redington Road, Hampstead

REPORT TITLE: Basement Impact Assessment

PROJECT REFERENCE: 108975

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Issue & Approval Schedule	ISSUE 1 DRAFT	Name	Signature	Date
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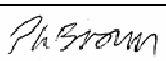
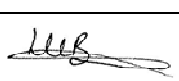
					Checked	
					Approved	
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					Approved	

This document has been prepared in accordance with procedure OP/P02 of the *Fairhurst Quality and Environmental Management System*

CONTENTS

APPENDICIES

1.0 Introduction

Planning permission was granted on 08/10/2013 (ref: 2012/2548/P) for the excavation to extend the lower ground floor area forwards to form a basement beneath the front section of the property and for the construction of a swimming pool set at a lower level and extending into the rear garden.

The maximum depth of excavation associated with approved development was approximately 3m below lower ground floor level (bgl).

A new proposal has been put forward to excavate under the entire footprint of the existing property to provide space for installation of a gym and to extend into the rear garden area to construct a swimming pool. Based on the information reviewed (outlined in section 1.1) it appears that the proposed basement will 'step down' along the natural slope toward the rear of the house such that it will extend to between 3.00-4.00mbgl beneath the existing property and approximately 5.00m bgl beneath the rear garden.

The information in this document aims to provide details of the local hydrological, geological and hydrogeological conditions beneath the site in the context of completing a Basement Impact Assessment (BIA) for the updated proposed development.

1.1 Data Sources

This section provides the baseline data used to complete the BIA in relation to the proposed development. Reference information used for this purpose is outlined below:

- British Geological Survey – 1:50,000 Geological Sheet 256, North London (Solid & Drift) (Ref 13.16);
- British Geological Survey borehole archive records.
- Environment Agency Groundwater Vulnerability Mapping (1:100,000 series) Sheet 40, Thames;
- Environment Agency Internet database (www.environment-agency.gov.uk);
- River Basin Management Plan (RBMP). Thames River Basin District (2009);
- Royal Borough of Kensington and Chelsea Strategic Flood Risk Assessment (SFRA, August 2009);
- Chelmer Consultancy Services (March 2013). Basement Impact Assessment, 69 Redington Road, London NW3 7RP. (Initial Ground Investigation)
- Chelmer Consultancy Services (March 2014). Factual Report, 69 Redington Road, London NW3 7RP. (Additional Ground Investigation)
- LBH Wembley Geotechnical & Environmental (February 2015). Independent Review of Basement Impact Assessment for planning application 2014/5705/P at 69 Redington Road, London NW3 7RP.
- Site reconnaissance survey and groundwater monitoring completed by Fairhurst (March 2015).
- Drawings of Proposed by Unknown, dated 10th July, 1st September and 21st October 2014, Refs: 69RR_SEC_PR_BASE_09 Rev E, 69RR_SEC_PR_AA_NS_10 Rev A, 69RR_SEC_PR_BB_DD_16 Rev C
- Construction Method Drawings by Hockley & Dawson Consulting Engineers, dated January 2013, Refs: 16279 1/102 – 16279 1/105 and 16279 1/101.

- Drawings and Method Statement of Underpinning Works by Abbey Pynford, dated 10th February 2015, Refs: GA19787-104C, GA19787-109A, GA19787-110A and GA19787-111A.
- Lower Ground Floor and Basement Sections with Adjacent Properties Drawing by Hockley & Dawson Consulting Engineers, dated January 2013, Refs: 16279 2/101.

1.2 Guidance and Frameworks

The proposed development is located in the London Borough of Camden (LBC) and it will be required to proceed in accordance with the guidance and policies outlined in the following documents:

- LBC (Nov 2010). Camden geological, hydrogeological and hydrological study. Guidance for subterranean development (produced by Arup Consulting).
- LBC. Camden Planning Guidance. Basements and lightwells (CPG 4).
- Development Policy (DP) 27 Basements and Lightwells

1.3 Regulatory Consultation

LBH Wembley Geotechnical and Environmental (LBH) on behalf of the London Borough of Camden completed an independent review of the Chelmer, March 2013 BIA. It is notable that the review completed by LBH did not include the Factual Report completed by Chelmer Consultancy Services in March 2014 or the Drawings of Underpinning Works by Abbey Pynford.

The salient comments relating to the assessment of groundwater conditions beneath the site were as follows:

'There is insufficient ground investigation and groundwater monitoring information to conclude the assessment of groundwater impacts. The submitted BIA relates to an earlier scheme that was significantly smaller and shallower than is now proposed.'

LBH concluded that 'the present submission does not meet the requirements of DP27, in respect of:

a) Maintaining the structural stability of the building and any neighbouring properties.

b) Avoiding adverse impact on drainage and run-off or causing other damage to the water environment

c) Avoiding cumulative impacts on structural stability or the water environment

LBH suggested that further information would need to be submitted by the Client to meet the requirements of DP27 as outlined below. It should be noted that this report addresses bullet points 1 to 4 and does not include bullet point 5, which is understood to have been covered by others:

- Additional ground investigation and groundwater monitoring to enable a better assessment for the possible presence of water-bearing seams. (Section 3.1 – Section 3.4)
- Information concerning the configuration of existing foundations to the host building and adjacent properties. (Section 3.5)
- A quantitative ground movement and damage category assessment for host building and neighbouring structures. (Section 3.6)
- A slope stability assessment. (Section 3.7)

- An arboricultural assessment. (Assessment not undertaken as part of this report)

1.4 BIA Approach

The BIA approach prescribed by LBC in the relevant guidance documents referenced above comprises the following elements:

- Screening;
- Scoping;
- Site Investigation and study (divided into desk study, field investigation, monitoring, reporting & interpretation);
- Impact Assessment; and
- Review & Decision Making (completed by LBC).

The above elements have been considered within the BIA completed by Chelmer Consultancy Services and the Review & Decision Making stage has been completed on behalf of LBC by LBH.

As such this section of the report aims to provide an updated Impact Assessment based on the supplemental ground investigation and monitoring data reported by Chelmer in March 2014. However, the baseline conditions in relation to the water environment are summarised in Section 2.0 of this Document.

2.0 Baseline Conditions

2.1 Site Environmental Setting

Relevant information relating to the sites environmental setting, using literature information and in the context of this assessment is summarised in the table below:

Table 1 – Environmental Setting

Geology & Aquifer Designations	Reference to the data sources referenced indicates that the site is underlain by the Claygate Member, which are designated a Secondary (A) Aquifer. The Claygate Member forms the upper unit of low permeability London Clay Formation which is designated, overall as an Unproductive Strata.
Hydrology	There are no surface water features within 250m of the site. However, information within the Chelmer Consulting Services report indicates that a culverted tributary of the 'lost' River Westbourne is located approximately along the boundary of the rear garden. Reference to the UK Hydrometric Register indicates that the annual average rainfall for the Thames region is 710mm.
Resource Potential & Ecological Sensitivity	The Secondary (A) Aquifer of the Claygate Member is not included within the relevant River Basin Management Plan (RBMP). However, it is considered to have some potential as a local scale resource and to provide an element of base flow to local surface water features. No local surface features (within 1km of the site) are included within the relevant RBMP. The Claygate Member has been assigned a moderate ecological quality and fails the chemical quality. Neither of these quality ratings are predicted to alter following the next cycle of RBMP in 2015.

2.2 Ground Investigation & Monitoring

Two phases of ground investigation have been undertaken by Chelmer Consultancy Services, which included the following:

- Completion of two hand auger boreholes to depths of between 5.20m and 6.00m bgl;
- Completion of three continuous flight auger boreholes to depths of between 8.00m and 15.00m bgl;
- Installation of three groundwater monitoring wells to depths of between 7.00m and 8.00m bgl; and
- Monitoring of groundwater levels on four occasions.

The information from the additional ground investigation and monitoring works has been used to complete an update of the baseline conditions, which is presented in the following sections.

2.3 Update of Baseline Conditions

2.3.1 Rainfall Infiltration & Recharge

The local area is primarily sub-urban (residential) and as such the majority of surface water run-off is likely to be directed to the surface water (and possibly combined) drainage system. However, where rear gardens exist and areas of green space (such as Hampstead Heath to the north) rainfall run-off to drains is likely to be reduce and taken up by evapotranspiration and the soil moisture deficit with the remainder potentially recharging the groundwater within the Bagshot Formation (outcropping 32m to the north of the site) and/or Claygate Member.

In the context of the site and proposed development, the existing front and rear gardens are the only areas of soft surfacing where rainfall infiltration could potentially recharge the underlying groundwater within the Claygate Member.

2.4 Local Ground & Groundwater Conditions

The ground conditions encountered are in general accordance with those described by the BGS and comprise Made Ground (hard surfacing and/or topsoil) overlying the Claygate Member of the London Clay Formation.

The Claygate Member was proven to a maximum depth of 15.00m bgl and reference to the BGS lexicon indicates that it has an average thickness of 16.00m. In general the Claygate Member was found to comprise a sequence of sandy and silty firm to very stiff clays, which locally become very sandy. A clayey, silty fine to medium sand unit was recorded at a depth of between 5.90m and 6.90m bgl in BH3 (located in the rear garden).

No groundwater strikes were recorded in the hand auger boreholes. However, groundwater strikes were recorded as seepages in all CFA boreholes at depths of between 4.90m and 6.25m bgl. The groundwater strikes recorded in BH2 and BH3 were coincident with the very sandy clay units and in BH1 within a unit described as a silty clay with sand partings.

In addition to the monitoring completed as part of the Chelmer site investigation works, a representative of Fairhurst completed a site visit on Friday 6th March 2015 in order to undertake additional groundwater monitoring on the existing wells. However, due to access restriction from the construction works only BH1 was accessible and recorded a groundwater level of 5.23m bgl.

Although the exploratory holes and monitoring wells have not been surveyed relative to ordnance datum (or local datum) appraisal of the borehole logs and relative site levels suggest that the same very sandy clay unit was encountered in all boreholes and that it forms a continuous unit beneath the site.

Comparison of groundwater strike and rest groundwater levels suggests that the very sandy clay forms a discrete groundwater unit that is confined by the overlying (relatively) lower permeability clays. In addition, based on an appraisal of the relative levels of the monitoring wells on site, the groundwater flow direction is interpreted to be in a generally southerly direction.

The ground investigation and monitoring information has been summarised in the following table:

Table 2 – Ground Investigation and Monitoring Information

Strata	Proven Thickness Range (m bgl)	Depth to Groundwater (m bgl)		Aquifer Designation
		Strike	Rest Level	
Made Ground	0.10 – 1.50	-	-	Not Applicable
Claygate Member	8.00 – 15.00	4.90 – 6.25	1.66 – 5.48	Secondary A

The groundwater monitoring data was collected in March 2014 and March 2015 and although this does not provide an indication of any seasonal fluctuations it is considered to be reflective of high winter groundwater levels.

The data provided in the Chelmer factual site investigation report includes three monitoring visits completed in March 2014. It is notable that the groundwater levels recorded in BH1 and BH2 during the second monitoring event (21/03/14) are approximately 3.5m higher than recorded in the first and third monitoring events. Monitoring results undertaken in March 2015 were also observed to be similar to results recorded within visit 1 and 3 of Chemer's ground investigation.

The monitoring records for the second round are considered to be anomalous and have been disregarded in favour of the records for the first and third monitoring events.

2.5 Existing and Proposed Basement Structures

A review of the LBC planning portal for Redington Road (Nov 2010 to present) indicates that the following proposed basement developments exist:

Table 3 – Proposed basement Development for Redington Road

Address	Planning Decision
26	Granted
29	Granted
36	Registered
50	Registered
69	Registered
87	Granted

It is not known if the proposed basements in neighbouring properties have been constructed or will be constructed in the future.

3.0 Impact Assessment

This section will provide an updated assessment of the project based on the new proposal to deepen the basement structure; the assessment will cover the considerations raised by LBH Wembley in order to be meet the requirement of DP27 as outlined below:

- Additional groundwater investigation and groundwater monitoring to enable a better assessment for the possible presence of water-bearing seams.
- Information concerning the configuration of existing foundations to the host building and adjacent properties.
- A quantitative ground movement and damage category assessment for host building and neighbouring structures.
- A slope stability assessment.

3.1 Impact on Local Groundwater

This section provides an assessment of potential impacts from the proposed basement development on the local groundwater conditions. Based on the review comments provided by LBH and reference to the LBC guidance documents, potential impacts on the following have been considered:

- Rainfall infiltration and Groundwater Recharge;
- Groundwater Levels and Flow; and
- Cumulative Effects.

3.2 Rainfall Infiltration & Groundwater Recharge

The front garden area will be retained and the location where the basement extends to facilitate the proposed swimming pool, is beneath an existing hard surfaced terrace. On this basis the proposed basement development is not considered to impact the potential for rainfall infiltration to recharge groundwater within the underlying Claygate Member.

3.3 Groundwater Levels & Flow

As previously outlined, the anticipated formation level for the basement beneath the existing property is approximately 3.00m-4.00m bgl and this will deepen to approximately 5.00m bgl in the area of the basement that will extend beneath the garden area.

Based on the groundwater level data reviewed, it is considered unlikely that the proposed basement beneath the footprint of the existing property will intercept the groundwater-bearing (very sandy clay) unit. The area of the proposed basement that will extend into the rear garden is likely to intercept the groundwater unit. However, the majority of the silty fine to medium sand unit (recorded at a depth of between 5.90m and 6.90m bgl in BH3) is likely to be maintained so that the basement will not effectively form an hydraulic 'cut-off' and there should be a pathway for groundwater to flow beneath the basement.

As noted, groundwater is interpreted to flow in a southerly direction and the orientation of the existing property and proposed basement are such that groundwater flow will be oblique rather than perpendicular to the interpreted groundwater flow direction. In addition, the length of basement that will potentially intercept groundwater flow is estimated to be <10m.

On this basis the potential rise in groundwater levels up hydraulic gradient of the proposed basement are considered to be minimal.

3.4 Cumulative Effects

The LBC guidance highlights the potential for cumulative effects to exacerbate potential impacts, particularly increases in groundwater levels and diversion of groundwater flow.

Based on the available information, there are currently six basement schemes either registered or granted planning on Redington Road (including the subject site). Of these proposed basements the nearest is displaced by approximately 9 intervening houses.

Given the distance between the site and the additional proposed basement developments the area for groundwater flow is considered to be large and the potential for cumulative effects is considered to be minimal.

This assessment is based on the understanding of current conditions and thus cannot be relied upon should future basement developments be approved within close proximity to the proposed development.

The table below provides a summary of the potential impacts and suggested mitigation measures:

Table 4 – Potential impact posed by local groundwater and proposed mitigation measures

Item	Description of Likely Impact	Mitigation Measures Required
Rainfall infiltration & recharge	The existing front and rear gardens will be retained. Where the basement extends to facilitate the proposed swimming pool is beneath an existing hard surfaced terrace. On this basis impacts are considered to be minimal.	None
Groundwater Levels & Flow	There is potential for a minor increase in groundwater levels and minor alteration of flow but overall impacts are considered to be minimal.	None
Cumulative Effects	There is a considerable distance between the proposed development and known basement proposals. On this basis impacts are considered to be minimal.	None

3.5 Configuration of existing foundations to the host building and adjacent properties.

Information of the configuration of the existing foundations of the host building has been provided within underpinning drawings provided by Abbey Pynford referenced below and in section 1.1:

- GA19787-104C
- GA19787-109A
- GA19787-110A

- GA19787-111A

It should be noted that information on the configuration of the existing foundations of the adjacent properties has not been provided, however it is considered that they are likely to be placed at a similar depth based on the similar construction type of the building and the typically consistent ground conditions encountered with the Chelmer Ground Investigations.

3.6 Assessment of Ground Movement and Damage Category

As part of the basement construction, excavation works will be required to underpin the existing foundations and to form the basement structure. The excavation works have the potential to cause ground movements which in turn could cause damage to the existing and neighbouring structures. In order to investigate the potential for property damage a design check has been undertaken in accordance with Arup guidance to assess the potential for structure damage in accordance with CIRIA C580 damage category chart.

The assessment compares the gross bearing capacity of the existing foundation prior to the installation of the basement against the bearing capacity of the foundation once excavation has been undertaken for underpinning works. The bearing capacity calculation uses Brinch Hansen (1970) formula for gross bearing capacity, and applies undrained soil parameters as the design scenario is for temporary works. The method for underpinning works is outlined in Drawing 16279-1/104, and the soil parameters and dig dimensions are derived from Chelmer ground investigation data (March 2013 and March 2014), and Abbey Pynford underpinning drawings (Drawing No. GA19787-104C, GA19787-109A, GA19787-110A and GA19787-111A) respectively.

The bearing capacity before excavation was indicated to be in the region of 356kPa compared to a bearing capacity of 323kPa once the underpinning excavation was advanced. The excavation causes a 10% decrease in bearing capacity which is considered to only be a slight reduction in capacity. The full design check calculations are provided within Appendix A.

Based on the above assessment the damage category is considered to be '2 – slight' or below for the existing host structure.

The nearest neighbouring structure is positioned 3m to the north of the host property, no as-built information on the foundation arrangements have been provided for review and it is assumed that no intrusive surveys have been undertaken or are likely. For the purpose of this assessment it has therefore been assumed that the foundation to the neighbouring building are to be similar to the host property as the building are likely to have been constructed within a similar historic period and the general ground conditions in the area are relatively consistent based on BGS published mapping and nearby intrusive investigation (Chelmer ground investigations). Based on the findings of the bearing capacity calculations for the host property and the distance of the neighbouring properties away from site a damage category of '0 – Negligible' is deemed appropriate.

3.7 Assessment of Slope Stability

An assessment of the slope stability of the site was carried out to ensure that the new basement development does not have detrimental impacts on the slope stability of the site and surrounding area. As part of the assessment a ground model has been produced of the existing development and the proposed basement development. The ground model has been created based on Chelmer ground investigation data (March 2013 and March 2014) and proposed sections drawing produced in July 2014 (company name is not present on the drawings). Loadings for the property used in the analysis are based on conservative assumptions, however these have very little effect on the slope stability.

The slope assessment profile is taken from the front of the house to the rear garden (east to west) as this is the worst case scenario as the ground slopes at the steepest angle between

these locations. Therefore this precludes the need to assess the ground profile in the north to south direction.

The slope assessment uses both the Janbu and Bishops simplified method of analysis, is analysed in accordance with EC7 using Design Approach (DA) 1 Combination 1 & 2. The results from the analysis are presented within the table below and a graphical representation is provided within Appendix B. It should be noted that the Janbu method gave lower factors of safety than the Bishops simplified method, therefore only the Janbu results have been displayed.

Table 5 - Minimum Slope Stability Factor of Safety Based on Janbu Analysis

	DA1 Combination 1 (Factor of Safety)	**DA2 Combination 2 (Factor of Safety)**
Existing ground profile	2.297	2.055
Proposed basement development ground profile.	1.529	1.354

Based on the findings above, although the construction of the basement does decrease the factor of safety (FoS) of the slope stability, the FoS remains above 1 which is acceptable in accordance with EC7.

3.8 Requirements for Mitigation Measures and On-going Monitoring

A review of the Abbey Pynford's method statement and drawings indicate that structural steel elements will be used to allow for the formation of openings and the removal of internal walls. However there are no specific details on what will be used as temporary support or the size and extent of any openings.

It is recommended that a suitably qualified engineer is consulted on the proposed temporary works design and methodology sequencing and that inspection of temporary openings on site is undertaken to confirm their stability, during the works. Any additional monitoring and mitigation measures should be recommended by the engineer following their assessment of the temporary opening design.

4.0 Conclusions

The assessment completed indicates that there is potential for the proposed basement development to impact local groundwater conditions. However, based on the information and data reviewed, the magnitude of the impacts is considered to be minimal.

Based on ground movement assessment and the likely position of the adjacent property foundations, it is considered that the impact of the new basement construction will be minimal.

An assessment of the slope stability indicates the effects of the new development are considered to be minimal.

Appendix A – Bearing Capacity Calculation

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FAIRHURST **CALCULATION SHEET**

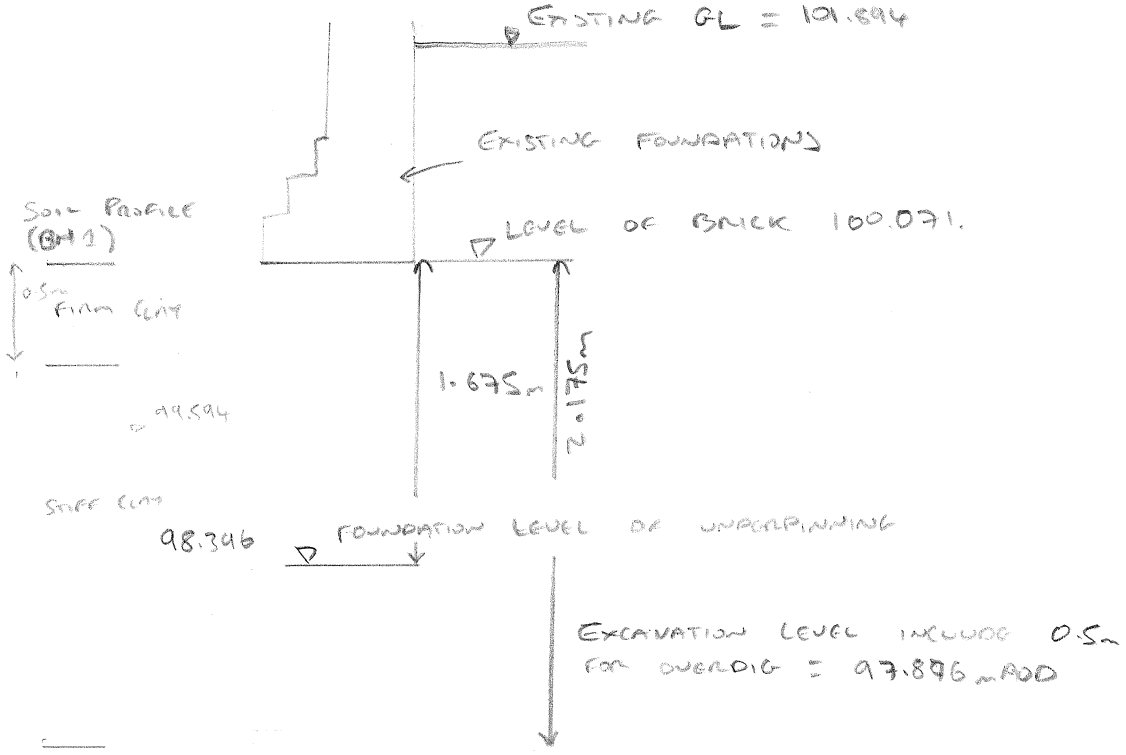
PROJECT	JOB No.	108975	Calculated by	CHRIS CHAPPELL
69 REDINGTON ROAD - BIA	SHEET No.	1 OF 2	Checked by	
CHECK ON BEARING CAPACITY DURING UNDERPINNING	DATE	12/03/15		

TO CONSTRUCT NEW BASEMENT DEVELOPMENT AT 69 REDINGTON ROAD, UNDERPINNING WORKS ARE REQUIRED TO UNDERPIN THE FOUNDATIONS OF THE EXISTING DWELLING.

DURING EXCAVATION ALONG SIDE THE EXISTING FOUNDATIONS TO EXPOSE THEM, IN ORDER TO PLACE THE UNDERPINNING STRUCTURE BENEATH, THE BEARING CAPACITY OF THE EXISTING FOUNDATION WILL BE REDUCED.

IN ORDER TO PROCEED WITH THE DESIGN CHECK A REVIEW OF DRAWING GA19787-104, GA19787-109, GA19787-110, GA19787-111 HAVE BEEN UNDERTAKEN TO IDENTIFY THE WORST CASE SCENARIO WHICH COULD OCCUR DURING UNDERPINNING WORKS.

SECTION 5-5 REQUIRES THE DEEPEST PIT AND IS UNDERTAKEN IN THE MOST UNFAVOURABLE SOIL DEPOSITS, AS OUTLINED BELOW:



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FAIRHURST | **CALCULATION SHEET**

PROJECT

69 REDINGTON ROAD - BIA

CHECK ON BEARING CAPACITY DURING UNDERPINNING

JOB No.	108975	Calculated by	CHARLI CHAPPELL
SHEET No.	2 OF 2	Checked by	
DATE	12/09/15		

BEARING CAPACITY FORMULA:

$$\text{GROSS } q_{ULT} = cN_c + p_o N_q + \tfrac{1}{2}\gamma B N_\gamma$$

AS THE CHECK IS FOR TEMPORARY WORKS UNDRAINED CONDITIONS WILL BE ANALYSED.

BASED ON THE NEAREST SPT TO THE UNDERSIDE OF EXISTING FOUNDATION BEING N=14 THIS WILL BE USED TO DERIVED THE C_u VALUE

THEREFORE: $C_u = N \times 4.5$ $\quad C_u = c$ (BELOW)

$= 63$ kPa

BEARING CAPACITY BEFORE UNDERPINNING EXCAVATION

$$\text{GROSS } q_{ULT} = cN_c + p_o N_q + \tfrac{1}{2}\gamma B N_\gamma$$

$= 63 \times 5.14 + 33 \times 1 + 0$

$= 356$ kPa

PARAMETERS

(or $C_u = 63$ kPa

$N_c = 5.14$

$N_q = 1$

$N_\gamma = 0$

$\gamma = 18$ kN/m3

$p_o = 1.8 \times 18 = 33$ kN/m2

B = NOT SPECIFIED ON DRAWING. USE: 0.6m

BEARING CAPACITY ONCE EXCAVATED

REDUCE FORMULA AS NO OVERBURDEN COMPENANT AVAILABLE DUE TO EXCAVATION:

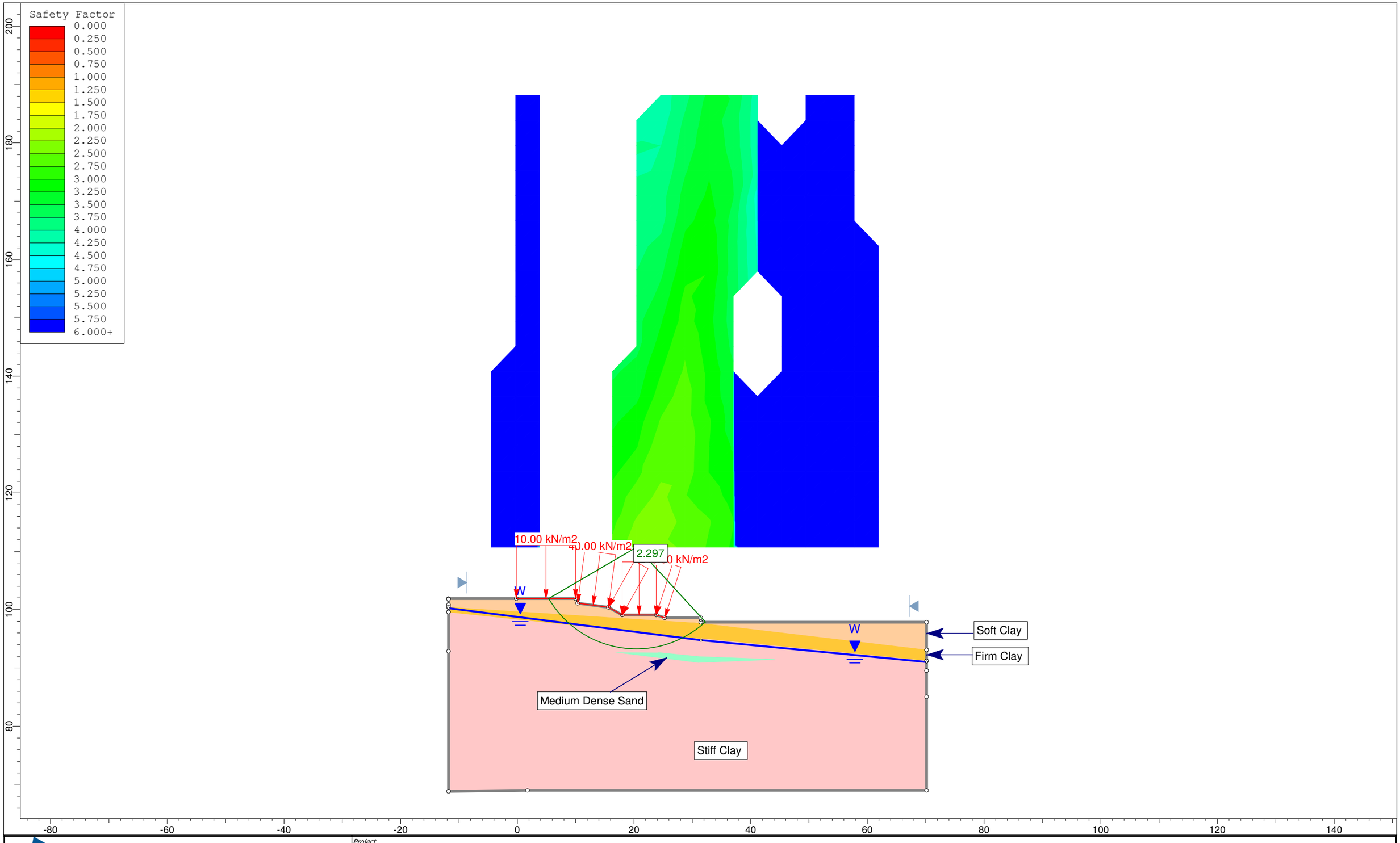
$$\text{GROSS } q_{ULT} = cN_c + \tfrac{1}{2}\gamma B N_\gamma$$

$= 63 \times 5.14 + 0$

$= 323$ kPa

THEREFORE REDUCTION OF CAPACITY ONCE EXCAVATED $= 10\%$.

Appendix B – Slope Stability Analysis



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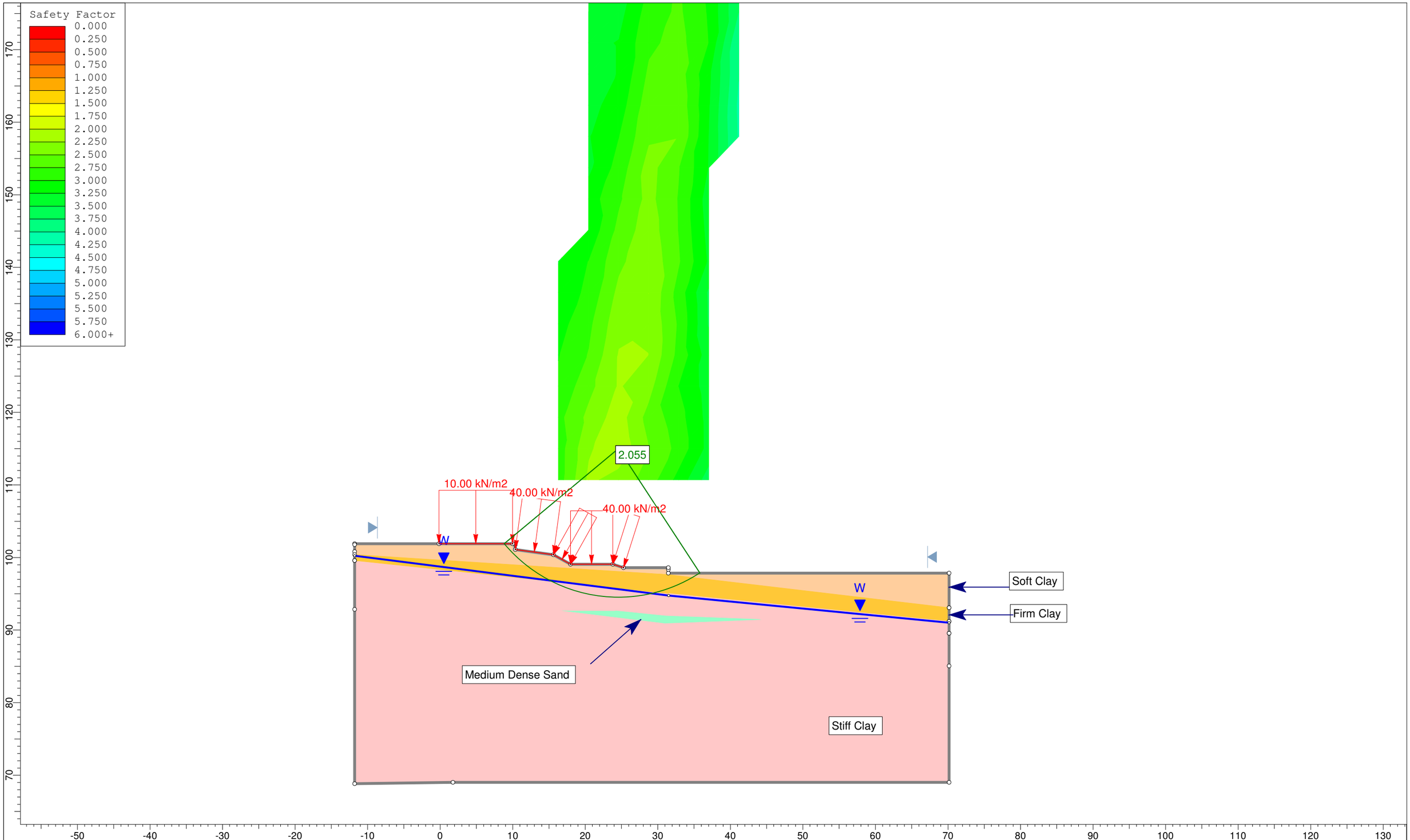
SLIDEINTERPRET 6.029



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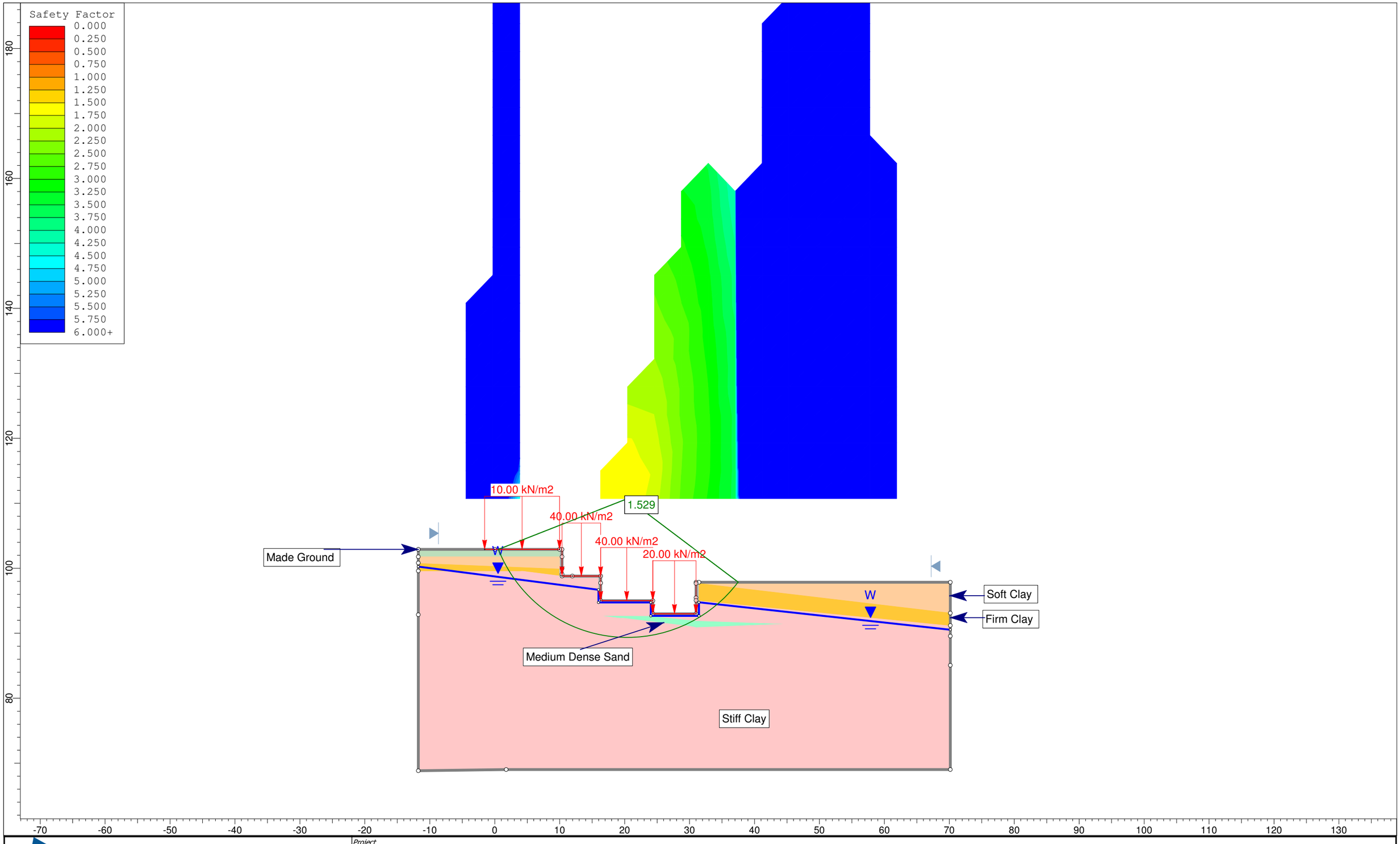
	Date 11/03/2015, 10:22:33		*File Name* 69 redington road Slide run - DA 1 Comb 2 - Existing.slim

SLIDEINTERPRET 6.029



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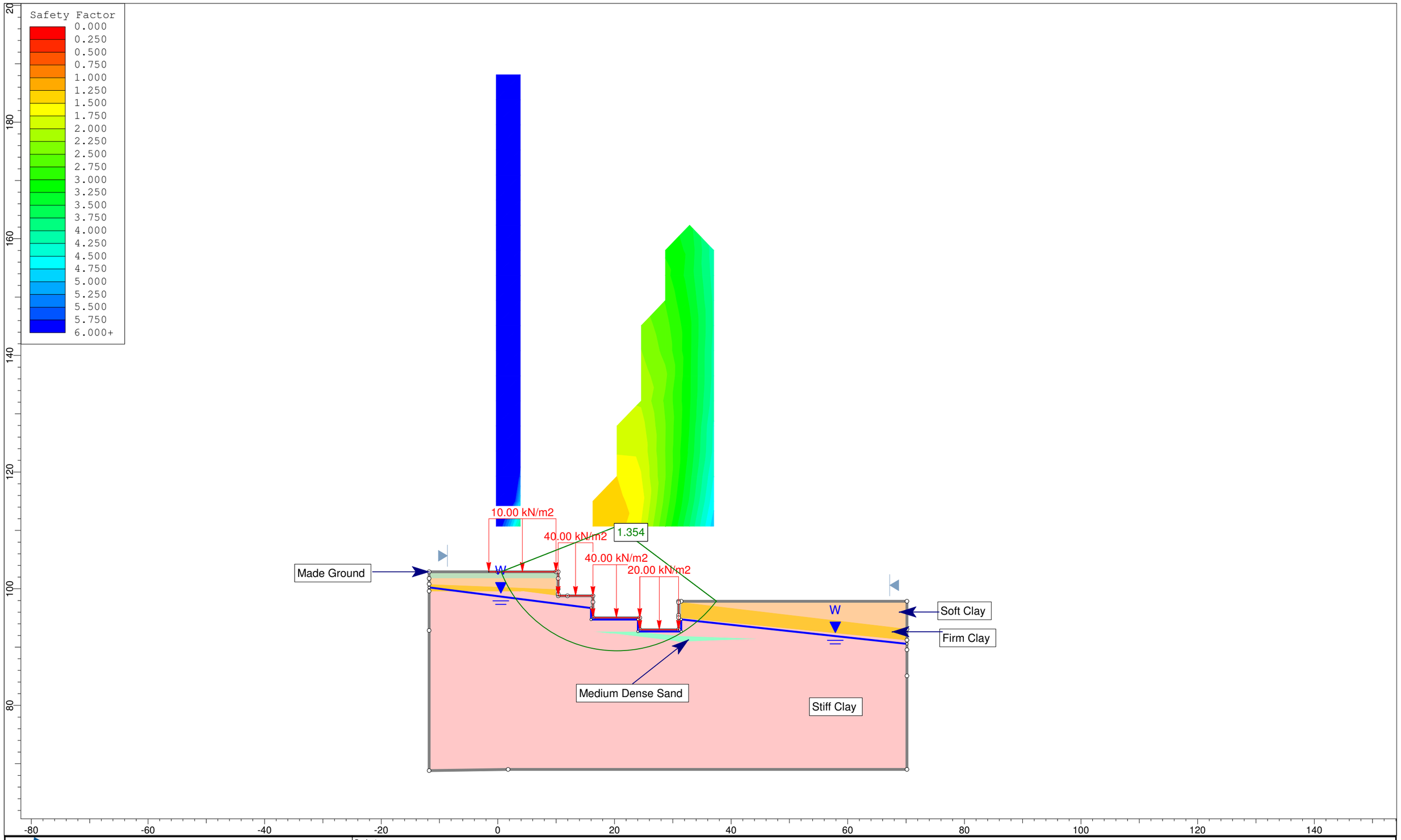

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	Date 11/03/2015, 10:22:33		*File Name* 69 redington road Slide run - DA 1 Comb 2 - With new basement.slim

SLIDEINTERPRET 6.029

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