APPENDIX B: KGA GEOTECHNICAL LIMITED (KGA) GIR

GEOTECHNICAL INVESTIGATION REPORT
PROPOSED RESIDENTIAL SUBDIVISION
GRAND VIEW ESTATE
OREWA

Prepared For:

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Reference: 7464-10

2 November 2015

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REPORT ISSUE AUTHORISATION

Geotechnical Investigation Report
Proposed Residential Subdivision
Grand View Estate
Orewa

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KGA GEOTECHNICAL

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Geotechnical Investigation Report
Proposed Residential Subdivision
Grand View Estate
Orewa

1.0 INTRODUCTION

At the request of Orewa West Investments Limited (OWI), KGA Geotechnical Limited (KGA) have carried out a geotechnical engineering investigation on two separately titled parcels of land, namely Lot 1 DP 310813 and Lot 3 DP 327701, which make up the Grand View Estate site (formerly known as Hall Farm West) in Orewa.

The purpose of this investigation is two-fold. Firstly, it has been carried out in order to assess the feasibility of the current proposed development, which at this point we understand is to be split over eight Stages of earthworks and development, and secondly to assess the engineering requirements for the overall development and to provide development specific recommendations for each Stage, where appropriate.

KGA Geotechnical Limited (KGA) have previously undertaken an investigation on the site, and the results of that work are presented in the report entitled "Preliminary Geotechnical Engineering Investigation, Proposed Subdivision, Hall Farm West, Orewa", dated 16 September 2013, reference No. 7464-1. Physically, the site has essentially remained unchanged since our earlier report was undertaken; only the extent of the proposed development has changed. As such, this document, and the detailed investigation presented herein, essentially follows on from, and expands upon our previous investigation. As a result, many of the findings of our previous investigation have been included within this report. However, in order to avoid repetition, we have only summarised the key points of our previous report, rather than reproduce the complete document. Additionally, we have not appended a complete copy of our previous report, as it is assumed that it is already held on file by Council. Regardless, it is recommended that the reader of this document familiarises themselves with the contents and findings of our earlier report before reading this report.

The investigation work carried out as part of the current investigation has been undertaken to augment the findings of our original work with respect to obtaining additional information from key areas of development.

Whilst the current investigation covers the overall proposed development, this report focuses on the southern portion of the site (Stage One) and the central gully (Stage Eight), as we understand that it is proposed to develop these areas first. In this way, specific attention has been given to Stage One and Stage Eight in order to allow specific Subdivision Consent and Engineering Approval to be obtained for these parts of the development initially.

The level of investigation carried out is also considered appropriate to support an application for a Subdivision Consent for the remainder of the site (Stages Two to Seven). However, the investigation undertaken at this time is not considered to be sufficiently detailed to allow comprehensive specific design parameters and recommendations to be provided for the engineering design of the remaining Stages. In this respect, further Stage specific investigation, analysis and design work will be required for Stages Two to Seven, as and when each Stage is submitted for Engineering Approval.

2.0 SITE DESCRIPTION & PROPOSED DEVELOPMENT

2.1 Site Description

The site is currently comprised of two separately Titled parcels of land that are separated by a paper road. The two blocks of land are Lot 1 DP 310813 and Lot 3 DP 327701 and, together, they have a total plan area of approximately 85ha.

Overall the site has an irregular plan shape and is located immediately west of the Northern Motorway State Highway One (ALPURT B1/B2), with the Orewa Interchange present to the south-east of the centre of the site. Aside from the motorway, the site is surrounded by rural land to the south and west, and Department of Conservation (DOC) land to the north. For reference, the above features and designations are shown on our Site Plan - Aerial Photograph drawing, attached as Sheet KGA 1.

In general, the site topography is steeply sloping, however there are some near level areas of note. An indication of the current topography is shown on our Site Plan - Topographic Contours drawing, attached as Sheet KGA 2. The site coverage includes a mix of grass pasture land, and areas of regenerating native bush and planted exotic trees. There is also some evidence of former sediment control measures in places towards the eastern site boundary.

A check of the Auckland Council online Geographical Information System (GIS) indicates that the site is not presently serviced by public stormwater, wastewater or water supply services.

2.2 Proposed Development Overview

We are in receipt of part of a series of drawings prepared by Airey Consultants Limited (ACL), entitled “Orewa West Investments Ltd, Grand View Estate, Orewa”, dated October 2015, Job No. 11712-01. These drawings depict the extent of the proposed development. We have also received a copy of a drawing entitled “Scheme Plan Of Subdivision Staging” prepared by Hampson & Associates Limited (HAL), reference no. 5970. For reference, a copy of the ACL and HAL drawings received are presented in Appendix 1.

The ACL drawings provided include:

- Earthworks staging plans,
- Final contours plans,
- Roading layout plans,
- Stormwater layout and flooding plans,
- Typical stream crossing details, and
- Wastewater layout.

Where appropriate, we have transposed relevant information from the ACL drawings on to our own drawings. In referring to the ACL drawings, we have generally referenced their sheet numbers only.

The HAL scheme plan provided shows that it is proposed to subdivide the site into 556 residential Lots over eight stages of development. KGA understand that each stage will also be split into a number of sub-stages, and that the necessary infrastructure will be developed such that each sub-stage can independently procured. In all, the proposed Lots and roading infrastructure constitute an overall site coverage of approximately 48ha. The remainder of the property is to be held within a governing body corporate. We understand that much of this land is to be planted in native vegetation, and that an extensive network of walking tracks will be constructed.

Access to the subdivision is to be gained via a new public road that will be formed off the western roundabout of the State Highway One, Orewa Interchange. This will directly provide access to the Stage One area, and the works for the subsequent Stages will progressively create a central loop road, along with other smaller roads that will allow access to the new Lots.

The stormwater plans provided indicate that all stormwater run-off generate from the finished development will be managed by way of five stormwater wetlands and up to twelve raingardens. Stormwater will be directed to these features via a reticulated network of pipes, swales and designated over land flowpaths. Additionally, a reticulated network will be constructed to accommodate all future wastewater effluent generated by the finished development. Via a series gravity feeds and rising mains from pumping stations, the reticulated wastewater network will connect into the existing wastewater network that is present within the properties to the east of the Motorway corridor.

No plans have been provided with respect to water supply. Instead, from discussions with ACL, we understand it is proposed to utilise individual domestic water supply tanks for each future Lot. As of writing this report we understand that a potential potable water bore investigation is underway to identify any aquifers at depth that could be used as a back-up water supply to the individual domestic water supply tanks.

We point out that the extent of the Stages shown on the HAL Scheme Plan is different to that shown on the ACL drawings. In this respect, we understand that the stages indicated on the ACL drawings are earthworks Stages and therefore constitute a larger site area. In general, when referring to each Stage of Development hereinafter, unless specifically mentioned, we are referring to the ACL defined earthworks Stages.

2.3 Site Description Update

The property largely remains unchanged from our previous investigation. The only main point of difference now is that the juvenile stands of gorse noted previously appear to have largely grown unchecked, and now cover much larger tracts of the site. We also noted the presence of some additional geomorphological features that were not evident or present two years ago. Where applicable, the additional geomorphological features have been added to our drawings.

3.0 SUMMARY OF PREVIOUS INFORMATION

3.1 Overview

Our previous investigation was prepared as a preliminary geotechnical investigation in support of a Plan Change application. Essentially, it constituted a feasibility study to investigate a proposal to subdivide the site into one hundred and five residential Lots in a clustered arrangement, and comprised:

- A detailed desk study of available third party reports, published geologic information, the Council Property File and analysis of stereoscopic aerial photographs,
- Comprehensive geomorphological walkover and mapping exercise,
- The excavation of four test pits, and the drilling of twenty five hand auger boreholes and twelve rotary machine boreholes,
- Slope stability analysis of specific locations as an indicator of the existing state of stability on the site, and
- General development recommendations which were to be subject to further investigation, and detailed analysis and design.

Whilst the key points from our previous report are presented below, it is recommended that the reader of this document familiarises themselves with the findings and recommendations of our earlier report in order to gain a complete understanding of the previous work that has already been undertaken by KGA on the subject site.

3.2 Desk Study

3.2.1. Third Party Reports

As part of our previous investigation, we were provided with the reports on two previous geotechnical assessments that had been undertaken on the site. These were:

1. Foundation Engineering Limited (FEL, now defunct), "*Geotechnical Assessment on Hall Farm (West) Development at Grand Drive, Orewa, For Eastwood Developments Limited*", Project No. 11747, dated 5 November 2004, and,
2. Beca Infrastructure Limited (BIL), "*Report, Northern Gateway, Grand View Estate, Land Capability Plan*", prepared for Crown Law, dated May 2006, reference No. unknown.

The findings and recommendations of the reports by FEL and BIL were summarised in detail within our previous geotechnical report, and reference should be made to that document with respect to this information, and also for the copies of the reports as provided to KGA.

A brief summary of each report is provided below.

2004 FEL report

This report was prepared to comment on any geotechnical constraints to future residential development. It comprised a desk study, Aerial Photograph Interpretation (API) and site walkover, but no subsurface investigation. FEL identified numerous geomorphological features on the site, including: soil creep, hummocky ground, shallow-seated rotational land movements, relict deep-seated land movements, debris mounds, mid-slope benches and areas of wet/boggy ground, which were all generally considered to be indicative of major land instability.

General comment was then provided as the developability of the site in its current state, noting that some parts of the site were suitable for moderately intensive residential building development (Zone A), other parts could potentially be made suitable for moderately intensive residential development through significant earthworks (Zone B), and that other parts were unlikely to be economic to develop altogether (Zone C). Regardless, FEL stated that their findings and recommendations, in addition to any future development plans, would need to be subject to specific subsurface investigation.

2006 BIL Report

Like the earlier FEL report, the BIL document was prepared to comment on the suitability of the site for future residential development and to outline any likely remediation measures needed in order to improve the stability of the land. BIL's investigation comprised a desk study, Aerial Photograph Interpretation (API) and site walkover. They also referenced some geotechnical information held on file from the ALPURT B1/B2 construction, where applicable. Despite this, detailed investigation and analysis was indicated to be required for the design of any future development on the site.

BIL only describe two geological units as being present on the site, as some materials indicated on an earlier geologic map (1989 1:50,000) were not identified at any of the investigation points for the ALPURT B1/B2 project.

BIL described the site as mainly being rural land with the site office for the ALPURT B2 construction near the eastern boundary of the site. They also indicated the presence of three notable areas of non-engineered fill that were placed during the preliminary earthworks for ALPURT B2; a plan was provided to indicate their approximate location (near to the current, eastern site boundary). Essentially, the Fill was placed in these locations as, for various reasons, it was not considered suitable to be re-used as engineered fill for the motorway formation works. Apparently, the central fill dump was partially engineered, however, the others were not.

The geologic conditions exposed in the motorway road cuts identified some small scale faulting, and the geological bedding was found to be relatively shallow dipping (5° - 10°). Of note, some bedding planes were identified as being sheared and clay coated with low shear strength values. One such seam was apparently identified at the base of a translational slide that was allegedly reactivated during the ALPURT works in April 2006. This slide is within the motorway land but adjacent to the site boundary near the Northern Pan-Handle area. Our previous investigation did not find any evidence of this feature within the subject site.

Like FEL, BIL reported that the site contained numerous geomorphological features of note, many of which were considered to be potentially reactivated by saturation, seismic activity, earthworks and/or watercourse down-cutting.

Shallow seated slope instability was considered to be occurring on slopes that are presently steeper than 1 Vertical on 3 Horizontal, where as historic and deep-seated complex movements were thought to be occurring at the soil/rock transition and are related to high-groundwater pressures at that interface point. Many of these historic, deeper seated features could potentially be reactivated by poor earthworks design, however BIL also commented that these areas could also potentially be made suitable for medium to high density development through substantial earthworks, including drainage and the filling-in of ephemeral gullies.

In terms of any future development, BIL commented that all stormwater should be disposed and controlled in such a way so as not to promote stream erosion, which could lead to slope instability.

BIL also zoned the site in terms of developable areas. In general, the flatter parts of the site were considered suitable for high density development, whereas the moderately and steeply sloping sections were considered suitable for moderate and low density development respectively. The final zone defined by BIL was the areas where development should be avoided, largely due to the likely economics of earth-working and stabilising those areas.

Of the non-engineered motorway fill dumps, BIL commented that the central fill dump would need to be investigated further to assess its suitability to support development; the northern and southern fill dumps were recommended to be removed if development was planned in these locations.

The comments contained within both the FEL and BIL reports highlight some very serious slope instability concerns on the site. For the detailed summaries of these reports, and the full, reproduced text of each, reference should be made to our earlier geotechnical report, as referenced in Section 1.0 above.

No new third party reports relating to the site have been sighted by KGA since our previous investigation was undertaken.

3.2.2. Geology

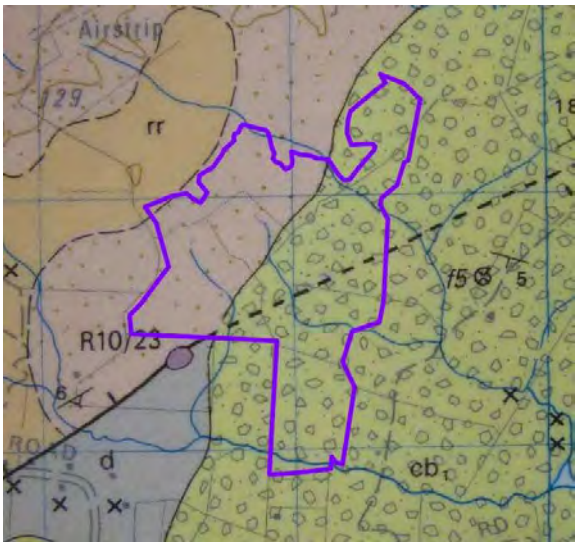
The geology of the site and surrounding area is detailed on the Geological Map of New Zealand, Sheet R10, Whangaparaoa (Scale 1:50,000), dated 1989. This shows the site (located at approximately R10 590117) to be underlain by three separate geologic units, namely:

- Post Miocene Chaos Breccia (cb) of Pleistocene age,
- Pakiri Formation (ri) of Miocene age, and
- Paremoremo Formation (rr) of Miocene age.

Both the (ri) and (rr) materials are subgroups within a larger unit known as the Waitemata Group (WG). Within the text associated with the geological map, the (cb) materials are described as having originating from the WG. However they, or at least the general area thereof, have been subjected to significant mass landslide movements during the Pleistocene epoch.

On Sheet R10, the (cb) materials are separated from the (ri) materials by a defined unconformity contact boundary, and the (ri) and (rr) materials are separated by an inferred contact boundary.

For reference, an excerpt from the Sheet R10, Whangaparaoa geology map, approximately centred on the subject site, is shown below.



Excerpt from Sheet R10, "Whangaparaoa" geological map. Extent of site boundary shown is approximate only. Excerpt not to scale.

From a geotechnical engineering perspective, the (ri) and (rr) lithology's are more or less identical. The (cb) materials are also similar in composition, however the theory behind their origin suggests some portions of the (cb) materials are in situ, whilst other parts are thought to have been displaced on a massive scale. As such, these materials are considered to be more prone to instability and mass movements than any of the other WG subgroups.

Of note, Sheet R10 also indicates that a concealed fault passes through the central portion of the site in an approximate southwest-northeast alignment. Other geologic features of note that are shown on Sheet R10 are bedding plane markers in the vicinity of the site which indicate that the (ri) materials are dipping at 6° degrees to the southeast, and that the (cb) materials are dipping at 5° to the southwest. An individual outcrop of Parnell Grit (a distinct subgroup of the WG, notable for being significantly stronger than other WG materials) is indicated approximately 2km west of the subject site (not shown on map excerpt).

The structural geologic features shown on the geologic map are significant in that faults, particularly significant ones, tend be associated with:

- High groundwater levels or artesian groundwater pressures,
- Deep-seated ground instability,
- Shallow-seated ground instability, and,
- Low strength soils,

Further to this, the shallow dip of bedding is significant in that many deep seated translational and complex instability features in the area of the subject site are considered to be structurally controlled and associated with weak, clay lined bedding planes within the rock mass itself.

Further to the above, we have also referenced the Institute of Geological and Nuclear Sciences geologic map, Map 3, Auckland (Scale 1:250,000), dated 2001. This coarse scale map generally shows similar features to Sheet R10 (referenced above), although the (cb) materials are not indicated, nor is the concealed fault that passes through the site.

We point out that all geologic maps, particularly those of coarse scale, are area based and compiled via a combination of remote sensing techniques and field information that is often obtained from discrete and distant locations. As a result, the presence or absence of any material or geologic feature on any site can only be confirmed by specific investigation techniques.

3.2.3. Council Property Files

Copies of the Council held Property Files were obtained for both Lots that make up the overall Grand View Estate site. The information presented on the two property files is largely identical and essentially relates entirely to the motorway construction works.

The earliest entry relates to the site offices for the APLURT project, however later entries relate to the motorway fill dump areas. One such entry highlights that historic instability features would be mitigated by filling in the proposed gully (towards the southern end of the site).

Aside from the above, no further relevant information was identified on either property file.

3.2.4. Aerial Photograph Interpretation (API)

Two sets of aerial photograph stereo pairs, dated 1940 and 2004 respectively, were obtained and examined using a desk mounted mirror stereoscope. This was undertaken to identify and confirm the general presence of the features mapped by others, and to identify any further features of note that were not presented by either FEL or BIL.

The API work identified:

- Structural lineaments (large scale geological faults/fractures),
- Arcuate and semi-arcuate features (recent and historic head-scarps),
- Distinct mounds or blocks (inferred debris lobes and/or intact blocks),
- Areas on steep slopes that appear disrupted or disturbed on a small scale (soil creep),
- Distinct areas of geomorphic change (different geologic units), and
- The three motorway fill areas.

Similar features (minus the motorway fills) were identified by both FEL and BIL. We did not attempt to recreate their findings, instead we identified and mapped only the most significant features, and any other features that were not reported by either FEL or BIL.

We point out that many indicators of historic instability were identified within the gullies that were filled in as part of the motorway formation works.

For reference, we have reproduced and updated the overall photo geomorphology plan from our previous report. This drawing, entitled Photo Geomorphological Plan - Overall, is attached as Sheet KGA 3.

3.3 Field Investigation

The field investigation undertaken previously included a detailed site reconnaissance walkover and a preliminary subsurface investigation.

The site walkover was conducted to observe the lie of the land, confirm the presence of the features identified during our API exercise and/or augment our desk study findings, and to mark out the subsurface investigation points. The walkover largely confirmed the features identified in the API exercise, and also identified some others that that were not present or visible in either of the aerial photograph stereo pairs obtained.

Our preliminary subsurface investigation comprised:

- Four machine excavated test pits (TP 1 - TP4),
- Twenty five hand auger boreholes (AH1 - AH25), and,
- Twelve rotary machine boreholes (MH1 - MH12).

The original test pits were excavated on 30 August 2013 by Frogley Earthmoving Limited using a 3.6t Terex TC37 excavator, with the subsurface materials encountered being logged by a KGA team member.

Each test pit was designated to be taken down to the extent of the machine's reach (approximately 3.2m), or until effective refusal was encountered, whichever being the shallower.

The twenty five hand auger boreholes were drilled between 23 August to 3 September 2013 and were logged by a KGA team member. All the boreholes were designated to be taken to a depth of 5m below ground level, or until effective refusal was encountered, whichever being the shallower. Following this, Scala penetrometer testing was undertaken through the base of each borehole. The Scala testing was intended to be advanced for an additional 2m below the base of each borehole, or until effective refusal was encountered, whichever being the shallower.

The twelve rotary machine boreholes were undertaken between 23 August to 11 September 2013 by DCN Drilling Limited using two separate rotary drilling rigs, each mounted on a Morooka chassis. The core recovered from each drill hole was logged by a KGA team member. Standpipe piezometers were installed in each of the machine boreholes in order to allow the long term monitoring of groundwater levels in the drill locations.

The ground conditions encountered at each investigation point were logged in general accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes', December 2005 as outlined by the NZ Geotechnical Society.

In each of the test pits, hand auger boreholes and rotary machine boreholes, a calibrated shear vane, used in accordance with New Zealand Geotechnical Society Guideline for Hand Held Shear Vane Test, 2001 was used to measure soil strengths, both in situ and remoulded. The vane shear strengths shown on the attached logs have been corrected in terms of BS 1377. It should be pointed out that where hand shear vane tests were undertaken within the machine boreholes, these were undertaken in the end of the core barrel before the material was extruded.

During that investigation, the site was revisited on 10 September 2013 in order to check each of the hand auger boreholes, and the piezometer standpipes installed within the rotary machine boreholes for standing groundwater. Where encountered, the measured depths to standing groundwater level were marked on the relevant borehole logs.

3.4 Geomorphology

The API exercise and site walkover previously undertaken revealed numerous significant geomorphic features of note, including:

- Lineaments and/or faults,
- Deep-seated instability,
- Shallow seated instability,
- Geology units, and,
- Surface and subsurface water drainage patterns.

In general, the approximate location and extent of these features are shown on Sheets KGA attached.

Some of the features that were identified during our API exercise have been subsequently obscured by the motorway construction earthworks, and those features could not be confirmed by onsite observations.

3.4.1. Lineaments

The general area of the site appears to be bisected by a number of lineaments which are considered to be the surface manifestation of large scale structural geological features (fractures and/or fault planes). These features are evident by their influence on the topography of the general area.

Where present, the features are often exploited by water as the path of least resistance, resulting in the observed major drainage features on the site. Concurrently, ridge lines often form parallel to these features.

3.4.2. Deep-Seated Instability

Several notable terraces and large scale areas of disrupted, hummocky ground were identified by the API work and our walkover. These are inferred to be evidence of deep seated translation and complex (combination of rotational and translational) mass movements.

In general, most of these features were considered to be historic, however one area towards the north-western corner of the site was considered to be active. In line with the findings of BIL, these movements are generally considered to be controlled by discontinuities or bedding planes within the underlying rock that are thought to be anywhere between 8m to 16m deep.

3.4.3. Shallow-Seated Instability

Two forms of shallow-seated instability were identified on the site. These are soil creep, and rotational and translational slides.

Soil creep was noted to be evident on many of the steeper slopes on the site.

Numerous shallow-seated slips and slides (<6m deep) were identified, both by the API exercise and during our reconnaissance site walkover. Most are considered historic, with the oldest being weathered and eroded such that only remnants are visible, however others are more distinct suggesting that they are much younger in age; there is even some which appear very recent (last 5 years) in age.

The slips that were not visibly active were generally considered to be potentially active and in a state of limit equilibrium.

3.4.4. Geology Units

Several localised geology units were identified in our API exercise and included:

- A suspected debris fan,
- Colluvium fields (landslide debris),
- Alluvium (river and stream deposits), and,
- Fill originating from the motorway construction.

A large scale, suspected debris fan, was identified towards the northern end of the site. Whilst unlikely to be present, if this feature does exist, it was consider it to be of ancient origin (i.e., when sea levels and climatic conditions were much different than today) and therefore stable.

Several distinct colluvium fields were downslope of large scale head-scarp features. In many locations, the colluvium fields included intact blocks and colluvium lobes indicative of both shallow and deep-seated instability features.

Localised deposits of alluvium were identified around streams and in the base of gullies.

Three distinct locations of fill were noted on the site from our walkover and API exercise. This material is present in three distinct locations which we have labelled as Motorway Fill 1, 2 and 3 on Sheet KGA 3.

3.4.5. Drainage

The ridges within the property divide the site into several watersheds, each of which eventually feed into the three main watercourses that are present on Grand View Estate. Overall, the smaller, tributary gullies were noted to contain ephemeral watercourses/overland flow paths that generally appear to only become active during winter, and also during periods of intense and prolonged rainfall.

At the extreme head of most of the tributary gullies, we observed localised wet and boggy areas that we have inferred to be indicative of natural groundwater springs and seepage areas.

In three distinct locations we identified small scale ‘sink-hole’ like depressions during our reconnaissance walkover. These features are inferred to be where shallow groundwater flow has created a subterranean cavity, which, over time, has enlarged, and the ground above has subsequently collapsed, resulting in the observed ‘sink-hole’ like feature.

Given the complex geomorphology of the site, it is highly possible that there are other subterranean cavities present elsewhere on the site that have not yet collapsed into sink-holes, particularly downslope of any elevated wet and boggy areas, of which there are many.

3.5 Subsurface Conditions

As the site has essentially remained physically unchanged since our initial investigation, the investigation points from our previous work on the site are considered to remain applicable to this current investigation. As such, the findings from our earlier work have been incorporated into this investigation and are specifically referenced in detail within the Sections below that discuss each Stage individually.

3.6 Stability

Slope stability was considered to be the primary geotechnical hazard to the proposed subdivision, although other parts of the site were also considered to be susceptible to consolidation settlement following a change in land use.

Qualitative and quantitative assessments of the stability of the site were carried out based upon our desk study, subsurface investigation results, third party proposed development drawings, and publicly available topographic contour data.

The qualitative assessment noted that soil creep, rotational and translational slope movements were identified on many parts of the site. Some of those features were considered to be historic, however, some were also observed to be active. The active features included: shallow seated soil creep, shallow seated rotational/translational movements, and some evidence of deeper seated block movements. The historic instability features within the gullies that have been filled by the motorway works, as identified from the API exercise, were considered to effectively stabilised by being sufficiently buttressed and buried by the fill placed in those gullies.

The alluvial soils and motorway fills were both considered likely to be susceptible to consolidation movements following a change in land use (i.e., filling). Considering the length of time that the motorway fills have been in place, the material towards the base of the thicker motorway fill is likely to have completely consolidated under the imposed weight of the material above. However, the upper levels of these fills is still likely to be unconsolidated, and it is possible that some settlement may take place in these areas following any further filling.

The qualitative assessment undertaken involved the computational modelling of cross sections of six parts of the site. The analyses undertaken modelled both the current and the formerly proposed ground surface under three separate load cases, namely:

1. Static conditions (measured groundwater),
2. Raised groundwater conditions,
3. Seismic conditions

In general the analyses returned favourable results for the measured groundwater analyses for each cross section. However, variable results were returned for the raised groundwater and seismic analyses for each section. The results of these analyses suggest that the site is presently stable under measured groundwater conditions, however it was noted that this was generally contrary to site observations.

In general, however, the analyses performed on the (then) proposed finished contours suggested that the proposed works will have a beneficial effect on the overall stability of the site where works are proposed to be undertaken. The gully fill areas would have buttressed and eliminated many of the noted instability features on the gully side slopes, rendering those areas stable.

Where the analyses returned unsatisfactory results, further analyses were undertaken to simulate the effect of including some potential remediation measures in order to assess their applicability. The remedial measures analysed included the construction of engineered shear keys and subsurface drainage, and the results of the follow up analyses suggested that such measures, if designed and implemented correctly, would be beneficial to overall, finished slope stability.

4.0 CURRENT GROUND INVESTIGATION

4.1 General

The current investigation has been undertaken in support of the latest proposed development plans for the site. Whilst the information from our previous work has been included, further subsurface investigation has been carried out in in order to acquire additional information, where appropriate. As part of the latest investigation we have also obtained representative samples for laboratory testing to determine parameters relating to soil strength, compressibility and earthworks compaction.

The proposed development details were not complete at the time the fieldwork was being undertaken and subject to change. As such there are still locations where specific subsurface information is absent.

4.2 Investigation Methodology

4.2.1. Reconnaissance Walkover

A detailed geotechnical and geomorphological site reconnaissance walkover was undertaken as part of our original investigation. A second walkover was conducted as part of this current investigation in order to physically observe the site and identify any points of difference from when we were previously on site two years ago.

During our walkover as part of this current investigation we noted additional sink-holes, wet/boggy areas, and some further shallow seated instability features. The approximate location of the additional features identified have been added to Sheet KGA 3. We point out that while some of these features are new since our last reconnaissance walkover (confirmed by comparing site photographs), others may have been present last time but were not immediately evident due to vegetation cover.

4.2.2. Subsurface Investigation

The results of our earlier investigation are considered to be applicable to this current investigation, and therefore they have been included within this report.

Our current subsurface investigation comprised an additional:

- Three machine excavated test pits (TP5 - TP7),
- Fifty eight hand auger boreholes (AH26 - AH83), and,
- Twelve rotary machine boreholes (MH13 - MH19 and MH21 - MH25).

The location of each test is shown on the investigation and geomorphology plans created to cover each Stage of the development, attached as Sheets KGA 4 to KGA 11. The location details of each point (easting's, northings and levels) were provided by Hampson & Associates Limited and are indicated on the logs presented in Appendix 2. Easting's and Northings are based on the New Zealand Transverse Mercator horizontal datum; levels are based on the Auckland vertical datum.

The machine excavated test pits were carried out in order to physically observe the condition and nature of the ground and to obtain representative bulk material samples for specific compaction testing. These were excavated by Frogley Earthmoving Limited using an 8t Kubota KX080-3, with the subsurface materials encountered being logged by a KGA team member.

Each test pit was designated to be taken down to the extent of the machine's reach, or until effective refusal was encountered, whichever being the shallower. Test Pit TP6, however, was terminated early once the sample was obtained as this investigation point was located immediately adjacent to a rotary machine borehole.

The fifty eight hand auger boreholes were drilled and logged by field technicians subcontracting direct to KGA. All the boreholes were designated to be taken to a depth of 5m below ground level, or until effective refusal was encountered, whichever being the shallower. Following this, Scala penetrometer testing was undertaken through the base of each borehole. The Scala testing was intended to be advanced for an additional 2m below the base of each borehole, or until effective refusal was encountered, whichever being the shallower.

The twelve rotary machine boreholes were drilled by DCN Drilling Limited using two separate rotary drilling rigs mounted on a Morooka chassis and a tractor chassis. The core recovered from each hole was logged by a KGA team member. Standpipe piezometers were installed in each of the machine holes in order to allow the long term monitoring of groundwater levels in the drill locations.

Four bulk bag samples were obtained from test pits TP5 (two samples) and TP6 and TP7 (one sample each). The depth of sampling is indicated on the appended logs. All samples were submitted to the IANZ recognised Geotechnics materials testing laboratory (Geotechnics) immediately upon completion of the test pit exercise in order to preserve them as close as possible to their in situ water content. These samples were subjected solid density testing (NZS4402:1986:Test 2.7.2) and dry density/water content relationship (compaction) tests (NZS4402:1986:Test 4.1.1 and NZS4402:1986:Test 2.1).

Seven undisturbed push tube samples were obtained from machine holes MH14 (one sample), MH15 (three samples), MH16, MH22 and MH26 (one sample each). The samples were immediately sealed, and submitted to Geotechnics immediately upon completion of drilling each hole in order to preserve the samples as close as possible to their in situ water content. The materials contained within the push tube samples were subjected to one-dimensional consolidation testing (NZS4402:1986:Test 7.1) and consolidated undrained triaxial testing (BS1377: Part 8, Clauses 5 - 7).

The ground conditions encountered at each investigation point were logged in general accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes', December 2005 as outlined by the NZ Geotechnical Society.

In each of the test pits, hand auger boreholes and rotary machine boreholes, a calibrated shear vane, used in accordance with New Zealand Geotechnical Society Guideline for Hand Held Shear Vane Test, 2001 was used to measure soil strengths, both in situ and remoulded, where appropriate. The vane shear strengths shown on the attached logs have been corrected in terms of BS 1377. It should be pointed out that where hand shear vane tests were undertaken within the machine boreholes, these were undertaken in the end of the core barrel before the material was extruded.

The site was subsequently revisited on 04 August 2015 in order to check each of the latest hand auger boreholes, and the piezometer standpipes installed within the rotary machine boreholes for standing groundwater. Another visit was conducted on 19 August 2015 in order to check the water levels within the piezometer standpipes of all machine holes only. Where encountered, the most recent measured depths to standing groundwater level are marked on the relevant borehole logs.

4.3 LABORATORY TEST RESULTS

Within the results of the compaction tests, Geotechnics generally described the materials received as silty clay and clayey silt, and silt, all with varying minor fractions of clay, sand and gravel.

Within the results of the one dimensional consolidation tests and consolidated undrained triaxial tests, Geotechnics generally describe the samples received as comprising clayey silt, silt and sandy silt with varying minor fractions of clay and sand.
The detailed results of the laboratory tests are presented within Appendix 3.

4.3.1. Solid Density

The solid density tests returned results of 2.69 t/m³ (TP5, at 2.0m below present ground level), 2.68 t/m³ (TP5, 4.5m), and 2.71 t/m³ (TP6, 2.0m), and 2.72 t/m³ (TP7, 2.5m). The average of these equates to 2.70 t/m³.

Excluding the deeper sample from TP5 (less weathered, in situ materials), and the materials sampled in TP6 (fill), the average from the near surface samples in TP5 and TP7 (in situ, residual soil) equates to 2.705 t/m³.

4.3.2. Compaction Tests

Only one sample tested (TP7 at 2.5m below present ground level), yielded a smooth, parabolic curve when plotting dry density vs soil water content. Table 1 below summaries the mass dry density test results.

Table 1. Summary of Laboratory Standard Compaction Tests.

Sample	Depth (m)	Natural Water Content (%)	Optimum Water Content (%)	Maximum Dry Density (t/m³)	Solid Density (t/m³)
TP5	2.0	41.7	33	1.39	2.69
TP5	4.5	36.3	18	1.61	2.68
TP6	2.0	27.6	19	1.63	2.71
TP7	2.5	42.4	33	1.37	2.72

From Table 1 it is clear that the materials sampled were all generally wet of optimum when tested. Along with nearby water level readings from our subsurface investigation, it is likely that the materials within all of the main borrow areas across the site will be wet of optimum from below a depth of 1m - 2m below present ground level.

4.3.3. One Dimensional Consolidation

Three undisturbed push tube samples were obtained from machine hole MH15. A summary of the parameters from the one dimensional consolidation tests is provided in Table 2 below.

Additional parameters from the tests (C_v) for the applied pressure range for each sample tested are presented Appendix 3.

Table 2. Summary of Laboratory One Dimensional Consolidation Tests.

Sample Depth (m)	3.35 - 3.4	6.3 - 6.35	9.35 - 9.4
Pre-Consolidation pressure, σ_{pc} (kPa)	105	200	200
Compression Index, C_c	0.2	0.2	0.25
Swell Index, C_s	0.05	0.04	0.064
Coefficient of volume compressibility, M_v	0.17 ~ 0.27	0.11 ~ 0.16	0.13 ~ 0.23
Initial void ratio	0.924	0.779	0.929

4.3.4. Consolidated Undrained Triaxial

The four push tube samples obtained for Consolidated Undrained Triaxial (CU) testing were targeted to be representative of the near surface soil types on site. Specifically, the samples obtained from MH16 and MH22 were targeted to be representative of the in situ, Waitemata Group residual soils, where as the samples from MH14 and MH25 were targeted to be representative of the colluvium materials. The results of the CU testing are summarised in Table 3 below, however the full results are reproduced in Appendix 3.

Table 3. Summary of Consolidated Undrained Triaxial (CU) Tests.

Sample	Depth (m)	Soil Type	Total Stress		Effective Stress	
			c (kPa)	Ø (deg)	C' (kPa)	Ø' (deg)
MH14	2.60 - 2.73	Colluvium	15	20	11	33
MH16	4.07 - 4.20	Residual Soil	22	21	13	32
MH22	4.17 - 4.30	Residual Soil	12	19	8	29
MH25	2.83 - 2.96	Colluvium	11	22	5	33

4.4 Geotechnical Parameters For Slope Stability Analysis

In conducting the slope stability analyses, we have generally re-used the parameters given within our previous report. Where appropriate, we have also modelled the parameters returned by the CU Triaxial testing conducted as part of this investigation in order to undertake sensitivity analyses with respect to parameter selection.

Mohr-Coulomb strength parameters have been selected to model the soils on the site, however the rock materials have been modelled using Generalised Hoek-Brown strength parameters based upon the samples returned from the machine boreholes. The Mohr-Coulomb parameters used are presented in Table 4 below.

Table 4. Geotechnical Parameters Used in Computational Slope Stability Analyses.

Stratum	Unit Weight, γ (kN/m³)	Cohesion, c' (kPa)	Angle of Friction, Ø' (deg)
Fill	18	2	28
Engineered Fill	18	5	33
Colluvium (vane shear strength < 75kPa) (vane shear strength > 75kPa	 18 18	 2 3	 28 30
Alluvium	18	2	28
Residual Waitemata Group Soils	18	5	30
Waitemata Group Soil/Rock (Transition)	18	10	37
Clay lined bedding plane and shear zones	18	0	15
Waitemata Group Rock	20	Generalised Hoek-Brown parameters used; See analyses.	

5.0 STAGE DESCRIPTION, INVESTIGATION & ANALYSIS

Each Stage of the development is discussed in separate sections below. This includes:

- The existing topography.
- The proposed works.
- The investigation carried out to date and the ground conditions present.
- Slope stability and consolidation (Stage One only) analyses undertaken.

5.1 Stage One

5.1.1. Physical Description

The Stage One earthworks area occupies approximately 11.6ha in the southern portion of the site, as is indicated on the ACL drawings 200, 201 and 210 presented within Appendix 1. In general the earthworks area for the Stage is defined by gullies to the north, west and south, and the subject site boundary to the east, but also includes land on the northern side of the gully to the north.

The very northern-most portions of Stage One comprise a small tributary gully that drains south towards the main watercourse and the future stream crossing area plus an area on the northern bank.

Towards the north of the Stage proper, the land is dominated by a high, W-E trending ridge which has a maximum elevation of about RL66. The northern flank of this ridge is steep, and is bisected by three smaller, tributary gullies, all of which drain to the north into the W-E flowing watercourse. Two of these gullies were noted to contain a series of discrete ‘sink-holes’, and closer to the main watercourse, the ground was noticeably wet and boggy underfoot.

To the south of the high ridge, the ground is a combination of moderately to steeply sloping down towards the watercourse that largely delineates the southern extent of Stage One. Near the southern watercourse, the site is bisected by three ephemeral gullies, all of which drain southwards. The land to the west of the Stage One area is a combination of moderately to steeply sloping ground, and there is evidence of some recent, localised slope instability in this location. Given the proximity of the watercourse to this location, it is possible that the watercourse undermined the stability of the bank, resulting in the localised instability.

From our previous investigation, we are aware that the moderately sloping area approximately in the centre of the Stage contains the large, southern-most motorway fill area. The information identified by our desk study and subsequent investigations suggests that the placement of this material essentially filled in a gully, and that the fill itself is highly variable in its composition and was likely placed with little to no engineering control in terms of drainage, undercutting, and compaction criteria.

Outcrops of in situ, Waitemata Group rock were noted to be present within the watercourse to the south of Stage One.

The API exercise and geomorphological walkover undertaken in our Previous investigation identified numerous indicators of historic slope instability within Stage One. The approximate location of these features are shown on Sheet KGA 4 attached.

5.1.2. Proposed Development

The HAL Scheme Plan provided show that Stage One is to comprise one hundred and nineteen residential Lots. The ACL Plans show that the formation of this Stage will involve creation of an access road into the site, as well as providing for access to the future Stage Two and Stage Six development areas.

The ACL drawings further show that it is proposed to create a more even site profile through the use of cut to fill earthworks that will affect an area of approximately 11.6ha. Considering the existing topography, the finished ground in some places will be up to 1 vertical on 3 horizontal, although, in most other places it will generally be at a grade of 1 vertical on 4 horizontal or flatter.

Retaining walls are indicated around the location of the accessway to Stage Two stream crossing abutments. ACL Drawing No. 407 suggests that the retaining walls forming the abutments will comprise reinforced concrete walls, and that the crossing itself will comprise a segmental concrete arch (bottomless culvert). ACL Drawing No. 201 suggests that retaining walls and stream crossings are likely to be up to a maximum height of 5m above the existing ground level.

The cut to fill plans indicates three main areas of cut and five main areas of fill, approximately as indicated as S1C1 - S1C3 and S1F1 - S1F5 respectively on our Stage One Investigation & Geomorphological Plan, attached as Sheet KGA 4.

Cut depths are indicated to be in the order of 16m, 11m and 8m for S1C1 - S1C3 respectively. These areas approximately correspond to the portions of this Stage with the highest elevations.

Fill depths are indicated to be in the order of 8m, and 7m for S1F1 and S1F2 respectively, and generally up to, or less than 5m for S1F3 to S1F5 each. The fill areas all coincide with the portions of lower elevation. In particular, S1F1 and S1F2 are located within two of small tributary gullies on the southern side of the main watercourse to the north, whereas S1F3 occupies a small tributary gully on the northern side of the main water course; S1F2 also includes the fill that will cross the perennial watercourse and allow construction of the access road to the Stage Two area.

The ACL Drawing No. 210 shows that the earthworks in this Stage will comprise 300,000m³ of cut and 70,000m³ of fill (compacted). The excess of 230,000m³ is to be placed and compacted in the future Stage Eight area and will occupy an area of approximately 3.2ha. Stage Eight is discussed in further detail in Section 5.8 below.

Lastly, the ACL Drawing No. 400 shows it is proposed to create a permanent stormwater wetland area (Wetland 1) towards the southern end of Stage One and a large rain-garden near the northern abutment of the stream crossing to Stage Two.

5.1.3. Investigation & Ground Conditions

As shown on our Stage One Investigation & Geomorphology Plan, the following investigation points are applicable to the development of the Stage One area:

- Five test pits: TP1, TP2, TP5 - TP7.
- Eight machine boreholes: MH1 - MH3 and MH13 - MH17.
- Seventeen hand auger boreholes: AH1, AH2, AH26 to AH35, AH60, AH63, AH64, AH81 and AH82.

The subsurface ground conditions encountered in the Stage One investigation points are briefly described below and summarised in Table 5 below. For a full detailed description of the subsurface conditions encountered, reference should be made to the exploratory hole logs presented within Appendix 2. In preparing a subsurface model of the Stage, we have inferred the subsoil conditions between the investigation points. However, it must be accepted that the conditions are likely to vary between points, particularly when points are remote.

Additionally, considering the discrete nature of the information obtained compared to the overall area of the site, assumptions have been made for those parts of the site where little subsurface information is presently available.

Fill: Fill was encountered in some of the test pits machine holes and hand auger boreholes within Stage One. Within the test pits and machine holes, the fill material comprised a melange that was generally moist to wet but also sometimes saturated at discrete depths, soft to very stiff, clay, silt and sand that also included occasional to frequent inclusions of fine gravel to cobble and boulder sized Waitemata Group rock pieces. Uncorrected SPT 'N' values within this material were found to range between N = 2 to N = 17. The fill identified within hand auger hole AH31 also identified similar conditions. Vane shear strengths within auger hole AH31, and the test pits where fill was encountered were found to range from 48kPa to being too hard to penetrate with the shear vane.

Within hand auger holes AH26, AH30, AH32 and AH33, the fill was found to comprise a surficial layer of topsoil intermixed with silt with occasional intermixed gravel. The fill in auger holes AH26 and AH30 were also found to overlie the in situ topsoil horizon.

In general the fill encountered is not considered to comprise engineered fill. With the exception of AH26, the fill encountered is all in the general location of the former Motorway Fill area. Our desk study identified that the bulk of this fill was likely placed with very little engineering control.

Topsoil: The topsoil was largely present across much of the site, although it was noted to be scarce in the location of Motorway Fill area within Stage One. Elsewise it was generally noted to be between about 100mm and 300mm thick, but was found to be up to 600mm thick in places (AH29).

Colluvium: Colluvium was found to be present from ground surface in many of the locations investigated. The thickness of the colluvium was highly variable; in places a thin as 0.3m (AH35) to 6.1m (MH1). The colluvium was largely found to comprise stiff to hard silt, clay and sand with varying minor degrees of each.

Alluvium: Alluvial deposits were generally encountered from ground surface; however in some places it was found underlying the fill or colluvium. This material was reported to comprise very soft to very stiff silt and clay, with varying minor degrees of each and sand. It was also recorded as being sensitive to extra sensitive (to disturbance) in places. The alluvium encountered was also recorded as containing frequent organic inclusions with an organic odour at some depths.

Residual Waitemata Group Soils: Residual soils derived from in situ weathering of the Waitemata Group materials were generally encountered across the Stage One area, either from ground surface or beneath any of the materials discussed above. These materials are logged as comprising stiff to very stiff clay and silt with varying minor degrees of each and sand. Shear strengths in the residual Waitemata Group soils often, but not always, increased with depth, and in many places were generally found to be in excess of 100kPa.

Waitemata Group Soil/Rock (Transition): A completely weathered to highly weathered horizon of Waitemata Group soil/rock was identified at depth within some of the hand auger boreholes, and within all of the machine boreholes. Where present, we consider this horizon to be where, in terms of overall weathering, the in situ materials transition from a soil to a rock. In general, it was logged as comprising very stiff to hard soil/extremely weak to very weak rock, silt or sand with varying degrees of sand or clay/siltstone or sandstone. Uncorrected SPT 'N' values ranging between N = 13 for 75mm to N = 50 for 45mm were returned within this material.

Waitemata Group Rock: Highly weathered to unweathered Waitemata Group rock was encountered within all of the machine boreholes. These materials were logged as being extremely weak to strong and generally comprised of sandstone and siltstone in alternating horizons of variable thickness. In some locations, horizons of conglomerate like material were also encountered. Sub-horizontal bedding was visible in the core recovered, however the orientation could not be determined. Within several of the machine boreholes we identified distinct clay lined bedding planes, as described by BIL, that ranged in thickness from about 5mm - 20mm thick. Steeply inclined to near vertical fractures were also visible; some of these were stained orange, however no filling was identified. Uncorrected SPT 'N' values in this material were found to range between N = 50 for 75mm to N = 50 for 10mm penetration.

Scala Penetrometer Testing: Scala penetrometer testing was carried out through the base of the hand auger boreholes with effective refusal being encountered below 2/3 of the tests undertaken (within 2.0m of the base of each borehole).

Groundwater: Our previous and current investigations were both carried out towards the end of winter when groundwater levels are typically elevated when compared to summer conditions. As a result, groundwater was identified in most of our boreholes. As the test pits were back-filled after excavation, these could not be checked for the presence of groundwater.

Table 5. Summary of Stage One Subsurface Information.

Bore hole	Original Ground RL	Fill	Colluvium	Alluvium	Waitemata Group Soils	Transition	Waitemata Group Rock	Depth to Standing Groundwater
TP1	42.81	0.0 - 3.0 *	n/a	n/a	n/a	n/a	n/a	†
TP2	50.07	0.0 - 3.0 *	n/a	n/a	n/a	n/a	n/a	†
TP5	34.52	n/a	n/a	n/a	0.0 - 4.6 *	n/a	n/a	†
TP6	38.06	0.0 - 2.3 *	n/a	n/a	n/a	n/a	n/a	†
TP7	65.77	n/a	n/a	n/a	0.0 - 4.8 *	n/a	n/a	†
MH1	25.63	n/a	0.0 - 6.1	n/a	n/a	6.1 - 7.2	7.2 - 17.2*	3.75
MH2	38.27	0.0 - 11.7	n/a	n/a	11.7 - 13.3	13.3 - 13.7	13.7 - 16.6 *	4.6
MH3	52.96	0.0 - 11.8	n/a	n/a	11.8 - 16	16 - 17.6	17.6 - 24.3 *	8.27
MH13	15.98	n/a	n/a	n/a	0.0 - 3.0	3.0 - 4.6	4.6 - 12.1 *	0
MH14	17.05	n/a	0.0 - 3.7	n/a	3.7 - 5.9	5.9 - 6.9	6.9 - 15.0 *	3
MH15	41.17	0.0 - 11.0	n/a	11.0 - 13.4	n/a	n/a	13.4 - 15.2 *	11.47
MH16	66.12	n/a	n/a	n/a	0.0 - 5.5	5.5 - 9.2	9.2 - 19.6 *	8.1
MH17	25.3	n/a	n/a	0.0 - 2.1	n/a	2.1 - 2.3	2.3 - 10.1 *	0.55
AH01	29.31	n/a	n/a	0.0 - 4.0 *	n/a	n/a	n/a	1.05
AH02	36.8	n/a	n/a	n/a	0.0 - 5.0 *	n/a	n/a	n/a
AH26	20.58	0.0 - 0.8	n/a	n/a	0.8 - 4.2 *	n/a	n/a	1.05
AH27	25.03	n/a	n/a	0.0 - 2.2 *	n/a	n/a	n/a	0.0
AH28	18.7	n/a	n/a	0.0 - 2.3	2.3 - 2.8 *	2.8 - 2.9 *	n/a	0.0
AH29	8.03	n/a	n/a	0.0 - 1.2 *	n/a	n/a	n/a	0.75
AH30	38.7	0.0 - 0.6	n/a	n/a	0.6 - 5.0 *	n/a	n/a	4.5
AH31	27.3	0.0 - 5.0 *	n/a	n/a	n/a	n/a	n/a	5.0
AH32	38.42	0.0 - 0.4	n/a	n/a	0.4 - 3.5 *	3.5 - 3.7 *	n/a	3.05
AH33	34.42	0.0 - 0.3	n/a	n/a	0.3 - 4.4	4.4 - 4.5 *	n/a	3.0
AH34	35.72	n/a	0.0 - 0.8	0.8 - 3.5	3.5 - 5.0 *	n/a	n/a	2.5
AH35	29.86	n/a	0.0 - 0.3	0.3 - 2.6	2.6 - 4.6 *	n/a	n/a	1.6
AH60	24.91	n/a	n/a	0.0 - 1.8	n/a	1.8 - 2.2 *	n/a	0.25
AH63	28.25	n/a	n/a	0.0 - 1.0	n/a	1.0 - 2.3 *	n/a	0.5
AH64	23.67	n/a	n/a	0.0 - 1.1 *	n/a	n/a	n/a	0.15
AH81	16.73	n/a	0.0 - 3.3	3.3 - 4.8	4.8 - 5.0 *	n/a	n/a	2.5
AH82	14.38	n/a	0.0 - 3.2	n/a	3.2 - 3.8	3.8 - 3.9 *	n/a	1.55

Note, all material depths indicated are in metres below ground level,

RL in metres above MSL according to survey information provided by Hampson & Associated Limited,

n/a = Material not encountered / Groundwater not present on check date,

* = End of borehole / end test pit, † = Standing groundwater unable to be checked on check date,

(c) = Collapsed at depth

5.1.4. Slope Stability Analysis

We consider that slope stability and consolidation settlement are the two main geotechnical risks to the development of Stage One.

With an area of recent slope instability noted towards the west, the stability of the slopes around the perimeter of the Stage One area, and the finished slopes in the gully fills to the north have been assessed. Furthermore, we have conducted settlement analyses on the motorway fill area to assess if it will undergo any further consolidation settlement as a result of the proposed earthworks and/or future development works, and if so, how much and how long will it take. The consolidation settlement assessments are reported in Section 5.1.5 below.

In order to assess the effect of the proposed development on the sloping ground around the perimeter of the Stage One area, we have prepared seven representative cross sections (Cross Sections 1A - 1G) at the locations shown on our Stage One Investigation & Geomorphology Plan, Sheet KGA 4. These cross sections, developed from the LiDAR contour information obtained from the Auckland Council online GIS service and the proposed finish contour information provided by ACL, were selected to represent the parts of the site where filling is to take place, or steep slopes will be present below the development. Details of the cross sections are shown in the slope stability calculations contained within Appendix 4.

In carrying out our analyses, we have modelled several separate load cases:

1. Current profile with current groundwater conditions (based on our field measurements),
2. Current profile with assumed raised groundwater conditions (to reflect possible winter groundwater conditions),
3. Current profile seismic (the current profile, measured groundwater conditions with an added seismic horizontal acceleration coefficient of 0.12g, based on a 150yr earthquake return period as per NZS1170.5:2004), and,
4. Proposed profile with current groundwater conditions,
5. Proposed profile with assumed raised groundwater conditions,
6. Proposed profile seismic.

All the analyses were performed using the computer-based programme "SLIDE" version 6.018 by Rocscience. For all the scenarios modelled, we have further assessed both potential circular and non-circular surfaces. For all non-circular analyses we have used the 'surface optimization' feature to refine the result for the lowest Factor of Safety result returned. All results reported were calculated using Spencer interslice interaction assumption method.

A summary of the Factor of Safety results returned from the analyses are presented in Table 6 below. For the detailed results, refer to Appendix 3.

Table 6. Summary of Slope Stability Analyses Factor of Safety Results.

Cross Section	Surface model	Original Ground Profile			Proposed Ground Profile		
		Measured GW	Raised GW	Seismic	Measured GW	Raised GW	Seismic
1A	Circ.	1.7 ✓	1.7 ✓	1.4 ✓	2.2 ✓	1.9 ✓	1.5 ✓
	Non-Circ.	1.4 ✗	1.7 ✓	1.2 ✓	2.1 ✓	1.8 ✓	1.4 ✓
1B	Circ.	1.4 ✗	1.3 ✓	1.1 ✗	1.4 ✗	1.3 ✓	1.1 ✗
	Non-Circ.	1.4 ✗	1.3 ✓	1.1 ✗	1.4 ✗	1.3 ✓	1.1 ✗
1C	Circ.	2.8 ✓	2.5 ✓	1.7 ✓	1.9 ✓	1.6 ✓	1.4 ✓
	Non-Circ.	2.9 ✓	2.5 ✓	1.6 ✓	1.8 ✓	1.6 ✓	1.3 ✓
1D	Circ.	1.6 ✓	1.3 ✓	1.2 ✓	2.2 ✓	2.1 ✓	1.5 ✓
	Non-Circ.	1.5 ✓	1.3 ✓	1.2 ✓	2.4 ✓	2.3 ✓	1.6 ✓
1E	Circ.	1.9 ✓	1.7 ✓	1.4 ✓	1.9 ✓	1.7 ✓	1.4 ✓
	Non-Circ.	1.9 ✓	1.6 ✓	1.4 ✓	1.9 ✓	1.6 ✓	1.4 ✓
1F	Circ.	2.2 ✓	1.8 ✓	1.6 ✓	2.0 ✓	1.6 ✓	1.4 ✓
	Non-Circ.	2.1 ✓	1.6 ✓	1.5 ✓	1.9 ✓	1.6 ✓	1.3 ✓
1G	Circ.	1.5 ✓	1.3 ✓	1.2 ✓	1.6 ✓	1.3 ✓	1.2 ✓
	Non-Circ.	1.5 ✓	1.2 ✗	1.1 ✗	1.5 ✓	1.2 ✗ (✓)	1.1 ✗ (✓)
Values Typically Accepted By Council		1.5	1.3	1.2	1.5	1.3	1.2

✗ = unsatisfactory result, ✓ = satisfactory result - = not analysed

The results of the analyses suggest that, in the current state, Sections 1C, 1D 1E and 1F are generally stable, and that proposed works will either have no detrimental effect, or will be beneficial to the overall stability of Sections 1A, 1C, 1D, 1E and 1F.

Only Section 1B returned unsatisfactory results under both the current and proposed state for some load cases. Close examination of the proposed state analyses suggests that the surfaces with the lowest Factors of Safety are downslope of, and beyond the area of the proposed development.

As such we have reassessed Section 1B by adjusting the search limits to focus the analyses nearer to the area of the proposed works. The results of the further assessment of Section 1B are presented in Table 7 below.

Table 7. Summary of Section 1B Further Slope Stability Analyses.

Cross Section	Surface model	Proposed Ground Profile - Adjusted Limits		
		Measured GW	Raised GW	Seismic
1B	Circ.	2.0 ✓	1.8 ✓	1. 4 ✓
	Non-Circ.	1.8 ✓	1.7 ✓	1.4 ✓
Values Typically Accepted By Council		1.5	1.3	1.2

✗ = unsatisfactory result, ✓ = satisfactory result - = not analysed

The when focusing the search limits nearer to the area of development, the re-analyses for Section 1B return satisfactory results for the proposed profile. This suggests that the proposed works in the area of Section 1B will not adversely affect the existing state of stability.

We point out that the analyses for Section 1G returned Factor of Safety results that are less than the values typically accepted by Council for the non-circular analyses of the raised groundwater and seismic load cases, for both the original ground profile and the proposed ground profile. In this instance, the surfaces analysed all intersected the future road reserve area between Stage One and Stage Six; no residential Lots are located in the area analysed. In this respect, we consider the lower Factor of Safety results returned to be acceptable given the risk of damage to persons and property from a slope failure affecting a road being less than that of a private Lots and residential dwellings.

Based on these results, we conclude that the proposed site formation works for Stage One will not have a detrimental effect on the existing state of stability. Furthermore, in many places the proposed works will have a beneficial effect on the stability of the Stage One area.

5.1.5. Consolidation Analysis

As indicated within Section 3.2.1, we are aware of a large volume of non-engineered fill that was placed in the Stage One area as part of the ALPURT B2 motorway construction works some time around 2005. The approximate extent of this non-engineered fill, referred to as Motorway Fill 1, is shown on our Stage One Investigation and Geomorphology Plan, attached as Sheet KGA 4. Additionally, Sheet KGA 4 includes the ACL Drawing No. 201 (Cut-Fill Plan) as an underlay in order to high-light the extent of the proposed site formation works in the location of the Motorway Fill 1. This shows that approximately the eastern half of the Motorway Fill area will be subject to bulk excavation earthworks, whilst bulk filling will take place on the western half.

In general the ACL Drawing No. 201 shows the deepest areas of cut (approximately 6m to 7m) are located around the southern and eastern fringes of the Motorway Fill 1 area, whilst the thickest portion of filling will be up to 4m to the southwest.

The investigation points present within the area mapped as Motorway Fill 1 include:

- Three test pits: TP1, TP2 and TP6.
- Three machine boreholes: MH2, MH3 and MH15.
- Three hand auger boreholes: AH30 to AH32.

In general these points indicate that the depth of in situ fill ranges between 0.4m (auger hole AH31) to 11.8m (machine hole MH3). Based on this, it is expected that the natural, in situ Waitemata Group soils will be exposed around the edges of the mapped fill area, but not towards the centre where the fill is the thickest.

As indicated in Section 3.2.1, we understand that Motorway Fill 1 was largely constructed with little engineering control, and that the materials used were otherwise considered unsuitable for reuse as bulk fill during the ALPURT B1/B2 construction. The materials logged in our investigation points confirm this, indicating the variable nature of the composition and strength of the material within the Motorway Fill 1 area.

Within Section 3.6 we note that considering the length of time that the fill has been in place (approximately 10 years at the time of writing this document), it is likely that the fill near the base will have consolidated under the self-weight of the material above.

However, the near surface materials are expected to be unconsolidated and therefore are likely to be susceptible to consolidation settlement following a change in land use. More specifically, if left unmitigated, consolidation settlement is expected to occur regionally where the area of bulk fill is proposed to the west, and locally where the future residential developments will utilise on site, above ground domestic water supply tanks.

Using the geological profile from machine holes MH2, MH3 and MH15, and the data obtained from the one dimensional consolidation tests carried out on the samples obtained from machine hole MH 15 (presented in Section 4.3.3 above), we have carried out representative settlement analyses using the computer-based programme, Settle 3D, version 3.015 to simulate the worst case scenario by modelling the thickest area of fill.

In conducting our analyses we have divided the non-engineered fill into three layers, with assigned properties for each adopting the results of the one dimensional consolidation laboratory tests as presented in Table 2 within Section 4.3.3 above. Additional parameters used within the settlement analyses to those presented within Table 2 are presented in Table 8 below:

Table 8. Parameters Used in Consolidation Settlement Analyses.

Motorway Fill 1	Layer 1	Layer 2	Layer 3
Depth below ground level (m)	0 ~ 3.5	3.5 ~ 7.0	7.0 ~ 10.0
Pre-Consolidation pressure, σ_{pc} (kPa)	105	200	200
Compression Index, C_c	0.2	0.2	0.25
Swell Index, C_s	0.05	0.04	0.064
Coefficient of volume compressibility, M_v (m^2/MN)	0.17 ~ 0.27	0.11 ~ 0.16	0.13 ~ 0.23
Initial void ratio	0.924	0.779	0.929
Unit weight (kN/m^3)	18	18	18
Poisson ratio	0.35	0.35	0.35

In conducting our analyses we have assessed five separate scenarios:

(i) 4m of engineered fill above existing ground surface,

(ii) Same as (i) but replace top 3m of existing fill with engineered fill,

(iii) 10,000L water tank placed on existing ground surface,

(iv) Same as (iii) but replace top 3m of existing fill with engineered fill,

(v) 10,000L water tank placed on to of 4m of engineered fill above existing ground surface,

(vi) Same as (v) but replace top 3m of existing fill with engineered fill.

The results of the above analyses are presented in Table 9 below.

Table 9. Summary of Consolidation Settlement Analyses.

Scenario		Estimated potential ground surface settlement (mm) due to applied loading	
		Based on consolidation parameters, C_c, C_s, P_c, etc.	Based on linear parameters, M_v
(i)	4m of engineered fill only	80	100
(ii)	Top 3m of existing fill undercut and replaced, 4m of engineered fill	34	46
(iii)	Water tank only	22	7
(iv)	Top 3m of existing fill undercut and replaced, water tank	4	4
(v)	Water tank on top of 4m of engineered fill	5	4
(vi)	Top 3m of existing fill replaced, 4m of fill added, water tank	5	3

Detailed results of our settlement calculations are presented within Appendix 5.

The results presented in Table 9 above are calculated estimates based upon our interpretation of the laboratory data returned. We also point out that these estimates are based on the settlement as a result of primary consolidation only. Regardless, we consider these results to be upper bound values; the actual settlements will likely vary across the Motorway Fill 1 area.

We point out that scenario (i) and (ii) above presents the estimated settlement at existing ground level due to load induced by proposed filling. This indicates how much additional material is likely to be required to top up the fill during construction in order to achieve the desired finished level, should the fill be placed upon the current ground level (scenario (i)), or if the top 3m of the Motorway Fill is undercut and replaced with engineered fill (scenario (ii)). The other scenarios present the estimated settlement at the proposed ground level due to the load imposed from a 10,000L domestic water tank only.

The results presented in Table 9 suggest that settlement could potentially be problematic for scenario (i) and (iii). However, scenarios (ii) and (iv) suggest that by undercutting and replacing the upper 3m of the Motorway Fill, the estimated level of settlement decreases significantly.

Scenarios (v) and (vi) suggest that the level of settlement following construction of a water tank upon 4m of proposed fill will produce settlement results that are likely within tolerable limits, regardless of weather the top of the motorway fill has been undercut or not.

Irrespective of scenarios (v) and (vi), we recommend that the upper 3m of motorway fill is undercut and replaced with engineered fill in order to reduce long term settlement and provide a more suitable founding stratum for the subdivision and future developments to be constructed upon. Further recommendations regarding the under-cutting of the motorway fill material are discussed in Section 6.2.1 below.

5.2 Stage Two

5.2.1. Physical Description

The Stage Two earthworks area occupies approximately 9.4ha adjacent to the eastern site boundary, as is indicated on the ACL drawings 200, 201 and 220 presented within Appendix 1. In general, Stage Two is largely defined by gullies to the north and south, a ridge to the west, and the overall site boundary to the east.

Towards the west, Stage Two is dominated by elevated, E-W and N-S trending ridges; the highest point (where the two ridge alignments meet) has a maximum elevation of about RL65. The northern flank of the E-W aligned ridge is moderate to steeply sloping, although it also contains some near level areas. Towards the centre of the Stage there is a large, near level area where the former ALPURT B2 project office and parking area were located, and also where the other, significant motorway fill is located within this stage. To the south, the land is moderately to steeply sloping and is bisected by two gullies that both drain towards the south; of the two, the eastern gully is smaller but no less steep, while the larger gully (outside of the Stage Two development area) contains a series of linked 'sink-holes'. The land to the west of the Stage Two area is generally moderately sloping.

To the south and north of Stage two there is evidence of historic, shallow seated, rotational instability, and deeper seated translational instability. There is also evidence of soil creep on the side slopes leading into the larger gully that is present to the south. The approximate location of the geomorphic features within Stage Two are shown on the Stage Two Investigation & Geomorphological Plan, attached as Sheet KGA 5.

5.2.2. Proposed Development

The HAL Scheme Plan provided show that Stage Two is to comprise one hundred residential Lots. The ACL Plans show that the formation of this Stage will involve the continuation of the access road from Stage One to the south, as well as providing for access to the future Stage Three development area. The works also include forming the stream crossing for the future accessway from Stage Three to Stage Four.

The ACL drawings show that it is proposed to create a more even site profile through the use of cut to fill earthworks that will affect an overall area of 9.4ha. The drawings suggest that the maximum, finished slope gradients will be in the order of 1 vertical on 3 horizontal. We note that there are some proposed Lots located on the steep slopes to the north of Stage Two where no cut to fill earthworks are proposed. In their current state, these slopes are generally at a grade of 1 vertical on 3 horizontal.

Retaining walls are indicated around the location of the accessway to the Stage Four stream crossing abutments. ACL Drawing No. 407 suggests that the retaining walls forming the abutments will comprise reinforced concrete walls, and that the crossing itself will comprise a segmental concrete arch (bottomless culvert). ACL Drawing No. 201 suggests that retaining walls and stream crossings are likely to be up to a maximum height of 5m above the existing ground level.

The cut to fill plans indicate one main area of cut, and four main areas of fill, approximately as indicated as S2C1 and S2F1 - S1F4 respectively on Sheet KGA 5.

The maximum depth of cut in S2C1 is indicated to be in the order of 14m; this area coincides with the highest ridge elevation within this Stage.

The depth of filling in S2F1 is indicated to be in the order of 8m, but less than 5m in the other significant fill areas within Stage Two. In general, most of the fill areas within Stage Two are located around the margins of the Stage, however S2F4 is located towards the centre of the Stage.

The ACL drawing 220 shows that the earthworks in this Stage will comprise 233,00m³ of cut and 26,000m³ of fill (compacted). The excess material cut from this stage will be placed and compacted part in the Stage Three area (3.0ha, 145,000m³) and part in the Stage Eight area (2.4ha, 62,000m³). Stage Three is discussed further in Section 5.3 below, whilst Stage Eight is discussed in Section 5.8 below.

The ACL Drawing No. 400 shows that it is proposed to create four permanent stormwater wetland areas within Stage Two; one at the western extent of Stage 2 (Wetland 2), one towards the southern end of Stage Two (Wetland 3), one to the north (Wetland 4) and one near the northern abutment of the Stage Seven stream crossing area (Wetland 5).

5.2.3. Investigation & Ground Conditions

As shown on Sheet KGA 5, the following investigation points are applicable to the Stage Two area:

- Two Test Pits: TP3 and TP4.
- Three Machine boreholes: MH9, MH10 and MH24.
- Seven Hand Auger Boreholes: AH61, AH62, AH65 - AH67, AH70 and AH78.

The subsurface ground conditions encountered in the Stage Two investigation points are briefly described below and summarised in Table 10 below. For a full detailed description of the subsurface conditions encountered, reference should be made to the exploratory logs presented within Appendix 2.

In preparing a subsurface model of Stage Two, the subsoil conditions have been inferred between our investigation points. However, it must be accepted that, in actuality, the conditions are likely to vary between points, particularly when the distance between locations is great. Additionally, considering the discrete nature of the information obtained compared to the overall area of the site, assumptions have been made for those parts of the site where little subsurface information is presently available.

Fill: Fill was encountered in machine hole MH10, and in test pit TP3 only. These are all investigation points located in the approximate area of Motorway Fill 2. Similar to the fill Motorway Fill 1 material encountered in Stage One, this material comprised a melange that was generally moist to wet but also sometimes saturated at discrete depths, firm to very stiff, clay, silt and sand that also included occasional to frequent inclusions of fine gravel to cobble sized Waitemata Group rock pieces. Uncorrected SPT 'N' values within this material were found to range between N = 2 to N = 12, with an average of N = 6.

In general, based upon composition and strength, the Motorway Fill 2 material encountered in Stage Two is not considered to comprise engineered fill. Our desk study also identified that the bulk of this fill was likely placed with very little engineering control.

Topsoil: Topsoil was present across most of Stage Two, although notably absent in the area of Motorway Fill 2. Where found, it was generally noted to be between 100mm and 400mm thick.

Colluvium: Colluvium was found to be present from ground surface in machine holes MH9 and MH24, and in auger hole AH65. The colluvium was largely found to comprise soft to stiff silt and clay, with varying minor degrees of each, along with sand and gravel.

Alluvium: Alluvial deposits were encountered from ground surface in hand auger holes AH62, AH66 and AH70, and beneath the colluvium in machine hole MH24. This material was reported to comprise very soft to very stiff clay, silt and sand, with varying minor degrees of each. Additionally, the material was noted to be extra sensitive to quick (disturbance). The material was also recorded as containing frequent organic inclusions with an organic odour at some depths.

Residual Waitemata Group Soils: With the exception of test pit TP3, and machine holes MH9, MH10 and MH24, residual soils derived from in situ weathering of the Waitemata Group materials were in all Stage Two investigation points, either from ground surface or beneath any of the other materials discussed above.

These materials are logged as comprising stiff to very stiff clay and silt with varying minor degrees of each and sand. Shear strengths in the residual Waitemata Group soils often, but not always, increased with depth, and in many places were generally found to be in excess of 100kPa.

Waitemata Group Soil/Rock (Transition): A completely weathered to highly weathered horizon of Waitemata Group soil/rock was identified at depth within some of the hand auger boreholes (AH66, AH70 and AH78), and within machine boreholes MH9 and MH10 only. In general, this material was logged as comprising very stiff to hard soil/extremely weak to very weak rock, silt or sand with varying degrees of sand or clay/siltstone or sandstone. Uncorrected SPT 'N' values of N = 17 and N = 39 were returned within this material.

Waitemata Group Rock: Highly weathered to unweathered Waitemata Group rock was encountered within all of the machine boreholes. These materials were logged as being extremely weak to strong and generally comprised of sandstone and siltstone in alternating horizons of variable thickness. In some locations, horizons of conglomerate like material were also encountered. Sub-horizontal bedding was visible in the core recovered, however the orientation could not be determined. Within several of the machine boreholes we identified distinct clay lined bedding planes. Steeply inclined to near vertical fractures were also visible; some of these were stained orange, however no filling was identified. Uncorrected SPT 'N' values in this material were found to range between N = 50 for 75mm to N = 50 for 50mm penetration.

Scala Penetrometer Testing: Scala penetrometer testing was carried out through the base of each hand auger borehole with effective refusal being encountered in about half of the tests undertaken (within 2.0m of the base of each borehole).

Groundwater: Our previous and current investigations were both carried out towards the end of winter when groundwater levels are typically elevated when compared to summer conditions. As a result, groundwater was identified in most of our boreholes. As the test pits were back-filled after excavation, these could not be checked for the presence of groundwater.

We point out that, when checking machine hole MH24 for groundwater, the groundwater was found to be bubbling out of the top of the piezometer, the top of which was finished 0.6m above present ground level. This was noted on several separate occasions following drilling.

Table 10. Summary of Stage Two Subsurface Information.

Bore hole	Original Ground RL	Fill	Colluvium	Alluvium	Waitemata Group Soils	Transition	Waitemata Group Rock	Depth to Standing Groundwater
TP3	51.72	0.0 - 0.35 *	n/a	n/a	n/a	n/a	n/a	†
TP4	53.32	n/a	n/a	n/a	0.0 - 2.7 *	n/a	n/a	†
MH9	47.11	n/a	0.0 - 6.1	n/a	n/a	6.1 - 6.5	6.5 - 15.0 *	0.95
MH10	54.38	0.0 - 11.9	n/a	n/a	n/a	11.9 - 19.0	19.0 - 20.7 *	0.75
MH24	18.02	n/a	0.0 - 1.9	1.9 - 5.6	n/a	n/a	5.6 - 15.1 *	> -0.6
AH61	48.42	n/a	n/a	n/a	0.0 - 5.0 *	n/a	n/a	0.75
AH62	38.44	n/a	n/a	0.0 - 2.8	2.8 - 3.3 *	n/a	n/a	0.0
AH65	39.03	n/a	0.0 - 2.1	n/a	2.1 - 5.0 *	n/a	n/a	0.6
AH66	20.72	n/a	n/a	0.0 - 2.2	2.2 - 3.5	3.5 - 3.7 *	n/a	0.0
AH67	40.45	n/a	n/a	n/a	0.0 - 5.0 *	n/a	n/a	2.9
AH70	30.07	n/a	n/a	0.0 - 1.8	1.8 - 2.4	2.4 - 2.8 *	n/a	0.0
AH78	21.8	n/a	n/a	n/a	0.0 - 3.0	3.0 - 3.1 *	n/a	n/a

Note, all material depths indicated are in metres below ground level,

RL in metres above MSL according to survey information provided by Hampson & Associated Limited,

n/a = Material not encountered / Groundwater not present on check date,

* = End of borehole / end test pit, † = Standing groundwater unable to be checked on check date,

(c) = Collapsed at depth

5.2.4. Slope Stability Analysis

Slope stability and consolidation settlement of the material within Motor Way Fill 2 are considered to be the two main geotechnical risks to the development of Stage Two. The stability of the slopes around the perimeter of the Stage Two area have been assessed, particularly where bulk filling is proposed to be undertaken.

The potential for consolidation settlement within Motorway Fill 2 is discussed in Section 5.2.5 below.

In order to assess the effect of the proposed development on the sloping ground around the perimeter of the Stage Two area, we have prepared three representative cross sections (Cross Sections 2A to 2C) at the locations shown on our Stage Two Investigation and Geomorphology Plan, attached as Sheet KGA 5. These cross sections were developed from the same base information as those prepared for Stage One (see Section 5.1.4), and the locations were selected to represent the parts of the site where filling is to take place above any steeply sloping ground, or where steep slopes will be present below the completed development. Details of the cross sections are shown in the slope stability calculations contained within Appendix 3.

As mentioned in Section 5.1.4 above, all analyses have been performed using the “SLIDE” computer programme under the same six initial load cases. All scenarios were assed for both potential circular and non-circular surfaces, and for the non-circular surfaces we have used the ‘surface optimization’ feature to refine the result for the lowest Factor of Safety result returned. All results reported were calculated using Spencer interslice interaction assumption method.

A summary of the Factor of Safety results returned from the analyses are presented in Table 11 below. For the detailed results, refer to Appendix 3.

Table 11. Summary of Slope Stability Analyses Factor of Safety Results.

Cross Section	Surface model	Original Ground Profile			Proposed Ground Profile		
		Measured GW	Raised GW	Seismic	Measured GW	Raised GW	Seismic
2A	Circ.	1.7 ✓	1.5 ✓	1.2 ✓	1.9 ✓	1.6 ✓	1.3 ✓
	Non-Circ.	1.7 ✓	1.4 ✓	1.1 ✗	1.9 ✓	1.6 ✓	1.3 ✓
2B	Circ.	1.4 ✗	1.2 ✗	0.9 ✗	1.3 ✗	1.2 ✗	0.9 ✗
	Non-Circ.	1.4 ✗	1.2 ✗	0.9 ✗	1.2 ✗	1.2 ✗	0.9 ✗
2C	Circ.	1.2 ✗	1.2 ✗	0.8 ✗	1.3 ✗	1.2 ✗	0.9 ✗
	Non-Circ.	1.2 ✗	1.2 ✗	0.8 ✗	1.3 ✗	1.2 ✗	0.9 ✗
Values Typically Accepted By Council		1.5	1.3	1.2	1.5	1.3	1.2

✗ = unsatisfactory result, ✓ = satisfactory result - = not analysed

The results of the analyses returned satisfactory results for the proposed ground profile for Section 2A.

The analyses returned unsatisfactory Factor of Safety results for the original ground profile for both Cross Sections 2B and 2C were returned. The proposed ground profile analyses for these sections also returned unsatisfactory results, indicating that the proposed works will not notably worsen, but also will not improve the existing state of stability to a point where the results can be considered satisfactory.

In order to improve the Factor of Safety results for the proposed profile for both Cross Sections 2B and 2C, we have undertaken several iterations to model the effect of various model adjustments or physical remedial measures. The modelled measures include:

- Adjusting the material parameters modelled (model adjustment),
- Adjusting the search limits of the analyses (model adjustment),
- Removing and replacing some materials (physical remedial measure)
- Subsurface drainage (physical remedial measure), and,
- In-ground retaining walls (physical remedial measure).

Through either one, or a combination of the above measures, we have obtained results for the proposed ground profile for both Cross Sections 2B and 2C which are considered to be satisfactory. These results, along with a brief description of the measures modelled, are presented in Table 12 and discussed further below.

Table 12. Summary of Section 1B Further Slope Stability Analyses.

Cross Section	Surface model	Proposed Ground Profile - Adjusted Limits			Notes
		Measured GW	Raised GW	Seismic	
2B	Circ.	1.6 ✓	1.6 ✓	1.1 ✗ (✓)	Subsurface drainage added, limits adjusted to search within development area.
	Non-Circ.	1.4 ✗ (✓)	1.5 ✓	1.0 ✗ (✓)	
2C	Circ.	1.7 ✓	1.7 ✓	1.3 ✓	Colluvium removed deep subsurface drainage added.
	Non-Circ.	1.7 ✓	1.7 ✓	1.2 ✓	
Values Typically Accepted By Council		1.5	1.3	1.2	

✗ = unsatisfactory result, ✓ = satisfactory result - = not analysed

We point out that the minimum Factor of Safety values returned for the non-circular, measured groundwater model, and the seismic reanalyses of Section 2B, were obtained through the location of a future road reserve. In this respect we consider the lower Factor of Safety results to be acceptable given the risk of damage to persons and property from a slope failure affecting a road being less than that of a private Lot and residential dwelling.

Furthermore, in running the non-circular, seismic analysis of Section 2A, we have further utilised the 'surface optimization' feature for all surfaces with a Factor of Safety less than 1.3. The output from this run shows the ten lowest surfaces and their Factor of Safety results, which are all either 1.2 or higher. In this respect, we consider these results to be acceptable.

Where appropriate, the implementation of the physical remedial measures modelled in order to achieve satisfactory Factor of Safety results is discussed in further detail in Section 6.0 below.

5.2.5. Consolidation Settlement

Based on the results of test Pit TP3 and machine hole MH10, the condition of the material within Motorway Fill 2 appears to be generally more consistent in terms of strength and composition than the material contained within Motorway Fill 1 (as discussed in Section 5.1.5 above). As a result, any consolidation induced ground settlement in the area of Motorway Fill 2 from the proposed works or future Lot development is generally assumed to be the same as, or less than the degree of settlement calculated for Motorway Fill 1. Additionally, due to the lack of specific laboratory test results from this material, we have opted not to undertake any specific consolidation induced settlement analyses at this time.

5.3 Stage Three

5.3.1. Physical Description

The Stage Three earthworks area occupies approximately 6.4ha towards the north-east of the overall site, as is indicated on the ACL Drawing Nos. 200, 201 and 230 presented within Appendix 1. In general, the Stage is largely defined by gullies to the north and east, and ridges to the south-west and west.

Topographically, the Stage occupies a main, NW-SE trending ridge near the south-western extent of the Stage, and three smaller ridges, all orientated NE-SW that branch off the main ridge. The maximum elevation of the main ridge within this Stage is approximately RL 75. The flanks of the three NE-SW trending ridges are all generally very steep. The gullies formed by the ridges all contain ephemeral watercourses.

During our previous investigation, we noted geomorphic features indicating evidence of historic and recent instability within the Stage, including head-scarps, block slides and areas of soil creep, notable areas of boggy/wet ground and sink-holes. The approximate location of the KGA observed and mapped geomorphic features within Stage Three are shown on the Stage Three Investigation & Geomorphological Plan, attached as Sheet KGA 6.

5.3.2. Proposed Development

The HAL Scheme Plan provided shows that Stage Three is to comprise thirty-six residential Lots. The ACL Plans show that the formation of this Stage will involve the continuation of the access road from Stage Two to the south, as well as completing the accessway to the Stage Four stream crossing area, and providing access to the future Stage Five development area.

As discussed in Section 5.2.2 above, some 145,000m³ of fill will have already been placed and compacted within the Stage Three, as part of the works carried out in Stage Two, affecting an area of approximately 3.0ha. Primarily, the fill from Stage Two will be used to begin filling in the gullies between the three NE-SW trending ridgelines. The ACL Drawing No. 230 shows that the remainder of the Stage Three works will affect an area of approximately 3.4ha and will comprise 90,000m³ of cut to fill earthworks that will complete the fills within this Stage.

The ACL Drawing No. 200 indicates that the proposed finished slope gradients will be up to 1 vertical on 3 horizontal in places, but are otherwise 1 vertical on 4 horizontal or flatter. We note that there are proposed Lots located on the steep slopes on the northern edge of the Stage where no cut to fill earthworks are proposed. In their current state, the slopes are generally at a grade of 1 vertical on 2.5 horizontal.

The cut to fill plans indicates three main areas of cut and three main areas of fill, approximately as indicated as S3C1 - S3C3 and S3F1 - S3F3 respectively on Sheet KGA 6.

Cut depths are indicated to be in the order of 14m in S3C1, and less than 5m for both S3C2 and S3C3. These locations approximately correspond to the ridges within this Stage.

Fill depths are indicated to be in the order of 15m, 8m for both S3F1 and S3F2 respectively, and less than 5m in S3F3. The fill areas generally coincide with the portions of lower elevation and gully areas. We point out that the ACL drawing A230 indicates that parts of S3F1 and S3F2, and all of S3F3 will be completed during the Stage Two works.

Lastly, the ACL Drawing No. 400 shows it is proposed to create two rain gardens within Stage Three, presumably to accommodate stormwater run-off from the created accessways only.

5.3.3. Investigation & Ground Conditions

As shown on our Stage Three Investigation & Geomorphology Plan, attached as Sheet KGA 6, the following investigation points are applicable to the development of Stage Three:

- One machine borehole: MH8.
- Ten hand auger boreholes: AH15, AH68 to AH76.

The subsurface ground conditions encountered in the Stage Three investigation points are briefly described below and summarised in Table 13 below. For a full detailed description of the subsurface conditions encountered, reference should be made to the logs presented within Appendix 2. In preparing a subsurface model of Stage Three, the subsoil conditions have been inferred between our investigation points, but it must be accepted that, in actuality, the conditions are likely to vary between points, particularly when the distance between locations is great. Additionally, considering the discrete nature of the information obtained, compared to the overall area of the site, assumptions have been made for the parts of the site where information is limited.

Topsoil: Aside from auger hole AH68, a capping layer of topsoil was present within all of the Stage Three investigation points. In general it was noted to be between 100mm to 300mm thick.

Colluvium: Colluvium was found to be present from ground surface in several of the locations investigated within Stage Three. The colluvium was largely found to comprise firm to very stiff, clay and silt, and loose to sand, varying minor degrees of each. In places the colluvium was recorded as being extra sensitive to quick (disturbance).

Alluvium: Alluvial deposits were encountered from ground surface in some parts of the site. This material was reported to comprise very soft to hard silt and very loose to loose sand, with varying minor degrees of each and clay. The material was also recorded as containing frequent organic inclusions with an organic odour at some depths.

Residual Waitemata Group Soils: Residual soils derived from in situ weathering of the Waitemata Group materials were generally encountered across the site, either from ground surface or beneath any of the materials discussed above. These materials are logged as comprising stiff to hard clay and silt with varying minor degrees of each and sand. Shear strengths in the residual Waitemata Group soils often, but not always, increased with depth, and in many places were generally found to be in excess of 100kPa.

Waitemata Group Soil/Rock (Transition): A completely weathered to highly weathered horizon of Waitemata Group soil/rock (Transition) was identified at depth within machine borehole MH8. In general, it was logged as comprising hard soil/extremely weak to very weak rock, silt and sand with varying degrees of clay, or siltstone/sandstone. One uncorrected SPT 'N' value of N = 20 for 75mm of penetration was returned within this material.

Waitemata Group Rock: Moderately to slightly weathered, extremely weak to weak Waitemata Group rock was encountered at depth within machine borehole MH8. These materials were logged as generally comprising sandstone and siltstone in alternating horizons of variable thickness. Sub-horizontal bedding was visible in the core recovered, however the orientation could not be determined. Uncorrected SPT 'N' values in this material were found to range between N = 25 to N = 50 for 75mm penetration.

Scala Penetrometer Testing: Scala penetrometer testing was carried out through the base of each hand auger borehole within Stage Three, with effective refusal being encountered in just over half of the tests undertaken (within 2.0m of the base of each borehole).

Groundwater: Our investigations were both carried out towards the end of winter when groundwater levels are typically elevated when compared to summer conditions. As a result, groundwater was identified in most of the Stage Three boreholes.

Table 13. Summary of Stage Three Subsurface Information.

Bore hole	Original Ground RL	Fill	Colluvium	Alluvium	Waitemata Group Soils	Transition	Waitemata Group Rock	Depth to Standing Groundwater
MH8	64.47	n/a	0.0 - 6.6	n/a	n/a	6.6 - 8.3	8.3 - 20.3 *	4.8
AH8	78.12	n/a	0.0 - 5.0 *	n/a	n/a	n/a	n/a	4.75
AH68	43.97	n/a	0.0 - 5.0 *	n/a	n/a	n/a	n/a	0.1
AH69	37.87	n/a	0.0 - 2.1	n/a	2.1 - 2.2 *	n/a	n/a	0.0
AH70	30.07	n/a	n/a	0.0 - 1.8	1.8 - 2.4	2.4 - 2.8 *	n/a	0.0
AH71	40.93	n/a	n/a	0.0 - 3.1	3.1 - 3.8 *	n/a	n/a	0.3
AH72	47.22	n/a	n/a	0.0 - 1.4	1.4 - 3.8 *	n/a	n/a	2.6 (c)
AH73	39.46	n/a	0.0 - 0.5	0.5 - 2.4 *	n/a	n/a	n/a	0.4
AH74	27.86	n/a	n/a	0.0 - 3.2 *	n/a	n/a	n/a	0.25
AH75	47.81	n/a	n/a	n/a	0.0 - 5.0 *	n/a	n/a	5.0
AH76	49.5	n/a	n/a	n/a	0.0 - 5.0 *	n/a	n/a	5.0

Note, all material depths indicated are in metres below ground level,

RL in metres above MSL according to survey information provided by Hampson & Associated Limited,

n/a = Material not encountered / Groundwater not present on check date, * = End of borehole

† = Standing groundwater unable to be checked on check date, (c) = Collapsed at depth

5.3.4. Slope Stability Analysis

The proposed site formation works largely involve cutting down the high ground, whilst filling up the lower-lying portions of the Stage. As a result we have assessed the effect of the effect of the proposed development on the stability of the ground in four representative locations, Cross Section 3A to 3D, as shown on Sheet KGA 6 attached. These cross sections were developed from the same base information as those prepared for Stage One (see Section 5.1.4), and the locations were selected to be representative of the steepest portions of the finished ground with respect to the underlying ground conditions present, as identified by our field investigation. Details of the cross sections are shown in the slope stability calculations contained within Appendix 3.

As discussed in Section 5.1.4 above, we have assessed Cross Sections 3A to 3D using the "SLIDE" computer programme under the same six initial load cases. All scenarios were assed for both potential circular and non-circular surfaces, and for the non-circular surfaces we have used the 'surface optimization' feature to refine the result for the lowest Factor of Safety result returned. All results reported were calculated using Spencer interslice interaction assumption method.

A summary of the Factor of Safety results returned from the analyses are presented in Table 14 below. For the detailed results, refer to Appendix 3.

Table 14. Summary of Slope Stability Analyses Factor of Safety Results.

Cross Section	Surface model	Original Ground Profile			Proposed Ground Profile		
		Measured GW	Raised GW	Seismic	Measured GW	Raised GW	Seismic
3A	Circ.	1.5	1.2 ✗	1.1 ✗	1.4 ✗	1.1 ✗	1.0 ✗
	Non-Circ.	1.4 ✗	1.1 ✗	1.0 ✗	1..4 ✗	1.0 ✗	1.0 ✗
3B	Circ.	1.3 ✗	1.0 ✗	1.0 ✗	1.5 ✓	1.5 ✓	1.1 ✗ (✓)
	Non-Circ.	1.3 ✗	0.9 ✗	1.0 ✗	1.5 ✓	1.5 ✓	1.1 ✗ (✓)
3C	Circ.	1.7 ✓	1.3 ✓	1.1 ✗	2.3 ✓	2.2 ✓	1.5 ✓
	Non-Circ.	1.5 ✓	1.1 ✗	1.1 ✗	2.2 ✓	2.2 ✓	1.4 ✓
3D	Circ.	1.5 ✓	1.3 ✓	1.0 ✗	1.5 ✓	1.3 ✓	1.0 ✗
	Non-Circ.	1.4 ✗	1.2 ✗	1.1 ✗	1.4 ✗	1.2 ✗	1.0 ✗
Values Typically Accepted By Council		1.5	1.3	1.2	1.5	1.3	1.2

✗ = unsatisfactory result, ✓ = satisfactory result - = not analysed

The Factor of Safety results returned for most of the runs modelling the original ground profile were unsatisfactory. However, the results returned for the proposed ground profile were generally better, particularly for Section 3C, where satisfactory results were returned for all proposed ground profile analyses, however variable results were returned for Sections 3B and 3D, and the results for Section 3A were all unsatisfactory. These results suggest that the proposed works will be beneficial to the site stability in the area of Section 3C, but will have a marginal effect, or a detrimental effect on the current state of stability in the areas of Sections 3A, 3B and 3D.

For the runs modelling the proposed ground profile for Section 3B, we note that only the seismic analyses returned unsatisfactory results. A closer examination of the results of these analyses shows the modelled surfaces intersecting the ground surface, upslope, in the location of a future road reserve. In this respect, we consider the lower Factor of Safety results returned to be acceptable given the risk of damage to persons and property from a slope failure affecting a road being less than that of a private Lots and residential dwellings.

In order to improve the Factor of Safety results for the proposed profile for both Cross Sections 3A and 3D, we have undertaken several iterations to model the effect of various model adjustments or physical remedial measures, as described in Section 5.2.4 above.

Through either one, or a combination of remedial measures, we have obtained results for the proposed ground profile for both Cross Sections 3A and 3D which are considered to be satisfactory. These results, along with a brief description of the measures modelled, are presented in Table 15 and discussed further below.

Table 15. Summary of Section 1B Further Slope Stability Analyses.

Cross Section	Surface model	Proposed Ground Profile - Adjusted Limits			Notes
		Measured GW	Raised GW	Seismic	
3A	Circ.	1.6 ✓	1.6 ✓	1.2 ✓	Subsurface drainage and shear key added.
	Non-Circ.	1.5 ✓	1.5 ✓	1.1 ✗ (✓)	
3D	Circ.	1.6 ✓	1.4 ✓	1.2 ✓	Four palisade retaining walls added
	Non-Circ.	1.6 ✓	1.4 ✓	1.2 ✓	
Values Typically Accepted By Council		1.5	1.3	1.2	

✗ = unsatisfactory result, ✓ = satisfactory result - = not analysed

We point out that the minimum Factor of Safety values returned for the non-circular, seismic load case reanalysis of Section 3A, were obtained through the location of a future road reserve. In this respect we consider the lower Factor of Safety result for this run to be acceptable given the risk of damage to persons and property from a slope failure affecting a road being less than that of a private Lot and residential dwelling.

We are aware that the remedial measured modelled for section 3D are extensive. In order to refine these measures, additional subsurface investigation and stability modelling will need to be undertaken in this location. Further investigation and analysis is discussed in further detail in Section 6.10 below.

Where appropriate, the implementation of the physical remedial measures modelled in order to achieve satisfactory Factor of Safety results is discussed in further detail in Section 6.0 below.

5.4 Stage Four

5.4.1. Physical Description

The Stage Four earthworks area occupies an area of approximately 5.4ha at the extreme northern end of the overall site, as is indicated on the ACL drawing Nos. 200, 201 and 240 presented within Appendix 1. In general the Stage is largely defined by the site boundary to the north, east and west, and a perennial watercourse to the south. It includes a narrow pan-handle extending to the south which will facilitate the continuation of the access road from the Stage Three area.

Topographically the Stage generally occupies two amphitheatres and that are present between three N-S aligned ridges, and a main, E-W trending ridge that is present towards the northern boundary of the Stage. Where the central and western N-S ridges meet the E-W ridge, the Stage is at its maximum elevations of RL 85 and RL88 respectively.

The westernmost N-S ridge lies outside of the property boundary. The easternmost N-S ridge also lies outside of the property to the northeast, but curves back into the site in a NE-SW orientation towards the southern end of the Stage proper. These two ridges, along with the central N-S ridge create the two amphitheatres. The eastern amphitheatre is truncated by the site boundary, but is generally narrow and steeply sided. The western amphitheatre is larger and contains some near level areas towards the north, becoming steeper to the south. It also has an ephemeral watercourse that drains to the south near the western side of the amphitheatre.

During our previous investigation, we noted geomorphic features indicating evidence of historic and recent instability within the Stage, including head-scarps, block slides and notable areas of boggy/wet ground around the northern end of the western amphitheatre. This Stage also includes the northernmost, and smallest motorway fill area, designated as Motorway Fill 3. The approximate location of the KGA observed and mapped geomorphic features within Stage Three are shown on the Stage Four Investigation & Geomorphological Plan, attached as Sheet KGA 7.

5.4.2. Proposed Development

The HAL Scheme Plan provided show that Stage Four is to comprise sixty-one residential Lots. The ACL Plans show that the formation of this Stage will involve the continuation of the access road from Stage three to the south, along with cut to fill earthworks that will affect only about half of both the western and eastern amphitheatres.

The ACL drawing No. 240 show that the cut to fill earthworks on Stage Four will affect an area of 5.4ha and will involve approximately 102,00m³ of cut and 22,000m³ of fill (compacted). The surplus cut material of 80,000m³ is to be placed and compacted in the future Stage Eight location, affecting an area of 2.5ha; Stage Eight is discussed in further detail in Section 5.8 below. Overall, the Stage will be finished to a gentle gradient of approximately 1 vertical on 4 horizontal or less, although in places it will be finished at grades of up to 1 vertical on 2 horizontal. ACL drawing no. 240 indicates that no residential Lots will be located where the ground is proposed to be finished at a grade of 1 vertical on 2 horizontal.

The cut to fill plans indicates two main areas of cut, and two main areas of fill, approximately as marked as S42C1, S4C2, S4F1 and S4F2 respectively on our Stage Four Investigation & Geomorphology Plan, attached as Sheet KGA 7. We note that there are also some minor areas of cut and fill located in discrete places around the periphery of Stage Four.

The maximum depth of cut is shown to be in the order of 7m in S4C1, and less than 5m in S4C2. S4C1 generally coincides with the main E-W aligned ridge, and the central N-S aligned ridge, where as S4C2 coincides with the portion of the eastern N-S ridge where it curves back into the site towards the southern end of Stage Four.

Fill depths are indicated to be in the order of 7m in S4F1, but less than 5m in S4F2. S4F1 coincides with the head of the steep gully within the site in the eastern amphitheatre; S4F2 is located near the head of the western amphitheatre where the ground is ground is presently gently sloping.

Lastly, the ACL Drawing No. 400 shows it is proposed to create one rain garden within Stage Four, presumably to accommodate stormwater run-off from the created accessways only. A stormwater wetland is to be created towards the southern end of Stage Four, however the ACL drawing No. 220 indicates that this will be created as part of the Stage Two formation works.

5.4.3. Investigation & Ground Conditions

As shown on Sheet KGA 7 the following investigation points are applicable to the Stage Four proposed earthworks area:

- Three machine boreholes: MH11, MH12 and MH25.
- Eight hand auger boreholes: AH20 to AH24, AH77, AH79 and AH80.

The subsurface ground conditions encountered in the Stage Four investigation points are briefly described below and summarised in Table 16 below. For a full detailed description of the subsurface conditions encountered, reference should be made to the exploratory logs presented within Appendix 2. In preparing a subsurface model of Stage Four, the subsoil conditions have been inferred between our investigation points. However, it must be accepted that, in actuality, the conditions are likely to vary between points, particularly when the distance between locations is great. Additionally, considering the discrete nature of the information obtained, compared to the overall area of the site, assumptions have been made for those parts of the site where information is limited.

Fill: Fill was encountered in auger hole AH20 only. In general, this material comprised firm to very stiff silt and clay, but also contained intermixed topsoil. Based on the identified strength and composition, and that no supporting third party information as compaction of this material, we consider that the fill identified is non-engineered.

Topsoil: Topsoil was largely found to be present in most of the Stage Four investigation points. Where identified, usually noted to be between about 100mm and 400mm thick.

Colluvium: Aside from auger hole AH24, colluvium was found to be present from ground surface in all of the Stage Four investigation points. The colluvium was found to be thicker than 5m in the machine boreholes, and in auger holes AH20 to AH23 and AH80. Where present, the colluvium was largely found to comprise firm to hard clay, silt and sand with varying minor degrees of each, along with intermixed limonitic sand and fine gravel.

Alluvium: Alluvial deposits were encountered below the colluvium in auger holes AH77 and AH79 only. This material was reported to comprise firm clay and silt, with varying minor degrees of each and sand. The material was also recorded as containing frequent organic inclusions including decomposing wood..

Residual Waitemata Group Soils: Residual soils derived from in situ weathering of the Waitemata Group materials were encountered from ground surface in auger hole AH24, and beneath the colluvium and/or alluvium in auger holes AH77, AH79 and AH80 only. These materials are logged as comprising firm to hard/medium dense clay, silt and sand with varying minor degrees of each. Vane shear strengths in the residual Waitemata Group soils tended to increase with depth, and in many places were generally found to be in excess of 100kPa.

Waitemata Group Soil/Rock (Transition): A completely weathered to highly weathered horizon of Waitemata Group soil/rock was identified at depth within auger holes AH77 and AH79, and within all of the machine boreholes. In general, it was logged as comprising medium dense to dense soil/extremely weak to very weak rock, sand with varying degrees of silt or clay/siltstone or sandstone. One uncorrected SPT 'N' value of N = 28 was returned within this material.

Waitemata Group Rock: Extremely weathered to slightly weathered Waitemata Group rock was encountered within machine boreholes MH11, MH12 and MH25. These materials were logged as being extremely weak to very strong, and generally comprised of sandstone and siltstone in alternating horizons of variable thickness. In some locations, horizons of conglomerate like material were also encountered. Within several of the machine boreholes we identified distinct clay lined bedding planes. Steeply inclined to near vertical fractures were also visible; some of these were stained orange, however no filling was identified. Uncorrected SPT 'N' values in this material were found to range between N = 10 to N = 50 for 40mm penetration.

Scala Penetrometer Testing: Scala penetrometer testing was carried out through the base of each hand auger borehole. Effective refusal was only encountered beneath two of the seven auger holes (within 2.0m of the base of each hole) drilled within Stage Four.

Groundwater: Our investigations were both carried out towards the end of winter when groundwater levels are typically elevated when compared to summer conditions. As a result, groundwater was identified in most of the Stage Four investigation points. Nested piezometers were installed in machine boreholes MH12 and MH25 to target specifically identified horizons.

Table 16. Summary of Stage Four Subsurface Information.

Bore hole	Original Ground RL	Fill	Colluvium	Alluvium	Waitemata Group Soils	Transition	Waitemata Group Rock	Depth to Standing Groundwater	
MH11	69.39	n/a	0.0 - 9.4	n/a	n/a	9.4 - 1.04	10.4 - 21.1 *	1.65	
MH12	72.15	n/a	0.0 - 6.5	n/a	n/a	6.5 - 7.4	7.4 - 19.7 *	1.4	11.1
MH25	46.23	n/a	0.0 - 6.8	n/a	n/a	6.8 - 8.3	8.3 - 21.1 *	2.0	12.0
AH20	36.91	0.0 - 1.8	1.8 - 5.0 *	n/a	n/a	n/a	n/a	3.8	
AH21	66.38	n/a	0.0 - 5.0 *	n/a	n/a	n/a	n/a	0.95	
AH22	58.1	n/a	0.0 - 4.2 *	n/a	n/a	n/a	n/a	1.85	
AH23	47.64	n/a	0.0 - 5.0 *	n/a	n/a	n/a	n/a	2.4	
AH24	84.54	n/a	n/a	n/a	0.0 - 5.0 *	n/a	n/a	4.5	
AH77	23.21	n/a	0.0 - 2.1	2.1 - 2.9	2.9 - 3.5	3.5 - 3.6 *	n/a	†	
AH79	37.79	n/a	0.0 - 1.5	1.5 - 3.7	3.7 - 4.0	4.0 - 4.1	n/a	1	
AH80	31.79	n/a	0.0 - 0.7	n/a	0.7 - 3.8 *	n/a	n/a	1.5	

Note, all material depths indicated are in metres below ground level,

RL in metres above MSL according to survey information provided by Hampson & Associated Limited,

n/a = Material not encountered / Groundwater not present on check date, * = End of borehole

† = Standing groundwater unable to be checked on check date, (c) = Collapsed at depth

5.4.4. Slope Stability Analysis

The proposed site formation works largely involve cutting down the high ground, whilst filling up the lower-lying portions of the Stage, to create a more even and gently sloping profile. As a result we have assessed the effect of the proposed development on the stability of the ground in two representative locations, Cross Section 4A and 4B, as shown on Sheet KGA 7 attached. These cross sections were developed from the same base information as those prepared for Stage One (see Section 5.1.4), and the locations were selected to be representative of the steepest portions of the finished ground, closest to the proposed Lots and infrastructure, with respect to the underlying ground conditions present, as identified by our field investigation. Details of the cross sections are shown in the slope stability calculations contained within Appendix 3.

As discussed in Section 5.1.4 above, we have assessed Cross Sections 4A and 4B using the "SLIDE" computer programme under the same six initial load cases. All scenarios were assed for both potential circular and non-circular surfaces, and for the non-circular surfaces we have used the 'surface optimization' feature to refine the result for the lowest Factor of Safety result returned. All results reported were calculated using Spencer interslice interaction assumption method.

A summary of the Factor of Safety results returned from the analyses are presented in Table 17 below. For the detailed results, refer to Appendix 3.

Table 17. Summary of Slope Stability Analyses Factor of Safety Results.

Cross Section	Surface model	Original Ground Profile			Proposed Ground Profile		
		Measured GW	Raised GW	Seismic	Measured GW	Raised GW	Seismic
4A	Circ.	2.1 ✓	1.6 ✓	1.5 ✓	2.4 ✓	2.0 ✓	1.7 ✓
	Non-Circ.	2.1 ✓	1.6 ✓	1.5 ✓	2.4 ✓	2.0 ✓	1.6 ✓
4B	Circ.	1.7 ✓	1.3 ✓	1.1 ✗	1.7 ✓	1.4 ✓	1.1 ✗
	Non-Circ.	1.7 ✓	1.4 ✓	1.1 ✗	1.6 ✓	1.4 ✓	1.1 ✗
Values Typically Accepted By Council		1.5	1.3	1.2	1.5	1.3	1.2

✗ = unsatisfactory result, ✓ = satisfactory result - = not analysed

The majority of the results returned, for both the original ground profile and the proposed ground profile, were satisfactory. In general this suggests that the proposed works will not have a detrimental effect on the existing state of stability. However, the results returned for the seismic analyses, for both the original and proposed profiles, for Section 4B, were unsatisfactory. These results suggest that the proposed development works in this particular area will not improve the current state of stability to a degree that can be considered satisfactory.

In order to improve the Factor of Safety results for the proposed profile for Cross Section 4B, we have undertaken several iterations to model the effect of various model adjustments or physical remedial measures, as described in Section 5.2.4 above.

Through either one, or a combination of remedial measures, we have obtained results for the proposed ground profile for both Cross Section 4B which are considered to be satisfactory. These results, along with a brief description of the measures modelled, are presented in Table 18 and discussed further below.

Table 18. Summary of Section 1B Further Slope Stability Analyses.

Cross Section	Surface model	Proposed Ground Profile - Adjusted Limits			Notes
		Measured GW	Raised GW	Seismic	
4B	Circ.	-	-	1.2 ✓	Subsurface drainage added beneath fill at toe of profile.
	Non-Circ.	-	-	1.2 ✓	
Values Typically Accepted By Council		1.5	1.3	1.2	

✗ = unsatisfactory result, ✓ = satisfactory result - = not analysed

Where appropriate, the implementation of the physical remedial measures modelled in order to achieve satisfactory Factor of Safety results is discussed in further detail in Section 6.0 below.

5.5 Stage Five

5.5.1. Physical Description

The Stage Five earthworks area occupies approximately 6.7ha towards the northwest of the site, as is indicated on the ACL drawing Nos. 200, 201 and 250, presented within Appendix 1. In general the Stage is largely defined by the site boundary to the north, east and west, and a NE-SW trending ridge to the south.

Topographically the Stage occupies some of the highest elevated land within the overall site (approximate RL94). North of the NE-SE trending ridge, the land is further divided by two N-S trending ridges and three smaller E-W trending ridges, all of which create several small but steep sided amphitheatres.

During our previous investigation, we noted geomorphic features indicating evidence of historic and recent instability within the Stage. Such features included head-scarps, block slides, areas of soil creep, sink-holes and notable areas of boggy/wet ground. In particular, an area to the west of the Stage Five area was noted to contain an area of boggy, wet ground, upslope of a 'sink-hole, which in turn was upslope of a head-scarp which appears to be recent and presently active.

Towards the base of many of the amphitheatres, particularly near the site boundary, we noted evidence of boggy/wet ground where there was a notable change in slope gradient. Many of the existing slopes within this Stage are at a grade of approximately 1 vertical on 2.5 horizontal, with localised areas up to 1 vertical on 2 horizontal. The approximate location of the KGA observed and mapped geomorphic features within Stage Three are shown on the Stage Five Investigation & Geomorphological Plan, attached as Sheet KGA 8.

5.5.2. Proposed Development

The HAL Scheme Plane provided shows that Stage Five is to comprise forty-six residential Lots. The ACL drawings show that the formation of this Stage will involve the continuation of the main loop road from Stage Three, along with cut to fill earthworks that will affect effectively remove the high ground and fill in two of the amphitheatres.

The ACL drawing A-250 further shows that the cut to fill earthworks on Stage Five will affect an area of 6.7ha and will involve approximately 129,000m³ of cut and 71,000m³ of fill (compacted). The surplus cut material of 58,000m³ is to be placed and compacted in the future Stage Eight portion of the development, affecting an area of 2.3ha of that Stage. Stage Eight is discussed in further detail in Section 5.8 below. In places, Stage Five will be finished to a gentle gradient of approximately 1 vertical on 4 horizontal or less, however in some locations it will be finished at grades of up to 1 vertical on 2 horizontal. We also note that there are proposed Lots located on the steep slopes to the north where no cut to fill earthworks are proposed. In their current state, the slopes are generally at a grade of 1 vertical on 2.5 horizontal.

The ACL drawing No. 201 indicates that there are two main areas of cut, and five main areas of fill, approximately as marked as S52C1 and S5C2, and S5F1 to S5F5 respectively on our Stage Five Investigation & Geomorphology Plan, attached as Sheet KGA 8.

The maximum depth of cut is shown to be in the order of 12m in S5C1 and 9m in S5C2 respectively. The main cut areas within this Stage both coincide with the ridge tops and areas of elevated terrain.

Fill depths are indicated to be in the order of 7m in S5F1, 5m in S5F2, and less than 5m in the other significant fill areas within Stage Five. S5F1, S5F2 and S5F3 all coincide with the small amphitheatre locations, whilst S5F3 is located towards the extreme north of the Stage where the ground is to be raised to form a more even slope profile.

5.5.3. Investigation & Ground Conditions

As shown on Sheet KGA 8 the following investigation points are applicable to the Stage Five proposed earthworks area:

- One machine borehole: MH22.
- Twelve hand auger boreholes: AH16 - AH18, AH47 - AH54, and AH83.

The subsurface ground conditions encountered in the Stage Five investigation points are briefly described below and summarised in Table 19 below. For a full detailed description of the subsurface conditions encountered, reference should be made to logs presented within Appendix 2.

In preparing a subsurface model of Stage Five, the subsoil conditions have been inferred between our investigation points. However, it must be accepted that, in actuality, the conditions are likely to vary between points, particularly when points are remote.

Fill: Fill was encountered in hand auger hole AH16 only. This material was recorded as comprising very stiff silt with occasional intermixed topsoil. It is thought to have been placed as part the formation of a farm track and is therefore is considered to be non-engineered.

Topsoil: The topsoil was found within most of the Stage Five investigation points and was generally noted to be between about 100mm and 300mm thick.

Colluvium: Colluvium was found to be present from ground surface in many of the Stage Five investigation locations. The colluvium was largely found to comprise stiff to very stiff clay and silt with varying minor degrees of each, and sand, as well as intermixed topsoil inclusions.

Alluvium: Alluvial deposits were encountered from ground surface in auger hole AH53, and beneath the colluvium in auger hole AH50 only. This material was reported to comprise firm to stiff silt and clay, with varying minor degrees of each and sand. The material was also recorded as containing frequent organic inclusions and was noted to be extra sensitive in places.

Residual Waitemata Group Soils: Residual soils derived from in situ weathering of the Waitemata Group materials were generally encountered in all of the Stage Five investigation points, either from ground surface or beneath any of the materials discussed above. These materials are logged as comprising stiff to hard, clay silt and sand with varying minor degrees of each. Shear strengths in the residual Waitemata Group soils often, but not always, increased with depth, and in many places were generally found to be in excess of 100kPa.

Waitemata Group Soil/Rock (Transition): A completely weathered to highly weathered horizon of Waitemata Group soil/rock was identified at depth within some of the hand auger boreholes, and within machine borehole MH22. In general, the transition materials were logged as comprising very stiff to hard soil/extremely weak to very weak rock, silt or sand with varying minor degrees of sand or clay/siltstone or sandstone. Uncorrected SPT 'N' values ranging between N = 9 to N = 25 were returned within this material.

Waitemata Group Rock: Moderately to slightly weathered Waitemata Group rock was encountered within machine borehole MH22. These materials were logged as being weak to strong, and generally comprised of sandstone and siltstone in alternating horizons of variable thickness. Steeply inclined to near vertical fractures were also visible; some of these were stained orange, however no filling was identified. Uncorrected SPT 'N' values in this material were found to range between N = 50 for 75mm to N = 50 for 10mm penetration.

Scala Penetrometer Testing: Scala penetrometer testing was carried out through the base of each hand auger borehole drilled within Stage Five. Effective refusal was encountered in only about 25% of the tests undertaken (within 2.0m of the base of each borehole.

Groundwater: Our investigations were both carried out towards the end of winter when groundwater levels are typically elevated when compared to summer conditions. As a result, groundwater was identified in most of our boreholes. Nested piezometers were installed in one of the machine boreholes in order to target specifically identified horizons.

Table 19. Summary of Stage Five Subsurface Information.

Bore hole	Original Ground RL	Fill	Colluvium	Alluvium	Waitemata Group Soils	Transition	Waitemata Group Rock	Depth to Standing Groundwater
MH22	77.6	n/a	0.0 - 3.8	n/a	3.8 - 5.3	5.3 - 8.3	8.3 - 19.6 *	0.3 | 2.35
AH16	55.72	0.0 - 0.8	n/a	n/a	0.8 - 5.0 *	n/a	n/a	2.85 (c)
AH17	60.89	n/a	0.0 - 1.0	n/a	1.0 - 2.9	2.3 - 3.25 *	n/a	2.6
AH18	48.5 (e)	n/a	0.0 - 0.5	n/a	0.5 - 5.0 *	n/a	n/a	3.8
AH47	71.26	n/a	0.0 - 0.4	n/a	0.4 - 4.4	4.4 - 4.6 *	n/a	1.45
AH48	77.33	n/a	0.0 - 0.4	n/a	0.4 - 5.0 *	n/a	n/a	4.05
AH49	53.62	n/a	0.0 - 2.2	n/a	2.2 - 4.5 *	n/a	n/a	2.6
AH50	51.99	n/a	0.0 - 1.2	1.2 - 3.3	n/a	3.3 - 3.5 *	n/a	1.35
AH51	63.4	n/a	0.0 - 5.0 *	n/a	n/a	n/a	n/a	1.3
AH52	61.63	n/a	n/a	n/a	0.0 - 5.0 *	n/a	n/a	4.95
AH53	34.36	n/a	n/a	0.0 - 0.6 *	n/a	n/a	n/a	0.05
AH54	31.72	n/a	n/a	n/a	0.0 - 3.6 *	n/a	n/a	3.05
AH83	40.0 (e)	n/a	n/a	n/a	0.0 - 1.3 *	n/a	n/a	†

Note, all material depths indicated are in metres below ground level,

RL in metres above MSL according to survey information provided by Hampson & Associated Limited,

(e) = estimated RL; borehole not physically surveyed,

n/a = Material not encountered / Groundwater not present on check date, * = End of borehole

† = Standing groundwater unable to be checked on check date, (c) = Collapsed at depth

5.5.4. Slope Stability Analysis

The proposed site formation works largely involve cutting down the high ground, whilst filling up the lower-lying portions of the Stage, in order to create a more even and gently sloping profile. As a result we have assessed the effect of the proposed development on the stability of the ground in six representative locations, Cross Section 5A to 5F, as shown on Sheet KGA 8 attached. These cross sections were developed from the same base information as those prepared for Stage One (see Section 5.1.4), and the locations were selected to be representative of the steepest portions of the finished ground, closest to the proposed Lots and infrastructure, with respect to the underlying ground conditions present, as identified by our field investigation. Details of the cross sections are shown in the slope stability calculations contained within Appendix 3.

As mentioned in Section 5.1.4 above, we have assessed Cross Sections 5A to 5F using the "SLIDE" computer programme, under the same six initial load cases. All scenarios were assed for both potential circular and non-circular surfaces, and for the non-circular surfaces we have used the 'surface optimization' feature to refine the result for the lowest Factor of Safety result returned. All results reported were calculated using Spencer interslice interaction assumption method.

A summary of the Factor of Safety results returned from the analyses are presented in Table 20 below. For the detailed results, refer to Appendix 3.

Table 20. Summary of Slope Stability Analyses Factor of Safety Results.

Cross Section	Surface model	Original Ground Profile			Proposed Ground Profile		
		Measured GW	Raised GW	Seismic	Measured GW	Raised GW	Seismic
5A	Circ.	1.5 ✓	1.3 ✓	1.0 ✗	1.5 ✓	1.4 ✓	1.1 ✗
	Non-Circ.	1.4 ✗	1.2 ✗	1.0 ✗	1.5 ✓	1.4 ✓	1.1 ✗
5B	Circ.	1.2 ✗	1.1 ✗	0.9 ✗	1.1 ✗	1.1 ✗	0.8 ✗
	Non-Circ.	1.1 ✗	1.1 ✗	0.9 ✗	1.1 ✗	1.1 ✗	0.9 ✗
5C	Circ.	1.6 ✓	1.3 ✓	1.1 ✗	1.9 ✓	1.5 ✓	1.3 ✓
	Non-Circ.	1.5 ✓	1.2 ✗	1.1 ✗	1.9 ✓	1.5 ✓	1.3 ✓
5D	Circ.	1.8 ✓	1.5 ✓	1.2 ✓	1.8 ✓	1.6 ✓	1.2 ✓
	Non-Circ.	1.8 ✓	1.4 ✓	1.2 ✓	1.8 ✓	1.6 ✓	1.2 ✓
5E	Circ.	1.6 ✓	1.2 ✗	1.1 ✗	1.7 ✓	1.4 ✓	1.2 ✓
	Non-Circ.	1.5 ✓	1.1 ✗	1.1 ✗	1.6 ✓	1.3 ✓	1.1 ✗
5F	Circ.	1.5 ✓	1.3 ✓	1.0 ✗	1.5 ✓	1.3 ✓	1.0 ✗
	Non-Circ.	1.4 ✗	1.3 ✓	1.0 ✗	1.4 ✗	1.2 ✗	1.0 ✗
Values Typically Accepted By Council		1.5	1.3	1.2	1.5	1.3	1.2

✗ = unsatisfactory result, ✓ = satisfactory result - = not analysed

The results of the analyses returned satisfactory results for all load cases for the proposed ground profile for Sections 5C and 5D. Variable Factor of Safety results were returned for the proposed ground surface for Sections 5A, 5E and 5F. The analyses for Section 5B returned unsatisfactory results for the proposed profile for all load cases assessed.

In general, the results returned for the proposed surface for Section 5A, 5B, 5E and 5F suggest that the proposed development works in these areas area will not improve the current state of stability to a degree that can be considered satisfactory.

In order to improve the Factor of Safety results for Sections 5A, 5B, 5E and 5F, we have undertaken several further iterations to model the effect of various model adjustments, or physical remedial measures, as described in Section 5.2.4 above.

Through either one, or a combination of model adjustments and/or remedial measures, we have obtained results for the proposed ground profile for Sections 5A, 5B, 5E and 5F which are considered to be satisfactory. These results, along with a brief description of the measures modelled, are presented in Table 21, and discussed further below.

Table 21. Summary of Sections 5A, 5B, 5E and 5F Further Slope Stability Analyses.

Cross Section	Surface model	Proposed Ground Profile - Adjusted Limits			Notes
		Measured GW	Raised GW	Seismic	
5A	Circ.	-	-	1.2 ✓	Colluvium removed and replaced with engineered fill, subsurface drainage added beneath engineered fill
	Non-Circ.	-	-	1.2 ✓	
5B	Circ.	1.6 ✓	1.5 ✓	1.2 ✓	Increased parameters for Waitemata Group soils, shear key, toe filling and several palisade retaining walls added
	Non-Circ.	1.7 ✓	1.5 ✓	1.2 ✓	
5E	Circ.	1.8 ✓	1.6 ✓	1.2 ✓	Colluvium removed and replaced with engineered fill, subsurface drainage added beneath engineered fill
	Non-Circ.	1.7 ✓	1.6 ✓	1.2 ✓	
5F	Circ.	2.2 ✓	2.1 ✓	1.4 ✓	Limits adjusted to search closer to development area.
	Non-Circ.	2.2 ✓	1.8 ✓	1.3 ✓	
Values Typically Accepted By Council		1.5	1.3	1.2	

✗ = unsatisfactory result, ✓ = satisfactory result - = not analysed

We note that the proposed works near Section 5F extend close to the site boundary, but the proposed roading infrastructure in this area is distal from earthworks boundary. As such, we have adjusted the model search limits to focus the analyses closer to the proposed roading infrastructure location. This has returned satisfactory results under all load cases assessed.

The remedial measures modelled for Section 5B are extensive and also deviate from the geotechnical parameters modelled elsewhere. In order to refine these measures, and the parameters modelled, additional subsurface investigation, laboratory testing and stability modelling will need to be undertaken in this location. Further investigation and analysis is discussed in further detail in Section 6.10 below.

Where appropriate, the implementation of the physical remedial measures modelled in order to achieve satisfactory Factor of Safety results is discussed in further detail in Section 6.0 below.

5.6 Stage Six

5.6.1. Physical Description

The Stage Six earthworks occupy an area of approximately 8.9ha towards the west of the overall site, as indicated on the ACL Drawing Nos. 200, 201 and 260 appended

Topographically the Stage is dominated by the main NW-SE ridge to the east, and another, smaller ridge in a similar alignment further to the west. The smaller ridge marks the watershed boundary between two gullies that bisect the Stage. The watercourses in these gullies floq towards the south and converge near the site boundary before exiting the property as one. The western flank of the main ridge is a combination of moderately to steeply sloping land that drops very steeply into the stream near the middle of the stage, however towards the north and the south it is more gently sloping into the stream. The flanks of the smaller ridge are also generally steeply sloping. The maximum elevation of the main ridge within this Stage is approximately RL90 at the extreme northern end of the Stage, whereas the smaller ridge has a maximum elevation of about RL61 within the Stage.

During our previous investigation, we noted geomorphic features indicating evidence of historic and recent instability within the Stage, including head-scarps, block slides and, notable areas of boggy/wet ground. The approximate location of the geomorphic features observed and mapped by KGA are shown on our Stage Six Investigation and Geomorphology Plan, attached as Sheet KGA 9.

5.6.2. Proposed Development

The HAL Scheme Plane provided shows that Stage Six is to comprise sixty-seven residential Lots. The ACL drawings show that the formation of this Stage will involve the continuation and completion of the main loop road from Stage One and Stage Five, as well as form the access road to the Stage Seven earthworks area.

The ACL Drawing No. 260 further shows that it is proposed to create a more even site profile on this Stage through the use of cut to fill earthworks that will affect an area of approximately 8.9ha. In some places the finished ground will be up to 1 vertical on 3 horizontal, however, in most areas will largely be at a grade of 1 vertical on 4 horizontal or flatter.

Retaining walls are indicated around the location of the accessway to Stage Seven stream crossing abutments. ACL Drawing No. 407 suggests that the retaining walls forming the abutments will comprise reinforced concrete walls, and that the crossing itself will comprise a segmental concrete arch (bottomless culvert). ACL Drawing No. 201 suggests that retaining walls and stream crossings are likely to be up to a maximum height of 5m above the existing ground level.

The ACL Drawing No. 260 shows that the cut to fill earthworks within Stage Six will comprise approximately 167,000m³ of cut and 75,000m³ of fill (compacted). The surplus cut material of 92,000m³ is to be placed and compacted in the future Stage Eight area, affecting an area of 2.3ha of that Stage. Stage Eight is discussed in further detail in Section 5.8 below.

The ACL Cut-Fill Plan (Drawing No. 201) indicates that there are three main areas of cut and two main areas of fill. These areas are approximately indicated as S6C1 to S6C3, and S6F1 and S1F2 respectively on our Stage Six Investigation & Geomorphology Plan, attached as Sheet KGA 9. Cut depths are indicated to be in the order of 11m in S6C1, 7m in S6C2, and less that 5m in S6C3. The main cut areas general coincide with the eastern main ridge, and the smaller western ridge areas.

Fill depths are indicated to be up to 6m is S6F1, and 5m in S6F2. S6F1 is near and includes the stream crossings to the smaller ridge and the future Stage Seven area, where as S6F2 is located towards the head of the gully that is between the main and smaller ridges.

5.6.3. Investigation & Ground Conditions

As shown on Sheet KGA 9, the following investigation points are applicable to the Stage Six area:

- Five machine boreholes: MH4 to MH6, MH18 and MH19.
- Eight hand auger boreholes: AH5 to AH7, AH10, AH38 to AH40 and AH46.

The subsurface ground conditions encountered in the Stage Six investigation points are briefly described below and summarised in Table 22 below. For a full detailed description of the subsurface conditions encountered, reference should be made to the exploratory logs presented within Appendix 2.

In preparing a subsurface model of Stage Six, the subsoil conditions have been inferred between our investigation points. However, it must be accepted that in actuality the conditions are likely to vary between points, particularly when the distance between locations is great. Additionally, considering the discrete nature of the information obtained compared to the overall area of the site, assumptions have been made for those parts of the site where little subsurface information is presently available.

Fill: Fill was encountered from ground surface in auger hole AH7 only. This material was found to comprise stiff silt with occasional topsoil inclusions. This material is thought to be related to the formation of a farm access track to cross the streams in this location and it is not considered to comprise engineered fill.

Topsoil: The topsoil was present in most of the Stage Six investigation points. Where present it was generally found to range between about 100mm and 300mm thick.

Colluvium: Colluvium was found to be present from ground surface in many of the locations investigated within Stage Six. The colluvium encountered was largely found to comprise soft to very stiff clay, silt and sand with varying minor degrees of each. It was also noted to contain inclusions of topsoil, rootlets, limonite gravel and sand sized cemented clasts.

Alluvium: Alluvial deposits were encountered from ground surface in some of the investigation points closest to the watercourses and low-lying portions of Stage Six. This material was reported to comprise very soft to stiff clay, silt and sand, with varying minor degrees of each, along with organic silt and peat. The material was also recorded as containing frequent organic inclusions with an organic odour at some depths.

Residual Waitemata Group Soils: Residual soils derived from in situ weathering of the Waitemata Group materials were generally encountered across the site, either from ground surface or beneath any of the materials discussed above. These materials are logged as comprising stiff to very stiff clay, and sand with varying minor degrees of each. Shear strengths in the residual Waitemata Group soils often, but not always, increased with depth, and in many places were generally found to be in excess of 100kPa.

Waitemata Group Soil/Rock (Transition): A completely weathered to highly weathered horizon of Waitemata Group soil/rock was identified at depth within some of the hand auger boreholes, and within all of the machine boreholes drilled within Stage Six. In general the transition horizon encountered was logged as comprising very stiff to hard soil/extremely weak to very weak rock, silt or sand with varying degrees of sand or clay/siltstone or sandstone. Uncorrected SPT 'N' values ranging between N = 17 for 75mm to N = 50 for 40mm were returned within this material.

Waitemata Group Rock: Highly weathered to unweathered Waitemata Group rock was encountered within all of the machine boreholes drilled within Stage Six. These materials were logged as being extremely weak to strong and generally comprised of sandstone and siltstone in alternating horizons of variable thickness. Sub-horizontal bedding was visible in the core recovered, however the orientation could not be determined. Within several of the machine boreholes we identified distinct clay lined bedding planes. Steeply inclined to near vertical fractures were also visible; some of these were stained orange, however no filling was identified. Uncorrected SPT 'N' values in this material were found to range between N = 50 for 75mm to N = 50 for 10mm penetration.

Scala Penetrometer Testing: Scala penetrometer testing was carried out through the base of each hand auger borehole and encountered effective refusal beneath all but one auger hole (AH39).

Groundwater: Our investigations were both carried out towards the end of winter when groundwater levels are typically elevated when compared to summer conditions. As a result, groundwater was identified in all of the Stage Six investigation points. Nested piezometers were installed in machine hole MH4 in order to target specifically identified horizons. As expected, groundwater was encountered at shallow depths within the investigation points located near to the existing water courses.

Table 22. Summary of Stage Six Subsurface Information.

Bore hole	Original Ground RL	Fill	Colluvium	Alluvium	Waitemata Group Soils	Transition	Waitemata Group Rock	Depth to Standing Groundwater
MH4	44.39	n/a	0.0 - 4.8	n/a	n/a	4.8 - 6.2	6.2 - 23.2 *	8.0 8.78
MH5	33.88	n/a	0.0 - 4.2	n/a	n/a	4.2 - 5.7	5.7 - 11.2 *	0.4
MH6	68.24	n/a	0.0 - 7.3	n/a	n/a	7.3 - 7.8	7.8 - 15.1 *	2.55
MH18	43.51	n/a	0.0 - 2.7	2.7 - 4.9	4.9 - 5.4	5.4 - 6.5	6.5 - 15.0 *	3.54
MH19	29.4	n/a	0.0 - 3.2	n/a	n/a	n/a	3.2 - 10.7 *	1.65
AH4	44.5	n/a	0.0 - 4.0 *	n/a	n/a	n/a	n/a	1.35
AH5	53.22	n/a	0.0 - 5.0 *	n/a	n/a	n/a	n/a	2.75
AH6	44.19	n/a	0.0 - 5.0 *	n/a	n/a	n/a	n/a	1.45
AH10	59.75	n/a	0.0 - 4.2 *	n/a	n/a	n/a	n/a	1.55
AH38	36.13	n/a	n/a	0.0 - 2.8	2.8 - 3.0	3.0 - 3.1 *	n/a	0.0
AH39	49.66	n/a	n/a	n/a	0.0 - 5.0 *	n/a	n/a	5.0
AH40	30.41	n/a	n/a	n/a	0.0 - 3.0	3.0 - 3.1 *	n/a	1.05
AH46	58.66	n/a	0.0 - 3.1	n/a	3.1 - 3.8	3.8 - 4.0 *	n/a	0.1

Note, all material depths indicated are in metres below ground level,

Material depths indicated in parentheses are inferred from material and strength descriptions / data interpretation,

RL in metres above MSL according to survey information provided by Hampson & Associated Limited,

n/a = Material not encountered / Groundwater not present on check date,

* = End of borehole / end test pit,

† = Standing groundwater unable to be checked on check date,

(c) = Collapsed at depth

5.6.4. Slope Stability Analysis

The site formation works largely involve cutting down the high ground whilst filling up the lower-lying portions of the Stage. As a result we have assessed the effect of the effect of the proposed development on the stability of the ground in two representative locations, Cross Section 6A and 6B, as shown on Sheet KGA 9 attached. These cross sections was developed from the same base information as those prepared for Stage One (see Section 5.1.4), and the locations were selected to be representative of the steepest portions of the finished ground with respect to the underlying ground conditions present, as identified by our field investigation. Details of the cross sections are shown in the slope stability calculations contained within Appendix 3.

As mentioned in Section 5.1.4 above, we have assessed Cross Sections 6A and 6B using the "SLIDE" computer programme under the same six initial load cases. All scenarios were assessed for both potential circular and non-circular surfaces, and for the non-circular surfaces we have used the 'surface optimization' feature to refine the result for the lowest Factor of Safety result returned. All results reported were calculated using Spencer interslice interaction assumption method.

A summary of the Factor of Safety results returned from the analyses are presented in Table 23 below. For the detailed results, refer to Appendix 3.

Table 23. Summary of Slope Stability Analyses Factor of Safety Results.

Cross Section	Surface model	Original Ground Profile			Proposed Ground Profile		
		Measured GW	Raised GW	Seismic	Measured GW	Raised GW	Seismic
6A	Circ.	1.8 ✓	1.5 ✓	1.2 ✓	2.0 ✓	1.7 ✓	1.4 ✓
	Non-Circ.	1.7 ✓	1.5 ✓	1.1 ✗	1.9 ✓	1.7 ✓	1.4 ✓
6B	Circ.	1.8 ✓	1.3 ✓	1.2 ✓	2.0 ✓	1.7 ✓	1.3 ✓
	Non-Circ.	1.8 ✓	1.4 ✓	1.2 ✓	1.9 ✓	1.7 ✓	1.3 ✓
Values Typically Accepted By Council		1.5	1.3	1.2	1.5	1.3	1.2

✗ = unsatisfactory result, ✓ = satisfactory result - = not analysed

The results of the analyses suggest that proposed works will either have no detrimental effect, or will be beneficial to the overall stability of Sections 6A and 6B.

Development recommendations applicable to Stage Six are discussed in Section 6.0 below.

5.7 Stage Seven

5.7.1. Physical Description

The Stage Seven earthworks area occupies an area of approximately 4.8ha adjacent to the extreme west of the overall site, as indicated on the ACL Drawing Nos. 200, 201 and 270 appended. It is bounded by the site boundaries to the south, west and north-west, and a NW-SE aligned gully to the east.

Aside from the gully to the east, Stage Seven is topographically dominated by a N-S aligned ridge to the north that then branches into two ridges that are then aligned NE-SW and NW-SE. The NE-SW branch approximately follows the western site boundary, whilst the NW-SE branch falls back into the Stage itself. There is also a small NE-SW trending spur that stems off the NW-SE ridge which creates a localised, south facing amphitheatre towards the extreme western corner of the Stage. This amphitheatre is currently covered in a plantation of pine trees, but appears to contain an ephemeral drainage channel that drains towards the south. Nearer to the southern boundary there was evidence of a small 'sink-hole', and it was noted that the land further downslope, within the neighbouring property, had been fenced and planted as a protected water-course feature. These features indicated the possible presence of a natural groundwater seep or spring near to the subject site boundary. Our investigation was unable to identify if the potential spring is located within the subject site or not.

Where the N-S ridge splits into two, the Stage has a maximum elevation of approximately RL83. The side slopes of the ridges within this Stage are very steep. During our investigations we identified geomorphic features to indicate historic and recent, active instability, including head-scarps, colluvium fields, areas of soil creep, wet/boggy ground and a 'sink-hole'. The approximate location of the geomorphic features observed and mapped by KGA are shown on our Stage Six Investigation and Geomorphology Plan, attached as Sheet KGA 10.

5.7.2. Proposed Development

The HAL Scheme Plan provided shows that Stage Seven is to comprise fifty-three residential Lots. The ACL drawings show that the formation of this Stage will involve the continuation and completion of the access road from the completed Stage Six stream crossings.

The ACL Drawing No. 270 further shows that it is proposed to create a more even site profile on this Stage through the use of cut to fill earthworks that will affect an area of approximately 4.8ha. Considering the existing topography, the finished ground in some places will be up to 1 vertical on 3 horizontal, although, in general the finished ground will be at a grade of 1 vertical on 4 horizontal or flatter.

The ACL Drawing No. 270 shows that the cut to fill earthworks within Stage Seven will comprise approximately 132,000m³ of cut and 62,000m³ of fill (compacted). The surplus cut material of 70,000m³ is to be placed and compacted in the future Stage Eight area, affecting an area of 1.4ha of that Stage. Stage Eight is discussed in further detail in Section 5.8 below.

The ACL Cut-Fill Plan (Drawing No. 201) indicates that there is one main area of cut, and two main areas of fill. These areas are approximately indicated as S7C1 and S7F1 and S7F2 respectively on our Stage Seven Investigation & Geomorphology Plan, attached as Sheet KGA 10.

Maximum cut depths are indicated to be in the order of 12m in S7C1. The main cut area general coincides with the high, steep sided NW-SE ridge within the Stage.

The maximum depth of filling is indicated to be approximately 10m with S7F1, and less than 5m in S7F2. S7F1 coincides with the amphitheatre between the NW-SE and NE-SW ridges, whereas S7F2 is located near the head of the gully marking the eastern extent of the Stage.

5.7.3. Investigation & Ground Conditions

As shown on our Stage Seven Investigation & Geomorphology Plan, attached as Sheet KGA 10, the following investigation points are applicable to the Stage Seven development:

- One machine boreholes: MH21.
- Six hand auger boreholes: AH8, AH9 and AH41 to AH45.

The subsurface ground conditions encountered in the Stage Seven investigation points are briefly described and summarised in Table 24 below. For a full detailed description of the subsurface conditions encountered, reference should be made to logs presented within Appendix 2. In preparing a subsurface model of Stage Seven, the subsoil conditions have been inferred between our investigation points. However, it must be accepted that, in actuality, the conditions are likely to vary between points, particularly when the distance between locations is great.

Additionally, considering the discrete nature of the information obtained compared to the overall area of the site, assumptions have been made for those parts of the site where little subsurface information is presently available.

Topsoil: The topsoil was largely present in most of the Stage Seven investigation points. Where encountered it was generally noted to be about 100mm thick on average.

Colluvium: Colluvium was found to be present from ground surface in all but one (auger hole AH42) of the Stage Seven investigation points. The colluvium was largely found to comprise firm to very stiff silt, clay, silt and sand with varying minor degrees of each. The material was noted to contain cemented clasts and limonite gravel. In some places it was also noted to be extra sensitive (to disturbance).

Alluvium: Alluvial deposits were encountered from ground surface in some parts of the site. This material was reported to comprise soft to stiff clay, silt and sand, with varying minor degrees of each. The material was also recorded as containing frequent organic inclusions.

Residual Waitemata Group Soils: Aside from auger holes AH9 and AH43, residual soils derived from in situ weathering of the Waitemata Group materials were encountered at depth, beneath any of the materials discussed above, in most of the Stage Seven investigation points. These materials are logged as comprising stiff to hard/loose to medium dense silt and sand with varying minor degrees of each and clay. Shear strengths in the residual Waitemata Group soils often, but not always, increased with depth, and in many places were generally found to be in excess of 100kPa.

Waitemata Group Soil/Rock (Transition): A completely weathered to highly weathered horizon of Waitemata Group soil/rock was identified at depth within hand auger boreholes AH41 and AH45, and within machine borehole MH21. In general, it was logged as comprising very stiff to hard soil/extremely weak to very weak rock, silt with varying degrees of sand and clay.

Waitemata Group Rock: Moderately weathered to unweathered Waitemata Group rock was encountered at depth within machine borehole MH21. These materials were logged as being strong and generally comprised of sandstone and siltstone in alternating horizons of variable thickness. Sub-horizontal bedding was visible in the core recovered; however the orientation could not be determined. A distinct clay lined bedding plane was also identified within this machine hole.

Steeply inclined to near vertical fractures were also visible; some of these were stained orange, however no filling was identified. Uncorrected SPT 'N' values in this material were found to range between N = 50 for 75mm to N = 50 for 30mm penetration.

Scala Penetrometer Testing: Scala penetrometer testing was carried out through the base of each hand auger borehole drilled within Stage Seven, with effective refusal being encountered in over half of the tests undertaken (within 2.0m of the base of each borehole).

Groundwater: Our investigations were both carried out towards the end of winter when groundwater levels are typically elevated when compared to summer conditions. As a result, groundwater was identified in all of the Stage Seven investigation points.

Table 24. Summary of Stage Seven Subsurface Information.

Bore hole	Original Ground RL	Fill	Colluvium	Alluvium	Waitemata Group Soils	Transition	Waitemata Group Rock	Depth to Standing Groundwater
MH21	59.23	n/a	0.0 - 3.7	n/a	3.7 - 5.4 *	5.4 - 5.8	5.8 - 13.5 *	2.87
AH8	78.12	n/a	0.0 - 0.5	n/a	0.5 - 5.0 *	n/a	n/a	4.75
AH9	64.31	n/a	0.0 - 5.0 *	n/a	n/a	n/a	n/a	2.85
AH41	56.42	n/a	0.0 - 3.3	n/a	3.3 - 4.0	4.0 - 4.1 *	n/a	3.9
AH42	41.6	n/a	n/a	0.0 - 3.7	3.7 - 5.0 *	n/a	n/a	0.6
AH43	47.03	n/a	0.0 - 5.0 *	n/a	n/a	n/a	n/a	4.95
AH44	64.22	n/a	0.0 - 0.6	n/a	0.6 - 5.0 *	n/a	n/a	4.95
AH45	51.69	n/a	0.0 - 1.2	n/a	1.2 - 1.9	1.9 - 2.0 *	n/a	1.95

Note, all material depths indicated are in metres below ground level,

RL in metres above MSL according to survey information provided by Hampson & Associated Limited,

n/a = Material not encountered / Groundwater not present on check date, * = End of borehole

† = Standing groundwater unable to be checked on check date, (c) = Collapsed at depth

5.7.4. Slope Stability Analysis

The proposed site formation works largely involve cutting down the high ground whilst filling up the lower-lying portions of the Stage. As a result we have assessed the effect of the effect of the proposed development on the stability of the ground in two representative locations, Cross Section 7A and 7B, as shown on Sheet KGA 10 attached.

These cross sections were developed from the same base information as those prepared for Stage One (see Section 5.1.4), and the locations were selected to be representative of the steepest portions of the finished ground with respect to the underlying ground conditions present, as identified by our field investigation. Details of the cross sections are shown in the slope stability calculations contained within Appendix 3.

As mentioned in Section 5.1.4 above, we have assessed Cross Sections 7A and 7B using the "SLIDE" computer programme under the same six initial load cases. All scenarios were assed for both potential circular and non-circular surfaces, and for the non-circular surfaces we have used the 'surface optimization' feature to refine the result for the lowest Factor of Safety result returned. All results reported were calculated using Spencer interslice interaction assumption method.

A summary of the Factor of Safety results returned from the analyses are presented in Table 25 below. For the detailed results, refer to Appendix 3.

Table 25. Summary of Slope Stability Analyses Factor of Safety Results.

Cross Section	Surface model	Original Ground Profile			Proposed Ground Profile		
		Measured GW	Raised GW	Seismic	Measured GW	Raised GW	Seismic
7A	Circ.	1.5 ✓	1.1 ✗	1.1 ✗	2.0 ✓	1.8 ✓	1.4 ✓
	Non-Circ.	1.5 v	1.1 ✗	1.1 ✗	2.0 ✓	1.5 ✓	1.3 ✓
7B	Circ.	3.1 ✓	2.1 ✓	1.5 ✓	1.6 ✓	1.4 ✓	1.2 ✓
	Non-Circ.	2.9✓	2.1 ✓	1.4 ✓	1.6 ✓	1.4 ✓	1.1 ✗
Values Typically Accepted By Council		1.5	1.3	1.2	1.5	1.3	1.2

✗ = unsatisfactory result, ✓ = satisfactory result - = not analysed

The Factor of Safety results returned for Section 7A under the original ground profile returned variable results. However, the results returned for the proposed ground profile were all satisfactory and much greater, indicating that the proposed works in this part of the Stage will have an overall beneficial effect on the state of stability in this area.

For Section 7B, the Factor of Safety results returned under the original ground profile returned satisfactory results. However, the results returned for the proposed ground profile were all lower than the original ground profile, but generally satisfactory, with the exception of the non-circular, seismic analysis, which was unsatisfactory.

In order to improve the result of the Section 7B proposed profile, non-circular, seismic analysis, we have re-run this model by physically adjusting the model (remove and replace the in situ alluvium material). This adjustment has returned a Factor of Safety result of 1.2, which is considered satisfactory.

Development recommendations applicable to Stage Seven are discussed in Section 6.0 below.

5.8 Stage Eight

5.8.1. Physical Description

The Stage Eight earthworks area occupies approximately 6ha in the centre of the overall site. It is bounded by Stage Two to the east, Stage Three to the north-east, Stage Five to the north, and Stage six to the west, as shown on the ACL Drawing Nos. 200, 201 and 280, presented in Appendix 1.

In general, the topography of the Stage is comprises a gully that is defined by ridges to the north (NE-SW), east (NW-SE) and west (NW-SE), and a watercourse to the south that drains to the east. At present the area contains two smaller watercourses towards the north that converge approximately in the centre of the Stage. The combined watercourse then flows to the southeast before changing direction to flow towards the east.

The side slopes leading down into the gully are generally very steep to the west and north, but are more moderately sloping on the eastern side of the gully.

The geomorphological walkover and aerial photograph interpretation exercise within our previous report identified evidence of deep-seated translational slides and historic head-scarps within this part of the site.

5.8.2. Proposed Development

The HAL Scheme Plan shows that Stage Eight is to comprise seventy-four residential Lots. ACL plans show that the earthworks for Stage 8 will largely comprise filling only, and that the fill for this stage will be sourced from the excess material cut from Stages One to Seven. As a result, the earthworks for Stage eight are expected to be completed concurrent with the earthworks for Stage Seven. We understand that the main watercourse within the Stage is to be recreated on top of the filled ground.

Through the bulk of Stage Eight, the ACL drawings show that the finished surface will be gently sloping with a south-easterly aspect. However, to the south of Stage Eight, the finished ground profile will be steeper, with gradients of up to 1 vertical on 3 horizontal. The ACL Drawing No. 201 suggests that the maximum depth of filling in Stage Eight will be approximately 25m thick.

5.8.3. Investigation & Ground Conditions

As shown on our Stage Eight Investigation & Geomorphology Plan, attached as Sheet KGA 11, the following investigation points are applicable to Stage Eight:

- One machine borehole: MH23.
- Eight hand auger boreholes: AH12 to AH14 and AH55 to AH59.

The subsurface ground conditions encountered in the Stage Eight investigation points are briefly described below and summarised in Table 26 below. For a full detailed description of the subsurface conditions encountered however, reference should be made to the exploratory logs presented within Appendix 2. We point out that, in order to prepare a subsurface model of the Stage, the subsoil conditions have been inferred between our investigation points. However, it must be accepted that, in actuality, the conditions are likely to vary between each borehole location, particularly when the distance between points is great. Additionally, considering the discrete nature of the information obtained compared to the overall area of the site, assumptions have been made for those parts of the site where little subsurface information is presently available.

Topsoil: The topsoil was encountered at ground surface at each investigation point within Stage Eight, and was generally noted to be between 100mm and 300mm thick.

Colluvium: Colluvium was found to be present from ground surface in borehole AH11 and AH12 only. The colluvium encountered was found to comprise firm to very clay and silt varying minor degrees of each and sand, along with occasional intermixed topsoil and sand sized cemented clasts.

Alluvium: Alluvial deposits were encountered from ground surface in most investigation points within Stage Eight. This material was reported to comprise very soft to very stiff clay, silt and sand, with varying minor degrees of each.

Residual Waitemata Group Soils: Residual soils derived from in situ weathering of the Waitemata Group materials were encountered in most boreholes drilled within Stage Eight, either from ground surface or beneath any of the materials discussed above. These materials are logged as comprising stiff to hard clay, silt and sand, with varying minor degrees of each. Shear strengths in the residual Waitemata Group soils often, but not always, increased with depth, and in most places were generally found to be in excess of 100kPa.

Waitemata Group Soil/Rock (Transition): Within Stage Eight, a completely to highly weathered horizon of Waitemata Group soil/rock was identified at depth within hand auger borehole AH56, and within machine hole MH2 only. In general, the transition horizon was logged as comprising very stiff to hard soil/extremely weak to very weak rock, silt or sand with varying degrees of sand or clay/siltstone or sandstone. Uncorrected SPT 'N' values of N = 13 to N = 50+ for 75mm were returned within this material.

Waitemata Group Rock: Highly weathered to unweathered Waitemata Group rock was encountered at depth within machine hole MH23. These materials were logged as being extremely moderately strong to strong, and generally comprised of sandstone and siltstone in alternating horizons of variable thickness. In some locations, horizons of conglomerate like material were also encountered. Sub-horizontal bedding was visible in the core recovered, however the orientation could not be determined. Steeply inclined to near vertical fractures were also visible; some of these were stained orange, however no filling was identified. Uncorrected SPT 'N' values in this material were found to range between N = 50 for 40mm of penetration to N = 50 for 20mm of penetration.

Scala Penetrometer Testing: Scala penetrometer testing was carried out through the base of each hand auger borehole within Stage Eight. Effective refusal was encountered below all but one (AH13), signifying the presence of dense, less weathered material within 2.0m of the base of the boreholes where refusal was encountered.

Groundwater: Given that most boreholes were drilled adjacent to the watercourses within this Stage, all boreholes, with the exception of borehole AH13, identified groundwater at shallow depth.

Table 26. Summary of Stage One Subsurface Information.

Bore hole	Original Ground RL	Fill	Colluvium	Alluvium	Waitemata Group Soils	Transition	Waitemata Group Rock	Depth to Standing Groundwater
MH23	32.04	n/a	0.0 - 2.5	n/a	n/a	2.5 - 3.6	3.6 - 13.6 *	-0.1
AH12	60.35	n/a	0.0 - 1.9	n/a	1.9 - 4.0	4.0 *	n/a	1.3
AH13	55.32	n/a	n/a	n/a	0.0 - 5.0 *	n/a	n/a	4.8 (c)
AH14	37.02	n/a	n/a	0.0 - 2.5	n/a	2.5 *	n/a	0.0
AH55	62.66	n/a	n/a	0.0 - 3.9 *	n/a	n/a	n/a	1.55
AH56	53.61	n/a	n/a	0.0 - 2.1	2.1 - 2.2	2.2 - 2.3 *	n/a	0.5
AH57	36.66	n/a	n/a	0.0 - 3.5 *	n/a	n/a	n/a	0.0
AH58	33.84	n/a	n/a	0.0 - 2.1 *	n/a	n/a	n/a	0.15
AH59	32.18	n/a	n/a	0.0 - 3.4	n/a	3.4 - 3.6 *	n/a	0.0

Note, all material depths indicated are in metres below ground level,

RL in metres above MSL according to survey information provided by Hampson & Associated Limited,

n/a = Material not encountered / Groundwater not present on check date, * = End of borehole

† = Standing groundwater unable to be checked on check date, (c) = Collapsed at depth

5.8.4. Slope Stability Analysis

Given that the bulk formation works essential comprise filling in an existing gully, the risk of any recent and historic instability features within the existing ground will effectively be removed as they will be buttressed by the filling. Thus, only the finished profile of the slope towards the southern end of Stage Eight has been analysed to confirm that the proposed works will not create an unstable slope.

In order to assess the effect of the proposed development, we have prepared a representative cross sections (Cross Sections 8A) at the locations shown on our Stage Eight Investigation and Geomorphology Plan, attached as Sheet KGA 11. This cross section was developed from the same base information as those prepared for Stage One (see Section 5.1.4), and the location was selected to be representative of the finished slope area to the south of Stage Eight. Details of the cross sections are shown in the slope stability calculations contained within Appendix 3.

As discussed in Section 5.1.4 above, we have assessed Cross Section 8A using the "SLIDE" computer programme under the same six initial load cases. All scenarios were assed for both potential circular and non-circular surfaces, and for the non-circular surfaces we have used the 'surface optimization' feature to refine the result for the lowest Factor of Safety result returned. All results reported were calculated using Spencer interslice interaction assumption method.

A summary of the Factor of Safety results returned from the analyses are presented in Table 27 below. For the detailed results, refer to Appendix 3.

Table 27. Summary of Slope Stability Analyses Factor of Safety Results.

Cross Section	Surface model	Original Ground Profile			Proposed Ground Profile		
		Measured GW	Raised GW	Seismic	Measured GW	Raised GW	Seismic
8A	Circ.	3.3 ✓	2.6 ✓	2.0 ✓	2.5 ✓	2.5 ✓	1.6 ✓
	Non-Circ.	3.3 ✓	2.4 ✓	1.8 ✓	2.4 ✓	2.4 ✓	1.5 ✓
Values Typically Accepted By Council		1.5	1.3	1.2	1.5	1.3	1.2

✗ = unsatisfactory result, ✓ = satisfactory result - = not analysed

The results of the analyses indicates that the proposed works fill slope has acceptable Factor of Safety results.

Development recommendations applicable to Stage Eight are discussed in Section 6.0 below.

6.0 DEVELOPMENT RECOMMENDATIONS

6.1 Bulk Earthworks

The site contains large scale instability features, many of which are the result of natural stream erosion that is removing the toe support of these features. The filling works carried out during the motorway construction have stabilised many features that were previously present in the locations of Motorway Fills 1 and 2, and also provided for more level land that, with appropriate treatment, will be available for residential development.

Based on this, we consider that the bulk in-filling of gullies and amphitheatres, if appropriately carried out following the recommendations below, will provide a significant benefit to the overall stability of the site by countering the natural processes that lead to large scale instability. Also, where such filling work is carried out to an engineered standard (including appropriate under-fill drainage) this would provide for large areas of safe and stable land that would be suitable for residential development.

Where bulk earthworks are to be carried out, we generally recommend that all in situ low strength and/or organic rich material is undercut and removed prior to filling in order to reduce any long term differential settlement arising from consolidation of the aforementioned materials. Under-fill drains should be constructed in the base of all gullies and amphitheatres before any filling takes place. A typical detail for an underfill drainage blanket is provided on Sheet KGA 14 attached.

In the case of Stage Eight, however, we consider that some low strength alluvial material may potentially be left in situ, and filled upon directly. This is based on the depth of proposed filling and the time required to complete the filling over successive earthworks stages, which will likely result in the low strength materials becoming consolidated during the course of the works such that any settlement is expected to be minor and within tolerable limits. We point out that the above will need to be assessed by the inspecting geotechnical for the earthworks prior to any fill taking place with Stage Eight. Where it is considered appropriate to leave some low strength materials in situ, we recommend that a series of settlement markers are installed prior to placing any fill so that the consolidation settlement of the in situ materials can be monitored over the course of the works.

6.1.1. Soil Fill General Recommendation

The results of the laboratory tests (Section 4.3) indicate that the in situ Waitemata Group Soils materials within the main areas of cut on site can be re-used as bulk fill and compacted to the requirements of NZS4431:1989, Earth Fill For Residential Construction.

The laboratory results suggest that the soils below 2m depth are likely to be wet of optimum on excavation. It should be noted that the depth to wet of optimum materials will vary between the different borrow areas on site, and will also vary seasonally. Provided the bulk formation earthworks are undertaken during the drier summer months, and consider the overall size of the site, wet of optimum materials should be able to be adequately conditioned via aeration methods.

As an alternative, wet of optimum materials may be conditioned via the application of varying quantities of chemical additives (lime and/or cement). Before this is carried out, however, representative samples of the materials to be chemically conditioned should be obtained and subjected to specific lime and/or lime/cement reactivity tests.

In terms of testing and certification to NZS4431:1989 standard, we recommend that all cohesive fill materials are tested via the maximum allowable air voids and minimum allowable undrained shear strength method. In this respect, the recommended testing criteria for these materials are:

Minimum undrained Vane Shear Strength (measured in situ by an IANZ calibrated shear vane)

General fill:	
Minimum single value *	110kPa
Average value from 10 *	120kPa
Within 500mm of road subgrade levels:	
Minimum single value *	120kPa
Average Value from 10 *	140kPa

* = vane readings corrected in accordance with BS1377.

Maximum Air Voids Percentage (as defined in NZS 4402: Part 1)

General fill:	
Maximum single value	10%
Within 500mm of road subgrade levels:	
Maximum single value	8%

6.1.2. Rock Fill General Recommendation

The borehole logs generally indicate that Transition and Waitemata Group Rock materials will likely be encountered in many of the deeper areas of cut, regardless of earthworks Stage, before reaching the target cut depth.

Given the practicalities of sample retrieval during our investigation, no representative bulk samples of these materials have yet been obtained for specific compaction testing. As such, we are unable to provide specific compaction criteria for this material at this time. Instead, it is recommended that representative samples are obtained as soon as possible, once the site formation works commence and appropriate plant is available on site for sample retrieval, such that appropriate compaction and testing criteria can be provided prior to be bulk earthworks exposing these materials in large volumes.

The above aside, based on anecdotal evidence from nearby developments, we understand that the in situ rock material will often require cross-ripping by bulldozers to allow the material to be easily scooped and relocated by conventional earth-working machinery. If not cross-ripped by bulldozer, the rock material may need to be mechanically excavated and loaded into trucks for relocation, particularly as the degree of weathering decreases and the strength of rock increases.

Once placed for filling, the rock material can often be broken down by a suitably sized pad-foot roller, and worked in a similar manner to a cohesive fill, albeit with some larger, intact rock pieces included. In this respect it is likely that a combination of both the maximum dry density and optimum water content method, and the maximum allowable air voids and minimum allowable undrained shear strength method, as per NZS4431:1989, would need to be employed in order to determine if the rock and transition materials are being appropriately compacted by the contractor. The use of these methods will need to be confirmed once representative samples can be obtained and tested.

The same anecdotal evidence suggests that it is best not to blend the transition and rock materials with any cohesive (soil) fill materials, as this can render the previously defined testing criteria for the soil fill and/or rock fill void. We therefore recommend that all cohesive (soil) fill, and granular (rock) fill materials are excavated, placed and compacted separately to avoid any significant blending or cross contamination of the two material type.

6.2 Motorway Fills

6.2.1. Stage One

As of writing this document, our investigations and laboratory tests suggest that the material in Motorway Fill 1 has been in place for approximately seven years. As a result, the deeper portions of Motorway Fill 1 are expected to have consolidated under the imposed load from the material above. However, the upper 3m of Motorway Fill 1 is of varying composition and strength, and will be susceptible to further consolidation.

Based on the results of our consolidation settlement analyses carried out in the area of Motorway Fill 1 (as per Section 5.1.5 above), in order to counteract the design challenges presented by this material and to help ensure the long term stability of the development and future structures to be constructed in this area, we recommend that the upper 3m (from designed finished level) of this material is removed and replaced with engineered fill.

Once stripped, prior to back-filling, the exposed ground should be inspected for any obvious soft spots or areas of unsuitable material, and any such material also removed. A network of under-fill drainage should then be constructed to specifically target any pockets of trapped ground water or natural springs that may be present within the existing fill material, and also to help prevent any natural groundwater from within the material below rising up into the engineered fill that is to be placed to reinstate the undercut.

A separator cloth and a tri-axial geo-grid of nominal strength should then be laid down before the ground is reinstated with engineered fill to the design level.

A general detail and plan showing the extent of the under-fill drainage network is shown on our Stage One - Motorway Fill Approximate Undercut Plan, attached as Sheet KGA 12.

6.2.2. Stage Two

Despite the notable deficit of subsurface data from the Motorway Fill 2 area compared to the Motorway Fill 1 area, the available information suggests that the materials within Motorway Fill 2 are of similar strength and composition to the materials within Motorway Fill 1.

In this respect, we recommend that Motorway Fill 2 is treated the same as Motorway Fill 1, and that the recommendations presented within Section 6.2.1 above are adopted for the treatment of this material.

We point out that the above recommendations should be confirmed, and/or amended following additional subsurface investigation, laboratory testing and analysis in the area of Motorway Fill 2. Such work will be required as part of Engineering Approval for the Stage Two development works. Additional investigations are discussed further in Section 6.10 below.

6.2.3. Stage Four

Hand auger borehole AH20 was drilled through the location of Motorway Fill 3. This shows the fill to be approximately 1.8m thick. We note that he ACL drawing No. 201 generally indicates that the area of Motorway Fill 3 will be subjected to cut earthworks that will range in depth from 0m to 3m. Based on this, we generally consider that most, if not all of this material will be removed as part of the bulk formation works.

Should any fill be found to be remaining in situ following the proposed excavation works, it should be assessed by the inspecting geotechnical engineer for the works. If the strength and composition of the remaining material is found to be unacceptable, it should be removed and replaced with engineered fill.

6.3 Sloping Ground

The ACL drawing No. 200 suggests that slopes of varying grades will be created across all Stages of development in order to facilitate the formation of the finished subdivision. In most places, where residential Lots are to be located, the finished slopes will be in the order of 1 vertical on 4 horizontal, or flatter. However, within all Stages there are permanent slopes that are to be formed where residential Lots are located that, at present, are indicated to be finished to a gradient of up to approximately 1 vertical on 2 horizontal. There are also some existing slopes within Stages Three and Five where residential Lots are proposed to be located, where no earthworks are indicated on the ACL drawing No. 200 at this time, where the present ground slope is up to 1 vertical on 2 horizontal.

In general, our slope stability analyses indicate that the proposed finished slopes will either be safe and stable, or can be made safe and stable following implementation of various remedial measures. Provided all bulk earthworks are carried out to NZS4431:1989 standard, it is our professional opinion that any designed slopes can be safely formed at a safe and stable, long term grade of up to 1 vertical on 3 horizontal.

Slopes steeper than 1 vertical on 3 horizontal, or where any remedial measures, and/or model adjustments have been incorporated into our analyses to obtain satisfactory Factor of Safety results, we recommend that additional subsurface investigation and analysis is undertaken to refine and/or confirm the measures and/or adjustments modelled. Further investigation is discussed in greater detail in Section 6.10 below.

All slopes formed in areas of cut as part of the bulk formation works are expected to be safe and stable at a long term finished grade of 1 vertical on 3 horizontal. The ACL drawing No. 200 suggests that there will not be any proposed cut slopes that will be finished at a grade steeper than 1 vertical on 3 horizontal.

6.4 Buttress Drains with Vertical Wellpoints

It is our opinion that the zones active instability observed at the site can be attributed primarily to groundwater and, in some locations, distinctly weak horizons at depth. The measured depths to groundwater, particularly in many of the rotary machine boreholes, suggests that pressurised, artesian groundwater is present in many locations on the site, and especially within any soft/weak horizons at depth where specifically targeted.

Deep subsurface drainage, in the form of buttress drains, has been modelled in several of our stability analyses in order to obtain satisfactory Factor of Safety results. The modelled drains will assist to improve stability by lowering the ground water table at specific locations to relieve pore water pressures; these drains will also have the effect of cutting off any perched water tables that may or may not be present at shallow depth.

We accept that, in many places, it is not feasible to excavate buttress drains to the depths required in order to intercept any deep weak horizons that exhibit pressurised artesian groundwater. In order to intercept and de-water these horizons, it may be necessary to use vertical well drains along the alignment of the buttress drains.

Vertical well drains will allow artesian pressures at depth to be relieved and enter into the buttress drain system and prevent any artesian groundwater from recharging any perched water tables that may be present on the site.

Considering the extent of the site, no definitive final depth for any vertical well drains can be given at this time. Instead, this should be determined at the detailed design phase of the Stages where further investigation and analysis identifies the need for such measures.

A preliminary indication of the locations where subsurface drains are likely to be required, as per the stability analyses undertaken as part of this current investigation, is shown on our Overall Suggested Remediation Measures Plan, attached as Sheet KGA 13.

Additionally, a suggested, typical detail for buttress drains and vertical well points is shown on Sheet KGA 14 attached.

6.5 Shear Keys

Shear keys improve stability by acting as a physical restraint to slope movement, a replacement for low strength materials or horizons of noted weakness, and providing a deep subsurface drain over a large area.

The stability analyses undertaken suggest that shear keys, in conjunction with buttress drains, may be necessary to improve the Factor of Safety against slope instability in the areas of Stage Two (Section 2C), Stage Three (Section 3A) and Stage Five (Section 5B). The shear keys modelled for these cross sections model the replacement of in situ materials, towards the toe of each section, with compacted granular hard-fill.

An approximate indication of the location and extent of the shear keys modelled in our analyses are shown on Sheet KGA 13 attached. We point out, however, that the dimensions of the shear keys modelled are an estimate only, and were adjusted to suit each model until satisfactory Factor of Safety results were returned. In this respect, the exact dimensions and extent of the shear keys modelled will need to be further refined by specific subsurface investigation and stability analysis before specific information can be provided to support an Engineering Approval application for these features.

Further investigation is discussed in further detail in Section 6.10 below. Specific recommendations regarding the construction of the shear keys will be provided with the investigation and analysis documentation for those features.

6.6 Stream Crossings

As indicated on the ACL drawing No. 200, three stream crossing will be formed during the course of the overall site development works. These crossings are located:

1. Between Stage One and Two (formed as part of the Stage One works),
2. Between Stage Three and Stage Four (formed as part of the Stage Two works), and,
3. Between Stage Six and Stage Seven.

ACL drawing No 401 shows that these crossings will comprise a segmental concrete arch, supported on pile supported reinforced concrete footings. ACL drawing 201 indicates that all three crossings will be formed at levels higher than the exiting ground, and ACL drawing 200 indicates that the fill forming the crossings, and part of the abutments to the crossings (Stage Six crossing in particular) will be supported by retaining walls. While we have not sighted any specific indication as to the form of the retaining walls for the stream crossings, we assume that these will likely comprise mass block style, gravity retaining walls to match the segmental concrete arch of the crossings themselves.

Specific recommendations for these crossings and abutment retaining walls are presented below.

6.6.1. Stage One/Two Crossing

Machine Hole MH17 and hand auger boreholes AH35 and AH60 were drilled at the location of the Stage One/Two stream crossing. In general, these boreholes show a capping layer of alluvium to approximately 2.0m - 2.5m depth, overlying in situ Waitemata Group soil, transition and rock materials (See Table 5 within Section 5.1.3 above).

The alluvium material present is noted to be firm to stiff, and groundwater was recorded to be present within 0.5m of present ground surface near to the existing watercourse (MH17 and AH60), and at about 1.5m below present ground away from the watercourse (AH35).

ACL drawing No. 201 indicates that the immediate approaches to the crossing are to be filled up to 6m above the existing ground level. To the south there is an existing gully that will also be filled (indicated as S1F2 on Sheet KGA 4 attached).

Considering the ground conditions present, and the thickness of proposed filling, we consider that the alluvial material in the area of the stream crossing and abutments will likely undergo consolidation settlement unless appropriate measures are undertaken.

In order to minimise the effects of consolidation settlement within the alluvial material, we recommend that either:

a) The alluvium is undercut to expose the very stiff to hard Waitemata Group soils/Transition materials, the undercut then back-filled with compacted granular hard-fill prior to construction of the fill, crossing footing and abutment retaining walls, or,
b) The crossing footings and abutment walls are pile supported, and the abutment fill comprises light-weight fill where any alluvium is present.

These options are discussed in more detail below.

Option a)

For Option a), the extent of the alluvium will need to be explored during construction by excavation, and the very stiff to hard Waitemata Group soils/Transition materials confirmed by the inspecting Geotechnical Engineer for the project.

The alluvium is anticipated to be thickest closest to the alignment of the watercourse, reducing in thickness away from the watercourse. On the southern side of the creek, however, the alluvium is known to extend up the base of the gully that comprises the bulk fill area, designated as S1F2 on sheet KGA 4 attached.

Where any undercut of alluvial materials is undertaken for the stream crossing and abutment retaining wall footings, we recommend that the base of the undercut extends a minimum horizontal distance of 2m beyond the extent of the crossing and abutment retaining wall footings.

The sides of the excavation should be lined with a non-woven geotextile separator fabric and back-filled immediately to prevent the collapse of the excavation and excessive ingress of water. All granular material placed within the undercut should comprise GAP65 to GAP100 sized crushed rock, or equivalent approved product.

Provided the undercut is reinstated as per the above recommendation, the abutment retaining walls and crossing footing may be ground bearing and designed assuming an ultimate unfactored bearing capacity of 300kPa.

If piles are still required below the crossing footing for structural reasons, these should be founded within the underlying, in situ Waitemata Group transition/rock materials at depth, and may be designed assuming an ultimate unfactored end bearing capacity of 1MPa. Skin friction on these piles should be ignored.

The abutment retaining walls may be designed assuming the following geotechnical parameters:

- Retained soil effective stress strength parameters — c' = 0kPa, Ø' = 30kPa
- Bulk unit weight of retained soil — 18kN/m^3
- Min value of coefficient of earth pressure — k = 0.55

Option b)

For recommendation b) above, we recommend that the crossing footing and abutment retaining walls are completely pile supported. These piles should be founded within the underlying, in situ Waitemata Group transition/rock materials at depth and may be designed assuming an ultimate unfactored end bearing capacity of 1MPa. Skin friction on these piles should be ignored. The back-fill required to bring the crossing and abutments up to the design level should comprise light-weight fill, such as Polyrock®, or equivalent approved product. The horizontal extent of the light-weight fill should extend away from the crossing and abutment retaining walls by either the extent of the alluvium (as identified by the inspecting Geotechnical Engineer for the project), or 10m, whichever being the shorter distance.

For Option b), the abutment retaining walls may be designed assuming the following geotechnical parameters:

- Light-weight fill strength parameter — s_u = 200kPa
- Light-weight fill unit weight — 1.05kN/m^3
- Coefficient of lateral earth pressure — nil (light-weight section)

6.6.2. Stage Three/Four Crossing

Machine Hole MH24 was drilled in the location the Stage Three/Four stream crossing. This borehole shows a capping layer of colluvium to a depth of approximately 2m, then very soft alluvium to approximately 6m depth, overlying in situ Waitemata Group rock materials. A piezometer, screened between 7.5m to 11.0m below ground level, was installed in this borehole. On the check date, groundwater was noted be under artesian pressure and bubbling out of the top of the piezometer stand-pipe that was finished 0.6m above existing ground level (see Table 10 within Section 5.1.3 above).

ACL drawing No. 201 indicates that the immediate approaches to the crossing, and the crossing itself, is proposed to be filled up to 4m above the existing ground level. This fill has been designated as S2F2 on Sheet KGA 5 attached).

Considering the ground conditions present, and the thickness of proposed filling, the alluvial material in the area of the stream crossing and abutments will likely undergo consolidation settlement if the crossing is constructed as presently proposed, unless appropriate measures are undertaken.

In order to minimise the effects of consolidation settlement within the underlying alluvial material, we recommend that the fill in the abutment areas are ‘over-filled’ for a nominal period, in order to pre-load the alluvium, allowing it to consolidate prior to the actual construction of the access road and other infrastructure. Once the desired degree of consolidation is achieved, the additional ‘over-fill’ may be removed.

We point out that no specific consolidation testing and settlement analyses have been undertaken in this area. As such, we are unable to provide specific details with respect to the required ‘over-load’ thickness and extent, any methods of increasing the rate of consolidation, and the time required to achieve the desired degree of consolidation before the road and other infrastructure can be built. As such, this element of the project must be subject to further specific investigation, laboratory testing and analysis before specific recommendations can be provided before Engineering Approval is sought for this element of the subdivision formation works. Further investigation is discussed in Section 6.10 below.

Consolidation of the underlying alluvium aside, the crossing footings and abutment retaining walls are recommended to be completely pile supported. These piles should be founded within the underlying, in situ Waitemata Group transition/rock materials at depth and may be designed assuming an ultimate unfactored end bearing capacity of 1MPa.

If the piles are construction prior to filling and consolidation of the underlying alluvium, the piles must be design to accommodate negative skin-friction values generated by the down-drag of the alluvium on the piles.

Alternatively, if the piles are constructed following the completion of the filling and pre-loading exercise, the piles may be designed assuming skin friction of 15kPa to be acting upon the shaft of each pile. This skin friction value should be ignored over the upper 1m embedded depth of each pile.

The abutment retaining walls are recommended to be designed assuming the following geotechnical parameters:

- Retained soil effective stress strength parameters — c' = 0kPa, Ø' = 30kPa
- Bulk unit weight of retained soil — 18kN/m^3
- Min value of coefficient of earth pressure — k = 0.55

6.6.3. Stage Six/Seven Crossing

Machine Hole MH19 and hand auger boreholes AH7 and AH40 were drilled in the location the Stage Six/Seven stream crossing. These boreholes show variable results, with a capping layer fill overlying alluvium then transition materials at approximately 2m below ground level in AH7, residual Waitemata Group soils overlying transition materials at approximately 3m below ground level in AH40, and colluvium to approximately 3m, overlying Waitemata Group rock in MH19. On the check date, groundwater was identified in all of these investigation points at depths ranging between 0.5m to 1.5m below ground level (see Table 22 in Section 5.6.3 above).

Whilst not specifically identified on the borehole logs, considering the nature of this location (where two watercourses converge), alluvial materials are anticipated to be present and widespread in between the investigation borehole locations.

ACL drawing No. 201 indicates that the immediate approaches to the crossing, and the crossing itself, is to be finished at a level that will be up to 7m above the existing ground level. This fill has been designated as S6F1 on Sheet KGA 9 attached.

Taking into account the ground conditions present and the thickness of proposed filling, we consider that the alluvial material in the area of the stream crossing and abutments will likely undergo consolidation settlement, if filled as presently designed, unless appropriate measures are undertaken.

In order to prepare a detailed design for the foundations and abutment retaining walls, we recommend that further specific subsurface investigation and analysis be undertaken. This should be carried out to better define the extent of any alluvium beneath the crossing foundations and abutment retaining wall locations, and to assess the effect of the placement of fill and construction of mass-block style retaining walls on the global site stability. Further investigation is discussed further in Section 6.10 below.

Depending on the results of the further investigation and analysis, it is likely that the recommendations presented for the Stage One/Two crossing (as discussed in Section 6.6.1) will apply.

6.7 Roads & Accessways

The ACL drawing 201 shows significant depths of cut and fill across the site. All areas where roading is proposed will therefore be constructed upon either cut ground or engineered fill.

Depending on the depth of cut, and the location of the road on site, the cut ground will vary in terms of strength and, as a result, the appropriate pavement design values (CBR) will also vary. In order to facilitate initial design, we recommend the preliminary design parameters presented in Table 28 below are adopted where the corresponding material types are exposed by the site formation works:

Table 28. Preliminary Geotechnical Parameters For Roadway and Accessway Design.

Stratum	Preliminary Design CBR value (%)
Motorway Fill	< 2
Engineered Fill	4
Colluvium (vane shear strength < 75kPa) (vane shear strength > 75kPa)	 < 2 3
Alluvium	< 2
Residual Waitemata Group Soils	4
Waitemata Group Soil/Rock (Transition)	7
Waitemata Group Rock	10

We point out that the values given within Table 28 above must be confirmed during construction once the roadways have been constructed to the designed subgrade level. Should the CBR values identified during construction differ to the suggested values given in Table 28 above, it may be necessary to amend the pavement design to suit the conditions present.

6.8 Stormwater

We understand that all aspects of stormwater disposal are being addressed by ACL and Hazel Hewitt & Associates Limited (HHA). The ACL drawing No. 400 indicates that stormwater from the finished development will be directed to a network of wetlands and rain gardens. In this respect, we provide comments below regarding groundwater levels and expected soil permeability.

We note that deep excavations over large areas are presently proposed on Stages One to Seven. With the measured depths to standing groundwater levels (as presented in Section 5.0 above), many excavations deeper than 2m will be below the current groundwater level. Following completion of the bulk earthworks, we anticipate that exposed ground moisture content, and the natural groundwater level, will remain elevated for some time following the completion of construction.

With respect to the above, the proposed site works will expose a range of materials, each of which are expected to vary in terms of material permeability,

No specific permeability or soakage testing has been undertaken at this time, and this should be confirmed at the detailed design phase of each Stage of the development. However, for the purposes of preliminary rain garden design, recommended permeability values are presented in Table 29 below.

Table 29. Preliminary Geotechnical Parameters For Roadway and Accessway Design.

Stratum	Preliminary permeability value range, k (m/s)
Motorway Fill	10^{-7} ~ 10^{-9}
Engineered Fill	10^{-7} ~ 10^{-9}
Colluvium (vane shear strength < 75kPa) (vane shear strength > 75kPa)	 10^{-7} ~ 10^{-9} 10^{-7} ~ 10^{-9}
Alluvium	10^{-8} ~ 10^{-9}
Residual Waitemata Group Soils	10^{-7} ~ 10^{-9}
Waitemata Group Soil/Rock (Transition)	10^{-8} ~ 10^{-9}
Waitemata Group Rock	10^{-8} ~ 10^{-10}

We point out that when groundwater levels are expected to be elevated, the site soils will have reduced capacity for stormwater soakage and are expected to quickly become saturated during periods of prolonged rainfall.

6.9 Wastewater

ACL drawing No. 500 shows that it is proposed to construct a reticulated wastewater sewer system on the site to service the future subdivision. This system is indicated to comprise a series of gravity feeds to three main pumping stations (Pump Stations 1, 2 and 3, located in the Stage One, Stage Six and Stage Two earthworks areas respectively), pressurised rising mains leading away from the pumping stations, and some low pressure systems to service small clusters of individual Lots to the north of Stages Three and Five. The constructed system will ultimately connect to the existing wastewater network that is present to the east of the motorway.

In general we expect that the majority of the system will be constructed via conventional trenching methods, however we expect that the connection to the existing system will be thrusted, or micro-tunnelled, beneath the motorway to connect to the existing network.

ACL drawing No. 501 provides typical detail for the three proposed pump stations. These typical details do not include levels, but do indicate that each pump station will include a vertical wet-well structure and a buried storage tank. Experience with similar structures elsewhere suggests that the invert levels of the wet-wells are likely to be in the order of 3m to 5m deep below the surrounding ground level.

ACL Drawing No. 201 suggests that:

- Pump Station 1 (Stage One) will likely be constructed within a combination of engineered fill, alluvium and/or in situ Waitemata Group soils,
- Pump Station 2 (Stage Six) will likely be constructed within engineered fill only,
- Pump Station 3 (Stage Two) will likely be constructed within a combination of engineered fill, alluvium and/or in situ Waitemata Group soils.

As a design measure, particularly for Pump Stations 1 and 3, we recommend that both the wet-well and storage tank structures are designed for hydrostatic uplift.

Additionally, it is possible that the construction of Pump Stations 1 and 3 may require excavation through potentially sandy, alluvial materials with a shallow depth to groundwater. Temporary support works for the excavations for these structures must take this into account to prevent any flow of the sandy materials into the excavation. At this stage we consider that, where present, the influx of groundwater should be manageable via pumping alone, although if more permeable horizons are encountered within the excavations, additional pumping/dewatering may be required.

6.10 Further Investigation

The findings, analyses and recommendations above are considered sufficient to support a Subdivision Consent application for Stages One to Eight. It is also considered appropriate to support an Engineering Approval application, but only for Stage One and Stage Eight.

Many parts of the site exhibit features of previous and current instability. Additionally, the proposed development works in some places will involve the creation of steep slopes (at a grade of 1 vertical on 3 horizontal, or steeper) and construction on areas of soft and compressible ground. We believe that appropriate engineering solutions can be derived that would help to mitigate or eliminate the hazards presented by the existing geomorphology and/or proposed development. These potential solutions include:

- Subsurface drainage,
- Shear keys,
- In-ground palisade retaining walls,
- Re-working of motorway fill materials,
- Under-cutting and replacing low strength materials, and/or
- Pre-loading to accelerate the rate of consolidation within soft, compressible soils.

As indicated in Section 5.0 and Section 6.0 above, additional subsurface investigation, laboratory analysis and testing is recommended to be undertaken in various parts of the site. As a minimum we recommend that a review of the available geotechnical information is undertaken before applying for Engineering Approval on Stages Two to Seven, however specific subsurface investigation has been recommended on Stages Two, Three, Five, Six and Seven in order to support Engineering Approval applications for the works in those Stages.

The further investigation needs of each Stage are discussed separately below.

6.10.1. Stage Two

Further investigation is required to establish a more detailed subsurface model in the location of Motorway Fill 2. Representative samples of the Motorway Fill 2 material should also be obtained and subjected to specific consolidation testing to allow detailed settlement analyses to be undertaken.

Additional subsurface data should be obtained from the north-facing slopes in the area of Cross Sections 2A and 2C (as per sheet KGA 5 attached). This information should be used to refine the subsurface model in this location and more accurately locate any materials that would need to be undercut and replaced in order to achieve an acceptable level of stability.

6.10.2. Stage Three

As indicated in Section 5.3.4, additional investigation and analysis is recommended in the area of sloping ground to the north of Stage Three. This area comprises very steep slopes where proposed Lots are positioned, but where no earthworks are proposed to take place.

Further analysis is required in this area in order to better define the subsurface model in this part of the site, and to refine the recommended measures to provide for safe and stable ground on which the residential Lots can be located.

Specifically, for this investigation, we recommend that representative samples are obtained for the purpose of laboratory analysis to precisely define the subsurface parameters modelled within our slope stability models

Additionally, as indicated in Section 6.6.2, additional investigation is recommended in the area of the Stage Three/Four stream crossing. In particular, representative samples should be obtained for the purpose of consolidation testing such that a specific design can be derived for our recommendation or pre-loading the filled area to consolidate the in situ alluvium in this location.

6.10.3. Stage Five

As indicated in Section 5.5.4, extensive remedial measures were modelled to obtain satisfactory Factors of Safety for the slopes to the north of Stage Five. Further investigation is recommended to more accurately define the subsurface model in this part of the site and refine the remedial measures modelled in order to obtain the satisfactory levels of slope stability.

Specifically, for this investigation we recommend that representative samples are obtained for the purpose of laboratory analysis to precisely define the subsurface parameters modelled within our slope stability models

6.10.4. Stage Six

As indicated in Section 6.6.3, further investigation and analysis is recommended in the area of the Stage Six/Seven stream crossings to identify the extent and nature of the alluvial soils at the crossing and abutment retaining wall locations. This will allow further detailed analysis of the effect of the proposed filling on the stability of this part of the site, which will then allow specific recommendations to be provided for the construction of the crossing and abutment retaining wall foundations.

6.10.5. Stage Seven

We had initially planned to drill a rotary machine borehole (MH20) within with S7F1 area (as designated on Sheet KGA 10). However, due to the density of the pine plantation that is currently present, we were unable to access the drill site. As a result, MH20 was cancelled. In order to complete the subsurface model for this part of the site, we recommend that machine hole MH20 is drilled at a later date once the pine plantation in this area is felled.

Additional subsurface investigation should be undertaken in the area of Cross Section 7A to more accurately define the extent of the low strength materials that will have to be removed as part of maintaining the stability of the area.

6.11 Subdivision Layout

Pending the results of the further investigations recommended the steep slopes to the north of Stage Three and Stage Five are considered to be problematic in terms of stability and identifying safe and stable building platform areas on the proposed Lots. In this respect, we consider that it would be beneficial if the general subdivision layout and earthworks in these Stages is adjusted such that the extent of the steeply sloping ground is reduced. In general, this could be achieved through the use of deeper cuts, and steeper Lots further to the south of the steeply sloping land.

6.12 Building Platforms

We consider that, provided the recommendations presented above are followed, and pending further investigation and analysis as described within Section 6.10, a safe and stable building platform area will be available on all of the future residential Lots, or can be made available with appropriate remedial measures constructed as part of the site formation works.

7.0 LIMITATIONS

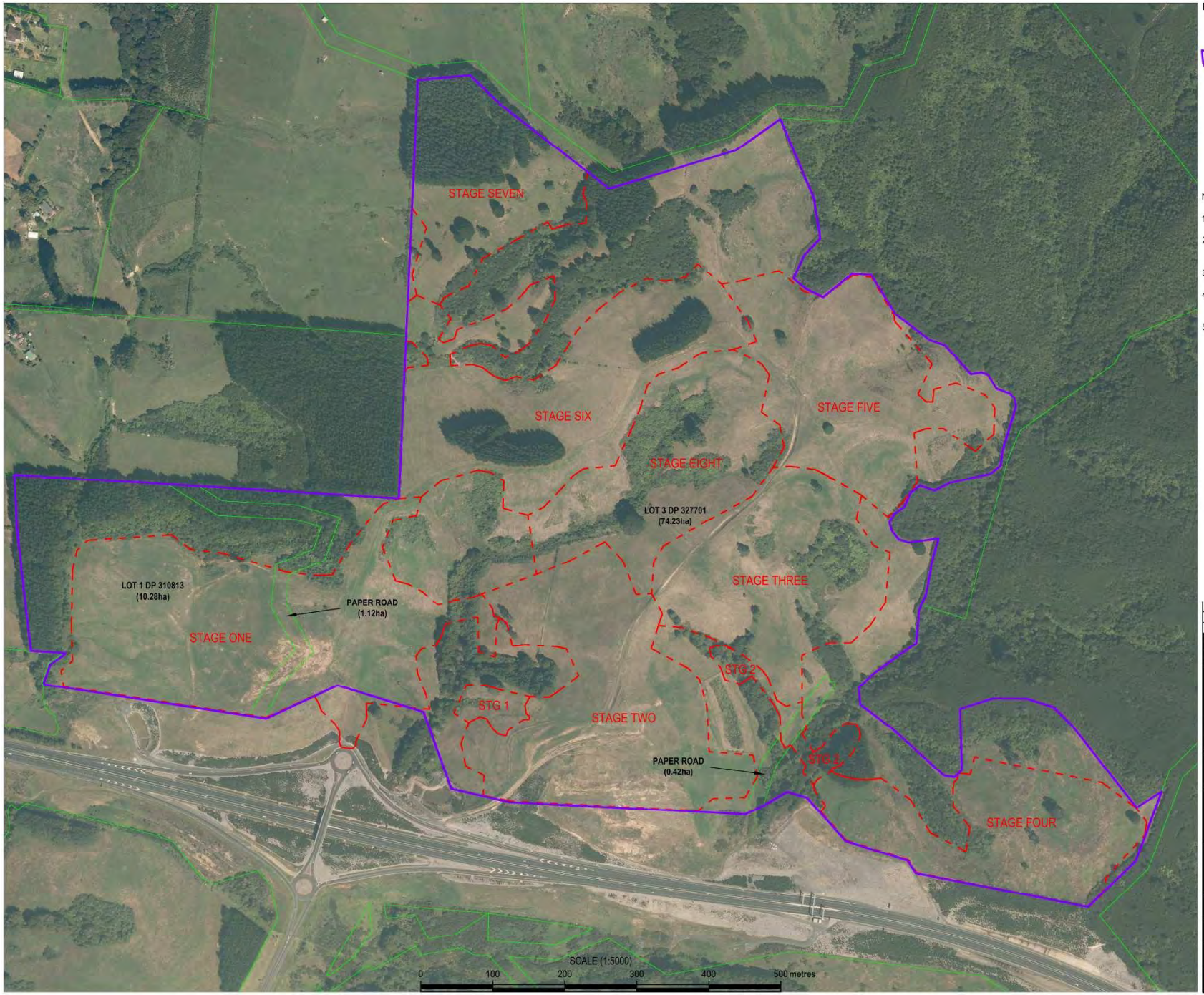
The conclusions and recommendations made in this report are based upon the results of our investigations carried out on site to date that include:

- Review of the Council Property Files for the subject site,
- Review of all other available pertinent information,
- Aerial photograph interpretation,
- Site walkover inspection,
- Exploration of the subsurface ground conditions by way of hand auger boreholes, rotary machine boreholes and mechanically excavated test pits,
- Specific laboratory testing of selected soil samples, and,
- Stability and (where applicable) consolidation analyses of key parts of each proposed Stage.

Through the above, we consider that the work undertaken and the recommendations provided are sufficient to support a Subdivision Consent application for all eight Stages of the site, but that the level of detail presented is only sufficient to support an Engineering Approval application for Stage One and Stage Eight.

Further investigation will need to be undertaken on Stages Two to Seven in order to confirm and/or refine the assumptions and recommendations made in generating this document.

This report was prepared in the context defined in Section 1.0, above and must not be relied upon by any other party other than that for whom it was prepared, their selected consultants, and the relevant Territorial Authority. It has been compiled with respect to the brief given to us, and must not be relied upon in any other context or recreated for any other purpose. Significant changes to the current proposed scheme plan will require geotechnical reassessment, as the recommendations and findings of this report may not remain applicable.



Key:

Subject property legal boundary

Other Lot boundaries

Proposed earthworks stage boundaries

Notes:

1. Locations of features approximate only
2. Locations of all buried services to be verified prior to construction
3. Legal boundaries adapted from Quickmap
4. Aerial Photograph adapted from Auckland Council online GIS system
5. Extent of proposed earthworks stage boundaries adapted from drawing prepared by Airey Consultants Limited entitled "Proposed Cut-Fill Plan", Project No. 11712-01, drawing No. 201, dated July 2015

North (approx)

DATE	REVISION	DESCRIPTION
Oct-2015	A	Investigation Report Issue

AMENDMENTS

Check all dimensions and levels on site before construction commences.
Dimensions must not be directly scaled off this drawing.
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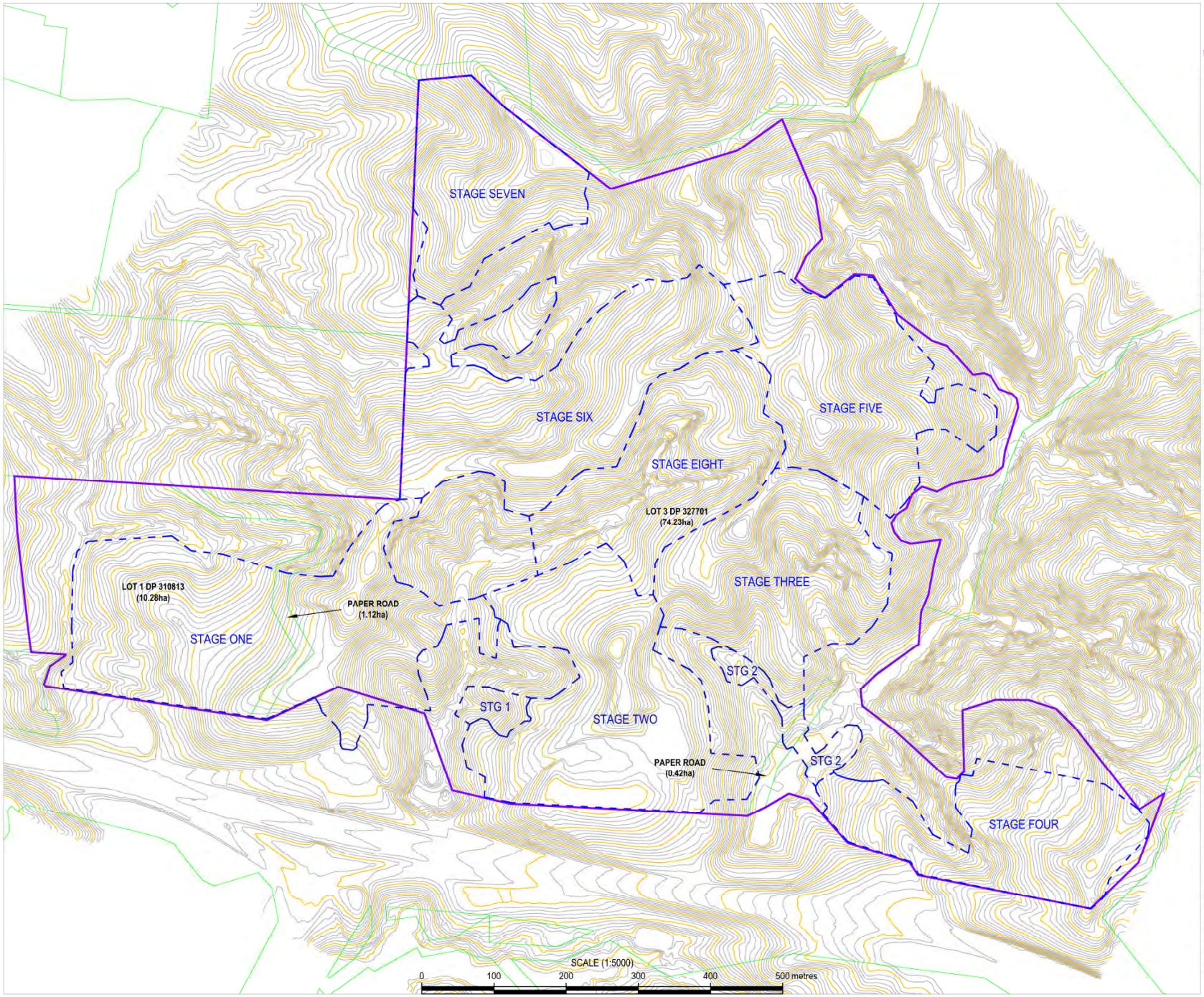
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PROJECT
PROPOSED SUBDIVISION
GRAND VIEW ESTATE
OREWA

TITLE
SITE PLAN - AERIAL PHOTOGRAPH

SCALE: (A3 ORIGINAL) 1:5000	DATE: Oct-2015
DRAWN BY: PH	CHECKED BY: RJH
REVISION NO: A	JOB NO: 7464
CAD REF: 7464_Detailed_Invest.dwg	SHEET NO: KGA 1



Key:

Subject property legal boundary

Other Lot boundaries

Proposed earthworks stage boundaries

Existing topographic contours, major interval = 5m

Notes:

1. Locations of features approximate only
2. Locations of all buried services to be verified prior to construction
3. Legal boundaries adapted from Quickmap
4. Topographic contour information adapted from Auckland Council online GIS system
5. Extent of proposed earthworks stage boundaries adapted from drawing prepared by Airey Consultants Limited entitled "Proposed Cut-Fill Plan", Project No. 11712-01, drawing No. 201, dated July 2015

North (approx)

DATE	REVISION	DESCRIPTION
Oct-2015	A	Report Issue

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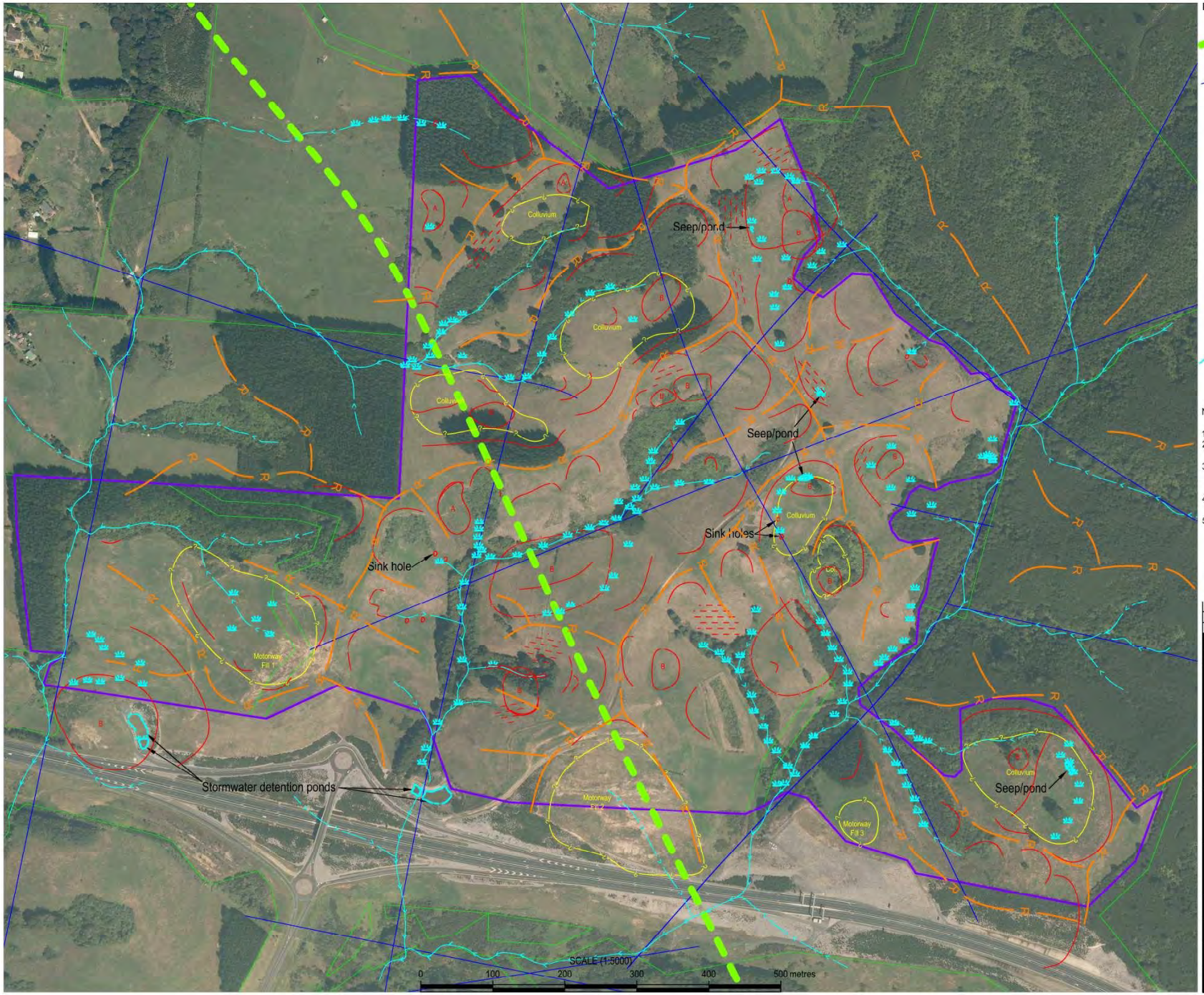
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TITLE
SITE PLAN - TOPOGRAPHIC CONTOURS

SCALE: (A3 ORIGINAL) 1:5000	DATE: Oct-2015
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REVISION NO: A	JOB NO: 7464
CAD REF: 7464_Detailed_Invest.dwg	SHEET NO: KGA 2



Key:

- Approximate trace of concealed fault according to the Geological Map of New Zealand, "Whangaparaoa", 1989, 1:50,000, Sheet R10
- Approximate location of lineaments, (large scale fractures and/or faults)
- Approximate location of ridges
- Approximate location of head-scarp features
- A — Approximate extent active instability features
- B — Approximate extent of relict block slide features
- Observed areas of active soil creep
- Colluvium — Inferred extent of notable geologic material (yellow)
- Perennial watercourse / ephemeral overland flow path. Question marks indicate watercourses obliterated by motorway earthworks
- Noted area of wet/boggy ground

Notes:

1. Locations of features approximate only
2. Presence and location of any existing buried services to be verified prior to construction
3. All geomorphologic features shown were identified via interpretation of stereoscopic aerial photograph pairs and on-site observations, locations may vary
4. Question marks around extent of features indicates inferred extent
5. Underlying aerial photograph adapted from Auckland Council online GIS system

North (approx)

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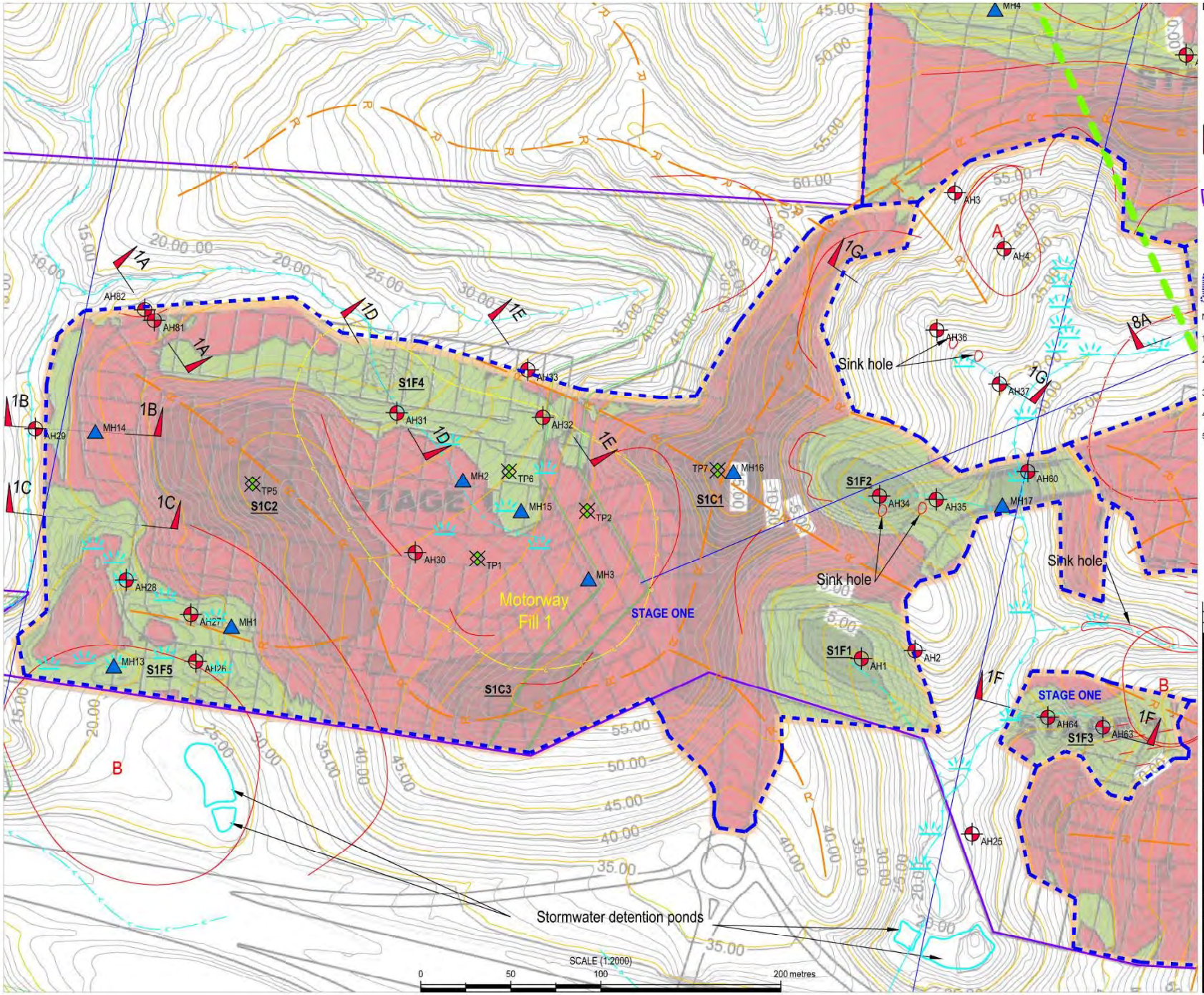
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PROJECT: PROPOSED SUBDIVISION
GRAND VIEW ESTATE
OREWA

TITLE: PHOTO GEOMORPHILOGICAL PLAN
OVERALL

SCALE: (A3 ORIGINAL) 1:5000	DATE: Oct-2015
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Oct-2015	A	Report Issue
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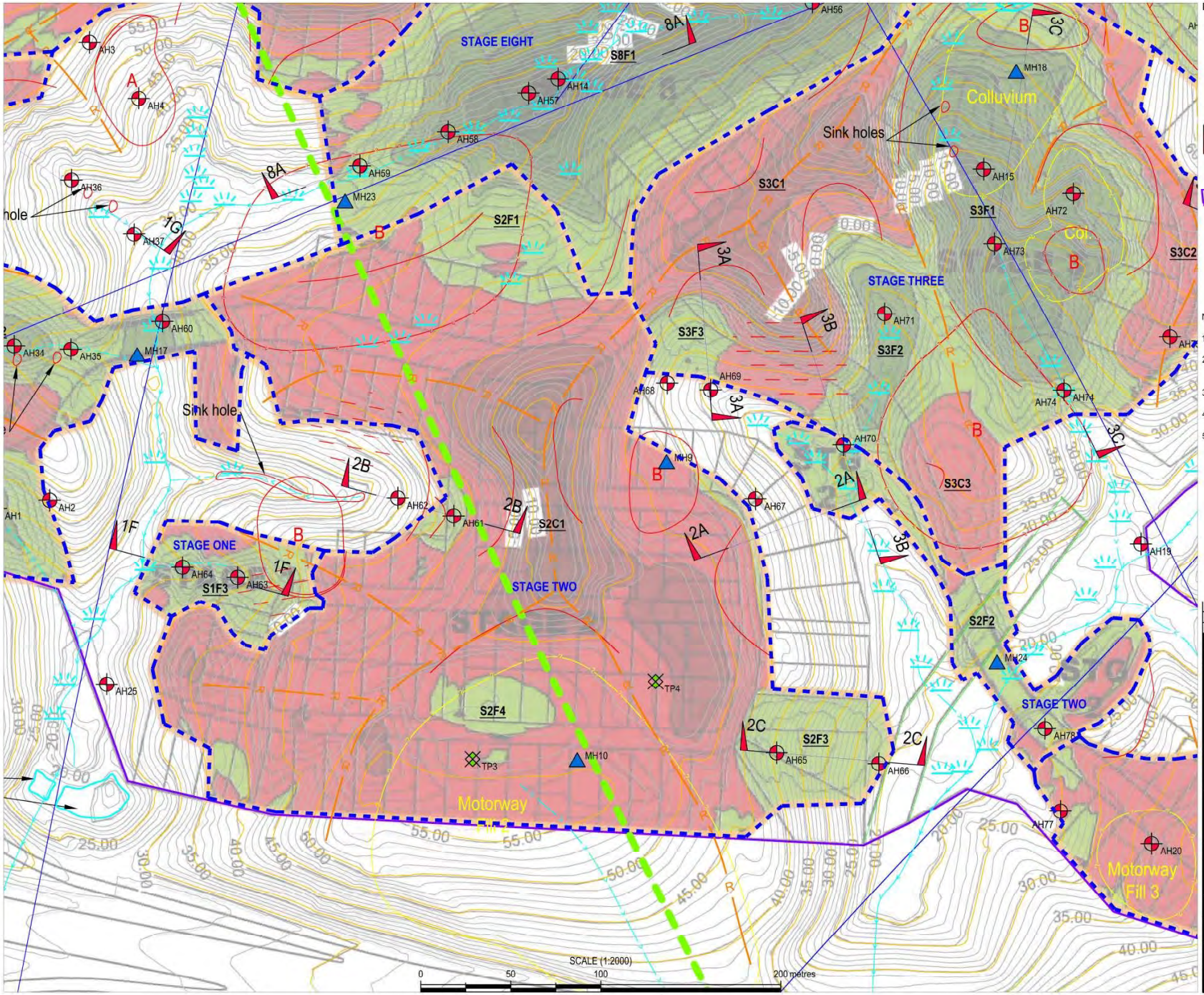
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TITLE
STAGE ONE
INVESTIGATION AND GEOMORPHOLOGY PLAN

SCALE: (A3 ORIGINAL) 1:2000	DATE: Oct 2015
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REVISION NO: A	JOB NO: 7464
CAD REF: 7464_Detailed_Invest.dwg	SHEET NO: KGA 4



Key:

- TP1 — Approximate test pit locations, KGA Geotechnical, 30 Aug 2013
- MH1 — Approximate rotary machine borehole locations, KGA Geotechnical, 22 Aug - 4 Sep 2013
- AH1 — Approximate hand auger borehole locations, KGA Geotechnical, 23 Aug - 4 Sept 2013
- A A' — Approximate cross section locations, KGA Geotechnical
- Subject property legal boundary
- Other Lot boundaries
- Stage earthworks boundary (as per ACL Drawing No. 200)

Notes:

1. Locations of features approximate only
2. Locations of all buried services to be verified prior to construction
3. Legal boundaries adapted from Quickmap
4. Refer to Sheet KGA 3 for geomorphology key
5. Underlay drawing adapted from Airey Consultants Limited plan entitled "Proposed Cut-Fill Plan", Project No. 11712-01, drawing No. 201, dated July 2015

North (approx)

DATE	REVISION	DESCRIPTION
Oct-2015	A	Report Issue

AMENDMENTS

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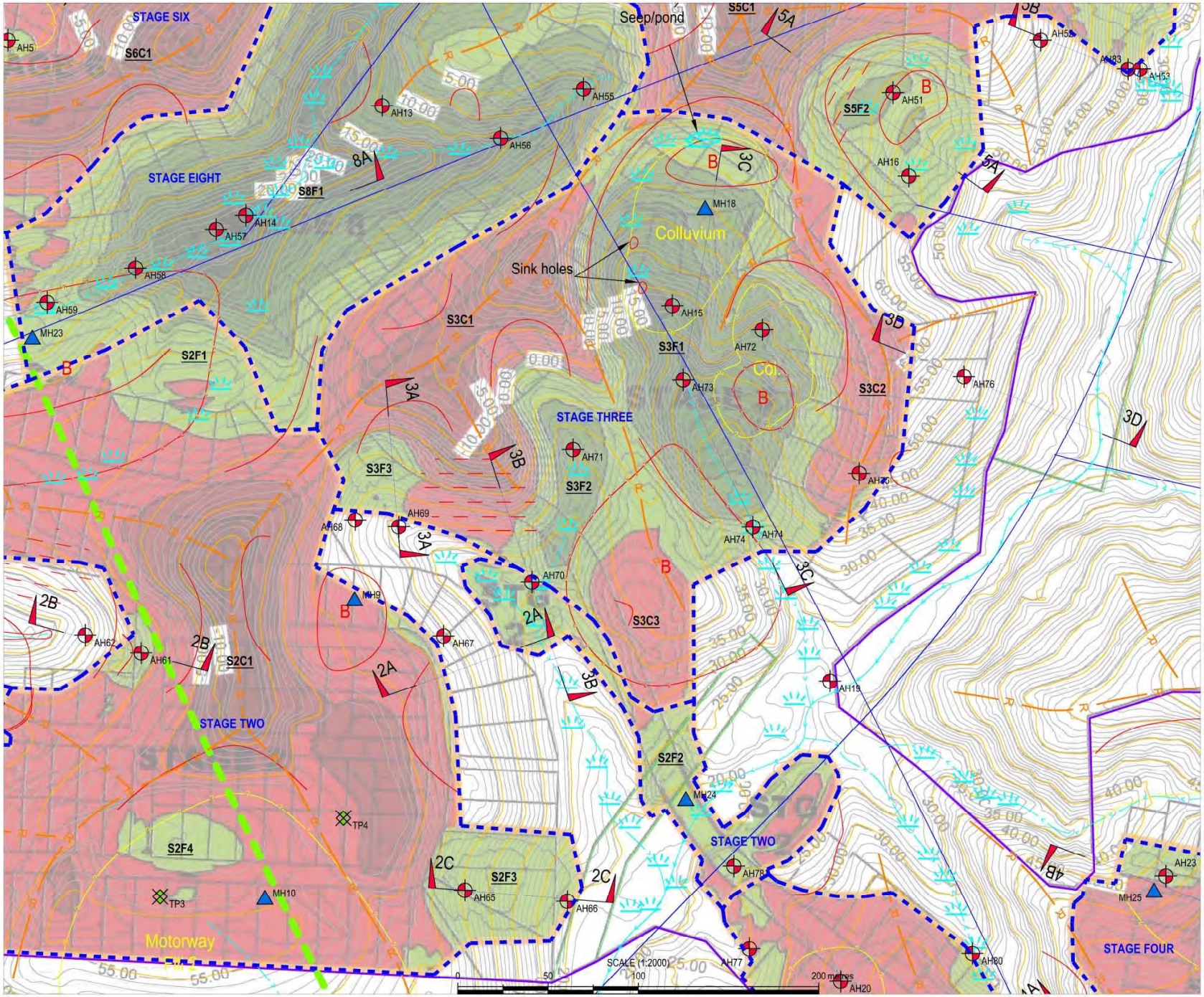
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TITLE
STAGE TWO
INVESTIGATION AND GEOMORPHOLOGY PLAN

SCALE: (A3 ORIGINAL)	DATE:
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REVISION NO:	JOB NO:
A	7464
CAD REF:	SHEET NO:
7464_Detailed_Invest.dwg	KGA 5



Key:

- TP1 — Approximate test pit locations, KGA Geotechnical, 30 Aug 2013
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- A A' — Approximate cross section locations, KGA Geotechnical
- Subject property legal boundary
- Other Lot boundaries
- Stage earthworks boundary (as per ACL Drawing No. 200)

Notes:

1. Locations of features approximate only
2. Locations of all buried services to be verified prior to construction
3. Legal boundaries adapted from Quickmap
4. Refer to Sheet KGA 3 for geomorphology key
5. Underlay drawing adapted from Airey Consultants Limited plan entitled "Proposed Cut-Fill Plan", Project No. 11712-01, drawing No. 201, dated July 2015

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Oct-2015	A	Report Issue

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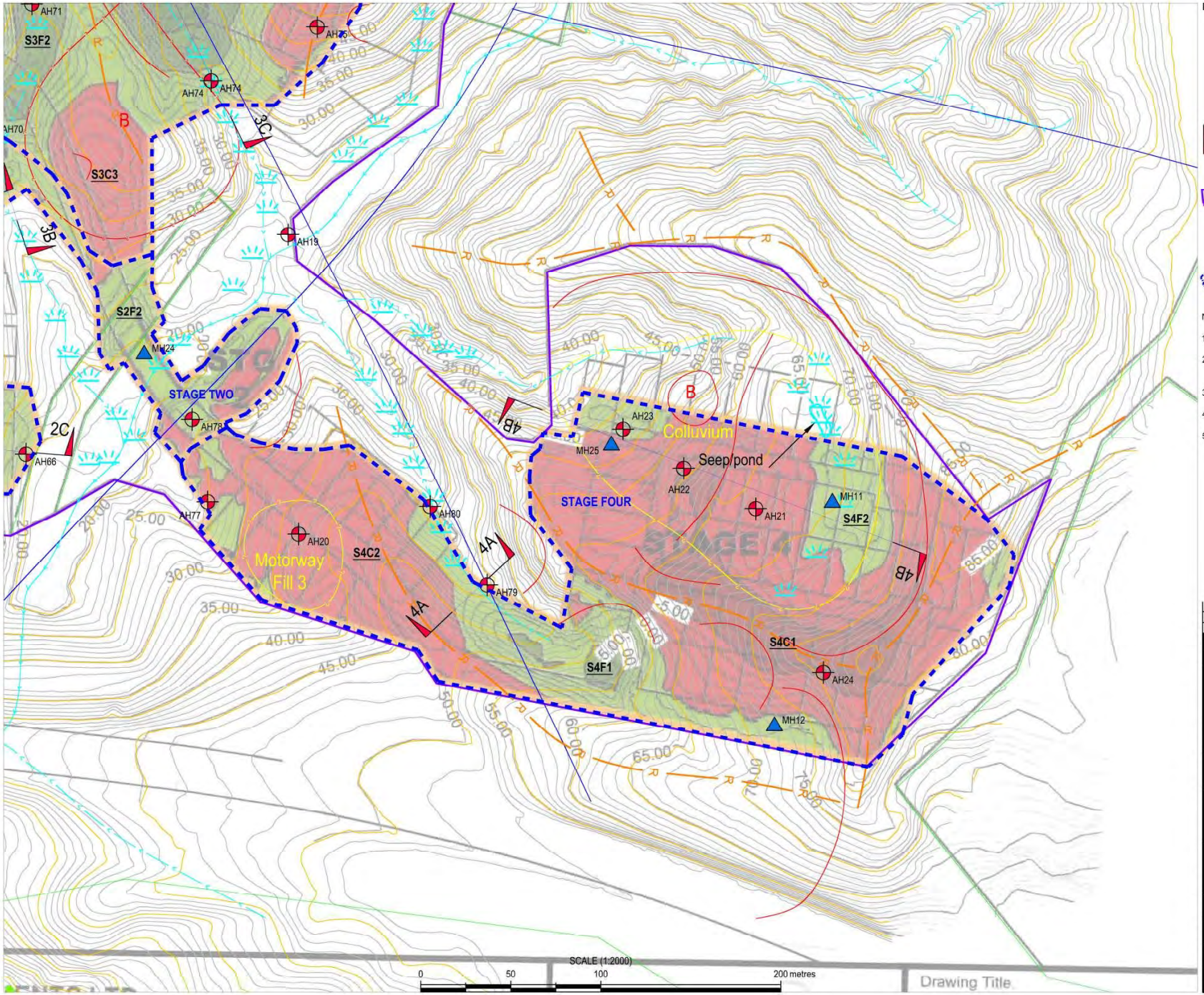
6 Omega St, Albany
Auckland, New Zealand
PO Box 302 361, NHMC
Tel: 09 478 6655
Fax: 09 478 6169
Email kga@kga.co.nz
KGA GEOTECHNICAL

CLIENT
OREWA WEST INVESTMENTS LIMITED

PROJECT
PROPOSED SUBDIVISION
GRAND VIEW ESTATE
OREWA

TITLE
STAGE THREE
INVESTIGATION AND GEOMORPHOLOGY PLAN

SCALE: (A3 ORIGINAL)	DATE:
1:2000	Oct 2015
DRAWN BY:	CHECKED BY:
PH	RJH
REVISION NO:	JOB NO:
A	7464
CAD REF:	SHEET NO:
7464_Detailed_Invest.dwg	KGA 6



Key:

- TP1 — Approximate test pit locations, KGA Geotechnical, 30 Aug 2013
- MH1 — Approximate rotary machine borehole locations, KGA Geotechnical, 22 Aug - 4 Sep 2013
- AH1 — Approximate hand auger borehole locations, KGA Geotechnical, 23 Aug - 4 Sept 2013
- A A' — Approximate cross section locations, KGA Geotechnical
- Subject property legal boundary
- Other Lot boundaries
- Stage earthworks boundary (as per ACL Drawing No. 200)

Notes:

1. Locations of features approximate only
2. Locations of all buried services to be verified prior to construction
3. Legal boundaries adapted from Quickmap
4. Refer to Sheet KGA 3 for geomorphology key
5. Underlay drawing adapted from Airey Consultants Limited plan entitled "Proposed Cut-Fill Plan", Project No. 11712-01, drawing No. 201, dated July 2015

North (approx)

DATE	REVISION	DESCRIPTION
Oct-2015	A	Report Issue

AMENDMENTS

Check all dimensions and levels on site before construction commences. Dimensions must not be directly scaled off this drawing. Only print copies of this drawing in full colour.

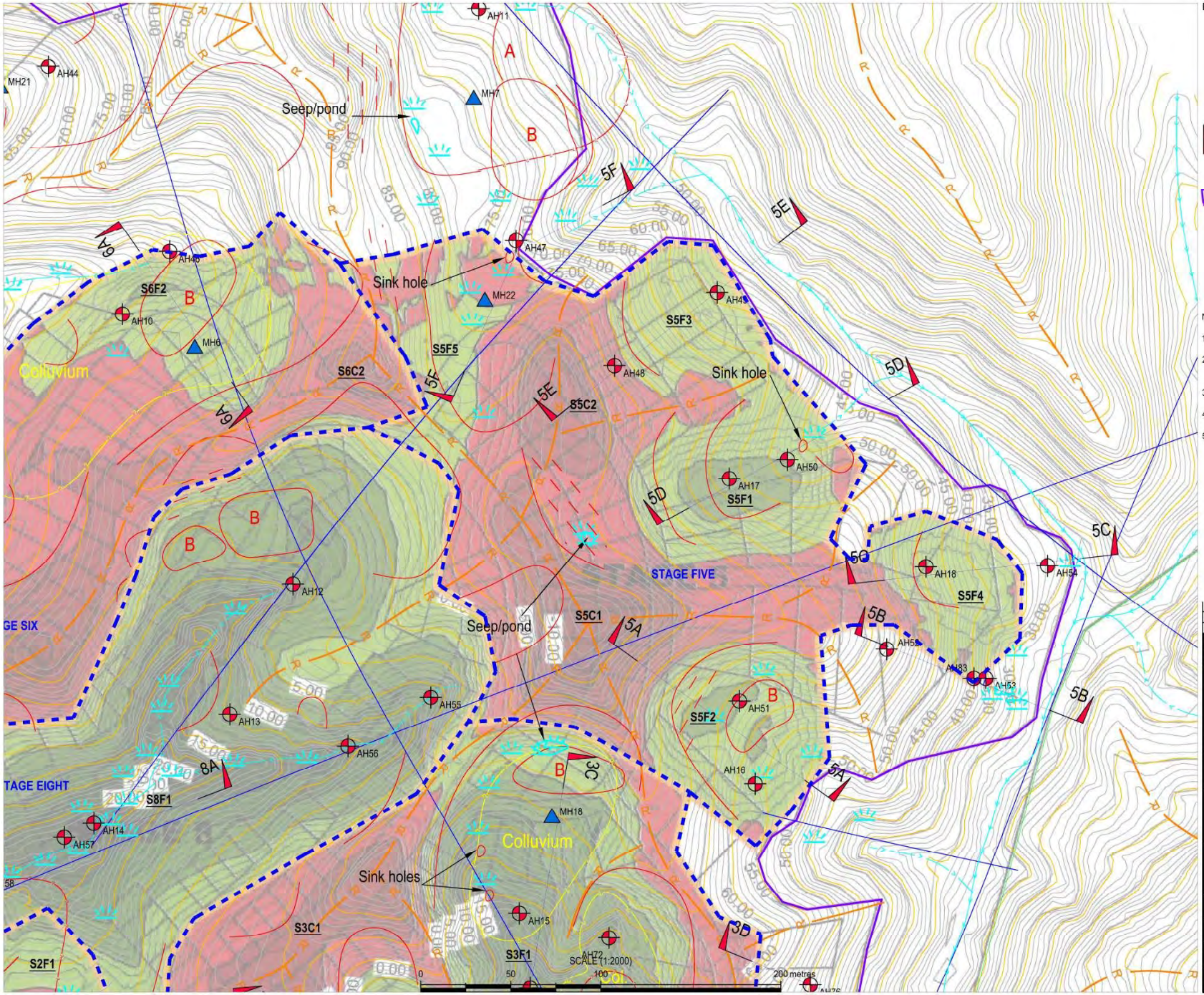
6 Omega St, Albany
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PO Box 302 361, NHMC
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Fax: 09 478 6169
Email kga@kga.co.nz
KGA GEOTECHNICAL

CLIENT
OREWA WEST INVESTMENTS LIMITED

PROJECT
PROPOSED SUBDIVISION
GRAND VIEW ESTATE
OREWA

TITLE
STAGE FOUR
INVESTIGATION AND GEOMORPHOLOGY PLAN

SCALE: (A3 ORIGINAL) 1:2000	DATE: Oct 2015
DRAWN BY: PH	CHECKED BY: RJH
REVISION NO: A	JOB NO: 7464
CAD REF: 7464_Detailed_Invest.dwg	SHEET NO: KGA 7



Key:

- TP1 — Approximate test pit locations, KGA Geotechnical, 30 Aug 2013
- MH1 — Approximate rotary machine borehole locations, KGA Geotechnical, 22 Aug - 4 Sep 2013
- AH1 — Approximate hand auger borehole locations, KGA Geotechnical, 23 Aug - 4 Sept 2013
- A A' — Approximate cross section locations, KGA Geotechnical
- Subject property legal boundary
- Other Lot boundaries
- Stage earthworks boundary (as per ACL Drawing No. 200)

Notes:

1. Locations of features approximate only
2. Locations of all buried services to be verified prior to construction
3. Legal boundaries adapted from Quickmap
4. Refer to Sheet KGA 3 for geomorphology key
5. Underlay drawing adapted from Airey Consultants Limited plan entitled "Proposed Cut-Fill Plan", Project No. 11712-01, drawing No. 201, dated July 2015

DATE	REVISION	DESCRIPTION
Oct-2015	A	Report Issue

AMENDMENTS

Check all dimensions and levels on site before construction commences. Dimensions must not be directly scaled off this drawing. Only print copies of this drawing in full colour.

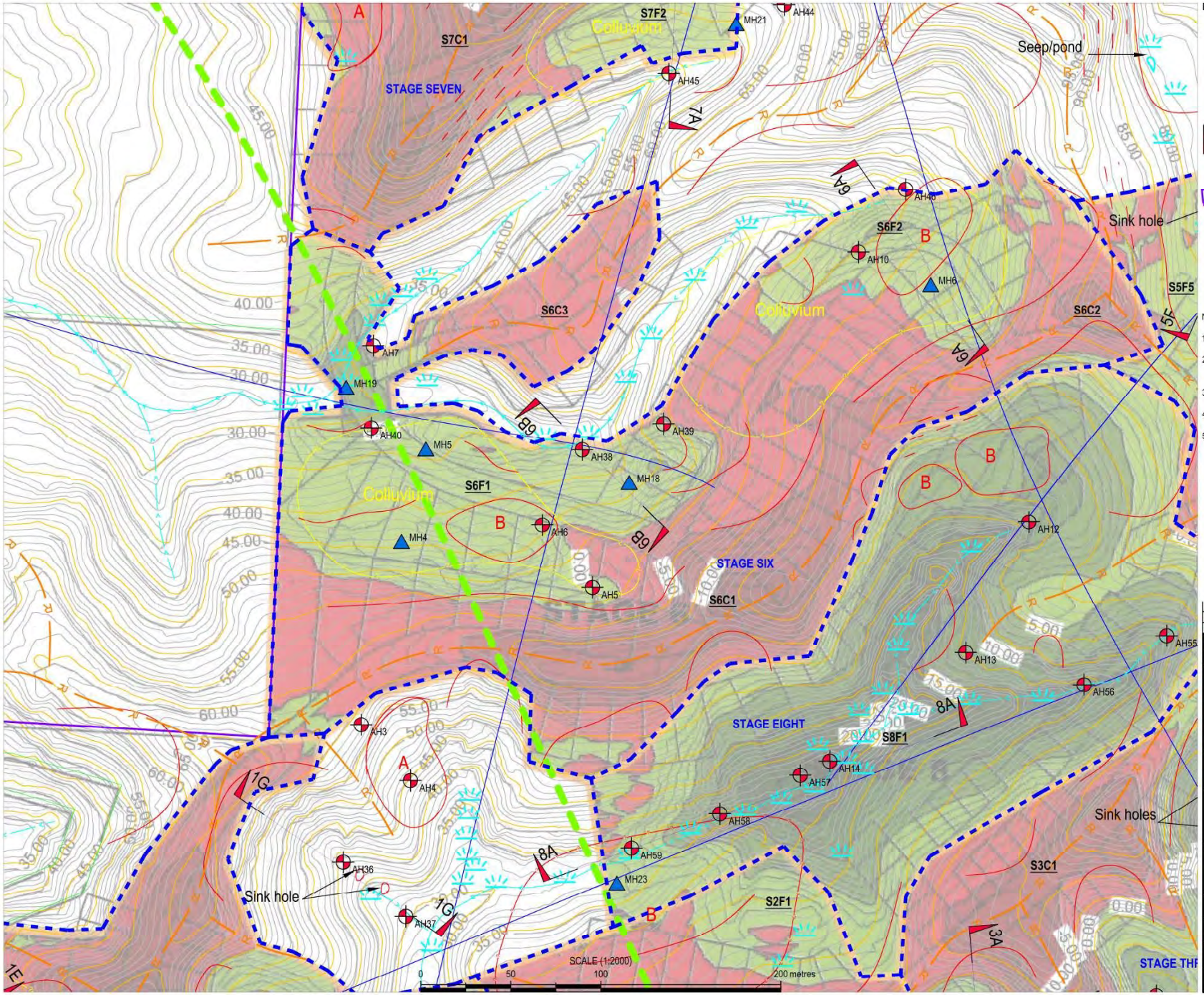
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PO Box 302 361, NHMC
Tel: 09 478 6655
Fax: 09 478 6169
Email kga@kga.co.nz
KGA GEOTECHNICAL

CLIENT
OREWA WEST INVESTMENTS LIMITED

PROJECT
PROPOSED SUBDIVISION
GRAND VIEW ESTATE
OREWA

TITLE
STAGE FIVE
INVESTIGATION AND GEOMORPHOLOGY PLAN

SCALE: (A3 ORIGINAL) 1:2000	DATE: Oct 2015
DRAWN BY: PHI	CHECKED BY: RJHI
REVISION NO: A	JOB NO: 7464
CAD REF: 7464_Detailed_Invest.dwg	SHEET NO: KGA 8



Key:

- TP1 — Approximate test pit locations, KGA Geotechnical, 30 Aug 2013
- MH1 — Approximate rotary machine borehole locations, KGA Geotechnical, 22 Aug - 4 Sep 2013
- AH1 — Approximate hand auger borehole locations, KGA Geotechnical, 23 Aug - 4 Sept 2013
- A A' — Approximate cross section locations, KGA Geotechnical
- Subject property legal boundary
- Other Lot boundaries
- Stage earthworks boundary (as per ACL Drawing No. 200)

Notes:

1. Locations of features approximate only
2. Locations of all buried services to be verified prior to construction
3. Legal boundaries adapted from Quickmap
4. Refer to Sheet KGA 3 for geomorphology key
5. Underlay drawing adapted from Airey Consultants Limited plan entitled "Proposed Cut-Fill Plan", Project No. 11712-01, drawing No. 201, dated July 2015

DATE	REVISION	DESCRIPTION
Oct-2015	A	Report Issue

AMENDMENTS

Check all dimensions and levels on site before construction commences. Dimensions must not be directly scaled off this drawing. Only print copies of this drawing in full colour.

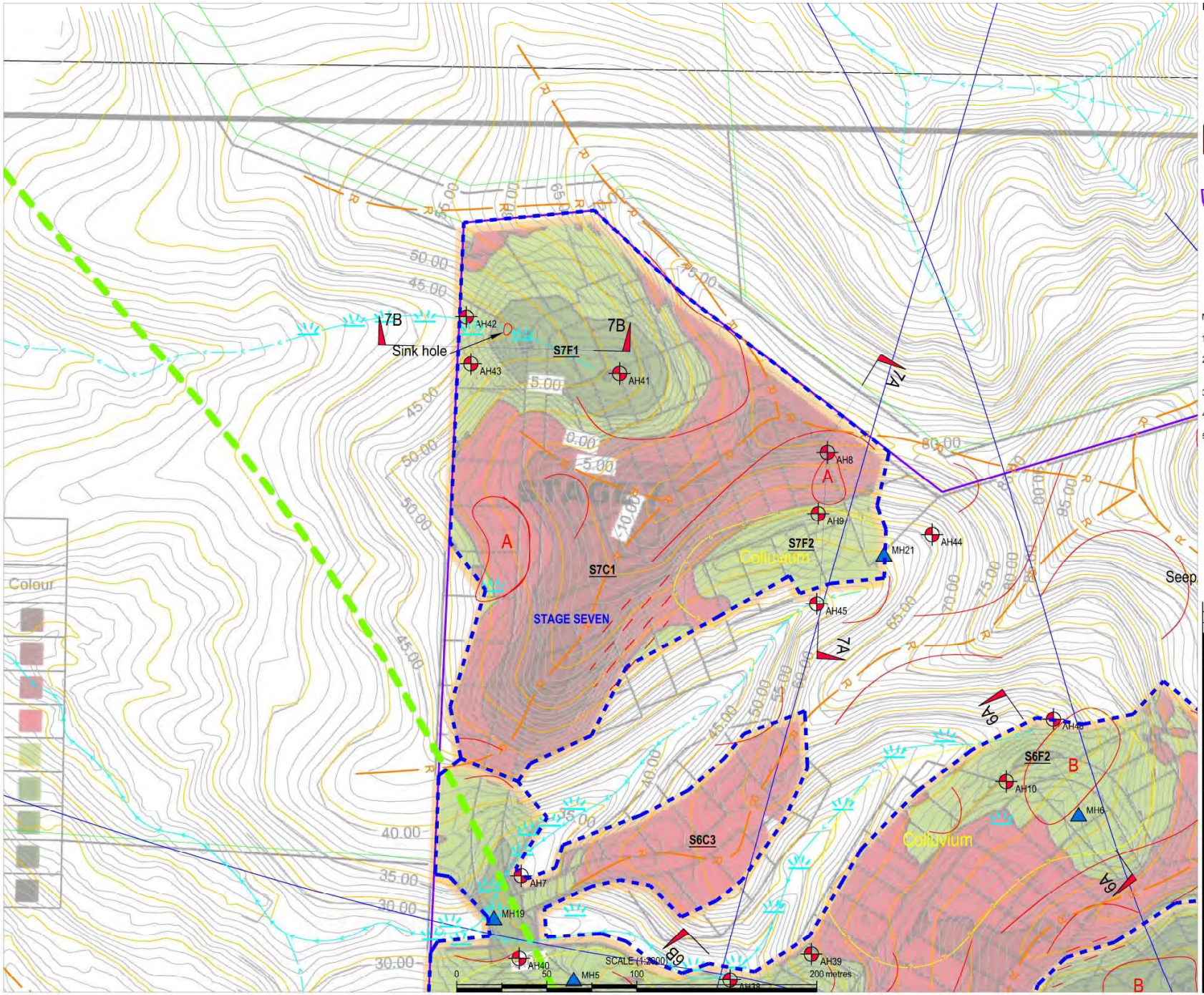
6 Omega St, Albany
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PO Box 302 361, NHMC
Tel: 09 478 6655
Fax: 09 478 6169
Email kga@kga.co.nz
KGA GEOTECHNICAL

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OREWA WEST INVESTMENTS LIMITED

PROJECT
PROPOSED SUBDIVISION
GRAND VIEW ESTATE
OREWA

TITLE
STAGE SIX
INVESTIGATION AND GEOMORPHOLOGY PLAN

SCALE: (A3 ORIGINAL) 1:2000	DATE: Oct 2015
DRAWN BY: PH	CHECKED BY: RJH
REVISION NO: A	JOB NO: 7464
CAD REF: 7464_Detailed_Invest.dwg	SHEET NO: KGA 9



Key:

- TP1 — Approximate test pit locations, KGA Geotechnical, 30 Aug 2013
- MH1 — Approximate rotary machine borehole locations, KGA Geotechnical, 22 Aug - 4 Sep 2013
- AH1 — Approximate hand auger borehole locations, KGA Geotechnical, 23 Aug - 4 Sept 2013
- A A' — Approximate cross section locations, KGA Geotechnical
- Subject property legal boundary
- Other Lot boundaries
- Stage earthworks boundary (as per ACL Drawing No. 200)

Notes:

1. Locations of features approximate only
2. Locations of all buried services to be verified prior to construction
3. Legal boundaries adapted from Quickmap
4. Refer to Sheet KGA 3 for geomorphology key
5. Underlay drawing adapted from Airey Consultants Limited plan entitled "Proposed Cut-Fill Plan", Project No. 11712-01, drawing No. 201, dated July 2015

North (approx)

DATE	REVISION	DESCRIPTION
Oct-2015	A	Report Issue

AMENDMENTS

Check all dimensions and levels on site before construction commences. Dimensions must not be directly scaled off this drawing. Only print copies of this drawing in full colour.

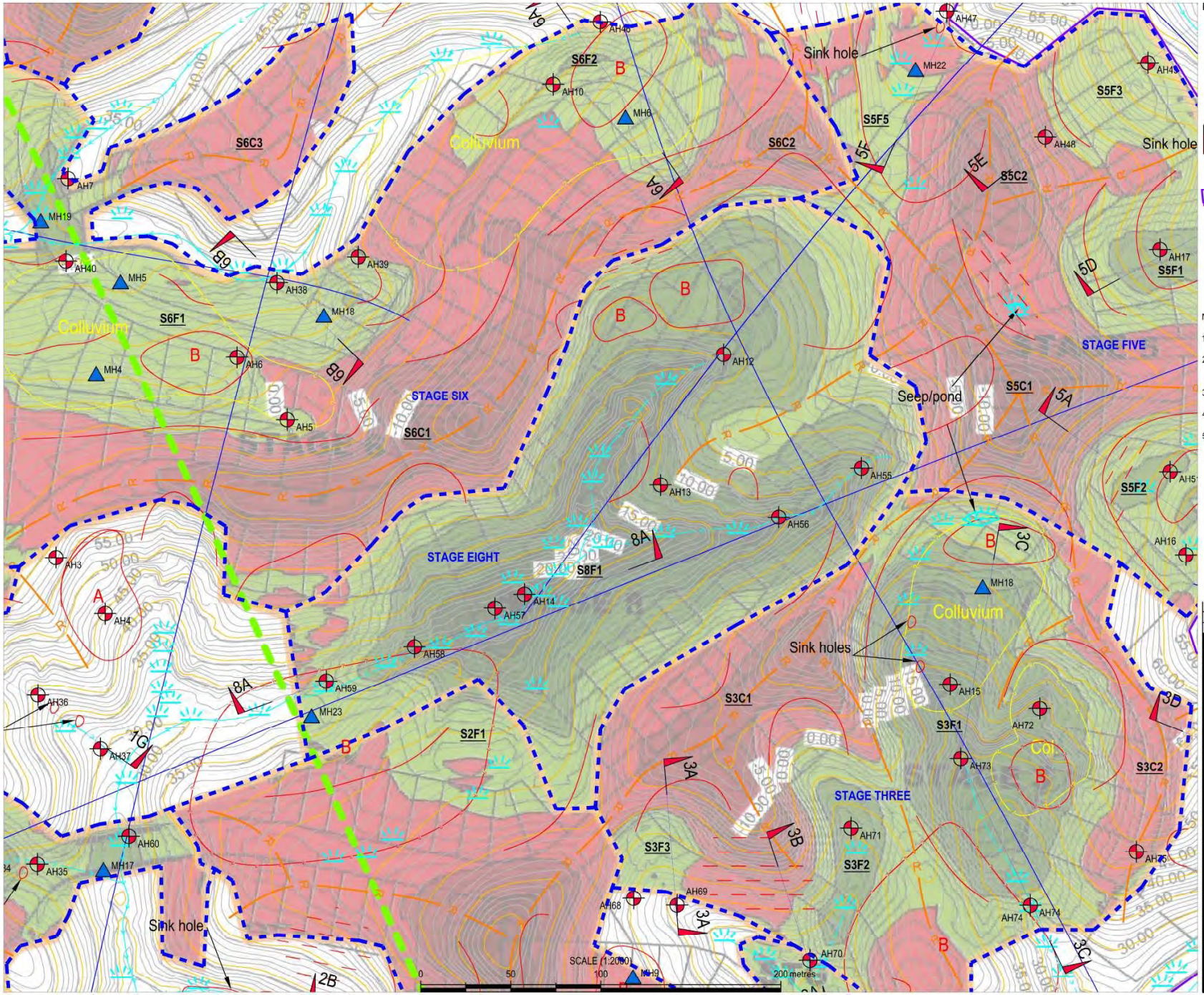
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Auckland, New Zealand
PO Box 302 361, NHMC
Tel: 09 478 6655
Fax: 09 478 6169
Email kga@kga.co.nz
KGA GEOTECHNICAL

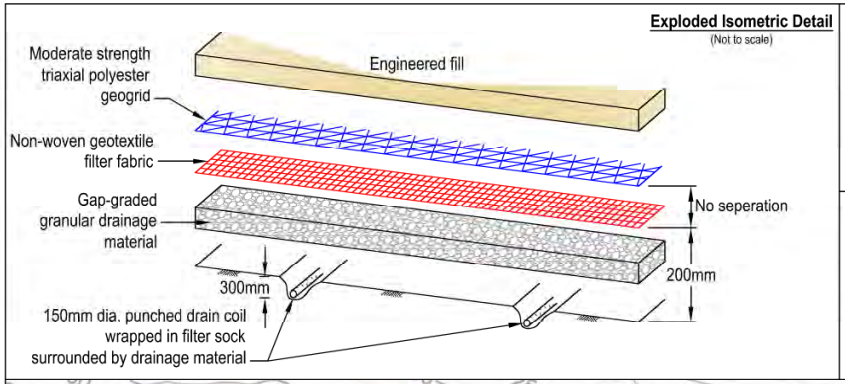
CLIENT
OREWA WEST INVESTMENTS LIMITED

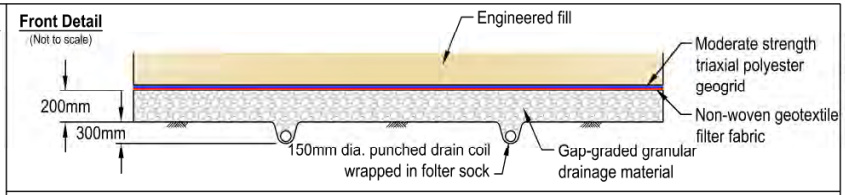
PROJECT
PROPOSED SUBDIVISION
GRAND VIEW ESTATE
OREWA

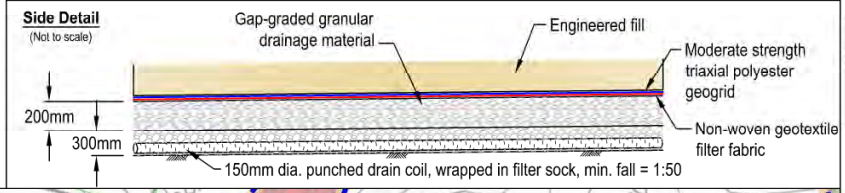
TITLE
STAGE SEVEN
INVESTIGATION AND GEOMORPHOLOGY PLAN

SCALE: (A3 ORIGINAL) 1:2000	DATE: Oct 2015
DRAWN BY: PHI	CHECKED BY: RJHI
REVISION NO: A	JOB NO: 7464
CAD REF: 7464_Detailed_Invest.dwg	SHEET NO: KGA 10


Key:
TP1
Approximate test pit locations, KGA Geotechnical, 30 Aug 2013
MH1
Approximate rotary machine borehole locations, KGA Geotechnical, 22 Aug - 4 Sep 2013
AH1
Approximate hand auger borehole locations, KGA Geotechnical, 23 Aug - 4 Sept 2013
A A'
Approximate cross section locations, KGA Geotechnical
Subject property legal boundary
Other Lot boundaries
Stage earthworks boundary (as per ACL Drawing No. 200)
Notes:
1. Locations of features approximate only
2. Locations of all buried services to be verified prior to construction
3. Legal boundaries adapted from Quickmap
4. Refer to Sheet KGA 3 for geomorphology key
5. Underlay drawing adapted from Airey Consultants Limited plan entitled "Proposed Cut-Fill Plan", Project No. 11712-01, drawing No. 201, dated July 2015
North (approx)
STAGE FIVE
STAGE SIX
STAGE EIGHT
STAGE THREE
Colluvium
Sink hole
Sink holes
Seep/pond
Col
S6C3
S6C2
S6C1
S6F1
S6F2
S5C2
S5C1
S5F1
S5F2
S5F3
S5F5
S8F1
S2F1
S3C1
S3C2
S3F1
S3F2
S3F3
SCALE (1:2000)
0 50 100 200 metres
Oct-2015 A Report Issue
DATE REVISION DESCRIPTION
AMENDMENTS
Check all dimensions and levels on site before construction commences. Dimensions must not be directly scaled off this drawing. Only print copies of this drawing in full colour.
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Email kga@kga.co.nz
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CLIENT
OREWA WEST INVESTMENTS LIMITED
PROJECT
PROPOSED SUBDIVISION
GRAND VIEW ESTATE
OREWA
TITLE
STAGE EIGHT
INVESTIGATION AND GEOMORPHOLOGY PLAN
SCALE: (A3 ORIGINAL) 1:2000
DATE: Oct 2015
DRAWN BY: PH
CHECKED BY: RJH
REVISION NO: A
JOB NO: 7464
CAD REF: 7464_Detailed_Invest.dwg
SHEET NO: KGA 11

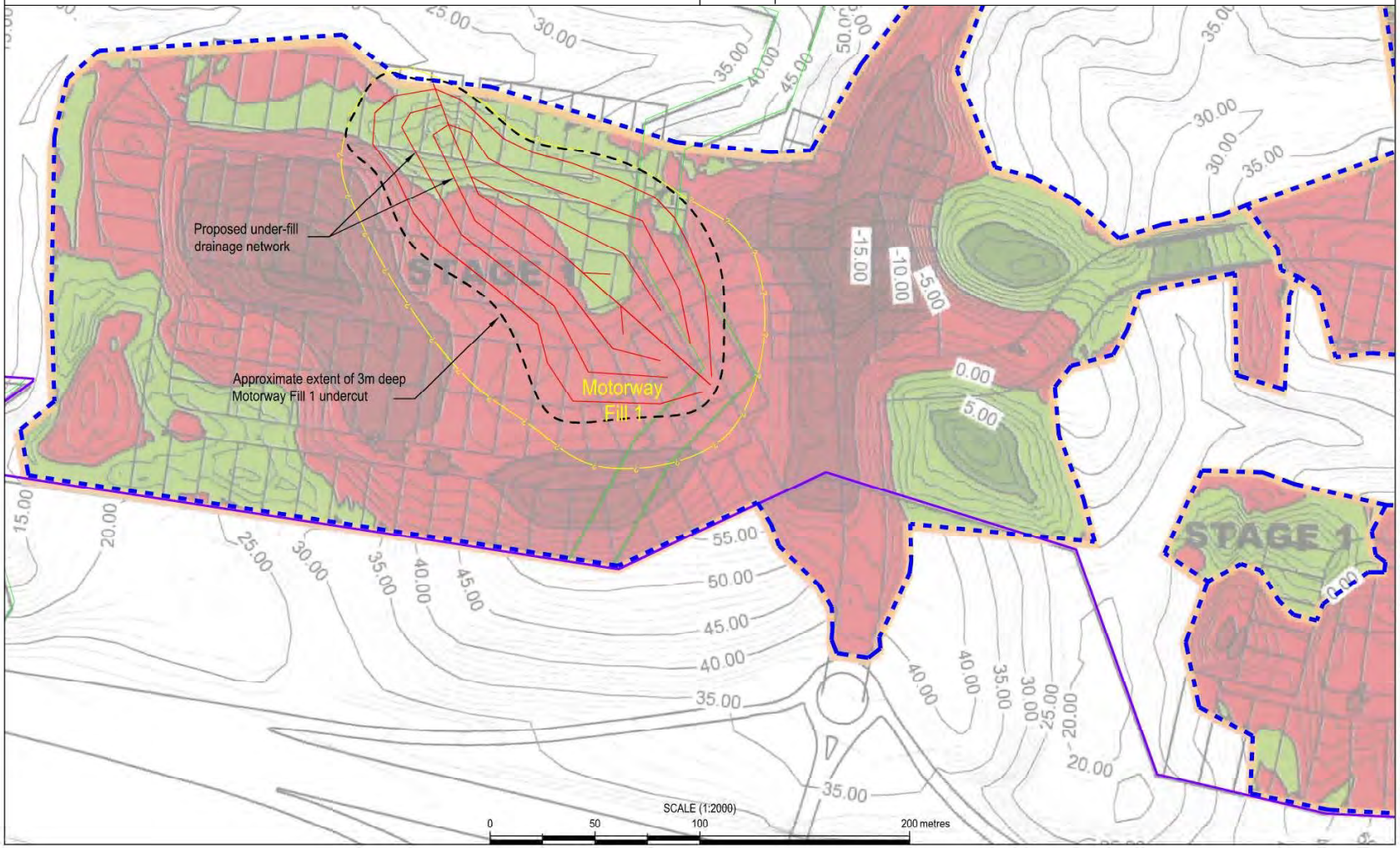






Notes:

1. Locations of features approximate only
2. Locations of all buried services to be verified prior to construction
3. Legal boundaries adapted from Quickmap
4. Underlay drawing adapted from Airey Consultants Limited plan entitled "Proposed Cut-Fill Plan", Project No. 11712-01, drawing No. 201, dated July 2015
5. Extent of Motorway Fill 1 determined by Aerial Photograph Interpretation, actual location may vary
6. Approximate extent of 3m undercut determined by existing subsurface investigation results, actual location may vary and to be determined by geotechnical engineer Stage One site formation earthworks



North (approx)

DATE	REVISION	DESCRIPTION
Oct-2015	A	Report Issue

AMENDMENTS

Check all dimensions and levels on site before construction commences. Dimensions must not be directly scaled off this drawing. Only print copies of this drawing in full colour.

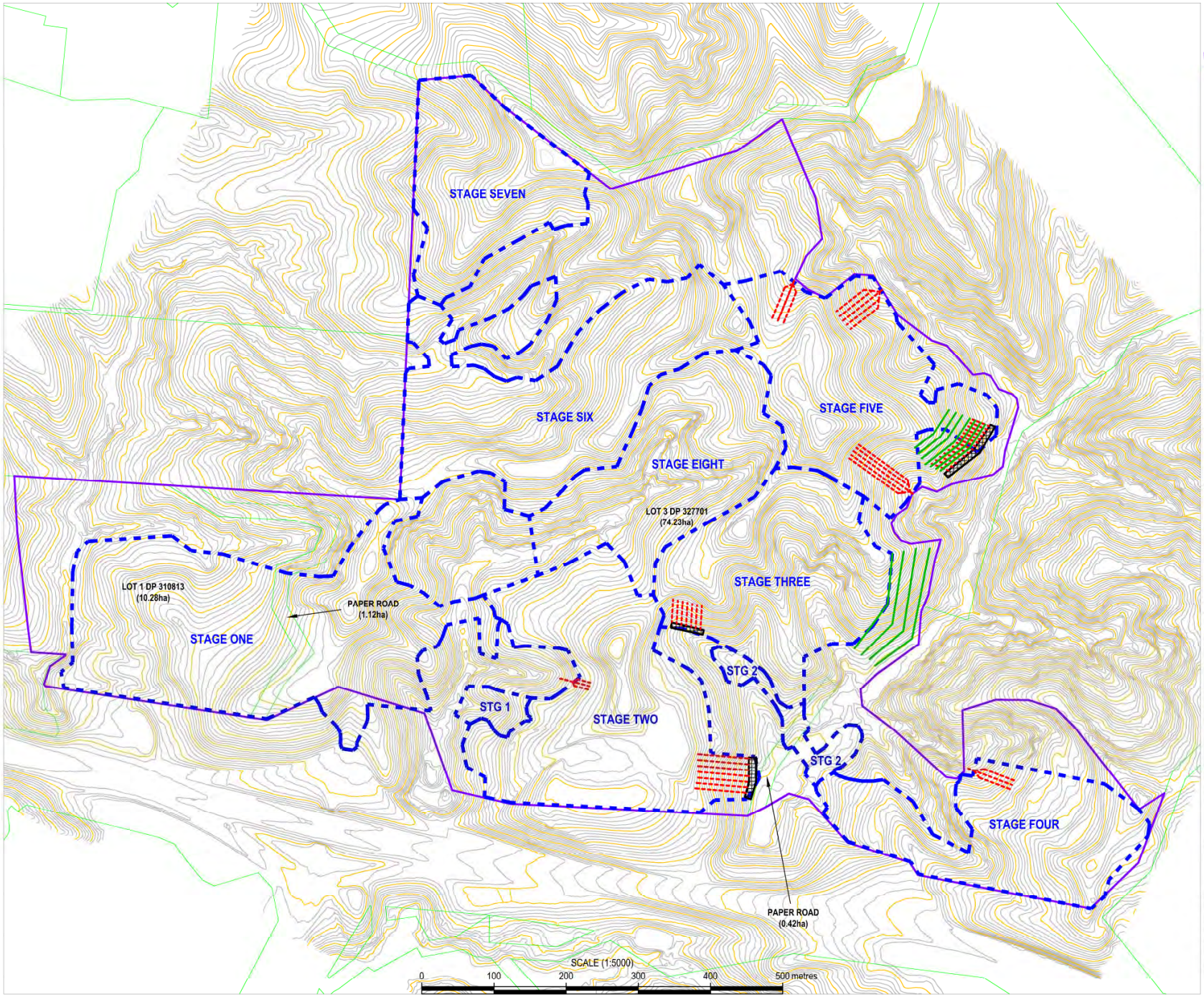
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KGA GEOTECHNICAL

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PROJECT
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GRAND VIEW ESTATE
OREWA

TITLE
STAGE ONE
MOTORWAY FILL APPROXIMATE UNDERCUT PLAN

SCALE: (A3 ORIGINAL)	DATE:
1:2000	Oct 2015
DRAWN BY: PH	CHECKED BY: RJH
REVISION NO: A	JOB NO: 7464
CAD REF: 7464_Detailed_Invest.dwg	SHEET NO: KGA 12



Key:

- Subject property legal boundary
- Other Lot boundaries
- Proposed earthworks stage boundaries
- Proposed shear key (location and extent TBC)
- Proposed buttress drain (location and extent TBC)
- Possible in-ground palisade retaining wall (location and extent TBC)

Notes:

1. Locations of features approximate only
2. Locations of all buried services to be verified prior to construction
3. Legal boundaries adapted from Quickmap
4. Extent of proposed earthworks stage boundaries adapted from drawing prepared by Airey Consultants Limited entitled "Proposed Cut-Fill Plan", Project No. 11712-01, drawing No. 201, dated July 2015
5. **DIMENSIONS AND EXTENT OF OF ALL MEASURES TO BE CONFIRMED BY DETAILED, STAGE SPECIFIC INVESTIGATION, ANALYSIS AND DESIGN, AS PER SECTION 5.0 OF KGA REPORT 7464-10**

North (approx)

DATE	REVISION	DESCRIPTION
Oct-2015	A	Report Issue

AMENDMENTS

Check all dimensions and levels on site before construction commences. Dimensions must not be directly scaled off this drawing. Only print copies of this drawing in full colour.

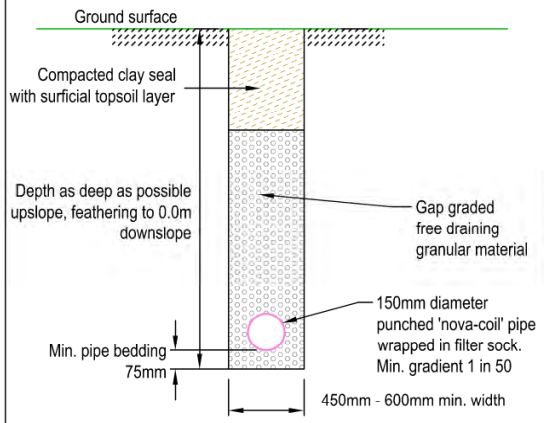
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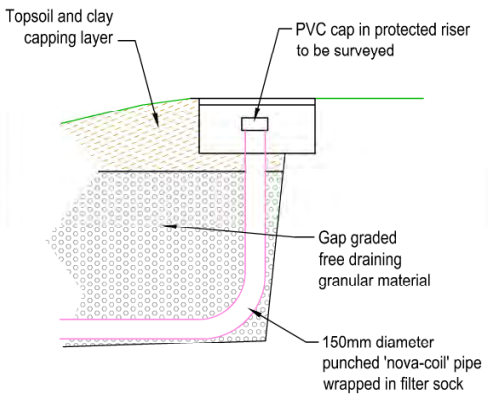
TITLE
OVERALL
SUGGESTED REMEDIATION
MEASURES PLAN

SCALE: (A3 ORIGINAL) 1:5000	DATE: Oct-2015
DRAWN BY: PIH	CHECKED BY: RJH
REVISION NO: A	JOB NO: 7464
CAD REF: 7464_Detailed_Invest.dwg	SHEET NO: KGA 13

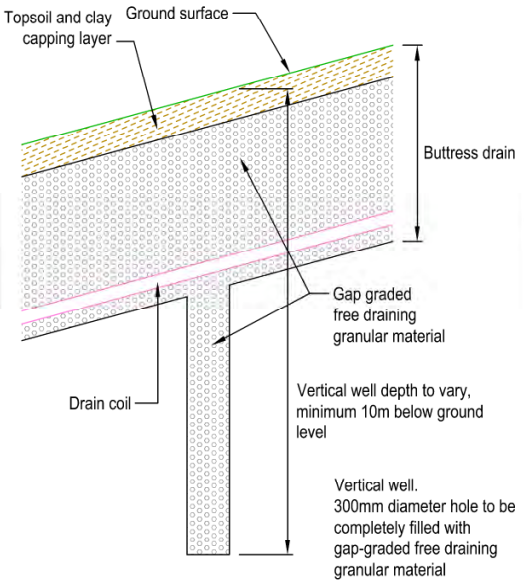


TYPICAL BUTTRESS DRAIN DETAIL
(not to scale)

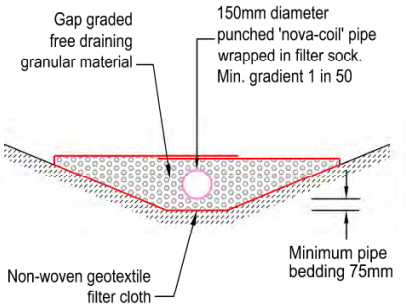
NOTE: EITHER buttress drain trench OR drain coil to be completely wrapped in geotextile filter cloth



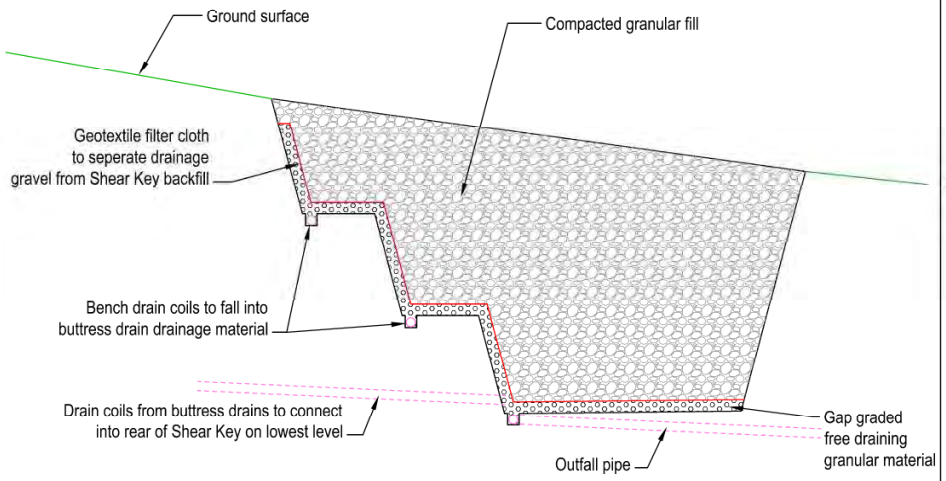
TYPICAL BUTTRESS DRAIN FLUSHING POINT DETAIL
(not to scale)



TYPICAL VVERTICAL WELL DETAIL
(not to scale)



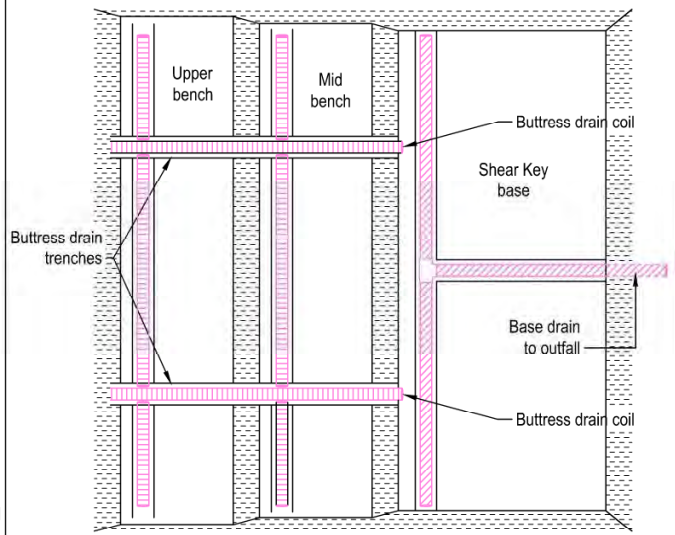
TYPICAL UNDERFILL DRAIN DETAIL
(not to scale)



NOTES: 1. Benching to suit the cut and ground conditions encountered

2. Base of Shear Key to be founded in rock to be identified and confirmed at the time of construction by a Chartered Professional Engineer (Geotechnical)

TYPICAL SHEAR KEY CROSS SECTION
(not to scale)



TYPICAL SHEAR KEY PLAN
(not to scale)

NOTE: Bench and base drains to run entire length of Shear Key

Notes:

1. **DIMENSIONS AND EXTENT OF OF ALL MEASURES TO BE CONFIRMED BY DETAILED, STAGE SPECIFIC INVESTIGATION, ANALYSIS AND DESIGN, AS PER SECTION 5.0 OF KGA REPORT 7464-10**

DATE	REVISION	DESCRIPTION
Oct-2015	A	Report Issue

AMENDMENTS

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OREWA WEST INVESTMENTS LIMITED

PROJECT
PROPOSED SUBDIVISION
GRAND VIEW ESTATE
OREWA

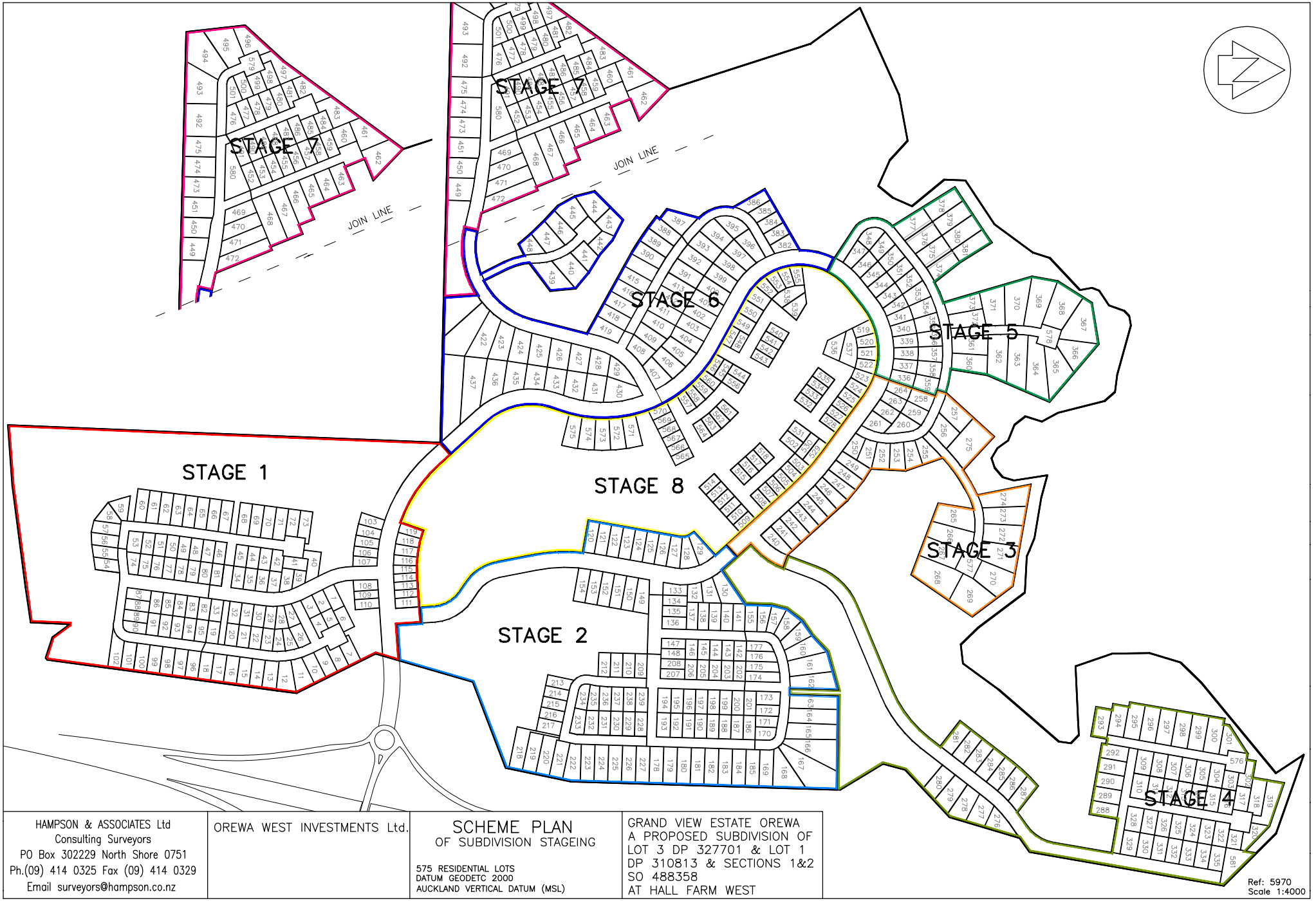
TITLE
SUGGESTED TYPICAL DETAILS FOR BUTTRESS DRAINS, VERTICAL WELLS & SHEAR KEYS

SCALE: (A3 ORIGINAL) 1:2000	DATE: Oct 2015
DRAWN BY: PH	CHECKED BY: RJH
REVISION NO: A	JOB NO: 7464
CAD REF: 7464_Detailed_Invest.dwg	SHEET NO: KGA 14

APPENDIX 1

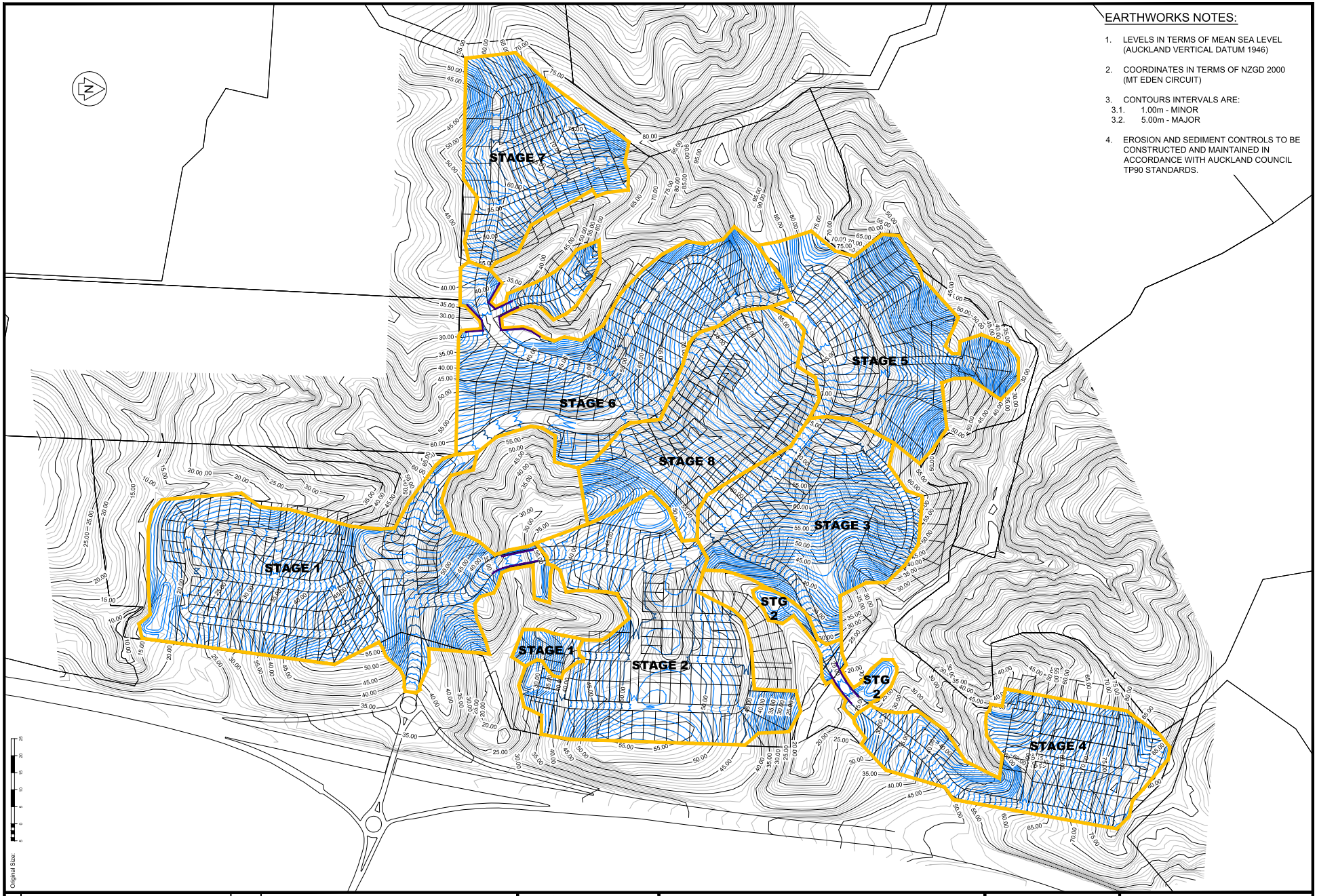
Pertinent Third Party Consultant Drawings
Provided to KGA Geotechnical Limited

Title	Author	Dwg No. / Ref No.	Date
Scheme Plan	HAL	5970	
Proposed Finished Contour Plan	ACL	200	July 2015
Proposed Cut-Fill Plan	ACL	201	July 2015
Stage 1 - Earthworks & Sediment Control Plan	ACL	210	August 2015
Stage 2 - Earthworks & Sediment Control Plan	ACL	220	August 2015
Stage 3 - Earthworks & Sediment Control Plan	ACL	230	August 2015
Stage 4 - Earthworks & Sediment Control Plan	ACL	240	August 2015
Stage 5 - Earthworks & Sediment Control Plan	ACL	250	August 2015
Stage 6 - Earthworks & Sediment Control Plan	ACL	260	August 2015
Stage 7 - Earthworks & Sediment Control Plan	ACL	270	August 2015
Stage 8 - Earthworks & Sediment Control Plan	ACL	280	August 2015
Proposed Stormwater Layout & Flooding Plan	ACL	400	July 2015
Arch Bridge Typical Detail	ACL	407	July 2015
Proposed Wastewater Layout Plan	ACL	500	July 2015
Preliminary Wastewater Pump Station Layout Plans, Typical Cross Section	ACL	501	July 2015



HAMPSON & ASSOCIATES Ltd Consulting Surveyors PO Box 302229 North Shore 0751 Ph.(09) 414 0325 Fax (09) 414 0329 Email surveyors@hampson.co.nz	OREWA WEST INVESTMENTS Ltd.	SCHEME PLAN OF SUBDIVISION STAGEING 575 RESIDENTIAL LOTS DATUM GEODETC 2000 AUCKLAND VERTICAL DATUM (MSL)	GRAND VIEW ESTATE OREWA A PROPOSED SUBDIVISION OF LOT 3 DP 327701 & LOT 1 DP 310813 & SECTIONS 1&2 SO 488358 AT HALL FARM WEST

Ref: 5970
Scale 1:4000



EARTHWORKS NOTES:

1. LEVELS IN TERMS OF MEAN SEA LEVEL (AUCKLAND VERTICAL DATUM 1946)
2. COORDINATES IN TERMS OF NZGD 2000 (MT EDEN CIRCUIT)
3. CONTOURS INTERVALS ARE:
   - 3.1. 1.00m - MINOR
   - 3.2. 5.00m - MAJOR
4. EROSION AND SEDIMENT CONTROLS TO BE CONSTRUCTED AND MAINTAINED IN ACCORDANCE WITH AUCKLAND COUNCIL TP90 STANDARDS.

Original Size: A1

No.	Revision Details	Date
----	----	----
----	----	----
----	----	----
----	----	----
----	----	----

(Current Revision Date : 09/10/2015)

LEGEND:

- PROPOSED CONTOUR (MAJOR)
- PROPOSED CONTOUR (MINOR)
- EXISTING CONTOUR (MAJOR)
- EXISTING CONTOUR (MINOR)
- EARTHWORKS STAGES

Design	SIM
Survey	AUCKLAND COUNCIL GIS
Drawn	SIM
Checked	ML
Date	July 2015
Scale	1:2500 (A1) 1:5000 (A3)
CAD Filename	11712-01 200.dwg

DRAFT

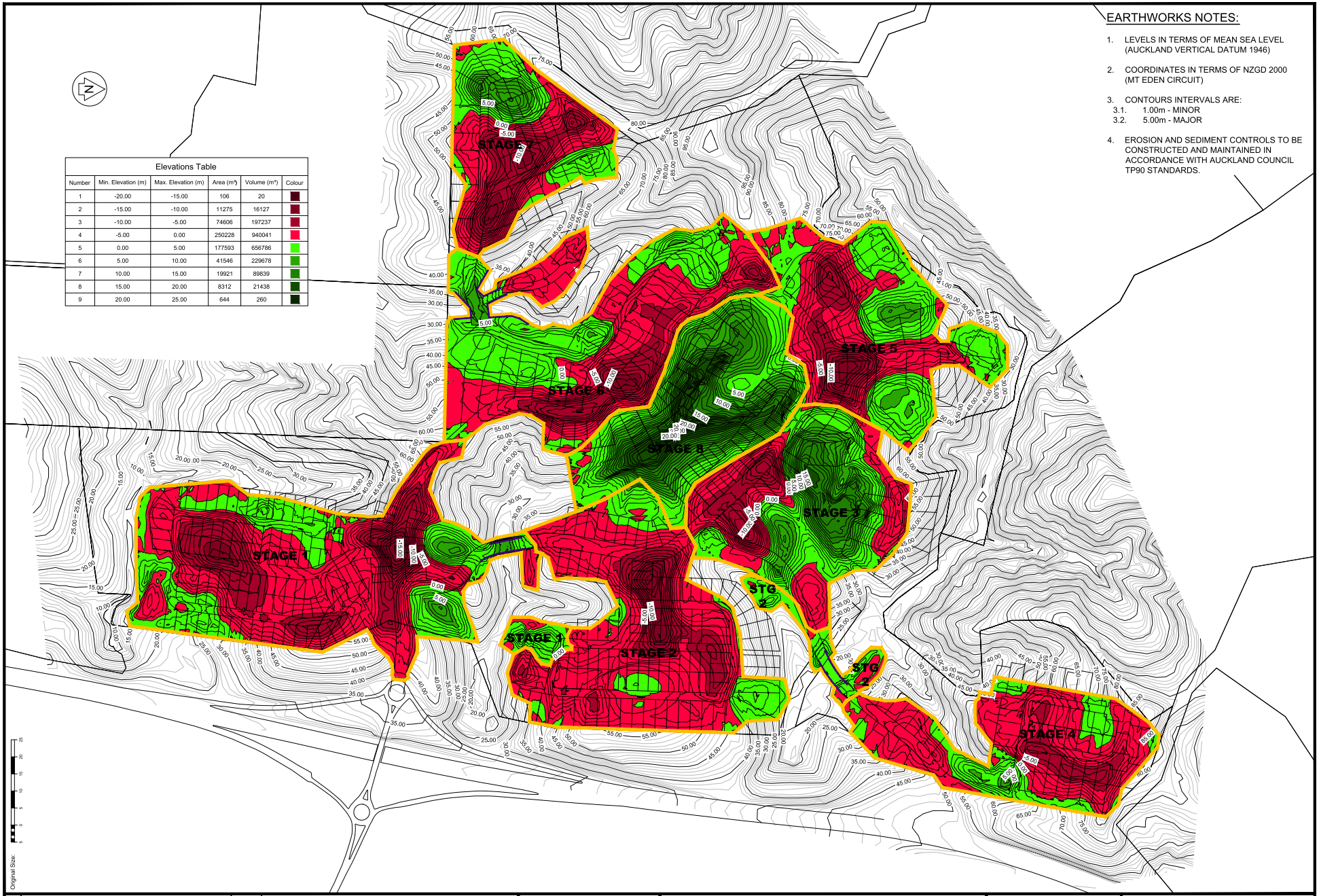
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Job Title.
OREWA WEST INVESTMENTS LTD
GRAND VIEW ESTATE, OREWA
LOT 3 DP 327701
AUCKLAND

AIREY CONSULTANTS LTD.
CONSULTING CIVIL & STRUCTURAL ENGINEERS
Takapuna, Pukekohe, Howick, Queenstown, Christchurch, Orewa
ACENZ

Drawing Title.
PROPOSED FINISHED CONTOUR PLAN

File No.	Rev.	Dwg. No.
11712-01	----	200



EARTHWORKS NOTES:

1. LEVELS IN TERMS OF MEAN SEA LEVEL (AUCKLAND VERTICAL DATUM 1946)
2. COORDINATES IN TERMS OF NZGD 2000 (MT EDEN CIRCUIT)
3. CONTOURS INTERVALS ARE:
   - 3.1. 1.00m - MINOR
   - 3.2. 5.00m - MAJOR
4. EROSION AND SEDIMENT CONTROLS TO BE CONSTRUCTED AND MAINTAINED IN ACCORDANCE WITH AUCKLAND COUNCIL TP90 STANDARDS.

Elevations Table

Number	Min. Elevation (m)	Max. Elevation (m)	Area (m²)	Volume (m³)	Colour
1	-20.00	-15.00	106	20	
2	-15.00	-10.00	11275	16127	
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5	0.00	5.00	177593	656786	
6	5.00	10.00	41546	229678	
7	10.00	15.00	19921	89839	
8	15.00	20.00	8312	21438	
9	20.00	25.00	644	260	

Original Size: 0 5 10 15 20 25

No.	Revision Details	Date
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(Current Revision Date : 09/10/2015)

LEGEND:
- PROPOSED CONTOUR (MAJOR)
- PROPOSED CONTOUR (MINOR)
- EXISTING CONTOUR (MAJOR)
- EXISTING CONTOUR (MINOR)
- EARTHWORKS STAGES

Design	SIM
Survey	AUCKLAND COUNCIL GIS
Drawn	SIM
Checked	ML
Date	July 2015
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CAD Filename	11712-01 200.dwg

DRAFT

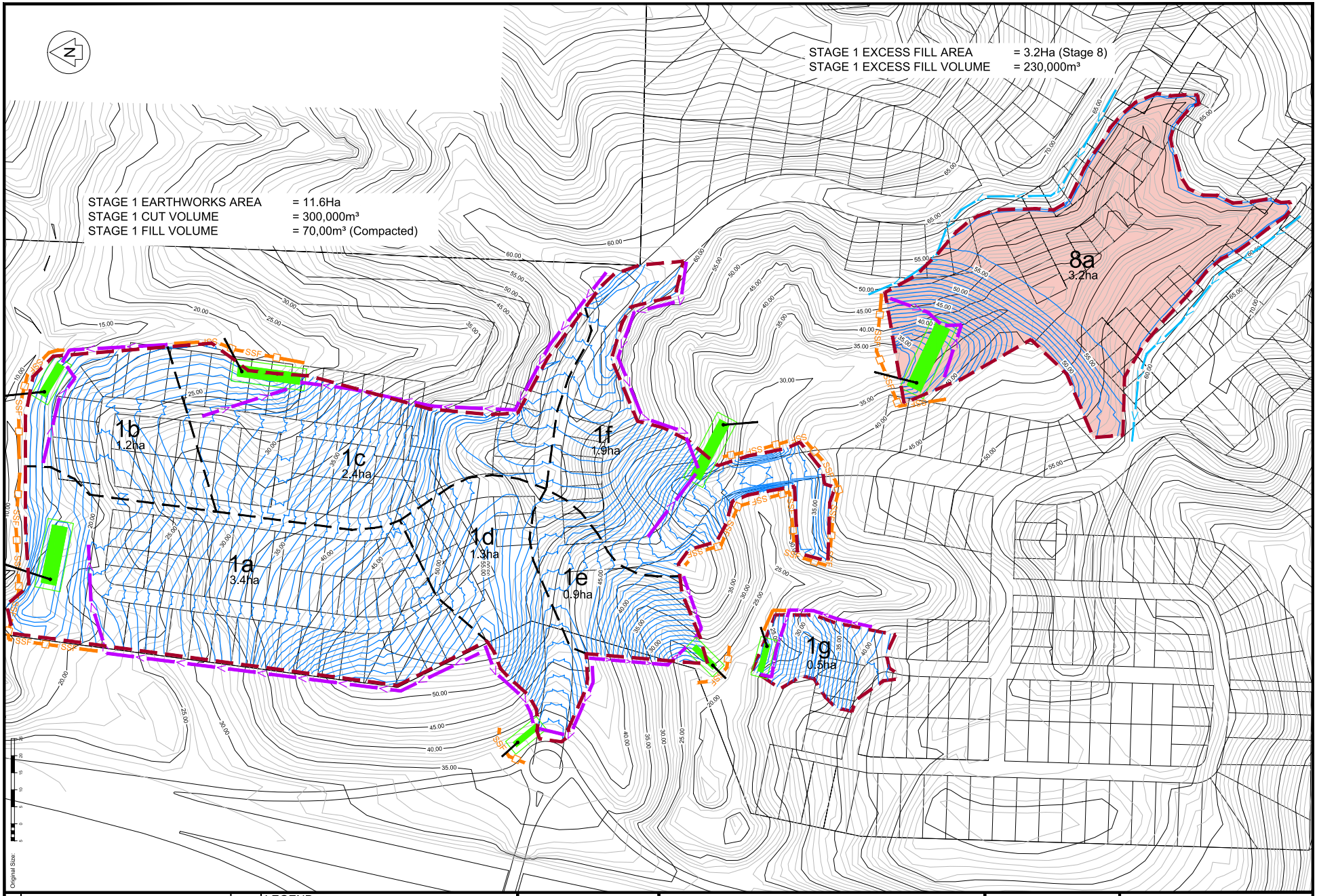
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Job Title.
OREWA WEST INVESTMENTS LTD
GRAND VIEW ESTATE, OREWA
LOT 3 DP 327701
AUCKLAND

AIREY CONSULTANTS LTD.
CONSULTING CIVIL & STRUCTURAL ENGINEERS
Takapuna, Pukekohe, Howick, Queenstown, Christchurch, Orewa
ACENZ

Drawing Title.
PROPOSED CUT-FILL PLAN

File No.	Rev.	Dwg. No.
11712-01	----	201



No.	Revision Details	(Current Revision Date : 09/10/2015)	Date
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LEGEND:

- EXISTING CONTOUR
- PROPOSED CONTOUR
- EXTENT OF EARTHWORKS STAGE
- CLEANWATER DIVERSION
- TOPSOIL STOCKPILE
- SILT FENCE
- SSF SUPER SILT FENCE
- RUNOFF DIVERSION
- SEDIMENT POND

Design	SIM
Survey	AUCKLAND COUNCIL GIS
Drawn	SIM
Checked	ML
Date	August 2015
Scale	1:1250 (A1) 1:2500 (A3)
CAD Filename	11712-01 210 EW Stage 1.dwg

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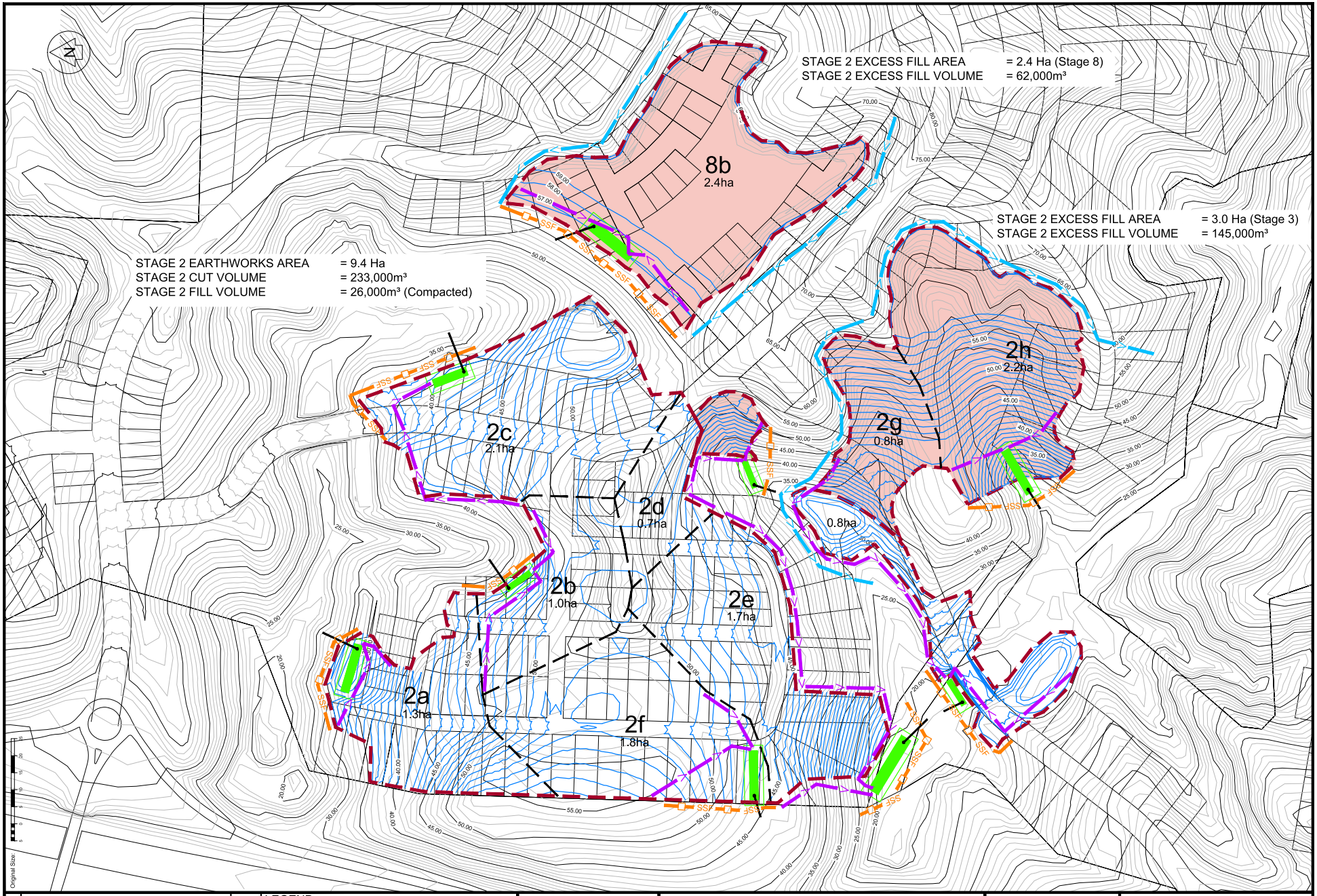
Job Title.
OREWA WEST INVESTMENTS LTD
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LOT 3 DP 327701
AUCKLAND

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Drawing Title.
STAGE 1 - EARTHWORKS & SEDIMENT CONTROL PLAN

File No.	Rev.	Dwg. No.
11712-01	----	210

Original Size: A1



No.	Revision Details	Date
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(Current Revision Date : 09/10/2015)

LEGEND:

- EXISTING CONTOUR
- PROPOSED CONTOUR
- EXTENT OF EARTHWORKS STAGE
- CLEANWATER DIVERSION
- TOPSOIL STOCKPILE
- SILT FENCE
- SSF SUPER SILT FENCE
- RUNOFF DIVERSION
- SEDIMENT POND

Original Size: A1

Design	SIM
Survey	AUCKLAND COUNCIL GIS
Drawn	SIM
Checked	ML
Date	August 2015
Scale	1:1250 (A1) 1:2500 (A3)
CAD Filename	11712-01 220 EW Stage 2.dwg

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Job Title.

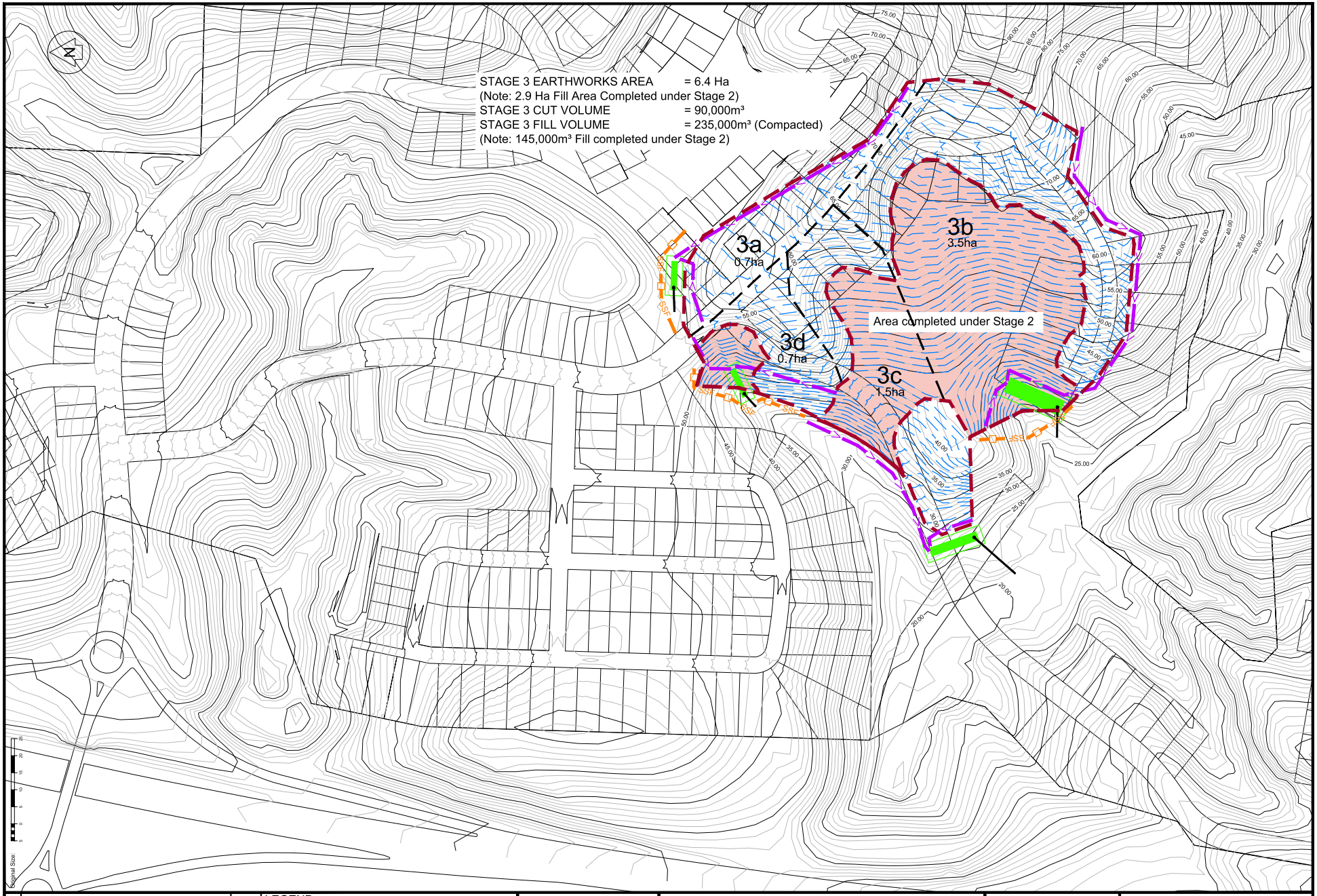
OREWA WEST INVESTMENTS LTD
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ACENZ

Drawing Title.

STAGE 2 - EARTHWORKS & SEDIMENT CONTROL PLAN

File No.	Rev.	Dwg. No.
11712-01	----	220



LEGEND:

- EXISTING CONTOUR
- PROPOSED CONTOUR
- EXTENT OF EARTHWORKS STAGE
- CLEANWATER DIVERSION
- TOPSOIL STOCKPILE
- SILT FENCE
- SSF SUPER SILT FENCE
- RUNOFF DIVERSION
- SEDIMENT POND

No.	Revision Details	Date
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(Current Revision Date : 09/10/2015)

Design	SIM
Survey	AUCKLAND COUNCIL GIS
Drawn	SIM
Checked	ML
Date	August 2015
Scale	1:1250 (A1) 1:2500 (A3)
CAD Filename	11712-01 230 EW Stage 3.dwg

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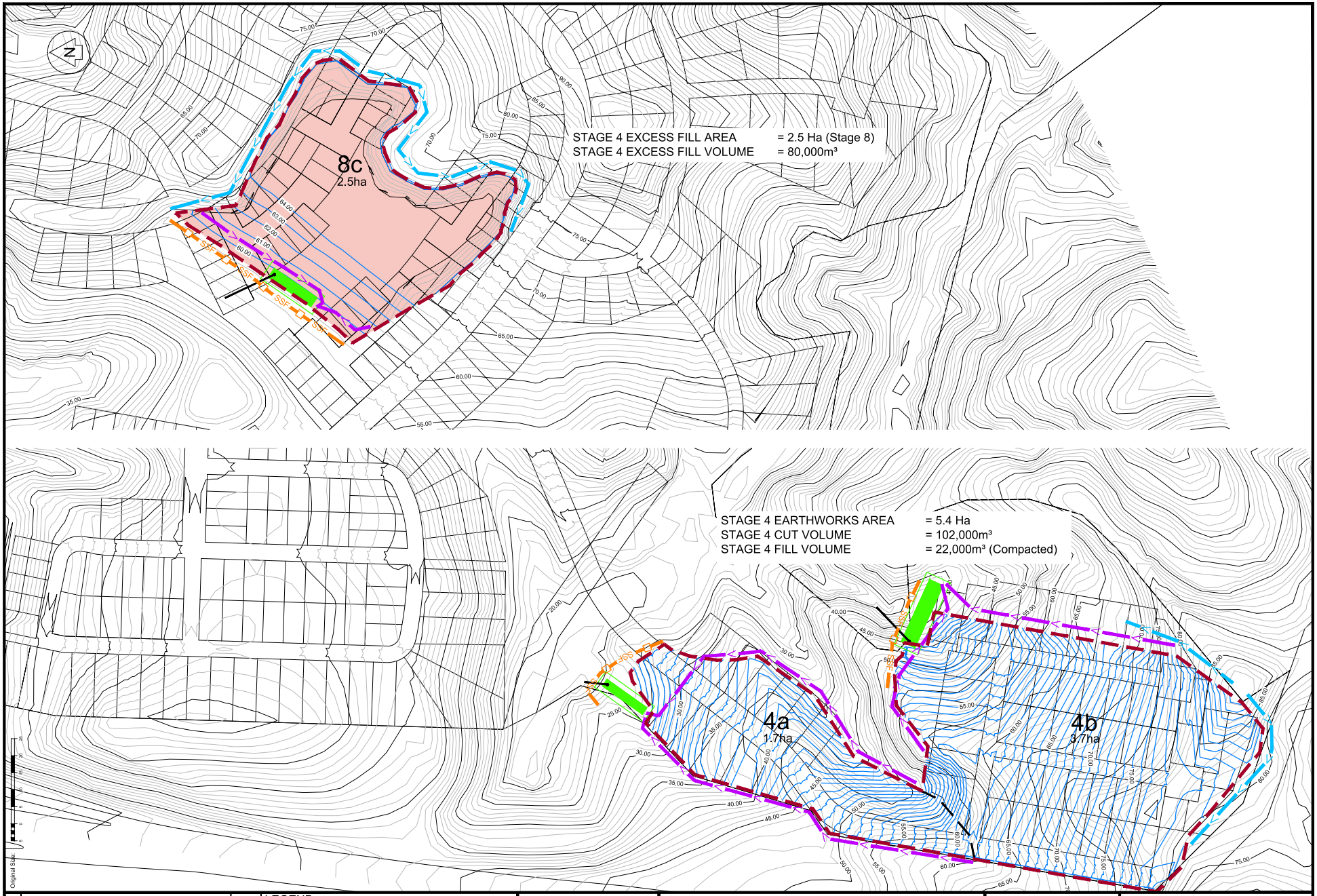
Job Title.
OREWA WEST INVESTMENTS LTD
GRAND VIEW ESTATE, OREWA
LOT 3 DP 327701
AUCKLAND

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ACENZ

Drawing Title.
STAGE 3 - EARTHWORKS & SEDIMENT CONTROL PLAN

File No.	Rev.	Dwg. No.
11712-01	----	230

Original Size: A1



No.	Revision Details	Date
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(Current Revision Date : 09/10/2015)

LEGEND:

- EXISTING CONTOUR
- PROPOSED CONTOUR
- EXTENT OF EARTHWORKS STAGE
- CLEANWATER DIVERSION
- TOPSOIL STOCKPILE
- SILT FENCE
- SSF SUPER SILT FENCE
- RUNOFF DIVERSION
- SEDIMENT POND

Design	SIM
Survey	AUCKLAND COUNCIL GIS
Drawn	SIM
Checked	ML
Date	August 2015
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CAD Filename	11712-01 240 EW Stage 4.dwg

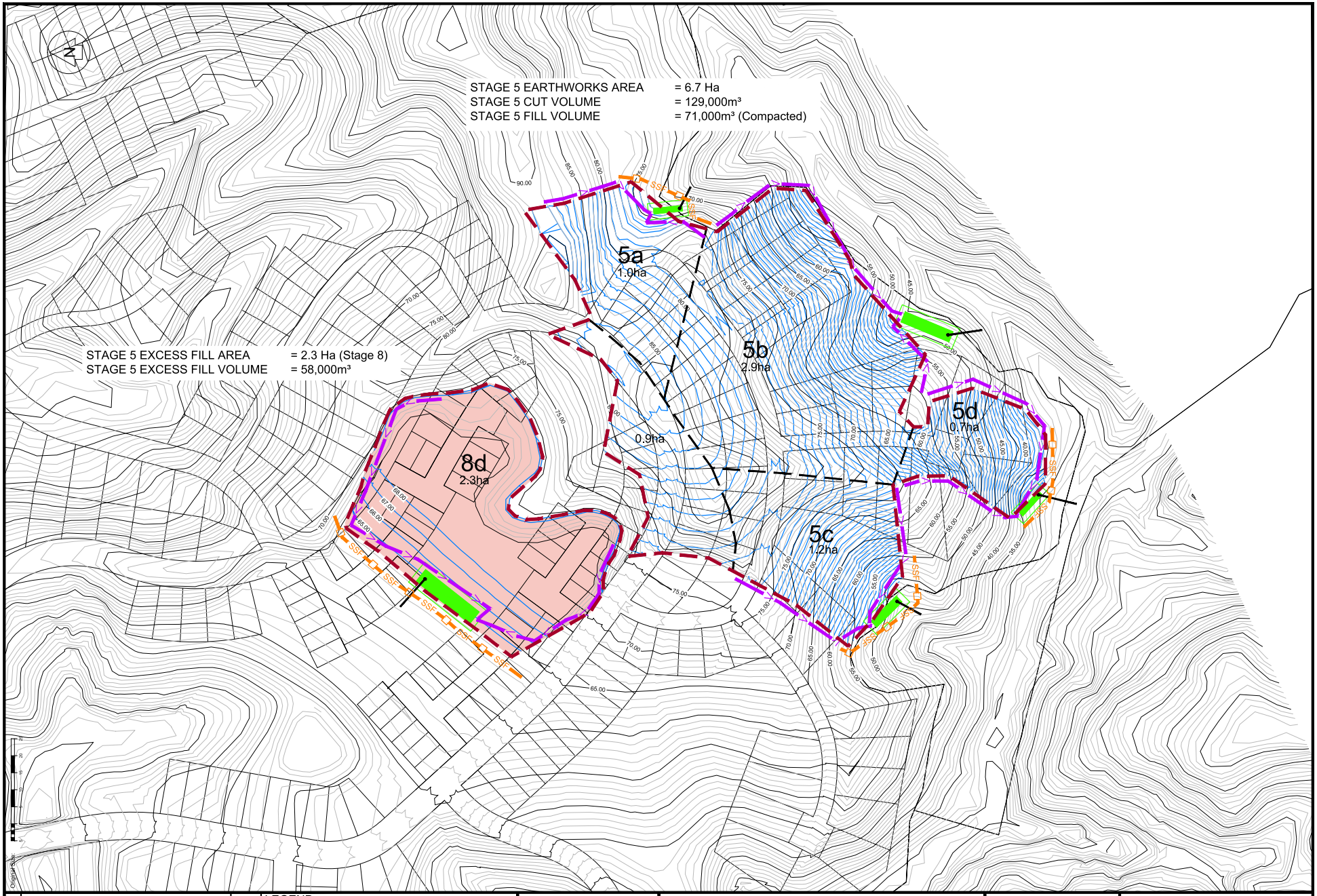
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LOT 3 DP 327701
AUCKLAND

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Takapuna, Pukekohe, Howick, Queenstown, Christchurch, Orewa
ACENZ

Drawing Title.
STAGE 4 - EARTHWORKS & SEDIMENT CONTROL PLAN

File No.	Rev.	Dwg. No.
11712-01	----	240



LEGEND:

- EXISTING CONTOUR
- PROPOSED CONTOUR
- EXTENT OF EARTHWORKS STAGE
- CLEANWATER DIVERSION
- TOPSOIL STOCKPILE
- SILT FENCE
- SSF SUPER SILT FENCE
- RUNOFF DIVERSION
- SEDIMENT POND

No.	Revision Details	Date
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(Current Revision Date : 09/10/2015)

Design	SIM
Survey	AUCKLAND COUNCIL GIS
Drawn	SIM
Checked	ML
Date	August 2015
Scale	1:1250 (A1) 1:2500 (A3)
CAD Filename	11712-01 250 EW Stage 5.dwg

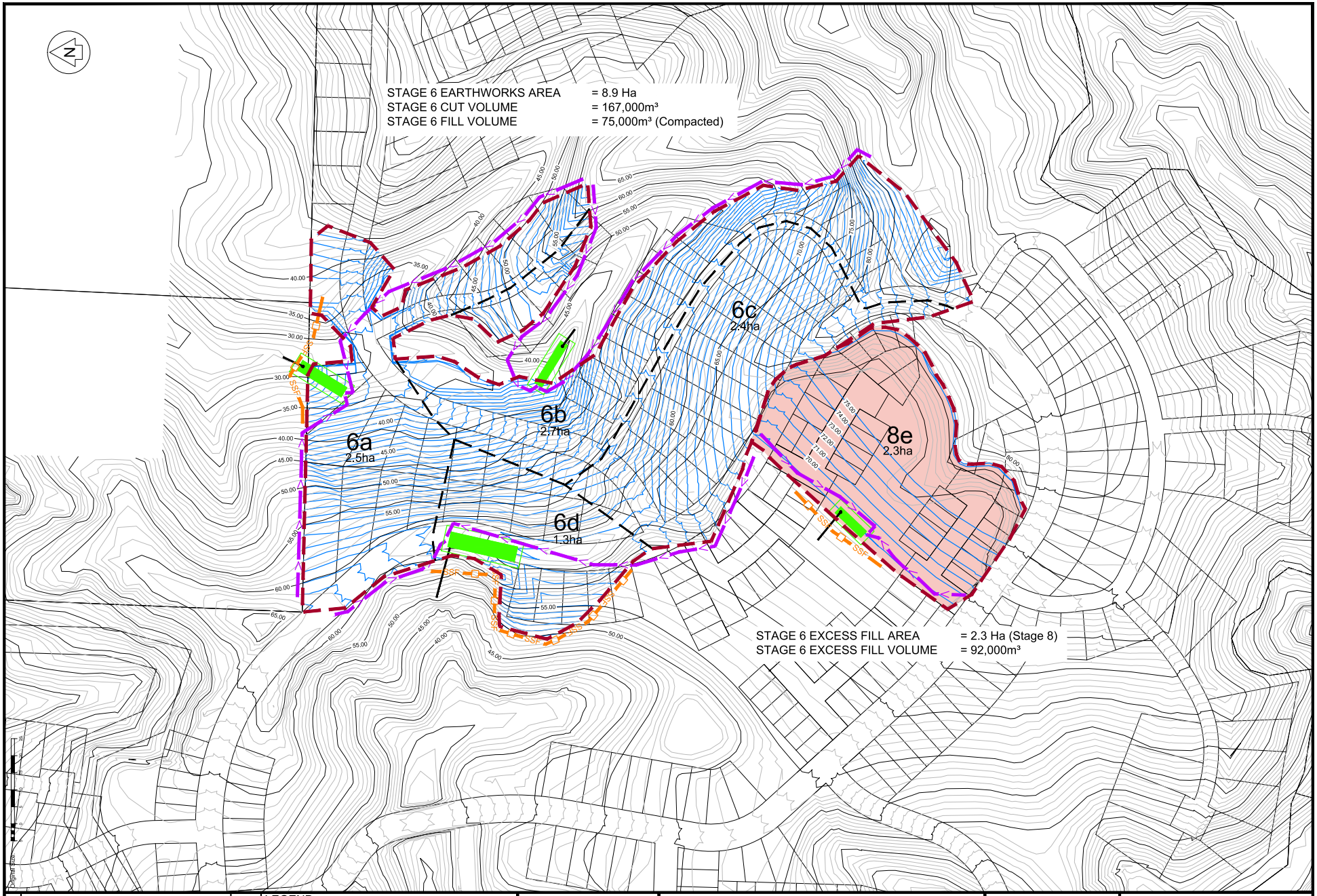
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GRAND VIEW ESTATE, OREWA
LOT 3 DP 327701
AUCKLAND

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Takapuna, Pukekohe, Howick, Queenstown, Christchurch, Orewa

Drawing Title.
STAGE 5 - EARTHWORKS & SEDIMENT CONTROL PLAN

File No.	Rev.	Dwg. No.
11712-01	----	250



LEGEND:

- EXISTING CONTOUR
- PROPOSED CONTOUR
- EXTENT OF EARTHWORKS STAGE
- CLEANWATER DIVERSION
- TOPSOIL STOCKPILE
- SILT FENCE
- SSF SUPER SILT FENCE
- RUNOFF DIVERSION
- SEDIMENT POND

No.	Revision Details	(Current Revision Date : 09/10/2015)	Date
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Design	SIM
Survey	AUCKLAND COUNCIL GIS
Drawn	SIM
Checked	ML
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CAD Filename	11712-01 260 EW Stage 6.dwg

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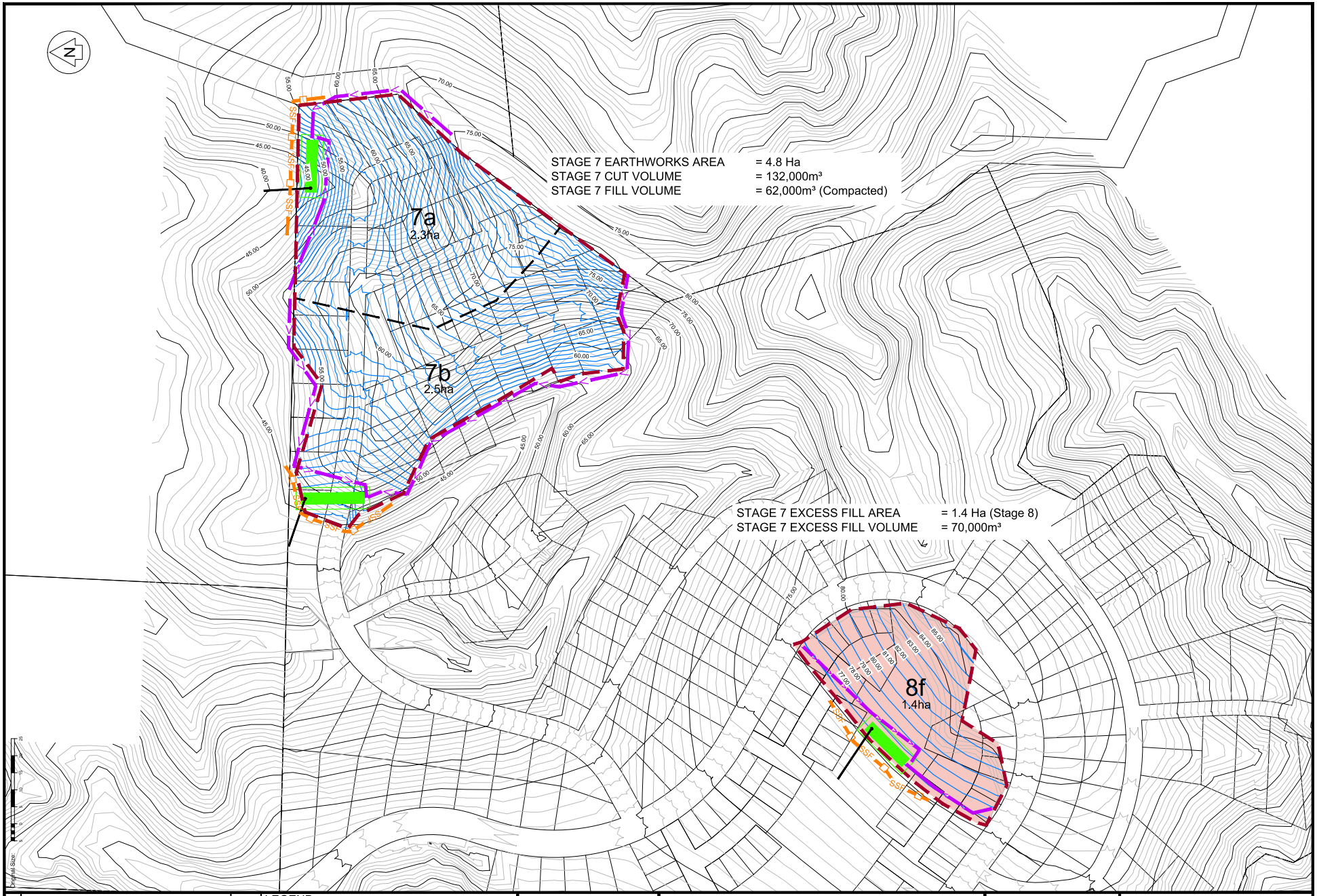
Job Title.
OREWA WEST INVESTMENTS LTD
GRAND VIEW ESTATE, OREWA
LOT 3 DP 327701
AUCKLAND

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Drawing Title.
STAGE 6 - EARTHWORKS & SEDIMENT CONTROL PLAN

File No.	Rev.	Dwg. No.
11712-01	----	260

Original Size



No.	Revision Details	(Current Revision Date : 09/10/2015)	Date
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LEGEND:

- EXISTING CONTOUR
- PROPOSED CONTOUR
- EXTENT OF EARTHWORKS STAGE
- CLEANWATER DIVERSION
- TOPSOIL STOCKPILE
- SILT FENCE
- SSF SUPER SILT FENCE
- RUNOFF DIVERSION
- SEDIMENT POND

Design	SIM
Survey	AUCKLAND COUNCIL GIS
Drawn	SIM
Checked	ML
Date	August 2015
Scale	1:1250 (A1) 1:2500 (A3)
CAD Filename	11712-01 270 EW Stage 7.dwg

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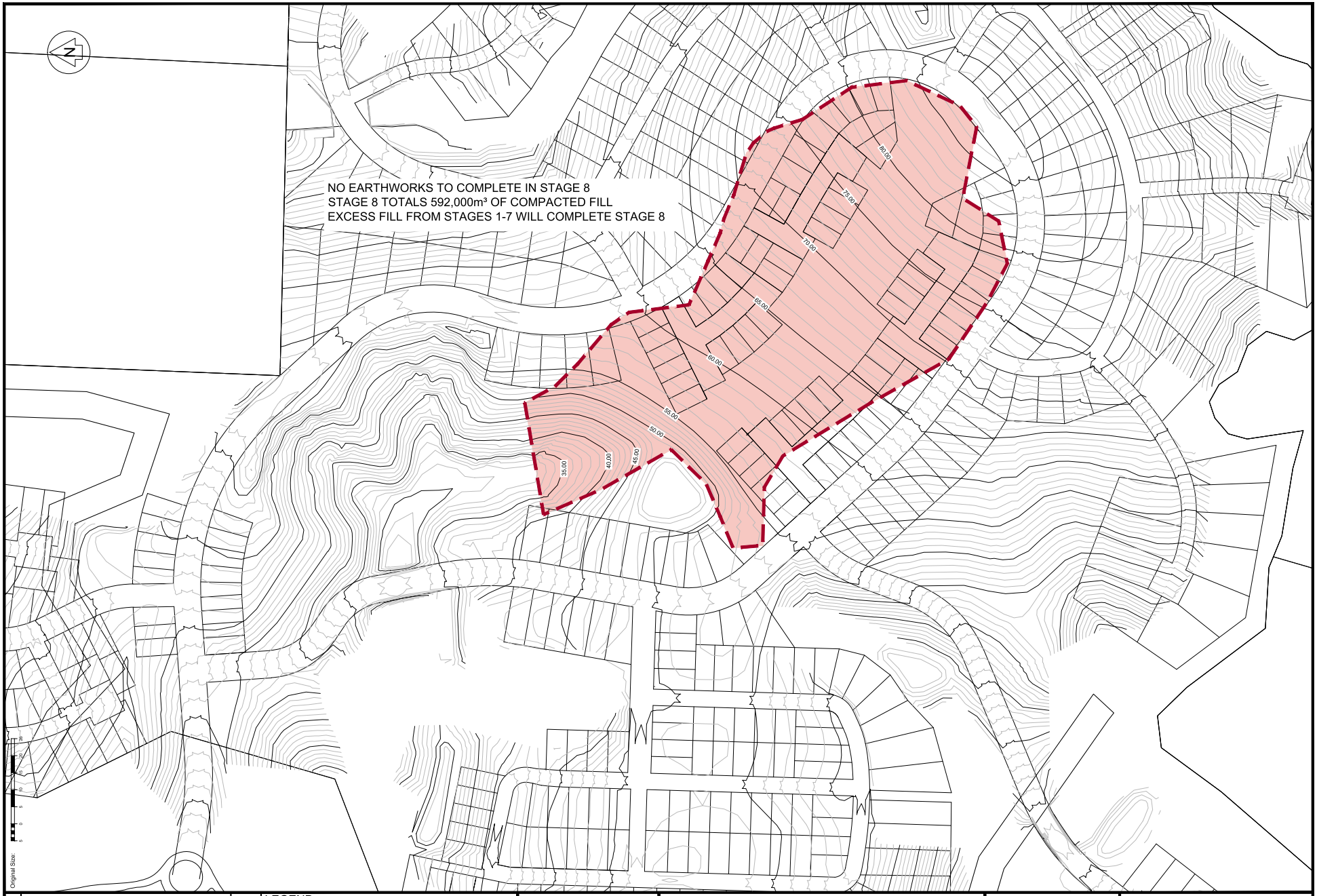
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OREWA WEST INVESTMENTS LTD
GRAND VIEW ESTATE, OREWA
LOT 3 DP 327701
AUCKLAND

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Drawing Title.
STAGE 7 - EARTHWORKS & SEDIMENT CONTROL PLAN

File No.	Rev.	Dwg. No.
11712-01	----	270

Original Size: A1



Original Size: A1

No.	Revision Details	Date
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(Current Revision Date : 09/10/2015)

LEGEND:

- EXISTING CONTOUR
- PROPOSED CONTOUR
- EXTENT OF EARTHWORKS STAGE
- CLEANWATER DIVERSION
- TOPSOIL STOCKPILE
- SILT FENCE
- SSF SUPER SILT FENCE
- RUNOFF DIVERSION
- SEDIMENT POND

Design	SIM
Survey	AUCKLAND COUNCIL GIS
Drawn	SIM
Checked	ML
Date	August 2015
Scale	1:1250 (A1) 1:2500 (A3)
CAD Filename	11712-01 280 EW Stage 8.dwg

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Job Title.

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LOT 3 DP 327701
AUCKLAND

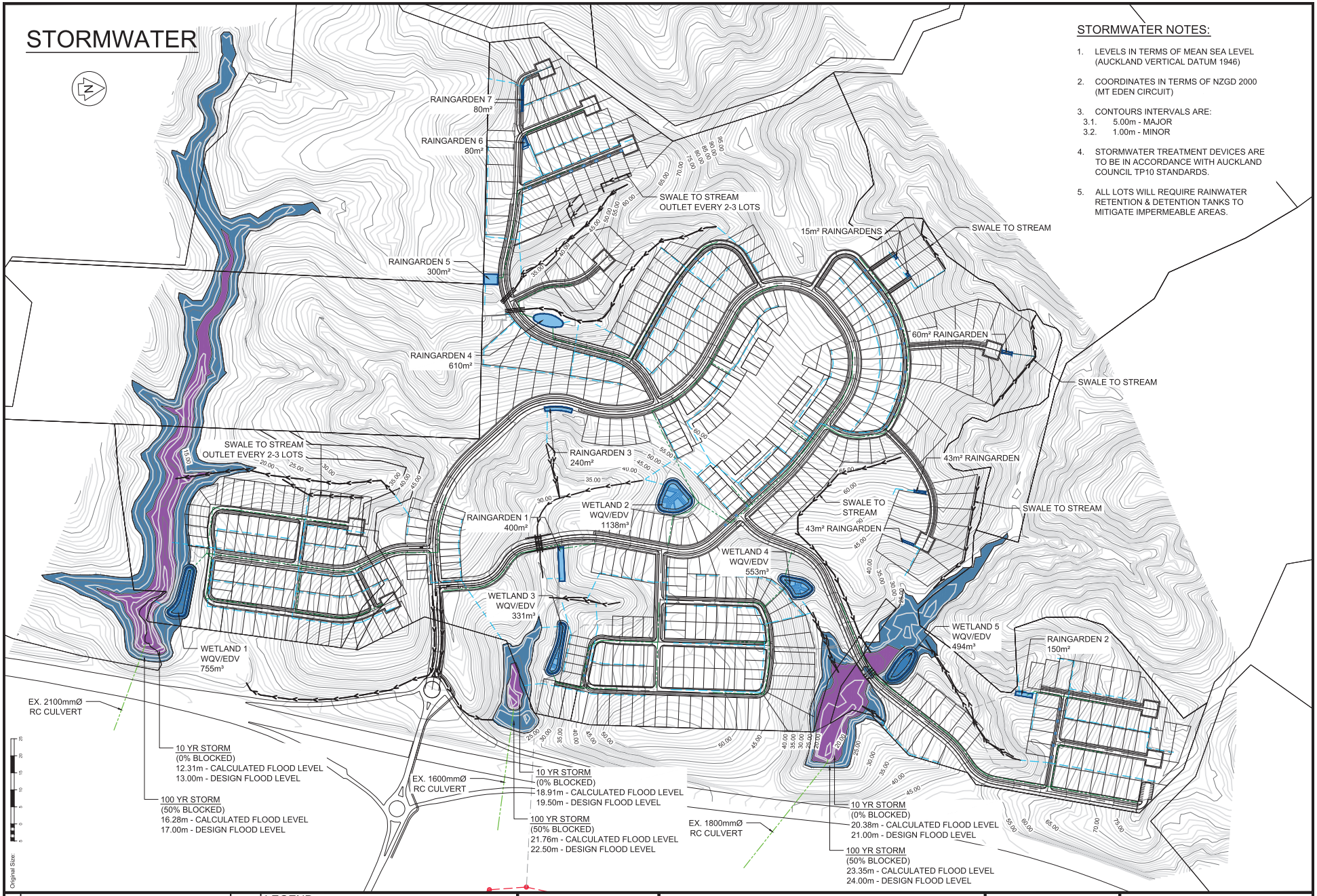
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Takapuna, Pukekohe, Howick, Queenstown, Christchurch, Orewa
ACENZ

Drawing Title.

STAGE 8 - EARTHWORKS & SEDIMENT CONTROL PLAN

File No.	Rev.	Dwg. No.
11712-01	----	280

STORMWATER



STORMWATER NOTES:

1. LEVELS IN TERMS OF MEAN SEA LEVEL (AUCKLAND VERTICAL DATUM 1946)
2. COORDINATES IN TERMS OF NZGD 2000 (MT EDEN CIRCUIT)
3. CONTOURS INTERVALS ARE:
   - 3.1. 5.00m - MAJOR
   - 3.2. 1.00m - MINOR
4. STORMWATER TREATMENT DEVICES ARE TO BE IN ACCORDANCE WITH AUCKLAND COUNCIL TP10 STANDARDS.
5. ALL LOTS WILL REQUIRE RAINWATER RETENTION & DETENTION TANKS TO MITIGATE IMPERMEABLE AREAS.

Original Size:

No.	Revision Details	Date
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(Current Revision Date : 16/10/2015)

LEGEND:

- STORMWATER - UNTREATED
- STORMWATER - TREATED
- OPEN WATERCOURSE
- WETLAND/RAINGARDEN
- 10YR FLOOD EXTENT
- 100YR FLOOD EXTENT (50% CULVERT BLOCKAGE)

Design	SIM
Survey	AUCKLAND COUNCIL GIS
Drawn	SIM
Checked	ML
Date	July 2015
Scale	1:2500 (A1) 1:5000 (A3)
CAD Filename	11712-01 400.dwg

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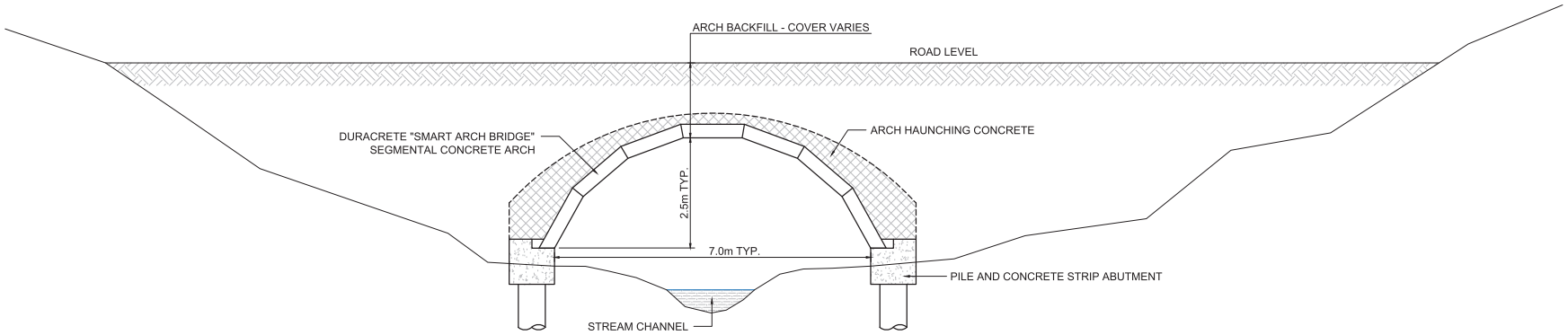
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Job Title.
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GRAND VIEW ESTATE, OREWA
LOT 3 DP 327701
AUCKLAND

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Takapuna, Pukekohe, Howick, Queenstown,Christchurch, Orewa
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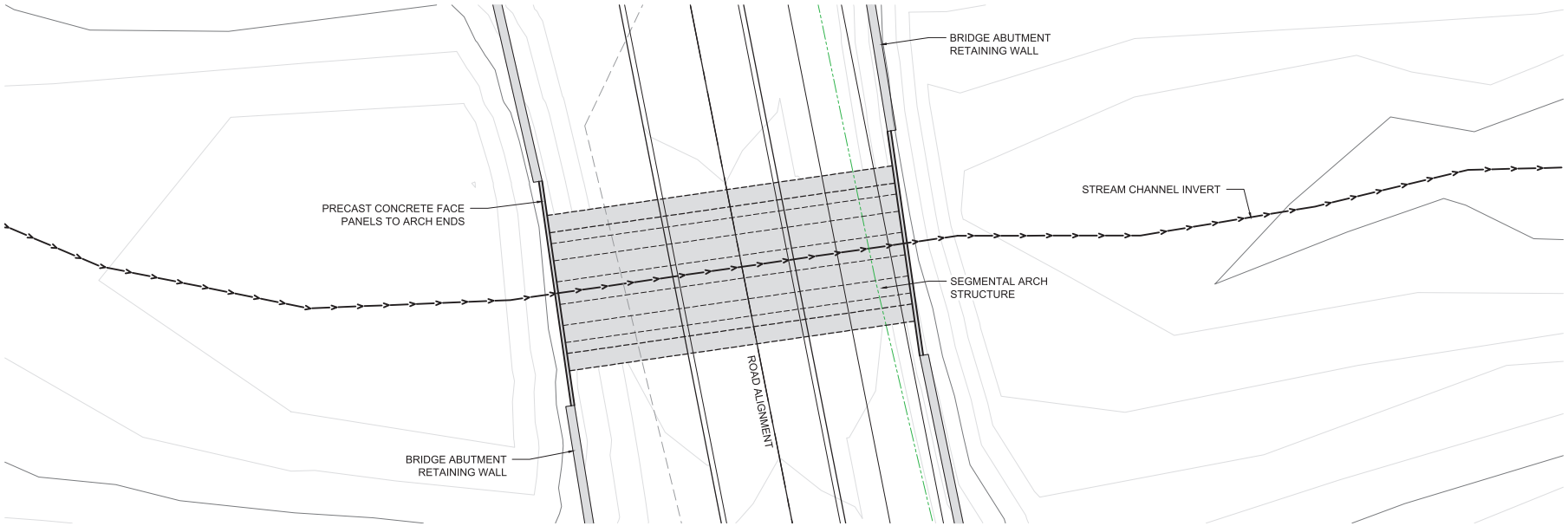
Drawing Title.
PROPOSED STORMWATER LAYOUT & FLOODING PLAN

File No.	Rev.	Dwg. No.
11712-01	-----	400



PROPOSED ARCH BRIDGE TYPICAL SECTION

SCALE: 1:100 (A3)



PROPOSED ARCH BRIDGE TYPICAL PLAN VIEW

SCALE: 1:200 (A3)

Original Size (A3)

No.	Revision Details	Date	No.	Revision Details	Date
A	Issue for ...	DD/MM/YY			

Design	SIM
Survey	AUCKLAND COUNCIL GIS
Drawn	SIM
Checked	ML
Date	02/07/2015
Scale	1:50 (A1), 1:100 (A3)
CAD Filename	11712-01 400.dwg

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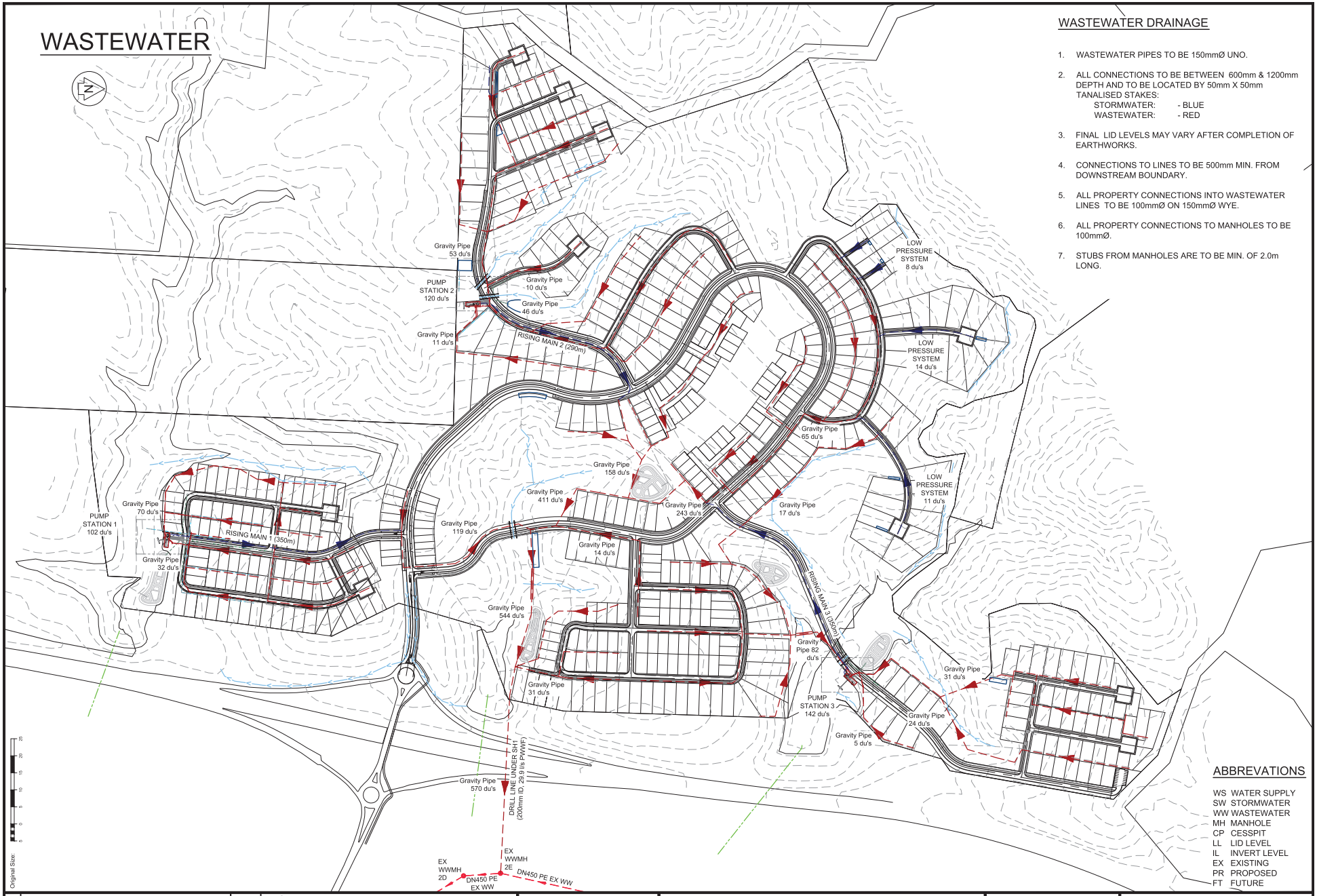
Job Title.
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LOT 3 DP 327701
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Drawing Title.
ARCH BRIDGE TYPICAL DETAIL

File No.	Rev.	Drawing No.
11712-01	-	407

WASTEWATER



WASTEWATER DRAINAGE

1. WASTEWATER PIPES TO BE 150mmØ UNO.
2. ALL CONNECTIONS TO BE BETWEEN 600mm & 1200mm DEPTH AND TO BE LOCATED BY 50mm X 50mm TANALISED STAKES:
   STORMWATER: - BLUE
   WASTEWATER: - RED
3. FINAL LID LEVELS MAY VARY AFTER COMPLETION OF EARTHWORKS.
4. CONNECTIONS TO LINES TO BE 500mm MIN. FROM DOWNSTREAM BOUNDARY.
5. ALL PROPERTY CONNECTIONS INTO WASTEWATER LINES TO BE 100mmØ ON 150mmØ WYE.
6. ALL PROPERTY CONNECTIONS TO MANHOLES TO BE 100mmØ.
7. STUBS FROM MANHOLES ARE TO BE MIN. OF 2.0m LONG.

ABBREVATIONS

WS	WATER SUPPLY
SW	STORMWATER
WW	WASTEWATER
MH	MANHOLE
CP	CESSPIT
LL	LID LEVEL
IL	INVERT LEVEL
EX	EXISTING
PR	PROPOSED
FT	FUTURE

Original Size: 0 5 10 15 20 25

No.	Revision Details	Date
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(Current Revision Date : 15/10/2015)

LEGEND:

- EX SW - UNTREATED
- EX SW - TREATED
- EX WW - GRAVITY
- EX WW - PRESSURE
- SW SWALE/CHANNEL
- SW TREATMENT DEVICE
- PR SW - UNTREATED
- PR SW - TREATED
- PR WW - GRAVITY
- PR WW - PRESSURE
- FT SW - UNTREATED
- FT SW - TREATED
- FT WASTEWATER
- EX. MH
- PROPOSED SWMH
- PROPOSED WWMH

Design	SIM
Survey	AUCKLAND COUNCIL GIS
Drawn	SIM
Checked	ML
Date	July 2015
Scale	1:2500 (A1) 1:5000 (A3)
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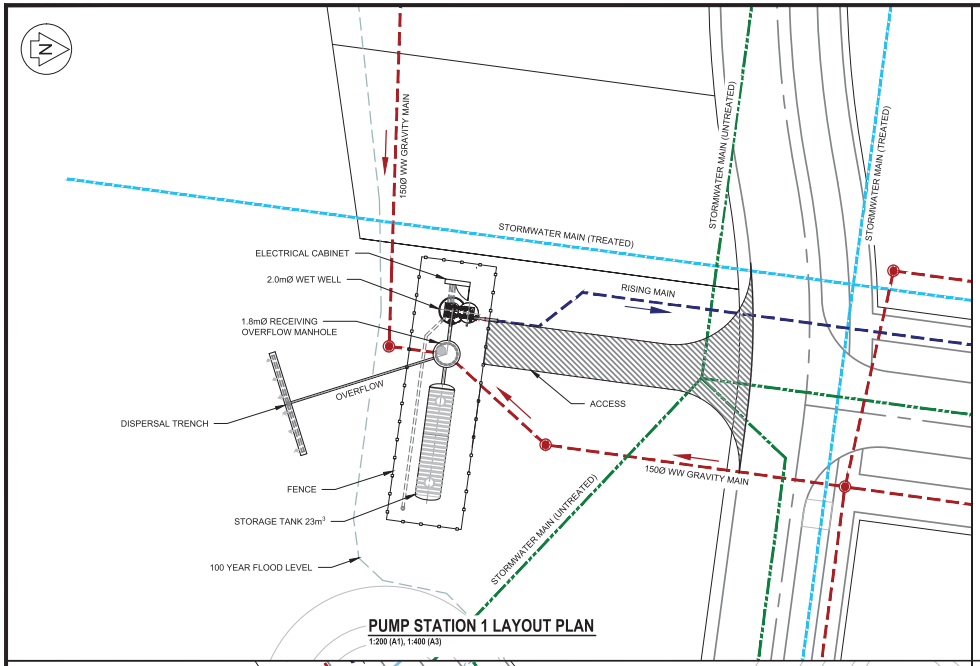
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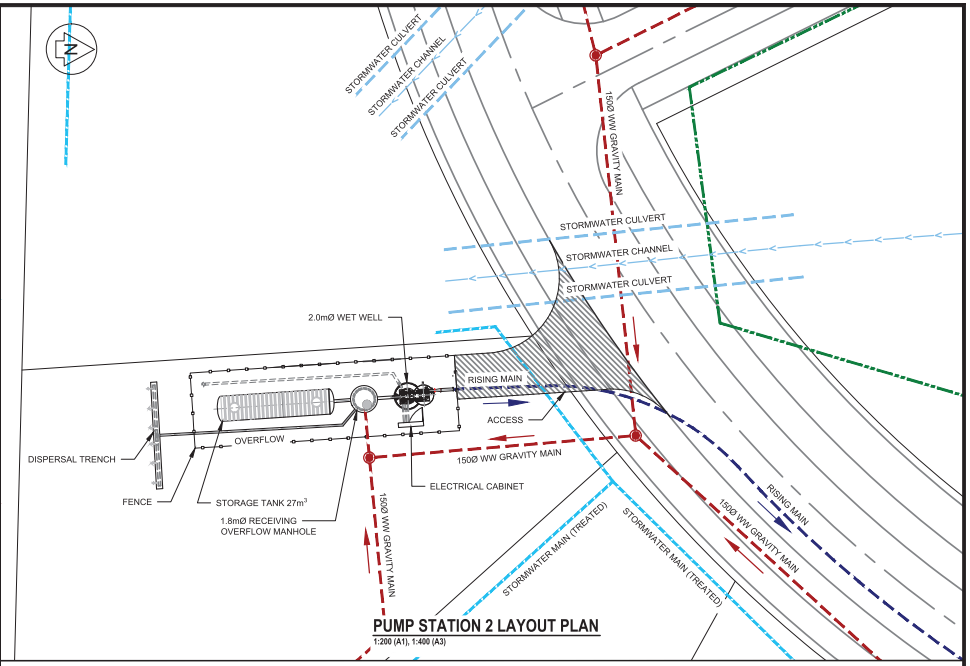
Drawing Title.
PROPOSED WASTEWATER LAYOUT PLAN

File No.	Rev.	Dwg. No.
11712-01	----	500



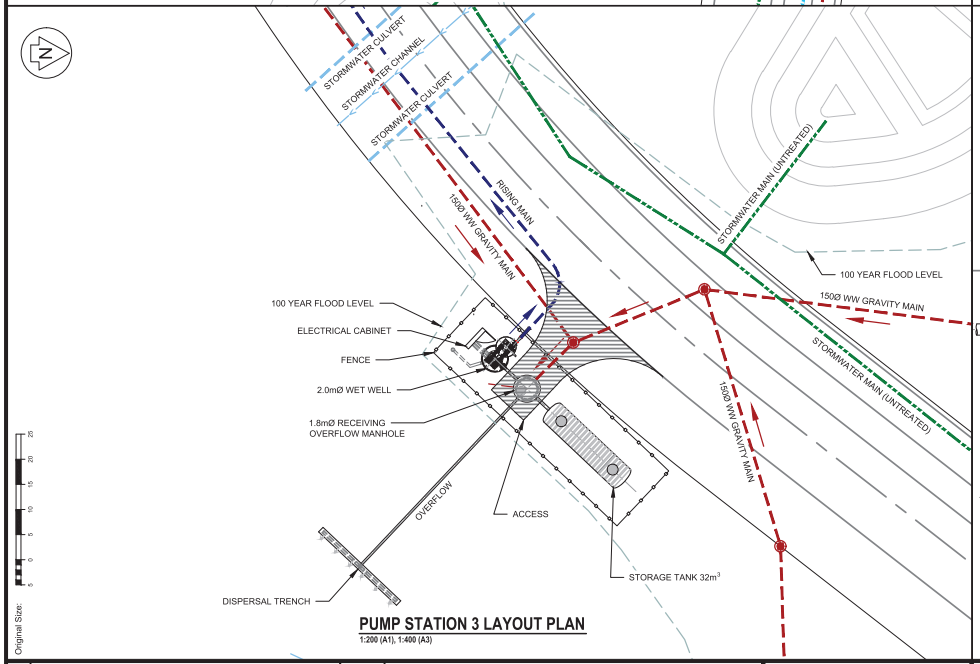
PUMP STATION 1 LAYOUT PLAN

1:200 (A1), 1:400 (A3)



PUMP STATION 2 LAYOUT PLAN

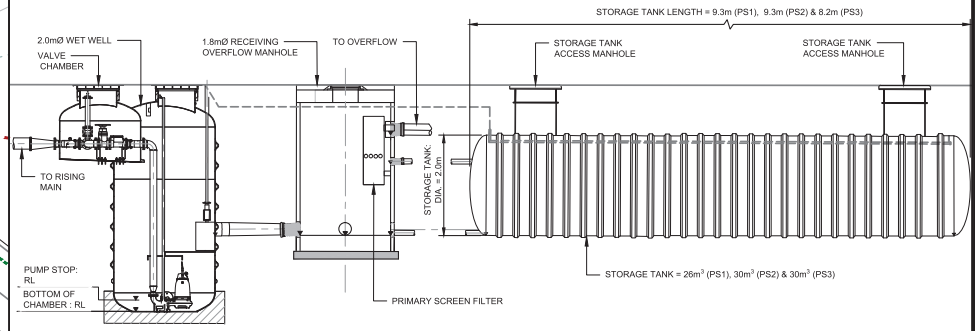
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PUMP STATION 3 LAYOUT PLAN

1:200 (A1), 1:400 (A3)

Original Size:



PUMP STATION TYPICAL SECTION

1:50 (A1), 1:100 (A3)

No.	Revision Details	Date
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(Current Revision Date : 15/10/2015)

LEGEND:

- EX SW - UNTREATED
- EX SW - TREATED
- EX WW - GRAVITY
- EX WW - PRESSURE
- SW SWALE/CHANNEL
- SW TREATMENT DEVICE
- EX. MH
- PROPOSED SWMH
- PROPOSED WWMH
- PR SW - UNTREATED
- PR SW - TREATED
- PR WW - GRAVITY
- PR WW - PRESSURE
- FT SW - UNTREATED
- FT SW - TREATED
- FT WASTEWATER

Design	PS
Survey	AUCKLAND COUNCIL GIS
Drawn	WL
Checked	PS
Date	July 2015
Scale	1:200 (A1) 1:400 (A3)
CAD Filename	11712-01 500.dwg

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Job Title.

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Drawing Title.

PRELIMINARY WASTEWATER PUMP STATION LAYOUT PLANS TYPICAL CROSS SECTION

File No.	Rev.	Dwg. No.
11712-01	----	501

APPENDIX 2

Subsurface Investigation Results

TRIAL PIT LOG

Job No.:	**7464**
Hole No.:	**TP01**
Date:	30/08/2013
Logged By:	PH
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748634.0, N 5949486.0 **Ground Level:** 42.81

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values
	42.71	TOPSOIL			TS		
		Silty CLAY. Yellow-orange, mottled light grey, very stiff, moist, moderate to high plasticity. Occasional cobbles of highly to moderately weathered Waitemata Group sandstone. [FILL]					
0.5							144
							51
1.0							115
							58
	41.31						
1.5							209
	41.21	SILT, some fine to medium sand. Grey, speckled white, very stiff, moist, slight plasticity					55
	41.01	Fine sandy SILT. Light grey, speckled orange, very stiff, moist, slight plasticity					
	40.91	SILT, some fine to medium sand. Grey, speckled white, very stiff, moist, slight plasticity					127
2.0							58
		SILT, some clay. Pink, speckled white, mottled grey, very stiff, moist, slight plasticity. Occasional highly to moderately weathered Waitemata Group sandstone gravel-cobbles intermixed					109
							58
	40.31						
2.5		SILT, some clay. Yellow, mottled grey and light grey, speckled orange, very stiff, moist, slight plasticity. Occasional highly weathered Waitemata Group sandstone gravel-cobbles intermixed					UTP
	40.11						-
		Clayey SILT. Grey, very stiff, mosit, moderate to high plasticity. Occasional weak to very weak Waitemata Group sandstone gravel-cobbles intermixed					146
	39.81						40
3.0		EOH:3.0m					
3.5							

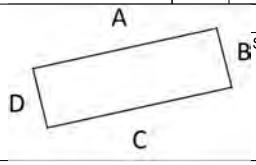
Groundwater Not Encountered

FILL

Strike of face A: 137 (degrees)

Length of face A: 2.6 (Meters)

Width of face B: 0.55 (Meters)



Other Comments

Strike of face A is 137°

Shear Vane

Corrected as per NZGS Guidelines Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Water

Standing Water Level ▼
Static Water Level ▽
Out Flow ▷
In Flow ◁

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS
Co-ordinates are only an indication of the location and cannot be used for any legal purpose.

KGA GEOTECHNICAL

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Printed: 15/10/2015 5:28:05 p.m.

TRIAL PIT LOG

Job No.:	**7464**
Hole No.:	**TP02**
Date:	30/08/2013
Logged By:	PH
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

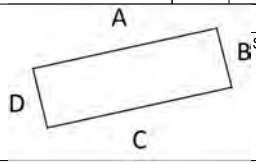
Coordinates: E 1748607.0, N 5949547.0 **Ground Level:** 50.07

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values
	49.97	TOPSOIL			TS		
	49.77	SILT. Yellow-brown, mottled grey, very stiff, moist, slight plasticity. Occasional fine to coarse angular gravel sized slightly to moderately weathered Waitemata Group sandstone intermixed. [FILL]					
0.5		SILT, some fine sand. Light grey, stiff, moist, slight plasticity. Occasional silty SAND horizons and frequent gravel to cobble sized highly weathered Waitemata Group sandstone intermixed					
1.0							129 76 75 36
1.5			Groundwater Not Encountered	FILL			164 58
2.0							109 49
2.5	47.47						
	47.37	SILT, some clay, minor fine sand. Pink, mottled light grey, very stiff, moist, slight to moderate plasticity					151 47
	47.07	Fine SAND. Grey, medium dense, moist to wet, no plasticity. Gravel to boulder sized highly weathered weak Waitemata Group sandstone intermixed					UTP -
3.0		EOH:3.0m					
3.5							

Strike of face A: 161 (degrees)

Length of face A: 2.8 (Meters)

Width of face B: 0.6 (Meters)



Other Comments

Strike of face A is 161°

Shear Vane

Corrected as per NZGS Guidelines Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Water

Standing Water Level ▼
Static Water Level ▽
Out Flow ▷
In Flow ◁

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS
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KGA GEOTECHNICAL

Produced with Core-GS

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TRIAL PIT LOG

Job No.:	**7464**
Hole No.:	**TP03**
Date:	30/08/2013
Logged By:	PH
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748828.0, N 5949965.0 **Ground Level:** 53.32

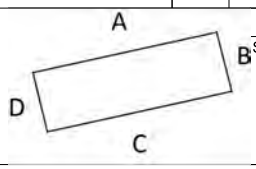
Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa)	Values
0.5	52.12	Silty CLAY. Yellow-orange, mottled light grey, firm to stiff, moist, moderate to high plasticity. Occasional cobbles of highly to moderately weathered Waitemata Group sandstone. [FILL]	Groundwater Not Encountered	FILL		82 11	
1.0						46 18	
1.5	51.62	Fine sandy SILT, some clay. Grey, mottled light grey, firm, wet, slight to moderate plasticity. Occasional organic material intermixed				67 31	
2.0	50.62	Silty CLAY. Yellow-orange, mottled light grey, firm to stiff, moist, moderate to high plasticity. Occasional cobbles of highly to moderately weathered Waitemata Group sandstone				78 36 73 44	
2.5						64 46	
3.0	50.02	Fine sandy SILT, some clay. Grey, mottled light grey, firm, wet, slight to moderate plasticity. Occasional organic material and moderately weathered gravel to cobble sized Waitemata Group sandstone intermixed 3.0m: Layer of organic matter (grass/rootlets)				80 47 166 67 138	
3.5	49.82	Sandy SILT, minor clay. Grey, very stiff, moist, slight plasticity. Occasional moderately to highly weathered inclusions of Waitemata Group sandstone EOH:3.5m				44 UTP -	

Vane Shear Strength (kPa) (refer notes for details): 50 100 150 200

Strike of face A: 98 (degrees)

Length of face A: 2.25 (Meters)

Width of face B: 0.55 (Meters)



Other Comments

Strike of face A is 098°

Shear Vane

Corrected as per NZGS Guidelines Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Water

Standing Water Level ▼
Static Water Level ▽
Out Flow ▷
In Flow ◁

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS
Co-ordinates are only an indication of the location and cannot be used for any legal purpose.

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Printed: 15/10/2015 5:28:05 p.m.

TRIAL PIT LOG

Job No.:	**7464**
Hole No.:	**TP04**
Date:	30/08/2013
Logged By:	PH
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

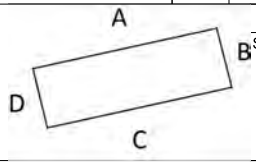
Coordinates: E 1748784.0, N 5950066.0 **Ground Level:** 52.72

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values
	52.32	TOPSOIL	Groundwater Not Encountered	TOPSOIL	TS		
0.5		Clayey SILT. Yellow, orange, pink, light grey, very stiff, moist, moderate plasticity		WAITEMATA GROUP SOILS			127 62
1.0	51.72	SILT, some clay, trace fine to medium sand. Pink, mottled light grey, stiff, moist to wet, moderate to high plasticity					153 75
1.5							116 62
2.0							93 42
2.5							71 42 76 51
	50.02	EOH:2.7m					131 56
3.0							
3.5							

Strike of face A: 46 (degrees)

Length of face A: 1.9 (Meters)

Width of face B: 0.55 (Meters)



Other Comments

Strike of Face A is 046°

Shear Vane

Corrected as per NZGS Guidelines Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Water

Standing Water Level ▼
Static Water Level ▽
Out Flow ▷
In Flow ◁

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS
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TRIAL PIT LOG

Job No.:	**7464**
Hole No.:	**TP05**
Date:	17/07/2015
Logged By:	PH
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

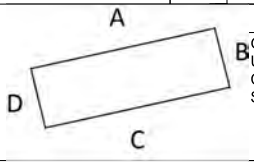
Coordinates: E 1748593.0, N 5949361.0 **Ground Level:** 34.52

Samples, Tests and Depth Related Notes	Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values
	0.0	34.32	TOPSOIL			TS		
			SILT with some clay; brownish yellow.Stiff to very stiff; moist; moderate plasticity.					
	0.5		0.6m: Yellow, light grey.					122 47
	1.0							141 78
		33.02						126 56
	1.5		SILT with some fine to coarse sand, trace clay; light yellowish grey. Stiff to very stiff; moist; low to moderate plasticity.					120 44
2.0m, Bulk sample	2.0			Groundwater Not Encountered	WAITEMATA GROUP SOILS			
	2.5	31.72						189 45
			CLAY with some silt; light grey. Very stiff to hard; moist; moderate to high plasticity.					198+ -
	3.0	31.32	3.1m - 3.2m: Orange band, SAND, trace silt, wet to saturated, medium dense, low plasticity					UTP -
			Fine to coarse SAND with trace silt; light grey speckled yellow. Medium dense; moist to wet; no plasticity.					
	3.5							UTP -
	4.0	30.32						
			Silty CLAY; bluish grey. Hard; moist; moderate to high plasticity. Lithorelic bedding visible					
4.5m, Bulk sample	4.5	29.92	EOH:4.6m					
	5.0							

Strike of face A: 22 (degrees)

Length of face A: 4.1 (Meters)

Width of face B: 0.8 (Meters)



Other Comments

Gentle slope, grass.
Use shear vane DR4681.
Correction factor is 1.5.
Strike of face A is 022°

Shear Vane

Corrected as per NZGS Guidelines Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Water

Standing Water Level ▼
Static Water Level ▽
Out Flow ▷
In Flow ◁

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS
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TRIAL PIT LOG

Job No.:	**7464**
Hole No.:	**TP06**
Date:	17/07/2015
Logged By:	PH
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

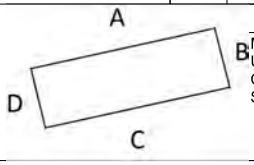
Coordinates: E 1748585.0, N 5949503.0 **Ground Level:** 38.06

Samples, Tests and Depth Related Notes	Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values
	0	37.96	TOPSOIL			TS		
			Silty fine to coarse SAND, trace clay & . Yellow/light grey/orange/bluish grey, moist to wet, low plasticity. Contains some to frequent fine gravel to coarse cobble sized, sub-rounded to sub-angular Waitemata Group Rock inclusions. Rock is very weak to weak, highly to slightly weathered.	Groundwater Not Encountered	FILL			
	0.5							132
								45
	1.0							
								89
	1.5							20
2.0m, Bulk sample	2.0							
		35.76	EOH:2.3m					48
	2.5							27
	3.0							
	3.5							

Strike of face A: 10 (degrees)

Length of face A: 4 (Meters)

Width of face B: 0.8 (Meters)



Other Comments

Moderate slope, Grass.
Use shear vane DR4681.
Correction factor is 1.5.
Strike of face A is 010°

Shear Vane

Corrected as per NZGS Guidelines Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Water

Standing Water Level ▼
Static Water Level ▽
Out Flow ▷
In Flow ◁

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS
Co-ordinates are only an indication of the location and cannot be used for any legal purpose.

KGA GEOTECHNICAL

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TRIAL PIT LOG

Job No.:	**7464**
Hole No.:	**TP07**
Date:	17/07/2015
Logged By:	PH
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

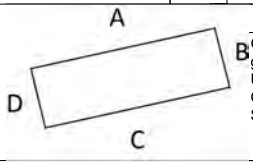
Coordinates: E 1748584.0, N 5949619.0 **Ground Level:** 65.77

Samples, Tests and Depth Related Notes	Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values
	0.0	65.47	TOPSOIL.			TS TS		
	0.5		Clayey SILT with minor fine sand; brownish yellow.Stiff; moist; Slightly to moderate plasticity.					150 62
	1.0	64.77	SILT with minor fine sand with trace clay; orange.Stiff; moist; Slightly to moderate plasticity.					105 56
	1.5		1.8m: Orange, limonitic fine to coarse gravel, angular to subangular.					UTP -
	2.0	63.67	Clayey SILT; light grey with orange streaks.Stiff; wet; moderately to high plasticity. 2.2m: Orange bands.	Groundwater Not Encountered	WAITEMATA GROUP SOILS			81 29
2.5m, Bulk sample	2.5		2.5m: Orange bands.					98 29
	3.0		2.9m: Orange bands. 3.1m: Orange bands.					198+ -
	3.5		3.5m: Orange bands.					
	4.0	61.97	Silty fine SAND with trace clay; light grey speckled orange. Loose to medium dense; wet, no to low plasticity.					UTP -
	4.5	61.27	Fine SAND with some silt and trace clay; orange. Loose to medium dense; moist to wet; non to low plasticity.					
	5.0	61.07	EOH:4.8m					

Strike of face A: 1 (degrees)

Length of face A: 4 (Meters)

Width of face B: 0.8 (Meters)



Other Comments

Gentle to moderate slope, grass.
Use shear vane DR4681.
Correction factor is 1.5.
Strike of face A is 001°

Shear Vane

Corrected as per NZGS Guidelines Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Water

Standing Water Level ▼
Static Water Level ▽
Out Flow ▷
In Flow ◁

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS
Co-ordinates are only an indication of the location and cannot be used for any legal purpose.

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Produced with Core-GS

Printed: 15/10/2015 5:28:05 p.m.

MACHINE BOREHOLE LOG

HOLE NO.: MH01

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision
JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748673mE, 5949350mN (NZTM 2000)
DATUM: 25.63m
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 02/09/2013
END DATE: 03/09/2013
LOGGED BY: WM
CHECKED BY: PH

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
70				104/74		RO			Topsoil. (TOPSOIL)			
95									Clayey SILT. Orange, stiff, moist, moderate plasticity. (COLLUVIUM)			
						RO			0.5m: Light grey mottled orange.			
				50/20					Fine sandy SILT. Light grey mottled orange, stiff, moist, low plasticity.			
100			N=2 1, 0 1, 0 1, 0 for 75 mm			RO		1.0	SILT some clay. Light grey, soft to firm, wet, low to moderate plasticity.			
				24/7		ISPT			1.5m - 2.0m: SPT sample not recovered.			
70						RO		2.0	Fine sandy SILT. Light grey, soft to firm, wet, low plasticity.			
			N=2 0, 0 0, 1 0, 1 for 75 mm						Silty fine SAND. Light grey, very loose, wet, no plasticity.		COLLUVIUM	
100						ISPT		3.0				
					19/08/2015	RO			SILT some clay and fine sand. Light grey, stiff, moist to wet, low to moderate plasticity.			
60			N=4 0, 1 1, 1 1, 1 for 75 mm					4.0	Fine SAND some silt. Light grey with orange and red limonitic staining, very loose, wet, no plasticity.			
100						ISPT			4.5m: Minor silt.			
									4.8m: Alternating orange and grey.			
75						RC		5.0				
			N=50 2, 8 13, 20 7 for 45 mm						5.6m - 6.1m: Reddish brown limonitic staining. Becomes loose.			
100						ISPT		6.0				
									Moderately weathered, grey, fine SANDSTONE, very weak, interbedded with frequent moderate to slightly weathered, grey SILTSTONE, very weak to weak in 40mm to 100mm thick beds every 100mm to 500mm. (TRANSITIONAL WAITEMATA GROUP)		TRANSITIONAL WAITEMATA GROUP	
100	80					RC						
								7.0	Slightly weathered, grey, massive SANDSTONE, moderately strong. SILTSTONE horizons are slightly weathered, strong to very strong. (WAITEMATA GROUP ROCK)			
									7.4m: Two fractures: very closely spaced, tight, gently inclined, roughness unknown, infilled with wet clay.			
100	75	20/300/700	N=50 , 25 30		10/09/2013	RC					WAITEMATA GROUP ROCK	
		500/500/500	for 15 mm			SPT		8.0				
70	25					RC						
			N=50 , 40 10					9.0				
									9.4m: Unweathered, very strong.			
80	65		for 5 mm			SPT			9.6m - 11.0m: Some water loss. No siltstone beds. Needed to be re-drilled due to pore sample recovery.			
						RC						

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Gently sloping, grassed.

Water	Shear Vane
▼ Standing Water Level	Corrected as per NZGS Guidelines
▽ Water Level At Time Of Drilling	Vane No.:
◁ In Flow ▷ Out Flow	UTP = Unable To Penetrate + = Peak Exceeded - = No Result

6 Omega St, Albany
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HOLE DEPTH: 17.2m

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Created: 29/10/2015 5:44:37 p.m.

MACHINE BOREHOLE LOG

HOLE NO.: MH01

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision

JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748673mE, 5949350mN (NZTM 2000)
DATUM: 25.63m
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 02/09/2013
END DATE: 03/09/2013
LOGGED BY: WM
CHECKED BY: PH

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
80	65					RC			Slightly weathered, grey, massive SANDSTONE, moderately strong. SILTSTONE horizons are slightly weathered, strong to very strong. (WAITEMATA GROUP ROCK) 10.0m: Fracture: moderately widely spaced, narrow, gently inclined, stepped smooth. 10.2m - 10.3m: Two fractures: closely spaced, very narrow, gently inclined, undulating rough, one fracture infilled with wet clay 3mm thick. 10.7m: Fracture: spacing unknown, very narrow, steeply inclined, undulating rough. 11.2m: Fracture: undulating smooth to slickensided fracture. Closed, subhorizontal to gently inclined			
90	80	100/200/300				RC		11.0				
100	100					RC		12.0	Slightly weathered, grey with purple tinge, medium to course SANDSTONE, very strong. 11.8m - 12.0m: Interbedded sandstone and siltstone in thin 10-50mm beds.			
									12.7m: Fracture: widely spaced, very narrow, gently inclined, undulating smooth.			
100	95	200/600/700				RC		13.0	Unweathered, grey and dark grey speckled white, matrix supported CONGLOMERATE, very strong, with random inclusions of slightly weathered, grey, SILTSTONE, strong (Parnell Grit). Clast size ranges from fine sand through to cobbles. 13.3m: Two fractures: closely spaced, narrow, moderately inclined, undulating rough.		WAITEMATA GROUP ROCK	
100	100	70/300/500				RC		14.0	Slightly weathered, grey, fine SANDSTONE, strong.			
100	100	700/750/800	N=50, 15 35 for 45 mm			RC		15.0				
								16.0	16.0m: Fracture: very widely spaced, very narrow, gently inclined, undulating smooth.			
		700/750/800				SPT		17.0	EOH: 17.2m			
								18.0				
								19.0				

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Gently sloping, grassed.

Water	Shear Vane
▼ Standing Water Level	Corrected as per NZGS Guidelines
▽ Water Level At Time Of Drilling	Vane No.:
◁ In Flow ▷ Out Flow	UTP = Unable To Penetrate + = Peak Exceeded - = No Result

6 Omega St, Albany
Auckland, New Zealand
PO Box 302 361, NHMC
Tel: 09 478 6655
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HOLE DEPTH: 17.2m

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Created: 29/10/2015 5:44:37 p.m.

MACHINE BOREHOLE LOG

HOLE NO.: MH02

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision
JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748591mE, 5949478mN (NZTM 2000)
DATUM: 38.27m
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 30/08/2013
END DATE: 02/09/2013
LOGGED BY: WG
CHECKED BY: PH

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
100			N=3 0, 1 0, 1 1, 1 for 75 mm	60/24		RO		0.0	Clayey SILT, minor fine sand. Orange-brown, speckled dark orange and brown, stiff, moist, moderate plasticity. Occasional topsoil, minor organics and fine to coarse gravel intermixed. (FILL)			
								0.5	SILT, some clay, minor fine sand. Orange, mottled light grey, speckled dark orange/brown and red-brown, stiff, moist, slight plasticity. Occasional to frequent fine gravel and occasional rootlets and topsoil intermixed			
								1.0	0.9m - 1.1m: Some fine sand. Occasional wood fragments intermixed			
100						ISPT						
								2.0	Clayey SILT, some fine sand. Light orange-brown, mottled light grey, speckled orange/grey and pink, stiff, moist, moderate plasticity. Occasional fine to coarse gravel, minor organics and topsoil intermixed			
70			N=9 1, 1 2, 2 2, 3 for 75 mm	97/63		RO						
100						ISPT		3.0				
									3.5m: Occasional sandy horizons (pockets). Moist to wet 3.7m: Coarse sand intermixed			
90			N=2 0, 0 1, 0 0, 1 for 75 mm	134/39	▼ 19/08/2015	RO		4.0				
100						ISPT			Fine sandy SILT, some clay. Orange-brown, mottled brown/orange and dark grey, speckled pink and grey, stiff, moist, slight to moderate plasticity. Occasional fine to medium gravel and minor organics intermixed		FILL	
					▽ 10/09/2013			5.0				
57			N=6 0, 1 1, 1 1, 3 for 75 mm	166/23		RO						
60						ISPT		6.0				
			N=13 2, 3 3, 3 3, 4 for 75 mm	181/30		RO		7.0	7.1m: Coarse gravel intermixed 7.4m: Dark brown, mottled black horizons. Below this, frequent loosely cemented white sand sized clasts intermixed			
88						ISPT						
								8.0	8.1m - 8.3m: Clayey SILT, some fine sand. Frequent fine to medium gravel intermixed 8.4m - 8.5m: No clay. Dark grey			
88			N=14 1, 2 2, 2	UTP/-		RO						

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Track mounted rig

Water	Shear Vane
▼ Standing Water Level	Corrected as per NZGS Guidelines
▽ Water Level At Time Of Drilling	Vane No.:
◁ In Flow ▷ Out Flow	UTP = Unable To Penetrate + = Peak Exceeded - = No Result

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HOLE DEPTH: 16.62m

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Created: 29/10/2015 5:44:37 p.m.

MACHINE BOREHOLE LOG

HOLE NO.: MH02

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision
JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748591mE, 5949478mN (NZTM 2000)
DATUM: 38.27m
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 30/08/2013
END DATE: 02/09/2013
LOGGED BY: WG
CHECKED BY: PH

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
100			5, 5 for 75 mm	UTP/-		ISPT			Fine sandy SILT, some clay. Orange-brown, mottled brown/orange and dark grey, speckled pink and grey, stiff, moist, slight to moderate plasticity. Occasional fine to medium gravel and minor organics intermixed			
92			N=10 1, 2 2, 2 3, 3 for 75 mm	159/72		RO		10.0	Clayey SILT, some fine sand. Orange-brown, mottled orange and light grey, speckled pink/brown and dark orange, stiff, moist, moderate plasticity. Occasional fine to medium gravel and trace minor organics intermixed 9.5m - 9.7m: Moist to wet 9.7m: Pink		FILL	
100						ISPT						
90			N=10 1, 2 2, 2 3, 3 for 75 mm	133/62		RO		11.0	10.9m: Topsoil intermixed 11.0m - 11.2m: Moist to wet. Frequent fine to medium gravel intermixed			
100						ISPT		12.0	TOPSOIL with intermixed material from the unit above. Original ground level Silty CLAY. Orange, mottled light grey, very stiff, moist, high plasticity. (WAITEMATA GROUP SOILS) 12.3m - 12.4m: SAND horizon (in SPT)	TS	WAITEMATA GROUP SOILS	
97			N=50 25, 0 33 for 75 mm	UTP/-		RO		13.0	Clayey SILT. trace fine sand. Grey, very stiff, moist, moderate plasticity 12.7m - 12.8m: Sandy SILT, minor clay horizon. Occasional dark orange limonite staining			
						SPT			Clayey SILT. Grey, very stiff, moist, moderate plasticity AND Completely to highly weathered, massive, SILTSTONE, very weak to weak. Fractures are closely spaced and undulating smooth. (TRANSITIONAL WAITEMATA GROUP)		TRANS WG.	
85	41		N=50 41 9 for 75 mm			RC		14.0	Slightly weathered, grey, massive, ALTERNATING SANDSTONE/SILTSTONE, strong to very strong. (WAITEMATA GROUP ROCK) 13.8m: Pocket of sand 14.2m: Clay seam 14.4m - 14.7m: SANDSTONE, slight discing		WAITEMATA GROUP ROCK	
		15/50/150				SPT		15.0				
97	63		N=50 25 35 for 75 mm			RC		16.0	15.4m - 15.7m: SANDSTONE with discing up to 20mm thick discs 15.4m: Fractures: generally subhorizontal, very closely to closely spaced and undulating smooth 15.5m: Siltstone is dominant with beds up to 300mm thick. SANDSTONE layers are between 15mm to 100mm thick			
		2/100/160				SPT			EOH: 16.62m			
								17.0				

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Track mounted rig

Water	Shear Vane
Standing Water Level	Corrected as per NZGS Guidelines
Water Level At Time Of Drilling	Vane No.:
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HOLE DEPTH: 16.62m

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Created: 29/10/2015 5:44:38 p.m.

MACHINE BOREHOLE LOG

HOLE NO.: MH03

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision
JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748646mE, 5949548mN (NZTM 2000)
DATUM: 52.96m
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 29/08/2013
END DATE: 30/08/2013
LOGGED BY: WM
CHECKED BY: PH

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
90			N=9 1, 2 2, 2 2, 3 for 75 mm	53/20		RO			Fine sandy SILT some clay. Streaky grey and orange, stiff, moist, low to moderate plasticity. (FILL)			
100						ISPT		1.0	0.6m: Trace gravel. 0.9m: Pinky orange. 1.1m: Intermixed grey and orange.			
80			N=10 1, 2 2, 2 3, 3 for 75 mm	140/17		RO		2.0	1.5m - 3.0m: Core is compressed, shear vane readings high due to crushed up cemented material within sample. Some of this type of material seen at ground level.			
100						ISPT		3.0	3.2m: Limonite inclusions. 3.4m: Firm.			
95			N=13 2, 3 3, 3 3, 4 for 75 mm	200/40		RO		4.0	Silty fine SAND. Grey with orange streaks, loose, moist, no to low plasticity.		FILL	
100						ISPT		5.0				
95			N=10 1, 2 2, 2 3, 3 for 75 mm	144/47		RO		6.0	6.0m - 7.5m: Highly compressed, soft.			
100						ISPT		7.0				
100			N=9 1, 1 2, 2 3, 2 for 75 mm	94/27		RO		8.0	Fine sandy SILT some clay, trace gravel. Orange and grey, firm to stiff, moist, moderate plasticity.			
80			N=7 1, 1 2, 2	94/27	19/08/2015							

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Gently sloping, grassed.

Water	Shear Vane
Standing Water Level	Corrected as per NZGS Guidelines
Water Level At Time Of Drilling	Vane No.:
In Flow / Out Flow	UTP = Unable To Penetrate + = Peak Exceeded - = No Result

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HOLE DEPTH: 24.3m

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Created: 29/10/2015 5:44:38 p.m.

MACHINE BOREHOLE LOG

HOLE NO.: MH03

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision
JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748646mE, 5949548mN (NZTM 2000)
DATUM: 52.96m
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 29/08/2013
END DATE: 30/08/2013
LOGGED BY: WM
CHECKED BY: PH

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
100			1, 2 for 75 mm	94/27		ISPT			Fine sandy SILT some clay, trace gravel. Orange and grey, firm to stiff, moist, moderate plasticity.			
95			N=13 2, 2 2, 3 4, 4 for 75 mm			RO		10.0				
100				130/63		ISPT			10.5m: Brown and orange. Possibly residual topsoil interface.		FILL	
95			N=11 1, 2 2, 2 3, 4 for 75 mm			RO		11.0	11.5m: Wet.			
100				187/117		ISPT			Silty CLAY. Orange, mottled light grey, very stiff, moist, high plasticity. (WAITEMATA GROUP SOILS)			
70						RO		12.0	12.2m: Stiff, some sand.			
100			N=6 1, 1 1, 2 1, 2 for 75 mm	90/47		ISPT		13.0	13.2m: Minor sand.		WAITEMATA GROUP SOILS	
100						RO		14.0	14.0m: Firm, wet. 14.4m: Saturated.			
100			N=4 1, 1 1, 1 1, 1 for 75 mm	80/43		ISPT		15.0	Silty SAND. Light grey mottled orange, very loose, moist, no to low plasticity.			
100			N=34 2, 3 4, 8 11, 11 for 75 mm	73/17		RO		16.0	SILT some clay. Grey, stiff, moist, low to moderate plasticity. TS			
100						ISPT			Silty fine SAND. Grey, loose, moist, no plasticity.			
100	70		N=50 25 33			RC		17.0	Moderately weathered, grey, fine SANDSTONE, very weak, interbedded with moderately weathered, grey, SILTSTONE, weak in 50mm to 800mm beds. (TRANSITIONAL WAITEMATA GROUP)		TRANSITIONAL WAITEMATA GROUP	
									Moderately weathered, grey, medium grained SANDSTONE, weak. (WAITEMATA GROUP ROCK)		WAITEMATA	

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Gently sloping, grassed.

Water	Shear Vane
Standing Water Level	Corrected as per NZGS Guidelines
Water Level At Time Of Drilling	Vane No.:
In Flow / Out Flow	UTP = Unable To Penetrate + = Peak Exceeded - = No Result

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HOLE DEPTH: 24.3m

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Created: 29/10/2015 5:44:38 p.m.

MACHINE BOREHOLE LOG

HOLE NO.: MH03

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision
JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748646mE, 5949548mN (NZTM 2000)
DATUM: 52.96m
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 29/08/2013
END DATE: 30/08/2013
LOGGED BY: WM
CHECKED BY: PH

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
85	80	150/200/300	for 75 mm			RC		19.0	Moderately weathered, grey, medium grained SANDSTONE, weak. (WAITEMATA GROUP ROCK) 18.4m: Fracture: very widely spaced, tight, very steeply inclined, planar smooth. 18.5m - 19.5m: Fractures: closely to moderately widely spaced, closed, gently inclined, planar smooth to undulating 19.4m: Limonitic staining.		GROUP ROCK	
85	75	100/150/200	N=50, 25 30			RC		20.0				
85	75	150/250/400	for 75 mm			RC		21.0	Moderately weathered, grey, SILTSTONE, weak. 20.9m - 21.4m: Fractures: moderately widely to widely spaced, closed, steeply inclined, planar smooth. 21.4m - 21.8m: Fractures: very close to widely spaced, closed, sub-horizontal to gently inclined, undulating smooth. Fracture at 21.4m infilled with clay.			
85	75		N=50 25 28			RC		22.0	Alternating slightly weathered, grey, fine SANDSTONE and SILTSTONE, weak, in 50mm to 150mm beds. Moderately weathered, grey, massive, SANDSTONE/SILTSTONE, weak 22.4m: Fractures are generally very closely spaced, undulating smooth to planar smooth and subhorizontal			
85	75		N=50 25 33			RC		23.0				
45	25	50/150/200	for 75 mm			RC		24.0	23.2m: Fracture: steeply inclined, planar smooth 23.7m: Core returned as highly fractured due to re-drilling over core dropped out of barrel. Possible subvertical fracture within this material			
		40/250/400	N=50 13, 23 50			RC						
			for 70 mm			IS PT						
								25.0	EOH: 24.3m			
								26.0				

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Gently sloping, grassed.

Water	Shear Vane
Standing Water Level	Corrected as per NZGS Guidelines
Water Level At Time Of Drilling	Vane No.:
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HOLE DEPTH: 24.3m

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Created: 29/10/2015 5:44:38 p.m.

MACHINE BOREHOLE LOG

HOLE NO.: MH04

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision

JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748329mE, 5949773mN (NZTM 2000)
DATUM: 44.39m
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 29/08/2013
END DATE: 30/08/2013
LOGGED BY: WM
CHECKED BY: PH

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
90						RO			Topsoil (WAITEMATA GROUP SOILS)			
									CLAY, some silt. Orange, stiff, moist, high plasticity,			
									0.6m: Light grey mottling.			
80			N=6 1, 1 1, 2 1, 2 for 75 mm	111/60		RO		1.0				
				124/77		ISPT			1.1m: Very stiff.			
100												
						RO		2.0	Clayey SILT, minor fine sand. Light grey mottled orange, stiff, moist to wet, moderate plasticity.		WGS	
65									2.4m: Moist, red limonite inclusions.			
100			N=5 1, 1 1, 1 1, 2 for 75 mm	71/25		ISPT		3.0				
90						RO		4.0	3.7m: Light grey mottled orange.			
									4.2m: Frequent limonitic bands.			
100			N=5 1, 1 1, 1 1, 2 for 75 mm	84/25		ISPT						
									Clayey SILT. Grey, very stiff to hard, moist, moderate plasticity.			
100						RO		5.0	Moderately weathered, grey, sandy SILTSTONE, extremely weak/Fine sandy SILT. Grey, hard, moist, no plasticity. (TRANSITIONAL WAITEMATA GROUP)		TRANSITIONAL WAITEMATA GROUP	
									5.4m: Two clayey SILT beds 100mm and 200mm thick.			
100			N=50 4, 25 21			ISPT			6.0m: Interbedded moderately weathered, grey, fine SANDSTONE, weak, in 20mm to 50mm beds every 200mm to 300mm depth.			
100			for 75 mm			RC		6.0	6.2m: Moderately inclined fractures, close to widely spaced, closed, undulating smooth. Some limonite in fractures.			
	90								Highly weathered, grey, massive SANDSTONE, weak. (WAITEMATA GROUP ROCK)		WAITEMATA GROUP ROCK	
									6.6m: Sub-horizontal to gently inclined fractures, very close to closely spaced, closed, planar rough to undulating rough.			
100						RC		7.0	Slightly weathered, grey fine SANDSTONE, very weak, occasionally interbedded with slightly weathered, grey SILTSTONE, weak, in beds 20mm to 50mm thick every 400mm to 500mm depth. 7.5m: Gently inclined fracture infilled with wet clay.			
	75		N=50 , 25 40									
		50/200/300	for 45 mm		19/08/2015	SPT		8.0				
30	25				30/09/2013	RC			8.2m: Poor sample recovery.			

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Near middle of slope, moderately sloping, grassed.

Water	Shear Vane
Standing Water Level	Corrected as per NZGS Guidelines
Water Level At Time Of Drilling	Vane No.:
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HOLE DEPTH: 23.2m

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MACHINE BOREHOLE LOG

HOLE NO.: MH04

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision
JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748329mE, 5949773mN (NZTM 2000)
DATUM: 44.39m
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 29/08/2013
END DATE: 30/08/2013
LOGGED BY: WM
CHECKED BY: PH

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
30	25		N=50 50, 0 0			RC			Slightly weathered, grey fine SANDSTONE, very weak, occasionally interbedded with slightly weathered, grey SILTSTONE, weak, in beds 20mm to 50mm thick every 400mm to			
			for 0 mm			SPT			Slightly weathered, grey, medium to course SANDSTONE, weak.			
100	75					RC		10.0	9.7m: Gently inclined fracture infilled with wet clay. 9.8m: Sub-vertical fracture, spacing unknown, narrow, undulating rough, limonite on fracture surfaces.			
			N=50 , 25 25						Slightly weathered, grey, fine SANDSTONE, very weak, occasionally interbedded with slightly weathered, grey, SILTSTONE, weak to moderately strong in 10mm to 200mm thick beds every 100mm to 400mm depth.			
		15/150/250	for 25 mm			SPT		11.0	11.1m: Two gently inclined fractures infilled with wet clay.			
95	90					RC						
			N=50 50, 0 0					12.0				
		80/180/400	for 0 mm			SPT						
100	65					RC		13.0	12.7m: Sub horizontal to gently inclined fractures, very close to closely spaced, closed, planar rough to undulating smooth. 13.0m: Steeply inclined fracture, widely spaced, very narrow, planar smooth.		WAITEMATA GROUP ROCK	
		30/75/200						14.0	13.8m: Steeply inclined fracture, widely spaced, narrow, stepped smooth. 14.0m: Sub-horizontal to gently inclined fractures, very closely to closely spaced, closed, undulating smooth. Some fractures are infilled with a little bit of wet clay.			
95	50		N=50 50 0			RC						
		40/90/130	for 40 mm			SPT		15.0	15.0m: Frequent fractures closely to very closely spaced, closed, sub-horizontal to gently inclined, undulating smooth. Some of the fractures are infilled with wet clay material. Siltstone beds around 50mm thick every 100-250mm. 15.4m: Steeply inclined fracture, widely spaced, very narrow, planar smooth.			
95	45					RC		16.0				
		30/100/200				RC			16.5m: Two gently inclined fractures, closely spaced, very narrow, undulating smooth.			
100	85							17.0				
		100/200/250				RC			17.0m: Core had to be re-drilled to collect sample. Retrieved sample is fragmented slightly weathered, SANDSTONE and SILTSTONE, moderately strong.			
40	35											

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Near middle of slope, moderately sloping, grassed.

Water	Shear Vane
▼ Standing Water Level	Corrected as per NZGS Guidelines
▽ Water Level At Time Of Drilling	Vane No.:
◁ In Flow ▷ Out Flow	UTP = Unable To Penetrate + = Peak Exceeded - = No Result

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HOLE DEPTH: 23.2m

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Created: 29/10/2015 5:44:38 p.m.

MACHINE BOREHOLE LOG

HOLE NO.: MH04

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision
JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748329mE, 5949773mN (NZTM 2000)
DATUM: 44.39m
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 29/08/2013
END DATE: 30/08/2013
LOGGED BY: WM
CHECKED BY: PH

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
40	35		N=50, 40 10 for 10 mm			RC / SPT			Slightly weathered, grey, fine SANDSTONE, very weak, occasionally interbedded with slightly weathered, grey, SILTSTONE, weak to moderately strong in 10mm to 200mm thick beds every 100mm to 400mm depth. 18.5m: Sample is fragmented alternating siltstone and sandstone, most likely the result of the above SPT.			
100	50					RC		19.0	18.8m: Gently inclined fractures, closely to moderately widely spaced, closed, planar smooth to undulating smooth. Some areas of the sandstone are moderately weathered, very weak and easily broken up along series of 2-5mm thick bedding planes.			
95	85	50/120/330				RC		20.0	20.0m: Gently inclined fractures, close to moderately widely spaced, closed, undulating smooth. Some 100mm thick areas of moderately weathered, thinly bedded sandstone, very weak. Siltstone beds become moderately strong.		WAITEMATA GROUP ROCK	
			N=50 50 0					21.0				
100	90	80/150/280	for 75 mm			RC / SPT		22.0	21.5m: Gently inclined fractures, moderately to widely spaced, tight (closed), planar rough. Sandstone becomes very weak to extremely weak, described as fine SAND trace silt, grey, medium dense, moist.			
			N=50, 25 35									
		50/200/370	for 65 mm			SPT		23.0	EOH: 23.2m			
								24.0				
								25.0				
								26.0				

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Near middle of slope, moderately sloping, grassed.

Water	Shear Vane
▼ Standing Water Level	Corrected as per NZGS Guidelines
▽ Water Level At Time Of Drilling	Vane No.:
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HOLE DEPTH: 23.2m

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MACHINE BOREHOLE LOG

HOLE NO.: MH05

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision

JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748278mE, 5949786mN (NZTM 2000)
DATUM: 33.88m
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 28/08/2013
END DATE: 28/08/2013
LOGGED BY: WM
CHECKED BY: PH

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
65			N=6 1, 1 1, 1 2, 2 for 75 mm		▼ 10/09/2013 ▽ 19/08/2015	RO		1.0	Topsoil. (TOPSOIL)		TS	
									Silty CLAY trace fine sand. Orange, stiff, moist, high plasticity. (COLLUVIUM) 0.4m: Brown/grey mottling.		COLLUVIUM	
100						ISPT		2.0	Clayey SILT minor to trace fine sand. Orange mottled grey, stiff, moist, moderate plasticity.			
						RO			2.0m: Some sand, orange. 2.2m: Limonitic band, very stiff.			
85			N=9 1, 1 1, 2 3, 3 for 75 mm	118/24					Silty fine SAND with some limonite inclusions. Orange mottled grey, medium dense, moist.			
								3.0	Silty CLAY. Grey mottled orange, stiff, moist, high plasticity.			
100						ISPT			Silty fine SAND. Orange mottled grey, medium dense, moist.			
									Fine sandy SILT. Grey, hard, moist, no to low plasticity. 3.4m: Sub-vertical limonite band.			
90						RO		4.0	Fine SAND minor silt. Grey and orange, medium dense, moist.			
			N=17 2, 3 3, 4 5, 5 for 75 mm						Alternating moderately weathered, grey with red limonite bands, fine to medium SANDSTONE and SILTSTONE, extremely weak. Soils descriptions are; fine to medium SAND. Grey with red limonite bands, medium dense, moist. Clayey SILT. Grey, hard, moist, moderate plasticity. (TRANSITIONAL WAITEMATA GROUP) 5.0m: Sand material is dominant with occasional clayey silt/siltstone beds 100-400mm thick.		TRANSITIONAL WAITEMATA GROUP	
100						ISPT		5.0				
						RO						
95	70		N=50 10, 38 8									
		50/120/250	for 15 mm			ISPT		6.0	Moderately weathered, grey, massive, SILTSTONE/SANDSTONE, very weak to moderately strong. (WAITEMATA GROUP ROCK)			
100	75					RC			6.6m: Drillers break. 7.1m: Fracture, spacing unknown, closed, sub-vertical, undulating rough.		WAITEMATA GROUP ROCK	
			N=50 5, 10 13, 27					7.0	Alternating bedding of slightly weathered, grey, fine SANDSTONE and SILTSTONE, strong. All fractures are very closely to closely spaced, closed, sub-horizontal, undulating rough. Beds are 50mm to 200mm thick.			
		50/100/300	for 75 mm			ISPT		8.0	7.3m: Fractures are generally very close to closely spaced, subhorizontal and undulating rough			
70	50					RC						
			N=50 0, 25 42, 0					9.0				
		20/50/180	for 0 mm			ISPT						
60	45					RC						

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Gently sloping, grassed.

Water	Shear Vane
▼ Standing Water Level	Corrected as per NZGS Guidelines
▽ Water Level At Time Of Drilling	Vane No.:
◁ In Flow ▷ Out Flow	UTP = Unable To Penetrate + = Peak Exceeded - = No Result

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HOLE DEPTH: 11.2m

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Created: 29/10/2015 5:44:38 p.m.

MACHINE BOREHOLE LOG

HOLE NO.: MH05

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision

JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748278mE, 5949786mN (NZTM 2000)
DATUM: 33.88m
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 28/08/2013
END DATE: 28/08/2013
LOGGED BY: WM
CHECKED BY: PH

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
60	45	30/70/150	N=50, 25 35 for 65 mm			RC SPT		11.0	Alternating bedding of slightly weathered, grey, fine SANDSTONE and SILTSTONE, strong. All fractures are very closely to closely spaced, closed, sub-horizontal, undulating rough. Beds are 50mm to 200mm thick.		WAITEMATA GROUP ROCK	
									EOH: 11.2m			

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Gently sloping, grassed.

Water	Shear Vane
Standing Water Level	Corrected as per NZGS Guidelines
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HOLE DEPTH: 11.2m

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MACHINE BOREHOLE LOG

HOLE NO.: MH06

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision
JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748186mE, 5950067mN (NZTM 2000)
DATUM: 68.24m
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 28/08/2013
END DATE: 28/08/2013
LOGGED BY: WG
CHECKED BY:

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
100	70		N=4 1, 1 1, 1 1, 1 for 75 mm	82/49		RO / ISPT		0.0	TOPSOIL (TOPSOIL)		TS	
									CLAY, some silt. Orange, mottled light grey, speckled grey-brown, stiff, moist, high plasticity. (COLLUVIUM)			
									0.3m: Topsoil staining, brown mottle			
									0.6m: Occasional rootlets intermixed			
								1.0				
									1.9m: Minor fine limonite sand at interface with lower unit			
100	93		N=3 1, 0 1, 0 1, 1 for 75 mm		10/09/2013 19/08/2015	RO / ISPT		2.0	Clayey SILT, minor to some fine sand. Light grey, mottled orange, stiff, moist, moderate plasticity			
								3.0	3.3m: Fine limonite gravel intermixed		COLLUVIUM	
100	100		N=4 1, 0 1, 1 1, 1 for 75 mm	50/24		RO / ISPT		4.0	Fine sandy SILT, trace to minor clay. Light grey, mottled orange, speckled pink and dark orange, moist, slight plasticity			
									4.2m: Band of dark orange fine limonite sand			
									4.5m: Pink-grey, mottled orange and light grey			
100	93		N=6 1, 1 1, 1 2, 2 for 75 mm	101/3		RO / ISPT		5.0	SILT, some clay, some fine sand. Light grey, mottled orange, stiff, moist, slight to moderate plasticity			
									5.5m: Silty fine SAND			
									Clayey SILT, trace fine sand. Light grey, speckled orange, very stiff, moist, moderate plasticity			
								6.0	5.8m: Dark red-brown sand pockets, frequent dark orange mottled with fine limonite sand			
									5.9m: Highly disturbed zone with occasional discoloured cemented clay and silty sand conglomerate inclusions			
100	97		N=50 25, 0 24 for 40 mm	UTP/-		RO / SPT / RC		7.0	Clayey SILT, trace to minor fine sand. Grey, firm to stiff, moist, moderate plasticity. Occasional inclusions of silty SAND conglomerate. Grey, speckled green, white, red and brown, very stiff, moist, slight plasticity			
									6.7m: 80:20 ratio of sand:conglomerate			
									7.3m - 14.8m: Becomes waek conglomerate rock with occasional intermixed clay and silt horizons			
100	45								CONGLOMERATE. Dark grey, mottled grey, white, red and green-grey, hard, moist. (TRANSITIONAL WAITEMATA GROUP)		IONAL WAITEMATA	
									7.4m: Sandy CONGLOMERATE. Dark grey, cemented. 30:70 ratio of sand(stone):conglomerate ratio			
									Completely to highly weathered, grey, speckled dark orange, massive		WG R	

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Track mounted rig

Water	Shear Vane
Standing Water Level	Corrected as per NZGS Guidelines
Water Level At Time Of Drilling	Vane No.:
In Flow / Out Flow	UTP = Unable To Penetrate + = Peak Exceeded - = No Result

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HOLE DEPTH: 15.09m

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MACHINE BOREHOLE LOG

HOLE NO.: MH06

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision
JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748186mE, 5950067mN (NZTM 2000)
DATUM: 68.24m
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 28/08/2013
END DATE: 28/08/2013
LOGGED BY: WG
CHECKED BY:

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
100	45		N=50 16, 18 16 for 25 mm			RC / SPT		9.0	SANDSTONE, very weak to weak. Frequent inclusions of sand conglomerate and occasional dark orange weathered inclusions (WAITEMATA GROUP ROCK)			
									Highly weathered, grey, speckled grey-green and white, massive, coarse SANDSTONE/SILTSTONE, weak to moderately strong. Fractures are very closely spaced, subhorizontal, closed and undulating rough. SILTSTONE layers are 100mm to 200mm thick and 300mm apart			
									8.2m: Coarse grained conglomerate with occasional dark red coarse gravel intermixed in a cemented clay matrix. weak to moderately strong			
									8.7m: Fine grained			
									9.3m: 10mm disc fractures, very closely spaced			
93	69		N=50 25, 0 25 for 35 mm			RC / SPT		10.0				
		2/150/350							10.3m: Disc fracture zone. Discs are 5-10mm and very closely spaced. Recovered as intact core, able to be easily fractured along bedding planes			
									10.6m: Disc fracture zone. Discs are 5-10mm and very closely spaced. Recovered as intact core, able to be easily fractured along bedding planes			
100	27		N=50 50, 0 0, 0 for 0 mm			RC / SPT		11.0	11.3m: Disc fracture zone. Discs are 5-10mm and very closely spaced. Recovered as intact core, able to be easily fractured along bedding planes, occasional clay infill			
									11.5m: Disc fracture zone. Discs are 5-10mm and very closely spaced. Recovered as intact core, able to be easily fractured along bedding planes, occasional clay lining along fractures		WGR	
		2/100/200						12.0	Slightly weathered to unweathered, grey, massive fine SANDSTONE, very to extremely strong			
73	60								12.0m: Disc fracture zone. Discs are 5-10mm and very closely spaced. Recovered as intact core, able to be easily fractured along bedding planes			
									12.2m: Zone of disc fracturing, discs are 10-20mm width			
									12.4m: Medium to coarse SANDSTONE			
								13.0	12.9m: Slight clay infill			
		10/80/250				Rotary cored						
									13.7m - 14.0m: Thin clay seam			
									13.8m - 14.8m: Slight clay infill			
								14.0	14.0m: Medium to coarse SANDSTONE			
100	65		N=50 34 16, 0						14.6m - 14.8m: Medium to coarse SANDSTONE			
									14.9m: Slight clay infill			
		20/50/170	for 75 mm			SPT		15.0	EOH: 15.09m			

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Track mounted rig

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HOLE DEPTH: 15.09m

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MACHINE BOREHOLE LOG

HOLE NO.: MH07

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision
JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748047mE, 5950221mN (NZTM 2000)
DATUM: 74.51m
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 27/08/2013
END DATE: 27/08/2013
LOGGED BY: WG
CHECKED BY: PH

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
100			N=7 2, 1 2, 1 2, 2 for 75 mm			RO		0.0	TOPSOIL (TOPSOIL)			
									Silty CLAY. Orange-brown, speckled light grey, stiff, moist, high plasticity. (COLLUVIUM)			
									0.2m - 1.0m: Occasional topsoil staining			
									0.3m: Orange, mottled light grey/dark orange and brown. Occasional to frequent minor organics			
								1.0	1.0m: Occasional fine limonite gravel intermixed			
100						ISPT						
									SILT, some clay. Light grey, mottled orange, speckled dark orange and pink-orange, stiff, moist, slight to moderate plasticity			
93			N=5 2, 1 1, 2 1, 1 for 75 mm			RO		2.0	2.1m: Dark red-brown fine sand pocket. Occasional black carbonaceous material intermixed			
									Clayey SILT, some fine sand. Orange-brown, speckled brown/grey and pink-brown, stiff, moist, moderate plasticity			
100						ISPT			2.8m: Sandy horizon			
								3.0	3.0m: Light grey, mottled orange. Occasional dark orange fine to medium limonite gravel			
93			N=9 1, 1 2, 1 3, 3 for 75 mm			RO			3.5m: Black carbonaceous material intermixed and frequent dark orange limonite horizons			
								4.0	4.0m: Black carbonaceous material intermixed and frequent dark orange limonite horizons			
100						ISPT			4.6m: SILT, some clay. Occasional black carbonaceous material intermixed			
67			N=8 1, 1 1, 2 2, 3 for 75 mm			RO		5.0	5.2m: Occasional black carbonaceous material intermixed		COLLUVIUM	
									5.3m: SILT, some clay			
100						ISPT		6.0	Fine sandy SILT, minor to some clay. Light grey, mottled orange, stiff, moist, slight plasticity			
									6.1m: Frequent dark red/black sand intermixed			
93			N=14 1, 2 3, 3 4, 4 for 75 mm		10/09/2013	RO			6.6m: Dark orange fine to medium limonite sand intermixed			
								7.0				
100						ISPT			Clayey SILT, minor to some fine sand. Light grey, mtotled orange, very stiff, moist, high plasticity			
									7.6m: Occasional red/black fine sand and very stiff clayey lumps intermixed			
83			N=9 2, 1 1, 2 3, 3 for 75 mm			RO		8.0	7.8m: Locally sandy SILT, some clay			
									8.2m: Limonite band			
									8.3m: Sandy SILT, some clay. Occasional limonte bands intermixed, approximately 20mm to 50mm spaced			
100						ISPT		9.0	8.8m: Trace fine sand			
									9.2m: Sandy horizon			
93			N=14 2, 2 2, 4		19/08/2015	RO			Clayey SILT, some fine sand. Light grey, speckled orange, very stiff, moist, moderate plasticity			
								10.0	9.9m: Dark orange, cemented limonite bands. 10mm to 20mm spacing			
									10.2m: Dark orange, cemented , 20mm to 100mm spacing			

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Track mounted rig

Water	Shear Vane
Standing Water Level	Corrected as per NZGS Guidelines
Water Level At Time Of Drilling	Vane No.:
In Flow / Out Flow	UTP = Unable To Penetrate + = Peak Exceeded - = No Result

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KGA GEOTECHNICAL

HOLE DEPTH: 20.11m

Generated by GEROC Core-GS

Created: 29/10/2015 5:44:38 p.m.

MACHINE BOREHOLE LOG

HOLE NO.: MH07

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision
JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748047mE, 5950221mN (NZTM 2000)
DATUM: 74.51m
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 27/08/2013
END DATE: 27/08/2013
LOGGED BY: WG
CHECKED BY: PH

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
100			4, 4 for 75 mm		19/08/2015	ISPT			Silty fine SAND, trace to minor clay. Light grey-brown, mottled orange, speckled dark orange, medium dense, moist, no plasticity			
83			N=11 2, 2 2, 3 3, 3 for 75 mm			RO		11.0	11.5m: Dark orange fine limonite sand band			
									Clayey SILT, minor to some fine sand. Grey, very stiff, moist, moderate plasticity		COLLUVIUM	
100						ISPT		12.0	Silty fine SAND, trace to minor clay. Light grey-brown, mottled orange, speckled dark orange, medium dense, moist, no plasticity. Occasional very stiff clay pockets intermixed			
93			N=47 3, 5 7, 11 14, 15 for 75 mm			RO			12.6m: Dark orange limonite sand band 12.7m: Clayey SILT band			
						ISPT		13.0				
100						RC		14.0	Clayey SILT. Grey, very stiff, moist, moderate plasticity (TRANSITIONAL WAITEMATA GROUP)			
									Fine to coarse sand extremely weathered CONGLOMERATE, trace to minor silt. Grey, speckled white, red, black, and green-grey, dense, moist, no plasticity. (Crumbles easily) 14.5m: Clayey SILT band			
			N=47 6, 8 10, 10 15, 12 for 75 mm					15.0	15.1m: Clayey SILT band			
100						ISPT						
						RC		16.0	SAND, trace to minor silt. Grey, dense, moist, no plasticity. Locally Clayey SILT		TRANSITIONAL WAITEMATA GROUP	
			N=50 25 40, 0 for 75 mm			SPT		17.0	17.5m: Also Completely weathered, grey, massive SANDSTONE, extremely to very weak			
93						RC			Fine to coarse sand CONGLOMERATE, trace to minor silt. Grey, speckled white, red, black, and green-grey, dense to very dense, moist, no plasticity.			
			N=50 25 35 for 75 mm			SPT		18.0	18.5m: Highly perturbed area. Clay lumps intermixed within conglomerate rock. Possible shear zone?			
100						RC		19.0	19.1m: Clayey SILT, minor to some fine sand layer 19.3m - 19.6m: SAND, trace to minor silt 19.6m: Highly perturbed area. Clay lumps intermixed within conglomerate rock			
			N=50 25 35 for 75 mm			SPT		20.0	EOH: 20.11m			

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Track mounted rig

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HOLE DEPTH: 20.11m

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Created: 29/10/2015 5:44:38 p.m.

MACHINE BOREHOLE LOG

HOLE NO.: MH08

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision

JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748446mE, 5950266mN (NZTM 2000)
DATUM: 64.47m
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 27/08/2013
END DATE: 27/08/2013
LOGGED BY: WM
CHECKED BY: PH

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
100			N=6 1, 1 2, 1 1, 2 for 75 mm	100/27		RO		0.0	Topsoil. (TOPSOIL)		TS	
100				97/48		RO		1.0	Silty CLAY trace fine sand. Orange mottled grey and brown, stiff, moist, moderate to high plasticity. Occasional organic fibres (rootlets). (COLLUVIUM)			
100						ISPT			1.4m: Light grey mottled orange.			
85			N=6 1, 1 1, 2 1, 2 for 75 mm	70/33		RO		2.0	2.2m: Topsoil bands, soft, wet to saturated. 2.4m: Firm to stiff.		COLLUVIUM	
100						ISPT		3.0	3.3m: Light grey mottled orange with limonite staining.			
100			N=5 1, 1 2, 1 1, 1 for 75 mm	60/20	10/09/2013 19/08/2015	RO		4.0	CLAY some silt and fine sand. Pinkish orange speckled grey mottled brown, soft to firm, saturated, high plasticity. Some organic fibres (rootlets).			
70						ISPT			SILT some clay and fine sand. Orange mottled light grey, firm to stiff, wet, moderate plasticity.			
100						RO		5.0	Silty fine SAND trace clay, occasional medium sand sized limonite. Light grey mottled orange, loose to medium dense, wet, low plasticity. 4.6m: Pink streaks.			
100			N=11 1, 2 2, 3 3, 3 for 75 mm	145/42		ISPT		6.0	Silty CLAY some fine to medium sand occasional medium sand sized limonite. Yellow streaked light grey, soft to firm, wet to saturated, high plasticity.			
90						RO			Silty fine SAND trace clay occasional medium to course sand sized angular limonite. Orangey brown speckled light grey streaky pink. loose to medium dense, moist to wet, low plasticity. 5.6m: 100mm band of silty CLAY trace fine sand, grey streaky yellow/orange, stiff moist, high plasticity.			
95	50					ISPT		7.0	Clayey SILT. Blueish grey, very stiff, moist, moderate plasticity. 5.8m: Significant limonite band.			
100		50/110/180	N=20 2, 2 4, 4 6, 6 for 75 mm			RO			Alternating moderately weathered, grey, SILTSTONE and fine SANDSTONE, extremely to very weak. SILT some clay, grey, hard, moist, low plasticity, and, fine to medium SAND minor silt, grey, medium dense, moist, no plasticity. (TRANSITIONAL WAITEMATA GROUP) 7.0m: Siltstone beds are up to 100mm thick, sandstone beds are up to 50mm thick.		TRANSITIONAL WAITEMATA GROUP	
100	65					ISPT		8.0				
100		40/90/200	N=25 3, 4 4, 6 7, 8 for 75 mm			RO			Moderately weathered, grey, fine to medium SANDSTONE, extremely weak. Fine to medium SAND minor silt, grey, medium dense, moist. (WAITEMATA GROUP ROCK) 8.8m: 150mm thick bed of moderately weathered, grey siltstone, very weak.		WAITEMATA GROUP ROCK	
90	85					ISPT		9.0				
			N=36 6, 6 6, 8			RO		10.0				

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Moderately sloping, grassed

Water	Shear Vane
▼ Standing Water Level	Corrected as per NZGS Guidelines
▽ Water Level At Time Of Drilling	Vane No.:
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KGA GEOTECHNICAL

HOLE DEPTH: 20.3m

Generated by GEROC Core-GS

MACHINE BOREHOLE LOG

HOLE NO.: MH08

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision

JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748446mE, 5950266mN (NZTM 2000)
DATUM: 64.47m
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 27/08/2013
END DATE: 27/08/2013
LOGGED BY: WM
CHECKED BY: PH

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
100	85	140/200/300	10, 12 for 75 mm			ISPT		11.0	Moderately weathered, grey, fine to medium SANDSTONE, extremely weak. Fine to medium SAND minor silt, grey, medium dense, moist. (WAITEMATA GROUP ROCK)			
			N=50 14, 19 42, 8			RO			10.6m: 20mm thick silty CLAY some fine sand, occasional course sand sized subrounded limonite. Orange mottled light grey streaky pink, firm, wet, moderate to high plasticity.			
									11.2m: 100mm thick siltstone bed, very weak.			
									11.5m: 100mm thick siltstone bed, very weak.			
100	80	100/150/350	for 50 mm			ISPT		12.0	12.0m: Bed spacing of 100mm to 200mm.			
65	55					RC		13.0	12.8m: Fracture, spacing unknown, closed, gently inclined, roughness unknown. Infilled with greenish black organic clay, wet to saturated, high plastcity, 10mm thick.			
			N=50 10, 15 30, 20									
65	50	30/170/290	for 25 mm			ISPT		14.0	14.3m: Sandstone becomes medium grained, extemely weak.			
			N=50 25 26			RC		15.0	14.5m: Sandstone reverts back to fine grained, very weak.		WAITEMATA GROUP ROCK	
75	60	40/80/250	for 75 mm			SPT		16.0	16.4m: 100mm thick siltstone bed, weak.			
			N=50 25 32			RC			16.7m: 100mm thick siltstone bed, weak.			
									16.9m: Fracture, spacing unknown, closed, steeply inclined, undulating smooth.			
60	45	20/70/300	for 75 mm			SPT		17.0	Slightly weathered, grey, SILTSTONE, weak.			
			N=50 25 30			RC		18.0	17.5m: 50mm thick sandstone bed, very weak.			
80	60	50/150/250	for 75 mm			SPT		19.0	Alternating bedding of slightly weathered, grey, fine SANDSTONE and SILTSTONE, weak. Alternating beds are 50mm to 100mm thick.			
			N=50 25 25			RC						
		50/100/200	for 75 mm			SPT		20.0	EOH: 20.3m			

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Moderately sloping, grassed

Water	Shear Vane
Standing Water Level	Corrected as per NZGS Guidelines
Water Level At Time Of Drilling	Vane No.:
In Flow / Out Flow	UTP = Unable To Penetrate + = Peak Exceeded - = No Result

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HOLE DEPTH: 20.3m

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Created: 29/10/2015 5:44:39 p.m.

MACHINE BOREHOLE LOG

HOLE NO.: MH09

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision

JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748663mE, 5950072mN (NZTM 2000)
DATUM: 47.11m
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 26/08/2013
END DATE: 27/08/2013
LOGGED BY: WG
CHECKED BY: PH

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
100			N=8 1, 2 2, 2 2, 2 for 75 mm	76/38	19/08/2015 10/09/2013	RO ISPT		1.0	TOPSOIL (TOPSOIL) Clayey SILT, trace fine sand. Red-brown, stiff, moist to wet, moderate plasticity. Frequent loosely cemented sand sized clasts and fine to medium limonite gravel. Occasional minor organic fibers and gravel intermixed. (COLLUVIUM) Silty CLAY. Light grey, mottled orange, stiff, moist, high plasticity		TOPSOIL COL.	
67			N=4 0, 1 1, 1 0, 2 for 75 mm	30/9		RO ISPT		2.0 3.0	Clayey SILT, some fine sand. Light grey/white, speckled orange, firm to stiff, moist to wet, slight plasticity. Frequent loosely cemented sand sized clasts intermixed			
83			N=3 0, 1 0, 1 1, 1 for 75 mm	27/9		RO ISPT		4.0 5.0	Fine sandy SILT, some clay. Light grey, mottled orange, stiff, moist, slight plasticity Clayey SILT, minor to some fine sand. Orange, mottled light grey, stiff, moist, slight to moderate plasticity			
93			N=17 0, 1 2, 2 4, 9 for 75 mm	76/30		RO ISPT		6.0	Fine sandy SILT, some clay. Grey, speckled orange, stiff, moist, no to slight plasticity. Occasional very stiff clayey pockets intermixed 5.7m: And 5.9m-6.0m; Silty CLAY			
100						RC			Fine sandy SILT, minor clay. Grey, very stiff, moist, no to slight plasticity AND Completely weathered, grey, massive, SANDSTONE/SILTSTONE, extremely to very weak. (TRANSITIONAL WAITEMATA GROUP)		WAITEMATA GROUP	
80	9		N=50 25 39	UTP/-		RC		7.0	Moderately to slightly weathered, grey, massive, SILTSTONE/SANDSTONE, moderately strong to strong. Fractures and extremely to closely spaced and undulating smooth. (WAITEMATA GROUP ROCK) 6.6m - 9.1m: SILTSTONE is dominant with occasional 100mm to 300mm SANDSTONE layers intermixed 6.9m: SANDSTONE		WAITEMATA GROUP ROCK	

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Water	Shear Vane
▼ Standing Water Level	Corrected as per NZGS Guidelines
▽ Water Level At Time Of Drilling	Vane No.:
◁ In Flow ▷ Out Flow	UTP = Unable To Penetrate + = Peak Exceeded - = No Result

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HOLE DEPTH: 15m

Generated by GEROC Core-GS

Created: 29/10/2015 5:44:39 p.m.

MACHINE BOREHOLE LOG

HOLE NO.: MH09

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision

JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748663mE, 5950072mN (NZTM 2000)
DATUM: 47.11m
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 26/08/2013
END DATE: 27/08/2013
LOGGED BY: WG
CHECKED BY: PH

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
60	22	0/50/105	for 75 mm	UTP/-		SPT / RC		9.0	Moderately to slightly weathered, grey, massive, SILTSTONE/SANDSTONE, moderately strong to strong. Fractures and extremely to closely spaced and undulating smooth. (WAITEMATA GROUP ROCK)			
			N=50 25 38						9.1m: SANDSTONE			
		10/30/100	for 75 mm						9.7m: Fractures have occasional clay infill			
97	16							10.0	Completely to highly weathered, grey, laminated SANDSTONE, exremely weak to very weak AND - SAND, some silt. Grey, very stiff, moist, no plasticity			
			N=50 25 30						Moderately to slightly weathered, grey, massive, SILTSTONE/SANDSTONE, moderately strong to strong. Fractures and exremely to closely spaced and undulating smooth to rough			
									10.1m: Highly fractured zone of very weak SANDSTONE			
									10.3m: Fracture with clay infill			
		2/60/200	for 75 mm					11.0	10.4m: Highly fractured zone of very weak SANDSTONE			
100	56								Moderately weathered, grey, speckled white/red and green-grey, massive, fine to coarse sandstone CONGLOMERATE, strong to very strong		WAITEMATA GROUP ROCK	
									11.6m: Fractures are generally subhorizontal, closely spaced, closed and undulating rough			
								12.0	12.2m: Clay seams			
									12.5m: Between 12.5m and 12.65m; Layers of SILTSTONE and SANDSTONE intermixed			
		10/70/300							12.7m: Fracture is moderately to steeply inclined and planar rough			
100	21							13.0	Moderately weathered, grey, coarse SANDSTONE, weak to moderately strong			
			N=50 25 28						12.8m: 150mm SILTSTONE layer with some clay infill in			
									13.1m: Disking, 2mm to 15mm discs			
								14.0	14.1m: Becomes intermixed with the CONGLOMERATE material from above			
73	9	2/20/100	for 75 mm			SPT / RC			Moderately weathered, grey, speckled white/red and green-grey, massive, fine to coarse sandstone CONGLOMERATE, strong to very strong			
									Highly weathered, grey, massive, SANDSTONE, weak. Fractures into discs that are 2mm to 10mm thick (possible bedding planes?), all are subhorizontal and closed. Clay lining some of the disk			
		5/20/100						15.0	EOH: 15m			

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

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HOLE DEPTH: 15m

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MACHINE BOREHOLE LOG

HOLE NO.: MH10

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision

JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748829mE, 5950023mN (NZTM 2000)
DATUM: 54.38m
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 23/08/2013
END DATE: 26/08/2013
LOGGED BY: WG
CHECKED BY: PH

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
67			N=5 0, 1 1, 1 1, 2 for 75 mm	91/30 45/24 63/17	19/08/2015 10/09/2013	RO ISPT		1.0	Silty CLAY, some fine sand. Orange, speckled brown/grey and dark orange, stiff, moist, moderate plasticity. Frequent loosely cemented sand sized clasts and black minor organics intermixed. Occasional inclusions of highly weathered sandstone rock. (FILL) 0.6m: Occasional topsoil intermixed 1.2m: Frequent red-brown fine to medium gravel intermixed		FILL	
100									Fine sandy CLAY, some silt. Orange, speckled dark orange/dark brown and grey, stiff, moist, moderate plasticity. Occasional white sand sized clasts intermixed			
57			N=3 0, 0 0, 1 1, 1 for 75 mm	74/29		RO ISPT		2.0 3.0	2.4m: Dark orange cemented limonite band 3.4m: Dark orange limonite band. Occasional fine rootlets intermixed			
100												
58			N=2 0, 0 0, 0 1, 1 for 75 mm	UTP/-		RO ISPT		4.0	4.0m - 4.3m: Coarse gravel intermixed, limonite staining 4.3m: SAND, grey, loose to medium dense, moist, no plasticity			
100									Fine sandy SILT, some clay. Orange, speckled grey/brown and dark orange, stiff, moist, slight to moderate plasticity 4.7m: Occasional minor organics (bark) intermixed			
53			N=10 0, 1 2, 1 3, 4 for 75 mm	54/15		RO ISPT		5.0 6.0	5.0m: Occasional light grey very stiff clay inclusions and fine to medium gravel intermixed 5.6m: Orange-pink, speckled grey/light grey and orange 6.2m: Dark grey/black horizon (50mm) of fine to medium sand, fine gravel and minor organics intermixed			
100												
60						RO			Clayey SILT, some fine sand. Green-dark grey, speckled grey and			

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Track mounted rig

Water	Shear Vane
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HOLE DEPTH: 20.7m

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MACHINE BOREHOLE LOG

HOLE NO.: MH10

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision

JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748829mE, 5950023mN (NZTM 2000)
DATUM: 54.38m
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 23/08/2013
END DATE: 26/08/2013
LOGGED BY: WG
CHECKED BY: PH

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
60			N=3 0, 0 1, 1 0, 1 for 75 mm	45/21		RO ISPT			brown-orange, stiff, moist, moderate plasticity. Occasional fine to coarse gravel intermixed		FILL	
100									7.7m: Frequent light grey very stiff clay inclusions, organics and rootlets and medium gravel intermixed			
69			N=5 0, 0 1, 1 1, 2 for 75 mm	39/24		RO ISPT		8.0 9.0	8.5m: Large bark fragment, frequent rootlets			
100												
83			N=12 2, 2 2, 2 3, 5 for 75 mm	UTP/24		RO ISPT		10.0	10.0m: Large weathered sandstone inclusion (100mm)			
100									Clayey SILT, some fine sand. Green-grey, mottled orange and brown, st, moist, slight plasticity. Frequent organic material and rootlets, dark brown topsoil intermixed (original ground surface?)	TS		
68			N=13 1, 2 3, 3 3, 4 for 75 mm			RO ISPT		11.0	11.4m: Brown-orange, mottled green grey	TS		
100								12.0	CLAY, some silt, minor fine sand. Orange, mottled light grey, speckled dark orange and grey, stiff, moist, high plasticity. (WAITEMATA GROUP SOILS)		WAITEMATA GROUP SOILS	
93			N=9 2, 1 2, 2 2, 3 for 75 mm	80/45 68/32		RO ISPT		13.0	12.6m: Trace fine sand. Frequent loosely cemented sand sized clasts intermixed 12.8m - 13.0m: Light grey, mottled orange 13.0m - 13.2m: Dark orange fine limonite sand band 13.2m - 13.3m: Orange, mottled light grey			
100									Fine sandy SILT, some clay. Light grey, mottled orange, stiff, moist, high plasticity. Frequent loosely cemented white sand sized clasts intermixed 13.7m: Light grey (buff), speckled orange (leached zone?)			

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Track mounted rig

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HOLE DEPTH: 20.7m

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Created: 29/10/2015 5:44:39 p.m.

MACHINE BOREHOLE LOG

HOLE NO.: MH10

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision

JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748829mE, 5950023mN (NZTM 2000)
DATUM: 54.38m
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 23/08/2013
END DATE: 26/08/2013
LOGGED BY: WG
CHECKED BY: PH

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
83			N=7 1, 1 1, 1 2, 3 for 75 mm	38/12		RO			Fine sandy SILT, some clay. Light grey, mottled orange, stiff, moist, high plasticity. Frequent loosely cemented white sand sized clasts intermixed			
									Silty fine SAND, some clay. Pink-grey, mottled light grey, speckled dark pink, stiff, moist, slight plasticity. Frequent loosely cemented white sand sized clasts intermixed			
									14.3m: Dark orange, highly weathered limonite zone. Occasional cemented limonite gravel intermixed			
100						ISPT		15.0				
									Silty fine SAND, some clay. Orange-brown, speckled orange/ white/brown and pink, very stiff, moist, moderate plasticity			
									15.5m: Limonite band (20mm thick)			
									15.9m: Limonite band (70mm thick)			
93			N=12 1, 3 3, 2 3, 4 for 75 mm	57/12		RO		16.0	Fine sandy SILT, some clay. Light pink-grey, mottled light grey, stiff, moist, slight plasticity		WAITEMATA GROUP SOILS	
									16.2m - 16.4m: Locally becomes clayey SILT, some fine sand			
									16.4m: Occasional red-brown sand pockets intermixed			
100						ISPT		17.0				
									17.3m: Dark orange/red cemented limonite bands approximately 20mm thick and spaced 50mm to100mm apart			
									17.7m - 19.3m: Black fine sand pocket			
100			N=37 1, 2 3, 5 9, 20 for 75 mm	148/54		RO		18.0	Silty CLAY, some fine sand. Grey, very stiff, moist, moderate to high plasticity. (TRANSITIONAL WAITEMATA GROUP)		TRANSITIONAL WAITEMATA GROUP	
									18.2m: Silty SAND. Grey			
									18.4m: ALSO Completely to highly weathered, grey, massive, ALTERNATING SANDSTONE/SILTSTONE, extremely weak. Occasional very weak to weak lithorelics intermixed			
									18.5m - 18.9m: Sandy SILT, some clay			
100	20	20/50/80		UTP/-		ISPT						
									18.9m: Slight clay filled seam			
						RC		19.0	Moderately to slightly weathered, grey, massive, ALTERNATING SANDSTONE/SILTSTONE, weak to moderately strong. (WAITEMATA GROUP ROCK)		WAITEMATA GROUP ROCK	
									19.2m - 19.3m: Clay lined fractures, not discoloured			
									19.3m: Fractures are generally very closely to closely spaced, closed and undulating smooth			
35	20		N=0 3, 7 50 for 55 mm			RC		20.0				
		10/80/100				ISPT						
									EOH: 20.7m			

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Track mounted rig

Water	Shear Vane
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HOLE DEPTH: 20.7m

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MACHINE BOREHOLE LOG

HOLE NO.: MH11

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision
JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748856mE, 5950638mN (NZTM 2000)
DATUM: 69.39m
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 03/09/2013
END DATE: 04/09/2013
LOGGED BY: WG
CHECKED BY: PH

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
93			N=11 1, 2 2, 3 3, 3 for 75 mm	211+/-	10/09/2013 19/08/2015	RO			TOPSOIL (TOPSOIL)		TS	
	100								Clayey SILT, minor to some fine sand. Orange, mottled light grey, stiff, moist, moderate plasticity. (COLLUVIUM) 0.3m: Topsoil mottling			
									Silty CLAY , trace fine sand. Orange, mottled light grey, speckled dark orange, very stiff, moist, high plasticity			
								1.0	Fine sandy SILT, minor clay. Grey, mottled orange, very stiff, moist, slight plasticity			
						ISPT						
									Silty CLAY, trace to minor fine sand. Orange, mottled light grey, stiff, moist, high plasticity			
75			N=4 1, 0 1, 1 1, 1 for 75 mm			RO		2.0	1.9m: Moist to wet (possibly SPT disturbed?)			
	100											
						ISPT		3.0				
									3.4m: Moist to wet			
100			N=4 0, 1 1, 1 1, 1 for 75 mm	39/15		RO		4.0			COL.	
						ISPT			4.5m: Wet			
								5.0				
70			N=7 1, 1 1, 2 2, 2 for 75 mm	57/18		RO			Clayey SILT, some fine sand. Light grey, mottled orange, firm, wet, moderate plasticity. Occasional dark orange fine to medium limonite sand intermixed 5.7m: Sandy SILT, some clay			
	100					ISPT		6.0	Fine sandy SILT, minor to some clay. Dark orange, mottled light orange, stiff, moist, slight plasticity. Occasional very stiff clayey inclusions 6.3m: Moist to wet			
									6.5m: Dark orange stained limonite band 6.7m: Clayey SILT, some fine sand 6.8m - 7.0m: Fine sand			
97			N=14 1, 2 2, 3 3, 6 for 75 mm	76/9		RO		7.0	7.3m: Dark orange stained limonite band			
	100					ISPT			Silty fine SAND, minor clay. Light orange, speckled dark orange, loose to medium dense, moist, no to slight plasticity 8.0m: Occasionall black carbonaceous material intermixed			

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Track mounted rig

Water	Shear Vane
Standing Water Level	Corrected as per NZGS Guidelines
Water Level At Time Of Drilling	Vane No.:
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HOLE DEPTH: 21.05m

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MACHINE BOREHOLE LOG

HOLE NO.: MH11

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision

JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748856mE, 5950638mN (NZTM 2000)
DATUM: 69.39m
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 03/09/2013
END DATE: 04/09/2013
LOGGED BY: WG
CHECKED BY: PH

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
100			N=21 2, 5 4, 5 5, 7 for 75 mm	211+/-		RO			Silty fine SAND, minor clay. Light orange, speckled dark orange, loose to medium dense, moist, no to slight plasticity 8.3m: Dark orange limonite band 8.5m: Dark orange limonite band 8.7m: Dark orange/red fine to medium limonite sand band with occasional fine angular limonite gravel intermixed		COLLUVIUM	
100						ISPT		9.0	Fine sandy SILT, some clay. Light orange, mottled dark orange and light grey, speckled brown and dark brown, very stiff, moist, slight to moderate plasticity. Occasional clayey horizons intermixed. Possible failure zone? 8.9m: Steeply inclined dark orange limonite band			
100			N=50 2, 11 22, 28 for 75 mm	UTP/-		RO		10.0	Silty fine to medium SAND, minor clay. Light orange, speckled dark orange, loose to medium dense, moist, no to slight plasticity. Frequent loosely cemented white sand sized clasts intermixed. (WAITEMATA GROUP SOILS) 9.8m: Grey Fine SAND, some silt, minor clay. Grey, speckled dark orange and white, medium dense to dense, moist, no plasticity AND Completely to moderately weathered, grey, massive SANDSTONE, extremely weak (TRANSITIONAL WAITEMATA GROUP) intermixed 10.0m: TRANSITIONAL WAITEMATA GROUP		WAITEMATA GROUP SOILS TRANSITIONAL WAITEMATA	
90	39					ISPT			Highly to moderately weathered, grey, massive, SANDSTONE, weak to very weak. (WAITEMATA GROUP ROCK) 10.1m: Clayey SILT and SILTSTONE			
90			N=50 16, 16 18 for 55 mm			RC		11.0	11.5m: Fracture is subhorizontal, stepped smooth to undulating rough			
		0/120/230				ISPT		12.0	Slightly weathered to unweathered, grey, massive, ALTERNATING SANDSTONE/SILTSTONE, very strong to extremely strong			
90	62					RC		13.0	12.8m: SANDSTONE is dominant with layers 50mm to 150mm thick - SILTSTONE layers are 30mm to 60mm thick		WAITEMATA GROUP ROCK	
		0/130/500	N=50 50 for 60 mm			ISPT			13.5m: Fractures are generally closely to moderately widely spaced, subhorizontal to gently inclined, closed and undulating rough to planar smooth			
91	90					RC		14.0	14.3m: Frequent black carbonaceous material intermixed. Bark remnants (partly fossilised)			
			N=50 36 14						14.9m: SILTSTONE			
		200/200/400	for 75 mm			ISPT		15.0	15.3m: Fracture is stepped smooth, closed and subhorizontal to gently inclined 15.5m - 16.2m: Fracture is planar rough, unknown spacing and moderately to steeply inclined			
93	50					RC						

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Track mounted rig

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HOLE DEPTH: 21.05m

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Created: 29/10/2015 5:44:39 p.m.

MACHINE BOREHOLE LOG

HOLE NO.: MH11

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision

JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748856mE, 5950638mN (NZTM 2000)
DATUM: 69.39m
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 03/09/2013
END DATE: 04/09/2013
LOGGED BY: WG
CHECKED BY: PH

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
93	50	0/200/400	N=50 50 for 45 mm			RC		17.0	Slightly weathered to unweathered, grey, massive, ALTERNATING SANDSTONE/SILTSTONE, very strong to extremely strong 16.2m: Core returned as highly fractured due to redrilling over the run to retrieve		WAITEMATA GROUP ROCK	
85	75		N=50 50			RC		18.0				
67		60/100/400	for 60 mm			RC		19.0	18.0m - 19.3m: All fractures are undulating rough to stepped smooth 19.3m: Possible subvertical, closed, undulating smooth to planar rough fracture. Possible drilling disturbed			
97	87		N=50 50 for 55 mm			RC		20.0				
		50/100/50	N=50 50 for 55 mm					21.0	20.9m: Slight clay infill EOH: 21.05m			
								22.0				
								23.0				

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Track mounted rig

Water	Shear Vane
▼ Standing Water Level	Corrected as per NZGS Guidelines
▽ Water Level At Time Of Drilling	Vane No.:
◁ In Flow ▷ Out Flow	UTP = Unable To Penetrate + = Peak Exceeded - = No Result

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HOLE DEPTH: 21.05m

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Created: 29/10/2015 5:44:39 p.m.

MACHINE BOREHOLE LOG

HOLE NO.: MH12

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision

JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748980mE, 5950606mN (NZTM 2000)
DATUM: 72.15m
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 02/09/2013
END DATE: 03/09/2013
LOGGED BY: WM/WG
CHECKED BY: PH

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
70			N=1 0, 0 0, 1 0, 0 for 75 mm	82/42	10/09/2013 19/08/2015	RO		0.0	Topsoil. (TOPSOIL)		TS	
									Silty CLAY. Orange mottled light grey, stiff, moist, high plasticity. Intermixed topsoil to 400mm depth, occasional minor organics. (COLLUVIUM)			
									0.6m: Light grey mottled orange. Minor fine sand down to			
						ISPT		1.0	CLAY some silt. Orange mottled light grey, stiff, moist, high plasticity.			
85			N=8 1, 1 1, 2 2, 3 for 75 mm	79/42		RO		2.0	CLAY some silt and minor to some fine sand. Light grey mottled orange, stiff, moist, high plasticity.			
									2.8m: Layer of fine to medium limonite sand and medium to course limonite gravel. Changes to light grey mottled orange and pink below this zone.			
						ISPT		3.0	Fine sandy SILT some clay. Frequent limonite sand intermixed. Light grey mottled orange and dark orange, stiff, moist, low plasticity.		COLLUVIUM	
93			N=15 2, 2 2, 4 4, 5 for 75 mm	119/53		RO		4.0	4.0m: Clayey SILT. Light grey, stiff, moist, moderate plasticity.			
									4.4m: Dark orange limonite inclusions intermixed.			
						ISPT		5.0	Fine sandy SILT. Dark orange mottled orangey brown and light grey, stiff, moist to wet, no to low plasticity, with localised horizons of silty fine SAND.			
100			N=19 2, 2 4, 5 5, 5 for 75 mm	113/24		RO			5.4m - 5.4m: Dark orange limonite sand intermixed.			
									Silty course SAND. Grey speckled white and dark grey, medium dense, moist, no to low plasticity.			
						ISPT		6.0	Sandy SILT. Grey, stiff, moist, no to low plasticity, with thin interbeds of silty fine SAND, grey, medium dense, moist, no plasticity.			
100			N=38 4, 5 8, 9 10, 11 for 75 mm			RO		7.0	Highly weathered, grey, SILTSTONE, extremely weak / SILT with minor fine sand, grey, hard, moist, no to low plasticity, interbedded with highly weathered, grey, fine SANDSTONE, extremely weak / fine SAND. Grey, medium dense, moist, no plasticity, in 10mm to 100mm thick beds. (TRANSITIONAL WAITEMATA GROUP)		TRANSITIONAL WAITEMATA GROUP	
						ISPT			Moderately weathered, grey, massive SANDSTONE, very weak. (WAITEMATA GROUP ROCK)		WAITEMATA GROUP ROCK	
	85					RC		8.0	7.9m: Sub-horizontal to gently inclined fractures, very close to moderately widely spaced, narrow to tight, undulating rough.			
100			N=50 25 40						8.7m: Thin black organic bands.			
		50/200/250	for 75 mm			ISPT		9.0	9.0m: Sub-horizontal fractures, close to moderately widely spaced, very narrow to narrow, planar smooth.			
									9.3m: Thin black organic bands.			
80	75		N=50 11, 15 21, 20			RC		10.0	Moderately weathered, grey, fine SANDSTONE, very weak to weak.			
									10.0m: Below 10.0m; weak.			

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Gentle slope, grassed.

Water	Shear Vane
▼ Standing Water Level	Corrected as per NZGS Guidelines
▽ Water Level At Time Of Drilling	Vane No.:
◁ In Flow ▷ Out Flow	UTP = Unable To Penetrate + = Peak Exceeded - = No Result

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HOLE DEPTH: 19.7m

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Created: 29/10/2015 5:44:39 p.m.

MACHINE BOREHOLE LOG

HOLE NO.: MH12

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision
JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748980mE, 5950606mN (NZTM 2000)
DATUM: 72.15m
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 02/09/2013
END DATE: 03/09/2013
LOGGED BY: WM/WG
CHECKED BY: PH

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
100	80	200/250/300	9 for 15 mm		19/08/2015 10/09/2013	ISPT / RC		11.0	Moderately weathered, grey, fine SANDSTONE, very weak to weak.			
			N=50 10, 15 26, 24						Slightly weathered, grey, medium to course SANDSTONE, moderately strong, with occasional fine gravel intermixed.			
75	30	100/180/250	for 50 mm			ISPT / RC		12.0	Moderately weathered, grey, fine SANDSTONE, weak, with occasional widely to very widely spaced interbeds of 50mm to 200mm thick moderately weathered, grey, SILTSTONE, weak to moderately strong.			
			N=50 14, 14 18, 32					13.0	12.0m: In general, fractures are sub-horizontal to gently inclined, very closely spaced to widely spaced, closed, planar rough to undulating smooth. 12.5m: Sandstone becomes course grained.			
70	40	10/50/200	for 75 mm			ISPT / RC		14.0				
			N=50 25 46					15.0	14.9m: Sandstone becomes fine grained.		WAITEMATA GROUP ROCK	
72	25	20/70/170	for 75 mm			SPT / RC		16.0	15.6m: Sub-horizontal fracture is infilled with wet clay.			
			N=50 25 29						16.3m: Sandstone is moderately to highly weathered, extremely weak / fine SAND minor to some silt, grey, medium dense, moist to wet, no plasticity. 16.4m: Sandstone becomes medium to course grained.			
100	50	0/50/110	for 75 mm			SPT / RC		17.0	17.1m: Steeply inclined to sub-vertical fracture, widely spaced, closed, undulating smooth.			
			N=50 25 35					18.0	17.7m: Steeply inclined fracture, widely spaced, closed, undulating smooth to rough. 17.9m: Disking, 5mm to 10mm thick discs. 18.2m - 18.5m: Disking, infilled with clay, 10mm to 25mm thick discs.			
93	60	5/50/280	for 75 mm			SPT / RC		19.0				
			N=50 25 26						19.3m: Sub-horizontal fracture is infilled with clay 10mm thick.			
		25/100/260	for 75 mm			SPT			EOH: 19.7m			
								20.0				

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Gentle slope, grassed.

Water	Shear Vane
▼ Standing Water Level	Corrected as per NZGS Guidelines
▽ Water Level At Time Of Drilling	Vane No.:
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HOLE DEPTH: 19.7m

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MACHINE BOREHOLE LOG

HOLE NO.: MH13

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision

JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748695mE, 5949284mN (NZTM 2000)
DATUM: 15.98m ()
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 21/07/2015
END DATE: 22/07/2015
LOGGED BY: WM
CHECKED BY: WM

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
25 50 75	25 50 75											
80					19/08/2015	RO			TOPSOIL. (TOPSOIL)	TS	TOPSOIL	
100				30/8		RO			Clayey SILT with minor fine sand and trace topsoil; yellow speckled orange and light grey. Stiff, wet, low to moderate plasticity. (WAITEMATA GROUP SOILS)			
100			N=5 1, 1 1, 1 1, 2 for 75 mm	75/44		RO		1.0	0.6m: No topsoil. 0.8m: 20mm soft zone. 1.2m: Minor fine sand. 1.3m: Light grey and yellow/orange.		WAITEMATA GROUP SOILS	
100				78/20		ISPT			1.6m: Light grey speckled orange, minor organics intermixed (plant fibres, rootlets.)			
90						RO		2.0	1.9m - 2.4m: Limonite fragments. Fine sandy SILT with minor clay; light grey speckled orange.Stiff; moist.			
100			N=13 1, 1 1, 2 4, 6 for 75 mm	UTP/-		ISPT		3.0	Fine SAND with some silt; grey. Loose to medium dense, wet. (TRANSITIONAL WAITEMATA GROUP)		TRANS WG.	
100						RO			SILT with trace fine sand; grey. Hard, moist, low plasticity/highly weathered grey SILTSTONE, very weak. 3.6m: Medium dense. 3.7m: Medium dense to dense. 3.9m: Medium dense.			
100			N=50 12, 23 50 for 50 mm			ISPT		4.0	4.3m: Dense.			
100						RC		5.0	Slightly weathered, grey SILTSTONE. Moderately strong. Interbedded with 10-20mm sandstone layers every 20-100mm. Drill breaks on SANDSTONE-SILTSTONE interfaces. (WAITEMATA GROUP ROCK)		WAITEMATA GROUP ROCK	
85	20		N=50 17, 33 for 50 mm						Slightly to moderately weathered, grey SANDSTONE. Moderately strong.			
100	90					SPT		6.0	Slightly weathered, grey SILTSTONE. Moderately strong. 6.2m - 6.5m: 10-40mm SANDSTONE bands every 5mm.			
100	95					RC			Slightly weathered, grey SANDSTONE. Moderately strong.			

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Near level-gentle slope. Bottom of gully, grass reids, paddock.

Water	Shear Vane
▼ Standing Water Level	Corrected as per NZGS Guidelines
▽ Water Level At Time Of Drilling	Vane No.:
◁ In Flow ▷ Out Flow	UTP = Unable To Penetrate
	+ = Peak Exceeded
	- = No Result

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HOLE DEPTH: 12.1m

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Created: 29/10/2015 5:44:39 p.m.

MACHINE BOREHOLE LOG

HOLE NO.: MH13

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision

JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748695mE, 5949284mN (NZTM 2000)
DATUM: 15.98m ()
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 21/07/2015
END DATE: 22/07/2015
LOGGED BY: WM
CHECKED BY: WM

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
100	95					RC			Slightly weathered, grey SANDSTONE. Moderately strong.			
100	100					RC		8.0	Unweathered, grey SILTSTONE. Strong. 7.6m: Widely spaced fracture, tight, moderately inclined, stepped smooth. 7.7m: Widely spaced fracture, tight, very steeply inclined, undulating smooth. Slightly weathered, grey SANDSTONE. Moderately strong. 7.8m: Thin bands of sandstone. 7.9m: 50mm fracture.			
100	95					RC		9.0	9.3m: Bedding is steeply inclined.			
100	100		N=50 34, 16 for 20 mm			RC		10.0 11.0 12.0	Unweathered, bluish grey, interbedded SILTSTONE and SANDSTONE. Strong.		ROCK	
						SPT		13.0	EOH: 12.1m			

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Near level-gentle slope. Bottom of gully, grass reids, paddock.

Water	Shear Vane
Standing Water Level	Corrected as per NZGS Guidelines
Water Level At Time Of Drilling	Vane No.:
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HOLE DEPTH: 12.1m

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MACHINE BOREHOLE LOG

HOLE NO.: MH14

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision

JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748565mE, 5949274mN (NZTM 2000)
DATUM: 17.05m ()
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 20/07/2015
END DATE: 21/07/2015
LOGGED BY: WM
CHECKED BY: WM

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
60				132/31		RO			TOPSOIL. (TOPSOIL)		TS	
80						RO			Clayey SILT with some fine sand; orange. Very stiff, moist to wet, moderate plasticity. (COLLUVIUM)			
									Silty CLAY with minor fine sand; orange speckled grey. Very stiff, moist, high plasticity.			
				99/41				1.0	1.0m: 20mm Fine sandy SILT.			
100	100		N=3 1, 0 0, 1 1, 1 for 75 mm			RO			Silty fine SAND; reddish orange. Loose, moist to wet.			
				45/16					1.2m: 20mm Light grey sandy SILT.			
									1.3m: 20mm Light orange sandy SILT.			
						ISPT			1.4m: Very loose.			
100	100							2.0	SILT with some clay and minor fine sand; orange mottled grey. Stiff, moist, low plasticity.		COL.	
									Silty fine SAND; reddish orange speckled light grey. Loose, wet.			
90			N=7 1, 0 1, 1 2, 3 for 75 mm			RO			SILT with some clay; orange speckled light grey. Stiff to very stiff, moist, low plasticity.			
				20/7	▼ 19/08/2015				2.7m: Light grey.			
100						ISPT		3.0	Silty fine SAND; light grey speckled orange. Loose, wet.			
									3.5m: 20mm Fine sandy SILT.			
100						RO			SILT with some clay; orange speckled light grey. Very stiff, moist, low plasticity. (WAITEMATA GROUP SOILS)		WAITEMATA GROUP SOILS	
			N=20 2, 4 4, 5 5, 6 for 75 mm					4.0	3.8m: Red/orange band.			
									3.9m: Alternating light grey/orange.			
				UTP/-					4.0m: 50mm SILT with some clay, light grey, very stiff to hard.			
									4.2m: 50mm SILT with some clay, dark orange, light grey,			
									4.6m: 50mm SILT.			
100								5.0	4.9m: Grey with orange staining, dense.			
									5.0m: 50mm SILT.			
									5.2m: 30mm SILT.			
									5.3m: 50mm SILT.			
100			N=29 3, 5 6, 7 8, 8 for 75 mm			RO						
						ISPT		6.0	Silty fine SAND; light greyish orange. Medium dense, moist to wet, poorly graded. (TRANSITIONAL WAITEMATA GROUP)		TRANSITIONAL WAITEMATA GROUP	
65												
100						RC			Moderately weathered, grey, fine grained SANDSTONE. Weak. (WAITEMATA GROUP ROCK)			
			N=50 9, 9 50 for 60 mm					7.0	No core recovery. 7.1m: 50mm SILTSTONE, moderately strong.	N/R		
100						ISPT			Moderately weathered, grey, fine grained SANDSTONE. Weak.		WGR	
									7.5m: Slightly weathered, Strong.			
									7.9m: Fine to medium grained SANDSTONE.			
100						RC		8.0	8.2m: Unweathered.			
			N=50 50 for 55 mm									
100	95							9.0	9.4m: Medium to coarse grained SANDSTONE.			
									9.5m: Drill to 9.5m due to difficult core recovery.			
100	95					RC						

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Gentle to moderately sloping, grassed paddock.

Water	Shear Vane
▼ Standing Water Level	Corrected as per NZGS Guidelines
▽ Water Level At Time Of Drilling	Vane No.:
◁ In Flow ▷ Out Flow	UTP = Unable To Penetrate
	+ = Peak Exceeded
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HOLE DEPTH: 15m

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MACHINE BOREHOLE LOG

HOLE NO.: MH14

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision

JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748565mE, 5949274mN (NZTM 2000)
DATUM: 17.05m ()
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 20/07/2015
END DATE: 21/07/2015
LOGGED BY: WM
CHECKED BY: WM

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
100	95					RC		11.0	Moderately weathered, grey, fine grained SANDSTONE. Weak. 10.1m: Medium grained sand to medium sized gravel CONGLOMERATE. 10.5m: Fine to medium grained SANDSTONE. 10.5m - 15.0m: Rock too solid for SPT 10.6m: Widely spaced fracture, closed, moderately inclined, planar smooth. 11.0m: 100mm unweathered SILTSTONE. Strong. 11.1m: 50mm fine to med sized gravel CONGLOMERATE. 11.2m: Fine to coarse grained SANDSTONE. 11.7m: Slightly weathered, moderately stong.			
100	55					RC		12.0	Slightly weathered, grey, SILTSTONE. 12.3m: Unweathered, strong. 12.4m: 30mm fine grained SANDSTONE. 12.5m: 100mm fine grained SANDSTONE. 12.8m: Medium grained SANDSTONE.		WAITEMATA GROUP ROCK	
100	25					RC		13.0				
100	55					RC		14.0				
								15.0	EOH: 15m 15.0m: Black carbonacous material intermixed in rock.			
								16.0				
								17.0				
								18.0				
								19.0				

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Gentle to moderately sloping, grassed paddock.

Water	Shear Vane
Standing Water Level	Corrected as per NZGS Guidelines
Water Level At Time Of Drilling	Vane No.:
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HOLE DEPTH: 15m

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Created: 29/10/2015 5:44:39 p.m.

MACHINE BOREHOLE LOG

HOLE NO.: MH15

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision

JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748608mE, 5949510mN (NZTM 2000)
DATUM: 41.17m
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 17/07/2015
END DATE: 20/07/2015
LOGGED BY: AM
CHECKED BY: WM

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
60				165/43		RO			TOPSOIL (TOPSOIL) SILT with minor clay and fine sand; greyish orange. Very stiff, moist, moderate plasticity. (FILL) 0.5m: Orange mottled grey, moist. 0.9m: Limonite stains.		FILL	
40			N=7 1, 0 1, 2 2, 2 for 75 mm	149/27		RO		1.0	Silty fine SAND with minor clay; orange mottled light grey. Very stiff, moist, moderate plasticity.			
1				54/16		ISPT			1.5m: Grey.			
53			N=3 1, 0 1, 0 1, 1 for 75 mm	41/14		RO		2.0	2.8m: Orange mottled light grey, firm.			
22						ISPT		3.0	3.3m: Grey mottled orange, soft to firm.			
100			N=13 2, 2 2, 2 4, 5 for 75 mm	73/19		RO			3.8m: Orange mottled grey light brown, soft. 3.9m: Coarse limonite gravels (50mm). 4.2m: Large clumps of grey, clayey SILT mixed in.			
10						ISPT		4.0				
66			N=17 1, 2 3, 4 6, 5 for 75 mm	65/30		RO		5.0	5.0m: Hard, limonite layering.			
100						ISPT		6.0	5.8m: Grey SILT mixed in, firm.			
90			N=13 2, 2 3, 3 3, 4 for 75 mm	146/35		RO		7.0	7.0m: Limonite layer. 7.1m: Mix of above, soft to hard. 7.2m: Grey, sandy SILT, stiff to very stiff.			
100						ISPT		8.0	8.2m: Limonite, stiff to hard.			
85			N=10 1, 2 2, 2 3, 3 for 75 mm	122/39		RO		9.0	9.0m: Orange mottled grey light brown, stiff to very stiff.			
100						ISPT						
57						RO						

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Water	Shear Vane
▼ Standing Water Level	Corrected as per NZGS Guidelines
▽ Water Level At Time Of Drilling	Vane No.:
◁ In Flow ▷ Out Flow	UTP = Unable To Penetrate + = Peak Exceeded - = No Result

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HOLE DEPTH: 15.22m

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Created: 29/10/2015 5:44:39 p.m.

MACHINE BOREHOLE LOG

HOLE NO.: MH15

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision

JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748608mE, 5949510mN (NZTM 2000)
DATUM: 41.17m
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 17/07/2015
END DATE: 20/07/2015
LOGGED BY: AM
CHECKED BY: WM

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
57			N=8 1, 2 2, 2 2, 2 for 75 mm	UTP/-		RO			Silty fine SAND with minor clay; orange mottled light grey. Very stiff, moist, moderate plasticity.			
64						ISPT			10.4m: Grass, organic soil mixed with above fill. 10.5m: Organic soil. Old topsoil.		FILL	
100			N=11 1, 1 2, 3 3, 3 for 75 mm	89/38	19/08/2015	RO		11.0	Clayey SILT; grey mottled orange. Firm to stiff, moist, high plasticity. (ALLUVIUM) 11.2m: Orange mottled grey. 11.3m: Fine limonite gravel.		ALLUVIUM	
60						ISPT		12.0	SILT with minor clay; grey. Stiff to very stiff, moist, low plasticity.			
100			N=50 5, 6 11, 13 26 for 75 mm	UTP/-		RO		13.0	Fine SAND with peat and coarse angular gravel; greenish grey. Medium dense, moist to wet; sand, fine to coarse, poorly graded; organics, fibrous. Silty fine SAND with trace organics; grey. Dense, moist.			
10						ISPT			Moderately weathered, grey, SILTSTONE. Weak to moderately strong. (WAITEMATA GROUP ROCK)		WAITEMATA GROUP ROCK	
100	100		N=50 20, 22 50 for 70 mm			RC		14.0	14.2m: Steeply inclined clean break (45 degrees).			
									Moderately weathered, grey, fine to medium grained, interbedded SILTSTONE and SANDSTONE. Very weak to moderately strong.			
						IS PT		15.0	EOH: 15.22m 14.6m - 14.8m: Drill breaks.			

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Water	Shear Vane
▼ Standing Water Level	Corrected as per NZGS Guidelines
▽ Water Level At Time Of Drilling	Vane No.:
◁ In Flow ▷ Out Flow	UTP = Unable To Penetrate + = Peak Exceeded - = No Result

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HOLE DEPTH: 15.22m

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Created: 29/10/2015 5:44:39 p.m.

MACHINE BOREHOLE LOG

HOLE NO.: MH16

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision

JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748586mE, 5949628mN (NZTM 2000)
DATUM: 66.12m
RIG: Tracked Rig **OPERATOR:** DCN Drilling Ltd

START DATE: 10/07/2015
END DATE: 13/07/2015
LOGGED BY: WM
CHECKED BY: PH

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
25 50 75	25 50 75								Topsoil (TOPSOIL)		TS	
75				169/54		RO			Silty CLAY; yellow and orange. Very stiff, moist, high plasticity. Organic material intermixed (rootlets). (WAITEMATA GROUP SOILS) 0.5m: No rootlets.			
65						RO			Clayey SILT; yellow and orange. Very stiff, moist, moderate plasticity. 0.8m: Light grey mottled orange.			
50				124/23		RO		1.0	Fine to medium sandy SILT with minor clay; orange. Very stiff, moist, low plasticity. 1.1m: Coarse sand and gravel intermixed. 1.3m: No coarse sand or gravel. Light grey and orange.			
				112/46		RO		2.0	SILT some clay with minor fine sand; light grey and orange. Very stiff, moist, low to moderate plasticity. Organic material intermixed (rootlets). 1.8m: Light grey speckled orange.			
55			N=10 1, 1 2, 2 3, 3 for 75 mm						Fine sandy SILTwith minor clay; grey and orange. Stiff, moist, no plasticity; sand, loose. 2.6m: Light grey 2.8m: Orange		WAITEMATA GROUP SOILS	
100				70/16		ISPT		3.0	Silty fine SAND; light grey mottled orange. Loose, moist.			
						RO			Clayey SILT; light grey mottled orange. Very stiff, moist, moderate plasticity. Fine sandy SILT; light grey mottled orange. Stiff, moist, no plasticity; sand, loose.			
75			N=10 1, 1 1, 3 3, 3 for 75 mm					4.0	Silty fine SAND; grey mottled orange. Loose, moist. 4.3m: 50mm of SILT minor clay, light grey, very stiff, moist, low to moderate plasticity			
100				81/20		ISPT			Fine sandy SILT; orange. Very stiff, moist, low plasticity.			
						RO		5.0	Silty fine SAND; reddish orange. Loose to medium dense, moist. 5.0m: 100mm of clayey SILT, orange speckled light grey, very stiff, moist, low to moderate plasticity.			
100			N=18 3, 3 4, 4 5, 5 for 75 mm						Fine sandy SILT; light grey speckled orange. Very stiff, moist, no to low plasticity. SILT some clay; grey. Hard, moist, low to moderate plasticity. (TRANSITIONAL WAITEMATA GROUP) 5.7m: Some fine sand, occasional orange speckles.			
				UTP/-				6.0	Fine sandy SILT; light grey. Hard, moist, no plasticity. 5.9m: 10mm lense of black carbonaceous material.			
100						ISPT			Silty fine SAND; orange speckled grey. Medium dense, moist. 6.0m: 10mm of hard carbonaceous and limonite lenses.		TRANS WG.	
						RO		7.0	6.9m: Light grey mottled orange. 7.0m: Orange.			
100			N=20 2, 2 3, 4 6, 7	UTP/-								

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Near level, top of ridgeline, grassed

Water	Shear Vane
Standing Water Level	Corrected as per NZGS Guidelines
Water Level At Time Of Drilling	Vane No.:
In Flow / Out Flow	UTP = Unable To Penetrate + = Peak Exceeded - = No Result

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HOLE DEPTH: 19.6m

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Created: 29/10/2015 5:44:39 p.m.

MACHINE BOREHOLE LOG

HOLE NO.: MH16

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision
JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748586mE, 5949628mN (NZTM 2000)
DATUM: 66.12m
RIG: Tracked Rig **OPERATOR:** DCN Drilling Ltd

START DATE: 10/07/2015
END DATE: 13/07/2015
LOGGED BY: WM
CHECKED BY: PH

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
100			for 75 mm	UTP/-	19/08/2015 13/07/2015	ISPT			Silty fine SAND; orange speckled grey. Medium dense, moist.			
									7.5m: 100mm SILT, orange and grey, hard, moist, moderate plasticity.			
								8.0	Moderately weathered, grey SILTSTONE. Weak.			
100			N=50 3, 5 9, 32 9 for 0 mm			RO			Silty fine SAND; grey. Medium dense to dense, moist.		TRANSITIONAL WAITEMATA GROUP	
									8.5m: 10mm lense of orange limonite.			
									8.8m: Limonite chunks intermixed.			
									8.9m: Grey.			
100						ISPT		9.0				
100	40	3800/380 0/3800				RC			Moderately weathered, grey SILTSTONE. Weak. (WAITEMATA GROUP ROCK) 9.6m: 50mm of silty fine SAND, grey, dense, moist.			
									9.7m: Moderately strong.			
									9.9m: Fracture, very widely spaced, closed, sub-horizontal, planar-rough.			
			N=50 9, 14 16, 24 10 for 0 mm					10.0	Moderately weathered, grey, massive, fine SANDSTONE. Weak.			
100						ISPT						
50	50					RC		11.0	10.9m - 11.5m: Core loss.			
			N=50 11, 39						11.7m: Drill breaks.			
			for 0 mm			ISPT		12.0	Slightly weathered, grey, massive, SILTSTONE. Moderately strong.			
100									Slightly weathered, grey, massive fine SANDSTONE. Weak.		WAITEMATA GROUP ROCK	
80	80					RC						
			N=50 33, 17					13.0	13.4m: Moderately strong.			
75	60		for 15 mm			ISPT			13.7m: Fracture, widely spaced, closed, gently inclined, undulating-smooth.			
100	70								14.1m: 200mm of slightly weathered SILTSTONE, moderately strong.			
95	80	3800/440 0/5000				RC		14.0	14.2m: Drill breaks.			
									14.3m: Sandstone becomes medium to coarse.			
100	40		N=50 27, 23						Slightly weathered, grey, SILTSTONE. Moderately strong. 14.6m - 15.0m: Many drill breaks.			

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Near level, top of ridgeline, grassed

Water	Shear Vane
▼ Standing Water Level	Corrected as per NZGS Guidelines
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HOLE DEPTH: 19.6m

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MACHINE BOREHOLE LOG

HOLE NO.: MH16

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision

JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748586mE, 5949628mN (NZTM 2000)
DATUM: 66.12m
RIG: Tracked Rig **OPERATOR:** DCN Drilling Ltd

START DATE: 10/07/2015
END DATE: 13/07/2015
LOGGED BY: WM
CHECKED BY: PH

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
100	55		for 0 mm			SPT			Slightly weathered, grey, SILTSTONE. Moderately strong.			
			N=50 50		13/07/2015	RC		16.0	15.3m: 200mm of fine SANDSTONE, moderately strong. 15.5m - 16.5m: Drill breaks every 25-150mm along bedding. 15.9m: 50mm of fine SANDSTONE, moderately strong. 16.0m: Losing water down hole.			
			for 70 mm			SPT						
80	20		N=50 30, 20		13/07/2015	RC		17.0	16.8m - 18.0m: Losing water down hole, drill breaks on bedding planes. 16.9m: Two 25mm bands of SANDSTONE, moderately strong.		ROCK	
			for 0 mm			SPT		18.0				
90	30	5000/500 0/5000	N=50 50			RC		19.0	18.2m: 50mm of SANDSTONE with organic black streaks (bioturbation). 18.7m: Fracture, widely spaced, closed, very steeply inclined, stepped-smooth. 18.8m: 150mm of fine to medium SANDSTONE, sample disturbed.			
			for 70 mm			SPT			Slightly weathered, grey, fine to medium grained SANDSTONE. Moderately strong. EOH: 19.6m			
								20.0				
								21.0				
								22.0				

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Near level, top of ridgeline, grassed

Water	Shear Vane
Standing Water Level	Corrected as per NZGS Guidelines
Water Level At Time Of Drilling	Vane No.:
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HOLE DEPTH: 19.6m

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MACHINE BOREHOLE LOG

HOLE NO.: MH17

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision

JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748605mE, 5949778mN (NZTM 2000)
DATUM: 25.3m ()
RIG: Tractor Mounted Rig **OPERATOR:** DCN Drilling

START DATE: 23/07/2015
END DATE: 24/07/2015
LOGGED BY: AM
CHECKED BY: WM

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
100	100		N=4 1, 1 1, 1 1, 1 for 75 mm	68/34	19/08/2015	RO		0.0	TOPSOIL (TOPSOIL)		TS	
									Silty CLAY; brown mottled orange. Stiff, moist, high plasticity. (ALLUVIUM)			
100	40			40/13		ISPT		1.0	Fine sandy SILT with some clay and minor organics (rootlets); grey. Firm to stiff, moist, high plasticity.		ALLUVIUM	
									No core recovery.			
100	100					RO		2.0	Clayey fine sandy SILT with minor organics (rootlets); grey. Firm to stiff, moist, high plasticity.			
			N=50 27, 23	UTP/-		RC			Clayey fine SAND; grey. Very stiff; moist; low plasticity. (WAITEMATA GROUP SOILS)		WGS	
						SPT		3.0	Moderately weathered, grey, sand, fine to medium grained, massive; SANDSTONE. Very weak. Interbedded with grey SILTSTONE. (WAITEMATA GROUP ROCK)			
96			for 40 mm			RC			Slightly weathered, grey, thinly laminated SILTSTONE. Weak to moderately strong. Interbedded with SANDSTONE; sand coarsens with depth.			
			N=50 50					4.0				
									4.4m - 4.6m: Coarse SANDSTONE.			
100			for 50 mm			RC		5.0				
									5.3m - 5.4m: Coarse SANDSTONE.			
			N=50 50						Slightly weathered; grey, fine to coarse grained, massive SANDSTONE. Weak to moderately strong. Sand coarsens with depth.		WAITEMATA GROUP ROCK	
			for 75 mm			RC		6.0				
									6.3m - 6.4m: SILTSTONE.			
90			N=50 35, 50					7.0				
									7.4m: Fine gravels.			
			for 10 mm			RC			Slightly to moderately weathered, grey, fine to coarse grained SANDSTONE. Weak to moderately strong. Sand coarsens with depth. 7.8m: Fine gravel sized clasts, well graded.			
80			N=50 34, 16					8.0				
			for 75 mm					9.0				
95			N=50 50			RC			9.4m - 9.6m: SILTSTONE.			
			for 70 mm					10.0	EOH: 10.07m			

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Very saturated swamp, bottom of gully by stream.

Water	Shear Vane
▼ Standing Water Level	Corrected as per NZGS Guidelines
▽ Water Level At Time Of Drilling	Vane No.:
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HOLE DEPTH: 10.07m

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Created: 29/10/2015 5:44:40 p.m.

MACHINE BOREHOLE LOG

HOLE NO.: MH18

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision
JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748296mE, 5949899mN (NZTM 2000)
DATUM: 43.51m ()
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 15/07/2015
END DATE: 17/07/2015
LOGGED BY: AM
CHECKED BY: WM

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
25 50 75	25 50 75											
80				93/34		RO			TOPSOIL. (TOPSOIL)		TS	
70						RO			Clayey SILT with some fine sand; orange mottled grey with dark brown. Stiff, moist, high plasticity. (COLLUVIUM)			
100			N=6	81/34		RO		1.0	0.8m: Fine to coarse SAND.			
100			1, 0						0.9m: Frequent,coarse sand sized cemented clasts.			
100			1, 1	68/31		ISPT			Fine sandy SILT with trace clay; grey mottled orange. Stiff, moist, low plasticity.		COLLUVIUM	
100			2, 2						1.6m: Grey mottled orange.			
100			for 75 mm			RO		2.0	Silty fine to coarse SAND with trace clay; grey mottled orange. Loose, moist, low plasticity.			
100			N=7						2.4m: Limonite staining.			
100			1, 0						2.7m: Orange staining.			
100			1, 2	41/14		ISPT		3.0	Silty fine to coarse SAND with trace peat; light brownish grey. Loose to medium dense, moist to wet. (ALLUVIUM)		ALLUVIUM	
100			2, 2		19/08/2015							
100			for 75 mm			RO		4.0	3.9m: Hard limonite layer 30-50mm, moderately inclined.			
100			N=11						Silty fine to coarse SAND with trace organics; orange. Loose to medium dense, moist to wet.			
100			1, 2						4.9m: Hard limonite layer 30mm, gently Inclined.			
100			2, 2						5.2m: Hard limonite layer 30-50mm, sub horizontal.			
100			3, 4	59/14		ISPT			Silty fine to coarse SAND with trace organics; grey mottled orange. Loose to medium dense, moist to wet.			
100			for 75 mm			RO		5.0	Fine SAND with some silt; orange. Medium dense, poorly graded. (WAITEMATA GROUP SOILS)		MATA GROUP	
100			N=44						Fine to medium SAND with some silt with trace clay; light orange. Medium dense; moist, poorly graded. (TRANSITIONAL WAITEMATA GROUP)			
100			4, 5						Silty fine SAND with trace clay; grey, dense, moist, very low plasticity/Highly weathered grey SANDSTONE, extremely weak.		TRANSITIONAL WAITEMATA GROUP	
100			7, 8									
100			12, 17	UTP/-		ISPT		6.0				
100			for 75 mm									
85						RC			Moderately weathered, grey, massive SANDSTONE. Weak to moderately strong. Sand becomes coarser with depth to fine gravel at base of unit. (WAITEMATA GROUP ROCK)			
100			N=50					7.0				
100			16, 16									
100			17, 33									
100			for 40 mm			ISPT						
100						RC		8.0	Moderately weathered, grey SILTSTONE. Moderate strength.			
100			N=50						Moderate to slightly weathered, grey, fine to coarse grained, massive SANDSTONE. Moderately strong. Horizontal bedding. Becomes coarser with depth.			
100			21, 39									
100			for 35 mm			ISPT		9.0				
100						RC			9.5m: Alternating, very fine, horizontal bedding.			

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Water	Shear Vane
▼ Standing Water Level	Corrected as per NZGS Guidelines
▽ Water Level At Time Of Drilling	Vane No.:
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HOLE DEPTH: 15m

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MACHINE BOREHOLE LOG

HOLE NO.: MH18

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision

JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748296mE, 5949899mN (NZTM 2000)
DATUM: 43.51m ()
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 15/07/2015
END DATE: 17/07/2015
LOGGED BY: AM
CHECKED BY: WM

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
100	100		N=50 18, 32 for 55 mm			RC / SPT		11.0	Moderate to slightly weathered, grey, fine to coarse grained, massive SANDSTONE. Moderately strong. Horizontal bedding. Becomes coarser with depth.	TS	WAITEMATA GROUP ROCK	
100	100		N=50 50 for 70 mm			RC / SPT		12.0	12.5m - 12.5m: SILTSTONE. 13.0m - 13.0m: SILTSTONE. 13.1m - 13.2m: SILTSTONE.	TS		
100	100		N=50 22, 23 for 25 mm			RC / SPT		13.0	Moderate to slightly weathered, grey, fine to coarse grained, massive SANDSTONE. Moderately strong. Horizontal bedding. Becomes coarser with depth.	TS		
								14.0				
								16.0	EOH: 15m			
								16.0				
								17.0				
								18.0				
								19.0				

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Water	Shear Vane
▼ Standing Water Level	Corrected as per NZGS Guidelines
▽ Water Level At Time Of Drilling	Vane No.:
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HOLE DEPTH: 15m

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Created: 29/10/2015 5:44:40 p.m.

MACHINE BOREHOLE LOG

HOLE NO.: MH19

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision
JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748244mE, 5949742mN (NZTM 2000)
DATUM: 29.4m ()
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 23/07/2015
END DATE: 23/07/2015
LOGGED BY: MW
CHECKED BY: WM

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
93			N=2 1, 0 0, 0 1, 1 for 75 mm	100/67 122/49 107/67	▼ 19/08/2015	RO ISPT		1.0	Topsoil (TOPSOIL)		TS	
80									Clayey SILT with some sand; light grey mottled orange. Firm, moist, moderate plasticity. (COLLUVIUM)			
100			N=20 1, 0 1, 3 5, 11 for 75 mm	62/26		RO ISPT		2.0 3.0	Clayey SILT with some fine sand; light grey mottled orange. Firm, moist, low plasticity.		COLLUVIUM	
100			N=50 2, 7 23 for 30 mm	UTP/-		RC ISPT		4.0	Moderately weathered, dark grey, moderately thin bedded SILTSTONE interbedded with SANDSTONE. Very weak, moderately to widely spaced, subhorizontal discontinuities. (WAITEMATA GROUP ROCK) 4.6m: Becoming weak.		WAITEMATA GROUP ROCK	
57									5.3m: Brown carbonaceous bands in thinly laminated SILTSTONE.			
100			N=50 12, 38 for 70 mm	UTP/-		RC ISPT		5.0 6.0				
100			N=50 20, 30 for 35 mm	UTP/-		RC ISPT		7.0	6.9m: Moderately inclined 30 degree joint, smooth to rough, planar discontinuities. 7.1m: Brown carbonaceous bands.			
100									7.6m: Brown carbonaceous bands.			
100								8.0	8.0m: Steeply inclined 60 degree joint; undulating smooth-undulating rough discontinuities.			
100			N=50 13, 37 for 70 mm	UTP/-		RC ISPT		9.0	8.7m: Steeply inclined 60 degree joint and very steeply inclined 80 degree joint. undulating rough. 9.3m: Moderately inclined 30 degree joint, smooth to rough, undulating.			
100			N=50 17, 34	UTP/-		RC ISPT		10.0				
			for 75 mm					11.0	EOH: 10.65m			

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Piezo installled from 7.5 to 9.5m bgl.

Water	Shear Vane
▼ Standing Water Level	Corrected as per NZGS Guidelines
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HOLE DEPTH: 10.65m

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MACHINE BOREHOLE LOG

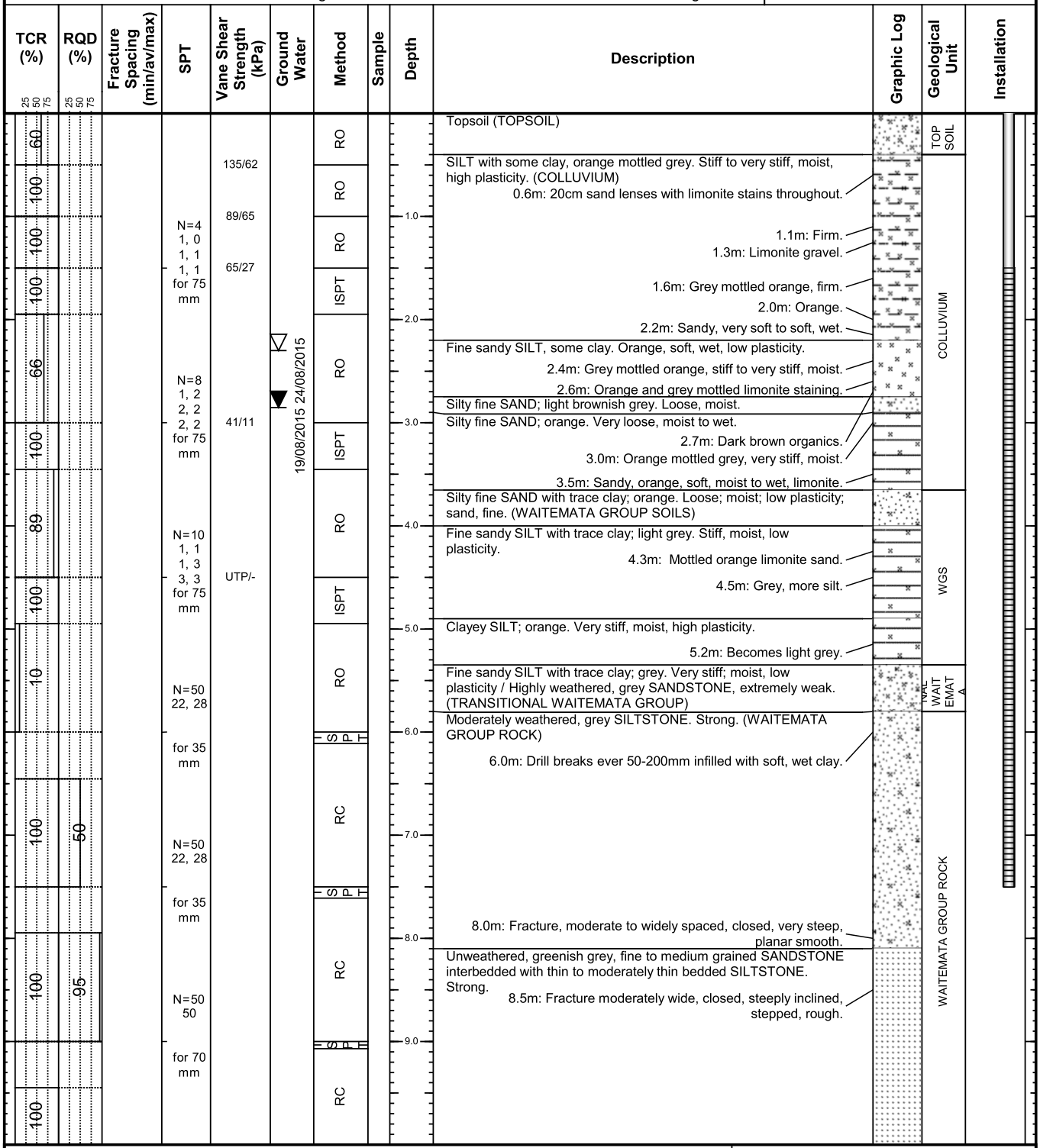
HOLE NO.: MH21

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision

JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748041mE, 5949958mN (NZTM 2000)
DATUM: 59.23m ()
RIG: Tractor Mounted Rig **OPERATOR:** DCN Drilling

START DATE: 24/07/2015
END DATE: 24/07/2015
LOGGED BY: AM
CHECKED BY: WM



Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Pine Forest. Ground very boggy under pine needles. moderatly sloping. Moved 4m to the right (looking downslope) of orginal marker.

Water	Shear Vane
▼ Standing Water Level	Corrected as per NZGS Guidelines
▽ Water Level At Time Of Drilling	Vane No.:
◁ In Flow ▷ Out Flow	UTP = Unable To Penetrate + = Peak Exceeded - = No Result

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KGA GEOTECHNICAL

HOLE DEPTH: 13.54m

Generated by GEROC Core-GS

Created: 29/10/2015 5:44:40 p.m.

MACHINE BOREHOLE LOG

HOLE NO.: MH21

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision
JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748041mE, 5949958mN (NZTM 2000)
DATUM: 59.23m ()
RIG: Tractor Mounted Rig **OPERATOR:** DCN Drilling

START DATE: 24/07/2015
END DATE: 24/07/2015
LOGGED BY: AM
CHECKED BY: WM

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
100	70		N=50 50 for 45 mm			RC		11.0	Unweathered, greenish grey, fine to medium grained SANDSTONE interbedded with thin to moderately thin bedded SILTSTONE. Strong. 10.0m - 13.5m: Drill breaks every 50-300mm.		WAITEMATA GROUP ROCK	
100	60		N=50 50 for 55 mm			RC		12.0				
			N=50 50 for 40 mm			RC		13.0	EOH: 13.54m			
								14.0				
								15.0				
								16.0				
								17.0				
								18.0				
								19.0				

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Pine Forest. Ground very boggy under pine needles. moderatly sloping. Moved 4m to the right (looking downslope) of orginal marker.

Water	Shear Vane
Standing Water Level	Corrected as per NZGS Guidelines
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HOLE DEPTH: 13.54m

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Created: 29/10/2015 5:44:40 p.m.

MACHINE BOREHOLE LOG

HOLE NO.: MH22

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision

JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748159mE, 5950228mN (NZTM 2000)
DATUM: 77.6m ()
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 14/07/2015
END DATE: 15/07/2015
LOGGED BY: WM
CHECKED BY: WM

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
25 50 75	25 50 75											
70 90				108/68	19/08/2015	RO			TOPSOIL. (TOPSOIL)			
									SILT with some clay and fine sand; orange speckled red, light grey. Very stiff, moist, low to moderate plasticity. (ALLUVIUM)		ALLUVIUM	
				95/54					Clayey SILT with minor fine sand; light grey mottled orange. Very stiff, moist, moderate plasticity; sand. (COLLUVIUM)			
90								1.0				
				81/51		ISPT			1.3m: Stiff.			
70				78/38								
						RO		2.0	2.0m: Some fine sand, light grey speckled orange.		COLLUVIUM	
55			N=5 1, 0 1, 1 1, 2 for 75 mm		19/08/2015							
100				86/41		ISPT						
						RC		3.0				
95									Fine sandy SILT with some clay; light grey. Stiff, moist, low plasticity. (WAITEMATA GROUP SOILS)		WAITEMATA GROUP SOILS	
			N=13 1, 2 3, 3 3, 4 for 75 mm					4.0	Clayey SILT with minor fine sand; light grey. Very stiff, moist, moderate plasticity.			
				135/39		SPT			4.3m: Trace fine sand, grey.			
100									4.4m: Orange and light grey.			
						RC			Silty fine SAND; light grey. Loose to medium dense, moist.			
								5.0	5.0m: Light grey, speckled orange.			
									5.1m: dark orange and grey.			
100	95		N=25 2, 4 4, 6 6, 9 for 75 mm						SILT with some fine sand; dark orange. Very stiff to hard, moist, low plasticity/ moderately weathered, grey, massive SILTSTONE. Very weak. (TRANSITIONAL WAITEMATA GROUP)		TRANSITIONAL WAITEMATA GROUP	
									5.5m: Minor fine sand, grey.			
						SPT		6.0	Silty fine SAND; grey. Medium dense, moist/ moderately weathered, grey, massive SANDSTONE. Weak.			
						RC			SILT with some fine sand; dark orange. Very stiff to hard, moist, low plasticity/ moderately weathered, grey, massive SILTSTONE. Very weak.			
90	80							7.0	Silty fine SAND; grey. Medium dense, moist/ moderately weathered, grey, massive SANDSTONE, weak.			
									7.4m: Fine to coarse SAND, minor silt.			
100			N=9 2, 1 1, 2 3, 3 for 75 mm						7.6m: Loose.			
									7.7m - 7.8m: Fine to medium sand.			
						SPT		8.0	8.1m: Medium dense.			
						RC			Moderately weathered, dark greenish grey, massive SILTSTONE. Very weak. Glauconite, black organic chunks. (WAITEMATA GROUP ROCK)		WAITEMATA GROUP ROCK	
100	10								8.5m - 8.9m: Medium to coarse sand banding.			
			N=50 10, 30 50 for 55 mm					9.0	9.1m: Glauconite fragments.			
						SPT			Moderately weathered; dark greenish grey; massive SANDSTONE. Strong			
						RC			9.5m: Fractures closely spaced, narrow to moderate steeply inclined, smooth undulating, limonite infill.			
100	95								9.8m: Fracture moderate to widely spaced, closed, steeply inclined, planar rough.			

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Water	Shear Vane
▼ Standing Water Level	Corrected as per NZGS Guidelines
▽ Water Level At Time Of Drilling	Vane No.:
◁ In Flow ▷ Out Flow	UTP = Unable To Penetrate + = Peak Exceeded - = No Result

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HOLE DEPTH: 19.57m

Generated by GEROC Core-GS

Created: 29/10/2015 5:44:40 p.m.

MACHINE BOREHOLE LOG

HOLE NO.: MH22

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision
JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748159mE, 5950228mN (NZTM 2000)
DATUM: 77.6m ()
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 14/07/2015
END DATE: 15/07/2015
LOGGED BY: WM
CHECKED BY: WM

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
100	95		N=50 13, 50			RC			Moderately weathered; dark greenish grey; massive SANDSTONE. Strong.			
100			for 75 mm			SPT			10.4m: 30mm SILTSTONE.			
									10.6m: Greenish grey.			
									10.7m - 10.7m: Dark grey.			
100	90					RC		11.0	10.8m: SILTSTONE 20mm and 30mm.			
									11.0m: SILTSTONE.			
			N=50 7, 13 21, 29						11.1m: orange.			
									11.5m: old fracture infilled with limonite, very steeply inclined, orange grey.			
100			for 35 mm			ISPT		12.0	11.7m: 50mm SILTSTONE, grey.			
									12.3m: orangy grey.			
									12.4m: 100mm orange very hard limonite, wet, fine gravel.			
100	62					RC			Slightly weathered, grey, laminated SILTSTONE. Weak.			
									12.7m: moderately strong.			
			N=50 9, 13 17, 33					13.0				
100			for 65 mm			ISPT						
								14.0				
100	90					RC						
			N=50 35, 15									
								15.0				
100			for 10 mm			SPT						
									15.4m - 15.7m: 250mm SANDSTONE.			
100	95					RC		16.0				
			N=50 31, 17						16.2m - 16.4m: 200mm SILTSTONE.			
100			for 15 mm			SPT						
								17.0	Slightly weathered, grey, fine to medium grained SANDSTONE interbedded with thin to moderately thin SILTSTONE. Moderately strong to strong.			
100	95					RC						
			N=50 31, 19									
								18.0				
100			for 10 mm			SPT						
									18.6m: Dark grey banding.			
100	95					RC		19.0				
			N=50 50						Slightly weathered SILTSTONE. Strong.			
			for 70 mm			SPT			EOH: 19.57m			

WAITEMATA GROUP ROCK

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Water	Shear Vane
Standing Water Level	Corrected as per NZGS Guidelines
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In Flow / Out Flow	UTP = Unable To Penetrate + = Peak Exceeded - = No Result

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KGA GEOTECHNICAL

HOLE DEPTH: 19.57m

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MACHINE BOREHOLE LOG

HOLE NO.: MH23

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision
JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748519mE, 5949893mN (NZTM 2000)
DATUM: 32.04m ()
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 22/07/2015
END DATE: 22/07/2015
LOGGED BY: WM
CHECKED BY: WM

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
25 50 75	25 50 75											
80					19/08/2015	RO			TOPSOIL. (TOPSOIL)		TOPSOIL	
60				52/15		RO			Clayey SILT with some fine sand; yellow-orange. Firm to stiff; wet; Moderate plasticity. (COLLUVIUM)		COLLUVIUM	
100				42/20		RO		1.0	1.2m: Light grey speckled orange, firm.			
									Silty fine to coarse SAND; grey speckled orange.Very loose; wet to saturated.			
				57/3					1.6m: Grey.			
100			N=13			RO		2.0	1.9m: Orange, loose, moist.			
			4, 5						Silty fine SAND; grey. Medium dense; wet to saturated; poorly graded / Highly weathered, grey, fine SANDSTONE, extremely weak. (TRANSITIONAL WAITEMATA GROUP)		TRANSITIONAL WAITEMATA GROUP	
			4, 3						2.7m: Grey, very loose, wet.			
			3, 3	UTP/-		ISPT		3.0	2.9m: Weak.			
50			for 75 mm									
									3.5m: Moderately weathered, grey, moderately thick to laminated coarse SANDSTONE, weak. Interbedded with thin (10mm) beds of SILTSTONE and fine grained SANDSTONE.			
92			N=50 +			RC		4.0	3.8m: Carbonaceous particles in thin band.			
			7, 17									
			20, 12	UTP/-								
			8, 22			ISPT			4.7m: Weak.			
90			for 75 mm						5.0m - 5.3m: Very closely spaced fractures, subvertical to subhorizontal.			
								5.0	Slightly weathered SILTSTONE interbedded with SANDSTONE; Moderately strong. (WAITEMATA GROUP ROCK)		WAITEMATA GROUP ROCK	
100			N=50			RC			5.4m: Carbonaceous particles.			
			15, 36						5.5m - 6.5m: Closely spaced; very narrow to tight; sub horzontal discontinuities.			
				UTP/-		SPT		6.0	6.0m: Closely spaced, very narrow to tight, subhorizontal discontiunities.			
100			for 40 mm									
						RC						
			N=50					7.0	7.1m: Fracture, widely spaced, sub-vertical, undulating smooth			
66			16, 34									
				UTP/-		SPT						
100			for 40 mm									
						RC		8.0	8.2m: Steeply inclined 45 degree two fractures; closely spaced; very narrow discontinuities (generally along sub-horizontal bedding plane.			
			N=50						8.7m: Fracture, moderately widely spaced, very steeply inclined, planar smooth.			
			25, 25	UTP/-		SPT		9.0	Slightly weathered, grey, coarse SANDSTONE; moderately strong. Losing carbonaceous particles			
100			for 25 mm									
						RC			Slightly weathered SILTSTONE interbedded with SANDSTONE, moderately strong.			
100												

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Strongly fractured from 5.0 to 5.3m bgl in SILTSTONE.. Piezo from 4.5 to 6.0m bgl.

Water	Shear Vane
▼ Standing Water Level	Corrected as per NZGS Guidelines
▽ Water Level At Time Of Drilling	Vane No.:
◁ In Flow ▷ Out Flow	UTP = Unable To Penetrate + = Peak Exceeded - = No Result

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KGA GEOTECHNICAL

HOLE DEPTH: 13.6m

Generated by GEROC Core-GS

MACHINE BOREHOLE LOG

HOLE NO.: MH23

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision

JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748519mE, 5949893mN (NZTM 2000)
DATUM: 32.04m ()
RIG: Tracked Rig **OPERATOR:** DCN Drilling

START DATE: 22/07/2015
END DATE: 22/07/2015
LOGGED BY: WM
CHECKED BY: WM

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
100	100		N=50 22, 28			RC			Slightly weathered SILTSTONE interbedded with SANDSTONE, moderately strong. 10.1m: 45 degree joint; undulating smooth.			
100	100		for 30 mm			SPT			Slightly weathered; grey; graded, bedded coarse SANDSTONE/fine grained CONGLOMERATE, strong. 10.6m - 10.8m: Two fractures, moderately widely spaced, very steeply inclined, planar smooth.			
100	100		N=50 30, 20			RC		11.0	Slightly weathered SILTSTONE interbedded with SANDSTONE, strong. Discrete carbonaceous particles throughout.		P ROCK	
100	100		for 25 mm			SPT		12.0	12.3m: very steeply inclined 75 degree joint; undulating rough. 12.5m: steeply inclined 45 degree joint; undulating smooth.			
100	100		N=50 28, 22			RC		13.0	13.1m: steeply inclined 55 degree joint; undulating rough.			
0			for 20 mm			SPT			EOH: 13.6m			
								14.0				
								15.0				
								16.0				
								17.0				
								18.0				
								19.0				

Notes & Abbreviations

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REMARKS

Strongly fractured from 5.0 to 5.3m bgl in SILTSTONE.. Piezo from 4.5 to 6.0m bgl.

Water	Shear Vane
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HOLE DEPTH: 13.6m

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MACHINE BOREHOLE LOG

HOLE NO.: MH24

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision

JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748774mE, 5950256mN (NZTM 2000)
DATUM: 18.02m ()
RIG: Tractor Mounted Rig **OPERATOR:** DCN Drilling

START DATE: 21/07/2015
END DATE: 21/07/2015
LOGGED BY: AS
CHECKED BY: WM

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
74			N=6 1, 0 1, 1 2, 2 for 75 mm		19/08/2015	RO			TOPSOIL. (TOPSOIL)		TS	
100									Clayey SILT; brown mottled red.Stiff; High plasticity. (COLLUVIUM)			
									0.6m - 0.7m: Topsoil.			
								1.0	No core recovered between 0.9 and 1.3m.			
100						ISPT			Clayey SILT; brown mottled red. Stiff; moist; high plasticity.		COLLUVIUM	
			N=0 1, 0 0, 0 0, 0 for 75 mm	13/1		RO		2.0	CLAY some fine sand; grey-orange.Very soft to soft; moist; high plasticity. (ALLUVIUM)			
74									2.4m: grey.			
									2.4m - 3.0m: oraganic bands.			
						ISPT		3.0	3.0m: soft to firm			
100						RO			3.6m - 3.7m: Fine grained sand.		ALLUVIUM	
									Clayey fine to medium SAND. Very soft to soft; moist; moderate plasticity.			
			N=3 1, 0 0, 1 1, 1 for 75 mm	11/1				4.0	4.0m - 4.5m: Sandy CLAY, soft, high plasticity.			
									4.3m - 5.1m: Sandy CLAY 4.3 to 5.1; sand is fine to medium grained.			
100						ISPT		5.0				
						RO			Fine sandy CLAY with minor organics; grey/black. Soft; high plasticity; organic material intermixed (woody fragments).			
81			N=50 31, 19						Fine sandy SILT. Stiff; moderate to high plasticity. Organic material intermixed.			
									No core recovered between 5.6 and 5.8m.			
100	100		for 15 mm			SPT		6.0	Slightly weathered; fine to medium SANDSTONE, moderately strong. (WAITEMATA GROUP ROCK)			
									6.6m - 6.9m: Highly weathered			
100	100		N=50 50			RC		7.0	6.9m: Joint, steeply inclined, undulating, smooth,			
									6.9m - 8.0m: Moderately weathered; grey; weak to moderately strong.			
100	100		for 50 mm						7.8m: 10mm SILT clasts between SILT/sandstone.			
								8.0	8.0m - 8.9m: Moderately weathered SILTSTONE; grey, moderately strong.			
100	100		N=50 50			RC						
								9.0	Moderately weathered to slightly weathered, grey, SILTSTONE, weak to moderately strong.			
100	100		for 50 mm						9.0m - 10.0m: Joint, sub-vertical, planar smooth. DB zone due to soft medium coarse sand interbedded between more competent silt/sandstone (laminated)			

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Water	Shear Vane
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HOLE DEPTH: 15.08m

Generated by GEROC Core-GS

Created: 29/10/2015 5:44:40 p.m.

MACHINE BOREHOLE LOG

HOLE NO.: MH24

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision

JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748774mE, 5950256mN (NZTM 2000)
DATUM: 18.02m ()
RIG: Tractor Mounted Rig **OPERATOR:** DCN Drilling

START DATE: 21/07/2015
END DATE: 21/07/2015
LOGGED BY: AS
CHECKED BY: WM

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
100	100		N=50 50			RC			Slightly weathered, dark grey-black, fine to medium SANDSTONE, strong. Minor calcareous inclusions.			
100	100		for 75 mm						10.0m - 10.5m: Joint, very steeply inclined, planar smooth. DB zone due to soft medium coarse sand interbedded between more competent silt/sandstone (laminated)			
80	80		N=50 50			RC		11.0	No core recovered between 11.6 and 12.0ml.			
			for 60 mm					12.0	Moderately weathered to slightly weathered, dark grey, SILTSTONE, weak to moderately strong.		WAITEMATA GROUP ROCK	
22	22		N=50 50			RC		13.0	No core recovered between 12.0 to 12.4m.			
			for 75 mm						Slightly weathered; dark grey; SILTSTONE/SANDSTONE; smooth undulating.			
66	66		N=50 41, 9			RC		14.0	13.9m: Slightly inclined; Joint; smooth undulating;			
								15.0	No core recovered between 14.4 to 15.0m.			
			for 5 mm						EOH: 15.08m			
								16.0				
								17.0				
								18.0				
								19.0				

Notes & Abbreviations

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REMARKS

Water	Shear Vane
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HOLE DEPTH: 15.08m

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Created: 29/10/2015 5:44:40 p.m.

MACHINE BOREHOLE LOG

HOLE NO.: MH25

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision

JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748824mE, 5950515mN (NZTM 2000)
DATUM: 46.23m ()
RIG: Tractor Mounted Rig **OPERATOR:** DCN Drilling

START DATE: 22/07/2015
END DATE: 23/07/2015
LOGGED BY: AS
CHECKED BY: WM

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
100	100					RO			TOPSOIL. (TOPSOIL)		TOP SOIL	
100	100			UTP/-		RO			Clayey SILT; brown, stiff to very stiff; moist; high plasticity. (COLLUVIUM)		COLLUVIUM	
100	100		N=5 1, 0 1, 1 1, 2 for 75 mm	70/38		RO		1.0	1.1m - 1.3m: Minor angular to subrounded. Sand is coarse to cobble sized.			
100	100					ISPT			1.3m: Brownish orange with minor dark horizons. Granular content increasing.			
100	100				19/08/2015	RO		2.0	SILT some fine to coarse sand, some clay, with some gravel; brownish orange, firm to stiff; moist, low plasticity. Gravel clasts up to 65mm, subrounded to rounded.			
100	100		N=5 1, 1 1, 1 1, 2 for 75 mm	74/27		ISPT		3.0				
100	100					RO		4.0	4.0m: Cobbles content increasing.			
100	100		N=7 1, 1 1, 1 2, 2 for 75 mm	57/11		ISPT						
100	100					RC		5.0				
100	100		N=9 1, 1 1, 2 3, 3 for 75 mm	94/40		ISPT		6.0	5.9m: stiff to very stiff. Clayey SILT; reddish orange; stiff to very stiff; moist; moderate plasticity.			
100	100					RC						
100	100		N=28 2, 4 5, 6 8, 9 for 75 mm	UTP/-		ISPT		7.0	Silty fine SAND. Greyish orange, medium dense to dense, moist. Laminations visible. (TRANSITIONAL WAITEMATA GROUP) 7.1m: Very weathered to weathered, grey.		TRANSITIONAL WAITEMATA GROUP	
100	100					RC		8.0	8.0m: Residual soil to completely weathered.			
50	100		N=10 7, 8 12, 12 16, 10 for 40 mm	UTP/-		ISPT		9.0	Moderately weathered, grey SILTSTONE, very weak (WAITEMATA GROUP ROCK) Moderately to slightly weathered grey fine to medium SANDSTONE, very weak No core recovered 8.6 to 9.0m. Moderately to slightly weathered; grey; fine to medium SANDSTONE, weak. (WAITEMATA GROUP ROCK) 9.6m: Drill breaks @ 9.6/9.77/9.9.		WGR	
100	100					RC						

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Water	Shear Vane
▼ Standing Water Level	Corrected as per NZGS Guidelines
▽ Water Level At Time Of Drilling	Vane No.:
◁ In Flow ▷ Out Flow	UTP = Unable To Penetrate + = Peak Exceeded - = No Result

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HOLE DEPTH: 21.1m

Generated by GEROC Core-GS

Created: 29/10/2015 5:44:40 p.m.

MACHINE BOREHOLE LOG

HOLE NO.: MH25

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision

JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748824mE, 5950515mN (NZTM 2000)
DATUM: 46.23m ()
RIG: Tractor Mounted Rig **OPERATOR:** DCN Drilling

START DATE: 22/07/2015
END DATE: 23/07/2015
LOGGED BY: AS
CHECKED BY: WM

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
100	100		N=50 13, 37 for 40 mm			RC			Moderately to slightly weathered; grey; fine to medium SANDSTONE, weak. (WAITEMATA GROUP ROCK)			
						SPT			10.0m - 10.5m: Drill break.			
									10.5m: Drill breaks. 10.5 to 10.73, 10.8 to 10.81, 10.95/11.17/11.2/11.3 to 11.45/11.66/11.8.			
100	90					RC		11.0	11.1m: 100mm SILTSTONE band			
			N=50 33, 17 for 20 mm						11.5m - 11.6m: Zone of highly weathered SANDSTONE, very weak.			
					19/08/2015				No core recovered 11.9 to 12.0m.			
						SPT		12.0	Moderately to slightly weathered; grey; fine to medium SANDSTONE, weak (WAITEMATA GROUP ROCK)			
100	100					RC			12.1m: Drill break. 12.14 to 12.21, 12.61,12.7,12.78 to 12.5.			
									12.4m - 12.7m: Carbonaceous laminations present.			
			N=50 50 for 75 mm					13.0	13.0m: Moderately weathered; grey; SANDSTONE; weak. sand is fine to medium.			
						SPT						
100	100					RC		14.0	14.0m: Fracture, very steep, planar smooth			
									14.5m: Returns to laminated SILTSTONE/SANDSTONE.			
			N=50 50 for 65 mm						14.5m - 15.0m: Drill breaks 14.5 to 15.0 every 100mm.			
						SPT		15.0	15.2m: Drill breaks 15.2/15.22/15.44.			
100	100					RC			Interbedded/ Laminated SILTSTONE and SANDSTONE. Slightly weathered to moderately weathered; grey; SILTSTONE; strong. Weathered to completely weathered; SANDSTONE.			
								16.0	16.0m: Change from thinly laminated to laminated.			
			N=45 14, 12 10, 7 7, 9 for 75 mm			ISPT						
100	100					RC		17.0	Extremely weathered grey SANDSTONE; thin to moderately bedded, extremely weak to very weak.			
									17.0m - 17.7m: Drill induced fracture zone.			
			N=50 50 for 40 mm			SPT			Grey; Laminated; SILTSTONE/SANDSTONE; strong to very strong.			
									17.8m: Steeply inclined joint; rough undulating.			
100	100					RC		18.0	18.4m - 18.5m: Drill break zone. 18.4 to 18.5,18.8,18.81,18.7,18.3,18.84.			
									19.1m: Drill breaks. 19.1/19.24/19.62.			
			N=50 50 for 60 mm			SPT		19.0	Slightly weathered, fine SANDSTONE; Very weak to weak.			
									19.4m: Drill breaks. 19.35 to 19.5.			
100						RC			19.7m: 200mm SILTSTONE			

WAITEMATA GROUP ROCK

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Water	Shear Vane
Standing Water Level	Corrected as per NZGS Guidelines
Water Level At Time Of Drilling	Vane No.:
In Flow / Out Flow	UTP = Unable To Penetrate + = Peak Exceeded - = No Result

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HOLE DEPTH: 21.1m

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Created: 29/10/2015 5:44:40 p.m.

MACHINE BOREHOLE LOG

HOLE NO.: MH25

CLIENT: Orewa West Investments Limited
PROJECT: Proposed Subdivision

JOB NO.: 7464

SITE LOCATION: Grand View Estate, Orewa
CO-ORDINATES: 1748824mE, 5950515mN (NZTM 2000)
DATUM: 46.23m ()
RIG: Tractor Mounted Rig **OPERATOR:** DCN Drilling

START DATE: 22/07/2015
END DATE: 23/07/2015
LOGGED BY: AS
CHECKED BY: WM

TCR (%)	RQD (%)	Fracture Spacing (min/av/max)	SPT	Vane Shear Strength (kPa)	Ground Water	Method	Sample	Depth	Description	Graphic Log	Geological Unit	Installation
100			N=50 18, 32			RC SPT		21.0	Grey; Laminated; SILTSTONE/SANDSTONE; strong to very strong. 20.1m - 20.3m: Drill break 20.13 to 20.3. 20.5m - 21.0m: Drill breaks. 20.5/20.7/20.79 20.6m - 20.7m: Drill breaks. 20.61 to 20.7 (along laminations) Slightly weathered; coarse SANDSTONE; Strong.		WAITEMATA GROUP ROCK	
			for 30 mm						EOH: 21.1m			

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

REMARKS

Water	Shear Vane
Standing Water Level	Corrected as per NZGS Guidelines
Water Level At Time Of Drilling	Vane No.:
In Flow / Out Flow	UTP = Unable To Penetrate + = Peak Exceeded - = No Result

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HOLE DEPTH: 21.1m

Generated by GEROC Core-GS

Created: 29/10/2015 5:44:40 p.m.

HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH01**
Date:	23/08/2013
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748689.0, N 5949699.0 **Ground Level:** 29.31

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit
0.0	29.11	Topsoil. [TOPSOIL]		TS
		Clayey SILT. Orange mottled light grey, stiff, moist, moderately plastic. [ALLUVIUM]		
0.5	28.61	Silty CLAY. Light grey mottled orange, stiff, moist, moderate to highly plastic. [ALLUVIUM]		
1.0	28.21	Clayey SILT. Light grey streaked orange, stiff, moist, moderately plastic. With occasional intermixed wood. (<5mm). [ALLUVIUM]	10/09/2015	
1.5		1.5m - 1.7m: Becomes grey with occasional black staining. (organic odour)	23/08/2013	
		1.7m - 2.1m: Becomes dark grey.		
2.0		2.1m - 2.4m: Becomes orange mottled light grey.		ALL
2.5	26.61	SILT minor to trace of clay. Dark grey, very stiff, wet, no to low plasticity. [ALLUVIUM]		
3.0				
3.5		3.5m: Becomes wet to saturated with trace of clay and fine to medium sand.		
	25.51	3.6m: No to poor recovery.		
	25.31	SILT some clay. Dark grey, very stiff, moist to wet, low to moderately plastic, poor sample recovery.		
4.0		4.0m: Hole collapsing no recovery.		
4.5				
5.0				

Graphic Log

Vane Shear Strength (kPa) (refer notes for details)

50 100 150 200

Values
99
49
49
20
56
30
70
30
151
63
88
43
108
39
85
43

Scala Penetrometer (blows / 50mm)

Depth (m)	Blows
4.05	1.0
4.10	1.0
4.15	1.0
4.20	1.0
4.25	1.0
4.30	1.0
4.35	1.0
4.40	2.0
4.45	1.0
4.50	2.0
4.55	1.0
4.60	1.0
4.65	1.0
4.70	1.0
4.75	1.0
4.80	2.0
4.85	2.0
4.90	1.0
4.95	3.0
5.00	3.0
5.05	4.0
5.10	5.0
5.15	5.0
5.20	3.0
5.25	4.0
5.30	3.0
5.35	3.0
5.40	3.0
5.45	4.0
5.50	3.0
5.55	4.0
5.60	3.0
5.65	4.0
5.70	4.0
5.75	4.0
5.80	3.0
5.85	4.0
5.90	4.0

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- Standing Water Level
- Water Level At Time Of Drilling
- Out Flow / In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Bottom of Moderate Slope (By Spring), Field

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH02**
Date:	23/08/2013
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748684.0, N 5949729.0 **Ground Level:** 36.8

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
0	36.6	Topsoil. [TOPSOIL]	Groundwater Not Encountered	TS	TS			5.05	0.5
								5.10	0.5
								5.15	0.5
								5.20	0.5
	36.3	Clayey SILT. Orange mottled light grey, stiff, moist, moderately plastic. [WAITEMATA GROUP SOILS]						5.25	0.5
0.5		Silty CLAY. Orange, stiff, moist, highly plastic. [WAITEMATA GROUP SOILS]					99 49	5.30	0.5
								5.35	1.0
								5.40	1.0
								5.45	1.0
								5.50	1.0
1.0							108 53	5.55	1.0
								5.60	1.0
	35.6							5.65	1.0
		Clayey SILT. Pink, very stiff, moist, moderately plastic. [WAITEMATA GROUP SOILS]						5.70	2.0
	35.4							5.75	1.0
		SILT some clay. Pink speckled light grey, very stiff, moist, low to moderately plastic. With occaional to frequent intermixed cemented white clasts (<2mm). [WAITEMATA GROUP SOILS]						5.80	2.0
1.5		1.5m: Becomes stiff.					85 49	5.85	1.0
		1.7m - 2.0m: Common intermixed cemented clasts (<2mm).						5.90	2.0
								5.95	2.0
								6.00	2.0
								6.05	2.0
2.0		2.0m - 2.2m: Fine angular gravel and fine to medium sand sized intermixed dark orange					66 36	6.10	3.0
								6.15	3.0
								6.20	3.0
	34.4							6.25	5.0
								6.30	6.0
2.5		SILT minor clay. Orange speckled pink, stiff, moist, low plasticity. With occasional intermixed cemented clasts (<2mm). [WAITEMATA GROUP SOILS]		WGS			124 53	6.35	3.0
	34.1	2.5m: Becomes very stiff.						6.40	3.0
		SILT some clay. Orange mottled pink, light grey and dark orange, very stiff, moist, low to moderately plastic. [WAITEMATA GROUP SOILS]						6.45	3.0
								6.50	3.0
								6.55	3.0
3.0		2.8m - 3.0m: Becomes pink mottled orange and light grey.					96 20	6.60	2.0
		3.0m - 3.3m: Becomes light pink mottled orange and light grey. Becomes stiff.						6.65	3.0
		3.2m - 3.8m: Pink speckled orange with trace of clay and frequent cemented clasts (<2mm).						6.70	3.0
								6.75	3.0
								6.80	4.0
								6.85	4.0
3.5							82 39	6.90	3.0
		3.8m - 4.6m: Becomes pink mottled light grey.							
4.0		4.0m: Trace of fine sand.					99 33		
4.5							93 39		
	32.2								
		SILT minor fine to medium sand with trace clay. Pink mottled light grey and orange, stiff, moist to wet, no plasticity. [WAITEMATA GROUP SOILS]							
	31.8								
5.0		5.0m: End of borehole					118 43		

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- Standing Water Level
- Water Level At Time Of Drilling
- Out Flow / In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Steep Slope, Field

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH03**
Date:	3/09/2013
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748430.0, N 5949751.0 **Ground Level:** 57.99

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
0.0	57.79	Topsoil. [TOPSOIL]		TS	TS			5.05	1.0
		Clayey SILT. Orange, very stiff, moist, moderately plastic. [WAITEMATA GROUP SOILS] [WAITEMATA GROUP SOILS]						5.10	1.0
								5.15	1.0
								5.20	2.0
0.5							140	5.25	1.0
							56	5.30	2.0
								5.35	6.0
								5.40	6.0
	57.09							5.45	3.0
1.0		SILT some clay. Light grey streaked orange, very stiff, moist, low to moderately plastic. [WAITEMATA GROUP SOILS]						5.50	4.0
							114	5.55	4.0
							36	5.60	4.0
								5.65	5.0
		1.3m - 1.8m: Occasional intermixed dark orange fine to coarse sand sized limonite.						5.70	6.0
								5.75	10.0
1.5							124	5.80	10.0
							30	5.85	10.0
								5.90	10.0
		1.8m - 2.1m: Occasional intermixed dark orange fine angular gravel sized limonite.						5.95	11.0
2.0							130	6.00	10.0
		2.1m - 3.2m: Frequent intermixed dark orange/black fine to coarse sand sized and fine angular gravel sized limonite.					39		
2.5							157		
							39		
				WAITEMATA GROUP SOILS					
3.0							202+		
		3.2m - 3.9m: Occasional intermixed dark orange fine to coarse sand sized limonite.							
3.5							170		
							43		
4.0		3.9m - 4.0m: Lense of dark orange fine to coarse sand sized and fine angular gravel sized limonite.					UTP		
		4.2m - 5.0m: Frequent intermixed dark orange/black fine to coarse sand sized and fine angular gravel sized limonite.	03/09/2013						
4.5							UTP		
			10/09/2013						
5.0	52.99	5.0m: End of Borehole					202+		

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- Standing Water Level
- Water Level At Time Of Drilling
- Out Flow / In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Moderate Slope, Field

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH04**
Date:	3/09/2013
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748461.0, N 5949778.0 **Ground Level:** 44.5

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
0.0	44.3	TOPSOIL [TOPSOIL]		TS	TS			4.05	2.0
	44.1	SILT some clay. Orange mottled light grey with brown staining, stiff, moist, low to moderately plastic. [COLLUVIUM] [COLLUVIUM]						4.10	3.0
0.5		Silty CLAY. Orange mottled light grey, very stiff, moist, highly plastic. [COLLUVIUM]					99	4.15	3.0
							43	4.20	2.0
								4.25	3.0
								4.30	3.0
								4.35	3.0
								4.40	4.0
								4.45	4.0
								4.50	5.0
1.0	43.5	SILT some clay. Light grey mottled orange, stiff, moist, low to moderately plastic. With occasional fine to coarse sand sized and fine angular gravel sized intermixed dark orange limonite. [COLLUVIUM]					63	4.55	4.0
							20	4.60	4.0
								4.65	6.0
								4.70	6.0
								4.75	7.0
		1.4m - 1.4m: Frequent intermixed dark orange fine to coarse sand sized and fine angular gravel sized limonite.	10/09/2013				114	4.80	8.0
1.5							33	4.85	8.0
		1.7m: Becomes light grey with no limonite.	03/08/2013					4.90	8.0
								4.95	7.0
								5.00	8.0
		1.9m - 2.1m: Minor fine to medium sand inclusion.						5.05	9.0
2.0							111	5.10	7.0
		2.1m - 2.6m: Clayey inclusions and occasional intermixed dark orange/black fine to coarse sand sized limonite.		COL			30	5.15	8.0
								5.20	7.0
								5.25	8.0
								5.30	5.0
2.5							143	5.35	5.0
	41.9						46	5.40	5.0
		Clayey SILT. Light grey streaked orange, very stiff, moist, moderately plastic. With occasional intermixed dark orange/black fine to coarse sand sized limonite. [COLLUVIUM]						5.45	6.0
								5.50	5.0
								5.55	6.0
								5.60	6.0
3.0							185	5.65	6.0
							39	5.70	6.0
								5.75	6.0
								5.80	7.0
								5.85	6.0
3.5		3.4m: Dark grey.					202+	5.90	8.0
		3.5m: Very stiff to hard.							
		3.6m - 3.8m: Occasional intermixed dark orange limonite staining.							
		3.8m: Grey.							
4.0	40.5						157		
		4.0m: Hole collapsing, end of borehole.					43		
4.5									
5.0									

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water	Shear Vane	Other Comments
▼ Standing Water Level	Corrected as per NZGS Guidelines	Moderate Slope, Field
▽ Water Level At Time Of Drilling	Vane No.:	
◁ Out Flow ▷ In Flow	UTP = Unable To Penetrate	
	+ = Peak Exceeded	
	- = No Result	

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH05**
Date:	28/08/2013
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748353.0, N 5949879.0 **Ground Level:** 53.22

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
		TOPSOIL [TOPSOIL]		TS	TS			5.05	1.0
	53.02							5.10	1.0
		Clayey SILT. Light grey mottled orange, very stiff, moist, moderately plastic. [COLLUVIUM] [COLLUVIUM]						5.15	0.5
								5.20	0.5
								5.25	1.0
0.5							133	5.30	2.0
							56	5.35	1.0
	52.52							5.40	1.0
		Silty CLAY. Orange mottled light grey, very stiff, moist, highly plastic. [COLLUVIUM]						5.45	2.0
								5.50	2.0
1.0		1.0m - 1.0m: Between 1.0 and 1.6m; becomes light grey streaked orange.					114	5.55	2.0
							56	5.60	3.0
								5.65	2.0
								5.70	3.0
								5.75	2.0
1.5		1.6m - 1.8m: Becomes light grey streaked orange with light brown staining and occasional intermixed cemented clasts (<2mm).					93	5.80	3.0
							56	5.85	3.0
	51.42							5.90	4.0
		Clayey SILT. Light grey streaked orange, stiff, moist, moderately plastic. With occasional intermixed cemented clasts (<2mm). [COLLUVIUM]						5.95	5.0
	51.22							6.00	6.0
								6.05	8.0
2.0							85	6.10	9.0
		Silty CLAY. Light grey mottled orange, stiff, moist, highly plastic. [COLLUVIUM]					46	6.15	10.0
								6.20	10.0
								6.25	10.0
								6.30	10.0
2.5	50.72						114	6.35	11.0
		Clayey SILT. Orange mottled light grey, very stiff, moist, moderately plastic. With occasional intermixed fine to medium sand sized dark orange limonite and staining. [COLLUVIUM]					33	6.40	11.0
	50.52								
		SILT some clay. Light grey mottled orange, very stiff, moist, low to moderately plastic. [COLLUVIUM]	28/08/2013 10/09/2013	COL					
3.0							202+		
	50.02						-		
		Clayey SILT. Light grey mottled orange, very stiff to hard, moist, moderately plastic. With occasional intermixed fine angular gravel sized dark orange limonite. [COLLUVIUM]							
3.5		3.5m - 3.5m: Frequent intermixed fine angular gravel sized dark orange limonite.					202+		
	49.52						-		
		SILT some clay. Light grey streaked orange, very stiff, moist, low to moderately plastic. [COLLUVIUM]							
4.0							175		
							53		
	48.92								
		Clayey SILT. Light grey streaked orange, very stiff, moist, moderately plastic. With occasional intermixed fine angular gravel and fine to medium sand sized limonite. [COLLUVIUM]							
4.5							143		
							33		
	48.22						99		
5.0		5.0m: End of Borehole					39		

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- Standing Water Level
- Water Level At Time Of Drilling
- Out Flow / In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Flat, Field

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH06**
Date:	27/08/2013
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748319.0, N 5949851.0 **Ground Level:** 44.19

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values
0.0	43.89	TOPSOIL [TOPSOIL]		TS	TS TS		
0.5	43.69	SILT some clay. Light grey mottled orange, very stiff, moist, low to moderately plastic. [COLLUVIUM]					157 56
		Clayey SILT. Light grey streaked orange, very stiff, moist, moderately plastic. [COLLUVIUM] 0.6m: Surface groundwater encountered.					
1.0	42.99	Silty CLAY. Light grey mottled orange, very stiff, moist, highly plastic. [COLLUVIUM]	10/09/2013				187 82
1.5							102 49
2.0		2.0m: Becomes stiff.					99 56
2.5				COL			85 49
3.0							73 46
3.5	40.69	Clayey SILT. Orange mottled light grey, stiff, moist to wet, moderately plastic. [COLLUVIUM]					53 30
4.0	40.29	SILT some clay. Grey, stiff, moist, low to moderately plastic. [COLLUVIUM]					70 33
4.5	39.99	Silty CLAY. Grey steraked orange, stiff, moist to wet, highly plastic. With occasional wood fragments (<5mm). [COLLUVIUM]					96 39
5.0	39.39	Clayey SILT. Grey streaked orange, very stiff, moist to wet, moderately plastic. With occasional intermixed fine to medium sand sized dark orange limonite.					202+
	39.19	5.0m: End of Borehole					

Scala Penetrometer (blows / 50mm)	
Depth (m)	Blows
5.05	1.0
5.10	2.0
5.15	2.0
5.20	3.0
5.25	3.0
5.30	3.0
5.35	6.0
5.40	7.0
5.45	10.0
5.50	11.0
5.55	12.0
5.60	16.0
5.65	25.0

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water	Shear Vane	Other Comments
▼ Standing Water Level	Corrected as per NZGS Guidelines	Gentle Slope, Field
▽ Water Level At Time Of Drilling	Vane No.:	
◁ Out Flow ▷ In Flow	UTP = Unable To Penetrate	
	+ = Peak Exceeded	
	- = No Result	

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH07**
Date:	27/08/2013
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748219.0, N 5949757.0 **Ground Level:** 30.51

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log
0.0		SILT some clay with minor topsoil. Orange mottled brown and light grey, stiff, moist to wet, low to moderately plastic. [FILL]		FILL	
		0.3m: Topsoil inclusions.	13/08/2015		
0.5	29.71	Clayey SILT. Light grey mottled orange, stiff, moist, moderately plastic. [ALLUVIUM]			
1.0	29.31	Silty CLAY. Light grey streaked orange, stiff, moist, highly plastic. [ALLUVIUM]		ALL	
	29.11	Clayey SILT. Grey streaked orange, stiff, moist to wet, moderately plastic. With occasional intermixed minor organics (<5mm). [ALLUVIUM]			
1.5	28.81	SILT some clay with minor to trace of fine sand. Light bluish grey, stiff, moist to wet, low to moderately plastic. [ALLUVIUM]			
2.0	28.41	2.0m: Becomes grey and very stiff.	27/08/2013		
		Clayey SILT. Dark grey, very stiff, moist, moderately plastic. [TRANSITIONAL WAITEMATA GROUP]		TRANS WG	
2.5	28.01	SILT some clay. Dark grey, very stiff, moist, low to moderately plastic. [TRANSITIONAL WAITEMATA GROUP]			
	27.81	Clayey SILT. Dark grey, very stiff to hard, moist, moderately plastic. [TRANSITIONAL WAITEMATA GROUP]			
3.0	27.51	3.0m: Unable to penetrate.			
3.5					
4.0					
4.5					
5.0					

Vane Shear Strength (kPa) (refer notes for details)

50	100	150	200	Values
				53
				17
				85
				33
				49
				23
				157
				59
				202
				-
				UTP
				-

Scala Penetrometer (blows / 50mm)

Depth (m)	Blows
3.05	6.0
3.10	7.0
3.15	10.0
3.20	10.0
3.25	8.0
3.30	7.0
3.35	5.0
3.40	6.0
3.45	7.0
3.50	8.0
3.55	10.0
3.60	10.0
3.65	9.0
3.70	9.0
3.75	25.0

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Gentle Slope, Field

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH08**
Date:	27/08/2013
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1747984.0, N 5949927.0 **Ground Level:** 78.12

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit
0.0	78.02	Topsoil. [TOPSOIL]		TS
		Clayey SILT. Orange mottled light grey/grey, very stiff, moist, moderately plastic. [COLLUVIUM]		COL
0.5	77.62	Clayey SILT. Orange mottled light grey, very stiff, moist, moderately plastic. [WAITEMATA GROUP SOILS]		WAITEMATA GROUP SOILS
		0.7m - 1.2m: Occasional intermixed fine to medium angular gravel sized limonite.		
1.0	76.92	SILT minor clay. Light grey mottled orange, very stiff, moist, low to moderately plastic. [WAITEMATA GROUP SOILS]		
1.5		1.4m - 1.8m: Occasional to frequent fine to medium sand sized intermixed dark orange		
		1.8m - 2.2m: Minor fine sand inclusions.		
2.0		2.2m - 2.3m: Frequent intermixed dark orange/black fine to medium angular gravel sized limonite with some clay inclusion.		
	75.82	SILT some fine sand. Orange mottled light grey, very stiff to hard, moist, no plasticity. With frequent dark orange fine to coarse sand sized dark orange limonite. [WAITEMATA GROUP SOILS]		
2.5		2.8m - 3.0m: Occasional intermixed cemented clasts (<2mm) and becomes orange speackled light grey. (granular)		
3.0	75.02	SILT some clay. Light grey mottled orange, very stiff, moist to wet, low to moderately plastic. With occasioanl intermixed dark orange and black limonite staining. [WAITEMATA GROUP SOILS]		
3.5		3.3m - 4.1m: Some fine to coarse sand inclusions.		
4.0	74.02	Clayey SILT. Light grey streaked orange, very stiff to hard, moist, moderately plastic. [WAITEMATA GROUP SOILS]		
4.5		4.5m - 5.0m: Occasional to frequent fine to coarse sand sized and fine angular gravel sized intermixed dark orange limonite.	10/09/2013	
5.0	73.12	5.0m: End of Borehole		

Vane Shear Strength (kPa) (refer notes for details)

Values
85
33
146
70
202+
-
157
46
143
46
151
33
202+
-
202+
-
202+
-
202+
-

Scala Penetrometer (blows / 50mm)

Depth (m)	Blows
5.05	3.0
5.10	3.0
5.15	5.0
5.20	5.0
5.25	5.0
5.30	6.0
5.35	7.0
5.40	7.0
5.45	6.0
5.50	7.0
5.55	5.0
5.60	6.0
5.65	7.0
5.70	8.0
5.75	8.0
5.80	8.0
5.85	8.0
5.90	9.0
5.95	8.0
6.00	10.0
6.05	10.0
6.10	11.0
6.15	11.0
6.20	11.0
6.25	12.0

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water	Shear Vane	Other Comments
▼ Standing Water Level	Corrected as per NZGS Guidelines	Steep Slope, Field
▽ Water Level At Time Of Drilling	Vane No.:	
◁ Out Flow ▷ In Flow	UTP = Unable To Penetrate	
	+ = Peak Exceeded	
	- = No Result	

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Job No.:	**7464**
Hole No.:	**AH09**
Date:	30/08/2013
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748018.0, N 5949922.0 **Ground Level:** 64.31

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
0	64.21	Topsoil. [TOPSOIL]		TS				5.05	1.0
		SILT some clay with minor topsoil. Orange mottled brown, dark grey and light grey, very stiff, moist, low to moderately plastic. [COLLUVIUM]						5.10	1.0
	63.91							5.15	1.0
		Clayey SILT. Orange mottled light grey, very stiff, moist, moderately plastic. [COLLUVIUM]						5.20	1.0
0.5							102	5.25	2.0
							56	5.30	2.0
	63.51							5.35	2.0
		Silty CLAY. Light grey mottled orange, very stiff, moist, highly plastic. [COLLUVIUM]						5.40	2.0
								5.45	2.0
1.0								5.50	3.0
							128	5.55	3.0
		1.1m - 2.0m: Occasional intermixed dark orange fine to medium sand sized limonite.					33	5.60	3.0
								5.65	3.0
								5.70	3.0
1.5								5.75	3.0
							102	5.80	3.0
							53	5.85	5.0
								5.90	6.0
								5.95	4.0
	62.31							6.00	5.0
2.0								6.05	4.0
		Clayey SILT. Light grey mottled orange, very stiff, moist, moderately plastic. With occasional to frequent intermixed fine to medium angular gravel sized and fine to medium sand sized dark orange limonite. [COLLUVIUM]					118	6.10	5.0
							46	6.15	4.0
		2.4m - 2.8m: Frequent to common limonite						6.20	4.0
								6.25	3.0
2.5								6.30	2.0
							114	6.35	4.0
				COL			49	6.40	4.0
								6.45	5.0
	61.51		▽ 10/09/2013 30/08/2013					6.50	6.0
3.0		SILT some clay. Light grey streaked orange, very stiff, moist, low to moderately plastic. With occasional fine to medium sand sized intermixed dark orange limonite. [COLLUVIUM]						6.55	5.0
							143	6.60	5.0
		3.0m - 3.1m: Lense of fine to coarse sand sized limonite.					49	6.65	4.0
								6.70	5.0
								6.75	5.0
3.5								6.80	5.0
								6.85	4.0
							140	6.90	5.0
		3.6m: Minor fine to medium sand inclusion.					43		
	60.51								
4.0		Clayey SILT. Light grey streaked orange, very stiff, moist, moderately plastic. With occasional to frequent intermixed dark orange fine to coarse sand sized limonite. [COLLUVIUM]					130		
	60.11	4.0m: Pockets of fine to medium sand, moist to					39		
		SILT with some fine to medium sand. Light grey mottled orange, very stiff, wet, no plasticity. With occasional intermixed dark orange fine to coarse sand sized limonite. [COLLUVIUM]							
4.5							143		
		4.4m: Becomes orange speckled light grey.					53		
	59.61								
		Clayey SILT. Light grey streaked dark orange, very stiff, moist, moderately plastic. [COLLUVIUM]							
	59.31						187		
5.0		5.0m: End of Borehole					46		

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Moderate Slope, Field

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH10**
Date:	27/08/2013
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748166.0, N 5950027.0 **Ground Level:** 59.75

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values
0	59.65	TOPSOIL [TOPSOIL]		TS			
	59.45	Clayey SILT. Orange, mottled grey/dark grey and light grey, very stiff, moist, moderately plastic. Occasional topsoil intermixed. [COLLUVIUM]					
0.5		Clayey SILT. Orange, mottled light grey, very stiff, moist, moderately plastic [COLLUVIUM]					102 49
1.0		1.0m: Stiff 1.1m: Speckled light grey, mottled orange. Occasional clayey inclusions					56 33
1.5	58.15	1.4m: Occasional dark orange fine to medium limonite sand and fine limonite gravel intermixed	▽ 27/08/2013 ▼ 10/09/2013				56 30
2.0		SILT, some clay. Orange, mottled light grey, stiff, moist, low to moderately plastic. Occasional fine to medium dark orange limonite sand and loosely cemented white clasts intermixed [COLLUVIUM] 1.8m: Frequent grey/white loosely cemented sand sized clasts intermixed 2.0m: Grey, streaked orange. Occasional clayey inclusions		COL			70 30
	57.45	Clayey SILT. Grey, streaked orange, very stiff, moist, moderately plastic [COLLUVIUM]					
2.5							82 43
	56.85	SILT, some clay. Grey, streaked orange, stiff, moist to wet, slight to moderately plastic. Occasional loosely cemented sand sized clasts intermixed [COLLUVIUM]					
3.0	56.55	SILT, some fine to medium sand, minor clay. Grey, mottled dark orange, stiff, wet, slight plasticity [COLLUVIUM]					79 30
3.5							85 49
	55.95	SILT, some clay. Dark grey, stiff, moist, slight to moderately plastic [COLLUVIUM]					
4.0	55.75	Clayey SILT. Dark grey, very stiff, moist, moderately plastic [COLLUVIUM]					108 49
	55.55	4.2m: Hole collapsing					
4.5							
5.0							

Scala Penetrometer (blows / 50mm)		
	Depth (m)	Blows
	4.15	2.0
	4.20	3.0
	4.25	3.0
	4.30	7.0
	4.35	8.0
	4.40	11.0
	4.45	11.0
	4.50	25.0

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Gently sloping

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH11**
Date:	30/08/2013
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1747996.0, N 5950224.0 **Ground Level:** 66.52

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log
0.0	66.42	Topsoil. [TOPSOIL]		TS	
		Clayey SILT. Orange mottled light and dark grey, very stiff, moist, moderately plastic. [COLLUVIUM]			
0.5	66.02	Silty CLAY. Orange mottled dark and light grey, very stiff, moist, highly plastic. [COLLUVIUM]	10/09/2013		
	65.82	Clayey SILT. Orange mottled light grey, very stiff, moist, moderately plastic. [COLLUVIUM]			
1.0	65.52	Silty CLAY. Orange streaked light grey, very stiff, moist, highly plastic. [COLLUVIUM]			
	65.32	SILT some clay. Orange, very stiff, moist, low to moderately plastic. With occasional plant fibers. [COLLUVIUM]			
1.5		1.4m - 1.7m: Becomes orange mottled light grey.			
		1.7m - 2.0m: Becomes light grey streaked orange with occasional intermixed loosely cemented SILT (<5mm).			
2.0		2.0m - 2.2m: Occasional to frequent intermixed fine to medium sand sized dark orange limonite.	30/08/2013	COL	
	64.32	SILT with some fine to medium sand. Orange speckled light grey, very stiff, wet, no plasticity. [COLLUVIUM]			
2.5		2.5m: Becomes very stiff to hard.			
	63.82	Clayey SILT with pockets of fine to coarse sand. Light grey mottled orange and dark orange, very stiff, moist to wet, moderately plastic. With intermixed dark orange limonite staining. [COLLUVIUM]			
	63.62	Clayey SILT. Dark grey, very stiff, moist, moderately plastic. [COLLUVIUM]			
3.0		3.4m: Becomes grey with pockets of red/orange fine to coarse sand.			
3.5		3.5m: Becomes stiff.			
		3.6m: Dark orange/red fine to coarse sand inclusions, and becomes wet.			
	62.72	SILT some clay. Light grey streaked orange, stiff, moist, low to moderately plastic. [WAITEMATA GROUP SOILS]			
4.0	62.32	Clayey SILT. Light grey, very stiff, moist, moderately plastic. [WAITEMATA GROUP SOILS]		WGS	
4.5		4.5m: Becomes very stiff to hard.			
5.0	61.52	5.0m: End of Borehole			

Vane Shear Strength (kPa) (refer notes for details)

50	100	150	200	Values
				135
				23
				111
				53
				114
				33
				146
				27
				202+
				-
				202+
				-
				73
				33
				114
				49
				202+
				-
				202+
				-

Scala Penetrometer (blows / 50mm)

Depth (m)	Blows
5.05	2.0
5.10	2.0
5.15	2.0
5.20	2.0
5.25	2.0
5.30	3.0
5.35	4.0
5.40	5.0
5.45	5.0
5.50	5.0
5.55	6.0
5.60	6.0
5.65	7.0
5.70	8.0
5.75	7.0
5.80	8.0
5.85	6.0
5.90	7.0
5.95	10.0
6.00	11.0
6.05	10.0
6.10	10.0
6.15	7.0
6.20	8.0
6.25	8.0
6.30	9.0
6.35	10.0
6.40	10.0
6.45	10.0
6.50	11.0
6.55	11.0
6.60	11.0

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- Standing Water Level
- Water Level At Time Of Drilling
- Out Flow / In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Gentle Slope, Field

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH12**
Date:	27/08/2013
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748316.0, N 5950122.0 **Ground Level:** 60.35

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
0	60.25	TOPSOIL [TOPSOIL]		TS				4.05	3.0
		Silty CLAY. Orange, mottled light grey and brown, stiff, moist, highly plastic. Occasional topsoil intermixed. [COLLUVIUM]						4.10	3.0
	59.95							4.15	4.0
		Silty CLAY. Orange, stiff, moist, highly plastic [COLLUVIUM]					49	4.20	3.0
0.5	59.75						13	4.25	3.0
		Clayey SILT. Orange, mottled light grey, stiff, moist, moderately plastic. Occasional loosely cemented sand sized clasts intermixed [COLLUVIUM]						4.30	3.0
								4.35	4.0
								4.40	12.0
	59.35							4.45	15.0
1.0		SILT, some clay. Orange, mottled light grey, stiff, moist to wet, low to moderately plastic. Frequent white and dark grey cmeneted clasts intermixed [COLLUVIUM]					53	4.50	25.0
							27		
			10/09/2013						
		1.3m: Pink, speckled light grey and orange							
1.5							56		
							46		
		1.7m: No clasts							
	58.45		27/08/2013						
2.0		Clayey SILT. Light grey, streaked orange, stiff, moist, moderate plasticity. [WAITEMATA GROUP SOILS]		COL			70		
							46		
	57.95								
2.5		SILT, minor clay, minor fine sand. Dark grey, streaked orange, stiff, moist, low plasticity [WAITEMATA GROUP SOILS]					130		
	57.65	2.5m: Very stiff					39		
		Fine to medium sandy SILT. Dark grey, mottled orange, very stiff, wet, no plasticity [WAITEMATA GROUP SOILS]							
3.0							102		
							33		
		3.3m: Dark grey							
3.5		3.5m: Frequent loosely cemented sand sized clasts intermixed					102		
							30		
4.0	56.35			WAITEMATA GROUP SOILS			UTP		
		4.0m: End of Borehole							
4.5									
5.0									

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Gently sloping

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH13**
Date:	26/08/2013
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748389.0, N 5950087.0 **Ground Level:** 55.32

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
0	55.12	TOPSOIL [TOPSOIL]	Groundwater Not Encountered	TS	TS			5.05	1.0
		Silty CLAY. Orange, stained light brown, very stiff, moist, highly plastic. [WAITEMATA GROUP SOILS]						5.10	0.5
								5.15	0.5
								5.20	1.0
								5.25	1.0
0.5		0.5m: Orange					130	5.30	1.0
							53	5.35	1.0
								5.40	1.0
		0.8m: Orange, streaked pink, mottled light grey						5.45	2.0
								5.50	2.0
1.0							140	5.55	2.0
							73	5.60	2.0
								5.65	2.0
		1.2m: Orange, mottled light grey. Occasional fine angular gravel intermixed						5.70	2.0
								5.75	3.0
1.5							140	5.80	2.0
							73	5.85	3.0
								5.90	3.0
								5.95	4.0
								6.00	4.0
								6.05	4.0
2.0							130	6.10	4.0
							73	6.15	4.0
	53.12							6.20	4.0
		Clayey SILT. Orange, mottled light grey, very stiff, moist, moderately plastic [WAITEMATA GROUP SOILS]						6.25	4.0
								6.30	3.0
2.5							111	6.35	4.0
							53	6.40	3.0
	52.62							6.45	4.0
		SILT, minor clay. Orange, mottled light grey, very stiff, moist, low plasticity. Occasional sand sized cemented clasts intermixed [WAITEMATA GROUP SOILS]						6.50	3.0
								6.55	3.0
								6.60	3.0
3.0							124	6.65	4.0
		3.0m: Orange, mottled pink and light grey. Frequent cemented sand sized clasts intermixed					36	6.70	3.0
								6.75	3.0
								6.80	3.0
	51.92							6.85	4.0
3.5		SILT, minor clay, minor fine to medium sand. Orange, mottled pink and light grey, very stiff, moist to wet, low plasticity. Frequent sand sized cemented clasts intermixed [WAITEMATA GROUP SOILS]					124	6.90	3.0
	51.62						53		
		SILT, some clay. Light grey, mottled orange, very stiff, moist to wet, low to moderately plastic [WAITEMATA GROUP SOILS]							
4.0							121		
		4.0m: Trace to minor clay					46		
		4.2m: Light pink-grey. Frequent loosely cemented sand sized clasts intermixed							
	51.02								
		SILT, trace to minor clay, minor fine to medium sand. Light pink, mottled orange and light grey, very stiff, moist to wet, no to low plasticity. Frequent loosely cemented sand sized clasts intermixed [WAITEMATA GROUP SOILS]					96		
4.5							43		
	50.32						114		
5.0		5.0m: End of Borehole					30		

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water	Shear Vane	Other Comments
▼ Standing Water Level	Corrected as per NZGS Guidelines	Gently sloping
▽ Water Level At Time Of Drilling	Vane No.:	
◁ Out Flow ▷ In Flow	UTP = Unable To Penetrate	
	+ = Peak Exceeded	
	- = No Result	

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH14**
Date:	27/08/2013
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748450.0, N 5950011.0 **Ground Level:** 37.02

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
0.0	36.82	TOPSOIL [TOPSOIL]	27/08/2013	TS	TS			2.55	25.0
		SILT, some clay. Dark grey-brown, streaked orange, very soft, moist to wet, low to moderately plastic. [ALLUVIUM]	10/09/2013						
0.4	36.52	0.4m: No sample recovery, saturated					7		
0.5		SILT, minor clay, minor fine to medium sand. Grey-brown, very soft, saturated, low plasticity. Common black minor organics intermixed [ALLUVIUM]		ALL					
1.0		1.0m: No recovery, can push auger down to 2.5m with minimal to no recovery.					17 7		
1.5							33 27		
2.0							33 17		
2.5	34.52	2.5m: End of Borehole					UTP		
3.0									
3.5									
4.0									
4.5									
5.0									

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water	Shear Vane	Other Comments
▼ Standing Water Level	Corrected as per NZGS Guidelines	Near level, swamp
▽ Water Level At Time Of Drilling	Vane No.:	
◁ Out Flow ▷ In Flow	UTP = Unable To Penetrate	
	+ = Peak Exceeded	
	- = No Result	

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH15**
Date:	26/08/2013
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748499.0, N 5950248.0 **Ground Level:** 47.53

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values
0.0	47.33	TOPSOIL [TOPSOIL]		TS	TS		
		SILT, some clay. Orange, mottled dark grey/light grey, very stiff, moist, low to moderately plastic. [COLLUVIUM]					
0.5	46.93	0.5m: Dark grey, streaked orange					143 66
	46.73	Silty CLAY. Orange, mottled dark grey/light grey, very stiff, moist, highly plastic [COLLUVIUM]					
1.0		Silty CLAY. Orange, mottled light grey, very stiff, moist, highly plastic [COLLUVIUM]	▽ 26/08/2013				85 13
	46.33	Clayey SILT. Orange, mottled light grey, very stiff, moist, moderately plastic [COLLUVIUM]					
1.5	46.03	Silty CLAY. Orange, mottled light grey, stiff, moist, highly plastic. Occasional fine to medium limonite gravel intermixed [COLLUVIUM]	▼ 10/09/2013	COL			82 53
2.0	45.23	Clayey SILT. Light grey, mottled orange, stiff, moist to wet, moderately plastic. Occasional loosely cemented sand sized clasts [COLLUVIUM]					82 36
2.5		2.6m: No clasts					79 20
3.0		3.0m: Very stiff 3.1m: Dark grey					127 30
	44.13	3.4m: Hole collapsing, End of Borehole					143 63
3.5							
4.0							
4.5							
5.0							

Scala Penetrometer (blows / 50mm)	
Depth (m)	Blows
3.45	0.5
3.50	0.5
3.55	1.0
3.60	1.0
3.65	1.0
3.70	1.0
3.75	1.0
3.80	1.0
3.85	1.0
3.90	1.0
3.95	1.0
4.00	2.0
4.05	2.0
4.10	3.0
4.15	1.0
4.20	2.0
4.25	2.0
4.30	2.0
4.35	1.0
4.40	2.0
4.45	2.0
4.50	2.0
4.55	1.0
4.60	2.0
4.65	2.0
4.70	2.0
4.75	2.0
4.80	2.0
4.85	2.0
4.90	2.0
4.95	2.0
5.00	3.0
5.05	3.0
5.10	4.0
5.15	3.0
5.20	4.0
5.25	3.0
5.30	3.0
5.35	4.0
5.40	3.0

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water	Shear Vane	Other Comments
▼ Standing Water Level	Corrected as per NZGS Guidelines	Base of steep slope
▽ Water Level At Time Of Drilling	Vane No.:	
◁ Out Flow ▷ In Flow	UTP = Unable To Penetrate	
	+ = Peak Exceeded	
	- = No Result	

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Job No.:	**7464**
Hole No.:	**AH16**
Date:	26/08/2013
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748427.0, N 5950379.0 **Ground Level:** 55.72

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
0	55.52	TOPSOIL [TOPSOIL]		TS	TS			5.05	0.5
								5.10	0.5
		Clayey SILT. Orange, mottled brown, very stiff, moist, moderately plastic. Occasional topsoil intermixed. [FILL]						5.15	1.0
								5.20	1.0
								5.25	1.0
0.5				FILL			157	5.30	1.0
							66	5.35	1.0
	54.92							5.40	1.0
								5.45	1.0
		Silty CLAY. Orange, mottled light grey, very stiff, moist, highly plastic. [WAITEMATA GROUP SOILS]						5.50	2.0
1.0							154	5.55	2.0
							56	5.60	2.0
		1.2m: Occasional fine angular limonite gravel intermixed						5.65	2.0
								5.70	2.0
								5.75	2.0
1.5							118	5.80	3.0
							79	5.85	3.0
	53.82							5.90	3.0
								5.95	3.0
								6.00	4.0
								6.05	4.0
2.0		Clayey SILT. Light grey, mottled orange, very stiff, moist, moderately plastic. Occasional loosely cemented sand sized clasts and fine to medium limonite sand intermixed [WAITEMATA GROUP SOILS]					127	6.10	5.0
							77	6.15	5.0
	53.42							6.20	5.0
		SILT, some clay. Orange, mottled light pink and light grey, very stiff, moist, low to moderately plastic. Occasional loosely cemented sand sized clasts intermixed [WAITEMATA GROUP SOILS]						6.25	5.0
								6.30	5.0
2.5			▽ 26/08/2013				127	6.35	5.0
							63	6.40	6.0
		2.7m: Clayey inclusions						6.45	6.0
	52.82							6.50	6.0
								6.55	6.0
		Silty CLAY. Pink, mottled light grey and orange, very stiff, moist, high plasticity [WAITEMATA GROUP SOILS]						6.60	7.0
3.0							85	6.65	8.0
							39	6.70	8.0
								6.75	6.0
	52.32							6.80	7.0
								6.85	7.0
3.5		SILT, some clay, minor fine to medium sand. Orange, mottled light grey, stiff to very stiff, moist to wet, low to moderately plastic [WAITEMATA GROUP SOILS]					124	6.90	8.0
							36		
		3.6m: Occasional to frequent dark orange fine to medium limonite sand intermixed							
	51.82								
4.0		SILT, minor clay, minor fine to medium sand. Dark orange, very stiff, wet, low plasticity. Frequent sand sized cemented clasts intermixed [WAITEMATA GROUP SOILS]		WAITEMATA GROUP SOILS			114		
							30		
4.5							82		
							39		
	50.72								
5.0		5.0m: End of Borehole					93		
							33		

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Moderately sloping

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH17**
Date:	30/08/2013
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748257.0, N 5950364.0 **Ground Level:** 60.89

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
	60.79	TOPSOIL [TOPSOIL]		TS				3.30	5.0
		Clayey SILTwith minor topsoil. Orange mottled brown and light grey, stiff, moist, moderately plastic. [COLLUVIUM]						3.35	4.0
								3.40	3.0
								3.45	4.0
								3.50	4.0
0.5		0.5m - 1.0m: Becomes orange mottled dark grey and brown.		COLLUVIUM			99	3.55	3.0
							36	3.60	3.0
								3.65	3.0
								3.70	3.0
								3.75	3.0
1.0	59.89						88	3.80	4.0
		Silty CLAY. Orange mottled light grey, stiff, moist, moderate to highly plastic. [WAITEMATA GROUP SOILS]					36	3.85	3.0
								3.90	3.0
								3.95	3.0
								4.00	3.0
1.5		1.5m: Becomes very stiff.		WAITEMATA GROUP SOILS			102	4.05	3.0
							53	4.10	3.0
								4.15	5.0
								4.20	6.0
	58.99							4.25	6.0
								4.30	8.0
2.0		Clayey SILT. Orange mottled light, stiff to very stiff, moist, moderately plastic. With occasional intermixed cemented clasts (<2mm). [WAITEMATA GROUP					85	4.35	7.0
	58.79	SILT some clay with some fine to medium sand. Orange mottled light grey, stiff, wet, low plasticity. [WAITEMATA GROUP SOILS]					49	4.40	7.0
								4.45	7.0
								4.50	8.0
								4.55	10.0
2.5		2.4m - 2.7m: Frequent dark grey intermixed cemented clasts (<3mm).	▼ 10/09/2013				66	4.60	10.0
							39	4.65	7.0
								4.70	7.0
		2.7m - 2.9m: Trace of fine sand and becomes moist to wet.	▽ 30/08/2013					4.75	6.0
	57.99							4.80	7.0
		SILT some fine to medium sand with trace of clay. Light grey streaked orange, stiff, moist to wet, no plasticity. With occasional intermixed cemented clasts (<3mm).						4.85	7.0
3.0				TRANS WG			UTP	4.90	9.0
	57.69	[TRANSITIONAL WAITEMATA GROUP]						4.95	10.0
							UTP	5.00	10.0
		3.3m: End of Borehole						5.05	10.0
								5.10	11.0
3.5								5.15	11.0
								5.20	10.0
4.0									
4.5									
5.0									

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Moderate Slope, Field

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH18**
Date:	30/08/2013
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748306.0, N 5950473.0 **Ground Level:** 48.5

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
0		Topsoil. [TOPSOIL]		TS	TS TS			5.05	1.0
	48.2							5.10	1.0
								5.15	2.0
								5.20	2.0
		SILT some clay. Orange mottled light grey and brown, stiff, moist, low to moderately plastic. With occasional to frequent intermixed topsoil. [COLLUVIUM]		COL				5.25	1.0
	48						99	5.30	2.0
0.5		Clayey SILT. Orange mottled light grey, stiff, moist, moderately plastic. [WAITEMATA GROUP SOILS]					39	5.35	2.0
								5.40	2.0
	47.6							5.45	3.0
								5.50	2.0
1.0		Silty CLAY. Light grey streaked orange, stiff, moist, highly palstic. [WAITEMATA GROUP SOILS]					85	5.55	3.0
							43	5.60	3.0
								5.65	3.0
								5.70	2.0
								5.75	3.0
1.5		1.5m: Very stiff.					124	5.80	3.0
							49	5.85	3.0
								5.90	3.0
	46.7							5.95	3.0
								6.00	3.0
		Clayey SILT. Orange mottled light grey, very stiff, moist, moderately plastic. With occasional intermixed cemented clasts (<4mm) and dark orange limonite staining. [WAITEMATA GROUP SOILS]						6.05	4.0
2.0							170	6.10	3.0
							63	6.15	4.0
	46.3							6.20	3.0
		Fine to medium Sandy SILT. Orange, very stiff, moist to wet, no plasticity. [WAITEMATA GROUP SOILS]						6.25	4.0
								6.30	3.0
	46							6.35	4.0
2.5							202+	6.40	3.0
		SILT some clay. Light grey streaked orange, very stiff, moist, low to moderately plastic. [WAITEMATA GROUP SOILS]					-	6.45	5.0
	45.8							6.50	3.0
		SILT some fine to medium sand. Orange, very stiff, moist to wet, no plasticity. [WAITEMATA GROUP SOILS]		WGS				6.55	3.0
								6.60	3.0
3.0							102	6.65	4.0
							49	6.70	4.0
								6.75	3.0
								6.80	4.0
								6.85	4.0
		3.4m: Orange speckled light grey.	▽ 30/08/2013				151	6.90	4.0
3.5							96		
			▼ 10/09/2013						
		3.9m - 4.0m: Lense with some clay.					128		
4.0							56		
	44.1								
		Fine to medium Sandy SILT. Dark orange/red, very stiff, wet, no plasticity. [WAITEMATA GROUP SOILS]					143		
4.5							63		
	43.5						185		
5.0		5.0m: End of Borehole					36		

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Steep Slope, Field

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH19**
Date:	26/08/2013
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748707.0, N 5950335.0 **Ground Level:** 21.67

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
0.0		Clayey SILT. Pink, mottled orange and light grey, stiff, moist, moderately plastic. [FILL]		FILL				5.05	1.0
								5.10	2.0
								5.15	2.0
								5.20	3.0
								5.25	4.0
0.5		0.5m: Occasional minor organics and topsoil intermixed					85	5.30	5.0
	20.97						36	5.35	4.0
		Clayey SILT. Grey, streaked orange, stiff, moist, moderately plastic. Occasional black minor organics intermixed. [ALLUVIUM]						5.40	5.0
	20.77							5.45	4.0
								5.50	4.0
1.0		Silty CLAY. Grey, mottled orange, stiff, moist, highly plastic [ALLUVIUM]					79	5.55	7.0
		1.1m: Moist to wet					36	5.60	9.0
								5.65	12.0
	20.37							5.70	25.0
		Clayey SILT. Light grey, mottled orange, stiff, moist to wet, moderately plastic. Occasional cemented sand sized clasts and plant fibres intermixed [ALLUVIUM]							
1.5	20.17						33		
		SILT, minor clay, minor fine to medium sand. Light grey, mottled orange, firm, wet, low plasticity [ALLUVIUM]					26		
	19.77		▽ 26/08/2013						
2.0		SILT, some clay, trace fine sand. Light grey, firm, moist to wet, low to moderately plastic. Occasional black minor organics intermixed [ALLUVIUM]					46		
							33		
	19.37								
		SILT, minor clay, minor fine to medium sand. Grey, firm, wet, low plasticity. Occasional sand sized cemented clasts intermixed [ALLUVIUM]							
2.5							127		
							56		
	18.97								
		Clayey SILT. Grey, very stiff, moist to wet, moderate plasticity [ALLUVIUM]		ALL					
	18.67						102		
3.0		SILT, minor clay, minor fine to medium sand. Light grey, mottled light brown-orange, very stiff, wet, low plasticity [ALLUVIUM]					46		
3.5		3.5m: Dark grey, wet to saturated					63		
							33		
4.0							49		
							33		
4.5		4.4m: Pushing down					70		
							46		
	16.97								
		Fine to medium sandy SILT. Dark grey, loose/stiff, wet, no plasticity [ALLUVIUM]							
	16.67	4.9m: Speckled green-grey					36		
5.0		5.0m: End of Borehole					30		

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Gently sloping

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH20**
Date:	2/09/2013
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748874.0, N 5950342.0 **Ground Level:** 36.91

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
	36.81	TOPSOIL [TOPSOIL]		TS				5.05	1.0
		SILT some clay. Orange mottled light grey, dark grey and orange, stiff, moist, low to moderately plastic. [FILL]						5.10	1.0
								5.15	1.0
								5.20	2.0
0.5							53	5.25	2.0
							17	5.30	2.0
								5.35	1.0
								5.40	2.0
	36.01							5.45	1.0
								5.50	2.0
1.0		Silty CLAY. Light grey mottled orange, stiff, moist, highly plastic. [FILL]		FILL			63	5.55	2.0
							23	5.60	2.0
								5.65	2.0
	35.51							5.70	1.0
								5.75	2.0
		SILT some clay. Orange mottled dark orange and dark grey, very stiff, moist, low to moderately plastic. [FILL]					173	5.80	2.0
1.5		1.5m: Occasional intermixed topsoil.					46	5.85	2.0
		1.6m - 1.7m: Lense of buried topsoil.						5.90	3.0
	35.11							5.95	3.0
		Clayey SILT. Light grey streaked dark orange and orange, very stiff, moist, moderately plastic.						6.00	3.0
	34.91	[COLLUVIUM]						6.05	3.0
2.0		Silty CLAY. Orange streaked dark orange and light grey, very stiff, moist, highly plastic. [COLLUVIUM]					151	6.10	4.0
							30	6.15	3.0
								6.20	3.0
								6.25	3.0
								6.30	3.0
2.5		2.4m - 2.7m: Orange speckled off-white.					154	6.35	3.0
							77	6.40	4.0
		2.7m - 3.2m: Orange mottled light grey.						6.45	3.0
								6.50	3.0
								6.55	3.0
								6.60	4.0
3.0							151	6.65	4.0
							82	6.70	4.0
								6.75	4.0
		3.2m - 3.9m: Orange mottled light grey, pink and with dark orange staining.						6.80	3.0
								6.85	4.0
3.5		3.4m - 3.9m: Occasional intermixed dark orange fine to medium sand sized limonite.		COL			133	6.90	4.0
							66		
			10/09/2013						
	33.01								
		Clayey SILT. Orange mottled light grey and pink, very stiff, moist, moderately plastic. With occasional intermixed dark orange fine to medium sand sized limonite. [COLLUVIUM]					151		
4.0		4.2m - 4.6m: Frequent intermixed dark orange fine to medium sand sized limonite as well as staining.					36		
			02/09/2013						
4.5							157		
							33		
		4.6m - 5.0m: Occasional to frequent dark orange intermixed fine angular gravel sized limonite.							
	31.91								
5.0		5.0m: End of Borehole					124		
							36		

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water	Shear Vane	Other Comments
▼ Standing Water Level	Corrected as per NZGS Guidelines	Gentle Slope, Field
▽ Water Level At Time Of Drilling	Vane No.:	
◁ Out Flow ▷ In Flow	UTP = Unable To Penetrate	
	+ = Peak Exceeded	
	- = No Result	

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH21**
Date:	2/09/2013
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748859.0, N 5950596.0 **Ground Level:** 66.38

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values
0.0	66.18	TOPSOIL [TOPSOIL]		TS			
	65.88	Clayey SILT. Orange mottled light grey with brown staining, very stiff, moist, moderately plastic. [COLLUVIUM]					
0.5		Silty CLAY. Orange mottled light grey with brown staining, very stiff, moist, highly plastic. [COLLUVIUM]					130 66
1.0		1.0m: No brown staining.	10/09/2013				124 66
1.5		1.5m - 2.3m: Light grey mottled orange.					114 49
2.0			02/09/2013				130 73
		2.3m - 3.7m: Orange mottled light grey.					
2.5				COL			114 70
3.0							114 56
3.5		3.5m: Stiff, moist to wet.					73 33
	62.68	SILT minor clay with minor fine sand. Light grey mottled orange, stiff, moist to wet, low plasticity. With occasional to frequent intermixed dark grey cemented clasts (<4mm). [COLLUVIUM]					
4.0		4.1m - 4.7m: Frequent intermixed cemented clasts (<5mm) and frequent intermixed dark orange fine to coarse sand sized limonite.					130 33
4.5							127 70
	61.68	SILT with some fine to medium sand. Orange speckled light grey, very stiff, wet to saturated. With frequent intermixed cemented clasts (<4mm). [COLLUVIUM]					
	61.38						
5.0		5.0m: End of Borehole					121 66

Scala Penetrometer (blows / 50mm)		
	Depth (m)	Blows
	5.05	1.0
	5.10	1.0
	5.15	1.0
	5.20	1.0
	5.25	1.0
	5.30	2.0
	5.35	4.0
	5.40	4.0
	5.45	4.0
	5.50	4.0
	5.55	5.0
	5.60	6.0
	5.65	6.0
	5.70	6.0
	5.75	6.0
	5.80	6.0
	5.85	7.0
	5.90	6.0
	5.95	7.0
	6.00	8.0
	6.05	9.0
	6.10	9.0
	6.15	9.0
	6.20	10.0
	6.25	10.0
	6.30	10.0
	6.35	11.0
	6.40	11.0
	6.45	11.0

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water	Shear Vane	Other Comments
▼ Standing Water Level	Corrected as per NZGS Guidelines	Near Level, Field
▽ Water Level At Time Of Drilling	Vane No.:	
◁ Out Flow ▷ In Flow	UTP = Unable To Penetrate	
	+ = Peak Exceeded	
	- = No Result	

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Job No.:	**7464**
Hole No.:	**AH22**
Date:	2/09/2013
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748837.0, N 5950556.0 **Ground Level:** 57.1

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
		TOPSOIL [TOPSOIL]		TS	TS			4.25	1.0
	56.8							4.30	1.0
		Clayey SILT. Orange mottled light grey and brown, very stiff, moist, moderately plastic. With occasional intermixed topsoil. [COLLUVIUM]						4.35	1.0
	56.6							4.40	1.0
0.5		Silty CLAY. Orange, very stiff, moist, highly plastic. With brown staining. [COLLUVIUM]					114	4.45	2.0
	56.2						59	4.50	1.0
		Clayey SILT. Orange, very stiff, moist, moderately plastic. With occasional fine angular gravel sized dark orange limonite. [COLLUVIUM]						4.55	2.0
1.0								4.60	2.0
		1.2m - 1.4m: Orange mottled light grey.						4.65	2.0
								4.70	2.0
		1.4m - 1.8m: Orange mottled light grey and pink.					99	4.75	2.0
							46	4.80	3.0
								4.85	4.0
								4.90	4.0
								4.95	4.0
1.5							85	5.00	5.0
							53	5.05	5.0
								5.10	6.0
								5.15	6.0
		1.8m - 2.3m: Pink streaked light grey and orange.	10/09/2013					5.20	7.0
								5.25	8.0
2.0							70	5.30	10.0
							39	5.35	10.0
								5.40	10.0
	54.8		02/09/2013	COL				5.45	11.0
		SILT with minor clay. Orange mottled light grey and pink, stiff, moist to wet, low plasticity. With occasional to frequent intermixed cemented clasts (<4mm) and occasional fine to medium sand sized dark orange limonite pockets. [COLLUVIUM]						5.50	11.0
	54.6						143	5.55	11.0
2.5		Clayey SILT. Light grey mottled orange, very stiff, moist, moderately plastic. With occasional pockets of fine to coarse sand sized dark orange limonite.					33		
	54.2								
		SILT with some fine to medium sand. Light grey speckled orange, stiff to very stiff, wet to saturated, no plasticity. [COLLUVIUM]					53		
3.0							33		
3.5		3.5m: Very stiff to hard.					202+		
		3.8m - 3.9m: Lense of fine to coarse sand sized and fine angular gravel sized limonite.							
	53.2								
		SILT some clay. Orange mottled light grey, very stiff to hard, moist, low to moderately plastic [COLLUVIUM]					99		
4.0							39		
	52.9	4.1m: Dark grey.					UTP		
		4.2m: Hole collapsing, End of Borehole.							
4.5									
5.0									

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water	Shear Vane	Other Comments
▼ Standing Water Level	Corrected as per NZGS Guidelines	Moderate Slope, Field
▽ Water Level At Time Of Drilling	Vane No.:	
◁ Out Flow ▷ In Flow	UTP = Unable To Penetrate	
	+ = Peak Exceeded	
	- = No Result	

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH23**
Date:	3/08/2015
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748815.0, N 5950522.0 **Ground Level:** 47.64

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit
0.0	47.44	Topsoil. [TOPSOIL]		TS
		Clayey SILT with light brown staining. Orange, very stiff, moist, moderately plastic. [COLLUVIUM]		
0.5		0.5m - 2.1m: Occasional intermixed cemented clasts (<2mm).		
		0.7m - 1.3m: Orange mottled light grey.		
1.0				
		1.3m - 1.7m: Orange speckled off white.		
1.5				
		1.7m - 2.1m: Orange mottled light grey.		
2.0	45.54			
		Silty CLAY. Orange mottled light grey, stiff, moist, highly plastic. With occasional to frequent intermixed cemented clasts (<4mm). [COLLUVIUM]	10/09/2013	COLLUVIUM
2.5		2.5m: No clasts.		
		2.8m - 3.6m: Orange mottled light grey and pink, with occasional fine to medium sand sized intermixed dark orange limonite.		
3.0				
3.5		3.5m - 3.7m: Orange mottled light grey.		
	43.94			
	43.74	Clayey SILT. Orange mottled light grey, very stiff, moist, moderately plastic. With dark orange limonite staining. [COLLUVIUM]	02/08/2013	
4.0	43.54	Silty CLAY. Orange mottled light grey, very stiff, moist, highly plastic. With dark orange limonite staining. [COLLUVIUM]		
	43.24	Clayey SILT. Orange mottled light grey streaked pink, very stiff, moist, moderately plastic. [COLLUVIUM]		
4.5		Silty CLAY. Orange mottled light grey, very stiff, moist, highly plastic. [COLLUVIUM]		
		4.5m: Stiff.		
		4.7m: Light grey mottled pink and orange.		
5.0	42.64			
		5.0m: End of Borehole		

Vane Shear Strength (kPa) (refer notes for details)

50	100	150	200	Values
				124
				23
				124
				70
				151
				70
				93
				56
				146
				70
				130
				66
				130
				73
				138
				70
				99
				49
				98
				39

Scala Penetrometer (blows / 50mm)

Depth (m)	Blows
5.05	1.0
5.10	1.0
5.15	1.0
5.20	1.0
5.25	1.0
5.30	1.0
5.35	1.0
5.40	2.0
5.45	2.0
5.50	2.0
5.55	1.0
5.60	1.0
5.65	2.0
5.70	2.0
5.75	2.0
5.80	2.0
5.85	3.0
5.90	4.0
5.95	4.0
6.00	4.0
6.05	4.0
6.10	4.0
6.15	4.0
6.20	5.0
6.25	5.0
6.30	6.0
6.35	6.0
6.40	6.0
6.45	5.0
6.50	6.0
6.55	6.0
6.60	6.0
6.65	5.0
6.70	6.0
6.75	5.0
6.80	6.0
6.85	6.0
6.90	7.0

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Moderate Slope, Field

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH24**
Date:	3/09/2013
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748950.0, N 5950633.0 **Ground Level:** 81.54

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
0	81.34	Topsoil. [TOPSOIL]		TS	TS			5.05	1.0
		Clayey SILT. Orange mottled light grey with brown staining, very stiff, moist, moderately plastic. [WAITEMATA GROUP SOILS]						5.10	1.0
	81.04							5.15	1.0
0.5		Clayey SILT. Orange, very stiff, moist, highly plastic. [WAITEMATA GROUP SOILS]					133	5.20	1.0
							63	5.25	1.0
	80.64							5.30	2.0
1.0		Clayey SILT. Orange mottled light grey, very stiff, moist, moderately plastic. [WAITEMATA GROUP SOILS]					138	5.35	1.0
	80.34						63	5.40	2.0
		SILT some clay. Light grey mottled orange and pink, very stiff, ,moist, low to moderately plastic. With occasional intermixed cemented clasts (<3mm). [WAITEMATA GROUP SOILS]						5.45	2.0
								5.50	2.0
1.5								5.55	2.0
							127	5.60	3.0
	79.84						70	5.65	2.0
		Silty CLAY. Pink mottled light grey, very stiff, moist, highly plastic. [WAITEMATA GROUP SOILS]						5.70	2.0
	79.64							5.75	2.0
		SILT minor clay. Pink mottled light grey and orange, very stiff, moist, low plasticity. [WAITEMATA GROUP SOILS]						5.80	3.0
2.0							99	5.85	3.0
	79.34						56	5.90	3.0
		SILT with some clay. Pink streaked dark pink and mottled light grey, stiff, moist, low to moderately plastic. With occasional intermixed cemented clasts (<3mm). [WAITEMATA GROUP SOILS]						5.95	4.0
		2.5m - 2.8m: Intermixed pockets of dark orange, fine to coarse sand sized limonite.						6.00	5.0
2.5								6.05	6.0
				WGS				6.10	5.0
							85	6.15	5.0
	78.74						46	6.20	5.0
		Clayey SILT. Light grey mottled pink, stiff, moist, moderately plastic. [WAITEMATA GROUP SOILS]						6.25	6.0
								6.30	5.0
3.0								6.35	6.0
	78.44							6.40	5.0
		SILT minor clay. Light pink mottled light grey and orange, stiff, moist, low plasticity. With occasional intermixed cemented clasts (<2mm). [WAITEMATA GROUP SOILS]						6.45	5.0
								6.50	5.0
								6.55	6.0
							88	6.60	6.0
							46	6.65	6.0
3.5								6.70	6.0
								6.75	6.0
								6.80	7.0
								6.85	6.0
							111	6.90	6.0
	77.84						56		
		Clayey SILT. Light grey mottled pink, very stiff, moist, moderately plastic. [WAITEMATA GROUP SOILS]							
	77.64								
4.0		SILT some clay tace of fine sand. Light pink mottled light grey, very stiff, moist to wet, low to moderately plastic. With frequent intermixed cemented clasts (<3mm). [WAITEMATA GROUP SOILS]					102		
							33		
4.5			▼ 10/09/2013				88		
		4.5m - 5.0m: Pink mottled light pink and grey.	▽ 03/09/2013				36		
	76.54						151		
5.0		5.0m: End of Borehole					33		

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water	Shear Vane	Other Comments
▼ Standing Water Level	Corrected as per NZGS Guidelines	Moderate Slope, Field
▽ Water Level At Time Of Drilling	Vane No.:	
◁ Out Flow ▷ In Flow	UTP = Unable To Penetrate	
	+ = Peak Exceeded	
	- = No Result	

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH25**
Date:	23/08/2013
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748786.0, N 5949761.0 **Ground Level:** 20.22

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log
0.0	20.02	TOPSOIL [TOPSOIL]		TS	
	19.82	Clayey SILT. Orange, mottled light grey and dark grey, very stiff, moist, moderately plastic. [COLLUVIUM]		COL	
0.5		Silty CLAY. Light grey, streaked orange, stiff, moist, highly plastic. [ALLUVIUM]			
	19.42	Clayey SILT. Light grey, streaked orange, stiff, moist, moderately plastic [ALLUVIUM]	10/09/2013		
1.0	18.92				
	18.72	SILT, some clay, trace to minor fine sand. Light grey, mottled orange, stiff, moist, low to moderately plastic [ALLUVIUM]	23/08/2013		
1.5		Silty fine to medium SAND. Light grey, stiff, wet to saturated, no plasticity. Occasional lenses of orange sand intermixed [ALLUVIUM]			
	18.32				
2.0		Fine to medium sandy SILT. Orange, speckled light grey, very stiff, wet, no plasticity [ALLUVIUM]		ALL	
		2.1m: Occasional dark grey sand sized cemented clasts intermixed			
2.5	17.62				
		SILT, some fine to medium sand. Orange,speckled light grey, very stiff, wet to saturated, no plasticity. Occasional to frequent sand sized cemented clasts [ALLUVIUM]			
3.0					
3.5					
	16.42				
	16.22	Fine to medium sandy SILT. Dark grey, very stiff, wet, no plasticity. [TRANSITIONAL WAITEMATA GROUP]		TRA NS WG	
4.0		4.0m: End of Borehole			
4.5					
5.0					

Vane Shear Strength (kPa) (refer notes for details)

50 100 150 200

Values
82
36
49
20
96
23
114
20
130
33
202+
-
157
46
UTP
-

Scala Penetrometer (blows / 50mm)

Depth (m)	Blows
4.05	6.0
4.10	7.0
4.15	7.0
4.20	8.0
4.25	12.0
4.30	12.0
4.35	12.0
4.40	13.0
4.45	25.0

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Base of moderate slope

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH26**
Date:	9/07/2015
Logged By:	BM
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748691.0, N 5949330.0 **Ground Level:** 20.58

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
0.0		Silty Topsoil. Brown, stiff, moist, no plasticity. [FILL]		FILL				4.25	10.0
								4.30	12.0
								4.35	25.0
0.5							65		
							19		
	19.78	Buried Topsoil. [TOPSOIL]		TS	TS				
	19.58		▼ 04/08/2015				35		
1.0		Clayey SILT. Brown, firm, moist, low to moderately plastic. [WAITEMATA GROUP SOILS]					15		
	19.38	Silty CLAY. Grey mottled orange, firm, wet, moderately plastic. [WAITEMATA GROUP SOILS]							
	19.08						54		
1.5		SILT with some clay. Grey mottled orange, stiff, moist, low plasticity. [WAITEMATA GROUP SOILS]	▽ 09/07/2015				32		
	18.88	SILT. Grey mottled orange, stiff, moist, no plasticity. [WAITEMATA GROUP SOILS]							
2.0		2.0m: Becomes very stiff and dark grey with occasional limonite staining.					134		
							29		
	18.18								
2.5		Fine, loose Sandy SILT. Dark grey with occasional limonite staining, very stiff, wet, no plasticity. With occasional fine limonite gravels. At 2.5m; becomes stiff. [WAITEMATA GROUP SOILS]		WGS			78		
							19		
3.0							89		
	17.38						19		
		SILT. Dark grey with occasional limonite staining, stiff, moist, no plasticity. [WAITEMATA GROUP SOILS]							
3.5		3.5m: Becomes very stiff.					161		
							51		
4.0							104		
							29		
	16.38	4.1m: With a trace of fine sand and dark grey.					UTP		
		4.2m: End of Borehole, unable to penetrate							
4.5									
5.0									

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Gully, Muddy. Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH27**
Date:	16/07/2015
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748665.0, N 5949327.0 **Ground Level:** 25.03

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details)	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
0.0	24.83	Topsoil, wet. [TOPSOIL]	04/08/2015	TS	TS	50 100 150 200		2.25	0.5
		Clayey SILT. Light grey mottled grey and orange, very stiff, wet, moderately plastic. With occasional intermixed black carbonaceous material. [ALLUVIUM]					125	2.30	0.5
0.5	24.32		16/07/2015				42	2.35	1.0
		SILT with some clay and minor fine sand. Orange mottled light grey, very stiff, wet, low plasticity. With occasional intermixed plant fibers.At 1m; firm and extra sensitive. [ALLUVIUM]		ALLUVIUM				2.40	2.0
1.0	23.83							2.45	1.0
		Organic SILT with black carbonaceous material and wood fragments(<35%) plus some clay. Black mottled grey, firm, wet to saturated, low plasticity. At 1.5m; becomes stiff. [ALLUVIUM]					28	2.50	2.0
1.5							3	2.55	2.0
		1.8m: Becomes brown mottled black.						2.60	2.0
2.0	23.03							2.65	2.0
		Organic Clayey SILT with some plant fibers and minor fine sand. Brown, stiff, wet to saturated, moderately plastic. [ALLUVIUM]					53	2.70	2.0
	22.83						14	2.75	2.0
		2.2m: End of Borehole, hole collapsing						2.80	2.0
2.5								2.85	2.0
								2.90	3.0
								2.95	4.0
								3.00	4.0
								3.05	5.0
								3.10	4.0
								3.15	4.0
								3.20	4.0
								3.25	5.0
							69	3.30	4.0
							22	3.35	5.0
							56	3.40	6.0
							25	3.45	6.0
								3.50	8.0
								3.55	9.0
								3.60	9.0
								3.65	10.0
								3.70	7.0
								3.75	8.0
								3.80	9.0
								3.85	10.0
								3.90	12.0
								3.95	13.0
								4.00	25.0

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Gentle Slope, Swamp. Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH28**
Date:	20/07/2015
Logged By:	RF
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748646.0, N 5949291.0 **Ground Level:** 18.7

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values
0.0	18.4	Topsoil/Silt, saturated and brown. [TOPSOIL]	20/07/2015	TS	TS TS		
0.5		Silty CLAY. Brownish grey mottled orange and brown, firm, saturated, highly plastic. [ALLUVIUM]	04/08/2015	ALLUVIUM			46 7
1.0		0.9m - 1.3m: Void.					0
1.5	17.4	Clayey SILT. Dark brown, saturated, moderately plastic. At 1.5m; becomes soft. [ALLUVIUM]					21 12
2.0	16.9	Silty CLAY. Light brownish grey, soft, saturated, highly plastic. [ALLUVIUM] 2.0m: Becomes firm.					43 10
2.5	16.4	Clayey SILT. Dark grey, firm, moist, moderately plastic. [WAITEMATA GROUP SOILS] 2.5m: Becomes very stiff.		WAITEMATA GROUP SOILS			153 37
3.0	15.9 / 15.8	SILT with a trace of fine sand. Dark grey, very stiff, moist, no plasticity. [TRANSITIONAL WAITEMATA 2.9m: End of Borehole, unable to penetrate		N S			UTP
3.5							
4.0							
4.5							
5.0							

Scala Penetrometer (blows / 50mm)

Depth (m)	Blows
3.95	7.0
4.00	7.0
4.05	14.0
4.10	18.0
4.15	20.0

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Water Course, Swamp. Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH29**
Date:	16/07/2015
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748562.0, N 5949240.0 **Ground Level:** 8.03

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
0.0		Topsoil and Topsoil like material. (Organic) [TOPSOIL]		TOPSOIL	TS			1.25	7.0
					TS			1.30	8.0
0.5					TS		97	1.35	25.0
					TS		31		
	7.33				TS				
		Organic SILT with some Topsoil like material and minor clay. Brown mottled grey streaked dark orange, stiff, moist, low plasticity. [ALLUVIUM]	▼ 16/07/2015						
	7.13		▽ 04/08/2015						
1.0		SILT with some clay and some fine sand. Dark grey streaked orange, stiff, wet, low plasticity. With occasional intermixed plant fibers. At 1m; firm. At 1.1m; becomes Sandy. [ALLUVIUM]		ALL			44		
							11		
	6.83						UTP		
		1.2m: End of Borehole, unable to penetrate							
1.5									
2.0									
2.5									
3.0									
3.5									
4.0									
4.5									
5.0									

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Bottom of Moderate Slope, Next to Stream. Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH30**
Date:	9/07/2015
Logged By:	RF
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748630.0, N 5949452.0 **Ground Level:** 38.7

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
0.0		50mm; Topsoil.SILT with some clay/Clayey. Orange mottled grey, very stiff, moist, low to moderately plastic. With occasional intermixed fine gravels. [FILL]	09/07/2015	FILL				5.05	1.0
								5.10	1.0
								5.15	2.0
								5.20	1.0
0.5							171+	5.25	2.0
	38.1							5.30	2.0
		Buried Topsoil. [TOPSOIL]		TS	TS			5.35	2.0
	37.9							5.40	2.0
		Silty CLAY. Brownish orange. very stiff, moist, moderately plastic. [WAITEMATA GROUP SOILS]						5.45	2.0
								5.50	2.0
1.0							144	5.55	2.0
							72	5.60	1.0
		1.2m: Becomes orange mottled light grey.						5.65	1.0
								5.70	2.0
								5.75	3.0
1.5							130	5.80	2.0
							67	5.85	2.0
	37							5.90	5.0
		Clayey SILT. Grey mottled orange, very stiff, moist, low to moderately plastic. [WAITEMATA GROUP SOILS]						5.95	4.0
								6.00	3.0
								6.05	2.0
2.0							106	6.10	3.0
							43	6.15	3.0
	36.4							6.20	3.0
		SILT with some clay. Light grey mottled orange, very stiff, moist, low plasticity. With occasional lense of CLAY. At 2.5m: stiff. [WAITEMATA GROUP SOILS]						6.25	4.0
								6.30	5.0
2.5							99	6.35	5.0
							31	6.40	6.0
								6.45	7.0
								6.50	7.0
								6.55	5.0
								6.60	4.0
3.0							98	6.65	4.0
							28	6.70	4.0
								6.75	6.0
								6.80	6.0
								6.85	6.0
3.5							96		
							26		
	34.9								
		Clayey SILT. Orange/dark orange mottled grey and light grey, stiff, moist to wet, low to moderately plastic. [WAITEMATA GROUP SOILS]							
4.0							54		
							22		
	34.3								
		SILT with some clay and trace of fine sand. Grey mottled orange, stiff, moist, low plasticity. At 4.5m; very stiff. [WAITEMATA GROUP SOILS]	04/08/2015						
4.5							109		
							23		
	33.7								
5.0		5.0m: End of Borehole					116		
							31		

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Moderate Slope, Grass. Hole data is for a set location only.

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Job No.:	**7464**
Hole No.:	**AH31**
Date:	9/07/2015
Logged By:	RF
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748553.0, N 5949441.0 **Ground Level:** 27.3

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
	27.2	Topsoil, Saturated. [TOPSOIL]	Groundwater Not Encountered	FILL				5.05	5.0
		Silty CLAY. Orange mottled light grey and brown, very stiff, moist, moderate to highly plastic. With occasional intermixed fine gravels. [FILL]						5.10	5.0
								5.15	3.0
								5.20	2.0
0.5							161	5.25	3.0
							69	5.30	5.0
								5.35	4.0
								5.40	4.0
								5.45	4.0
								5.50	4.0
1.0		0.9m: With occasional pockets of SILT with some clay.					171+	5.55	4.0
							-	5.60	4.0
								5.65	4.0
								5.70	3.0
								5.75	4.0
1.5							123	5.80	4.0
							56	5.85	4.0
								5.90	4.0
								5.95	4.0
								6.00	4.0
								6.05	4.0
2.0							148	6.10	4.0
							97	6.15	5.0
								6.20	4.0
								6.25	7.0
								6.30	6.0
2.5							135	6.35	5.0
							64	6.40	4.0
		2.6m: Becomes brownish grey/grey and orange.						6.45	4.0
								6.50	3.0
								6.55	4.0
3.0							171+	6.60	3.0
							-	6.65	3.0
								6.70	3.0
								6.75	2.5
								6.80	2.5
								6.85	3.0
3.5							153	6.90	3.0
							69		
	23.4								
4.0		SILT with minor to trace of clay. Grey mottled dark grey and orange, very stiff, moist, no to low plasticity. With frequent fine to medium gravels. [FILL]					171+		
							-		
4.5							UTP		
							-		
	22.6								
		Silty CLAY. Orange mottled brown and grey, hard, moist, highly plastic. [FILL]							
	22.3						128		
5.0		5.0m: End of Boerhole					72		

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- Standing Water Level
- Water Level At Time Of Drilling
- Out Flow / In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Moderate Slope, Grass. Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH32**
Date:	9/07/2015
Logged By:	BM
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748555.0, N 5949522.0 **Ground Level:** 38.42

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
		Silty Topsoil. Orange/grey/brown, very stiff, moist, no plasticity. With fine to medium gravels. [FILL]	09/07/2015	FILL				3.70	7.0
	38.02							3.75	7.0
								3.80	5.0
								3.85	6.0
		SILT with some clay. Orange mottled brown with occasional limonite staining, very stiff, moist, low plasticity. [WAITEMATA GROUP SOILS]					147	3.90	5.0
0.5							48	3.95	8.0
								4.00	8.0
								4.05	10.0
		0.9m: Becomes orange mottled grey.						4.10	8.0
								4.15	9.0
1.0							95	4.20	10.0
	37.32	1.0m: Becomes stiff.					51	4.25	15.0
		Silty CLAY. Orange mottled grey, stiff, moist, moderately plastic. [WAITEMATA GROUP SOILS]						4.30	8.0
								4.35	9.0
								4.40	12.0
								4.45	8.0
1.5		1.5m: Becomes very stiff, grey mottled orange with occasional limonite staining.					104	4.50	7.0
							43	4.55	10.0
	36.62							4.60	8.0
		SILT with minor clay. Grey mottled orange with occasional limonite staining, very stiff, moist, low plasticity. [WAITEMATA GROUP SOILS]						4.65	10.0
	36.42							4.70	14.0
2.0		SILT (crumbly). Grey mottled orange, stiff, moist, no plasticity. [WAITEMATA GROUP SOILS]		WAITEMATA GROUP SOILS			98	4.75	20.0
							26		
2.5		2.5m: Becomes very stiff with occasional bands of dark orange limonite and fine limonite gravels.					134		
							35		
			04/08/2015						
3.0							190		
							37		
	34.92								
3.5		Silty (Fine, dense) SAND. Dark grey, hard, moist, no plasticity. [TRANSITIONAL WAITEMATA GROUP]		AN S W			UTP		
	34.77								
		3.7m: End of Borehole, unable to penetrate							
4.0									
4.5									
5.0									

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Slope. Boggy. Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH33**
Date:	9/07/2015
Logged By:	BM
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748529.0, N 5949514.0 **Ground Level:** 34.42

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log
0.0	34.12	Silty Topsoil. Orange mottled brown, very stiff, moist, no plasticity. With occasional fine gravels. [FILL]		FILL	
		SILT with some clay. Orange, very stiff, moist, low plasticity. [WAITEMATA GROUP SOILS]		WAITEMATA GROUP SOILS	
1.0		0.9m: Becomes reddish orange.			
1.5	32.62				
2.0		SILT. Reddish orange mottled grey, very stiff, moist, no plasticity. With occasional fine limonite gravels. At 2m: becomes stiff. [WAITEMATA GROUP SOILS]			
3.0		3.0m: Becomes very stiff. 3.1m: Hard band of dark orange limonite.	04/08/2015		
3.5	30.62				
4.0		SILT with some clay. Dark grey, very stiff, moist, low plasticity. [WAITEMATA GROUP SOILS] 4.0m: Becomes hard.			
	30.22				
		Fine, dense Sandy SILT. Dark grey, hard, wet, no plasticity. [WAITEMATA GROUP SOILS]	09/07/2015		
	30.02				
4.5	29.92	SILT with a trace of fine sand. Dark grey, hard, moist, no plasticity. [TRANSITIONAL WAITEMATA GROUP] 4.5m: End of Borehole, unable to penetrate		N S	
5.0					

Vane Shear Strength (kPa) (refer notes for details)

50 100 150 200

Values
147
62
152
57
101
37
89
26
89
32
109
32
152
29
UTP
UTP

Scala Penetrometer (blows / 50mm)

Depth (m)	Blows
4.55	9.0
4.60	11.0
4.65	16.0
4.70	20.0

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Slope, Muddy, Hole data is for a set location only.

6 Omega St, Albany
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KGA GEOTECHNICAL

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Printed: 15/10/2015 5:29:54 p.m.

HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH34**
Date:	9/07/2015
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748599.0, N 5949709.0 **Ground Level:** 35.72

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
0.0	35.62	Topsoil. [COLLUVIUM]		COL.				5.05	1.0
		SILT with some clay. Orange mottled light grey with brown staining, very stiff, moist, low plasticity. At 0.3m; becomes orange mottled light grey and grey. [COLLUVIUM]						5.10	1.0
								5.15	1.0
								5.20	2.0
0.5		0.5m: With occasional intermixed clasts (<2mm).					108	5.25	2.0
							42	5.30	2.0
	34.92							5.35	2.0
		SILT with minor clay. Grey mottled dull orange, very stiff, moist, low plasticity. [ALLUVIUM]		ALLUVIUM				5.40	2.0
								5.45	3.0
								5.50	4.0
1.0							111	5.55	4.0
							36	5.60	4.0
								5.65	3.0
								5.70	4.0
								5.75	4.0
1.5	34.22						111	5.80	5.0
		Clayey SILT. Orange mottled light grey, very stiff, moist, moderately plastic. [ALLUVIUM]					61	5.85	4.0
								5.90	5.0
								5.95	5.0
	33.82							6.00	6.0
								6.05	6.0
2.0		Silty CLAY. Orange mottled light grey, very stiff, moist, highly plastic.At 2.2m; becomes light grey mottled orange. [ALLUVIUM]					111	6.10	7.0
							56	6.15	6.0
								6.20	7.0
								6.25	7.0
								6.30	8.0
2.5			04/08/2015				122	6.35	8.0
							44	6.40	8.0
								6.45	8.0
	32.92							6.50	8.0
		SILT with some clay. Light grey streaked orange with brown staining, very stiff, moist, low plasticity. At 2.9m; becomes brown mottled light grey with occasional intermixed plant fibers. [ALLUVIUM]						6.55	8.0
3.0			▽ 09/07/2015				139	6.60	9.0
							61	6.65	9.0
								6.70	10.0
	32.42							6.75	8.0
		SILT with some fine sand and trace clay. Light grey mottled orange, very stiff, wet, no plasticity. With occasional intermixed plant fibers. [ALLUVIUM]						6.80	8.0
								6.85	7.0
3.5	32.22						153	6.90	8.0
		SILT with some clay. Grey, very stiff, moist, low to moderately plastic. [WAITEMATA GROUP SOILS]		WAITEMATA GROUP SOILS			47		
4.0	31.72						97		
		SILT with some fine sand. Grey, stiff, wet, no plasticity. [WAITEMATA GROUP SOILS]					42		
	31.32								
		SILT with some clay. Grey, stiff, moist to wet, low plasticity. At 4.5m; becomes very stiff. [WAITEMATA GROUP SOILS]					100		
4.5	31.12						33		
		Fine to medium, loose Sandy SILT. Grey, very stiff, wet, no plasticity. [WAITEMATA GROUP SOILS]							
5.0	30.72						97		
		5.0m: End of Borehole					53		

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Steep Slope, Field. Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH35**
Date:	9/07/2015
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748600.0, N 5949741.0 **Ground Level:** 29.86

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit
0.0	29.76	Topsoil. [TOPSOIL]		TS
	29.56	SILT with some clay and minor Topsoil. Orange mottled brown, stiff, moist, low plasticity. [COLLUVIUM]		COL
0.5		SILT with minor clay. Grey mottled orange and light grey, stiff, moist, low plasticity. [ALLUVIUM]		ALL
	29.16	Clayey SILT. Orange mottled light grey, stiff, moist, moderately plastic. [ALLUVIUM]		
1.0	28.66	Silty CLAY with fine sandy pockets. Orange mottled light grey, stiff, moist, highly plastic. [ALLUVIUM]		
	28.36		▽ 09/07/2015	
1.5		SILT with some fine sand and minor clay. Orange mottled light grey, stiff, moist to wet, low plasticity. [ALLUVIUM]	▼ 04/08/2015	
	28.06	Fine to medium, loose Sandy SILT. Grey mottled orange, stiff, wet, no plasticity. [ALLUVIUM]		
2.0	27.86	Clayey SILT. Grey mottled orange, stiff, moist to wet, moderately plastic. With occasional intermixed plant fibers. [ALLUVIUM]		
2.5	27.26	SILT with some clay. Dark grey, stiff, moist to wet, low to moderately plastic. [WAITEMATA GROUP SOILS]		WAITEMATA GROUP SOILS
3.0		3.0m: Becomes very stiff.		
3.5		3.4m: With pockets of blackish grey and occasional intermixed clasts (<3mm).		
4.0		4.0m: Becomes extra sensitive.		
	25.46	4.2m: Becomes wet with frequent intermixed clasts (<3mm).		
4.5	25.31	Fine to medium, loose Sandy SILT with some clasts (<3mm) and a trace of clay. Dark grey with pockets of brown, very stiff, wet to saturated, no plasticity. [WAITEMATA GROUP SOILS]		
		4.6m: End of Borehole, unable to penetrate		
5.0				

Vane Shear Strength (kPa) (refer notes for details)

50 100 150 200

Values	Depth (m)	Blows
	4.60	2.0
	4.65	2.0
	4.70	2.0
	4.75	2.0
	4.80	2.0
81	4.85	3.0
28	4.90	9.0
	4.95	25.0
56		
28		
86		
28		
69		
19		
97		
31		
153		
25		
114		
25		
153		
14		
UTP		
-		

Scala Penetrometer (blows / 50mm)

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Bottom of Steep Slope, Field. Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH36**
Date:	9/07/2015
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748506.0, N 5949741.0 **Ground Level:** 36.54

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log
0.0	36.44	Topsoil. [TOPSOIL]		TS	
	36.14	SILT with some clay and minor Topsoil. Orange mottled brown and grey, stiff, moist, low plasticity. [COLLUVIUM]		COL	
0.5	35.94	SILT with some clay. Orange mottled light grey, very stiff, moist, low plasticity. [WAITEMATA GROUP SOILS]			
		Clayey SILT. Orange mottled light grey, stiff, moist to wet, moderately plastic. With pockets of fine to medium angular gravel sized limonite. [WAITEMATA GROUP SOILS]			
1.0		1.2m: With some fine to coarse dark orange sand sized limonite and becomes light grey streaked orange.			
	35.14	SILT with some clay and some fine to coarse sand sized limonite. Light grey mottled orange and dark orange, stiff, moist, low plasticity. At 1.5m; very stiff. [WAITEMATA GROUP SOILS]			
1.5	34.84	Clayey SILT. Light grey mottled orange, very stiff, moist to wet, moderately plastic. With pockets of fine to medium dark orange sand sized limonite. [WAITEMATA GROUP SOILS]			
2.0	34.54	Silty CLAY. Light grey mottled orange, stiff, moist, highly plastic. With pockets of fine to medium dark orange sand sized limonite. [WAITEMATA GROUP	▼ 09/07/2015 04/08/2015	WGS	
	34.24	Clayey SILT with some fine to medium sand sized limonite. Orange mottled light grey and dark orange, stiff, moist to wet, moderately plastic. At 2.5m; very stiff. [WAITEMATA GROUP SOILS]	▽		
2.5	33.84	Clayey SILT. Dark grey mottled orange, very stiff, moist, low plasticity. [WAITEMATA GROUP SOILS]			
3.0	33.54	Fine, loose Sandy SILT. Dark grey, very stiff, wet, no plasticity. NB; Shear vane taken in sandy material. At 3.3m; with Clayey inclusions. [WAITEMATA GROUP SOILS]			
	33.04	SILT with some clay. Dark grey, very stiff, moist, low plasticity. At 3.7m; with Sandy pockets. [WAITEMATA GROUP SOILS]			
3.5					
4.0	32.44	4.0m: Becomes very stiff to hard.			
	32.24	4.1m; Clayey SILT with pockets of fine sand. Dark grey, very stiff to hard, moist to wet, moderately plastic. [WAITEMATA GROUP SOILS]			
4.5	31.94	4.3m; Fine to medium, medium dense Sandy SILT. Dark grey, very stiff to hard, wet, no plasticity.At 4.5m; with SAND inclusion. [WAITEMATA GROUP SOILS]			
		4.6m: End of Borehole, unable to penetrate			
5.0					

Vane Shear Strength (kPa) (refer notes for details)

50 100 150 200

Values
75
33
83
28
122
44
94
61
156
33
139
33
167
42
194+
-
194+
-
UTP
-

Scala Penetrometer (blows / 50mm)

Depth (m)	Blows
4.65	3.0
4.70	2.0
4.75	3.0
4.80	3.0
4.85	5.0
4.90	6.0
4.95	6.0
5.00	6.0
5.05	5.0
5.10	6.0
5.15	6.0
5.20	6.0
5.25	6.0
5.30	6.0
5.35	6.0
5.40	7.0
5.45	7.0
5.50	8.0
5.55	7.0
5.60	7.0
5.65	7.0
5.70	8.0
5.75	6.0
5.80	6.0
5.85	6.0
5.90	7.0
5.95	6.0
6.00	6.0
6.05	6.0
6.10	6.0
6.15	6.0
6.20	7.0
6.25	5.0
6.30	6.0
6.35	6.0
6.40	7.0
6.45	6.0
6.50	7.0
6.55	6.0
6.60	7.0

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

▼ Standing Water Level

▽ Water Level At Time Of Drilling

◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Steep Slope, Field. Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH37**
Date:	9/07/2015
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748536.0, N 5949776.0 **Ground Level:** 28.61

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit
0.0	28.51	Topsoil. [TOPSOIL]		TS
		SILT with minor fine sand and minor to trace of clay. Orange mottled brown and grey, stiff, moist, very low plasticity. [ALLUVIUM]		
0.5		0.5m: Becomes grey mottled orange.		
	27.81			
		SILT with some clay. Grey mottled orange, stiff, moist to wet, low plasticity. With occasional intermixed plant fibers. At 1m; extra sensitive. [ALLUVIUM]	04/08/2015	
1.0	27.31			
		Clayey SILT. Light grey mottled orange, stiff, moist, moderately plastic. With occasional intermixed plant fibers. [ALLUVIUM]		ALLUVIUM
1.5	26.81			
		SILT with some clay and a trace of fine sand. Light grey mottled orange, stiff, moist, no plasticity. At 2m; very stiff [ALLUVIUM]	09/07/2015	
2.0	26.51			
	26.31	SILT with some fine sand and minor clay. Light grey mottled orange, very stiff, moist to wet, low plasticity. [ALLUVIUM]		
		Fine to medium, loose Sandy SILT with a trace of clay. Light grey with brown staining, very stiff, wet, no plasticity. With occasional intermixed plant fibers. At 2.5m; becomes firm with frequent plant and wood fragments (<5mm diameter) and wet to saturated. NB; Shear vane taken in sandy material. [ALLUVIUM]		
2.5	25.81			
	25.61	2.8m; Clayey SILT. Grey, firm, moist to wet, moderately plastic. With occasional intermixed plant fibers. [ALLUVIUM]		
3.0		3m; Clayey SILT. Dark grey, very stiff to hard, moist to wet, moderately plastic. [TRANSITIONAL WAITEMATA GROUP]		TRANS WG
	25.31	~~3.3m: End of Borehole, unable to penetrate~~		
3.5				
4.0				
4.5				
5.0				

Vane Shear Strength (kPa) (refer notes for details)

50	100	150	200	Values
				89
				31
				69
				8
				97
				39
				155
				56
				42
				14
				194+
				-
				UTP
				-

Scala Penetrometer (blows / 50mm)

Depth (m)	Blows
3.35	6.0
3.40	6.0
3.45	2.0
3.50	3.0
3.55	3.0
3.60	3.0
3.65	11.0
3.70	25.0

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Gentle Slope. Field (Bottom of Steep Area). Hole data is for a set location only.

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HAND AUGER LOG

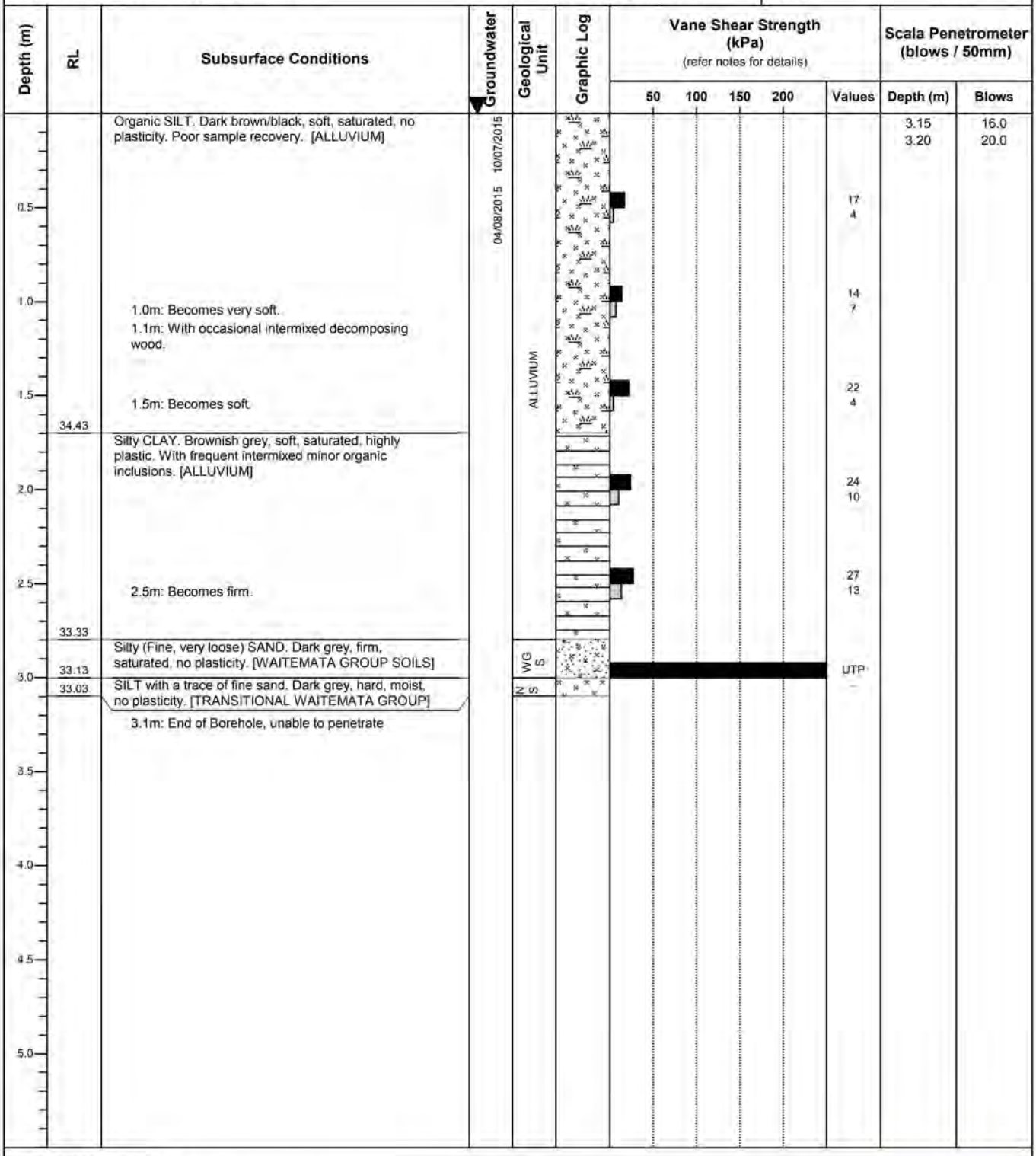
Job No.:	**7464**
Hole No.:	**AH38**
Date:	10/07/2015
Logged By:	RF
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748277.0, N 5949873.0 **Ground Level:** 36.13



Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Water Course, Swamp. Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH39**
Date:	10/07/2015
Logged By:	BM
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748262.0, N 5949918.0 **Ground Level:** 49.66

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
0	49.46	Silty Topsoil. Brown, very stiff, moist, no plasticity. [TOPSOIL]	Groundwater Not Encountered	TS	TS			5.05	2.5
		SILT. Orange, very stiff, moist, no plasticity. [WAITEMATA GROUP SOILS]		WAITEMATA GROUP SOILS				5.10	2.5
								5.15	2.0
								5.20	2.0
0.5							147	5.25	2.0
							57	5.30	2.5
								5.35	2.5
								5.40	2.0
								5.45	2.0
								5.50	3.0
1.0							127	5.55	2.0
							54	5.60	3.0
								5.65	3.0
		1.3m: Becomes reddish orange with occasional limonite staining and fine gravels.						5.70	3.0
								5.75	2.5
1.5							112	5.80	2.5
							35	5.85	3.0
								5.90	3.0
		1.8m: Becomes orange mottled grey.						5.95	3.0
								6.00	3.0
								6.05	4.0
2.0		2.0m: Becomes stiff, grey mottled orange.					81	6.10	4.0
							35	6.15	4.0
								6.20	4.0
								6.25	4.0
								6.30	4.0
2.5		2.5m: Becomes orange.					71	6.35	4.0
							35	6.40	3.0
								6.45	4.0
								6.50	5.0
								6.55	4.0
								6.60	4.0
3.0							95	6.65	5.0
							32	6.70	5.0
								6.75	5.0
								6.80	5.0
								6.85	5.0
3.5		3.5m: Becomes grey mottled orange and very stiff.					101	6.90	5.0
							35		
4.0		4.0m: Becomes stiff.					95		
							35		
4.5		4.5m: Becomes very stiff					138		
							51		
	44.66								
5.0		5.0m: End of Borehole					119		
							54		

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

General Slope, Grass. Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH40**
Date:	10/07/2015
Logged By:	BM
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748265.0, N 5949756.0 **Ground Level:** 30.41

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
0.0	30.21	Silty Topsoil. Brown, very stiff, moist, no plasticity. [TOPSOIL]		TS	TS			3.15	10.0
		SILT with some clay. Orange, very stiff, moist, low plasticity. [WAITEMATA GROUP SOILS]						3.20	10.0
0.5							109	3.25	13.0
							46	3.30	13.0
	29.51							3.35	20.0
1.0	29.31	Clayey SILT. Orange, very stiff, moist, low to moderately plastic. At 1m; stiff. [WAITEMATA GROUP SOILS]	04/08/2015	WAITEMATA GROUP SOILS			81		
		Silty CLAY. Orange mottled grey, stiff, moist, moderately plastic. [WAITEMATA GROUP SOILS]					37		
1.5	28.91	1.4m: Becomes grey mottled orange.					81		
		SILT with some clay. Grey mottled orange, stiff, moist, low plasticity. [WAITEMATA GROUP SOILS]					32		
	28.61								
2.0		SILT. Grey mottled orange, stiff, moist, no plasticity. [WAITEMATA GROUP SOILS]					98		
	28.21						23		
		Fine, loose Sandy SILT. Grey, stiff, wet, no plasticity. [WAITEMATA GROUP SOILS]	10/07/2015						
2.5	27.91						147		
		SILT. Dark grey, very stiff, moist, no plasticity. [WAITEMATA GROUP SOILS]					49		
	27.61								
		Fine, loose Sandy SILT. Dark grey, very stiff, wet, no plasticity. [WAITEMATA GROUP SOILS]							
3.0	27.41						UTP		
	27.31	SILT. Dark grey, hard, moist, no plasticity. [TRANSITIONAL WAITEMATA GROUP]		N S					
		3.1m: End of Borehole, unable to penetrate							
3.5									
4.0									
4.5									
5.0									

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- Standing Water Level
- Water Level At Time Of Drilling
- Out Flow / In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

General Slope, Grass. Hole data is for a set location only.

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KGA GEOTECHNICAL

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH41**
Date:	13/07/2015
Logged By:	BM
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1747940.0, N 5949811.0 **Ground Level:** 56.42

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
	56.32	Topsoil. [TOPSOIL]	13/07/2015	TS				4.15	8.0
		Clayey SILT. Grey mottled brown and orange, very stiff, moist, low to moderately plastic. [COLLUVIUM]						4.20	25.0
	56.02								
0.5		SILT with some clay. Orange mottled grey, very stiff, moist, low plasticity. [COLLUVIUM]					104 49		
1.0		1.0m: Becomes stiff and grey mottled orange					95 43		
		1.2m: With occasional limonite staining and fine gravels.							
1.5		1.5m: Becomes very stiff		COL			127 46		
2.0	54.32	2.0m: Becomes stiff.					71 46		
		Clayey SILT. Grey mottled orange with occasional limonite staining, stiff, moist, low to moderately plastic. With occasional fine limonite gravels. [COLLUVIUM]							
	54.02								
2.5		Silty CLAY. Grey mottled orange, stiff, moist, moderately plastic. With occasional organic matter (1-5mm) [COLLUVIUM]					68 40		
3.0							74 37		
	53.12								
3.5		SILT with some clay. Dark grey, stiff, moist, low plasticity.At 3.5m; very stiff. [WAITEMATA GROUP SOILS]		WAITEMATA GROUP SOILS			112 35		
4.0	52.42		04/08/2015				UTP		
	52.32	SILT. Dark grey, hard, moist, no plasticity. [TRANSITIONAL WAITEMATA GROUP]		TS					
		4.1m: End of Borehole, unable to penetrate							
4.5									
5.0									

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

General Slope, Pine Trees. Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH42**
Date:	13/07/2015
Logged By:	RF
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1747909.0, N 5949726.0 **Ground Level:** 41.6

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
0.0		Clayey SILT. Grey/dark grey mottled dark orange, stiff, moist, low to moderately plastic. With occasional intermixed decomposing wood. [ALLUVIUM]		ALLUVIUM				5.05	4.0
								5.10	4.0
								5.15	4.0
								5.20	5.0
								5.25	6.0
0.5			04/08/2015				63	5.30	6.0
							22	5.35	6.0
		0.7m: Becomes moist to wet.						5.40	7.0
								5.45	7.0
								5.50	5.0
1.0							37	5.55	6.0
	40.5	1.0m: Becomes firm.					15	5.60	7.0
		Silty CLAY. Brownish grey, firm, moist to wet, highly plastic. With frequent intermixed minor organics (1-5mm). [ALLUVIUM]						5.65	8.0
								5.70	8.0
								5.75	10.0
1.5							21	5.80	12.0
		1.5m: Becomes soft.					9	5.85	25.0
2.0							28		
		2.0m: Becomes firm.					16		
	39.3								
		Fine to medium Sandy Clayey SILT. Grey, firm, wet, low to moderately plastic. With occasional organic inclusions (1-10mm). At 2.5m; becomes stiff. [ALLUVIUM]							
2.5							51		
							16		
3.0							64		
	38.5						22		
		Silty (Medium to coarse, loose) SAND. Grey/dark grey, stiff, saturated, no plasticity. Shear vane NA at 3.5m. [ALLUVIUM]	13/07/2015						
3.5							0		
	37.9						-		
		SILT with a trace of fine sand. Orange mottled dark orange, moist to wet, no plasticity. [WAITEMATA GROUP SOILS]		WAITEMATA GROUP SOILS					
4.0							111		
		4.0m: Becomes very stiff.					35		
	37.3								
		Silty (Fine to medium, loose) SAND. Brownish grey/grey, saturated, no plasticity.At 5m; loose to medium dense. [WAITEMATA GROUP SOILS]							
4.5							0		
							-		
	36.6								
5.0		5.0m: End of Borehole					171+		
							-		

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Water Course, Grass. Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH43**
Date:	13/07/2015
Logged By:	RF
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1747935.0, N 5949729.0 **Ground Level:** 47.03

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
	46.93	Topsoil. [TOPSOIL]	13/07/2015	TS				5.05	1.0
		Silty CLAY. Orange, very stiff, moist, moderate to highly plastic. [COLLUVIUM]						5.10	1.0
								5.15	2.0
								5.20	2.0
0.5							147	5.25	1.0
							64	5.30	1.0
	46.33							5.35	2.0
		Clayey SILT. Reddish orange mottled orange, very stiff, moist, low to moderately plastic. [COLLUVIUM]						5.40	1.0
								5.45	1.0
								5.50	1.0
1.0							144	5.55	1.0
							59	5.60	1.0
								5.65	1.0
	45.63							5.70	1.0
								5.75	1.0
1.5		SILT with a trace of fine sand. Reddish orange, very stiff, moist, no plasticity. [COLLUVIUM]					127	5.80	1.0
							31	5.85	1.0
	45.33							5.90	2.0
		SILT with some clay. Pink mottled grey, very stiff, moist, low plasticity. With occasional intermixed weakly cemented clasts (2-10mm). At 2m; Extra sensitive and stiff. [COLLUVIUM]						5.95	2.0
								6.00	2.0
								6.05	2.0
2.0							73	6.10	2.0
							5	6.15	2.0
	44.83							6.20	2.0
		SILT with a trace of fine sand. Pink, stiff, moist, no plasticity. [COLLUVIUM]						6.25	2.0
								6.30	2.0
2.5		2.5m: Becomes very stiff		COLLUVIUM			111	6.35	3.0
							35	6.40	3.0
								6.45	3.0
								6.50	4.0
								6.55	5.0
								6.60	5.0
3.0		2.9m: Becomes light grey/grey and dry.					109	6.65	4.0
							35	6.70	5.0
	43.73							6.75	6.0
								6.80	6.0
		Medium to coarse, loose SAND. Orange/dark orange mottled grey, very stiff, moist, no plasticity. With black carbonaceous inclusions (2-5mm). [COLLUVIUM]						6.85	7.0
3.5							0	6.90	7.0
	43.23								
		SILT with a trace of fine sand. Light grey, moist, no plasticity. [COLLUVIUM]							
4.0							120		
							40		
4.5							122		
	42.43						35		
		Fine to medium, loose SAND. Orange mottled dark orange, very stiff, moist to wet, no plasticity. With frequent intermixed weakly cemented clasts (1-10mm). [COLLUVIUM]							
	42.03		04/08/2015				0		
5.0		5.0m: End of Borehole							

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- Standing Water Level
- Water Level At Time Of Drilling
- Out Flow / In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Steep Slope, Trees. Hole data is for a set location only.

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Job No.:	**7464**
Hole No.:	**AH44**
Date:	13/07/2015
Logged By:	RF
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748029.0, N 5949985.0 **Ground Level:** 64.22

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
0.5	63.62	Clayey SILT. Orange mottled grey and brown, firm, moist, low to moderately plastic. [COLLUVIUM]	13/07/2015	COLLUVIUM			41 13	5.05 5.10 5.15 5.20 5.25 5.30	3.0 3.0 4.0 4.0 4.0 5.0
1.0	63.12	Silty CLAY. Orange mottled light grey, firm, moist, moderate to highly plastic. [WAITEMATA GROUP SOILS] 1.0m: Becomes stiff.					96 35	5.35 5.40 5.45 5.50 5.55 5.60	10.0 11.0 11.0 11.0 8.0 7.0
	62.82	Silty (Fine, loose) SAND. Orange/dark orange with limonite staining, stiff, moist, no plasticity. [WAITEMATA GROUP SOILS]						5.65 5.70 5.75	7.0 5.0 6.0
1.5	62.52	Clayey SILT. Light grey mottled orange, stiff, moist, low to moderately plastic. [WAITEMATA GROUP SOILS]					86 33	5.80 5.85 5.90	5.0 6.0 6.0
2.0		SILT with a trace of fine sand. Orange mottled grey, stiff, moist, no plasticity. [WAITEMATA GROUP SOILS] 2.0m: Becomes very stiff		WAITEMATA GROUP SOILS			149 37	5.95 6.00 6.05 6.10 6.15 6.20	7.0 7.0 7.0 6.0 5.0 5.0
2.5	61.42						171+	6.25 6.30 6.35 6.40	6.0 10.0 7.0 6.0
3.0	61.12	Clayey SILT. Light grey/grey, very stiff, moist, low to moderately plastic. [WAITEMATA GROUP SOILS]					160 38	6.45 6.50 6.55 6.60 6.65 6.70	8.0 7.0 7.0 7.0 6.0 6.0
3.5		SILT with a trace of fine sand. Grey mottled orange, very stiff, moist, no plasticity. With the occasional lense of SILT with some clay. [WAITEMATA GROUP SOILS]					171+	6.75 6.80 6.85 6.90	7.0 7.0 8.0 8.0
4.0							171+		
	59.82								
4.5		Silty (Fine, medium dense) SAND. Grey, very stiff, moist, no plasticity. [WAITEMATA GROUP SOILS]					171+		
	59.22								
5.0		5.0m: End of Borehole	04/08/2015				171+		

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- Standing Water Level
- Water Level At Time Of Drilling
- Out Flow / In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Toe of Slope, Trees. Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH45**
Date:	13/07/2015
Logged By:	BM
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748068.0, N 5949921.0 **Ground Level:** 51.69

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
	51.59	Topsoil. [TOPSOIL]	13/07/2015	TS				2.05	11.0
		SILT with some clay. Grey mottled orange, very stiff, moist, low plasticity.At 0.3m; becomes orange mottled grey with occasional limonite staining. [COLLUVIUM]						2.10	14.0
	51.19							2.15	19.0
0.5		SILT. Grey mottled orange and brown, very stiff, moist, no plasticity. [COLLUVIUM]		COL			138	2.20	25.0
		0.8m: Becomes orange mottled grey with frequent limonite staining and fine gravels.					19		
1.0		1.0m: Becomes grey mottled orange and brown with frequent limonite staining and fine gravels.					106		
	50.49						19		
		Clayey SILT. Grey, very stiff, moist, low to moderately plastic. [WAITEMATA GROUP SOILS]							
1.5	50.19			WGS			UTP		
		Fine, medium dense Sandy SILT with some clay. Grey, hard, moist to wet, low plasticity. [WAITEMATA GROUP SOILS]					-		
	49.79								
2.0	49.69	SILT with a trace of fine sand. Dark grey, hard, moist, no plasticity. [TRANSITIONAL WAITEMATA GROUP]	04/08/2015	NS			UTP		
		2.0m: End of Borehole, unable to penetrate					-		
2.5									
3.0									
3.5									
4.0									
4.5									
5.0									

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- Standing Water Level
- Water Level At Time Of Drilling
- Out Flow / In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Slope, Muddy, Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH46**
Date:	10/07/2015
Logged By:	RF
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748141.0, N 5950050.0 **Ground Level:** 58.66

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
0.0		Silty CLAY. Orange mottled grey, firm, moist to wet, highly plastic. Extra sensitive. [COLLUVIUM]	04/08/2015 ▼ 10/07/2015 ▽	COLLUVIUM				4.05	4.0
								4.10	6.0
								4.15	12.0
								4.20	9.0
0.5		0.4m: Becomes wet.					38 4	4.25	12.0
	57.96							4.30	20.0
		Fine Sandy Clayey SILT. Grey/dark grey mottled orange, firm, saturated, low to moderately plastic. [COLLUVIUM]							
1.0							82 24		
	57.56	1.0m: Becomes stiff.							
		Silty CLAY with a trace of fine sand. Light grey mottled orange, stiff, saturated, highly plastic. [COLLUVIUM]							
1.5							36 20		
	56.86								
		SILT with minor to trace of clay and sand. Grey mottled orange, firm, saturated, no to low plasticity. With occasional organic inclusions (2-5mm). 2m; soft [COLLUVIUM]							
2.0							23 4		
2.5							18 5		
3.0							38 21		
	55.56	3.0m: Becomes firm.							
		Silty (Fine, very loose) SAND. Dark grey, firm, saturated, no plasticity. [WAITEMATA GROUP SOILS]		WAITEMATA GROUP SOILS					
3.5		3.5m: Very stiff.					171+ -		
	54.96								
	54.86	Clayey SILT. Dark grey, very stiff, moist, moderately plastic. [WAITEMATA GROUP SOILS]							
	54.66	Silty (Fine, dense) SAND. Dark grey, very stiff, moist, no plasticity. [TRANSITIONAL WAITEMATA GROUP]		TRANS WG			UTP -		
4.0		4.0m: End of Borehole, unable to penetrate							
4.5									
5.0									

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Water Course, Bushes. Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH47**
Date:	13/07/2015
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748125.0, N 5950245.0 **Ground Level:** 71.26

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details)	Values
0.0	71.06	Topsoil. [TOPSOIL]		TS			
	70.86	SILT with some clay and minor Topsoil. Orange mottled light grey, grey and brown, very stiff, moist, low plasticity. [COLLUVIUM]		COL			
0.5	70.66	Clayey SILT. Orange mottled light grey, very stiff, moist, moderately plastic. [WAITEMATA GROUP SOILS]					122
		Silty CLAY. Orange mottled light grey with brown staining, very stiff, moist, highly plastic. [WAITEMATA GROUP SOILS]					53
1.0	70.26	Clayey SILT. Orange mottled light grey, very stiff, moist, moderately plastic. [WAITEMATA GROUP SOILS]					103
	69.96						53
1.5		Silty CLAY. Orange mottled light grey, very stiff, moist, highly plastic. [WAITEMATA GROUP SOILS]	04/08/2015				111
	69.56						53
2.0		Clayey SILT. Light grey mottled orange, very stiff, moist, moderately plastic. [WAITEMATA GROUP SOILS]					69
		2.0m: Becomes stiff.					28
		2.3m: With CLAY inclusion and occasional fine to coarse sand sized limonite.					
	68.86			WGS			
2.5		Silty CLAY. Light grey mottled orange, stiff, moist, highly plastic. [WAITEMATA GROUP SOILS]					69
		2.7m: With pockets of dark orange fine to coarse sand sized limonite and becomes moist to wet.					33
3.0							56
	68.06						25
		Clayey SILT. Light grey mottled orange with dark orange limonite staining, stiff, moist to wet, moderately plastic. [WAITEMATA GROUP SOILS]					
3.5	67.76		13/07/2015				100
		SILT with some fine to medium sand, some clasts (<3mm) and some clay. Light grey mottled grey, off white and pink, very stiff, moist to wet, low plasticity. [WAITEMATA GROUP SOILS]					19
4.0		4.0m: Becomes wet and stiff..					94
	67.06						28
		SILT with some clasts (<3mm), minor clay and minor fine sand. Light grey mottled grey with occasional reddish brown and dull orange, stiff, wet, low plasticity. [WAITEMATA GROUP SOILS]					
	66.86						
4.5	66.71	4.4m: Fine to medium, loose Sandy SILT. Orange mottled light grey and dark orange, stiff, wet, no plasticity. At 4.5m: hard. [TRANSITIONAL WAITEMATA		AN S W			UTP
		4.6m: End of Borehole, unable to penetrate					-
5.0							

Scala Penetrometer (blows / 50mm)	
Depth (m)	Blows
4.60	5.0
4.65	4.0
4.70	6.0
4.75	7.0
4.80	8.0
4.85	9.0
4.90	5.0
4.95	5.0
5.00	6.0
5.05	7.0
5.10	10.0
5.15	11.0
5.20	25.0

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Top of Steep Slope, Field. Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH48**
Date:	13/07/2015
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748195.0, N 5950300.0 **Ground Level:** 77.33

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details)	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
	77.23	Topsoil. [TOPSOIL]		TS		50 100 150 200		5.05	1.0
		SILT with some clay and some Topsoil. Orange mottled brown, very stiff, moist, low plasticity. With occasional intermixed black carbonaceous material. [COLLUVIUM]		COL.				5.10	1.0
	76.93							5.15	1.0
		Clayey SILT. Orange with brown staining, very stiff, moist, moderately plastic. [WAITEMATA GROUP SOILS]						5.20	2.0
0.5							156	5.25	2.0
		0.8m: Becomes orange mottled light grey.					75	5.30	3.0
								5.35	3.0
								5.40	3.0
								5.45	3.0
1.0		1.0m: Becomes stiff.					97	5.50	4.0
							14	5.55	4.0
		1.2m: With some fine angular gravel sized						5.60	4.0
		1.4m: No limonite and common clasts (<3mm). At 1.5m; becomes light pink mottled orange and light grey with clasts (<5mm).						5.65	3.0
								5.70	4.0
								5.75	4.0
1.5							108	5.80	4.0
	75.73						44	5.85	4.0
		SILT with some clay. Light pink mottled light grey and orange, very stiff, moist, low plasticity. At 1.7m; with minor clay and becomes orange mottled light grey with frequent intermixed clasts (<3mm). At 2m; with a trace of clay and becomes light pink speckled light grey.At 2.3m; with some intermixed clasts (<3mm) and moist to wet. At 2.5m; very stiff to hard with intermixed clasts (<30%) <3mm, becomes orange mottled light grey and pink with occasional plant fibers. [WAITEMATA GROUP SOILS]						5.90	5.0
								5.95	5.0
								6.00	5.0
								6.05	6.0
2.0							114	6.10	6.0
							56	6.15	5.0
								6.20	6.0
								6.25	6.0
								6.30	6.0
2.5				WAITEMATA GROUP SOILS			194+	6.35	7.0
							-	6.40	8.0
								6.45	8.0
								6.50	8.0
								6.55	8.0
								6.60	9.0
3.0							125	6.65	10.0
	74.23	3.0m: Becomes very stiff.					36	6.70	11.0
		SILT with minor fine sand and minor clay. Pink mottled orange, very stiff, wet, no plasticity. With frequent intermixed clasts (<3mm). At 3.3m; with pockets of dark orange fine to medium angular gravel sized limonite. 3.5m; hard. [WAITEMATA GROUP SOILS]						6.75	13.0
								6.80	13.0
								6.85	15.0
3.5							UTP	6.90	25.0
	73.63						-		
		SILT with some clay. Orange mottled pink and light grey, hard, moist to wet, low plasticity. With frequent intermixed black carbonaceous material. [WAITEMATA GROUP SOILS]	▼ 04/08/2015						
4.0							181		
		4.0m: Becomes very stiff.					42		
		4.3m: Becomes light grey.	▽ 13/07/2015						
4.5							194+		
		4.5m: Becomes very stiff to hard with minor fine sand and a trace of clay.					-		
	72.63								
		Silty (Fine to medium, medium dense) SAND. Grey, very stiff to hard, wet to saturated, no plasticity. At 4.9m; with some clay inclusions. [WAITEMATA GROUP SOILS]							
	72.33						122		
5.0		5.0m: End of Borehole					42		

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Moderate Slope, Field. Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH49**
Date:	13/07/2015
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748154.0, N 5950357.0 **Ground Level:** 53.62

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values
0.0	53.42	Topsoil. [TOPSOIL]		TS	TS		
		SILT with some clay. Orange mottled grey and streaked orange, very stiff, moist, low to moderately plastic. [COLLUVIUM]					
0.5	53.12	Clayey SILT. Orange mottled light grey, grey and streaked orange, very stiff, moist, moderately plastic. [COLLUVIUM]					108 42
		0.7m: Becomes orange mottled light grey.					
1.0	52.52	Silty CLAY. Light grey mottled orange with brown staining, very stiff, moist, highly plastic. At 1.3m; with pockets of plant fibers. and topsoil staining. [COLLUVIUM]		COL			111 56
1.5		1.5m: Becomes stiff.					89 47
		1.6m: Becomes moist to wet.					
2.0	51.42						75 44
	51.22	Silty CLAY. Orange mottled light grey, stiff, moist to wet, highly plastic. [WAITEMATA GROUP SOILS]					
2.5		Fine to medium, loose Sandy SILT with minor clay. Orange mottled light grey, stiff, wet, low plasticity. At 2.5m; shear vane taken in sandy material. [WAITEMATA GROUP SOILS]	04/08/2015				72 28
3.0	50.42		13/07/2015	WGS			67 19
		Silty (Fine to medium, loose) SAND. Light grey streaked orange, stiff, saturated, no plasticity. [WAITEMATA GROUP SOILS]					
3.5							0
4.0	49.62						142 42
		Fine to coarse, loose Sandy SILT. Light grey mottled orange, wet to saturated, no plasticity. NB; Shear vane taken in sandy material. [WAITEMATA GROUP SOILS]					
	49.17						0
4.5		4.5m: End of Borehole, Sandy and Hole collapsing					
5.0							

Depth (m)	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
	4.50	1.0
	4.55	2.0
	4.60	2.0
	4.65	1.0
	4.70	2.0
	4.75	2.0
	4.80	2.0
	4.85	1.0
	4.90	2.0
	4.95	2.0
	5.00	2.0
	5.05	2.0
	5.10	2.0
	5.15	2.0
	5.20	3.0
	5.25	2.0
	5.30	3.0
	5.35	2.0
	5.40	3.0
	5.45	3.0
	5.50	3.0
	5.55	3.0
	5.60	3.0
	5.65	5.0
	5.70	5.0
	5.75	5.0
	5.80	6.0
	5.85	7.0
	5.90	7.0
	5.95	7.0
	6.00	6.0
	6.05	7.0
	6.10	6.0
	6.15	7.0
	6.20	5.0
	6.25	6.0
	6.30	5.0
	6.35	5.0
	6.40	4.0
	6.45	4.0

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Bottom of Moderate Slope, Field. Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH50**
Date:	13/07/2015
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748247.0, N 5950396.0 **Ground Level:** 51.99

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
0	51.89	Topsoil. [TOPSOIL]		TS				3.50	5.0
		SILT with some clay. Orange mottled pink and grey, very stiff, moist, low plasticity. [COLLUVIUM]						3.55	5.0
								3.60	5.0
								3.65	6.0
		0.4m: With pockets of black carbonaceous					153	3.70	9.0
0.5				COLLUVIUM			33	3.75	10.0
		0.6m: Becomes grey mottled orange.						3.80	10.0
								3.85	11.0
								3.90	12.0
								3.95	13.0
1.0							122	4.00	11.0
							39		
	50.79								
		SILT with some clay. Grey streaked dark orange, very stiff, moist, low plasticity. With occasional intermixed plant fibers. 1.5m: lense of Clayey material. [ALLUVIUM]	04/08/2015						
1.5	50.49	Silty CLAY. Grey streaked dark orange with dark orange limonite staining, stiff, moist to wet, highly plastic. With occasional intermixed plant fibers. Extra sensitive. [ALLUVIUM]	13/07/2015				56		
							6		
	50.09								
2.0		SILT with some fine to medium sand and minor clay. Dark grey mottled light grey and brown, stiff, wet, low plasticity. With frequent pockets of black carbonaceous material. Organic smell. 2m: Firm. [ALLUVIUM]					47		
	49.79						17		
		SILT with some clay. Dark grey, firm, wet, low plasticity. With occasional intermixed plant fibers. [ALLUVIUM]							
	49.59								
2.5		Clayey SILT with minor fine to medium sand. Dark grey, firm, wet, moderately plastic. With frequent intermixed plant fibers and occasional clasts and minor organics (<4mm). [ALLUVIUM]		ALL			42		
							19		
	48.99								
3.0		Fine to medium, loose Sandy SILT with some clay. Light grey with black staining, stiff, wet, low plasticity. With occasional black carbonaceous material and clasts (<2mm). 3.2m: with common wood fragments (<10mm diameter). [ALLUVIUM]					56		
							28		
	48.69								
	48.54	3.3m: Silty (Fine to medium, loose) SAND. Dull greenish grey with pockets of brown, stiff, wet, no plasticity. [TRANSITIONAL WAITEMATA GROUP]		ANSW			UTP		
3.5		3.5m: End of Borehole, unable to penetrate					-		
4.0									
4.5									
5.0									

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
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Other Comments

Moderate Slope. Field. Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH51**
Date:	14/07/2015
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

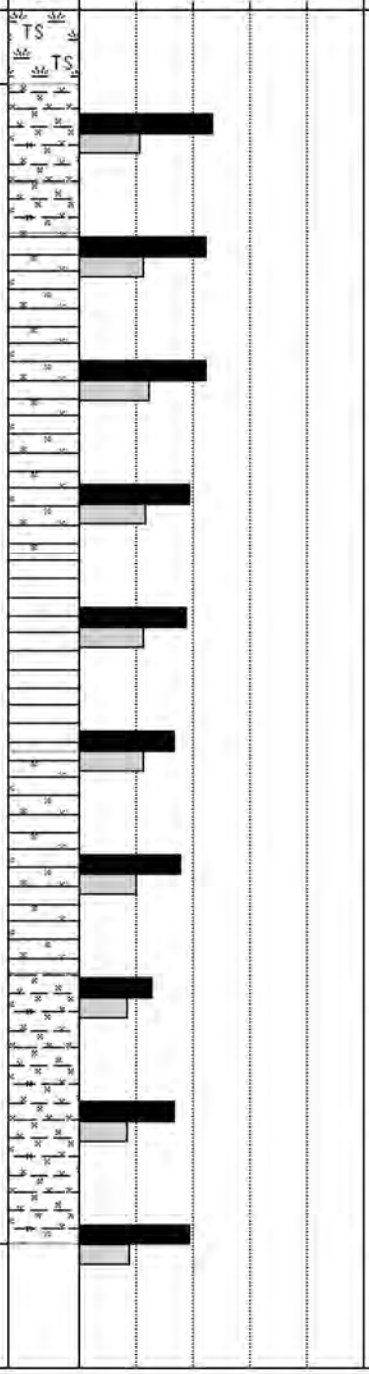
Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748381.0, N 5950372.0 **Ground Level:** 63.4

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit
0.0	63.4	Topsoil. [TOPSOIL]		TS
	63.1	SILT with some clay. Orange mottled light grey streaked dark orange, very stiff, moist, low plasticity. [COLLUVIUM]		
0.5	62.7	Clayey SILT. Light grey mottled orange, very stiff, moist, moderately plastic. [COLLUVIUM]		
	62.5	Silty CLAY. Orange mottled light grey, very stiff, moist, highly plastic. [COLLUVIUM]		
1.0		1.2m: Becomes light grey streaked orange.	04/08/2015	
1.5		1.8m: With brown staining.		
2.0		2.0m: Becomes moist to wet and stiff.		
	61.2	CLAY with some Silt. Orange mottled light grey, stiff, moist to wet, highly plastic. [COLLUVIUM]		COL
2.5				
3.0	60.4	Silty CLAY. Orange mottled light grey, stiff, moist, highly plastic. [COLLUVIUM]		
3.5		3.7m: With pockets of pink and fine angular limonite gravels plus moist to wet.		
	59.5	Clayey SILT. Light grey mottled orange, stiff, wet, moderately plastic. With pockets of dark orange fine to coarse sand sized limonite. [COLLUVIUM]		
4.0		4.2m: With frequent intermixed clasts (<2mm), pink mottled orange, light grey and becomes moist to wet.	14/07/2015	
4.5		4.6m: Becomes light pink mottled light grey and orange plus wet.		
	58.4			
5.0		5.0m: End of Borehole		

Vane Shear Strength (kPa) (refer notes for details)



Values
117
53
111
56
111
61
97
58
94
56
83
56
89
50
64
42
83
42
97
44

Scala Penetrometer (blows / 50mm)

Depth (m)	Blows
5.05	1.0
5.10	1.0
5.15	1.0
5.20	2.0
5.25	2.0
5.30	2.0
5.35	2.0
5.40	2.0
5.45	3.0
5.50	3.0
5.55	2.0
5.60	3.0
5.65	3.0
5.70	3.0
5.75	3.0
5.80	3.0
5.85	3.0
5.90	4.0
5.95	5.0
6.00	5.0
6.05	5.0
6.10	6.0
6.15	6.0
6.20	5.0
6.25	6.0
6.30	6.0
6.35	6.0
6.40	6.0
6.45	6.0
6.50	7.0
6.55	8.0
6.60	6.0
6.65	6.0
6.70	7.0
6.75	8.0
6.80	8.0
6.85	9.0
6.90	7.0

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Flat part on Moderate Slope, Field. Hole data is for a set location only.

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KGA GEOTECHNICAL

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH52**
Date:	14/07/2015
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748352.0, N 5950451.0 **Ground Level:** 61.63

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
	61.53	Topsoil. [TOPSOIL]	14/07/2015	TS				5.05	1.0
		SILT with minor clay. Orange mottled light grey, very stiff, moist, low plasticity. [WAITEMATA GROUP SOILS]						5.10	1.0
	61.23							5.15	2.0
								5.20	2.0
		Clayey SILT. Orange mottled light grey, very stiff, moist, moderately plastic. [WAITEMATA GROUP SOILS]					125	5.25	2.0
0.5							42	5.30	3.0
								5.35	3.0
								5.40	4.0
								5.45	4.0
		1.0m: With frequent intermixed clasts (<1mm) and very stiff to hard.						5.50	4.0
1.0	60.53						194+	5.55	5.0
		SILT with some clay. Orange speckled pink, light grey and dark orange, very stiff to hard, moist, low plasticity. With frequent intermixed clasts (<1mm). [WAITEMATA GROUP SOILS]						5.60	6.0
	60.33							5.65	5.0
								5.70	6.0
								5.75	5.0
		SILT with some fine to coarse sand sized limonite and minor clay. Orange speckled dark orange and light grey, very stiff to hard, moist, low plasticity. At 1.5m; no limonite, orange mottled light grey, pink and very stiff. [WAITEMATA GROUP SOILS]					100	5.80	5.0
1.5							33	5.85	6.0
								5.90	6.0
								5.95	9.0
								6.00	8.0
								6.05	8.0
2.0							128	6.10	8.0
		2.1m: Becomes orange mottled dark orange and light grey with some clasts (<3mm) and minor to trace of clay.					33	6.15	7.0
								6.20	8.0
								6.25	6.0
		2.4m: Becomes pink mottled orange, dark orange and light grey with some clay inclusions. 2.5m:						6.30	7.0
2.5				WGS			97	6.35	7.0
							31	6.40	7.0
								6.45	6.0
		2.7m: With a trace of clay and fine sand, wet and pink mottled orange. 2.8m; with pockets of fine to coarse sand. At 3m; with some clasts (<3mm) and very stiff.						6.50	7.0
								6.55	6.0
								6.60	6.0
3.0							111	6.65	6.0
							39	6.70	5.0
								6.75	5.0
		3.3m: With fine Sandy inclusions.						6.80	5.0
								6.85	5.0
3.5		3.5m: With pockets of fine to coarse sand sized and fine angular gravel sized limonite.					153	6.90	5.0
							47		
		3.8m: With some clay inclusions.							
4.0							150		
							44		
	57.33								
		SILT with some fine to medium sand and a trace of clay. Pink mottled light pink, orange and light grey, very stiff, moist to wet, no plasticity. With occasional intermixed black carbonaceous material. At 4.5m; with minor to trace of fine sand. [WAITEMATA GROUP SOILS]					139		
4.5							42		
			04/08/2015						
	56.63						125		
5.0		5.0m: End of Borehole					42		

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Steep Slope, Field. Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH53**
Date:	14/07/2015
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748368.0, N 5950507.0 **Ground Level:** 34.36

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
	34.26	Topsoil. [ALLUVIUM]	14/07/2015 04/08/2015	ALL.				0.05	0.3
		SILT with some clay. Brownish grey, wet to saturated, low plasticity. With frequent intermixed plant fibers and wood fragments. [ALLUVIUM]						0.10	0.3
								0.15	0.3
								0.20	0.5
								0.25	0.5
0.5	33.81						UTP	0.30	0.5
		0.6m: End of Borehole, unable to penetrate. Tried several times in vicinity all pulled up short. Rock?						0.35	0.5
								0.40	1.0
		Scala pentrometer test completed beside hole starting at surface - Bounce at 1.75m.						0.45	2.0
								0.50	1.0
1.0								0.55	2.0
								0.60	2.0
								0.65	2.0
								0.70	3.0
								0.75	3.0
								0.80	3.0
1.5								0.85	3.0
								0.90	4.0
								0.95	5.0
								1.00	5.0
								1.05	5.0
2.0								1.10	4.0
								1.15	5.0
								1.20	4.0
								1.25	5.0
								1.30	3.0
2.5								1.35	4.0
								1.40	4.0
								1.45	5.0
								1.50	5.0
								1.55	6.0
3.0								1.60	7.0
								1.65	8.0
								1.70	8.0
								1.75	13.0
								1.80	25.0
3.5									
4.0									
4.5									
5.0									

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Steep Slope, Bush Edge. Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH54**
Date:	14/07/2015
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748305.0, N 5950541.0 **Ground Level:** 31.72

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details)	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
0.0	31.62	Topsoil. [TOPSOIL]		TS				3.60	4.0
		SILT with some clay. Grey mottled orange with brown staining, very stiff, moist, low plasticity. [WAITEMATA GROUP SOILS]						3.65	3.0
								3.70	4.0
								3.75	4.0
								3.80	4.0
0.5	31.12	0.5m: Becomes orange mottled light grey.					139 61	3.85	5.0
		Clayey SILT. Orange mottled light grey streaked dark orange, very stiff, moist, moderately plastic. [WAITEMATA GROUP SOILS]						3.90	5.0
	30.82							3.95	5.0
								4.00	5.0
								4.05	5.0
1.0		SILT with some clay. Orange mottled light grey streaked dark orange with brown staining, very stiff, moist, low plasticity.At 1.2m; becomes light grey mottled orange. [WAITEMATA GROUP SOILS]					139 69	4.10	4.0
								4.15	5.0
								4.20	4.0
								4.25	5.0
								4.30	6.0
1.5				WAITEMATA GROUP SOILS			111 42	4.35	7.0
								4.40	9.0
		1.7m: With pockets of fine to medium sand.						4.45	10.0
								4.50	10.0
								4.55	10.0
								4.60	11.0
2.0		2.0m: Becomes hard with some fine to medium sand sized limonite.					UTP -	4.65	17.0
	29.52							4.70	25.0
		Silty (Fine to coarse , medium dense) SAND with some clasts (<3mm). Orange speckled light grey, hard, wet, no plasticity. [WAITEMATA GROUP SOILS]							
2.5							UTP -		
		2.7m: With intermixed clasts (<30%) <3mm.							
	28.72		▼ 14/07/2015				111 42		
3.0		SILT with some clay. Light grey, very stiff, moist to wet, low plasticity. [WAITEMATA GROUP SOILS]	▽ 04/08/2015						
	28.52								
		Silty (Fine to medium, loose) SAND. Light grey mottled orange, very stiff, wet, no plasticity. At 3.3m; saturated. [WAITEMATA GROUP SOILS]							
3.5	28.17						UTP -		
		3.6m: End of Borehole, unable to penetrate							
4.0									
4.5									
5.0									

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Bottom of Moderate to Steep Slope, Field. Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH55**
Date:	9/07/2015
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748379.0, N 5950198.0 **Ground Level:** 62.66

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log
0.0	62.46	Topsoil. [TOPSOIL]		TS	TS
		SILT with minor clay. Grey streaked orange, very stiff, moist, low plasticity. At 0.5m; Becomes light grey mottled orange and dark orange with occasional intermixed black carbonaceous material. [ALLUVIUM]			
0.5	62.06	Clayey SILT with minor fine sand. Light grey mottled orange, very stiff, moist to wet, moderately plastic. With frequent intermixed black carbonaceous material. [ALLUVIUM]			
1.0	61.46	Silty CLAY. Orange mottled light grey, stiff, moist, highly plastic.At 1.5m; With pockets of fine to medium sand. [ALLUVIUM]			
1.5			04/08/2015		
		1.7m: With occasional intermixed plant fibers. At 1.8m; With pockets of fine to coarse dark orange sand sized limonite and wet.	09/07/2015		
2.0	60.66	Clayey SILT. Bluish grey mottled orange, stiff, wet, moderately plastic. [ALLUVIUM]		ALL.	
	60.46	Fine to medium, loose Sandy SILT. Grey, stiff, moist to wet, no plasticity. With occasional intermixed plant fibers. At 2.5m; wet. NB; Shear vane taken in sandy material. [ALLUVIUM]			
2.5					
3.0	59.36	Silty (Fine to medium, loose) SAND. Dark grey, very stiff, saturated, no plasticity. Poor recovery. [ALLUVIUM]			
3.5		3.7m: With intermixed clasts (<40%) <3mm. Granular.			
	58.78	3.9m: End of Borehole, hole collapsing			
4.0					
4.5					
5.0					

Vane Shear Strength (kPa) (refer notes for details)

50 100 150 200

Values
156
64
94
47
97
42
94
25
103
19
100
14
0
153
28

Scala Penetrometer (blows / 50mm)

Depth (m)	Blows
3.95	1.0
4.00	1.0
4.05	1.0
4.10	2.0
4.15	2.0
4.20	3.0
4.25	3.0
4.30	3.0
4.35	2.0
4.40	3.0
4.45	5.0
4.50	6.0
4.55	5.0
4.60	5.0
4.65	5.0
4.70	5.0
4.75	5.0
4.80	6.0
4.85	7.0
4.90	8.0
4.95	9.0
5.00	10.0
5.05	10.0
5.10	11.0
5.15	11.0
5.20	11.0
5.25	12.0

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Moderate Slope. Scrub. Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH56**
Date:	10/07/2015
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748407.0, N 5950152.0 **Ground Level:** 53.61

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
0.0	53.41	Topsoil. [TOPSOIL]		TS	TS			2.35	4.0
	53.21	SILT with some clay. Grey streaked orange, firm, moist to wet, low plasticity. With occasional intermixed black carbonaceous material. [ALLUVIUM]						2.40	5.0
0.5		SILT with some fine sand and minor to trace of clay. Light grey mottled orange, firm, moist to wet, very low plasticity. With occasional intermixed plant fibers.	▼ 04/08/2015				33	2.45	5.0
	52.91	Silty (Fine to medium, very loose) SAND. Light grey mottled orange, firm, saturated, no plasticity. 1m; Extra sensitive. NB; Shear vane taken in sandy material. At 1.1m; Becomes brownish grey, pushing down with poor recovery. [ALLUVIUM]	▽ 10/07/2015	ALL.			6	2.50	5.0
1.0								2.55	5.0
								2.60	5.0
								2.65	6.0
								2.70	7.0
								2.75	10.0
								2.80	10.0
							25	2.85	10.0
							3	2.90	12.0
1.5								2.95	25.0
							28		
							11		
	51.81	SILT with some clay, some fine sand and some plant fibers. Grey, firm, saturated, low plasticity. [ALLUVIUM]							
2.0							33		
	51.51						11		
	51.41	2.1m; Fine to medium, very loose Sandy SILT. Dark grey, firm, saturated, no plasticity. [WAITEMATA GROUP SOILS]		WGS					
	51.31	2.2m; Clayey SILT. Dark grey, firm, moist, moderately plastic. [TRANSITIONAL WAITEMATA GROUP]		NSS			UTP		
2.5		2.3m: End of Borehole, unable to penetrate					-		
3.0									
3.5									
4.0									
4.5									
5.0									

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Gentle Slope, Swamp. Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH57**
Date:	21/07/2015
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748457.0, N 5949995.0 **Ground Level:** 36.66

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details)	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
0.0	36.46	Topsoil. [TOPSOIL]	04/08/2015	TS	TS	50 100 150 200		3.55	1.0
								3.60	2.0
								3.65	2.0
								3.70	3.0
	36.16	SILT with some clay. Light grey streaked orange mottled brownish grey, stiff, moist, low plasticity. [ALLUVIUM]						3.75	2.0
0.5		Clayey SILT. Light grey mottled orange, stiff, moist, moderately plastic. With common intermixed plant fibers. [ALLUVIUM]					97	3.80	3.0
		0.8m: No plant fibers.					47	3.85	3.0
								3.90	4.0
								3.95	3.0
1.0		1.0m: Becomes very stiff.						4.00	4.0
							128	4.05	5.0
	35.46						56	4.10	6.0
		SILT with some clay and some fine sand. Light grey mottled orange, very stiff, moist to wet, low plasticity. At 1.5m: with occasional intermixed plant fibers and Clayey inclusions. [ALLUVIUM]						4.15	6.0
								4.20	7.0
								4.25	8.0
1.5							111	4.30	8.0
							36	4.35	7.0
								4.40	8.0
								4.45	10.0
		1.9m: Becomes wet with occasional intermixed clasts (<2mm).						4.50	10.0
								4.55	11.0
2.0	34.66		21/07/2015	ALL			89	4.60	12.0
		Fine to medium, loose Sandy SILT with some clay. Orange mottled light grey, stiff, wet, low plasticity. With frequent intermixed clasts (<2mm). NB; Shear vane taken in sandy material. [ALLUVIUM]					39	4.65	11.0
								4.70	12.0
		2.4m: Becomes saturated and light brown mottled light grey.							
2.5		2.5m: Becomes firm.					39		
							14		
	33.76								
		SILT with some clay and some fine sand. Light grey, firm, wet, low plasticity. At 3m; becomes stiff. [ALLUVIUM]					50		
3.0							17		
		3.3m: Becomes saturated.							
	33.16						114		
3.5		3.5m: End of Borehole, hole collapsing.					28		
4.0									
4.5									
5.0									

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Gentle Slope, Swamp Edge. Hole data is for a set location only.

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Job No.:	**7464**
Hole No.:	**AH58**
Date:	21/07/2015
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748479.0, N 5949950.0 **Ground Level:** 33.84

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit
0.0	33.84	Topsoil. [TOPSOIL]	▼ 21/07/2015 ▽ 04/08/2015	TS
	33.54	SILT with some clay. Grey streaked orange, stiff, wet, low plasticity. [ALLUVIUM]		ALL
0.5	33.34	Clayey SILT. Grey streaked dark orange, stiff, wet, moderately plastic. [ALLUVIUM]		
	33.14	Silty CLAY with minor fine sand. Light grey mottled orange, stiff, wet, moderately plastic. [ALLUVIUM]		
1.0		1.0m: Becomes firm.		
	32.64	Clayey SILT. Light grey mottled orange, firm, wet to saturated, moderately plastic. [ALLUVIUM]		
1.5		1.5m: Becomes stiff.		
	31.94	Fine to medium, loose Sandy SILT. Dark grey, stiff, wet, no plasticity. At 2m; hard. [ALLUVIUM]		
2.0	31.79	2.1m: End of Borehole, unable to penetrate		

Vane Shear Strength (kPa) (refer notes for details)

Values
67
28
46
25
69
28
UTP
-

Scala Penetrometer (blows / 50mm)

Depth (m)	Blows
2.10	3.0
2.15	2.0
2.20	1.0
2.25	1.0
2.30	0.5
2.35	0.5
2.40	1.0
2.45	1.0
2.50	1.0
2.55	1.0
2.60	1.0
2.65	2.0
2.70	2.0
2.75	3.0
2.80	2.0
2.85	2.0
2.90	2.0
2.95	3.0
3.00	2.0
3.05	2.0
3.10	2.0
3.15	1.0
3.20	2.0
3.25	2.0
3.30	2.0
3.35	2.0
3.40	3.0
3.45	2.0
3.50	2.0
3.55	3.0
3.60	3.0
3.65	2.0
3.70	3.0
3.75	3.0
3.80	4.0
3.85	5.0
3.90	5.0
3.95	6.0
4.00	7.0
4.05	7.0
4.10	6.0
4.15	8.0
4.20	10.0
4.25	25.0

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Flat, Swamp. Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH59**
Date:	21/07/2015
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748498.0, N 5949901.0 **Ground Level:** 32.18

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
0	31.98	Topsoil. [TOPSOIL]	04/08/2015	TS	TS			2.05	3.0
		SILT with some clay. Blackish grey mottled brown and orange, stiff, wet, low plasticity. With frequent intermixed minor organics. [ALLUVIUM]						2.10	2.0
	31.68		21/07/2015					2.15	1.0
0.5		Silty CLAY. Light grey mottled orange, stiff, wet, highly plastic. [ALLUVIUM]						2.20	1.0
							56	2.25	1.0
		0.8m: Becomes wet to saturated.					8	2.30	1.0
								2.35	2.0
1.0								2.40	2.0
								2.45	2.0
	31.08	1.0m: Becomes soft.						2.50	2.0
		Clayey SILT. Orange mottled light grey, soft, wet to saturated, moderately plastic. Poor recovery and begins to push down. [ALLUVIUM]					17	2.55	2.0
							3	2.60	2.0
								2.65	2.0
								2.70	1.0
1.5								2.75	2.0
							28	2.80	1.0
							11	2.85	1.0
								2.90	1.0
	30.38							2.95	2.0
		Silty (Fine to medium, very loose) SAND. Orange speckled light grey, firm, saturated, no plasticity. Poor recovery. 2m; hard. Scaled then redrilled 2-3.6m. [ALLUVIUM]		ALL				3.00	2.0
								3.05	2.0
2.0							UTP	3.10	2.0
							-	3.15	2.0
								3.20	2.0
								3.25	2.0
								3.30	2.0
2.5							0	3.35	2.0
							-	3.40	2.0
								3.45	2.0
								3.50	3.0
								3.55	4.0
								3.60	5.0
3.0								3.65	11.0
		3.1m - 3.3m: Lense of some clay.						3.70	12.0
								3.75	10.0
	28.78							3.80	11.0
								3.85	10.0
3.5		SILT with some clay. Dark grey, medium dense, wet, low plasticity. Poor recovery. [WAITEMATA GROUP		WGS				3.90	25.0
	28.58								
		3.6m: End of Borehole, hole collapsing. NB: Scaled then redrilled 2-3.6m.							
4.0									
4.5									
5.0									

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Gentle Slope, Swamp. Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH60**
Date:	9/07/2015
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748585.0, N 5949792.0 **Ground Level:** 24.91

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
0.0	24.71	Topsoil. [TOPSOIL]	04/08/2015	TS	TS			2.25	6.0
		Clayey SILT. Orange mottled light grey, stiff, moist to wet, moderately plastic. [ALLUVIUM]						2.30	7.0
0.5	24.41	Silty CLAY. Orange mottled light grey, stiff, wet, highly plastic. [ALLUVIUM]					56 14	2.35	10.0
	24.01	Fine to medium, loose Sandy SILT with minor clay. Orange mottled light grey, stiff, wet, very low plasticity. At 1m; firm. [ALLUVIUM]	09/07/2015	ALL.			28 11	2.40	25.0
1.0	23.71	SILT with some clay. Light grey mottled orange, firm, wet to saturated, low plasticity. [ALLUVIUM]							
	23.41	SILT with some clay. Grey, stiff, moist to wet, low plasticity. [ALLUVIUM]					97 25		
1.5	23.11	SILT with some fine sand and minor clay. Grey, stiff, wet, low plasticity. [TRANSITIONAL WAITEMATA GROUP]		TRANS WG.			83 17		
2.0	22.71	2.1m: Becomes dark grey.					UTP -		
		2.2m: End of Borehole, unable to penetrate							
2.5									
3.0									
3.5									
4.0									
4.5									
5.0									

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Gentle Slope, Trees. Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH61**
Date:	10/07/2015
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748692.0, N 5949954.0 **Ground Level:** 48.42

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
0.0	48.22	Topsoil. [TOPSOIL]		TS	TS			5.05	1.0
		SILT with some clay. Orange with brown staining, stiff, moist, low plasticity. [WAITEMATA GROUP SOILS]						5.10	1.0
								5.15	1.0
								5.20	1.0
								5.25	1.0
0.5							61	5.30	1.0
							14	5.35	2.0
			04/08/2015					5.40	2.0
								5.45	2.0
								5.50	2.0
1.0		1.0m: Becomes moist to wet.					61	5.55	2.0
							11	5.60	2.0
								5.65	2.0
	47.12							5.70	2.0
		SILT with some fine sand and minor clay. Orange mottled light grey, stiff, moist to wet, low plasticity. [WAITEMATA GROUP SOILS]						5.75	2.0
1.5							83	5.80	3.0
							17	5.85	3.0
	46.72							5.90	3.0
		Fine to medium, loose Sandy SILT with minor to trace of clay. Orange mottled light grey, stiff, moist to wet, very low plasticity.At 2m; with frequent intermixed clasts (<3mm). [WAITEMATA GROUP SOILS]						5.95	3.0
								6.00	4.0
								6.05	4.0
2.0							56	6.10	4.0
							11	6.15	4.0
	46.22							6.20	5.0
		SILT with some clay and some clasts (<3mm). Orange mottled light grey, stiff, moist to wet, low plasticity. [WAITEMATA GROUP SOILS]						6.25	4.0
								6.30	5.0
2.5	45.92			WAITEMATA GROUP SOILS			83	6.35	4.0
		Fine to medium, loose Sandy SILT with minor clay. Light grey mottled orange, stiff, wet, low plasticity. [WAITEMATA GROUP SOILS]					28	6.40	5.0
	45.72							6.45	5.0
		Silty (Fine to medium, loose) SAND. Light grey mottled orange, stiff, wet, no plasticity. [WAITEMATA GROUP SOILS]						6.50	5.0
								6.55	4.0
			10/07/2015					6.60	5.0
3.0		3.0m: NB; Shear vane taken in sandy material.					89	6.65	5.0
							28	6.70	5.0
								6.75	6.0
								6.80	6.0
								6.85	5.0
3.5							0	6.90	6.0
4.0	44.42						86		
		SILT with some clay. Light grey, stiff, wet, low plasticity. [WAITEMATA GROUP SOILS]					33		
	44.02								
		Fine to medium, loose Sandy SILT. Grey streaked pink, stiff, wet, no plasticity. [WAITEMATA GROUP SOILS]					86		
4.5							28		
	43.42						72		
5.0		5.0m: End of Borehole					28		

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Gentle Slope, Field. Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH62**
Date:	10/07/2015
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748683.0, N 5949923.0 **Ground Level:** 38.44

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details)	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
0.0	38.34	Topsoil. [TOPSOIL]	04/08/2015	TS		50 100 150 200		3.35	3.0
		SILT with some clay. Orange mottled light grey, very stiff, moist, low plasticity. [ALLUVIUM]						3.40	3.0
								3.45	3.0
								3.50	4.0
0.5	37.84						114	3.55	2.0
		Clayey SILT. Orange mottled light grey, very stiff, moist, moderately plastic. [ALLUVIUM]					58	3.60	3.0
	37.64							3.65	3.0
		SILT with some clay and minor to trace of fine sand. Orange mottled light grey, very stiff, moist to wet, low plasticity. [ALLUVIUM]						3.70	4.0
								3.75	6.0
1.0								3.80	7.0
							100	3.85	11.0
							50	3.90	11.0
	37.14							3.95	11.0
		SILT with some fine sand and some clay. Light grey mottled orange, very stiff, moist to wet, low plasticity. [ALLUVIUM]	10/07/2015	ALLUVIUM				4.00	12.0
	36.94							4.05	25.0
1.5							153		
		Clayey SILT. Light grey mottled orange, very stiff, moist, moderately plastic. Extra sensitive with pockets of dark orange fine to coarse sand sized limonite.					11		
	36.64								
		SILT with some clay. Grey streaked orange with dark orange limonite staining, very stiff, moist to wet, low plasticity. At 2m; stiff. [ALLUVIUM]							
2.0							94		
							53		
	36.14								
		Clayey SILT. Light grey mottled orange, stiff, moist to wet, low plasticity. Between 2.5m and 2.8m; with pockets of brown. [ALLUVIUM]							
2.5							58		
							17		
	35.64								
		Clayey SILT. Dark grey, stiff, moist, moderately plastic.At 3m; hard. [WAITEMATA GROUP SOILS]							
3.0				WGS			UTP		
							-		
	35.24								
	35.14	3.2m; SILT with some clay. Dark grey, hard, moist to wet, low plasticity. [WAITEMATA GROUP SOILS]					UTP		
		3.3m: End of Borehole, unable to penetrate					-		
3.5									
4.0									
4.5									
5.0									

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Moderate Slope, Field. Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH63**
Date:	10/07/2015
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748727.0, N 5949834.0 **Ground Level:** 28.25

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
0.0	28.05	Topsoil. [TOPSOIL]		TS	TS			2.30	6.0
		SILT with some clay. Grey streaked orange, firm, moist, low to moderately plastic. [ALLUVIUM]						2.35	7.0
0.5	27.75	Clayey SILT. Light grey mottled orange, firm, moist to wet, moderately plastic. [ALLUVIUM]	04/08/2015	ALL.			42 14	2.40	11.0
	27.45	SILT with some clay. Light grey mottled orange, firm, moist to wet, low plasticity. [ALLUVIUM]	10/07/2015				194+ -	2.45	25.0
1.0	27.25	SILT with some clay. Dark grey, very stiff to hard, moist, low plasticity. At 1.2m; with minor clay. [TRANSITIONAL WAITEMATA GROUP]		TRANSITIONAL WAITEMATA GROUP			UTP -		
1.5		1.5m - 2.2m: With some clay, hard and moist to					UTP -		
2.0		1.8m: With dark orange limonite staining.					UTP -		
	26	2.3m: End of Borehole, unable to penetrate							
2.5									
3.0									
3.5									
4.0									
4.5									
5.0									

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Steep Slope, Field. Hole data is for a set location only.

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Job No.:	**7464**
Hole No.:	**AH64**
Date:	10/07/2015
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748721.0, N 5949803.0 **Ground Level:** 23.67

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
0.0	23.57	Topsoil. [TOPSOIL]	04/08/2015	TS				1.15	3.0
		SILT with some clay. Grey mottled orange streaked dark orange, stiff, wet, low plasticity. At 0.4m; Becomes light grey mottled orange with a trace of fine sand. [ALLUVIUM]						1.20	3.0
								1.25	3.0
								1.30	3.0
	23.17		10/07/2015					1.35	4.0
0.5		Fine to medium, loose Sandy SILT. Orange mottled light grey, stiff, wet, no plasticity. NB; Shear vane taken in sandy material. [ALLUVIUM]		ALL			56 14	1.40	5.0
	22.97							1.45	6.0
								1.50	6.0
		Silty (Fine to medium, loose) SAND. Orange mottled grey, stiff, wet, no plasticity.At 1m; hard with pockets of dark orange fine to coarse sand sized limonite. [ALLUVIUM]						1.55	4.0
								1.60	5.0
1.0							UTP	1.65	10.0
	22.57							1.70	10.0
		1.1m: End of Borehole, unable to penetrate						1.75	25.0
1.5									
2.0									
2.5									
3.0									
3.5									
4.0									
4.5									
5.0									

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Gentle Slope, Trees. Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH65**
Date:	14/07/2015
Logged By:	BM
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748824.0, N 5950133.0 **Ground Level:** 39.03

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details)	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
0.0	38.83	Topsoil. [TOPSOIL]	14/07/2015	TS	TS	50 100 150 200		5.05	1.0
								5.10	1.0
								5.15	1.5
								5.20	1.5
	38.53	SILT. Reddish orange mottled brown with occasional limonite staining, stiff, moist, no plasticity. [COLLUVIUM]						5.25	1.0
0.5		Silty CLAY. Orange mottled grey, stiff, moist, moderate to highly plastic. [COLLUVIUM]	04/08/2015	COL.			89 35	5.30	1.0
								5.35	1.0
								5.40	1.5
								5.45	1.5
								5.50	2.0
1.0							89 40	5.55	2.0
								5.60	2.0
								5.65	3.0
	37.63							5.70	3.0
								5.75	3.0
1.5		Clayey SILT. Grey with occasional limonite staining, stiff, moist, moderately plastic. With 50-100mm voids encountered and frequent organic matter. At 1.5m; firm. [COLLUVIUM]					42 15	5.80	3.0
								5.85	3.0
								5.90	3.0
								5.95	3.0
								6.00	3.0
								6.05	4.0
2.0							49 15	6.10	4.0
	36.93							6.15	3.0
		Clayey SILT. Grey mottled orange, firm, moist, low to moderately plastic. [WAITEMATA GROUP SOILS]						6.20	3.0
								6.25	4.0
								6.30	4.0
2.5		2.5m: Becomes stiff.					95 40	6.35	4.0
								6.40	4.0
								6.45	4.0
								6.50	4.0
								6.55	4.0
	36.03							6.60	4.0
3.0		SILT with some clay. Grey mottled orange, stiff, moist, low plasticity.At 3.3m; becomes grey mottled reddish orange. [WAITEMATA GROUP SOILS]					92 32	6.65	4.0
								6.70	5.0
								6.75	4.0
								6.80	4.0
								6.85	5.0
3.5		3.4m: Becomes dark orange mottled grey with frequent limonite staining and fine gravels. 3.5m, very stiff.		WAITEMATA GROUP SOILS			138 35	6.90	4.0
	35.23								
		SILT, Pinkish orange, very stiff, moist, no plasticity. [WAITEMATA GROUP SOILS]							
4.0		4.0m: Becomes stiff.					98 46		
4.5		4.5m: Becomes very stiff					127 51		
		4.8m: With occasional fine limonite gravels and staining.							
	34.03								
5.0		5.0m: End of Borehole					98 54		

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Slope, Grass. Hole data is for a set location only.

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Job No.:	**7464**
Hole No.:	**AH66**
Date:	14/07/2015
Logged By:	BM
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748830.0, N 5950190.0 **Ground Level:** 20.72

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
		Topsoil. [TOPSOIL]	04/08/2015	TS	TS			3.75	8.0
	20.52							3.80	10.0
		Silty CLAY. Grey mottled brown, firm, moist, moderate to highly plastic. With plant roots and organic matter. [ALLUVIUM]						3.85	14.0
0.5		0.4m: Becomes orange mottled grey.					32	3.90	25.0
		0.6m: With frequent organic inclusions.					12		
1.0		1.0m: Becomes soft.					15		
			14/07/2015	ALLUVIUM			8		
		1.2m: Becomes saturated.							
1.5		1.5m: Becomes firm.					29		
							15		
		1.8m: With occasional wood inclusions.							
2.0		2.0m: Becomes stiff.					78		
	18.52						35		
		SILT with some clay. Grey, stiff, saturated, low plasticity. [WAITEMATA GROUP SOILS]							
2.5	18.22						115		
		Clayey SILT. Dark grey, very stiff, moist, low to moderately plastic. [WAITEMATA GROUP SOILS]					32		
	17.82								
3.0		SILT with a trace of fine sand. Dark grey, very stiff, moist, no plasticity. At 3m: hard. [WAITEMATA GROUP SOILS]		WGS			UTP		
	17.22						UTP		
3.5		Fine, dense SAND. Dark grey, hard, saturated, no plasticity. [TRANSITIONAL WAITEMATA GROUP]		TRA NS WG					
	17.02						UTP		
		3.7m: End of Borehole							
4.0									
4.5									
5.0									

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- Standing Water Level
- Water Level At Time Of Drilling
- Out Flow / In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

General Slope, Muddy. Hole data is for a set location only.

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Job No.:	**7464**
Hole No.:	**AH67**
Date:	14/07/2015
Logged By:	BM
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748683.0, N 5950121.0 **Ground Level:** 40.45

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log
0.0	40.25	Topsoil. [TOPSOIL]		TS	TS
		Silty CLAY. Brownish orange, very stiff, moist, moderately plastic. [WAITEMATA GROUP SOILS]		WAITEMATA GROUP SOILS	
0.5		0.6m: Becomes light grey mottled orange.			
1.0	39.05				
1.5		Clayey SILT. Light grey mottled orange, very stiff, moist, low to moderately plastic. With occasional lense of low plasticity SILT with some clay. [WAITEMATA GROUP SOILS]			
2.0	38.05				
2.5		SILT with some clay. Orange mottled light grey, very stiff, moist, low plasticity. At 2.5m; becomes stiff. [WAITEMATA GROUP SOILS]			
	37.65				
3.0		SILT with a trace of clay. Orange/dark orange with frequent limonite staining, stiff, moist to wet, no plasticity. [WAITEMATA GROUP SOILS]	04/08/2015		
3.5			14/07/2015		
	36.55				
4.0		SILT with some clay. Light grey mottled orange, stiff, saturated, low plasticity. [WAITEMATA GROUP SOILS]			
	36.25				
4.5		Silty (Fine, loose) SAND. Orange, stiff, saturated, no plasticity. [WAITEMATA GROUP SOILS]			
	35.75				
		SILT with some clay. Grey mottled orange, stiff, saturated, low plasticity. [WAITEMATA GROUP SOILS]			
	35.45				
5.0		5.0m: End of Borehole			

Vane Shear Strength (kPa) (refer notes for details)

50 100 150 200

Values	Scala Depth (m)	Scala Blows
	5.05	1.5
	5.10	1.5
	5.15	1.5
	5.20	1.5
	5.25	2.0
147	5.30	2.0
53	5.35	3.0
	5.40	2.0
	5.45	3.0
	5.50	3.0
113	5.55	3.0
50	5.60	3.0
	5.65	2.5
	5.70	2.5
	5.75	3.0
128	5.80	4.0
51	5.85	4.0
	5.90	3.0
	5.95	3.0
	6.00	4.0
	6.05	4.0
108	6.10	5.0
35	6.15	4.0
	6.20	5.0
	6.25	5.0
	6.30	5.0
97	6.35	5.0
32	6.40	6.0
	6.45	6.0
	6.50	6.0
	6.55	6.0
	6.60	5.0
73	6.65	6.0
31	6.70	6.0
	6.75	7.0
	6.80	6.0
	6.85	7.0
80	6.90	7.0
33		
76		
31		
67		
32		
125		
37		

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

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Job No.:	**7464**
Hole No.:	**AH68**
Date:	14/07/2015
Logged By:	RF
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748618.0, N 5950072.0 **Ground Level:** 43.97

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit
0.0	43.57	Clayey SILT. Grey/dark grey mottled orange, very stiff, moist, low to moderately plastic. [COLLUVIUM]	04/08/2015	
0.5		Silty CLAY with pockets of fine Silty Sand. Orange mottled brown and light grey, very stiff, moist, moderate to highly plastic. [COLLUVIUM]		
1.0	42.77	1.0m: Extra sensitive and stiff.		
		Silty CLAY. Light grey mottled orange, stiff, moist, moderately plastic. [COLLUVIUM]		
1.5	42.17	1.5m: Becomes very stiff.		
		Clayey SILT. Pink mottled light grey and orange, very stiff, moist to wet, low to moderately plastic.At 2m; becomes firm. [COLLUVIUM]		
2.0	41.67		14/07/2015	
		Fine Sandy SILT with some clay. Light grey, firm, wet, low plasticity. [COLLUVIUM]		COL
2.5		2.5m: Becomes stiff.		
		2.7m: Becomes saturated.		
3.0	40.77			
		Silty (Fine to medium, loose) SAND. Orange mottled grey and white, stiff, saturated, no plasticity. With occasional coarse Sand inclusions. [COLLUVIUM]		
3.5		3.5m: From 3.5m; Shear vane not accessed.		
4.0				
4.5		4.6m: With frequent weakly cemented clasts (1-5mm).		
5.0	38.97	5.0m: End of Borehole		

Vane Shear Strength (kPa) (refer notes for details)

50 100 150 200

Values
117
47
90
9
107
60
43
21
69
22
97
32
0

Scala Penetrometer (blows / 50mm)

Depth (m)	Blows
5.05	1.0
5.10	1.5
5.15	1.5
5.20	2.0
5.25	3.0
5.30	3.0
5.35	3.0
5.40	4.0
5.45	3.0
5.50	4.0
5.55	4.0
5.60	4.0
5.65	4.0
5.70	4.0
5.75	5.0
5.80	5.0
5.85	5.0
5.90	4.0
5.95	5.0
6.00	5.0
6.05	6.0
6.10	7.0
6.15	6.0
6.20	7.0
6.25	7.0
6.30	7.0
6.35	7.0
6.40	7.0
6.45	8.0
6.50	9.0
6.55	9.0
6.60	9.0
6.65	9.0
6.70	9.0
6.75	9.0
6.80	9.0
6.85	9.0
6.90	9.0

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- Standing Water Level
- Water Level At Time Of Drilling
- Out Flow / In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Steep Slope, Grass. Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH69**
Date:	14/07/2015
Logged By:	RF
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748622.0, N 5950096.0 **Ground Level:** 37.87

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
0.0	37.57	Topsoil. [TOPSOIL]	04/08/2015	TS	TS TS			2.25	3.0
		Clayey SILT. Dark brownish grey/grey, stiff, moist, low to moderately plastic. [COLLUVIUM]						2.30	3.0
0.5	37.17						92	2.35	8.0
		Silty CLAY. Orange/dark orange with frequent limonite staining, stiff, moist to wet, moderate to highly plastic. Extra sensitive. [COLLUVIUM]	14/07/2015				33	2.40	9.0
1.0	36.67							2.45	6.0
		SILT with some clay and a trace of fine to medium sand. Bluish grey/grey, stiff, wet, low plasticity. With occasional organic inclusions (1-5mm) and Extra sensitive. [COLLUVIUM]		COL			74	2.50	4.0
1.5	36.17						6	2.55	6.0
		SILT. Brown/dark brown, stiff, saturated, no plasticity. With common weakly cemented clasts (2-10mm). [COLLUVIUM]						2.60	5.0
2.0	35.77	2.0m: Becomes firm. Extra sensitive.					59	2.65	5.0
	35.67	2.1m; SILT with a trace of fine sand. Dark orange, hard, moist, no plasticity. [WAITEMATA GROUP SOILS]		WGS			4	2.70	9.0
2.5		2.2m: End of Borehole					31	2.75	6.0
							2	2.80	5.0
3.0							UTP	2.85	9.0
								2.90	9.0
3.5								2.95	14.0
4.0								3.00	25.0
4.5									
5.0									

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Water Course, Grass. Hole data is for a set location only.

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Job No.:	**7464**
Hole No.:	**AH70**
Date:	14/07/2015
Logged By:	RF
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748653.0, N 5950170.0 **Ground Level:** 30.07

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
0	29.67	Organic SILT. Black, soft, saturated, no plasticity. [ALLUVIUM]	14/07/2015 04/08/2015	ALL				2.85	8.0
								2.90	9.0
								2.95	6.0
								3.00	7.0
								3.05	11.0
0.5		Silty CLAY. Brown, soft, saturated, highly plastic. With frequent organic inclusions (1-5mm). [ALLUVIUM]					18 4	3.10	17.0
								3.15	25.0
1.0		1.0m: Becomes very soft.					13 5		
	28.87								
1.5		Clayey SILT. Brownish grey/grey, very soft, saturated, low to moderately plastic. With occasional organic inclusions (1-5mm). At 1.5m; becomes firm. [ALLUVIUM]					47 21		
	28.27								
2.0		Clayey SILT. Dark orange, firm, moist, low to moderately plastic. With frequent dark orange limonite staining. At 2m; very stiff. [WAITEMATA GROUP SOILS]		WGS			133 43		
	27.97								
		SILT with some clay. Orange mottled dark orange mottled grey, very stiff, moist, low plasticity. With frequent dark orange limonite staining. At 2.3m; becomes dark grey. [WAITEMATA GROUP SOILS]							
	27.67								
2.5		SILT with a trace of fine sand. Dark grey, very stiff, moist, no plasticity. [TRANSITIONAL WAITEMATA GROUP]		TRANS WG			171+ -		
	27.27						UTP -		
		2.8m: End of Borehole, unable to penetrate							
3.0									
3.5									
4.0									
4.5									
5.0									

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Water Course, Bush clad. Hole data is for a sel location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH71**
Date:	20/07/2015
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748579.0, N 5950193.0 **Ground Level:** 40.93

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
	40.73	Topsoil. [TOPSOIL]		TS	TS			3.85	3.0
		SILT with some clay. Grey streaked dark orange mottled brown, stiff, moist, low plasticity. At 0.3m; with minor clay and occasional intermixed black carbonaceous material.At 0.5m; becomes orange mottled light grey/grey. [ALLUVIUM]	04/08/2015				94	3.90	3.0
0.5							42	3.95	2.0
								4.00	3.0
		0.8m - 1.0m: With some clay and becomes orange mottled light grey.						4.05	3.0
	39.93							4.10	4.0
1.0		Clayey SILT. Light grey mottled orange, stiff, moist, moderately plastic. [ALLUVIUM]					81	4.15	5.0
							33	4.20	5.0
	39.53							4.25	6.0
		SILT with some fine sand and some clay. Light grey streaked orange with brown staining, stiff, moist to wet, low plasticity. With occasional intermixed plant fibers. At 1.6m; becomes wet with frequent intermixed minor organics. [ALLUVIUM]						4.30	6.0
1.5			20/07/2015	ALLUVIUM				4.35	6.0
							69	4.40	6.0
							14	4.45	7.0
	39.03							4.50	14.0
		Fine, loose Sandy SILT. Grey, stiff, wet, no plasticity. With occasional intermixed plant fibers. At 2m; Firm and Shear vane taken in sandy material. [ALLUVIUM]						4.55	12.0
2.0							44	4.60	12.0
	38.73						11	4.65	13.0
		SILT with some clay. Grey, firm, wet, low plasticity. [ALLUVIUM]						4.70	14.0
								4.75	16.0
2.5		2.5m: With saturated pockets of fine sand and pockets of wood fragments (<10mm diameter).					42		
							33		
3.0		3.0m: Becomes hard.					UTP		
	37.83								
		SILT with minor clay and minor fine sand. Orange mottled light grey, hard, moist to wet, low plasticity. At 3.3m; no clay. [WAITEMATA GROUP SOILS]		WAITEMATA GROUP SOILS					
3.5		3.5m - 3.8m: With minor clay.					UTP		
	37.13								
		3.8m: End of Borehole, hole collapsing					194+		
4.0									
4.5									
5.0									

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Moderate Slope. Field. Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH72**
Date:	20/07/2015
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748512.0, N 5950298.0 **Ground Level:** 47.22

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
0.0	47.02	Topsoil. [TOPSOIL]	04/08/2015	TS	TS			3.85	3.0
								3.90	3.0
	46.82	SILT with some clay. Orange mottled light grey, stiff, moist, low plasticity. [ALLUVIUM]						3.95	3.0
								4.00	3.0
		SILT with minor clay. Light grey streaked orange, stiff, moist, low plasticity. [ALLUVIUM]					69	4.05	3.0
0.5							31	4.10	3.0
								4.15	4.0
		0.8m: Becomes wet, light grey with some clay.		ALL.				4.20	4.0
								4.25	4.0
								4.30	5.0
1.0							69	4.35	5.0
	46.02						14	4.40	5.0
								4.45	6.0
		Fine to medium, loose Sandy SILT. Light grey mottled orange, stiff, wet, no plasticity. [ALLUVIUM]						4.50	7.0
	45.82							4.55	7.0
		SILT with some clay and minor fine sand. Light grey, stiff, wet, low plasticity. At 1.5m; very stiff. Between 1.6-1.8m; lense of fine to medium Sand and becomes orange mottled light grey. [WAITEMATA GROUP SOILS]					103	4.60	8.0
1.5							31	4.65	10.0
								4.70	11.0
								4.75	13.0
								4.80	25.0
		2.0m: Becomes stiff.					94		
2.0							22		
	45.02								
		Fine to medium, loose Sandy SILT. Light grey streaked orange, stiff, wet, no plasticity. [WAITEMATA GROUP SOILS]	20/07/2015	WAITEMATA GROUP SOILS					
	44.72						100		
2.5		SILT with some clay and fine Sandy pockets. Light grey streaked orange, very stiff, moist to wet, low plasticity. [WAITEMATA GROUP SOILS]					28		
							194+		
3.0		3.0m: Becomes grey and very stiff to hard.					-		
	43.92	3.2m: Becomes orange mottled light grey.							
		Fine to medium, medium dense Sandy SILT. Orange mottled light grey, very stiff to hard, wet to saturated, no plasticity. [WAITEMATA GROUP SOILS]							
	43.72						UTP		
3.5		SILT with some clay. Orange mottled light grey, hard, moist to wet, low plasticity. [WAITEMATA GROUP SOILS]					-		
	43.42						UTP		
		3.8m: End of Borehole, unable to penetrate					-		
4.0									
4.5									
5.0									

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Moderate Slope. Bush. Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH73**
Date:	20/07/2015
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748541.0, N 5950254.0 **Ground Level:** 39.46

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
0	39.36	Topsoil. [TOPSOIL]		TS				2.45	6.0
		SILT with some clay. Orange, firm, moist to wet, low plasticity. With occasional intermixed clasts. [COLLUVIUM]		COL				2.50	6.0
			▼ 20/07/2015 04/08/2015					2.55	10.0
	38.96		▽					2.60	12.0
0.5		SILT with some clay. Dark grey mottled orange, firm, wet, low plasticity. With occasional intermixed wood fragments (<10mm diameter) and frequent carbonaceous material and plant fibers. Extra sensitive.					33	2.65	10.0
	38.66						3	2.70	10.0
		Fine to medium, very loose Sandy SILT. Dark grey/grey, wet to saturated, firm, no plasticity. With frequent intermixed minor organics. [ALLUVIUM]		ALL				2.75	10.0
1.0	38.46						14	2.80	10.0
		Silty (Fine to coarse, very loose) SAND. Grey, soft, wet to saturated, no plasticity. Poor recovery and sample pushing down. Extra sensitive. NB; Shear vane taken in sandy material. [ALLUVIUM]							
	38.06								
1.5		Fine to medium, very loose Sandy SILT with some clay. Blackish grey, soft, fully saturated, low plasticity. No to poor recovery, pushing down with difficult sample identification. NB; Shear vane taken in sandy material. At 2m; stiff. [ALLUVIUM]					19		
							6		
2.0							56		
		2.2m: Becomes brownish orange with frequent medium angular Gravels.					14		
		2.3m: Becomes brown							
	37.06						UTP		
2.5		2.4m: End of Borehole, unable to penetrate							
3.0									
3.5									
4.0									
4.5									
5.0									

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Gentle to Moderate Slope, Field. Hole data is for a set location only.

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Job No.:	**7464**
Hole No.:	**AH74**
Date:	20/07/2015
Logged By:	SR
Sheet:	1 of 1

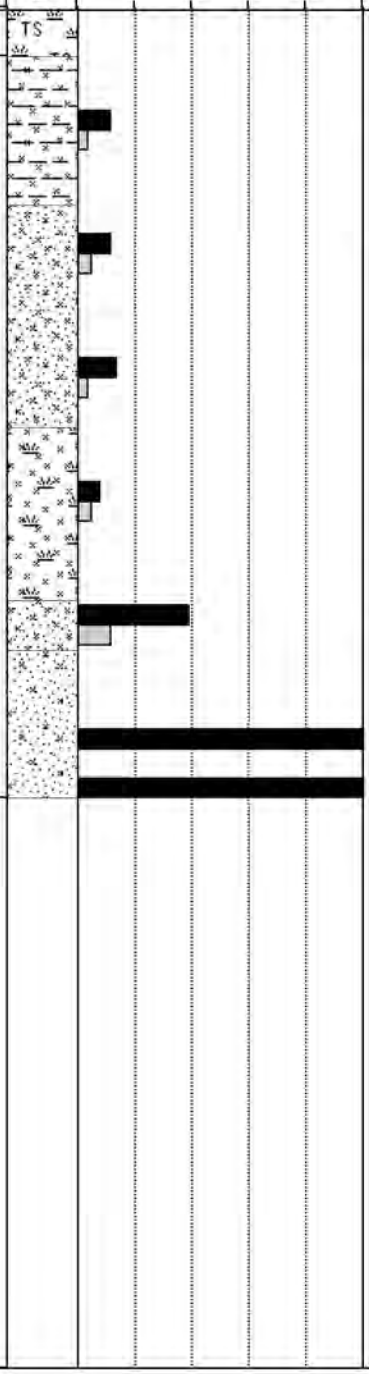
Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748622.0, N 5950293.0 **Ground Level:** 27.86

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit
0.0	27.66	Topsoil. [TOPSOIL]		TS
		Clayey SILT. Dark grey streaked orange with occasional brown, firm, moist to wet, moderately plastic. At 0.4m; becomes orange mottled light grey and wet. [ALLUVIUM]	04/08/2015	
0.5	27.06		20/07/2015	
		Fine to medium, very loose Sandy SILT with minor clay. Brownish grey, firm, saturated, low plasticity. [ALLUVIUM]		
1.0		1.2m: Becomes fully saturated, light grey with frequent plant fibers. Begins to push down.		
1.5	26.16			ALLUVIUM
		Organic Clayey SILT. Brown, firm, fully saturated, moderately plastic. [ALLUVIUM]		
2.0		2.0m: Poor recovery, soft, pushing down with difficult sample identification.		
	25.46			
2.5		Fine to coarse, very loose Sandy SILT with minor clay. Grey mottled brown, soft, wet to saturated, low plasticity. With occasional intermixed plant fibers. NB; Shear vane taken in sandy material. [ALLUVIUM]		
	25.26	Silty (Fine to coarse, loose) SAND. Grey, stiff, wet to saturated, no plasticity. NB; Shear vane taken in sandy material. [ALLUVIUM]		
3.0	24.66	3.2m: End of Borehole, unable to penetrate		
3.5				
4.0				
4.5				
5.0				



Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
	3.25	3.0
	3.30	4.0
	3.35	5.0
	3.40	5.0
	3.45	9.0
28	3.50	10.0
8	3.55	12.0
	3.60	12.0
	3.65	13.0
	3.70	25.0
28		
11		
33		
8		
19		
11		
97		
28		
UTP		
-		
UTP		
-		

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Bottom of Moderate to Steep Slope. Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH75**
Date:	14/07/2015
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748592.0, N 5950351.0 **Ground Level:** 47.81

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
	47.61	Topsoil. [TOPSOIL]	Groundwater Not Encountered	TS	TS			5.05	0.5
	47.41	SILT with some clay. Orange with brown staining, very stiff, moist, low plasticity. [WAITEMATA GROUP SOILS]						5.10	0.5
0.5		Clayey SILT. Orange with brown staining, very stiff, moist, moderately plastic. [WAITEMATA GROUP SOILS]					153	5.15	1.0
		0.7m: Becomes orange mottled pink and light grey. At 0.8m; becomes pink mottled light grey and orange.					56	5.20	1.0
1.0	46.61							5.25	1.0
		SILT with some clay. Pink speckled light grey and orange, very stiff, moist, low plasticity. With frequent intermixed clasts (<1mm). At 1.4m; with minor to trace of clay and no clasts. [WAITEMATA GROUP SOILS]					128	5.30	2.0
							69	5.35	2.0
1.5								5.40	2.0
								5.45	1.0
								5.50	2.0
								5.55	1.0
								5.60	2.0
								5.65	1.0
								5.70	1.0
								5.75	2.0
							111	5.80	2.0
							47	5.85	5.0
								5.90	5.0
								5.95	5.0
								6.00	6.0
								6.05	3.0
2.0		2.0m: With pockets of brown and stiff.					69	6.10	4.0
		2.1m - 2.5m: With minor clay.					17	6.15	2.0
								6.20	3.0
								6.25	3.0
								6.30	2.0
2.5	45.31							6.35	3.0
		SILT with some fine sand. Pink speckled light grey, very stiff, moist, no plasticity. [WAITEMATA GROUP SOILS]					108	6.40	4.0
							33	6.45	3.0
		2.8m - 3.3m: With some clay pockets.						6.50	3.0
								6.55	3.0
3.0								6.60	3.0
							100	6.65	3.0
							28	6.70	4.0
								6.75	2.0
	44.51							6.80	3.0
		SILT with some clay. Pink mottled light pink, orange and light grey, very stiff, moist to wet, low plasticity. At 3.6m; with SILT pockets and pockets of brown fine sand. [WAITEMATA GROUP SOILS]						6.85	3.0
3.5							142	6.90	3.0
							58		
4.0	43.81						103		
		SILT with a trace of clay and fine sand. Pink speckled light grey, very stiff, moist, no plasticity. At 4.2m; with pockets of some clay and some fine sand inclusions. [WAITEMATA GROUP SOILS]					36		
4.5							100		
							42		
		4.7m: With pockets of black/brown material.							
5.0	42.81						122		
		5.0m: End of Borehole					42		

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- Standing Water Level
- Water Level At Time Of Drilling
- Out Flow / In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Steep Slope, Scrub. Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH76**
Date:	14/07/2015
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748538.0, N 5950409.0 **Ground Level:** 49.5

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
0.0	49.5	Topsoil. [TOPSOIL]	Groundwater Not Encountered	TS	TS			5.05	1.0
	49.3							5.10	1.0
		SILT with some clay. Orange mottled light grey, stiff, moist, low plasticity. [WAITEMATA GROUP SOILS]						5.15	1.0
	49.1							5.20	2.0
		Clayey SILT. Orange mottled light grey streaked dark orange, stiff, moist, moderately plastic. [WAITEMATA GROUP SOILS]						5.25	2.0
0.5							97	5.30	3.0
							14	5.35	3.0
								5.40	3.0
								5.45	2.0
								5.50	2.0
1.0							125	5.55	2.0
	48.4	1.0m: Becomes very stiff.					53	5.60	2.0
		Silty CLAY. Orange speckled light grey, very stiff, moist, highly plastic. [WAITEMATA GROUP SOILS]						5.65	2.0
	48.2							5.70	2.0
		SILT with some clay. Orange mottled with dark orange limonite staining, very stiff, moist, low plasticity. With pockets of fine to coarse sand sized limonite. At 1.5m; becomes light pink mottled orange, pink, dark orange and light grey. [WAITEMATA GROUP SOILS]						5.75	2.0
1.5							114	5.80	2.0
							61	5.85	2.0
								5.90	2.0
	47.7							5.95	3.0
		Clayey SILT. Pink mottled light pink, orange and light grey, very stiff, moist, moderately plastic. [WAITEMATA GROUP SOILS]						6.00	3.0
								6.05	2.0
2.0							139	6.10	3.0
	47.4						56	6.15	2.0
		SILT with some clasts (<1mm) and minor clay. Pink speckled light grey and orange, very stiff, moist. low plasticity. [WAITEMATA GROUP SOILS]						6.20	3.0
	47.1							6.25	2.0
		SILT with some fine sand and minor to trace of clay. Pink speckled orange and light grey, stiff, moist to wet, very low plasticity. At 2.5m; becomes stiff. [WAITEMATA GROUP SOILS]						6.30	3.0
2.5							92	6.35	2.0
							56	6.40	3.0
	46.8							6.45	3.0
		SILT with some clay. Pink mottled orange, stiff, moist to wet, low to moderately plastic.At 3m; with fine Sandy inclusions. [WAITEMATA GROUP SOILS]						6.50	3.0
								6.55	2.0
								6.60	3.0
3.0							86	6.65	2.0
							42	6.70	3.0
								6.75	2.0
								6.80	2.0
								6.85	2.0
3.5							142	6.90	3.0
		3.5m: Becomes moist to wet with pockets of dark orange fine to coarse sand sized limonite.					36		
	45.8								
		Fine to medium, loose Sandy SILT. Orange mottled pink, very stiff, wet, no plasticity. With pockets of fine to coarse sand sized and fine angular gravel sized limonite. [WAITEMATA GROUP SOILS]							
4.0	45.5						114		
		SILT with some clay and fine Sandy inclusions. Pink mottled light grey, very stiff, moist to wet, low plasticity. [WAITEMATA GROUP SOILS]					32		
4.5							100		
							47		
		4.7m: Becomes wet with minor clay.							
	44.5						111		
5.0		5.0m: End of Borehole					39		

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- Standing Water Level
- Water Level At Time Of Drilling
- Out Flow / In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Steep Slope, Field. Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH77**
Date:	20/07/2015
Logged By:	BM
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748856.0, N 5950291.0 **Ground Level:** 23.21

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
	23.11	Topsoil. [TOPSOIL]		T S				3.65	8.0
		Silty CLAY. Orange mottled grey, stiff, moist, moderately plastic. [COLLUVIUM]						3.70	19.0
0.5							82	3.75	25.0
		0.6m: Becomes grey mottled orange.					36		
1.0		1.0m: Becomes wet.		COLLUVIUM			64		
	21.81						31		
1.5		Clayey SILT with a trace of fine sand. Grey mottled orange, stiff, saturated, low to moderately plastic. At 1.5m; becomes firm. [COLLUVIUM]	▽ 20/07/2015				43		
							18		
2.0	21.11	2.0m: Becomes stiff.					51		
		Silty CLAY with a trace of fine sand. Grey, stiff, saturated, moderately plastic. With occasional organic matter. [ALLUVIUM]					21		
2.5		2.5m: Becomes firm.		ALLUVIUM			43		
	20.31						21		
3.0		SILT with a trace of fine sand. Dark grey, firm, moist, no plasticity. At 3m; becomes very stiff. [WAITEMATA GROUP SOILS]		WAITEMATA GROUP SOILS			133		
							26		
3.5	19.71						UTP		
	19.61	Silty (Fine, dense) SAND. Dark grey, moist, no plasticity. [TRANSITIONAL WAITEMATA GROUP]		N S					
		3.6m: End of Borehole, unable to penetrate							
4.0									
4.5									
5.0									

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Bank, Grass. Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH78**
Date:	20/07/2015
Logged By:	BM
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748810.0, N 5950282.0 **Ground Level:** 21.8

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
0.0	21.7	Topsoil. [TOPSOIL]	Groundwater Not Encountered	TS				3.15	8.0
		Clayey SILT. Orange mottled grey and brown, very stiff, moist, low to moderately plastic. [WAITEMATA GROUP SOILS]						3.20	4.0
	21.5	SILT with some clay. Orange mottled grey, very stiff, moist, low plasticity. [WAITEMATA GROUP SOILS]						3.25	5.0
0.5	21.3	SILT. Grey mottled orange, very stiff, moist, no plasticity. [WAITEMATA GROUP SOILS]					133	3.30	6.0
							31	3.35	6.0
								3.40	6.0
1.0	20.8	Silty CLAY. Grey, very stiff, moist, moderately plastic. [WAITEMATA GROUP SOILS]					117	3.45	8.0
	20.6	SILT with some clay. Grey, very stiff, moist, low plasticity. [WAITEMATA GROUP SOILS]					36	3.50	10.0
	20.4	Silty CLAY. Orange, very stiff, moist, moderately plastic. [WAITEMATA GROUP SOILS]						3.55	11.0
1.5	20.3	SILT. Greyish orange, hard, moist, no plasticity. [WAITEMATA GROUP SOILS]		WGS			UTP	3.60	12.0
		1.8m: Becomes dark orange with frequent limonite staining.						3.65	15.0
2.0							UTP	3.70	13.0
		2.1m: Becomes dark grey with occasional limonite gravels and staining.						3.75	25.0
2.5							UTP		
3.0	18.8						UTP		
	18.7	Silty (Fine, dense) SAND. Dark grey, hard, moist, no plasticity. [TRANSITIONAL WAITEMATA GROUP]		KNSW			UTP		
		3.1m: End of Borehole, unable to penetrate							
3.5									
4.0									
4.5									
5.0									

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- Standing Water Level
- Water Level At Time Of Drilling
- Out Flow / In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Slope. Boggy. Hole data is for a set location only.

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Job No.:	**7464**
Hole No.:	**AH79**
Date:	20/07/2015
Logged By:	RF
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748902.0, N 5950447.0 **Ground Level:** 37.79

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
0.0		Clayey/ slightly clayey SILT. Orange mottled brown and grey, very stiff, moist, low to moderately plastic. With pockets of dry friable SILT. [COLLUVIUM]		COLLUVIUM			121 19	4.15 4.20 4.25 4.30 4.35 4.40 4.45 4.50 4.55	5.0 8.0 8.0 11.0 10.0 8.0 14.0 14.0 25.0
0.5	37.09	Silty CLAY. Orange mottled grey, very stiff, moist to wet, highly plastic. With frequent minor organics (1-5mm). [COLLUVIUM]							
1.0			04/08/2015 20/07/2015				106 45		
1.5	36.29	Silty CLAY. Brownish grey/orange, firm, wet, highly plastic. With frequent minor organics (1-3mm). [ALLUVIUM]		ALLUVIUM			46 17		
2.0		1.9m: Becomes saturated. 2.0m: Becomes stiff.					54 23		
2.5		2.5m: Becomes firm.					33 6		
3.0	35.09	Fine Sandy SILT with some clay. Light grey, firm, saturated, low plasticity. With occasional decomposing wood inclusions. [ALLUVIUM]					39 21		
3.5							43 21		
4.0	34.09 33.79	Silty CLAY. Dark grey, firm, moist, moderately plastic. [WAITEMATA GROUP SOILS]		WGS			UTP		
4.5	33.69	Silty (Fine, dense) SAND. Dark grey, hard, moist, no plasticity. [TRANSITIONAL WAITEMATA GROUP] 4.1m: End of Borehole, unable to penetrate		N S					
5.0									

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- Standing Water Level
- Water Level At Time Of Drilling
- Out Flow / In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Water Course, Bush. Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH80**
Date:	20/07/2015
Logged By:	RF
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748858.0, N 5950415.0 **Ground Level:** 31.79

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values
0.0	31.39	Topsoil. [TOPSOIL]		TS	TS		
0.5	31.09	Clayey SILT. Brown mottled orange and grey, stiff, moist to wet, low to moderately plastic. With occasional wood inclusions. [COLLUVIUM]		COL			65 32
1.0		Silty CLAY. Brownish grey mottled orange, stiff, moist, highly plastic. [WAITEMATA GROUP SOILS] 1.1m: Becomes orange mottled light grey		WAITEMATA GROUP SOILS			78 46
1.5	30.09	1.5m: Becomes very stiff.	04/08/2015				101 46
2.0	29.69	Fine Sandy SILT with some clay. Grey mottled orange, very stiff, wet, low plasticity. [WAITEMATA GROUP SOILS] 2.0m: Becomes stiff.	20/07/2015				85 29
2.5	29.09	Clayey SILT. Grey mottled orange, stiff, moist, low to moderately plastic. [WAITEMATA GROUP SOILS] 2.5m: Becomes very stiff.					194 74
3.0		Silty (Fine, loose to medium dense) SAND. Dark grey, very stiff, saturated, no plasticity. [WAITEMATA GROUP SOILS] 3.0m: Becomes hard.					217+
3.5	27.99						217+
4.0		3.8m: End of Borehole, hole collapsing					
4.5							
5.0							

Scala Penetrometer (blows / 50mm)

Depth (m)	Blows
3.85	4.0
3.90	2.0
3.95	2.0
4.00	3.0
4.05	4.0
4.10	4.0
4.15	5.0
4.20	5.0
4.25	6.0
4.30	6.0
4.35	7.0
4.40	6.0
4.45	6.0
4.50	12.0
4.55	25.0

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- Standing Water Level
- Water Level At Time Of Drilling
- Out Flow / In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Water Course, Bush. Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH81**
Date:	9/07/2015
Logged By:	RF
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748502.0, N 5949306.0 **Ground Level:** 16.73

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details)	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
						50 100 150 200		5.05	2.5
	16.53	Topsoil. [TOPSOIL]		TS	TS			5.10	2.5
		Silty CLAY. Orange mottled light brown, very stiff, moist, moderately plastic. [COLLUVIUM]						5.15	2.0
								5.20	3.0
0.5							120	5.25	3.0
	16.03						42	5.30	4.0
		SILT with some clay. Orange mottled light grey, very stiff, moist to wet, low plasticity. [COLLUVIUM]						5.35	4.0
								5.40	5.0
								5.45	6.0
								5.50	5.0
1.0		1.0m: Becomes stiff.					68	5.55	7.0
							14	5.60	7.0
	15.43							5.65	6.0
								5.70	7.0
		Silty CLAY. Orange/dark orange with frequent limonite staining, stiff, moist to wet, highly plastic. At 1.5m; firm [COLLUVIUM]						5.75	12.0
1.5							47	5.80	15.0
	15.13						10	5.85	25.0
		Silty (Fine, very loose) SAND. Light grey/grey, firm, wet, no plasticity. [COLLUVIUM]		COL					
2.0							65		
							26		
	14.43								
		SILT with some clay. Light brownish grey, stiff, moist, low plasticity. [COLLUVIUM]	▼ 04/08/2015				171+		
2.5		2.5m: Becomes very stiff.					-		
	14.03								
		Silty (Fine, medium dense) SAND. Orange, very stiff, saturated, no plasticity. [COLLUVIUM]	▽ 09/07/2015						
3.0		3.0m: Firm.					43		
							9		
	13.43								
		Clayey SILT. Dark Bluish grey, firm, saturated, moderately plastic. With occasional carbonaceous inclusions (2-5mm). [ALLUVIUM]							
3.5							49		
	13.13						12		
		Silty (Fine, very loose) SAND. Dark grey, firm, saturated, no plasticity. [ALLUVIUM]							
	12.83								
		Clayey SILT. Dark grey, firm, moist, low to moderately plastic. 4m; very stiff. [ALLUVIUM]		ALL			118		
4.0							41		
	12.53								
		Medium to coarse, loose SAND. Grey, very stiff, saturated, no plasticity. [ALLUVIUM]							
4.5							0		
							-		
	11.93								
		Fine, loose Sandy SILT. Dark grey, saturated, no plasticity. [WAITEMATA GROUP SOILS]		WGS					
	11.73						111		
5.0		5.0m: End of Borehole					26		

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Moderate Slope, Grass. Hole data is for a set location only.

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Job No.:	**7464**
Hole No.:	**AH82**
Date:	14/07/2015
Logged By:	RF
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748496.0, N 5949301.0 **Ground Level:** 14.38

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
	14.18	Topsoil. [TOPSOIL]		TS	TS			3.95	8.0
		Silty CLAY. Orange, firm, moist, moderately plastic. [COLLUVIUM]						4.00	10.0
	13.88							4.05	10.0
0.5		SILT with a trace of clay. Light grey mottled orange, firm, moist to wet, no plasticity. With frequent weakly cemented clasts (2-10mm). [COLLUVIUM]					33 5	4.10	20.0
1.0		1.0m: Becomes soft.					24 7		
	13.08								
		Silty (Fine, very loose) SAND. Orange, soft, wet, no plasticity. [COLLUVIUM]							
1.5		1.5m: Becomes very stiff. Shear vane taken in sandy material.	04/08/2015				112 27		
	12.68								
	12.48	Clayey SILT. Dark orange, very stiff, moist, low to moderately plastic [COLLUVIUM]		COL					
2.0		Silty (Fine, loose) SAND. Dark grey, very stiff, wet, no plasticity. At 2m; stiff. [COLLUVIUM]					81 15		
	12.18								
		Clayey SILT. Dark grey, stiff, moist, low to moderately plastic. [COLLUVIUM]	14/07/2015						
2.5	11.78						92 35		
		Fine to medium Sandy Clayey SILT. Grey, stiff, wet, low plasticity. [COLLUVIUM]							
	11.48								
3.0		Silty (Medium to coarse, loose) SAND. Brownish grey, saturated, no plasticity. With occasional decomposing wood inclusions. [COLLUVIUM]					0		
	11.18								
		Clayey SILT with a trace of fine sand. Dark grey, moist, low to moderately plastic. [WAITEMATA GROUP SOILS]		WAITEMATA GROUP SOILS					
3.5							145 56		
	10.58								
	10.48	3.8m; SILT with a trace of fine sand. Dark grey, hard, moist, no plasticity. [TRANSITIONAL WAITEMATA GROUP]		NS			UTP		
4.0		3.9m: End of Borehole, unable to penetrate							
4.5									
5.0									

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- ▼ Standing Water Level
- ▽ Water Level At Time Of Drilling
- ◁ Out Flow ▷ In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Below Slip, Grass. Hole data is for a set location only.

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HAND AUGER LOG

Job No.:	**7464**
Hole No.:	**AH83**
Date:	16/07/2015
Logged By:	SR
Sheet:	1 of 1

Client: Orewa West Investments Limited

Project: Proposed Subdivision

Location: Grand View Estate, Orewa

Coordinates: E 1748367.0, N 5950500.0 **Ground Level:** 40

Depth (m)	RL	Subsurface Conditions	Groundwater	Geological Unit	Graphic Log	Vane Shear Strength (kPa) (refer notes for details) 50 100 150 200	Values	Scala Penetrometer (blows / 50mm) Depth (m)	Blows
	39.9	Topsoil. [TOPSOIL]	Groundwater Not Encountered	TS				1.30	6.0
		SILT with some clay. Brownish orange, very stiff to hard, moist, low plasticity. [WAITEMATA GROUP SOILS]		WAITEMATA GROUP SOILS				1.35	7.0
								1.40	6.0
								1.45	6.0
0.5		0.5m: With minor clay and orange mottled brownish orange with pockets of fine angular gravel sized limonite. At 0.7m; with some fine to coarse sand sized limonite and orange speckled light grey. At 0.8m; with a trace of clay and becomes orange mottled dark orange. 1m; no clay content and hard. At 1.2m; with black carbonaceous inclusions and fine sandy pockets.					194+	1.50	5.0
								1.55	4.0
								1.60	5.0
								1.65	5.0
								1.70	6.0
								1.75	6.0
1.0							UTP	1.80	7.0
								1.85	8.0
	38.75							1.90	9.0
		1.3m: End of Borehole, unable to penetrate					UTP	1.95	10.0
								2.00	10.0
1.5								2.05	10.0
								2.10	10.0
								2.15	11.0
								2.20	10.0
2.0									
2.5									
3.0									
3.5									
4.0									
4.5									
5.0									

Notes & Abbreviations

Soils logged in accordance with 'The guidelines for the classification and description of soil and rock for engineering purposes' December 2005, NZGS

Water

- Standing Water Level
- Water Level At Time Of Drilling
- Out Flow / In Flow

Shear Vane

Corrected as per NZGS Guidelines
Vane No.:
UTP = Unable To Penetrate
+ = Peak Exceeded
- = No Result

Other Comments

Steep Slope, Trees. Up Slope from 53.
Hole data is for a set location only.

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APPENDIX 3

Laboratory Test Results

KGA Geotechnical Limited
8/6 Omega St
Albany
PO Box 302 361 North harbour
Auckland 0751

Attention: Paul Hardcastle

Dear Paul

LABORATORY TEST REPORT
Hall Farm West
Dry Density/ Water Content Relationship, Solid Density

Introduction

Geotechnics Christchurch were requested to perform Laboratory testing on 4 samples.

Sampling Procedure

Sample has been tested as received from the customer.

Sample Location Plan

None.

Samples

4x samples were received into the laboratory and allocated the laboratory reference: 219/15.

Date of Sample Receipt

24 July 2015.

Customer's Instructions

To determine the specific gravity (solid density - vacuum method), and maximum dry density and optimum water content by standard compaction test for each of the 4 samples.

Test Methods

NZS 4402 : 1986 Test 2.7.2 Determination of the solid density of soil particles - Method for medium and fine soils.

NZS 4402 : 1986 Test 4.1.1 Determination of the dry density/water content relationship - New Zealand standard compaction test.

NZS 4402 : 1986 Test 2.1 Determination of the water content.

Test Results

Dry density/water content relationship results attached as Appendix 1 of this report.
Solid density results attached as Appendix 2 of this report.

Test Remarks

New Zealand Standard Compaction Tests (MDD)

The plotted air voids lines are calculations not covered under the test method and are therefore not IANZ accredited.

The solid density of soil particles used in the calculations to plot air void percentage was measured.

Sample Description

Attached as Appendices 1 and 2 of this report.

General Remarks

Samples not destroyed during testing, will be retained for one month from the date of this report before being discarded.

Descriptions are enclosed for your information, but are not covered under our scope of IANZ accreditation.

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

If we can be of any further assistance, feel free to call us on phone +64 3 361 0300.

GEOTECHNICS LTD

Report prepared by:

.....
Mike Millar
CHRISTCHURCH MANAGER
Approved Signatory

Authorised for Geotechnics by:

.....
Paul Burton
PROJECT DIRECTOR

Report checked by:

.....
Paul Burton
REGIONAL MANAGER

Attached to this report:

- Appendix 1-Dry density/water content relationship results (4 pages)
- Appendix 2-Solid density results (4 pages)

GEOTECHNICS

Appendix 1

- Dry density/water content relationship results

Our Ref: 720362.0320/REP1

Customer Ref: 7464-Hall Farm West

29/07/2015

45A Parkhouse Road
Wigram
Christchurch
New Zealand

p. +64 3 361 0300

Geotechnics Project ID 720362.0320/REP1

Customer Project ID 7464

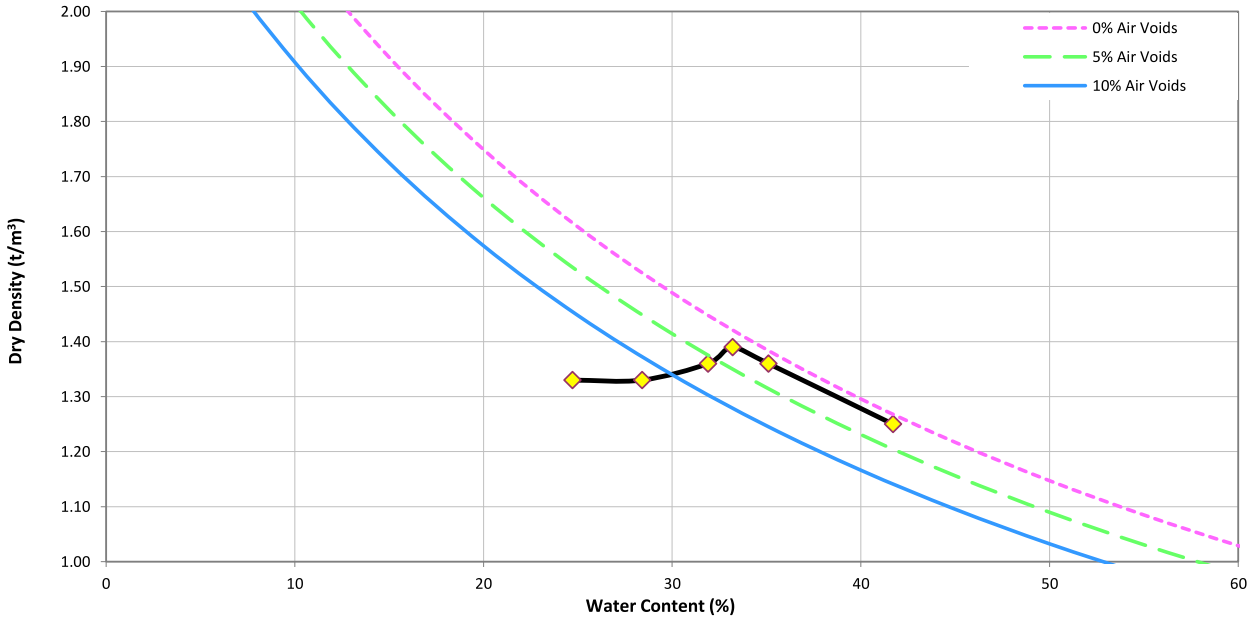
Determination of the Dry Density / Water Content Relationship - NZS 4402:1986 Test 4.1.1 (Standard Compaction)

Sample Details

Geotechnics Sample ID	219/15-TP5 2.0m
Date Tested	27/07/2015
Sample	**Hall Farm West - Auckland - TP5 2.0m (2.00m)**
Sample Description	Silty CLAY, mottled light greyish brown/brownish yellow/light yellow, with trace of fine sand.
Specimen	TP5 2.0m (2.0m)
Specimen Description	Silty CLAY, mottled light greyish brown/brownish yellow/light yellow, with trace of fine sand.

Test Result

Dry Density / Water Content Relationship



Maximum Dry Density	Optimum Water Content	Solid Density*	Whole Sample NWC
1.39 t/m³	33%	2.69 t/m³	41.7%

Natural Water Content	(NWC)						✓	
Water Content	(%)	24.7	28.4	31.9	33.2	35.1	41.7	
Dry Density	(t/m³)	1.334	1.327	1.356	1.387	1.356	1.249	
Undrained Shear Strength	(kPa)							

Test Remark(s)

• The material used for testing was natural, whole soil. • *The solid density was measured. • The amount of material retained on a 19mm sieve was 0% by wet mass. • Measured solid density (specific gravity) reference: Report 720362.0320/REP1 Appendix 2 29/07/2015.

This test is IANZ accredited.

Approved By

Date 31/07/2015

GEOTECHNICS

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Wigram
Christchurch
New Zealand

p. +64 3 361 0300

Geotechnics Project ID 720362.0320/REP1

Customer Project ID 7464

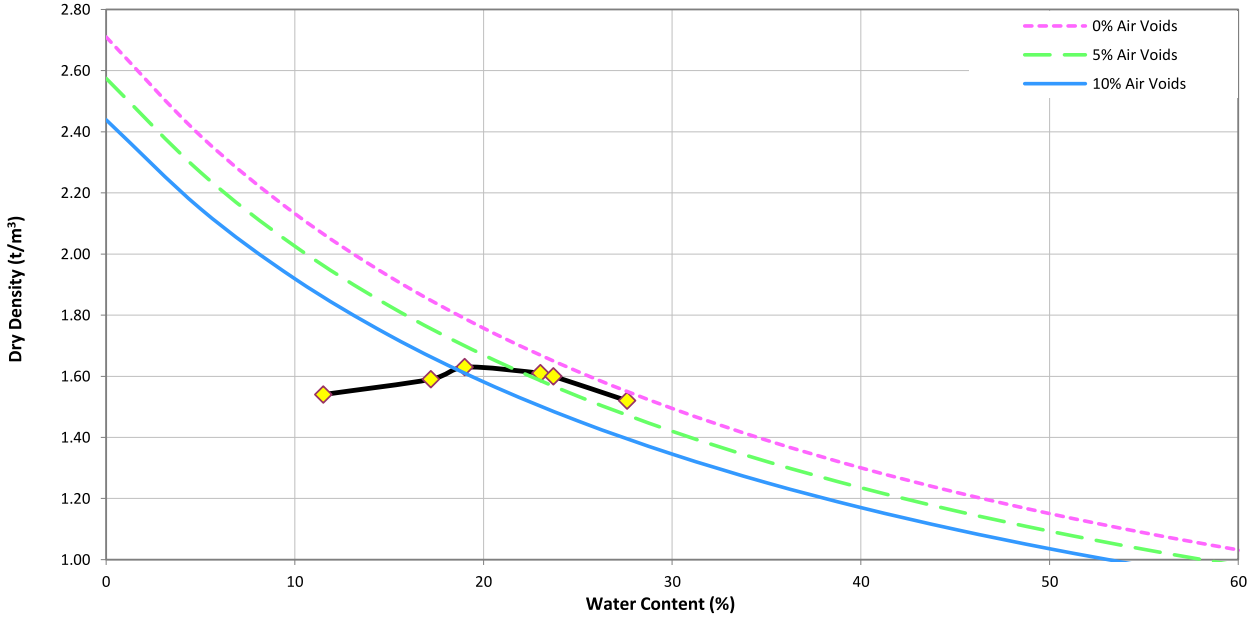
Determination of the Dry Density / Water Content Relationship - NZS 4402:1986 Test 4.1.1 (Standard Compaction)

Sample Details

Geotechnics Sample ID	219/15-TP6 2.0m
Date Tested	27/07/2015
Sample	**Hall Farm West - Auckland - TP6 2.0m (2.00m)**
Sample Description	Clayey SILT, minor sand fine, mottled grey/reddish brown/light yellow/brown, with trace of organics and gravel fine to coarse sub-rounded to sub-angular
Specimen	TP6 2.0m (2.0m)
Specimen Description	Clayey SILT, minor sand fine, mottled grey/reddish brown/light yellow/brown, with trace of organics and gravel fine to coarse sub-rounded to sub-angular

Test Result

Dry Density / Water Content Relationship



Maximum Dry Density	Optimum Water Content	Solid Density*	Whole Sample NWC
1.63 t/m³	19%	2.71 t/m³	27.6%

Natural Water Content	(NWC)						✓	
Water Content	(%)	11.5	17.2	19.0	23.0	23.7	27.6	
Dry Density	(t/m³)	1.542	1.586	1.627	1.610	1.595	1.517	
Undrained Shear Strength	(kPa)							

Test Remark(s)

• The material used for testing was natural, fraction <19mm sieve. • *The solid density was measured. • The amount of material retained on a 19mm sieve was 1% by wet mass. • Measured solid density (specific gravity) reference: Report 720362.0320/REP1 Appendix 2 29/07/2015.

This test is IANZ accredited.

Approved By

Date 31/07/2015

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Geotechnics Project ID 720362.0320/REP1

Customer Project ID 7464

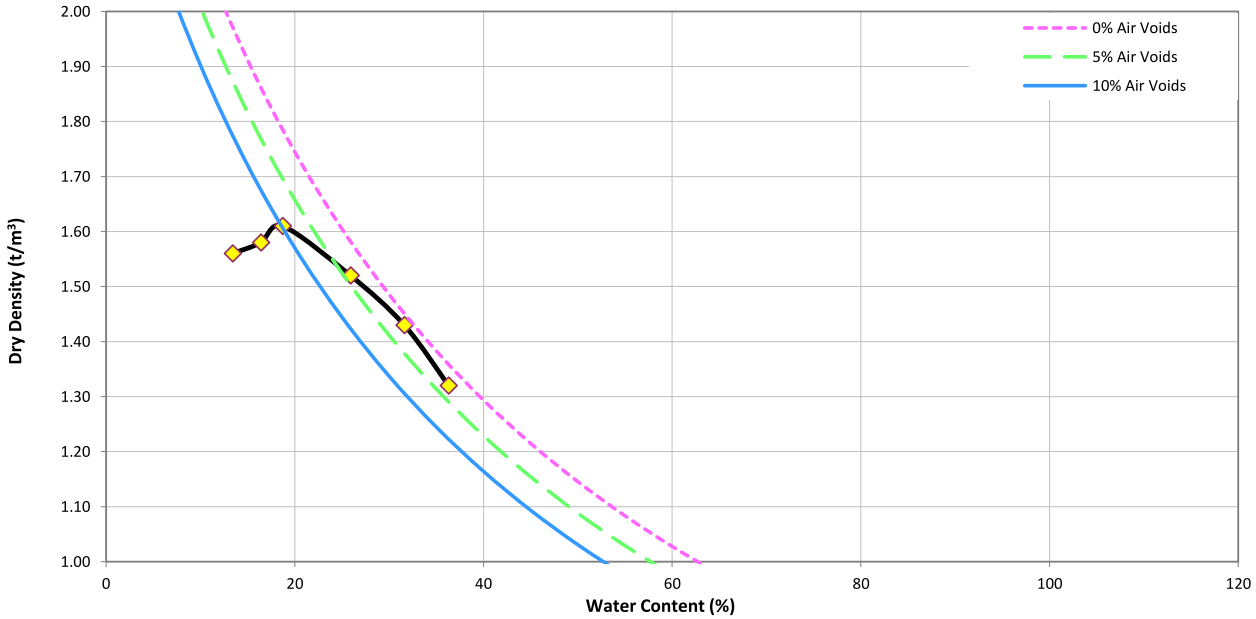
Determination of the Dry Density / Water Content Relationship - NZS 4402:1986 Test 4.1.1 (Standard Compaction)

Sample Details

Geotechnics Sample ID	219/15-TP5 4.5m
Date Tested	27/07/2015
Sample	**Hall Farm West - Auckland - TP5 4.5m (4.50m)**
Sample Description	SILT, some sand fine, with minor clay, yellow mottles/light brownish grey.
Specimen	TP5 4.5m (4.5m)
Specimen Description	SILT, some sand fine, with minor clay, yellow mottles/light brownish grey.

Test Result

Dry Density / Water Content Relationship



Maximum Dry Density	Optimum Water Content	Solid Density*	Whole Sample NWC
1.61 t/m³	18%	2.68 t/m³	36.3%

Natural Water Content	(NWC)						✓	
Water Content	(%)	13.4	16.4	18.7	25.9	31.6	36.3	
Dry Density	(t/m³)	1.558	1.579	1.608	1.522	1.426	1.321	
Undrained Shear Strength	(kPa)							

Test Remark(s)

• The material used for testing was natural, whole soil. • *The solid density was measured. • The amount of material retained on a 19mm sieve was 0% by wet mass. • Measured solid density (specific gravity) reference: Report 720362.0320/REP1 Appendix 2 29/07/2015.

This test is IANZ accredited.

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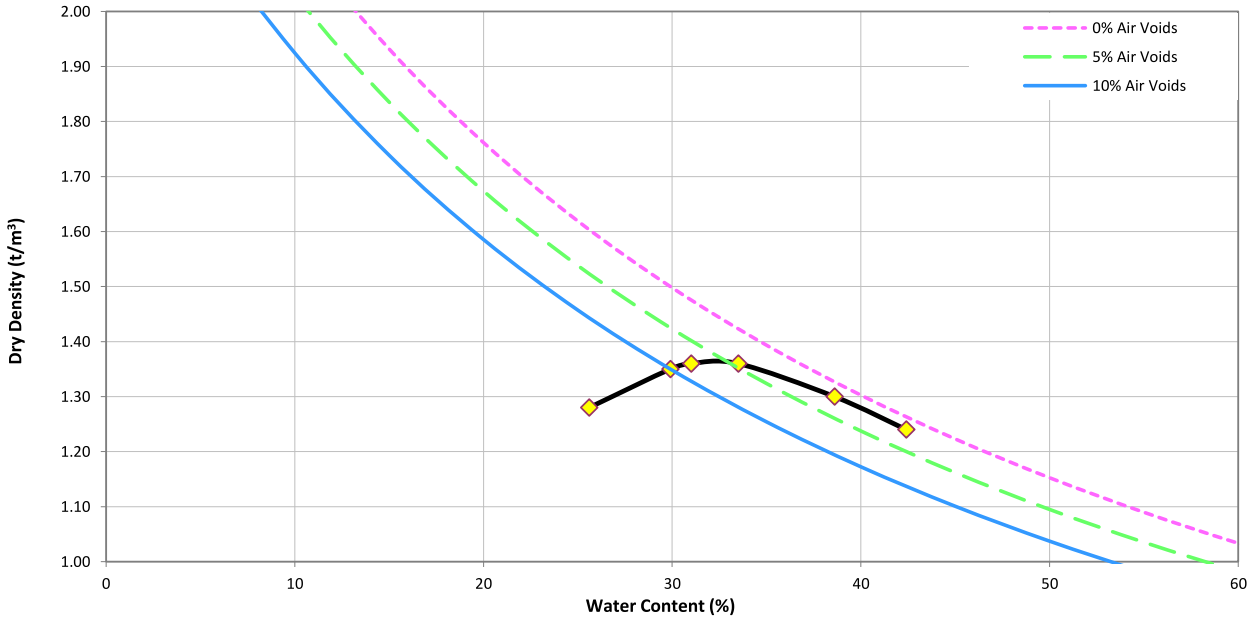
Determination of the Dry Density / Water Content Relationship - NZS 4402:1986 Test 4.1.1 (Standard Compaction)

Sample Details

Geotechnics Sample ID	219/15-TP7 2.5m
Date Tested	27/07/2015
Sample	**Hall Farm West - Auckland - TP7 2.5m (2.50m)**
Sample Description	Silty CLAY, mottledyellow/light greyish brown/brownish yellow/light yellow, with trace of fine sand and rootlets.
Specimen	TP7 2.5m (2.5m)
Specimen Description	Silty CLAY, mottledyellow/light greyish brown/brownish yellow/light yellow, with trace of fine sand and rootlets.

Test Result

Dry Density / Water Content Relationship



Maximum Dry Density	Optimum Water Content	Solid Density*	Whole Sample NWC
1.37 t/m³	33%	2.72 t/m³	42.4%

Natural Water Content	(NWC)						✓	
Water Content	(%)	25.6	29.9	31.0	33.5	38.6	42.4	
Dry Density	(t/m³)	1.283	1.351	1.359	1.362	1.303	1.240	
Undrained Shear Strength	(kPa)							

Test Remark(s)

• The material used for testing was natural, whole soil. • *The solid density was measured. • The amount of material retained on a 19mm sieve was 0% by wet mass. • Measured solid density (specific gravity) reference: Report 720362.0320/REP1 Appendix 2 29/07/2015.

This test is IANZ accredited.

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Appendix 2

- Solid density test results

Our Ref: 720362.0320/REP1

Customer Ref: 7464-Hall Farm West

29/07/2015

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Geotechnics Project ID	720362.0320/REP1
Customer Project ID	7464

Determination of Solid Density of Medium & Fine Soils - NZS 4402:1986 Test 2.7.2 (Vacuum)

Sample Details	
Geotechnics Sample ID	219/15-TP 5 2.0m
Date Tested	28/07/2015
Sample	**Hall Farm West - Auckland - TP 5 2.0m (2.00m)**
Sample Description	Silty CLAY, mottled light greyish brown/brownish yellow/light yellow, with trace of fine sand.
Specimen	TP 5 2.0m (2.0m)
Specimen Description	Silty CLAY, mottled light greyish brown/brownish yellow/light yellow, with trace of fine sand.

Test Result	
Average Solid Density	**2.69 t/m³**

Test Remark(s)

- The material used for testing was air dried, whole soil.

This test is IANZ accredited.

Approved By

Date 31/07/2015

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Geotechnics Project ID	720362.0320/REP1
Customer Project ID	7464

Determination of Solid Density of Medium & Fine Soils - NZS 4402:1986 Test 2.7.2 (Vacuum)

Sample Details	
Geotechnics Sample ID	219/15-TP 5 4.5m
Date Tested	28/07/2015
Sample	**Hall Farm West - Auckland - TP 5 4.5m (4.50m)**
Sample Description	SILT, some sand fine, with minor clay, yellow mottles/light brownish grey.
Specimen	TP 5 4.5m (4.5m)
Specimen Description	SILT, some sand fine, with minor clay, yellow mottles/light brownish grey.

Test Result	
Average Solid Density	**2.68 t/m³**

Test Remark(s)

- The material used for testing was air dried, whole soil.

This test is IANZ accredited.

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Geotechnics Project ID	720362.0320/REP1
Customer Project ID	7464

Determination of Solid Density of Medium & Fine Soils - NZS 4402:1986 Test 2.7.2 (Vacuum)

Sample Details	
Geotechnics Sample ID	219/15-TP 6 2.0m
Date Tested	28/07/2015
Sample	**Hall Farm West - Auckland - TP 6 2.0m (2.00m)**
Sample Description	Clayey SILT, minor sand fine, mottled grey/brown/light yellow/reddish brown, with trace of organics and gravel fine to coarse sub-rounded to sub-angular.
Specimen	TP 6 2.0m (2.0m)
Specimen Description	Clayey SILT, minor sand fine, mottled grey/brown/light yellow/reddish brown, with trace of organics and gravel fine to coarse sub-rounded to sub-angular.

Test Result	
Average Solid Density	**2.71 t/m³**

Test Remark(s)

- The material used for testing was air dried, fraction passing 19mm sieve.

This test is IANZ accredited.

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Geotechnics Project ID	720362.0320/REP1
Customer Project ID	7464

Determination of Solid Density of Medium & Fine Soils - NZS 4402:1986 Test 2.7.2 (Vacuum)

Sample Details	
Geotechnics Sample ID	219/15-TP 7 2.5m
Date Tested	28/07/2015
Sample	**Hall Farm West - Auckland - TP 7 2.5m (2.50m)**
Sample Description	Silty CLAY, mottled yellow/light greyish brown/brownish yellow/light yellow, with trace of fine sand and rootlets.
Specimen	TP 7 2.5m (2.5m)
Specimen Description	Silty CLAY, mottled yellow/light greyish brown/brownish yellow/light yellow, with trace of fine sand and rootlets.

Test Result	
Average Solid Density	**2.72 t/m³**

Test Remark(s)

- The material used for testing was air dried, whole soil.

This test is IANZ accredited.

Approved By Date 31/07/2015

KGA Geotechnical Limited
PO Box 302 361
Auckland, North Shore City 0751

Attention: Paul Hardcastle

Dear Mr. Hardcastle

LABORATORY TEST REPORT
Lot 1 DP 310813 & Lot 3 DP 327701, Hall Farm West

Introduction

Sampling Procedure

Samples have been tested as received from the customer.

Sample/Test Location Plan

None.

Samples

Seven tube samples were received. All samples were labelled with borehole number and depth.

Date of Sample Receipt

July 2015

Customer's Instructions

The detailed testing instructions were provided with e-mails, dated 10 July 2015 to 27 July 2015, from Mr. Hardcastle.

Test Method

NZS 4402:1986 Test 7.1 One-Dimensional Consolidation
BS1377: Part 8: 1990: Clause 5 Saturation
BS1377: Part 8: 1990: Clause 6 Consolidation
BS1377: Part 8: 1990: Clause 7 Consolidated-undrained Triaxial Compression Test with Pore Pressure Measurement

Test Results

Table 1 – Test Results Summary

MH No.	Depth (m)	One-dimensional Consolidation Test	CU Triaxial Test
MH14	2.60 – 2.73	--	Page7 to page 11
MH15	3.35 – 3.40	Page 4	--
	6.30 – 6.35	Page 5	
	9.35 – 9.40	Page 6	
MH16	4.07 – 4.20	--	Page 12 to page 16
MH22	4.17 – 4.30	--	Page 17 to page 21
MH26	2.83 – 2.96	--	Page 21 to page 26

Test Remarks

Sample MH14, Depth 2.60 to 2.73 (m) is quite homogeneous and light grey coloured inside the sample though there was orange colour on its outer surface between 2.60 to 2.67 (m).

The other test remarks are detailed on the presentation page.

Sample Descriptions

Sample descriptions are included on the presentation page.

General Remarks

Samples not destroyed during testing, will be retained for one month from the date of this report before being discarded.

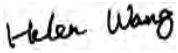
Descriptions are enclosed for your information, but are not covered under our scope of IANZ accreditation.

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

If we can be of any further assistance, feel free to call us on phone 09 356 3510.

GEOTECHNICS LTD

Report prepared by:



.....
Helen Wang
Triaxial Laboratory manager

Authorised for Geotechnics by:

.....
Steven Anderson
Regional Manager

Report checked by:

.....
Steven Anderson
Regional Manager

IANZ ACCREDITED LABORATORY

All tests reported herein have been performed in accordance with the laboratory's scope of accreditation

5-Aug-15
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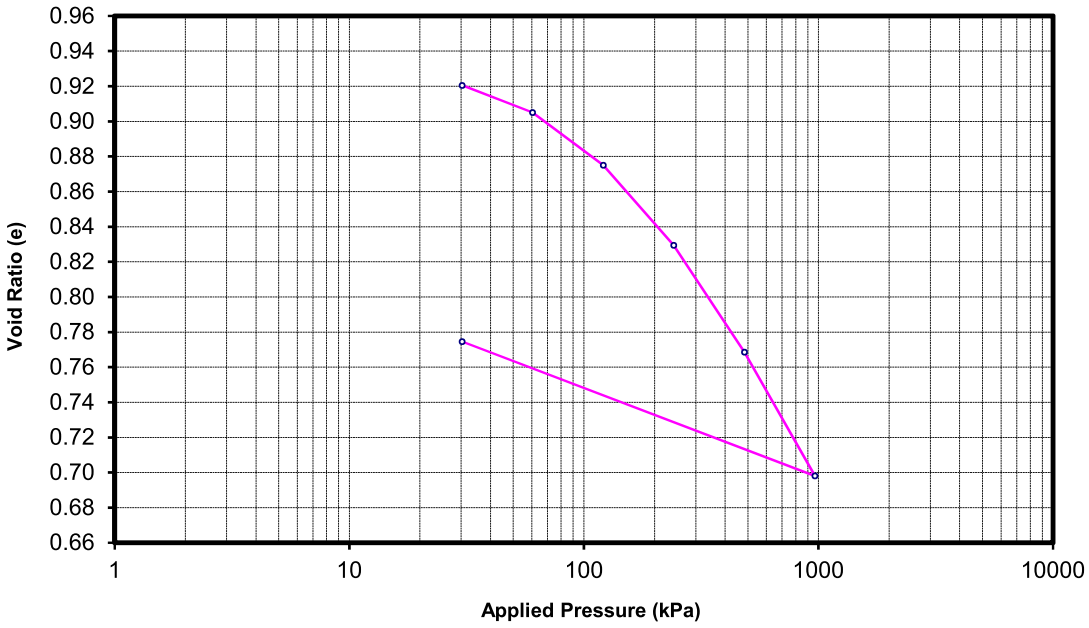
Project Name: **Hall Farm West** Page 4 of 26 KGA Ref No.: **7464**

Site Address: **Lot 1 DP 310813 & Lot 3 DP 327701** Our Job No.: **616672.001**

MH No.: **15** Depth: **3.35-3.40 (m)**

Test Method Used: NZS 4402:1986 Test 7.1 One-Dimensional Consolidation

ONE-DIMENSIONAL CONSOLIDATION TEST



Pressure (kPa)		Void Ratio (e)	Pressure Increment (kPa)	Coefficient of Consolidation Cv (m^2/yr)	Coefficient of Volume Compressibility Mv (m^2/MN)
As received	0	0.924			
Preload	30.2	0.921	0 to 30.2	NA	0.061
	60.3	0.905	30.2 to 60.3	2.7	0.27
	121	0.875	60.3 to 121	2.3	0.26
	241	0.829	121 to 241	2.2	0.20
	483	0.769	241 to 483	2.0	0.14
	966	0.698	483 to 966	1.6	0.083
Unload	30.2	0.775	966 to 30.2	NA	NA

Sample History: Undisturbed core trimmed at NWC. SQR of time fitting method used.

Description: clayey SILT with minor sand, firm to stiff, light yellowish brown mixed with light to dark grey, mottled orange-red.

Initial Dry Density (t/m³): 1.39 Initial Water Content: 33.4%

Solid Density (t/m³): 2.68 (Assumed) Initial Saturation: 97%

Temperature During Testing: Max = 17 ^{0}C Min = 15 ^{0}C

Remarks: The calculations of void ratio are affected by the solid density value. We have assumed a value of 2.68 t/m³.
Sample description is not IANZ accredited.

Entered by: ST Date: 31.07.2015 Checked by: MP Date: 31.07.2015

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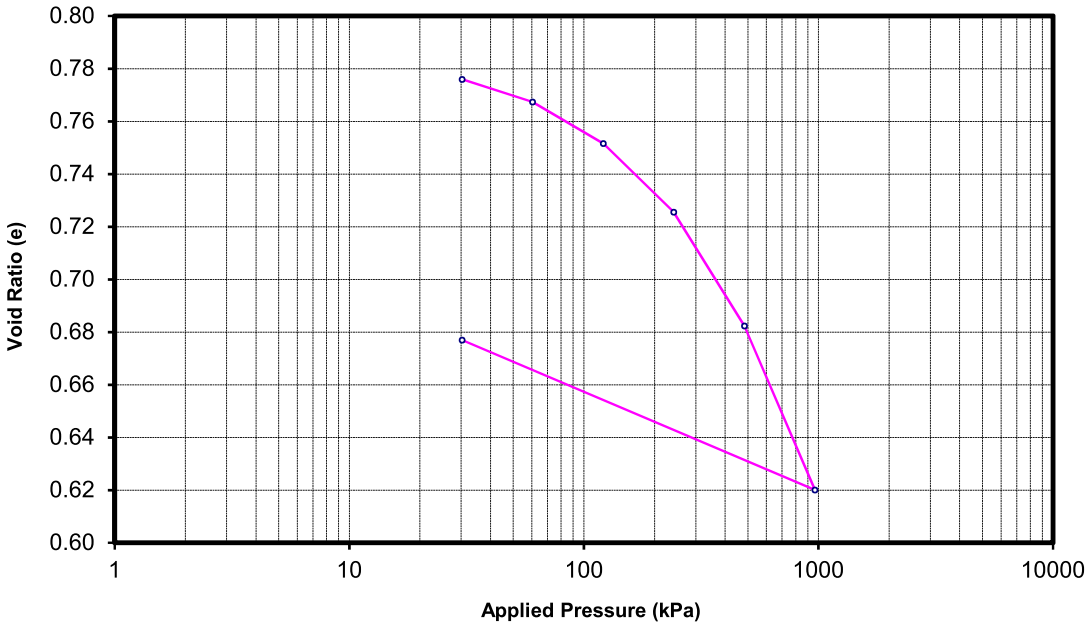
Project Name: **Hall Farm West** Page 5 of 26 KGA Ref No.: **7464**

Site Address: **Lot 1 DP 310813 & Lot 3 DP 327701** Our Job No.: **616672.001**

MH No.: **15** Depth: **6.30-6.35 (m)**

Test Method Used: NZS 4402:1986 Test 7.1 One-Dimensional Consolidation

ONE-DIMENSIONAL CONSOLIDATION TEST



Pressure (kPa)		Void Ratio (e)	Pressure Increment (kPa)	Coefficient of Consolidation Cv (m^2/yr)	Coefficient of Volume Compressibility Mv (m^2/MN)
As received	0	0.779			
Preload	30.2	0.776	0 to 30.2	NA	0.065
	60.3	0.767	30.2 to 60.3	5.3	0.16
	121	0.752	60.3 to 121	4.1	0.15
	241	0.726	121 to 241	3.5	0.12
	483	0.682	241 to 483	2.7	0.10
	966	0.620	483 to 966	1.9	0.077
Unload	30.2	0.677	966 to 30.2	NA	NA

Sample History: Undisturbed core trimmed at NWC. SQR of time fitting method used.

Description: clayey SILT with minor sand, firm to stiff, grey to dark grey mixed with light yellowish orange brown, mottled red.

Initial Dry Density (t/m³): 1.51 Initial Water Content: 28.4%

Solid Density (t/m³): 2.68 (Assumed) Initial Saturation: 97%

Temperature During Testing: Max = 17 ^{0}C Min = 15 ^{0}C

Remarks: The calculations of void ratio are affected by the solid density value. We have assumed a value of 2.68 t/m³.
Sample description is not IANZ accredited.

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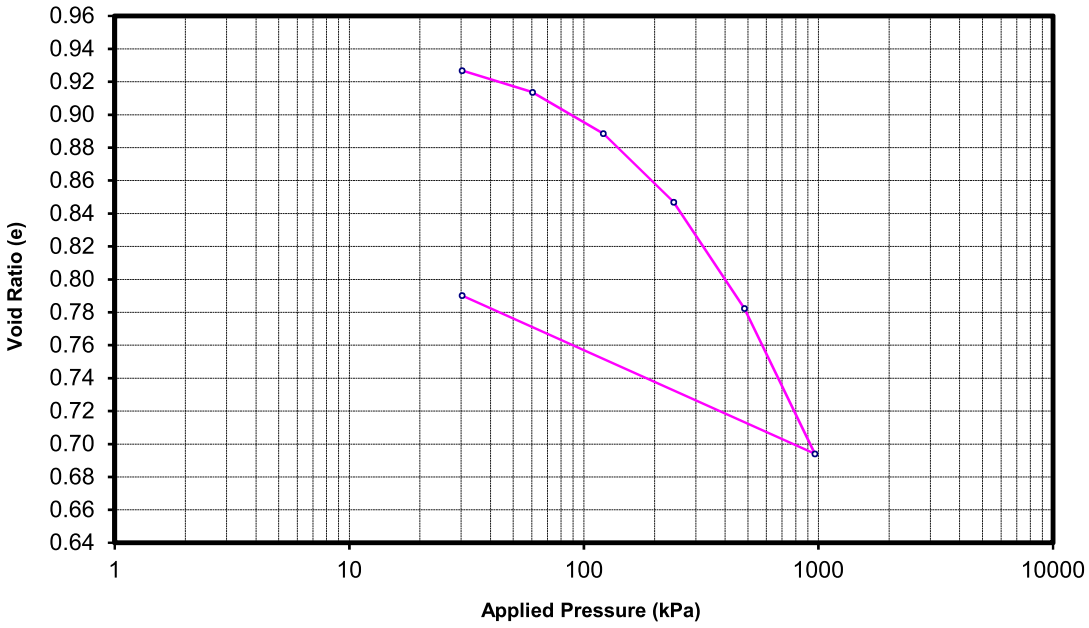
Project Name: **Hall Farm West** Page 6 of 26 KGA Ref No.: **7464**

Site Address: **Lot 1 DP 310813 & Lot 3 DP 327701** Our Job No.: **616672.001**

MH No.: **15** Depth: **9.35-9.40 (m)**

Test Method Used: NZS 4402:1986 Test 7.1 One-Dimensional Consolidation

ONE-DIMENSIONAL CONSOLIDATION TEST



Pressure (kPa)		Void Ratio (e)	Pressure Increment (kPa)	Coefficient of Consolidation Cv (m^2/yr)	Coefficient of Volume Compressibility Mv (m^2/MN)
As received	0	0.929			
Preload	30.2	0.927	0 to 30.2	NA	0.034
	60.3	0.914	30.2 to 60.3	4.5	0.23
	121	0.889	60.3 to 121	3.5	0.22
	241	0.847	121 to 241	1.9	0.18
	483	0.782	241 to 483	1.1	0.14
	966	0.694	483 to 966	1.0	0.10
Unload	30.2	0.790	966 to 30.2	NA	NA

Sample History: Undisturbed core trimmed at NWC. SQR of time fitting method used.

Description: clayey SILT with minor sand, firm to stiff, grey to dark grey mixed with light yellowish orange brown, mottled red.

Initial Dry Density (t/m³): 1.39 Initial Water Content: 33.5%

Solid Density (t/m³): 2.68 (Assumed) Initial Saturation: 97%

Temperature During Testing: Max = 17 ^{0}C Min = 15 ^{0}C

Remarks: The calculations of void ratio are affected by the solid density value. We have assumed a value of 2.68 t/m³.
Sample description is not IANZ accredited.

Entered by: ST Date: 31.07.2015 Checked by: MP Date: 31.07.2015

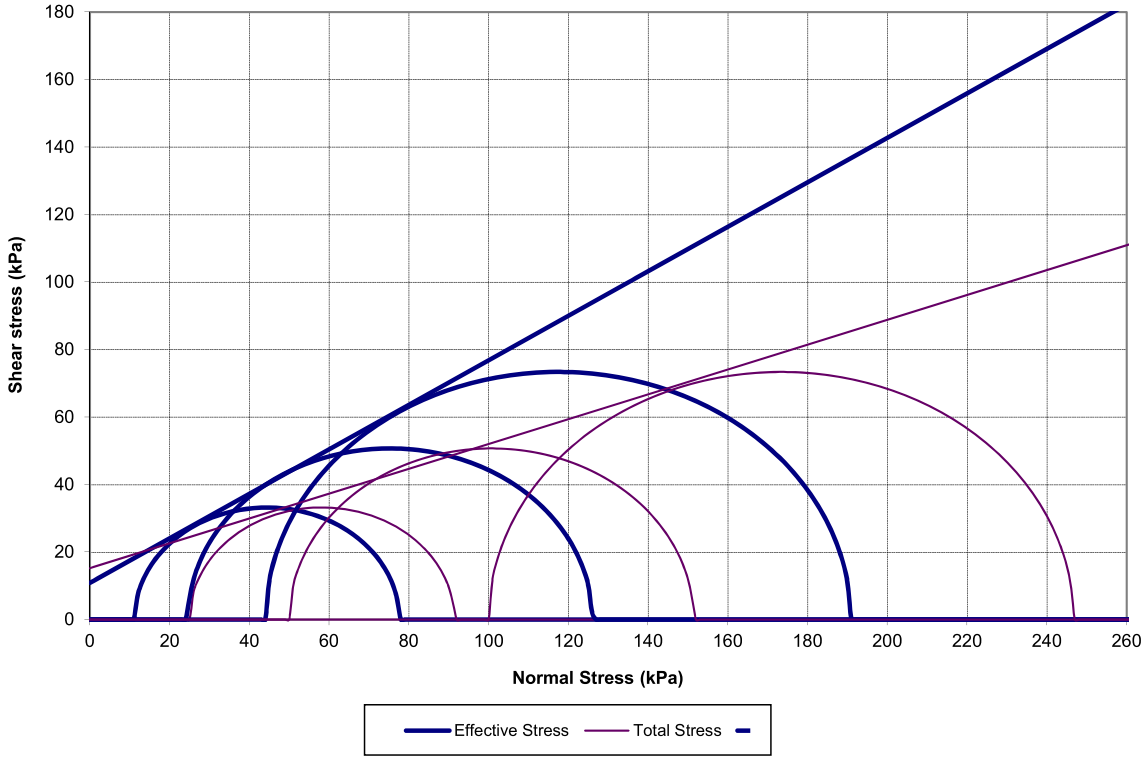
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Form No.:	TP1
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Plate No.:
Page 7 of 26
Site: Lot 1 DP 310813 & Lot 3 DP 3277 Your Ref No.: 7464
Job No.: 616672.000
Test pit/Bh No.: MH14 Sample No.: -- Depth: 2.60 -- 2.73 (m)
Test method used: BS1377:Part 8:1990:Clause 5 Saturation BS1377:Part 8:1990:Clause 6 Consolidation
BS1377:Part 8:1990:Clause 7 Consolidated-undrained triaxial compression test with pore pressure measurement

CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST (3 STAGES)

MOHR CIRCLES OF TOTAL AND EFFECTIVE STRESSES



Initial Sample Height:	130.08	mm	Initial Water Content:	59.6	%
Initial Sample Diameter:	60.30	mm	Initial Bulk Density:	1.66	t/m³
Initial B Value:	60	%	Initial Dry Density:	1.04	t/m³
B Value before Consolidation:	96	%	Final Water Content:	58.4	%

	Consolidation Stage			Failure Values				
	Cell Pressure (kPa)	Back Pressure (kPa)	Eff. Consol. Stress (kPa)	Deviator Stress (kPa)	Pore Pressure Change During Shearing δμ(kPa)	Effective Principal Stress (kPa) Major σ1'	Effective Principal Stress (kPa) Minor σ3'	Vertical Strain (%)
STAGE 1	425	400	25	66.43	13.8	77.63	11.20	1.05
STAGE 2	450	400	50	101.44	25.4	126.04	24.60	1.70
STAGE 3	500	400	100	146.74	55.9	190.84	44.10	3.05

		Total			Effective	
Angle of Frictional Resistance:	ϕ =	20	°	ϕ′ =	33	°
Cohesion:	c =	15	kPa	c' =	11	kPa
Linear Regression Coefficient:	r =	0.994		r =	1.000	

Sample History: Undisturbed core trimmed at natural water content.

Soil description: SILT, with some clay, firm, light brown with orange, medium to high plasticity, dilatant.

Failure Mode: Planar / Plastic **Test Speed:** 0.026 (mm/min)

Test Remarks: The sample was saturated by increments of cell pressure and back pressure.
Failure for each stage was determined bythe maximum effective stress ratio. Strength parameters have been derived by using a linear regression fitting method.

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Form No.:	TG2
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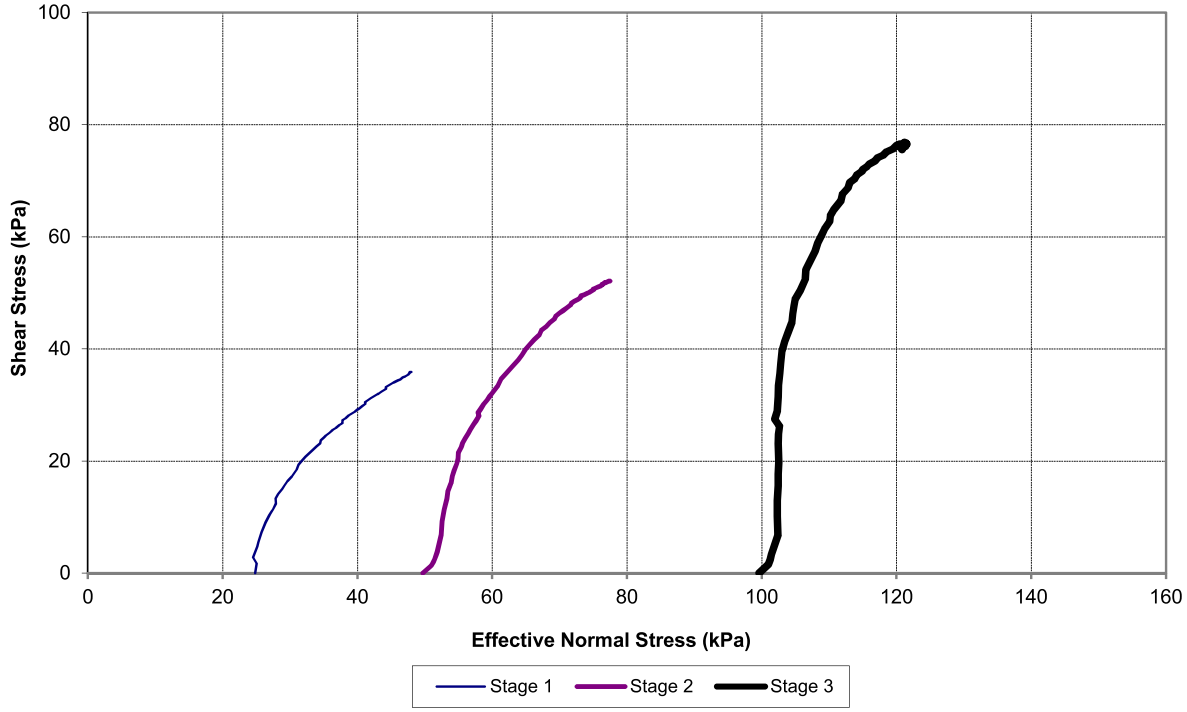
Plate No.:

Site: Lot 1 DP 310813 & Lot Your Ref No.: 7464 Job No.: 616672.000

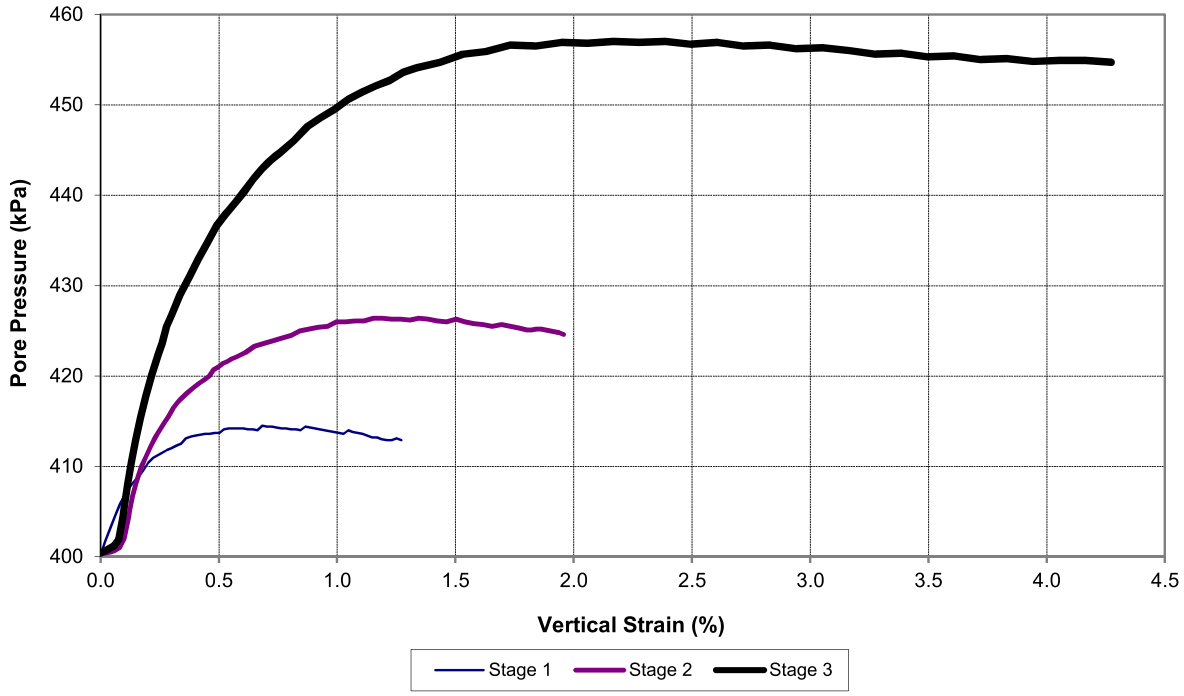
Test pit/Bh No.: MH14 Sample No.: -- Depth: 2.60 -- 2.73 (m)

GRAPHS

STRESS PATH



PORE PRESSURE Vs VERTICAL STRAIN



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Form No.:	TG1-1
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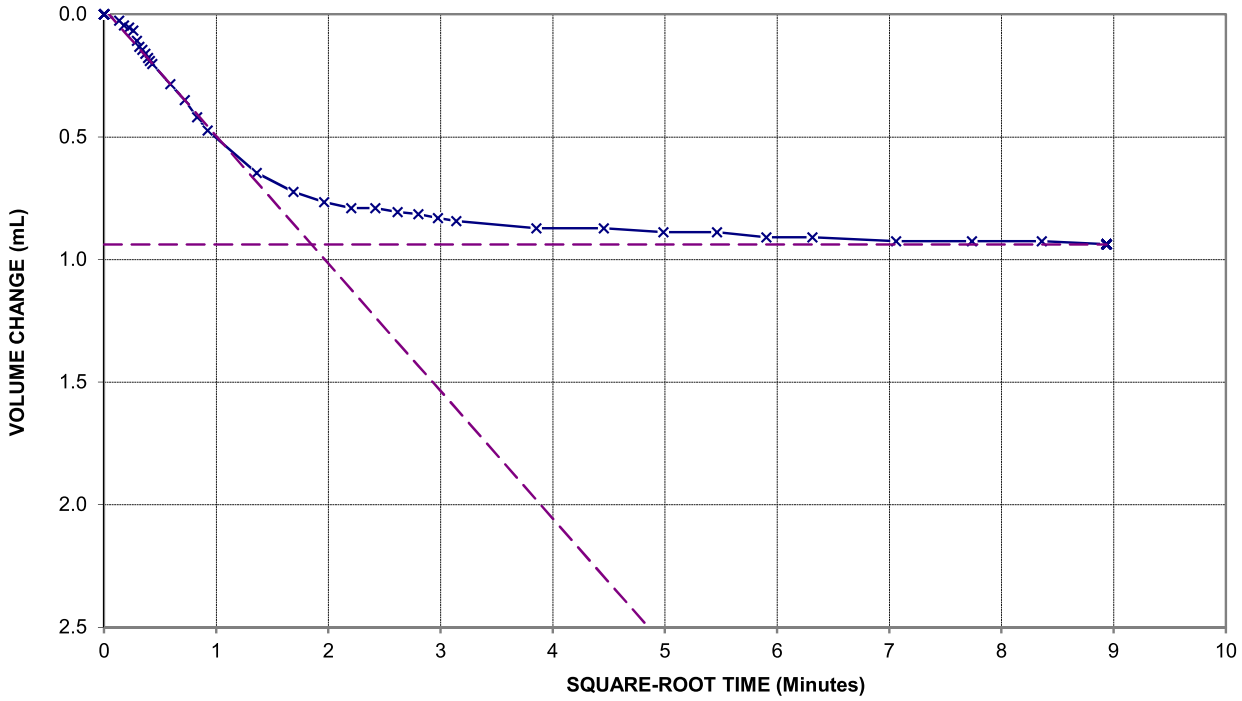
Plate No.:

Site: Lot 1 DP 310813 & Lot Your Ref No.: 7464 Job No.: 616672.000

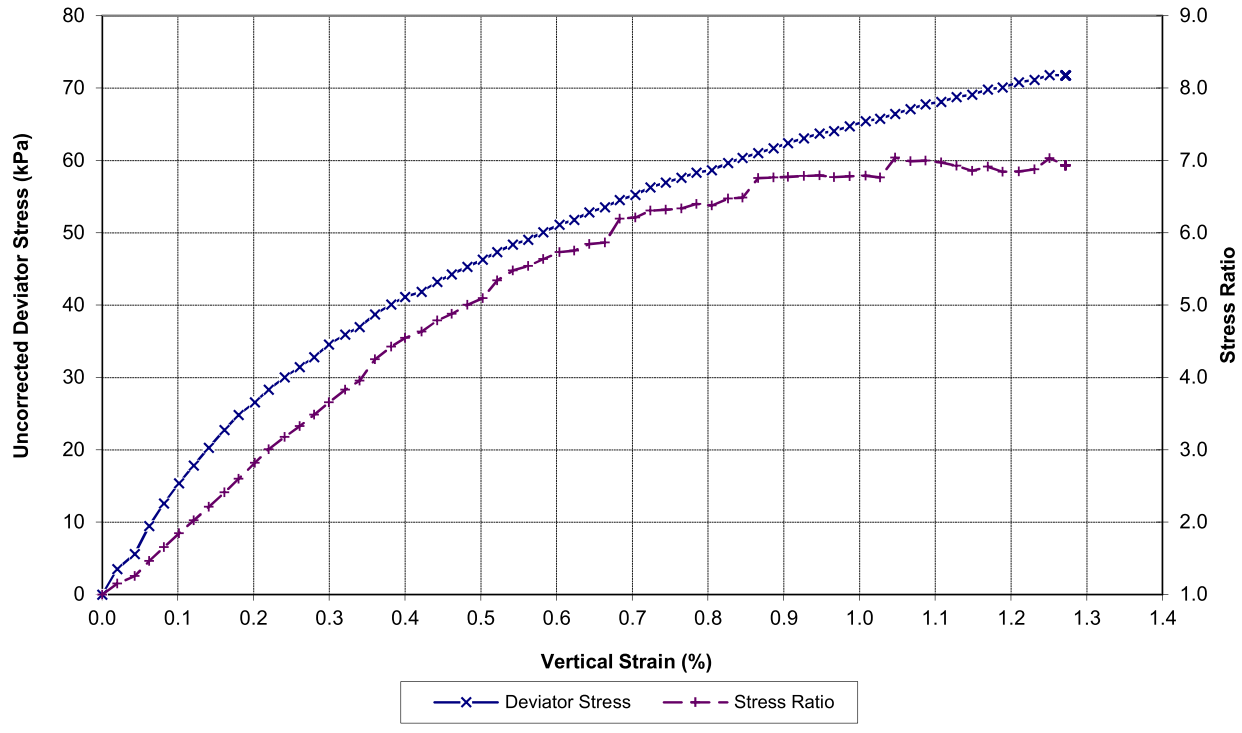
Test pit/Bh No.: MH14 Sample No.: -- Depth: 2.60 -- 2.73 (m)

STAGE 1 GRAPHS

CONSOLIDATION



STRESS-STRAIN CURVE



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Form No.:	TG1-2
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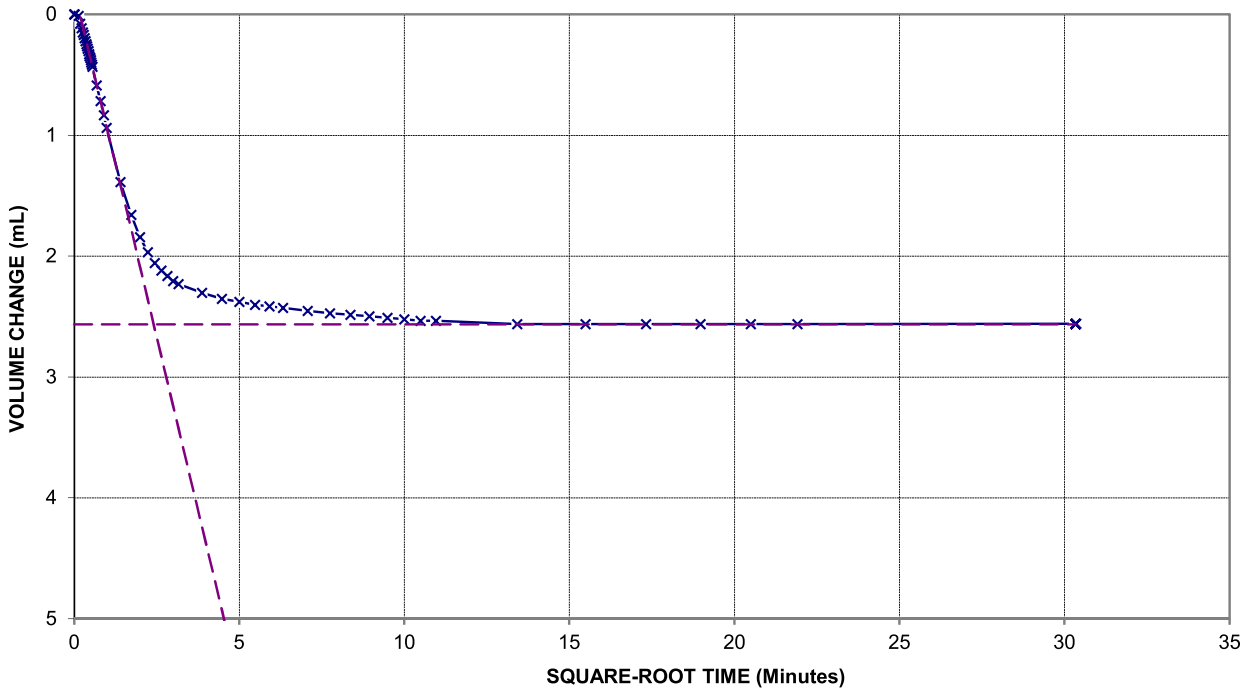
Plate No.: Page 10 of 26

Site: Lot 1 DP 310813 & Lot Your Ref No.: 7464 Job No.: 616672.000

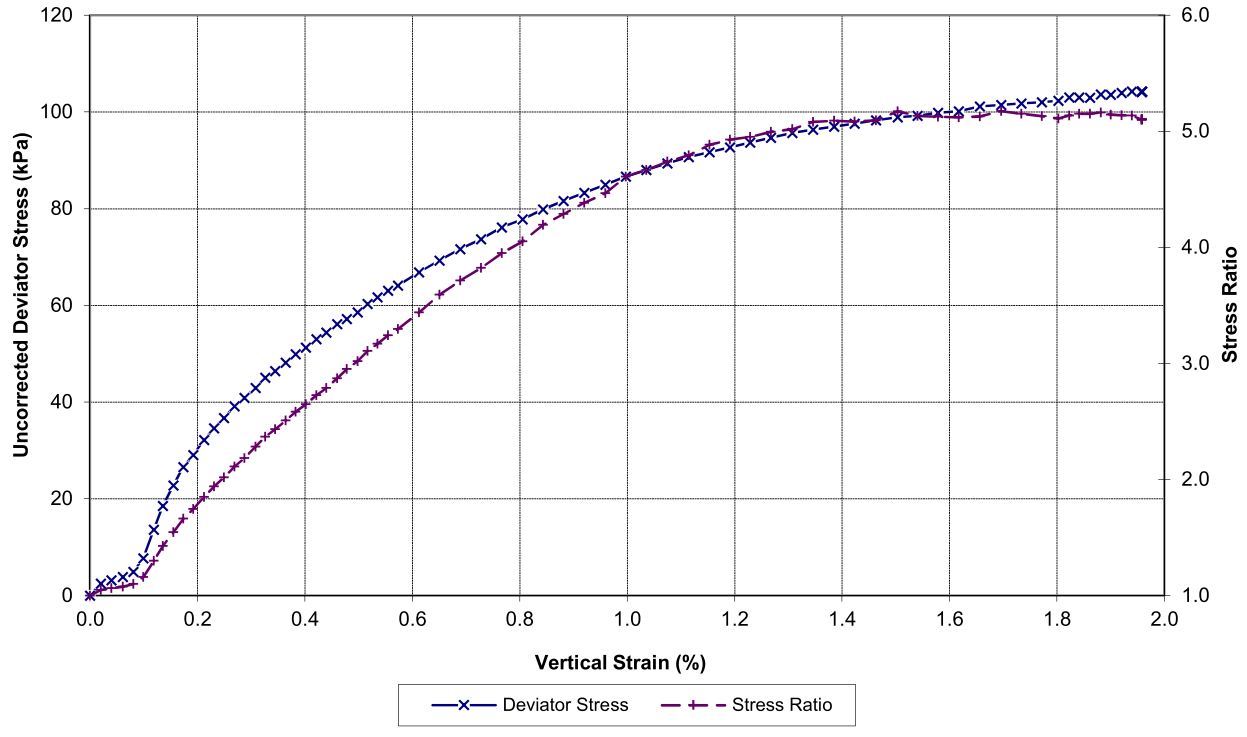
Test pit/Bh No.: MH14 Sample No.: -- Depth: 2.60 -- 2.73 (m)

STAGE 2 GRAPHS

CONSOLIDATION



STRESS-STRAIN CURVE



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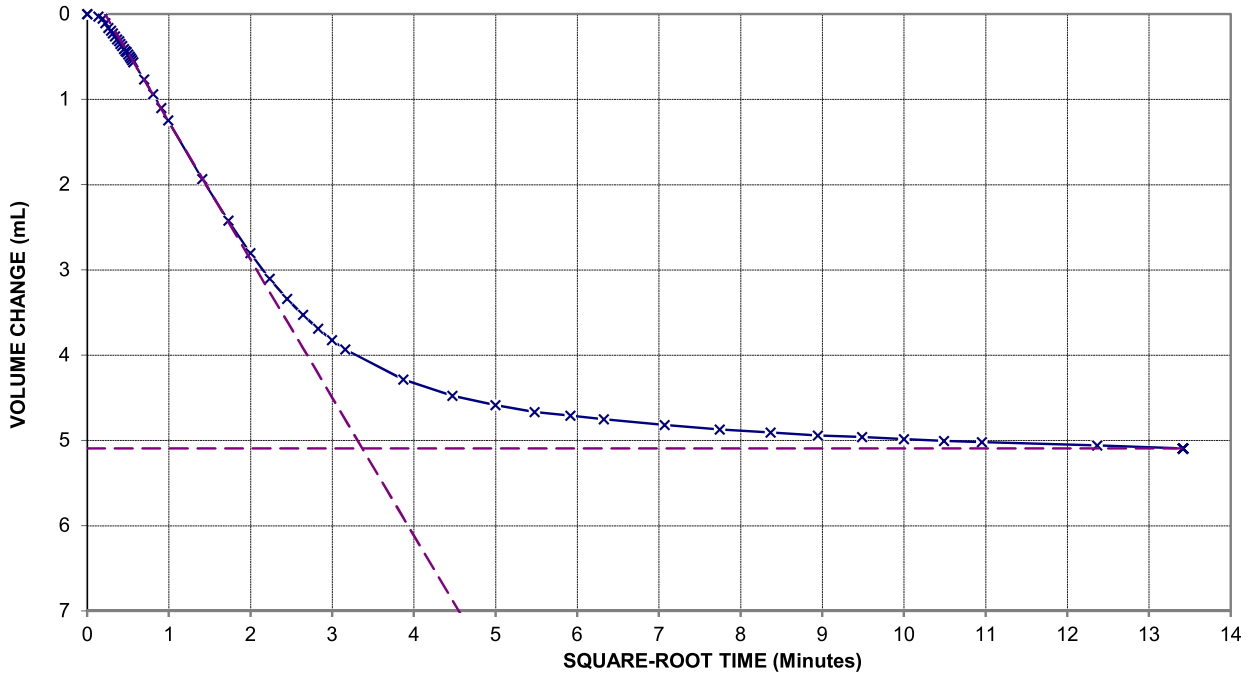
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Site: Lot 1 DP 310813 & Lot Your Ref No.: 7464 Job No.: 616672.000

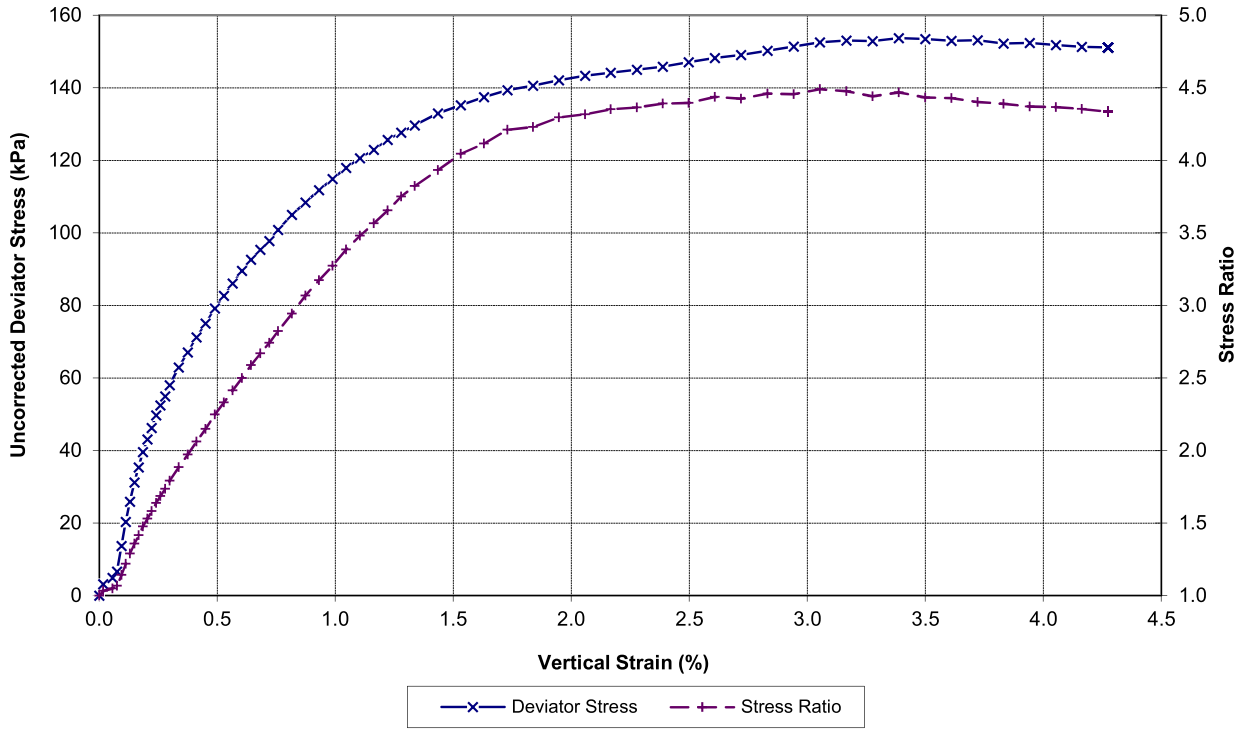
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STAGE 3 GRAPHS

CONSOLIDATION



STRESS-STRAIN CURVE



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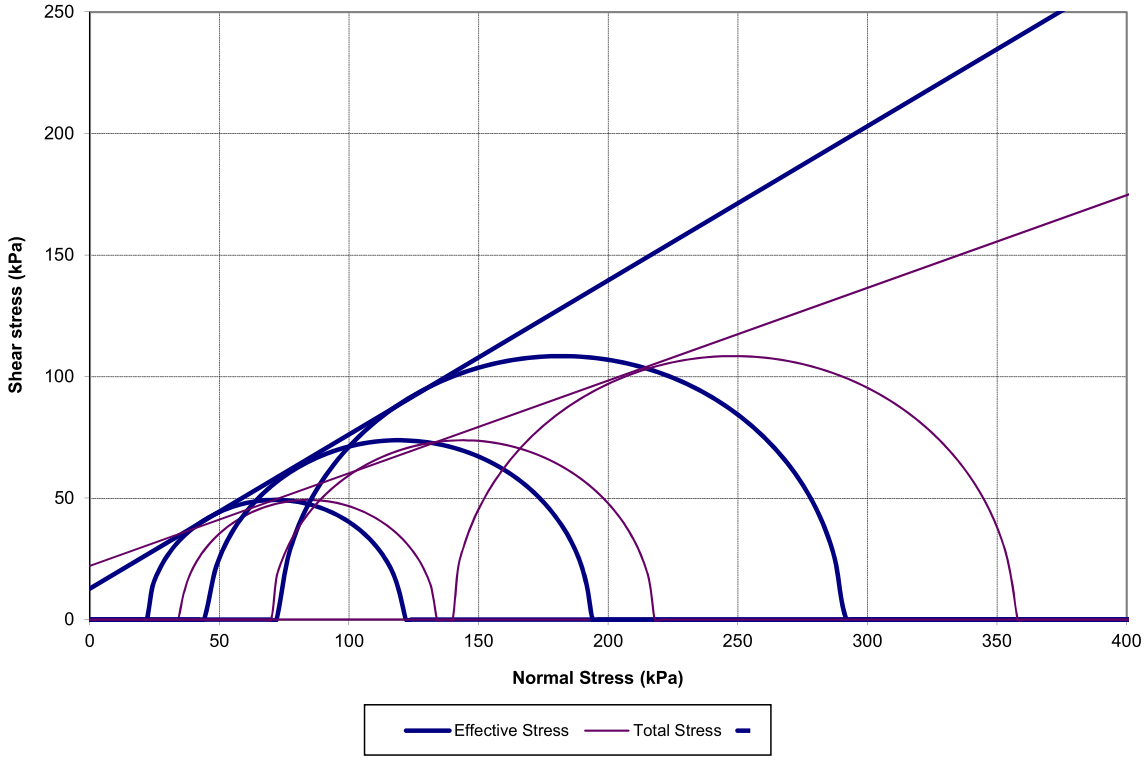
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Form No.:	TP1
P:\616672\WorkingMaterial\MH16\MH16.xlsx	

Plate No.: Page 12 of 26
Site: Lot 1 DP 310813 & Lot 3 DP 3277 Your Ref No.: 7464 Job No.: 616672.000
Test pit/Bh No.: MH16 Sample No.: -- Depth: 4.07 -- 4.20 (m)
Test method used: BS1377:Part 8:1990:Clause 5 Saturation BS1377:Part 8:1990:Clause 6 Consolidation
BS1377:Part 8:1990:Clause 7 Consolidated-undrained triaxial compression test with pore pressure measurement

CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST (3 STAGES)

MOHR CIRCLES OF TOTAL AND EFFECTIVE STRESSES



Initial Sample Height:	128.80	mm	Initial Water Content:	35.8	%
Initial Sample Diameter:	60.48	mm	Initial Bulk Density:	1.73	t/m³
Initial B Value:	12	%	Initial Dry Density:	1.27	t/m³
B Value before Consolidation:	94	%	Final Water Content:	39.7	%

	Consolidation Stage			Failure Values				
	Cell Pressure (kPa)	Back Pressure (kPa)	Eff. Consol. Stress (kPa)	Deviator Stress (kPa)	Pore Pressure Change During Shearing δμ(kPa)	Effective Principal Stress (kPa) Major σ1'	Effective Principal Stress (kPa) Minor σ3'	Vertical Strain (%)
STAGE 1	485	450	35	98.50	12.7	120.80	22.30	1.49
STAGE 2	520	450	70	147.58	24.5	193.08	45.50	2.08
STAGE 3	590	450	140	216.91	66.6	290.31	73.40	5.01

		Total			Effective	
Angle of Frictional Resistance:	ϕ =	21	°	ϕ′ =	32	°
Cohesion:	c =	22	kPa	c' =	13	kPa
Linear Regression Coefficient:	r =	0.996		r =	1.000	

Sample History: Undisturbed core trimmed at natural water content.

Soil description: 4.07 ~ 4.11 (m): SILT, with some clay and minor sand, soft, light grey, medium to high plasticity, dilatant.
4.11 ~ 4.20 (m): SILT, with some sand and minor clay, firm, orange brown with light grey, low to medium plasticity, dilatant.

Failure Mode: Planar / Plastic **Test Speed:** 0.03 (mm/min)

Test Remarks: The sample was saturated by increments of cell pressure and back pressure.
Failure for each stage was determined by the maximum effective stress ratio. Strength parameters have been derived by using a linear regression fitting method.

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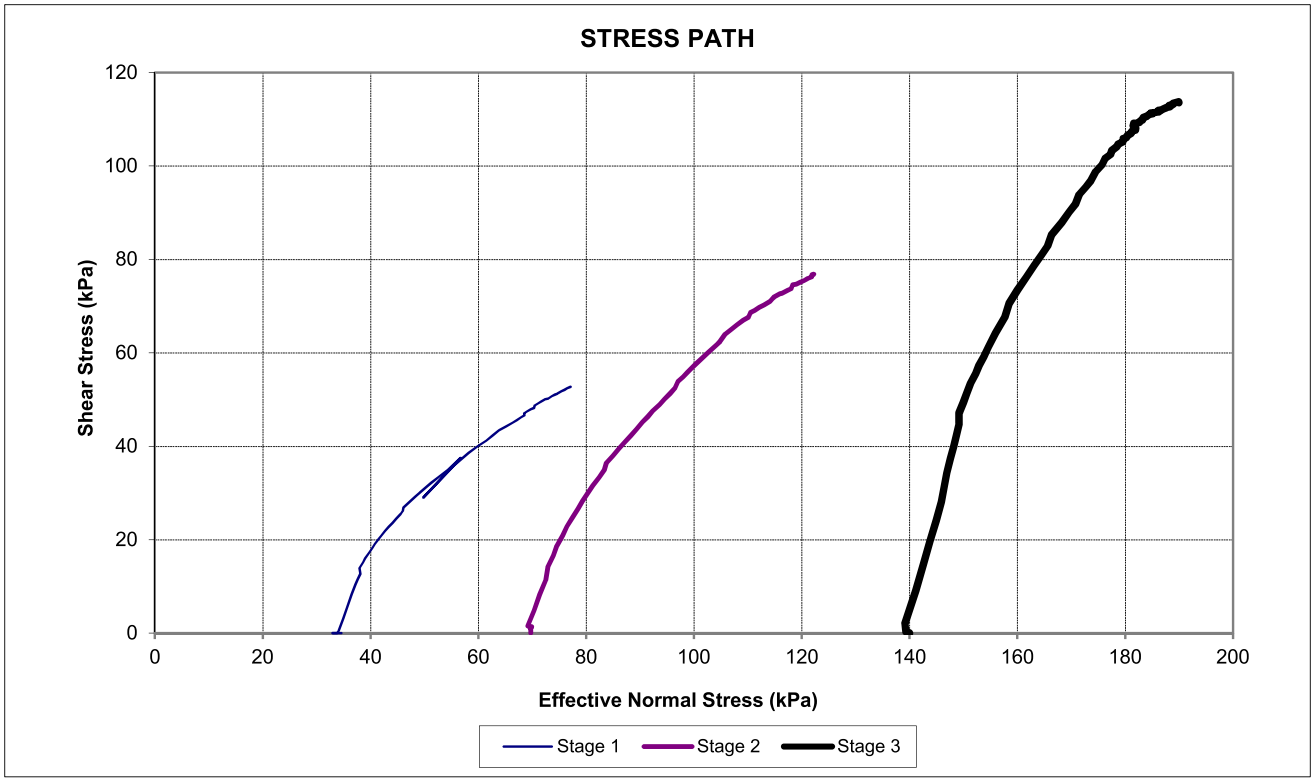
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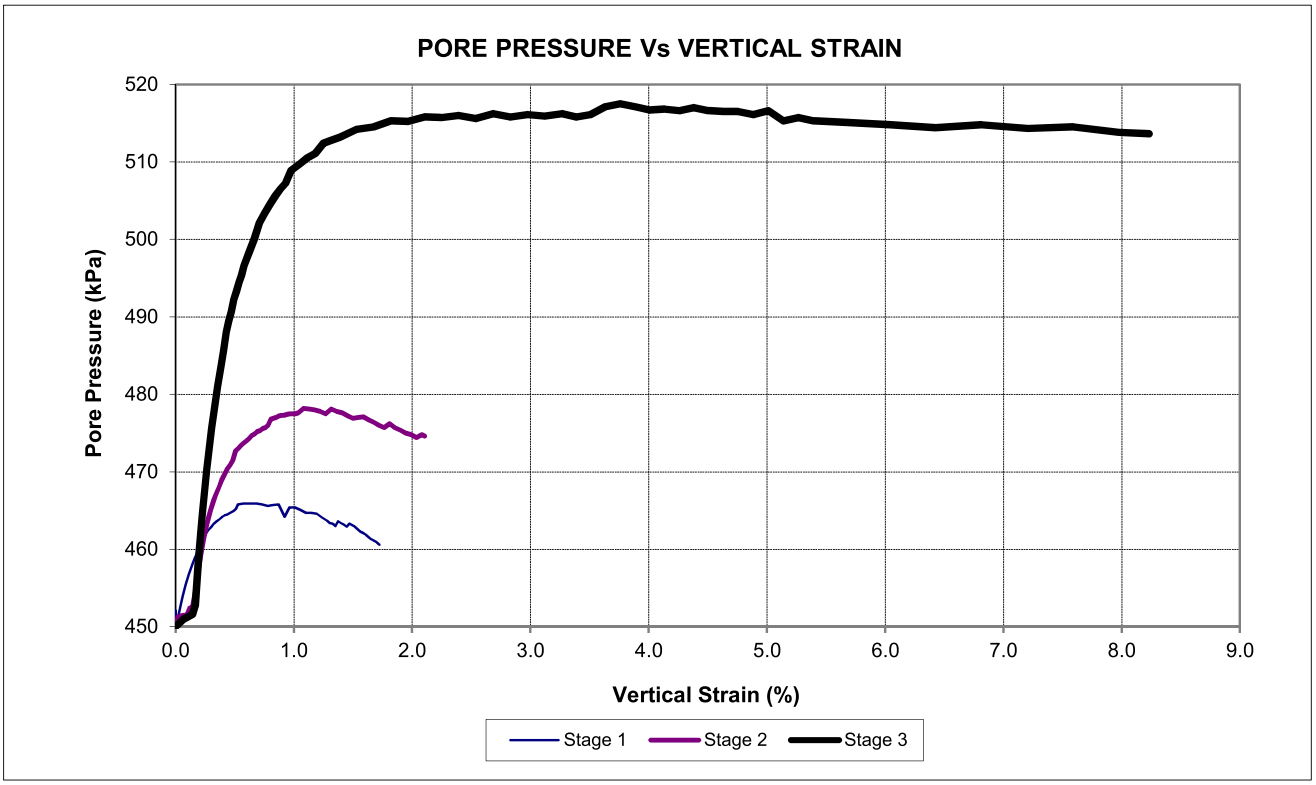
Plate No.:

Site: Lot 1 DP 310813 & Lot Your Ref No.: 7464 Job No.: 616672.000

Test pit/Bh No.: MH16 Sample No.: -- Depth: 4.07 -- 4.20 (m)

GRAPHS





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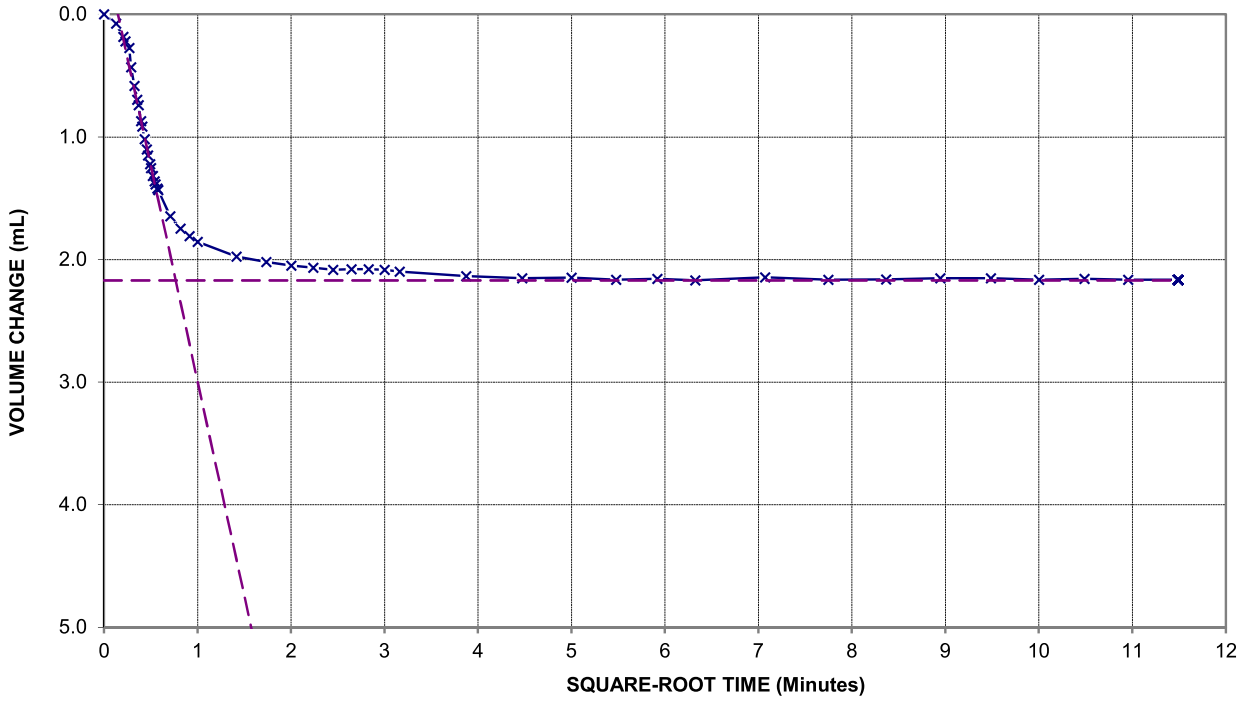
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Site: Lot 1 DP 310813 & Lot Your Ref No.: 7464 Job No.: 616672.000

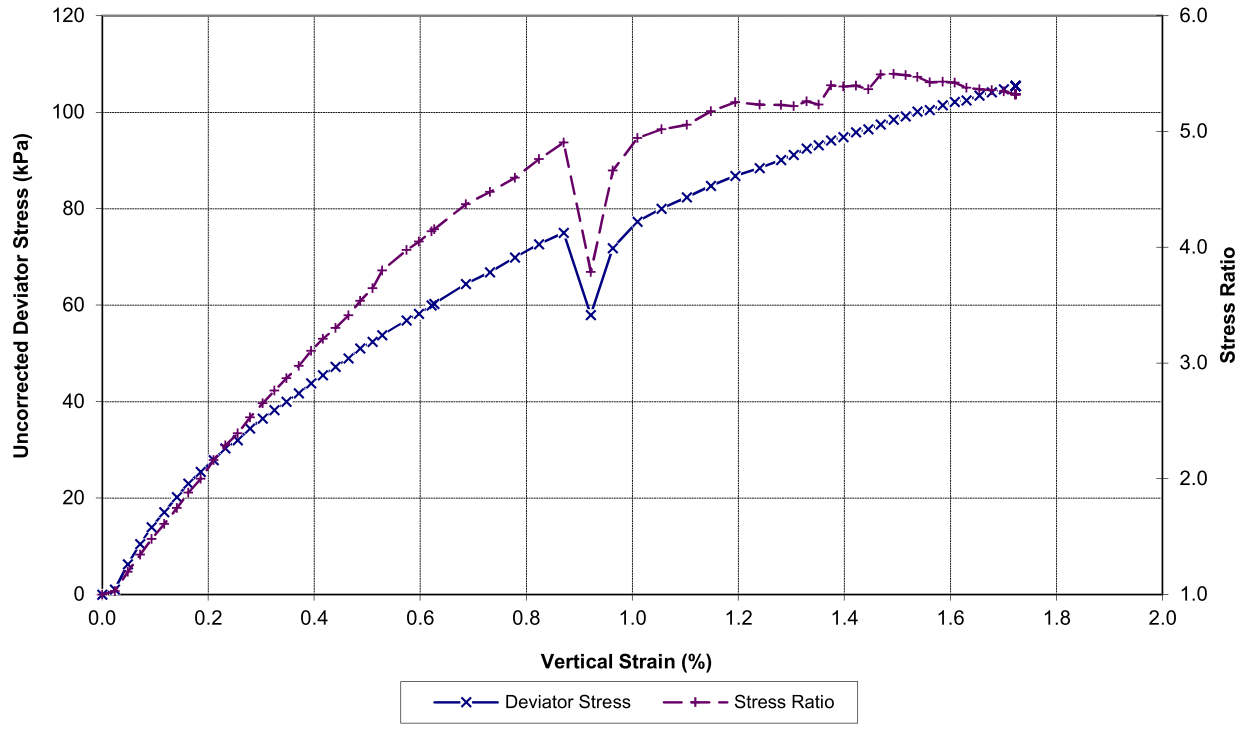
Test pit/Bh No.: MH16 Sample No.: -- Depth: 4.07 -- 4.20 (m)

STAGE 1 GRAPHS

CONSOLIDATION



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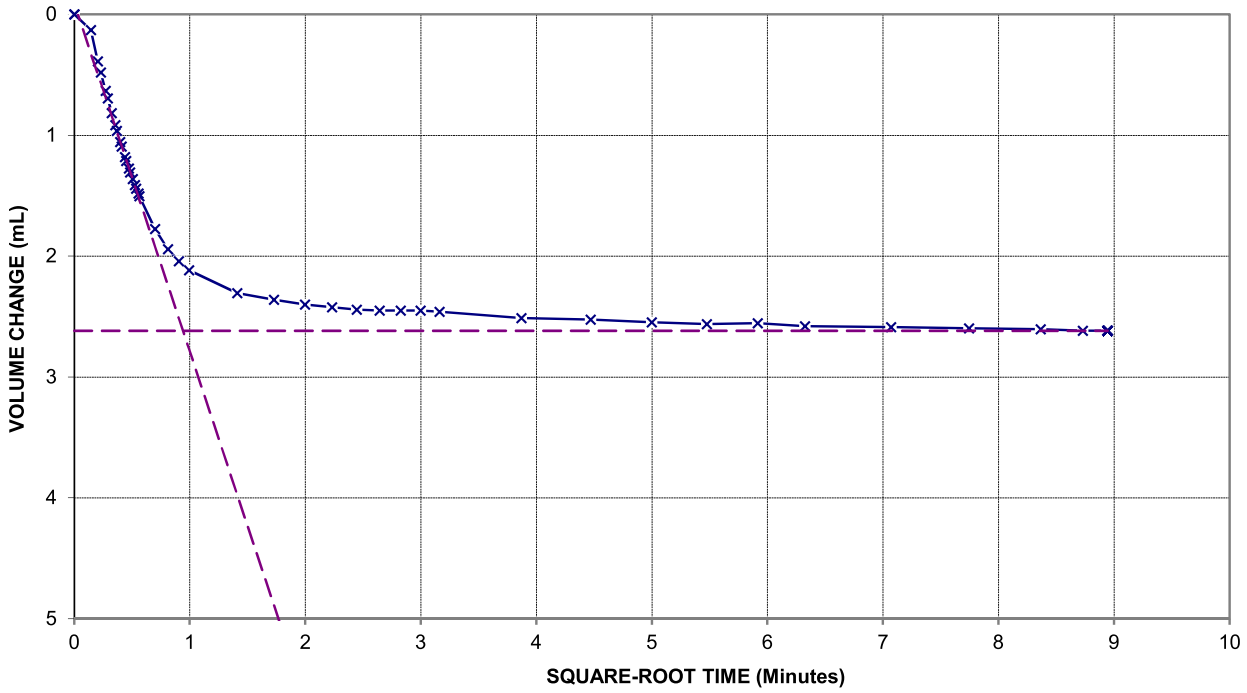
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Site: Lot 1 DP 310813 & Lot Your Ref No.: 7464 Job No.: 616672.000

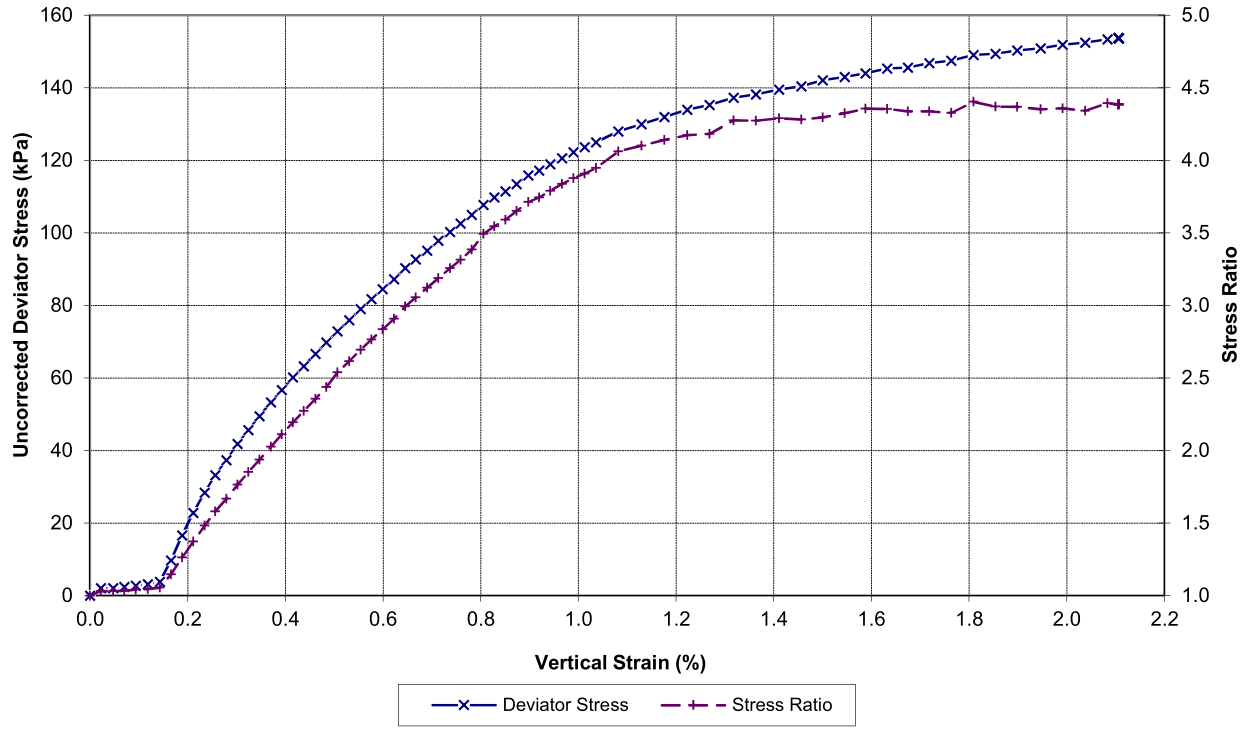
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STAGE 2 GRAPHS

CONSOLIDATION



STRESS-STRAIN CURVE



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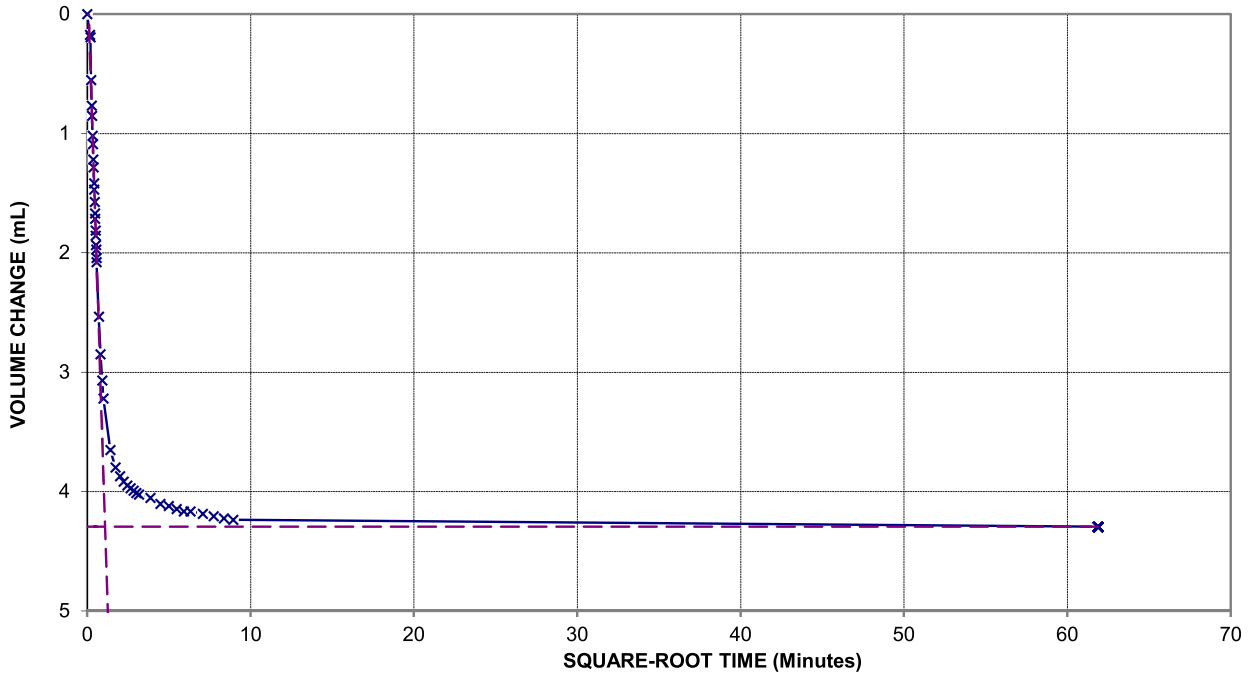
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Site: Lot 1 DP 310813 & Lot Your Ref No.: 7464 Job No.: 616672.000

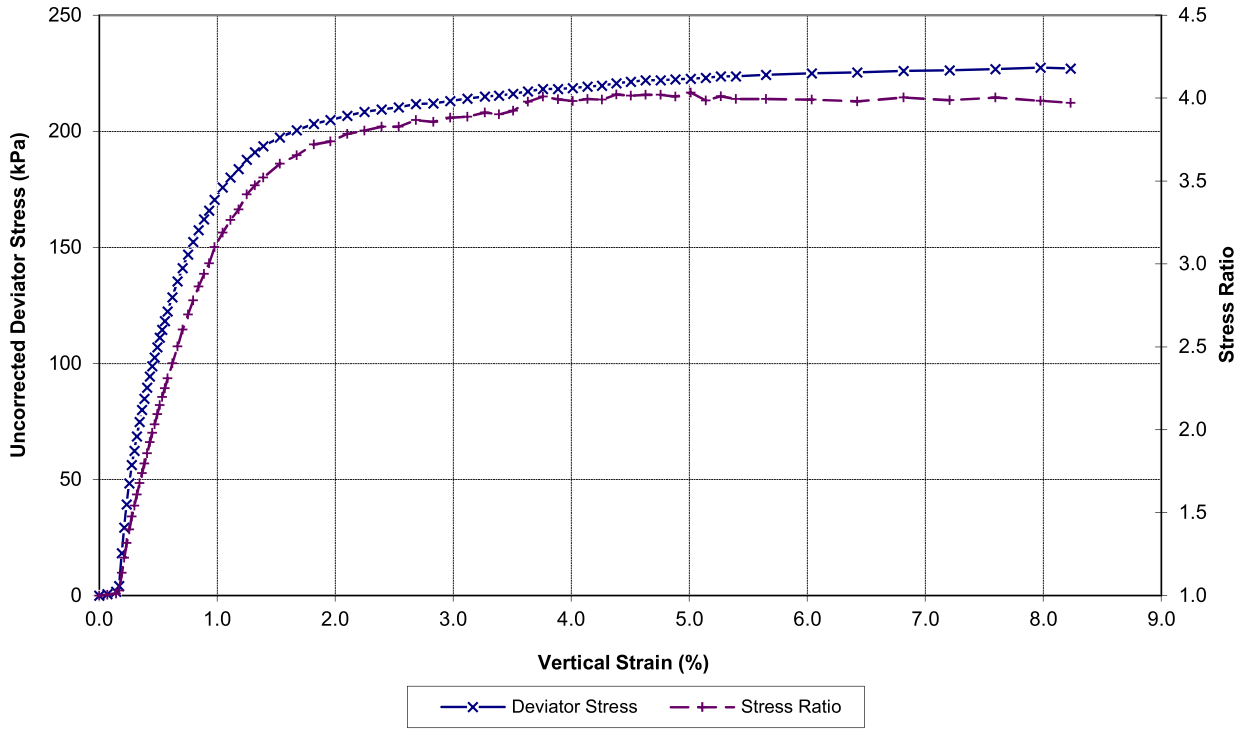
Test pit/Bh No.: MH16 Sample No.: -- Depth: 4.07 -- 4.20 (m)

STAGE 3 GRAPHS

CONSOLIDATION



STRESS-STRAIN CURVE



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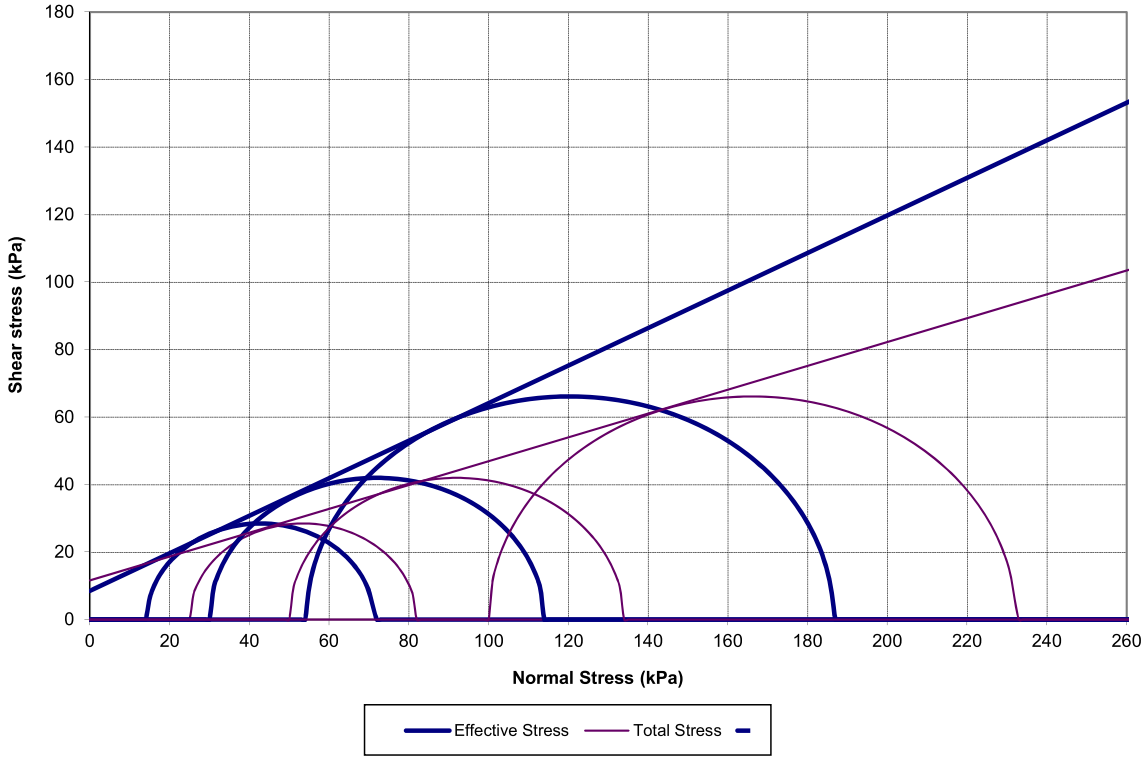
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Plate No.:

Site: Lot 1 DP 310813 & Lot 3 DP 3277 Your Ref No.: 7464 Job No.: 616672.000
Test pit/Bh No.: MH22 Sample No.: -- Depth: 4.17 -- 4.30 (m)
Test method used: BS1377:Part 8:1990:Clause 5 Saturation BS1377:Part 8:1990:Clause 6 Consolidation
BS1377:Part 8:1990:Clause 7 Consolidated-undrained triaxial compression test with pore pressure measurement

CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST (3 STAGES)

MOHR CIRCLES OF TOTAL AND EFFECTIVE STRESSES



Initial Sample Height:	129.65	mm	Initial Water Content:	66.6	%
Initial Sample Diameter:	60.18	mm	Initial Bulk Density:	1.78	t/m³
Initial B Value:	12	%	Initial Dry Density:	1.07	t/m³
B Value before Consolidation:	98	%	Final Water Content:	65.4	%

	Consolidation Stage			Failure Values				
	Cell Pressure (kPa)	Back Pressure (kPa)	Eff. Consol. Stress (kPa)	Deviator Stress (kPa)	Pore Pressure Change During Shearing δμ(kPa)	Effective Principal Stress (kPa) Major σ1'	Effective Principal Stress (kPa) Minor σ3'	Vertical Strain (%)
STAGE 1	325	300	25	56.95	10.7	71.25	14.30	1.63
STAGE 2	350	300	50	83.99	20	113.99	30.00	2.39
STAGE 3	400	300	100	132.24	45.7	186.54	54.30	3.34

		Total			Effective	
Angle of Frictional Resistance:	ϕ =	19	°	ϕ′ =	29	°
Cohesion:	c =	12	kPa	c' =	8	kPa
Linear Regression Coefficient:	r =	1.000		r =	1.000	

Sample History: Undisturbed core trimmed at natural water content.

Soil description: SILT, with some clay, soft, light grey with dark grey and orange brown, medium to high plasticity, dilatant.

Failure Mode: Planar / Plastic **Test Speed:** 0.023 (mm/min)

Test Remarks: The sample was saturated by increments of cell pressure and back pressure.
Failure for each stage was determined by the maximum effective stress ratio. Strength parameters have been derived by using a linear regression fitting method.

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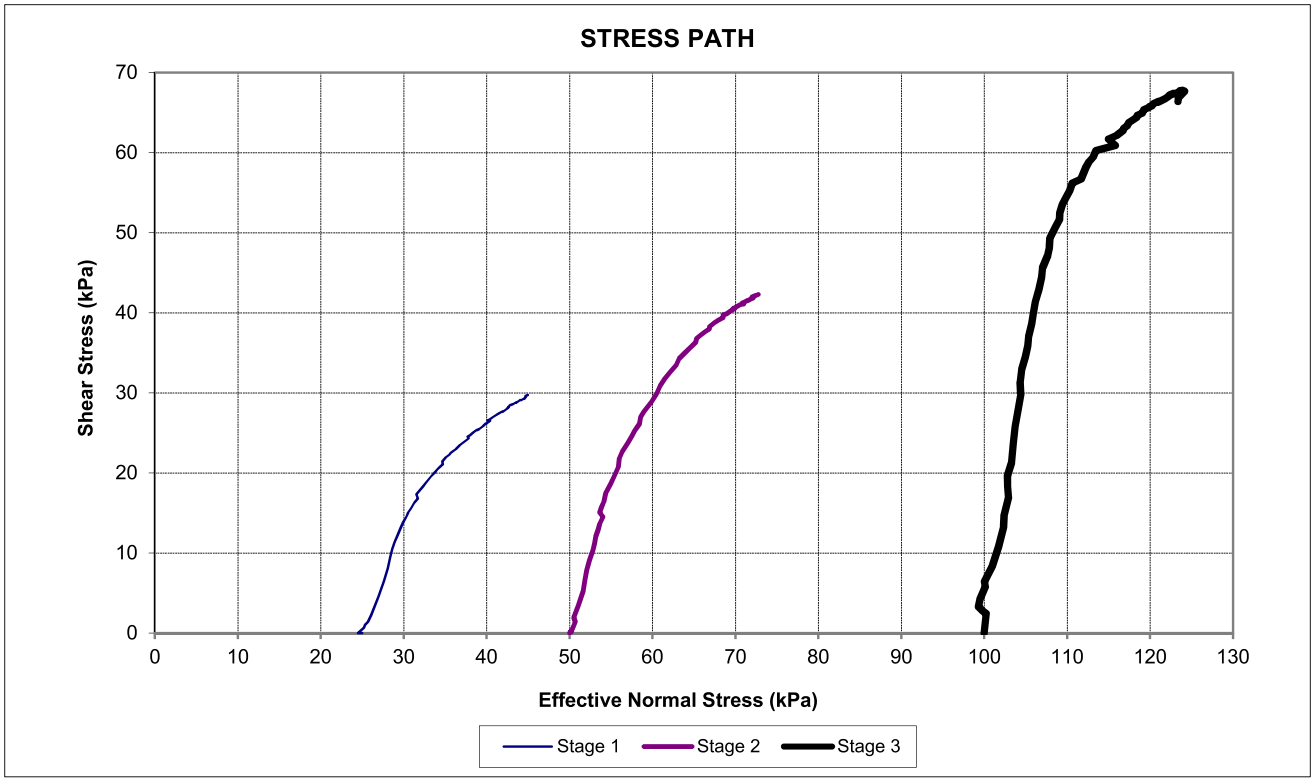
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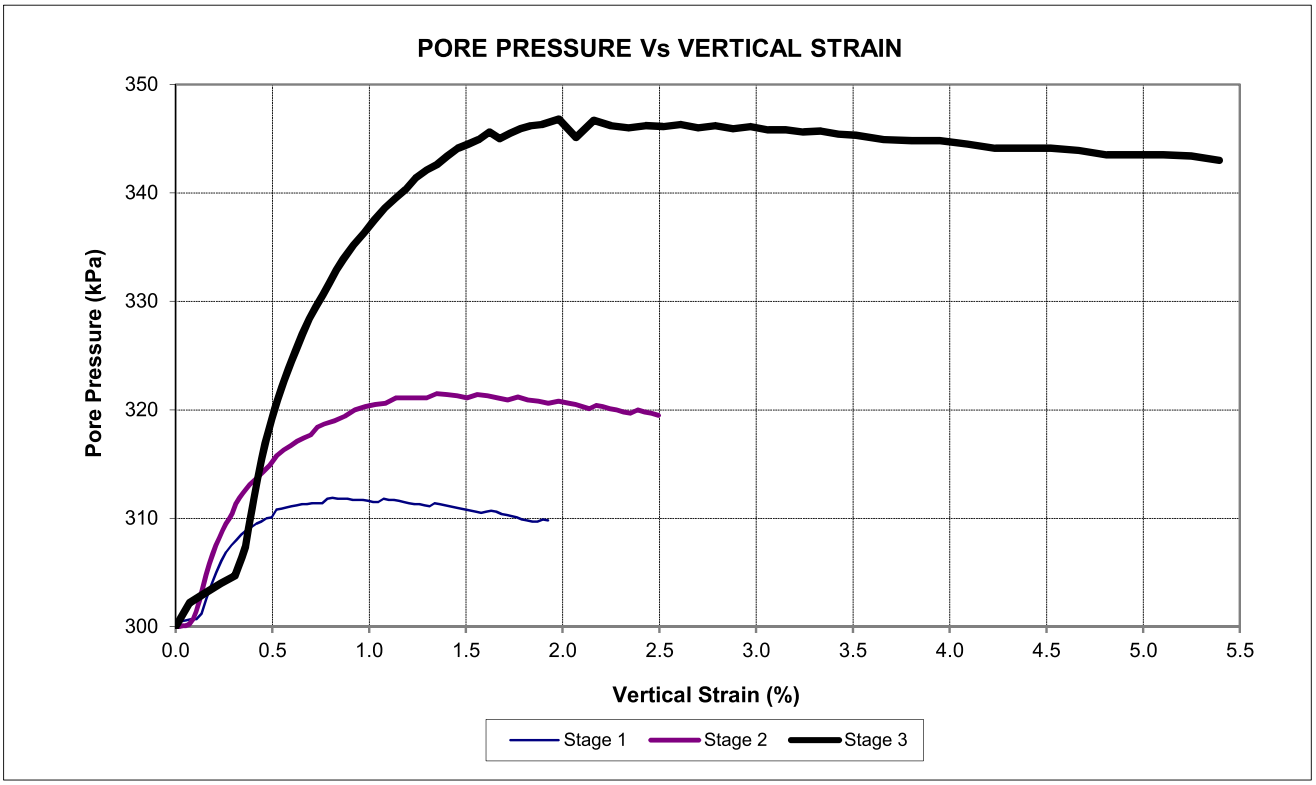
Plate No.:

Site: Lot 1 DP 310813 & Lot Your Ref No.: 7464 Job No.: 616672.000

Test pit/Bh No.: MH22 Sample No.: -- Depth: 4.17 -- 4.30 (m)

GRAPHS





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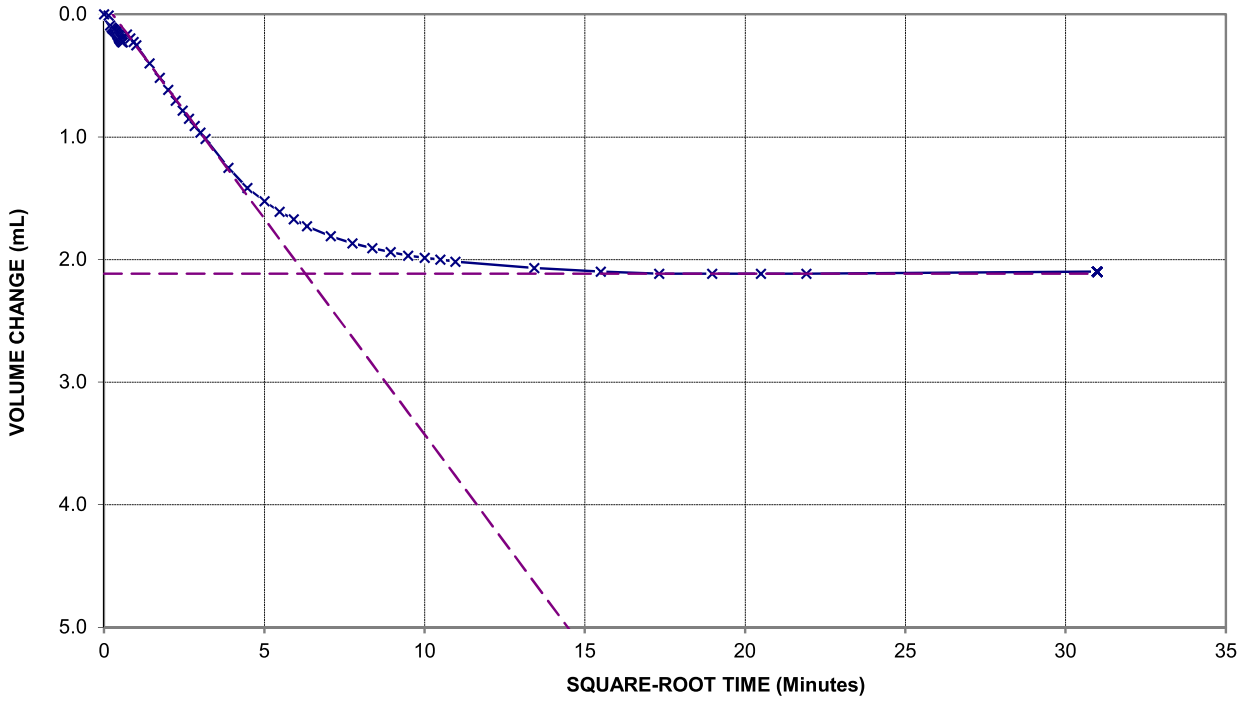
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Site: Lot 1 DP 310813 & Lot Your Ref No.: 7464 Job No.: 616672.000

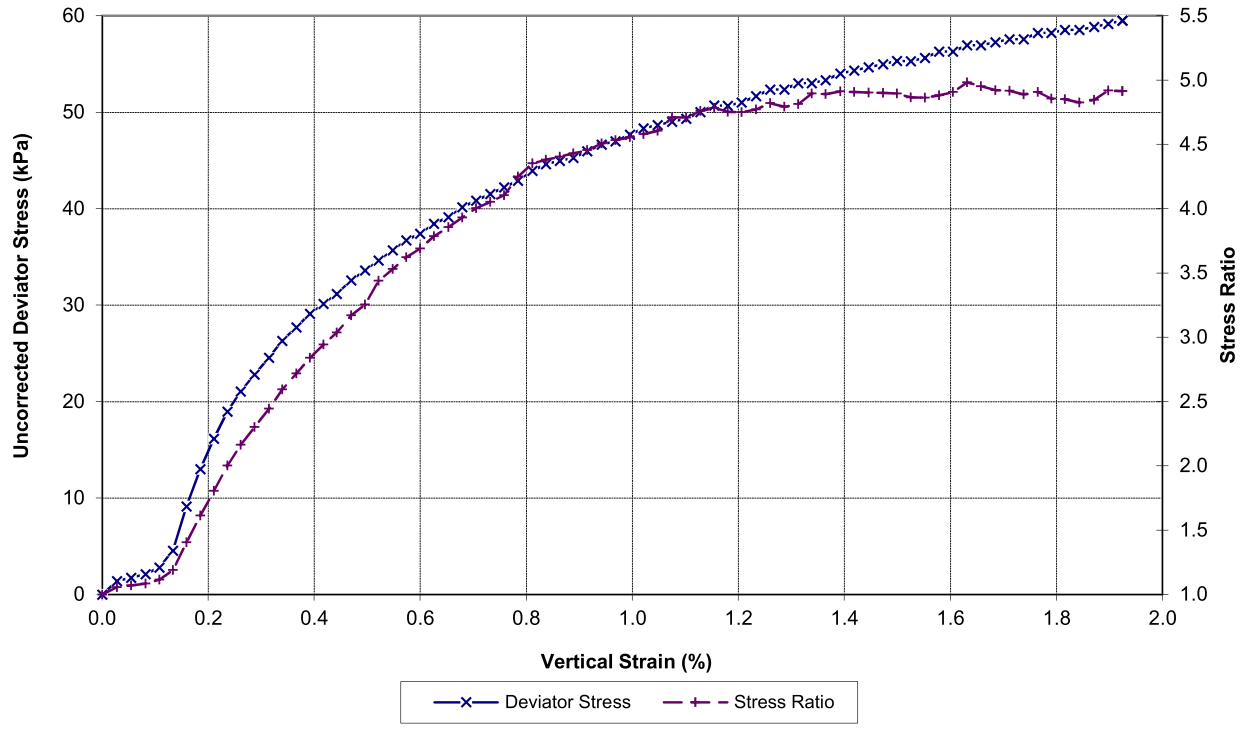
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STAGE 1 GRAPHS

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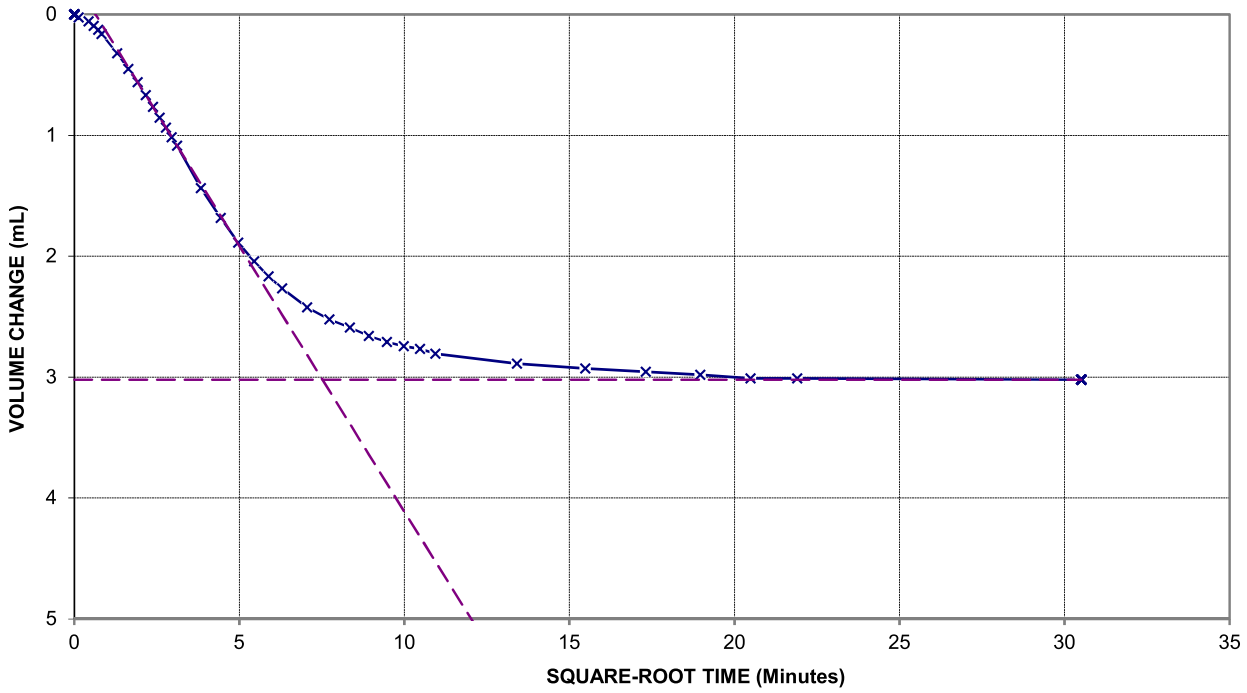
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Site: Lot 1 DP 310813 & Lot Your Ref No.: 7464 Job No.: 616672.000

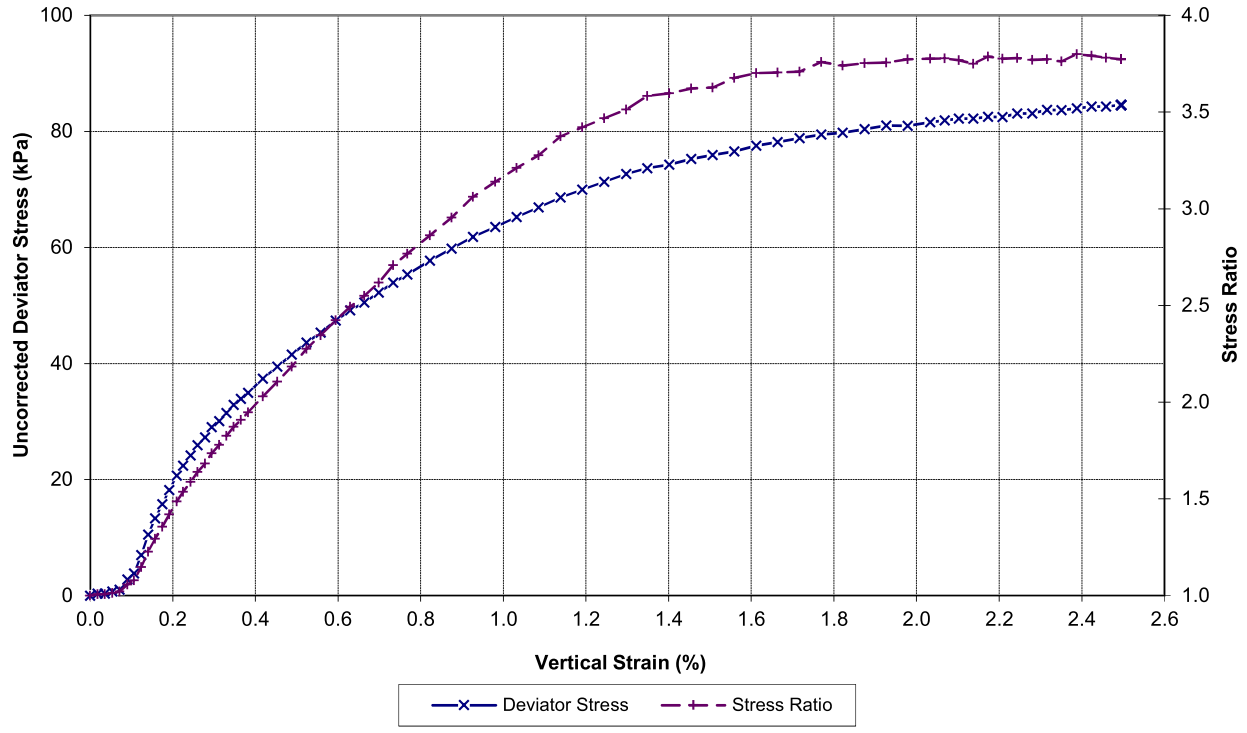
Test pit/Bh No.: MH22 Sample No.: -- Depth: 4.17 -- 4.30 (m)

STAGE 2 GRAPHS

CONSOLIDATION



STRESS-STRAIN CURVE



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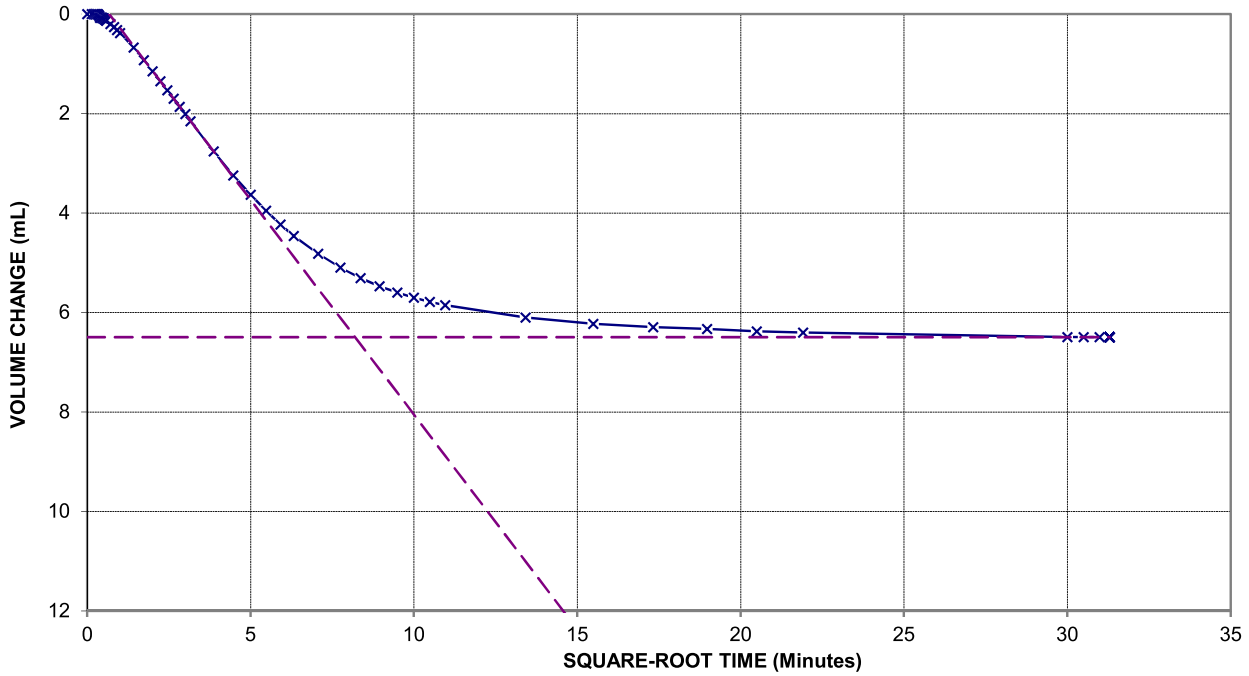
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Site: Lot 1 DP 310813 & Lot Your Ref No.: 7464 Job No.: 616672.000

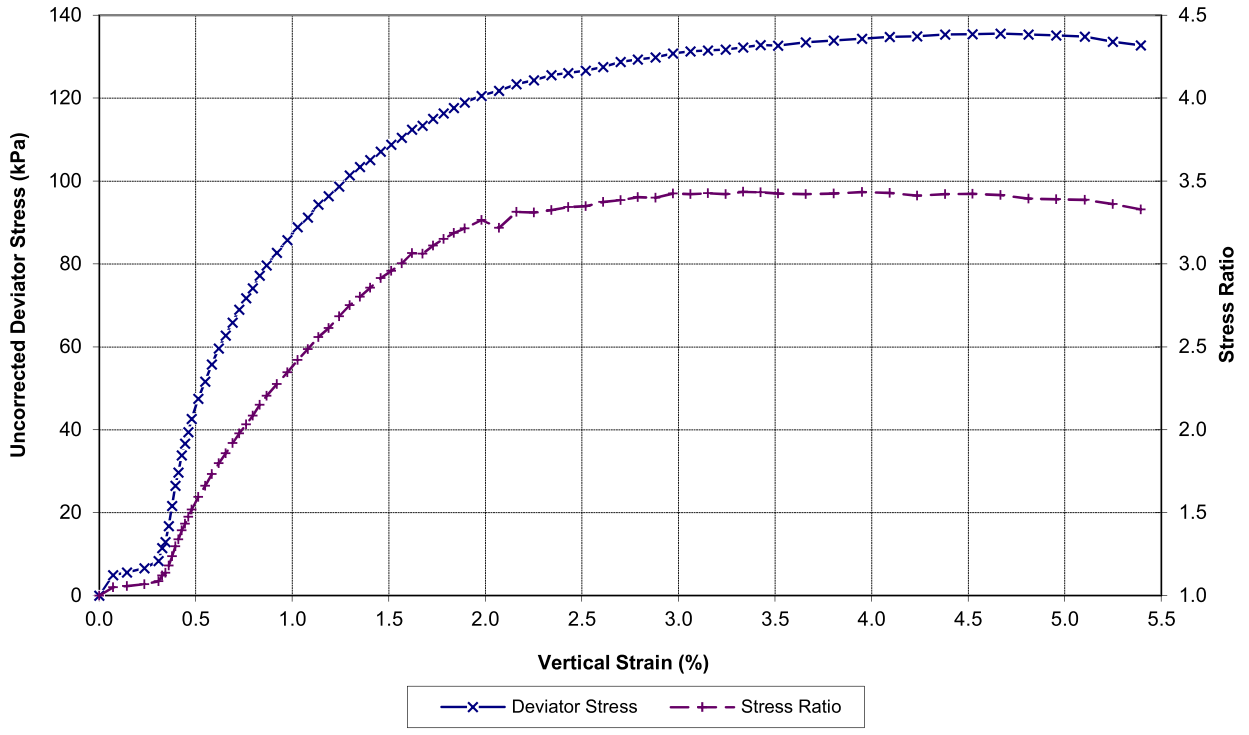
Test pit/Bh No.: MH22 Sample No.: -- Depth: 4.17 -- 4.30 (m)

STAGE 3 GRAPHS

CONSOLIDATION



STRESS-STRAIN CURVE



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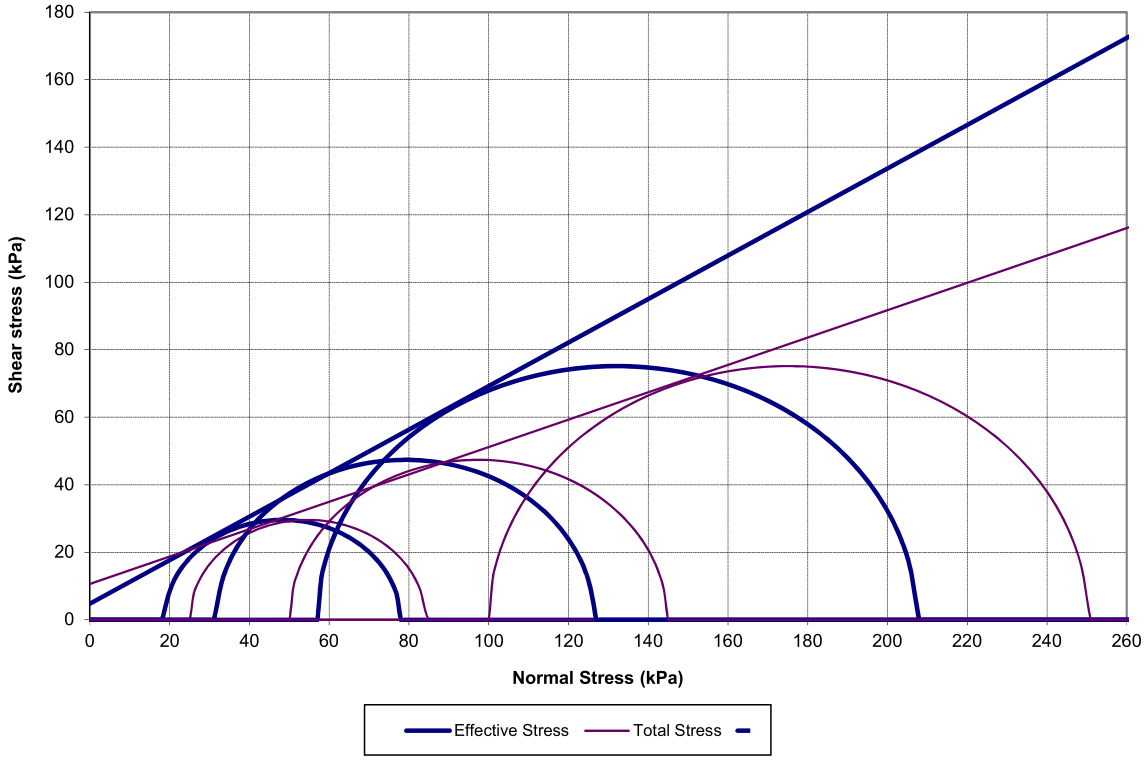
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Plate No.:
Page 22 of 26
Site: Lot 1 DP 310813 & Lot 3 DP 3277 Your Ref No.: 7464
Job No.: 616672.000
Test pit/Bh No.: MH25 Sample No.: -- Depth: 2.83 -- 2.96 (m)
Test method used: BS1377:Part 8:1990:Clause 5 Saturation BS1377:Part 8:1990:Clause 6 Consolidation
BS1377:Part 8:1990:Clause 7 Consolidated-undrained triaxial compression test with pore pressure measurement

CONSOLIDATED-UNDRAINED TRIAXIAL COMPRESSION TEST (3 STAGES)

MOHR CIRCLES OF TOTAL AND EFFECTIVE STRESSES



Initial Sample Height:	127.01	mm	Initial Water Content:	40.9	%
Initial Sample Diameter:	59.97	mm	Initial Bulk Density:	1.81	t/m³
Initial B Value:	62	%	Initial Dry Density:	1.28	t/m³
B Value before Consolidation:	96	%	Final Water Content:	39.8	%

	Consolidation Stage			Failure Values				
	Cell Pressure (kPa)	Back Pressure (kPa)	Eff. Consol. Stress (kPa)	Deviator Stress (kPa)	Pore Pressure Change During Shearing δμ(kPa)	Effective Principal Stress (kPa) Major σ1'	Effective Principal Stress (kPa) Minor σ3'	Vertical Strain (%)
STAGE 1	475	450	25	59.15	6.3	77.85	18.70	2.38
STAGE 2	500	450	50	94.75	18.3	126.45	31.70	2.11
STAGE 3	550	450	100	150.28	43	207.28	57.00	2.96

		Total			Effective	
Angle of Frictional Resistance:	ϕ =	22	°	ϕ′ =	33	°
Cohesion:	c =	11	kPa	c' =	5	kPa
Linear Regression Coefficient:	r =	0.998		r =	0.999	

Sample History: Undisturbed core trimmed at natural water content.

Soil description: SILT, sandy, with minor clay, soft to firm, light brown with orange brown, dark brown and black.

Failure Mode: Planar / Plastic **Test Speed:** 0.026 (mm/min)

Test Remarks: The sample was saturated by increments of cell pressure and back pressure.
Failure for each stage was determined by the maximum effective stress ratio. Strength parameters have been derived by using a linear regression fitting method.

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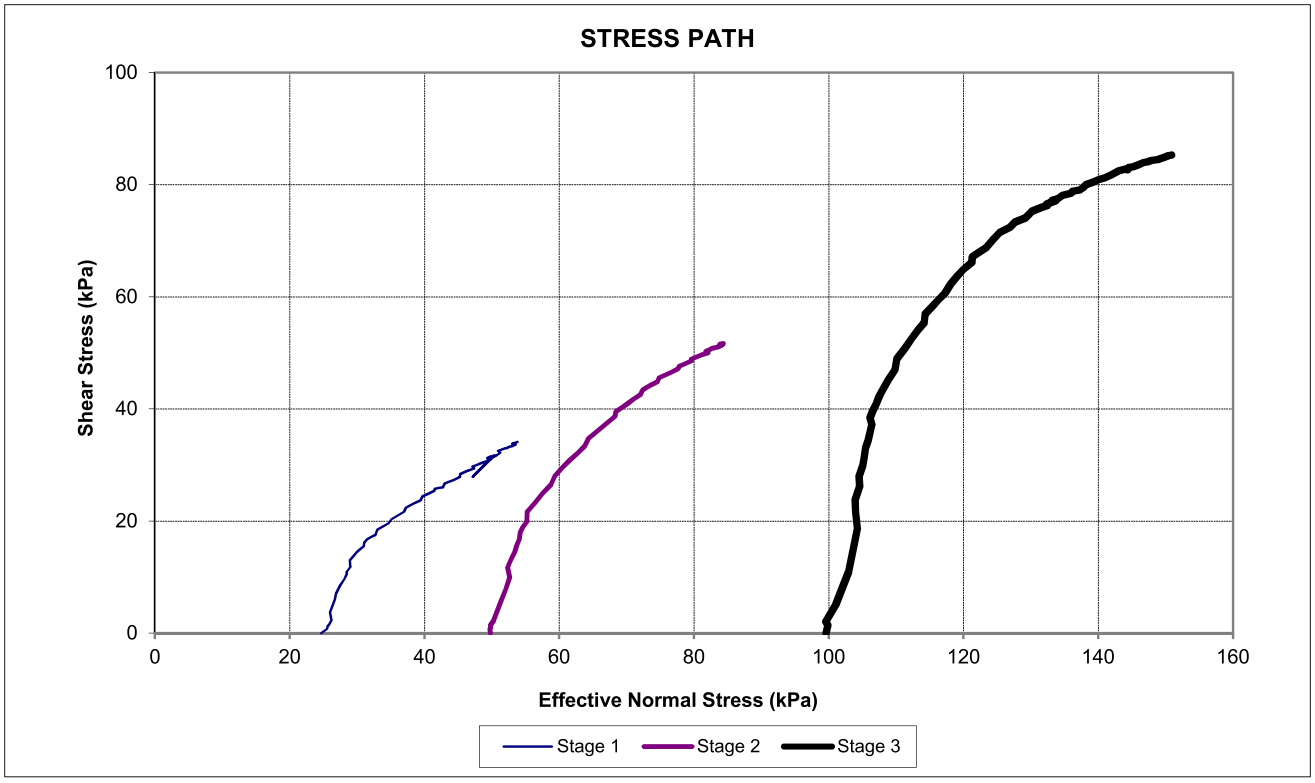
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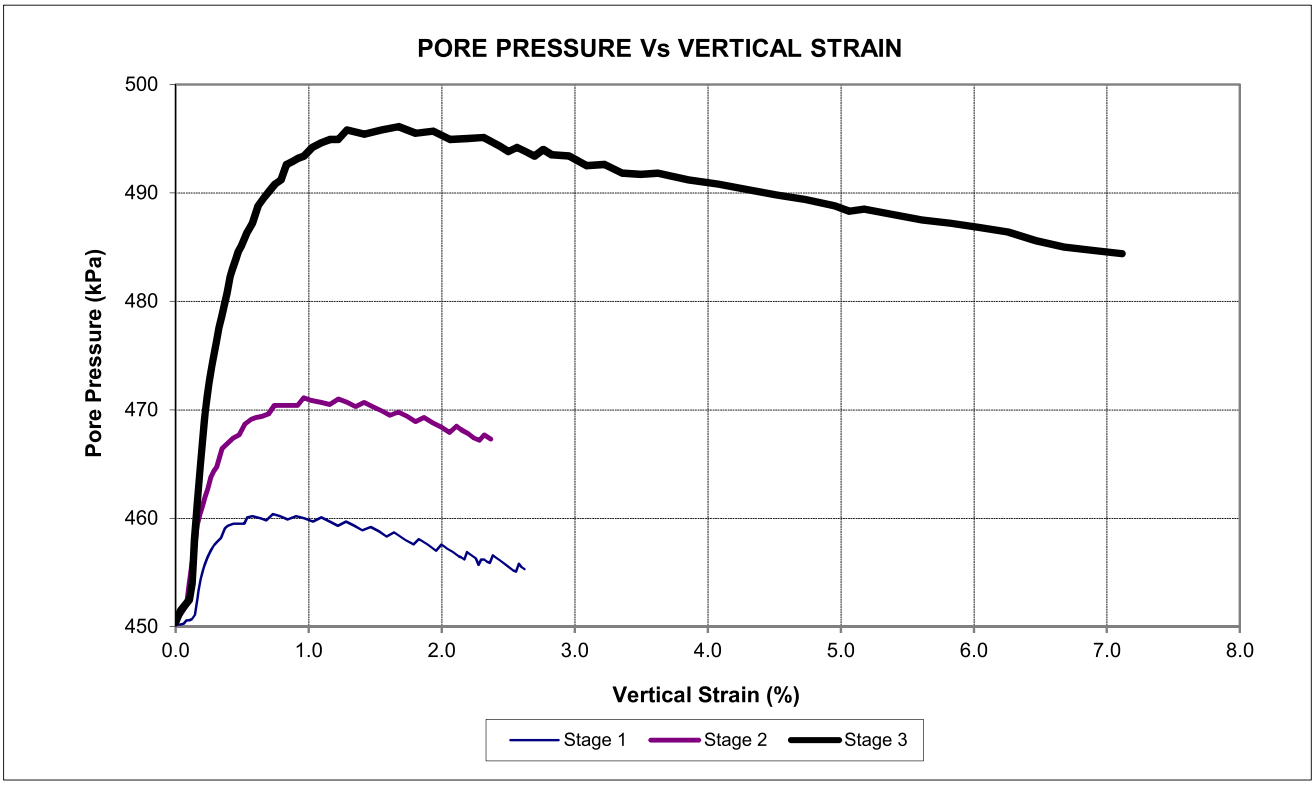
Plate No.:

Site: Lot 1 DP 310813 & Lot Your Ref No.: 7464 Job No.: 616672.000

Test pit/Bh No.: MH25 Sample No.: -- Depth: 2.83 -- 2.96 (m)

GRAPHS





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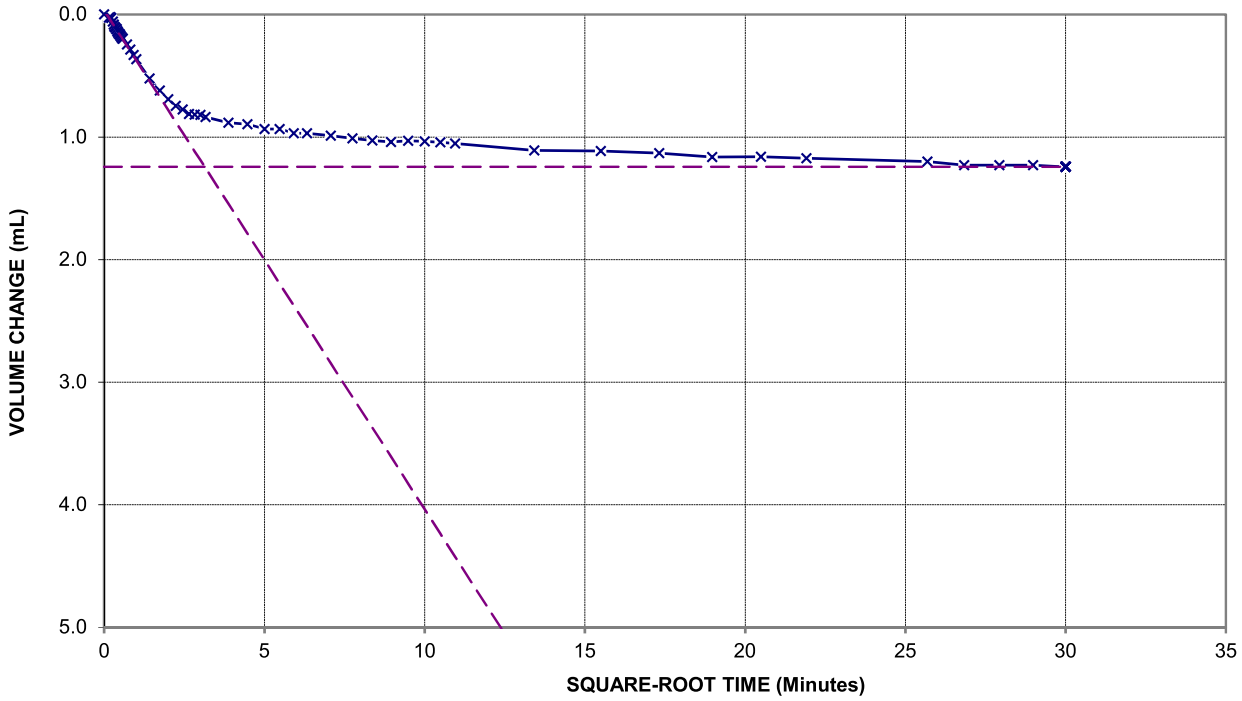
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Site: Lot 1 DP 310813 & Lot Your Ref No.: 7464 Job No.: 616672.000

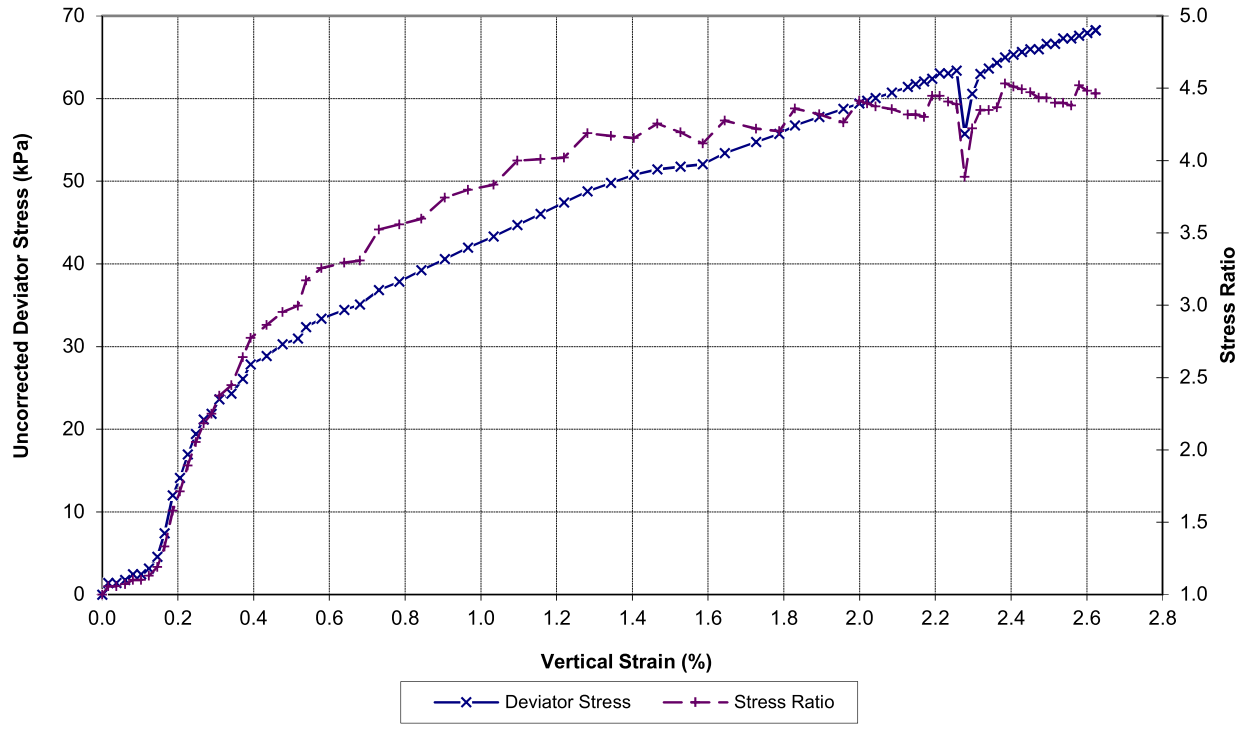
Test pit/Bh No.: MH25 Sample No.: -- Depth: 2.83 -- 2.96 (m)

STAGE 1 GRAPHS

CONSOLIDATION



STRESS-STRAIN CURVE



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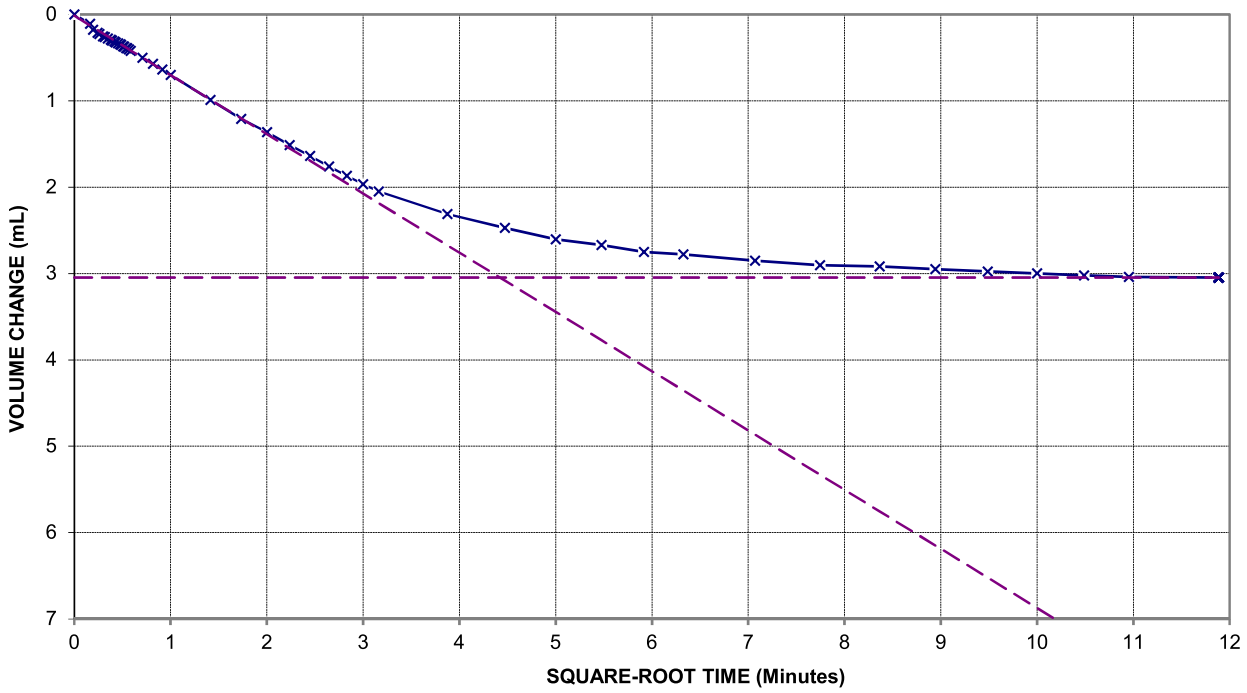
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Site: Lot 1 DP 310813 & Lot Your Ref No.: 7464 Job No.: 616672.000

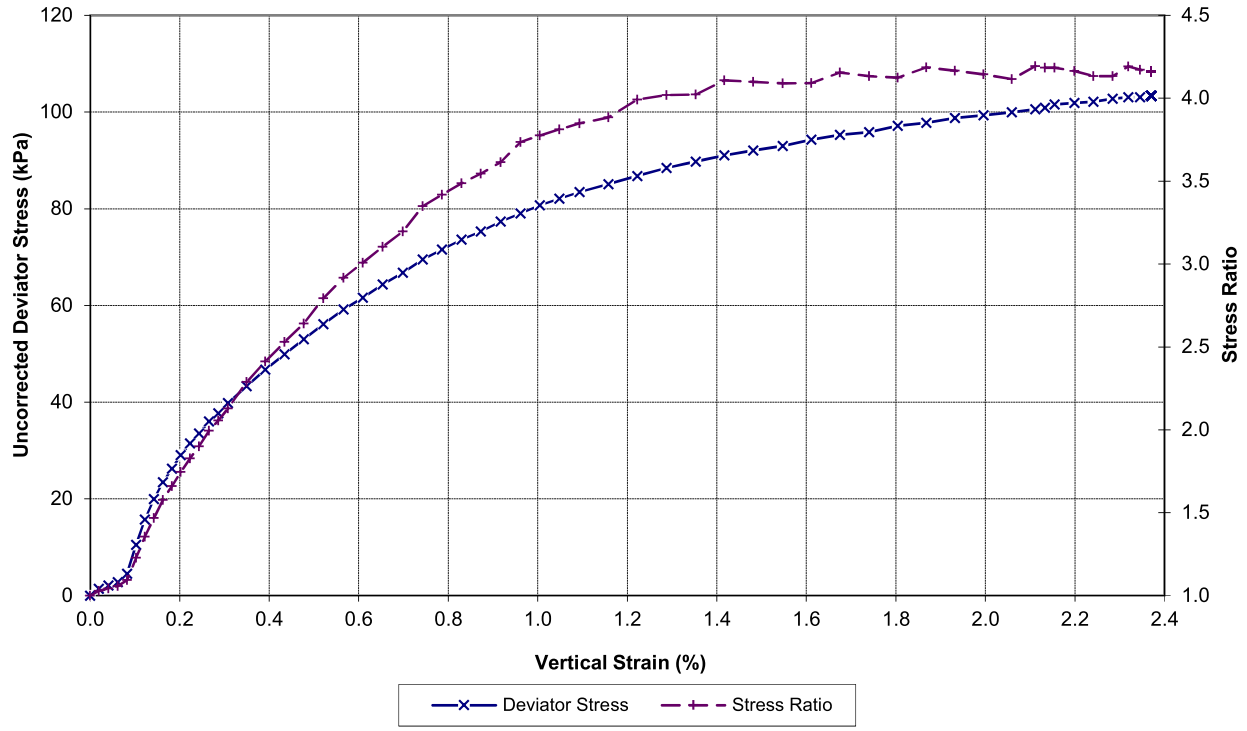
Test pit/Bh No.: MH25 Sample No.: -- Depth: 2.83 -- 2.96 (m)

STAGE 2 GRAPHS

CONSOLIDATION



STRESS-STRAIN CURVE



Entered by: Date: 31/07/15 Checked by: KMH Date: 4/08/15

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w. www.geotechnics.co.nz

Form No.:	TG1-3
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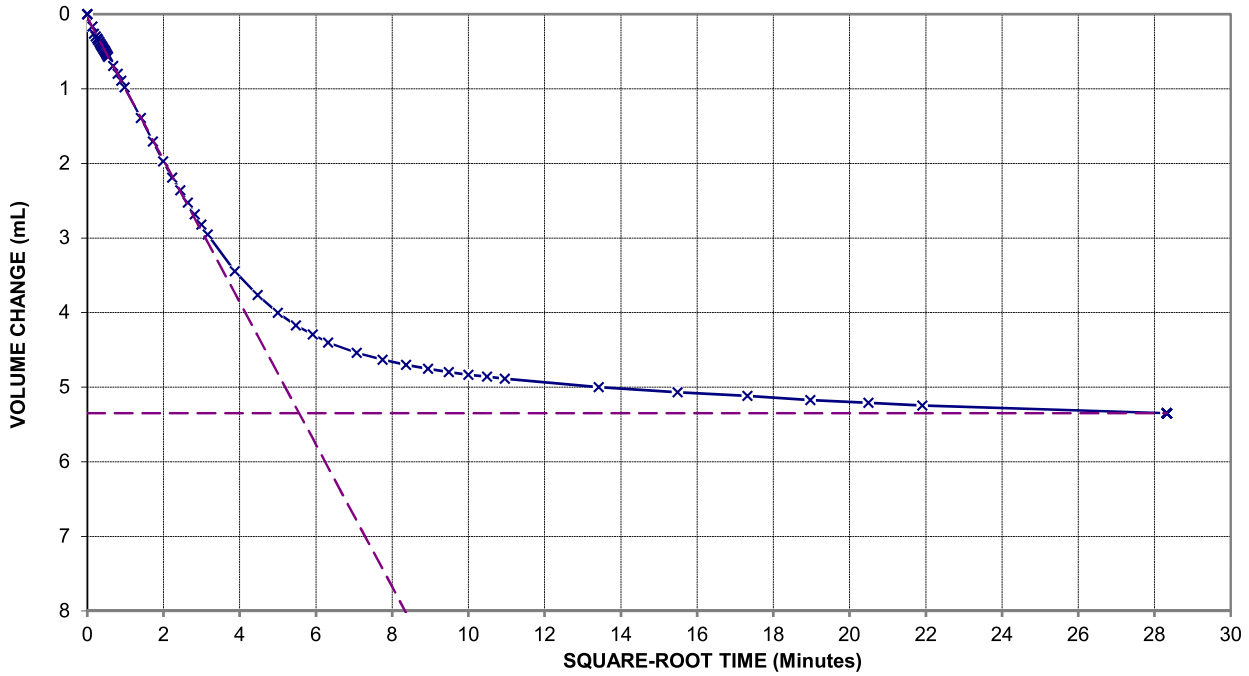
Plate No.:

Site: Lot 1 DP 310813 & Lot Your Ref No.: 7464 Job No.: 616672.000

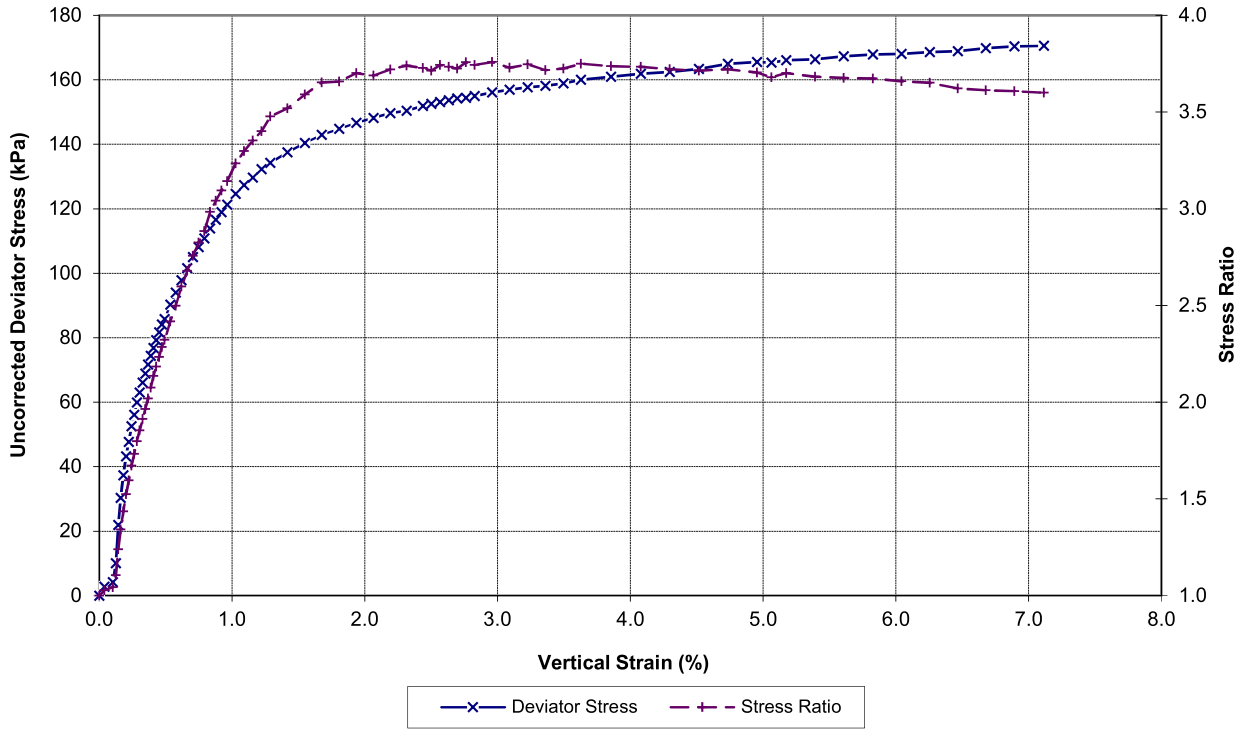
Test pit/Bh No.: MH25 Sample No.: -- Depth: 2.83 -- 2.96 (m)

STAGE 3 GRAPHS

CONSOLIDATION



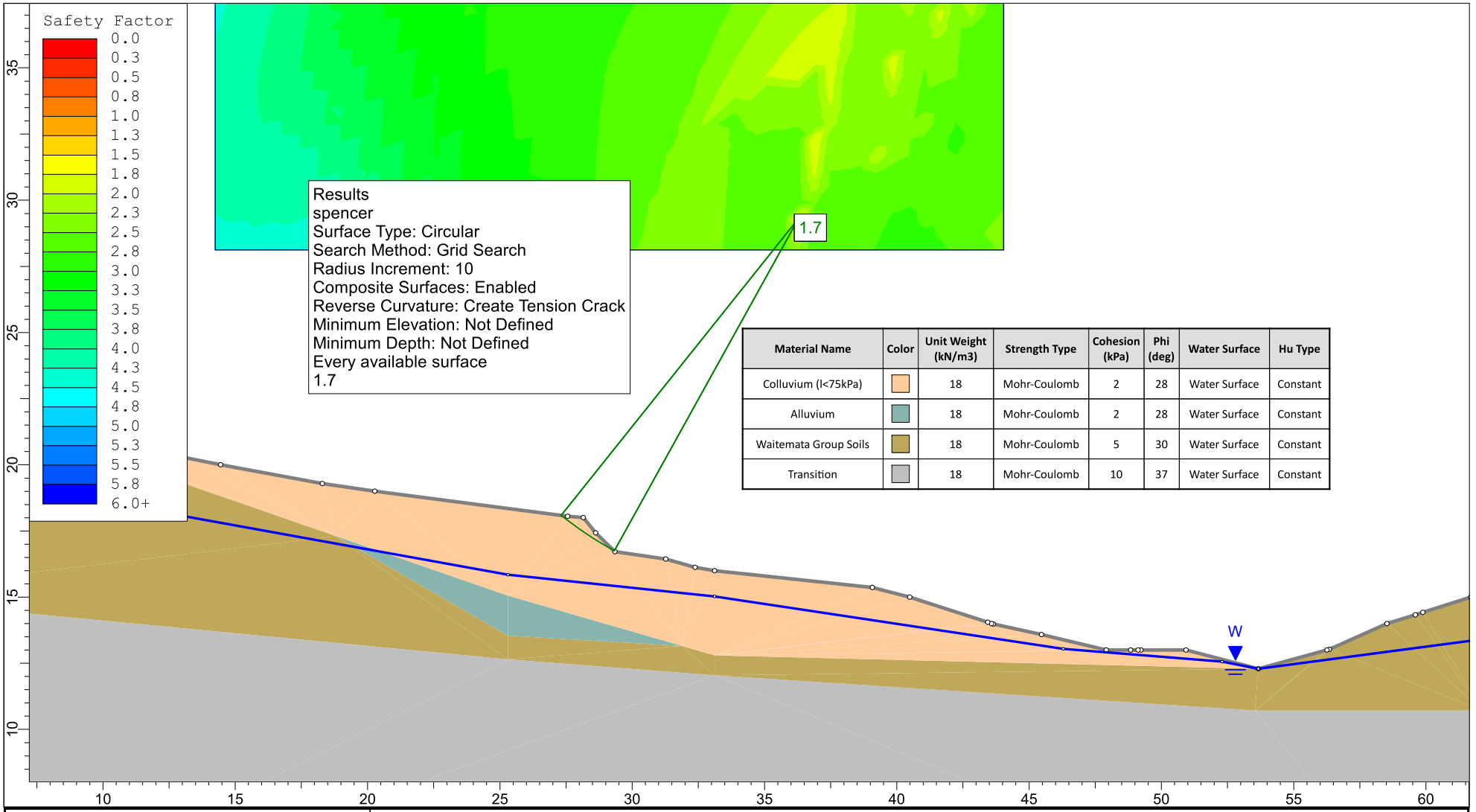
STRESS-STRAIN CURVE



Entered by: Date: 31/07/15 Checked by: KMH Date: 4/08/15

APPENDIX 4

Slope Stability Results



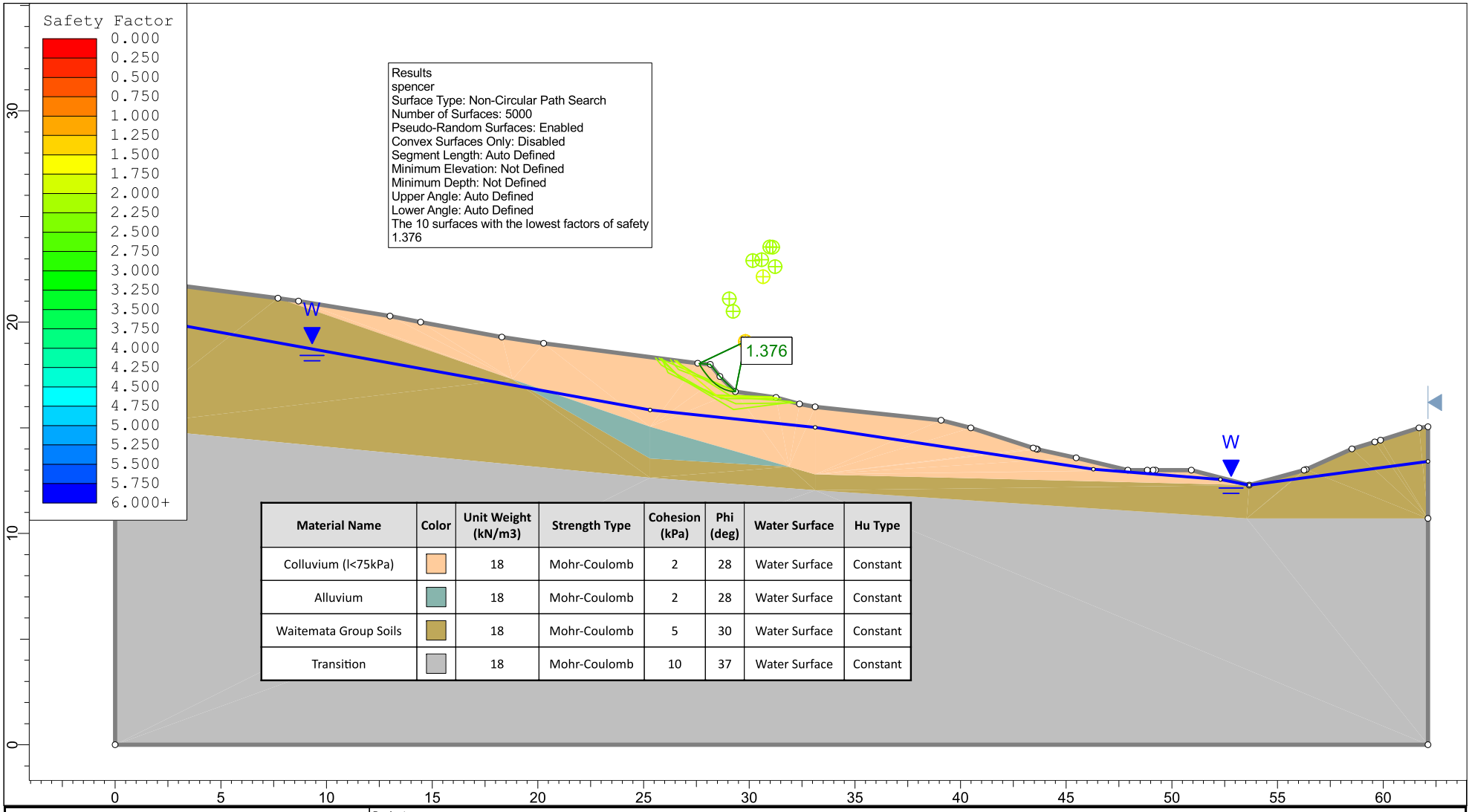
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section AA - Run 1				
Drawn By	PH	Scale	1:200	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1AA - Run 1.slim



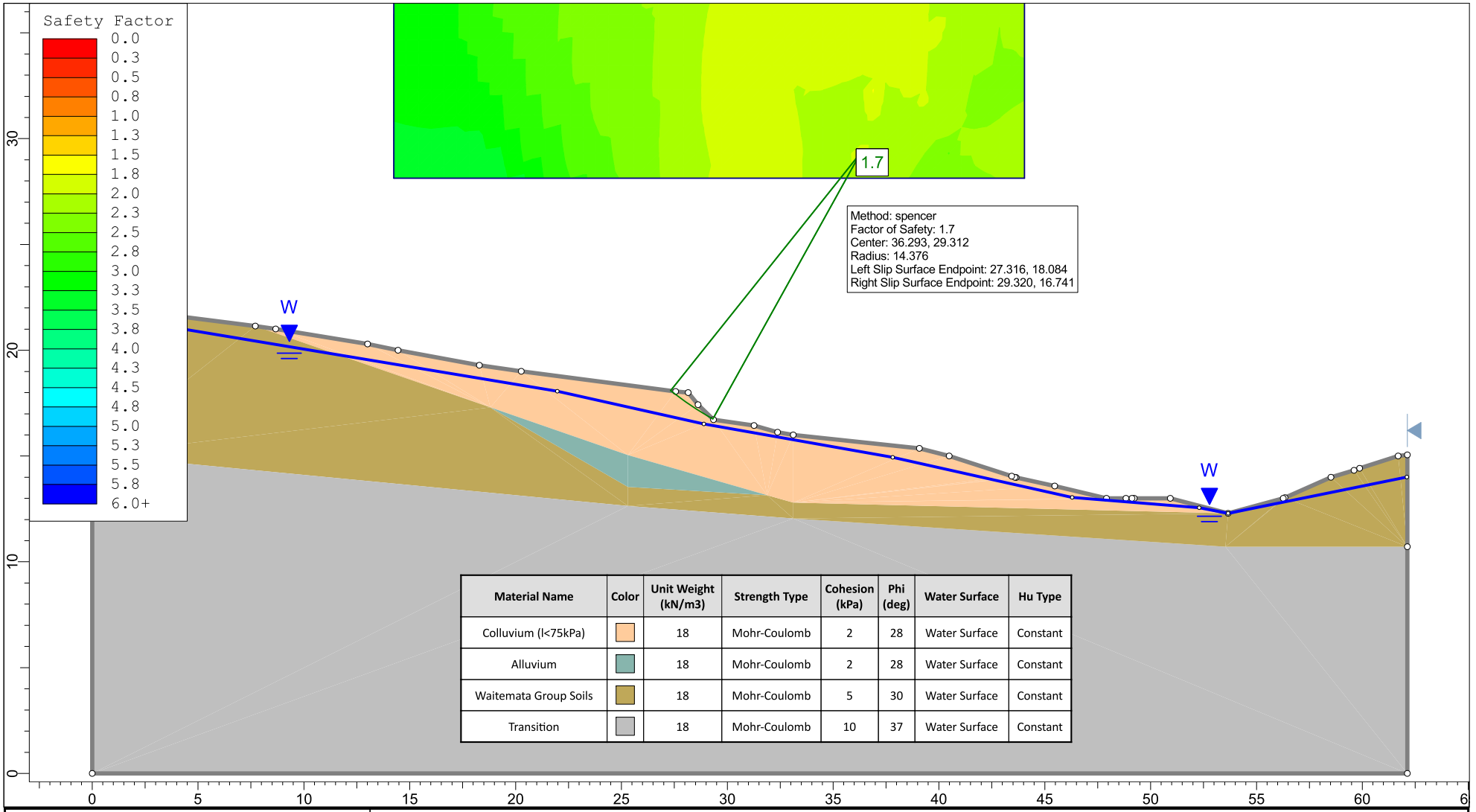
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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SLIDEINTERPRET 6.018

Project	Proposed Subdivision - Grand View Estate, Orewa			
Analysis Description	Stage 1, Section AA - Run 2			
Drawn By	PH	*Scale*	1:250	*Company* KGA Geotechnical
Date	31/08/2015			*File Name* 7464 - S1AA - Run 2.slim



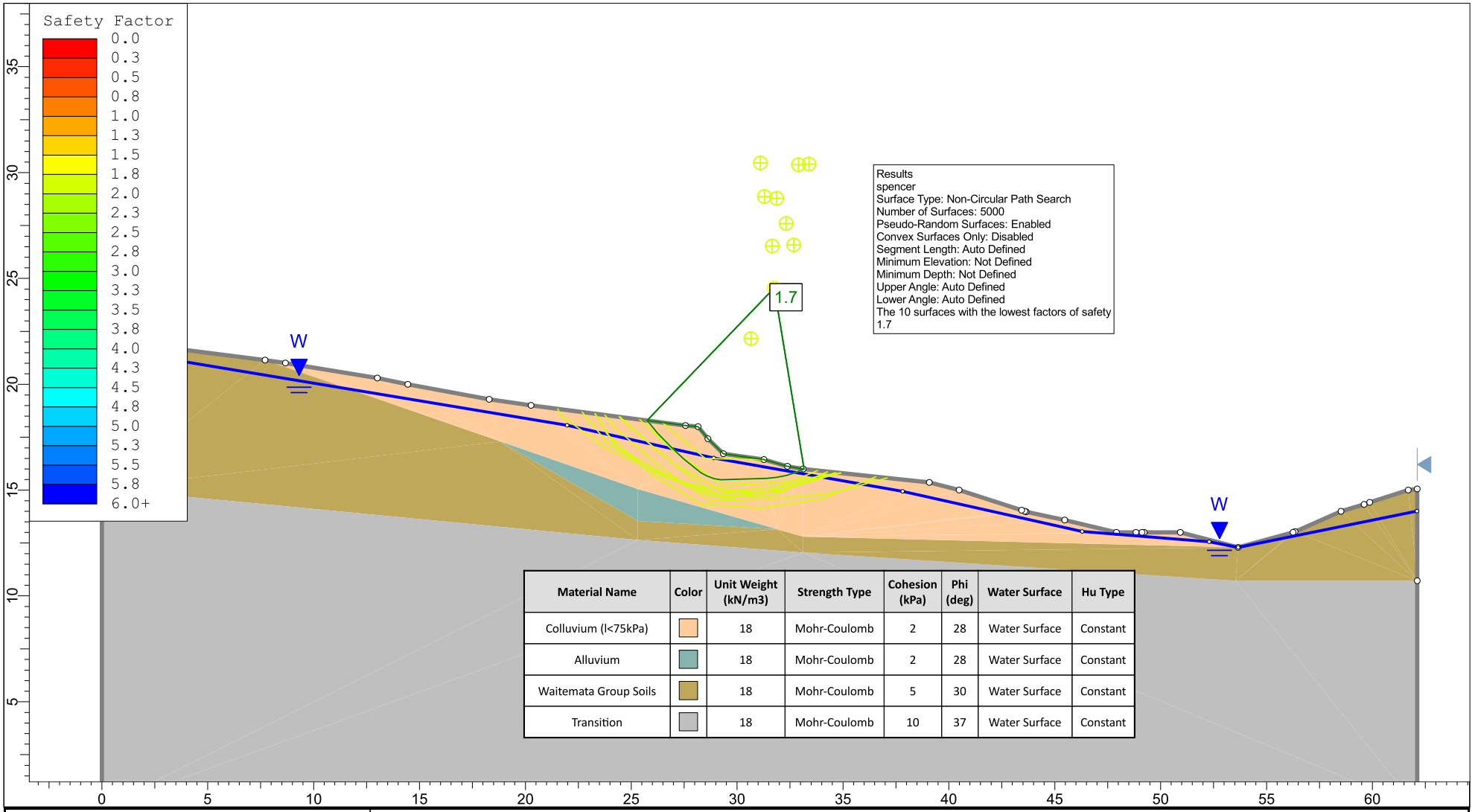
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section AA - Run 3				
Drawn By	PH	Scale	1:250	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1AA - Run 3.slim



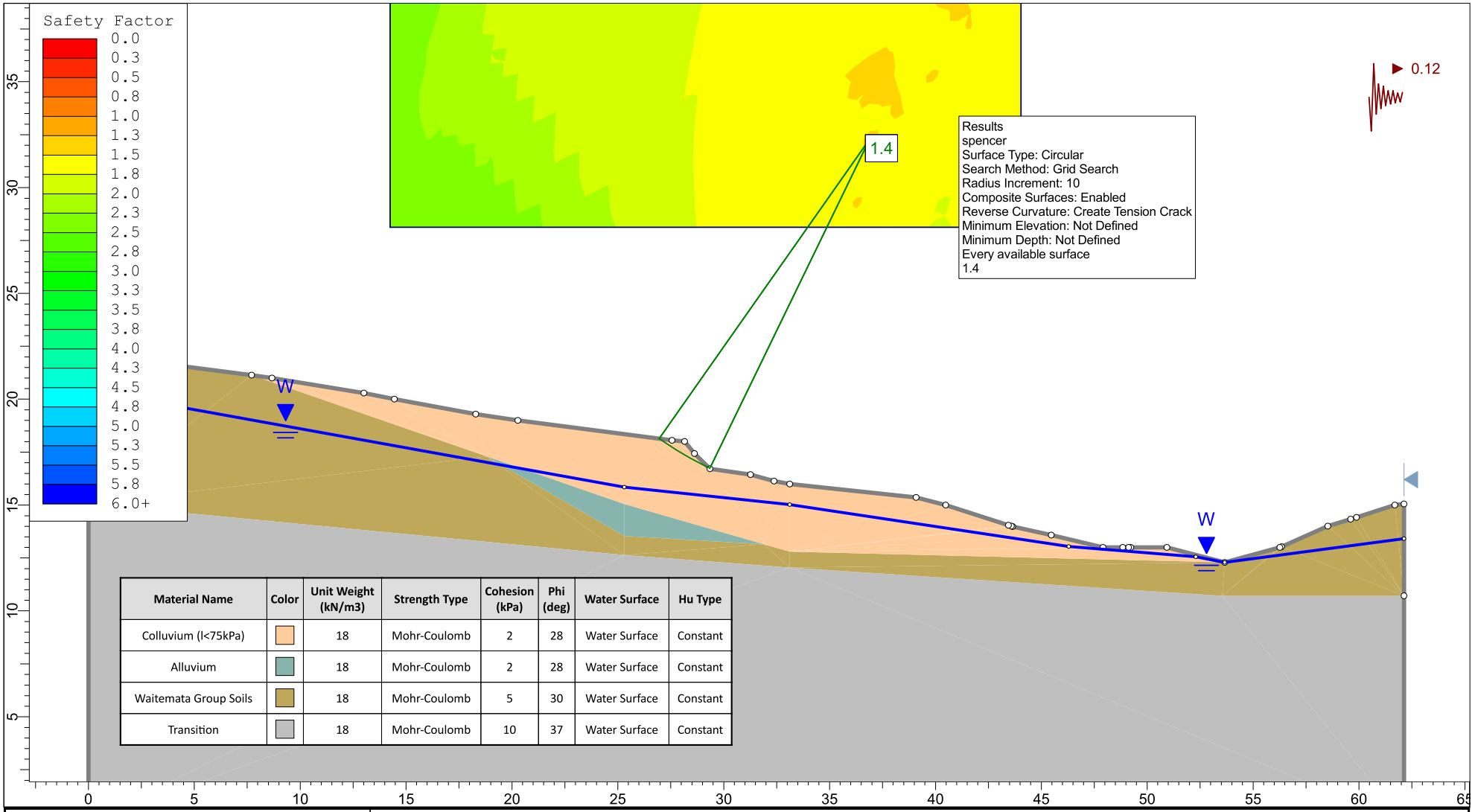
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section AA - Run 4				
Drawn By	PH	Scale	1:250	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1AA - Run 4.slim



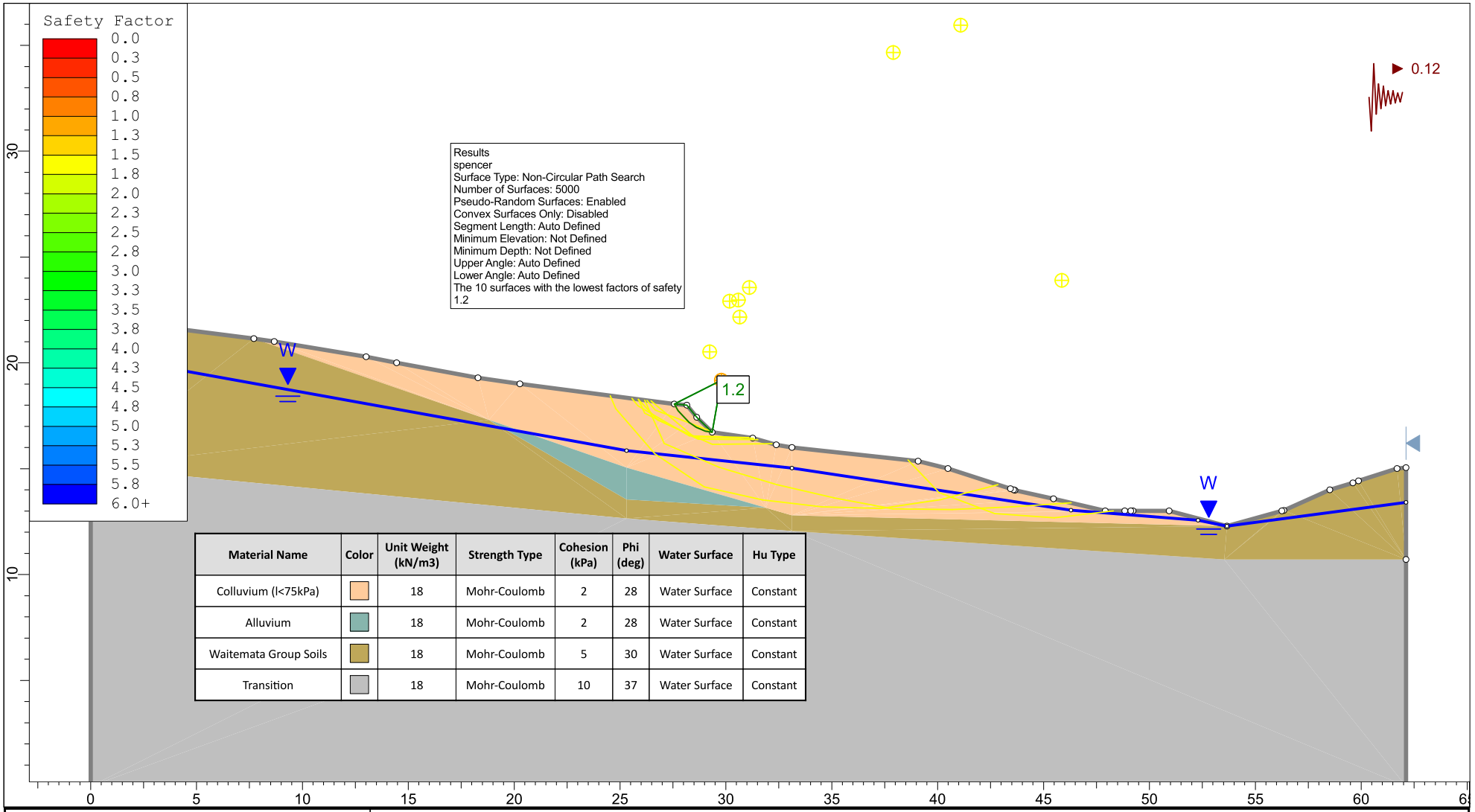
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 1, Section AA - Run 5		
Drawn By	PH	Scale 1:250	Company KGA Geotechnical
Date	31/08/2015		File Name 7464 - S1AA - Run 5.slim



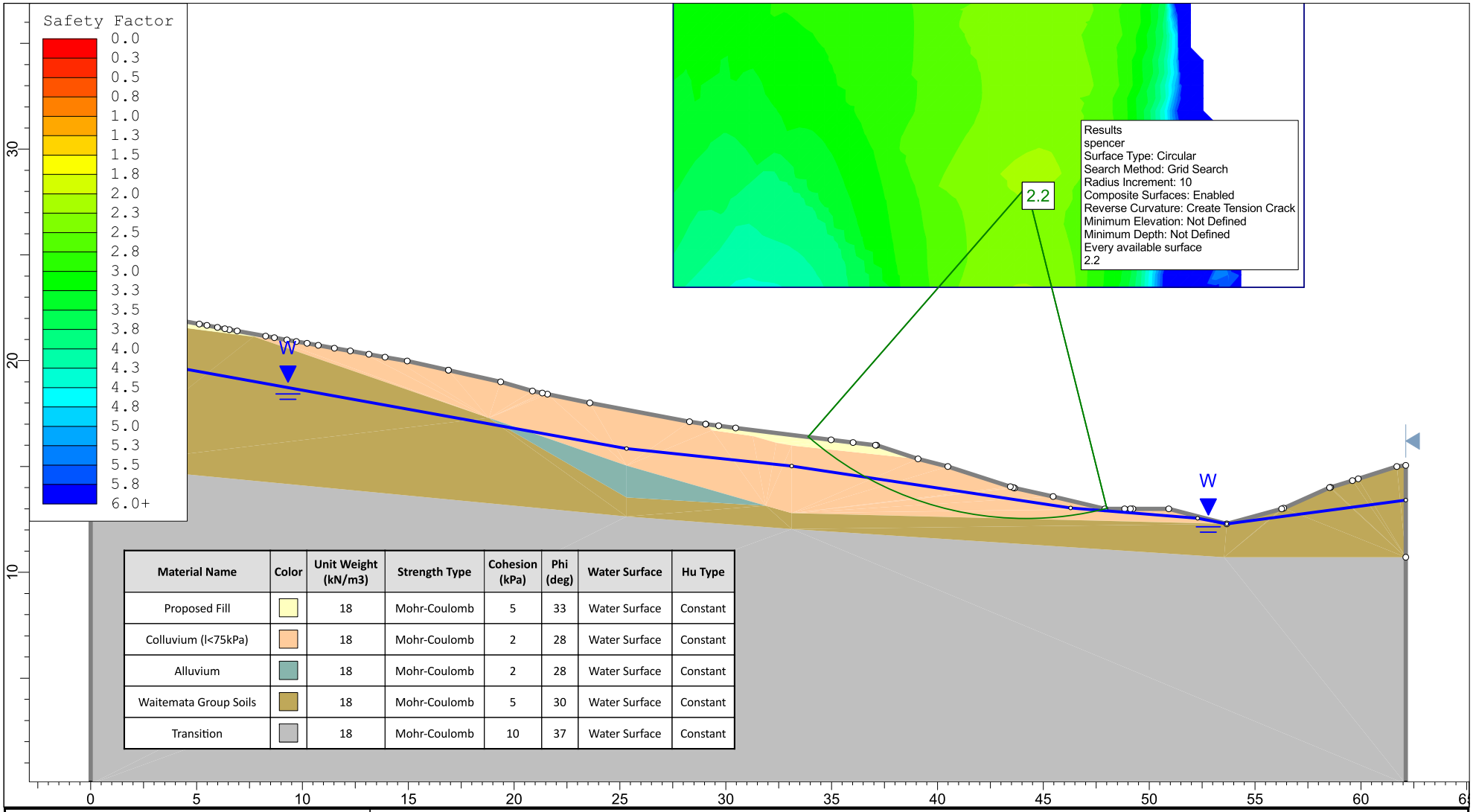
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section AA - Run 2				
Drawn By	PH	*Scale*	1:250	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S1AA - Run 6.slim



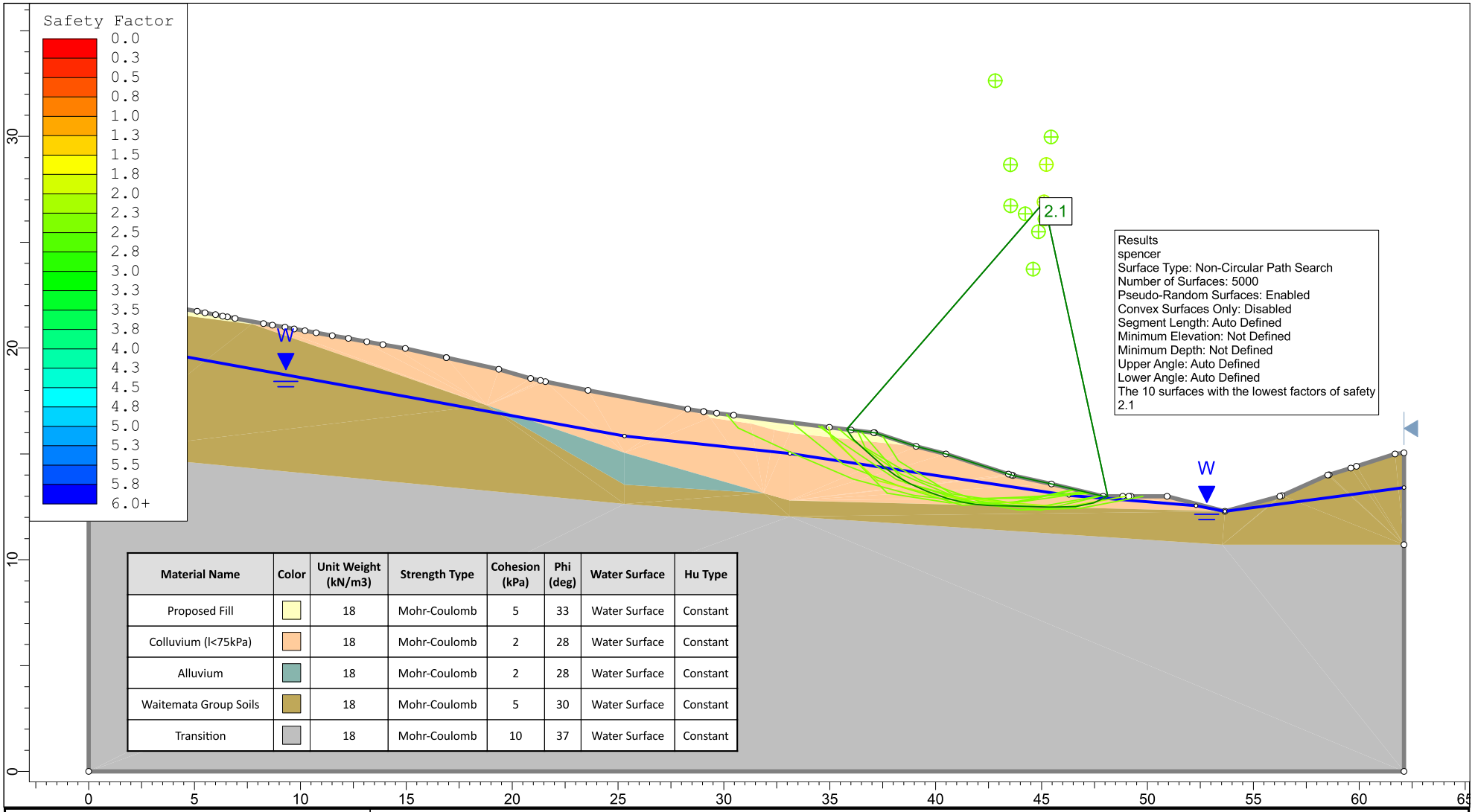
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section AA - Run 7				
Drawn By	PH	Scale	1:250	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1AA - Run 7.slim



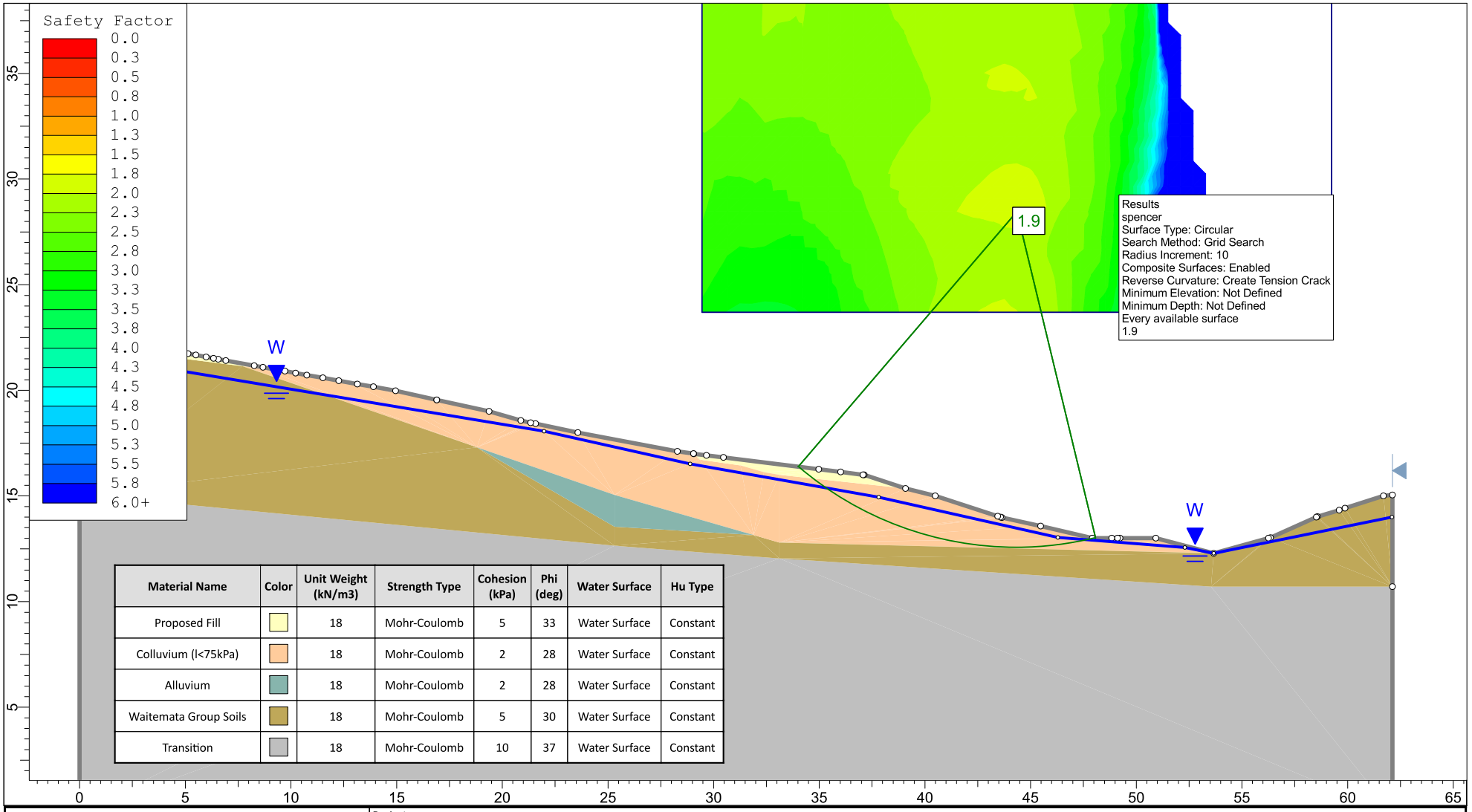
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 1, Section AA - Run 8		
Drawn By	PH	Scale	1:250
Company	KGA Geotechnical		
Date	31/08/2015	File Name	7464 - S1AA - Run 8.slim



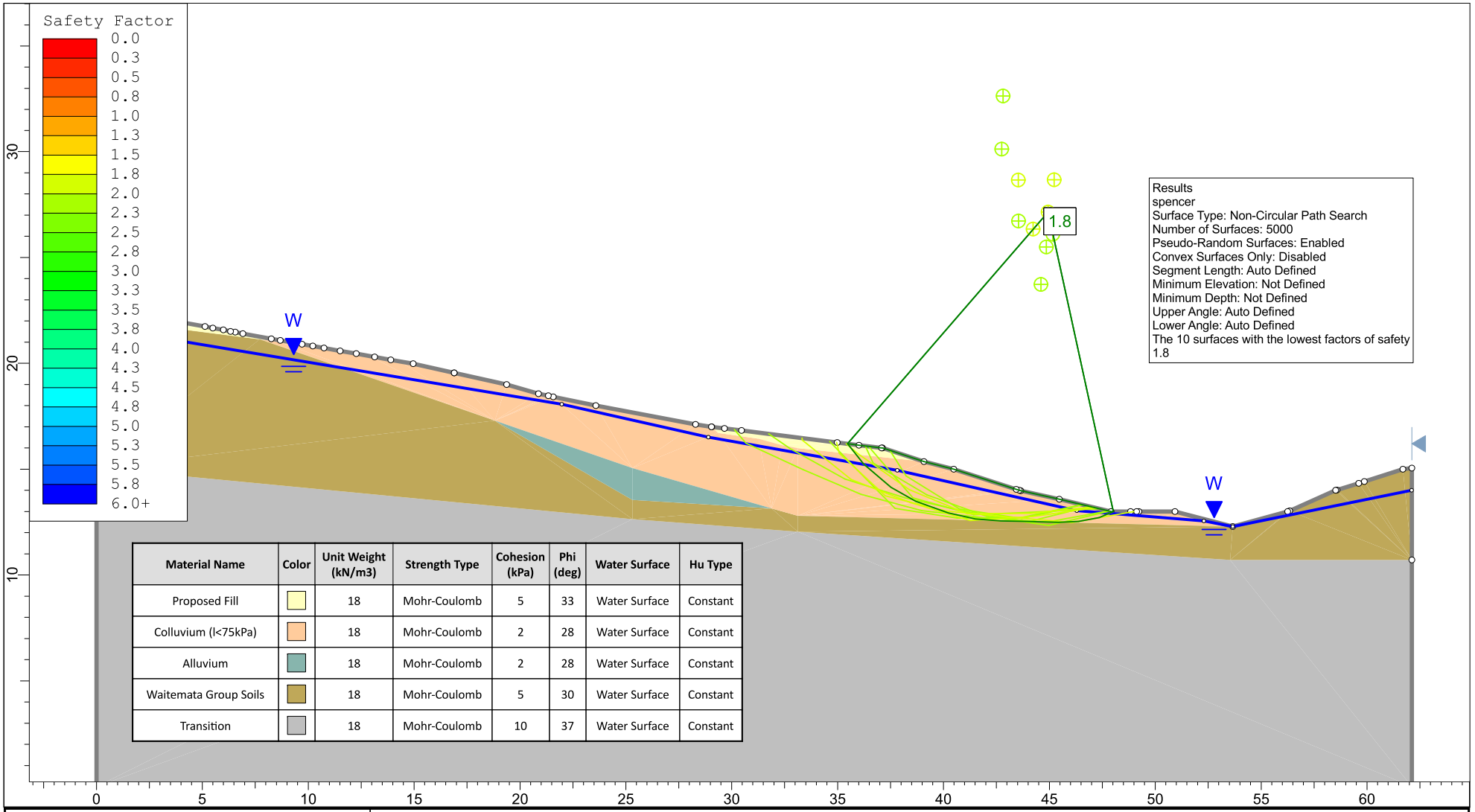
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section AA - Run 9				
Drawn By	PH	*Scale*	1:250	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S1AA - Run 9.slim



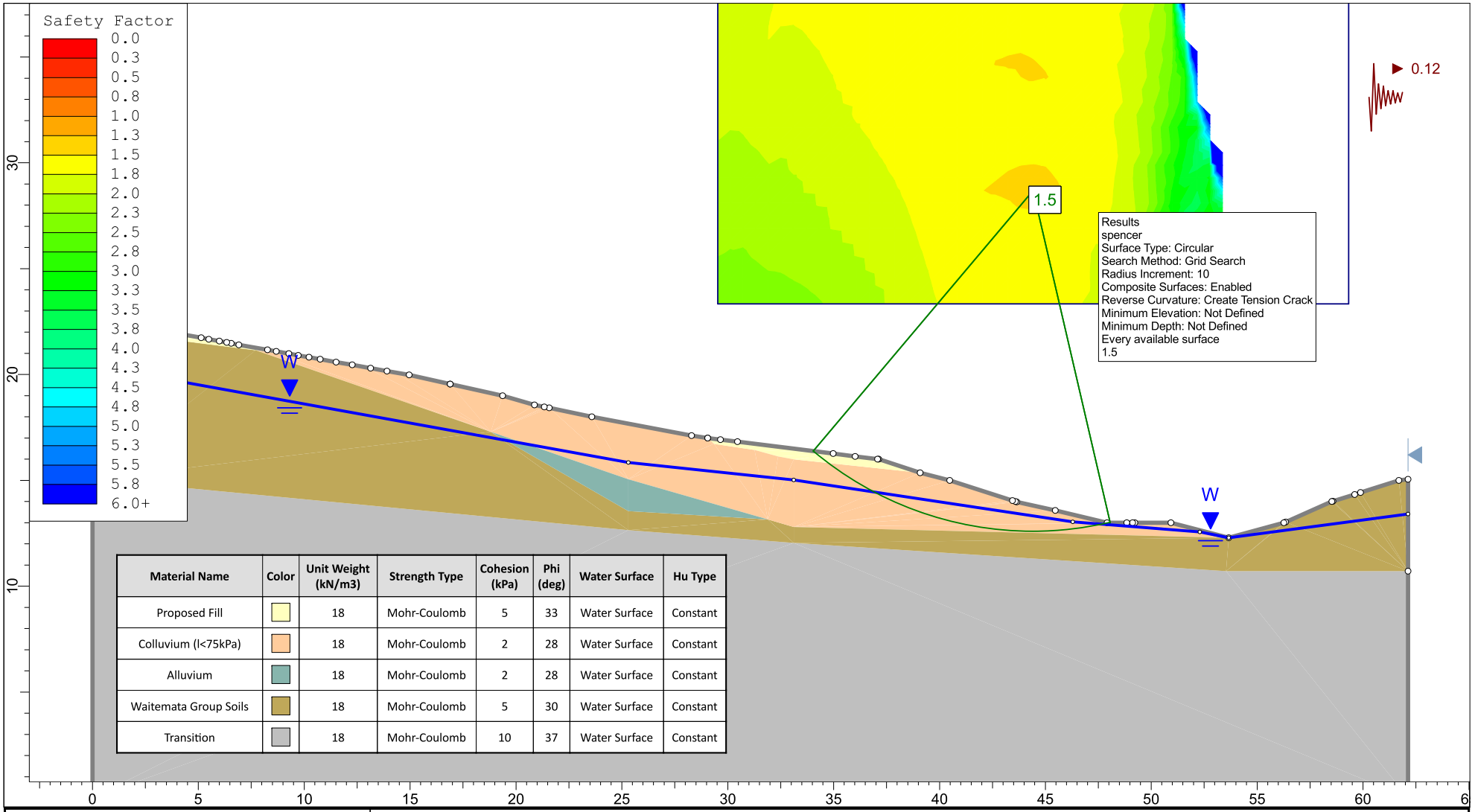
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section AA - Run 10				
Drawn By	PH	Scale	1:250	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1AA - Run 10.slim



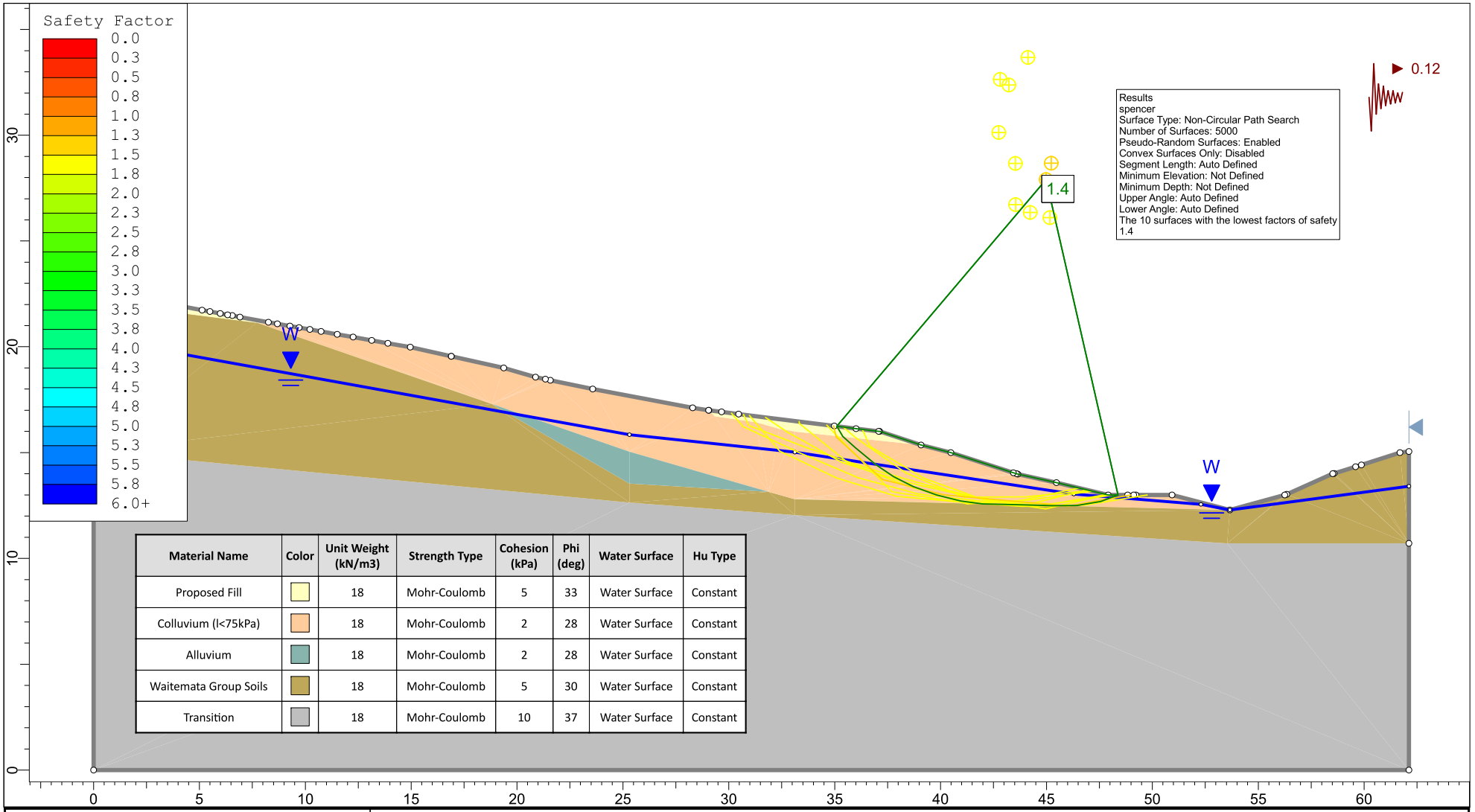
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 1, Section AA - Run 11		
Drawn By	PH	Scale	1:250
Company	KGA Geotechnical		
Date	31/08/2015	File Name	7464 - S1AA - Run 11.slim



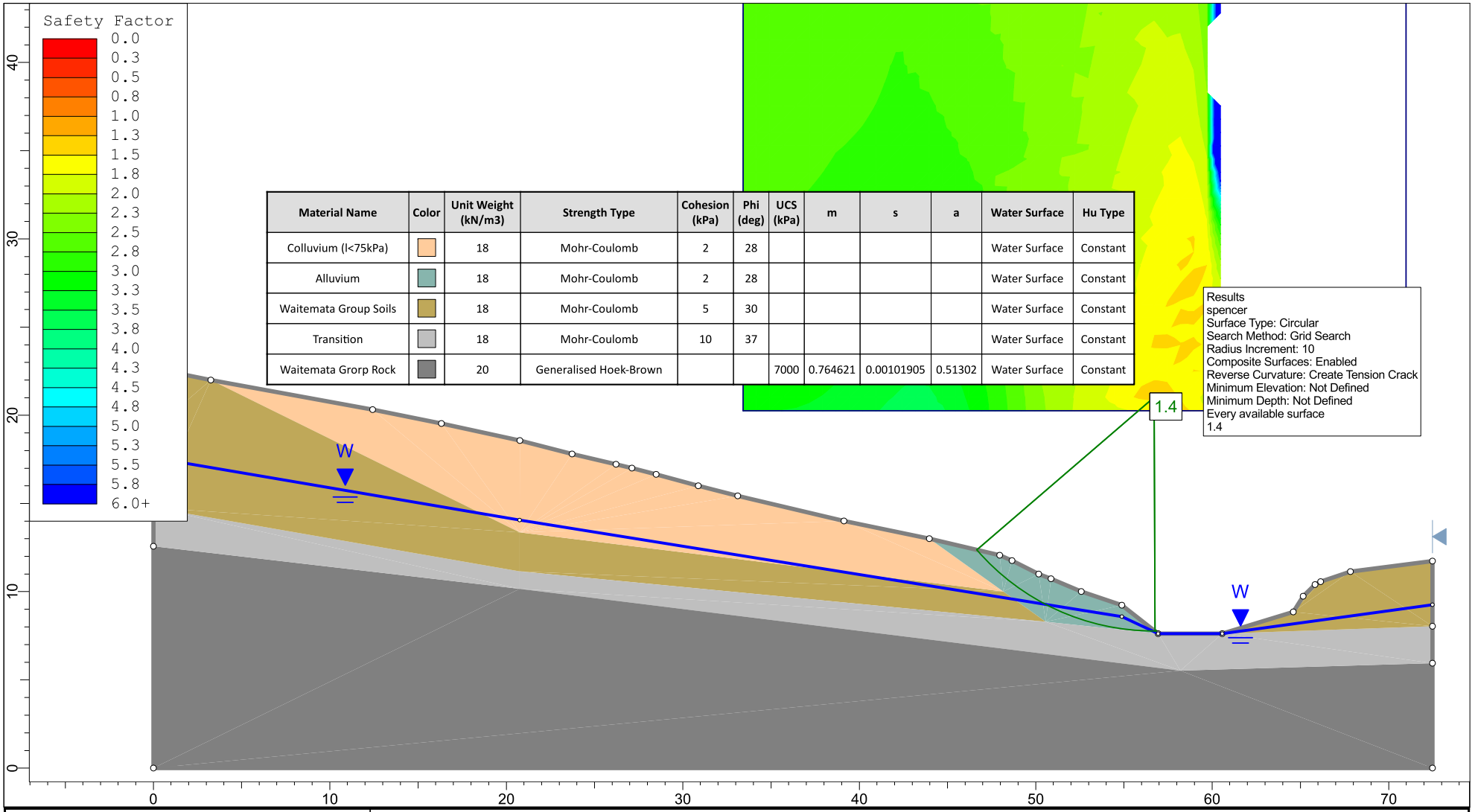
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 1, Section AA - Run 12		
Drawn By	PH	Scale	1:250
Company	KGA Geotechnical		
Date	31/08/2015	File Name	7464 - S1AA - Run 12.slim



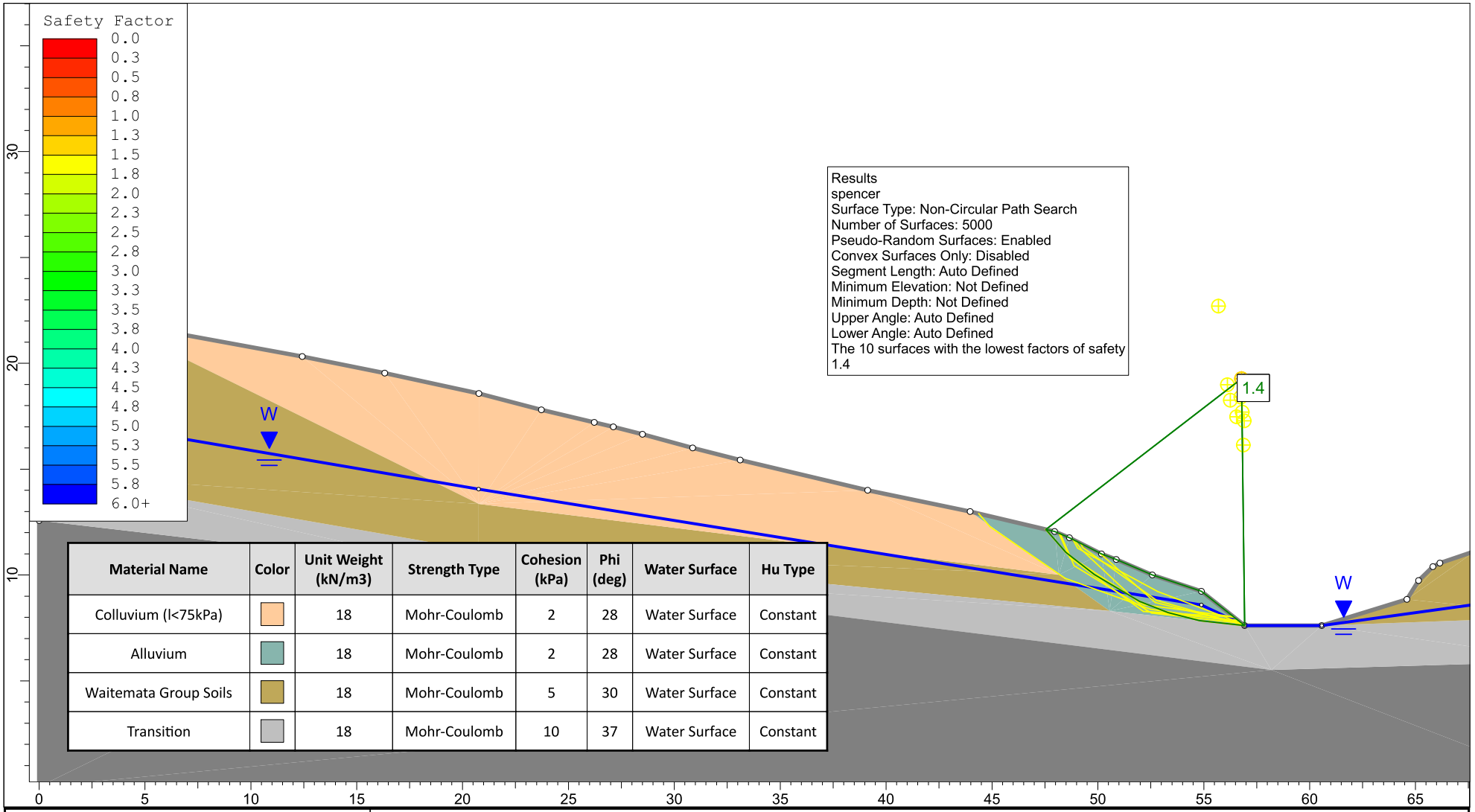
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	m	s	a	Water Surface	Hu Type
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28					Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28					Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30					Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37					Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	0.764621	0.00101905	0.51302	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section BB - Run 1				
Drawn By	PH	Scale	1:300	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1BB - Run 1.slim



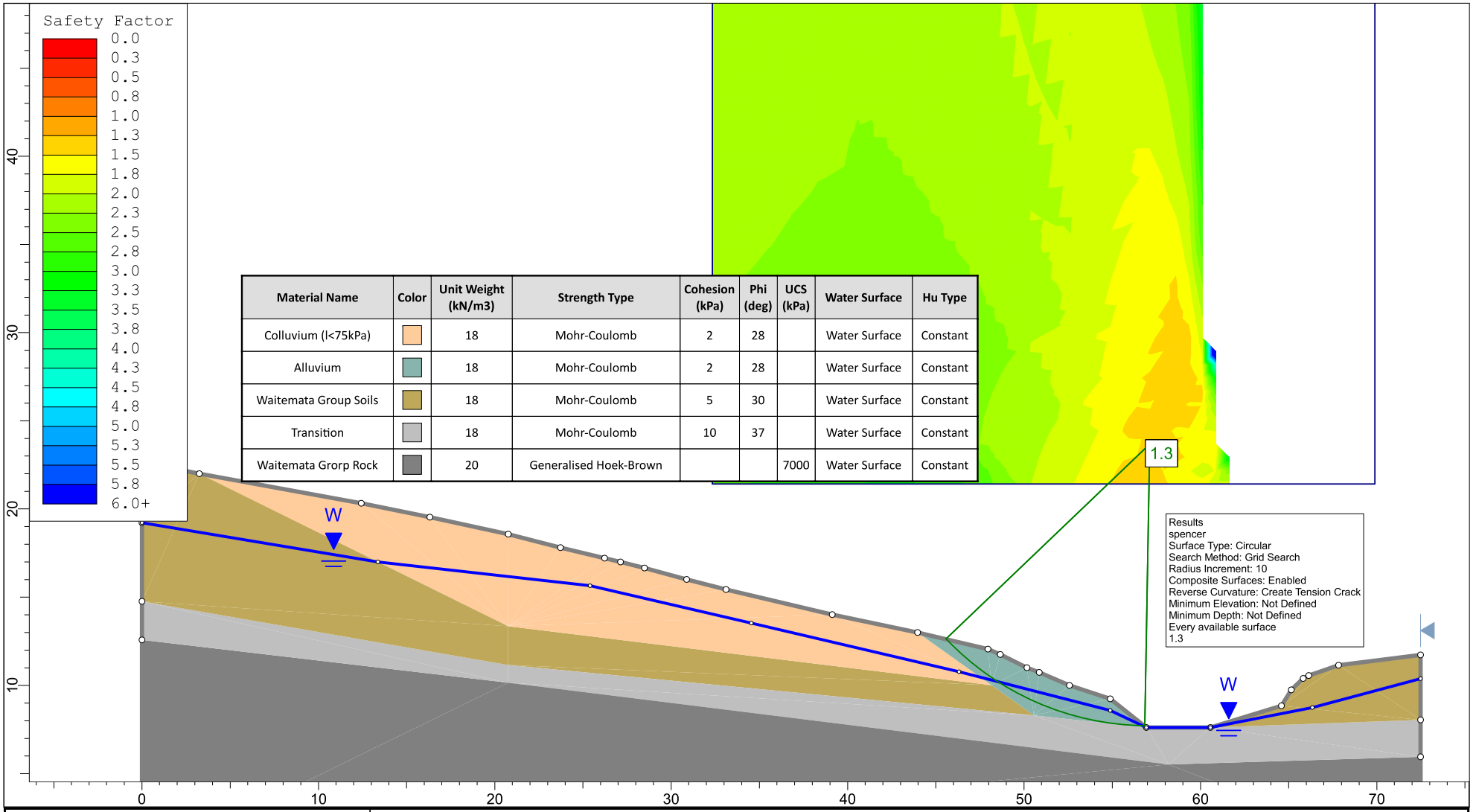
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section BB - Run 2				
Drawn By	PH	Scale	1:250	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1BB - Run 2.slim



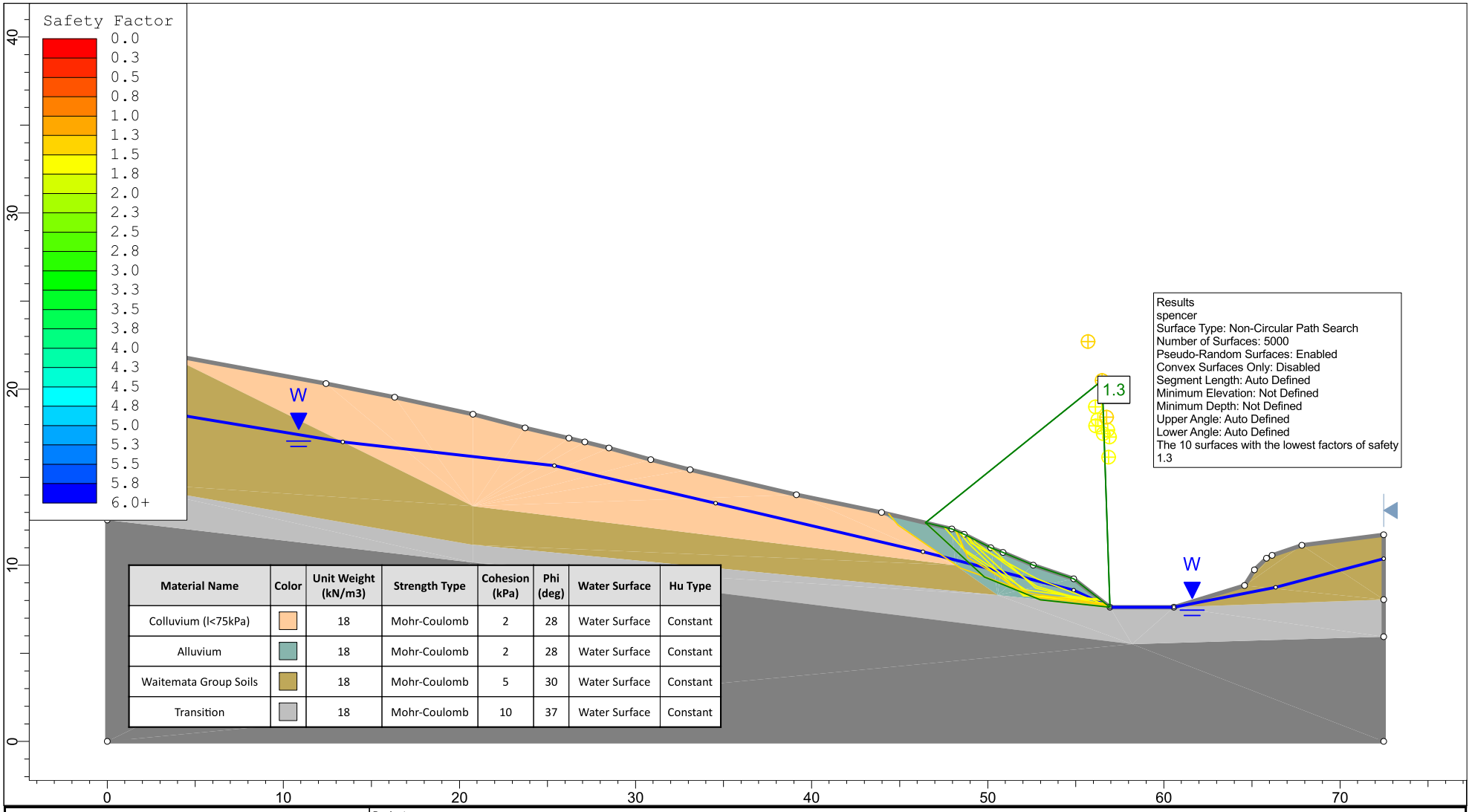
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 1, Section BB - Run 3		
Drawn By	PH	*Scale* 1:300	*Company* KGA Geotechnical
Date	31/08/2015		*File Name* 7464 - S1BB - Run 3.slim



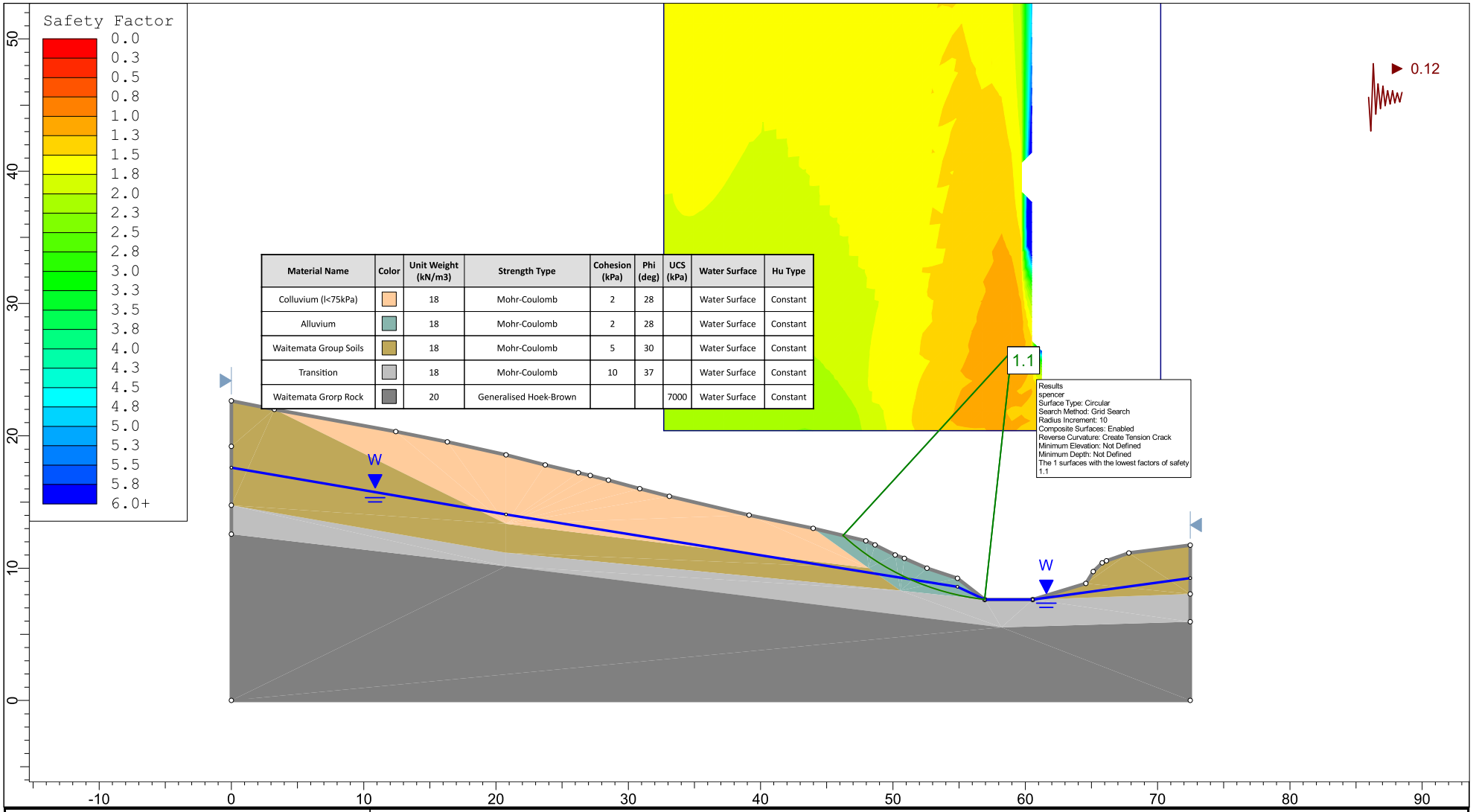
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 1, Section BB - Run 4		
Drawn By	PH	*Scale* 1:300	*Company* KGA Geotechnical
Date	31/08/2015		*File Name* 7464 - S1BB - Run 4.slim



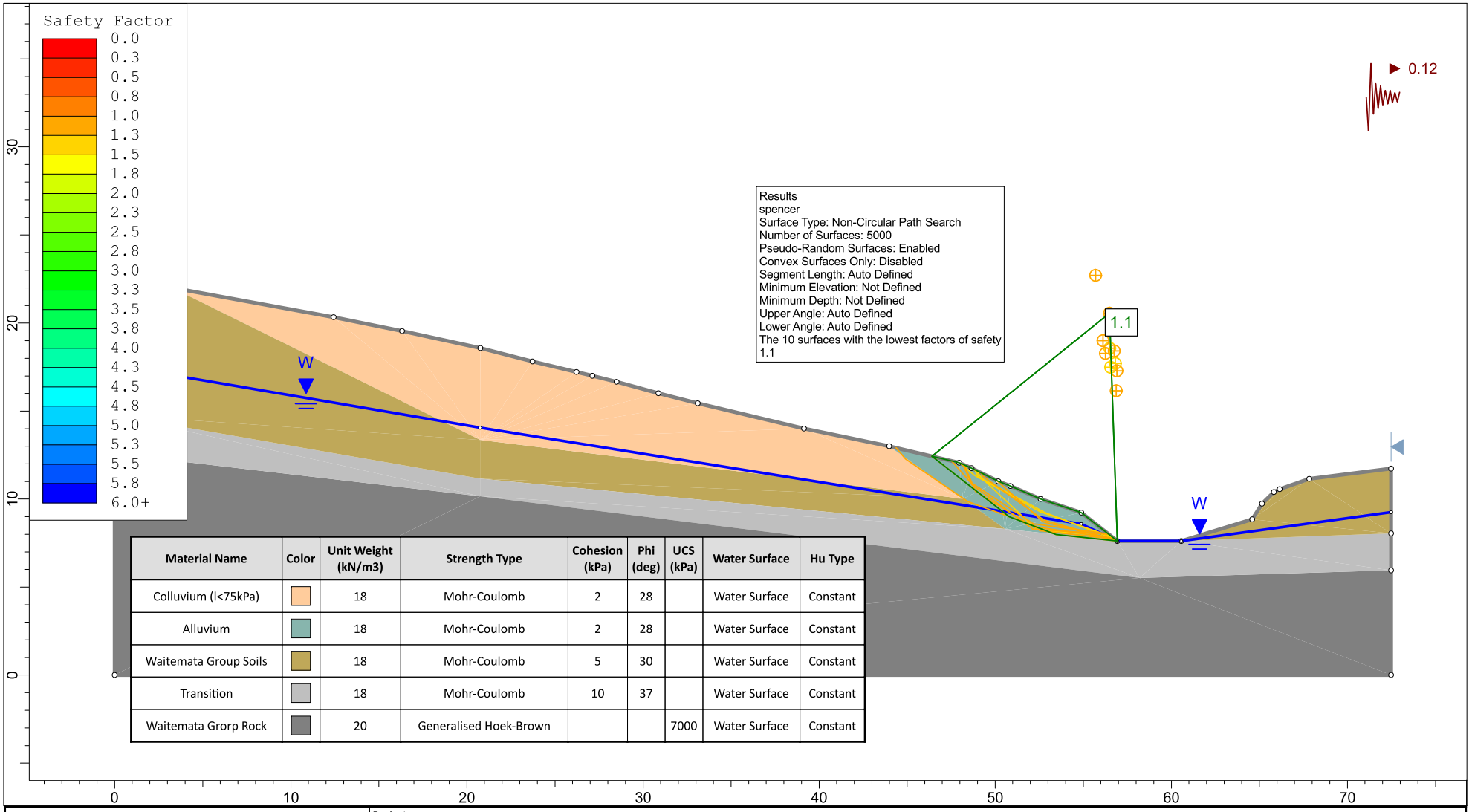
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section BB - Run 5				
Drawn By	PH	*Scale*	1:400	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S1BB - Run 5.slim



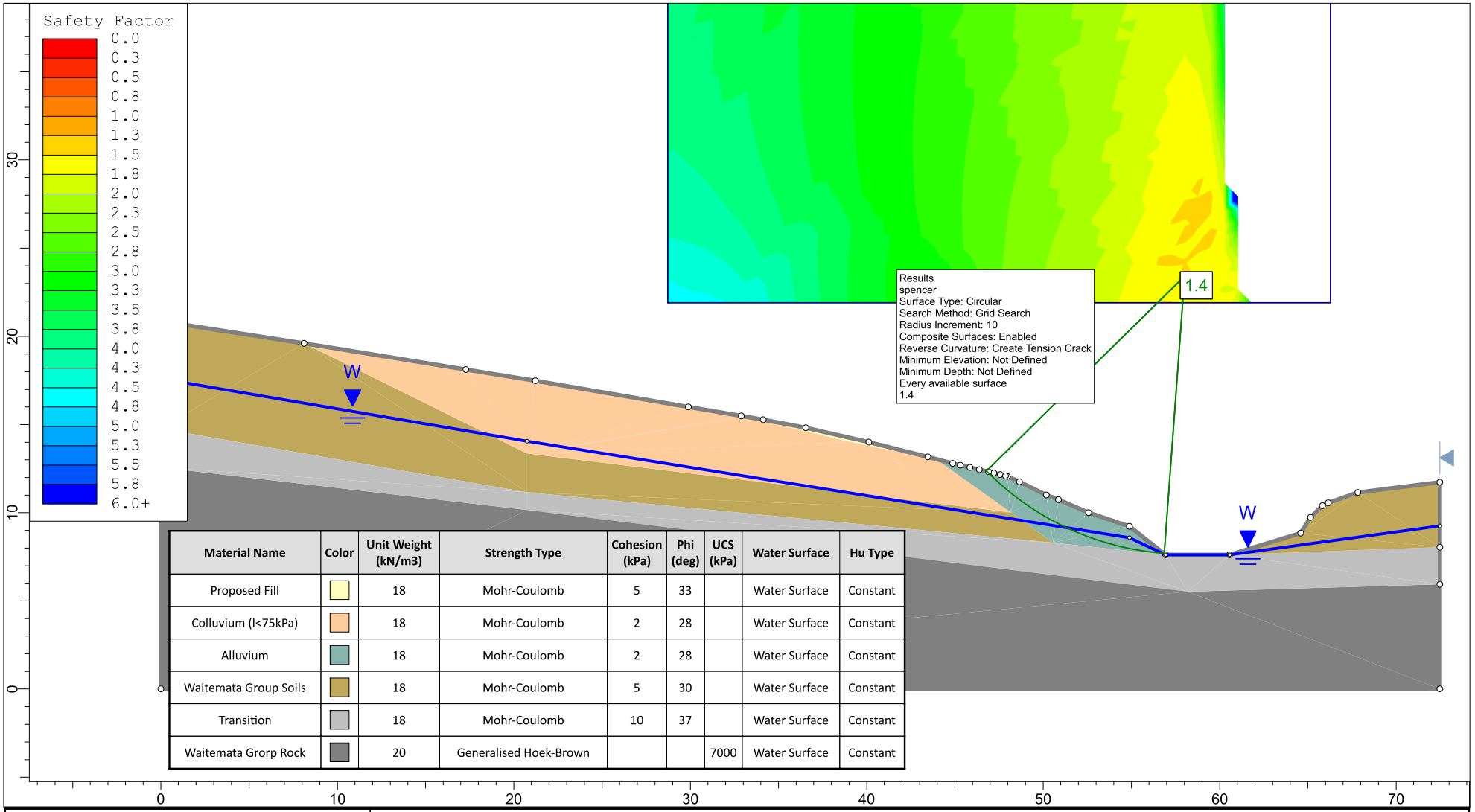
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 1, Section BB - Run 6		
Drawn By	PH	Scale	1:300
Company	KGA Geotechnical		
Date	31/08/2015	File Name	7464 - S1BB - Run 6.slim



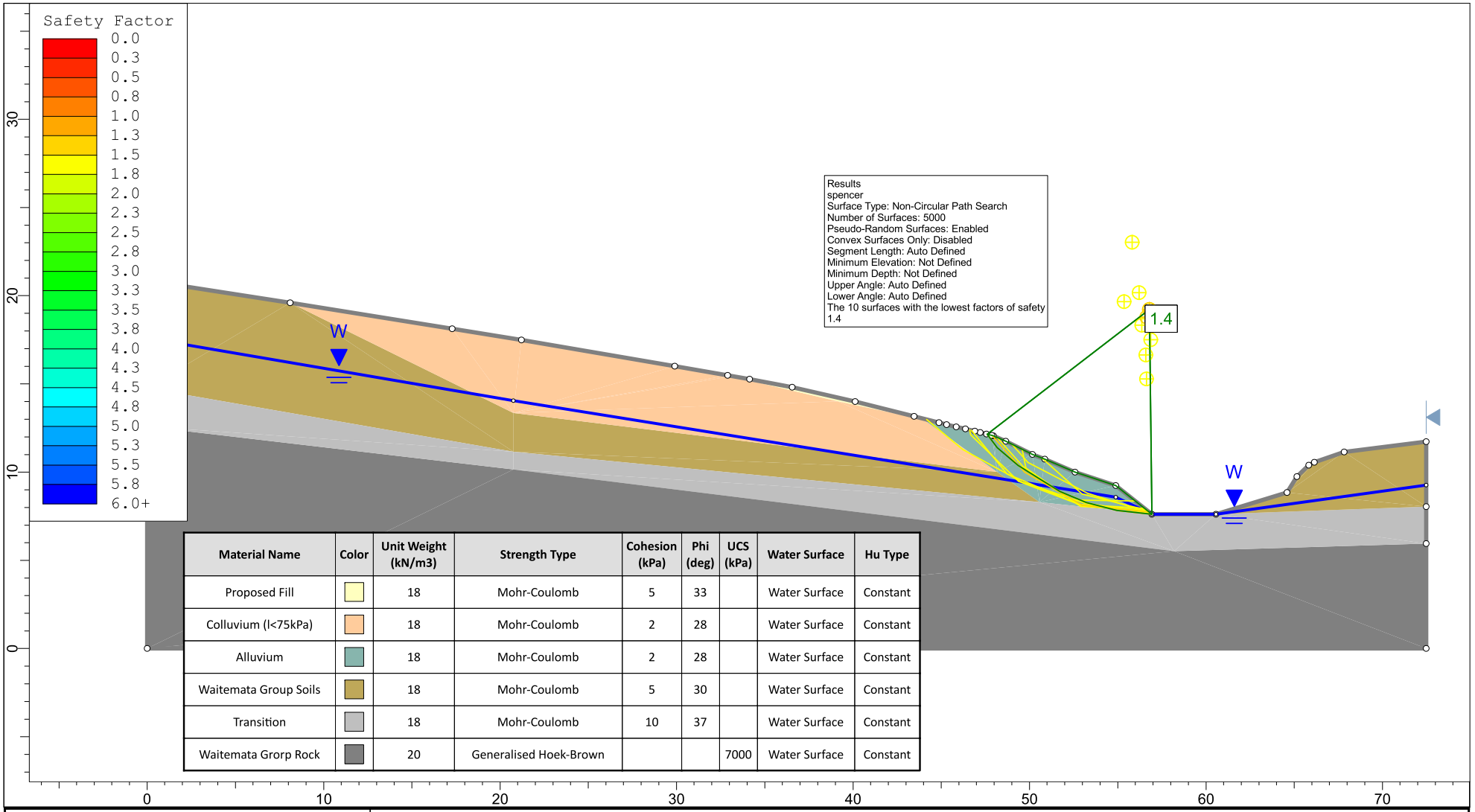
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa			
Analysis Description	Stage 1, Section BB - Run 7			
Drawn By	PH	Scale	1:300	Company: KGA Geotechnical
Date	31/08/2015			File Name: 7464 - S1BB - Run 7.slim



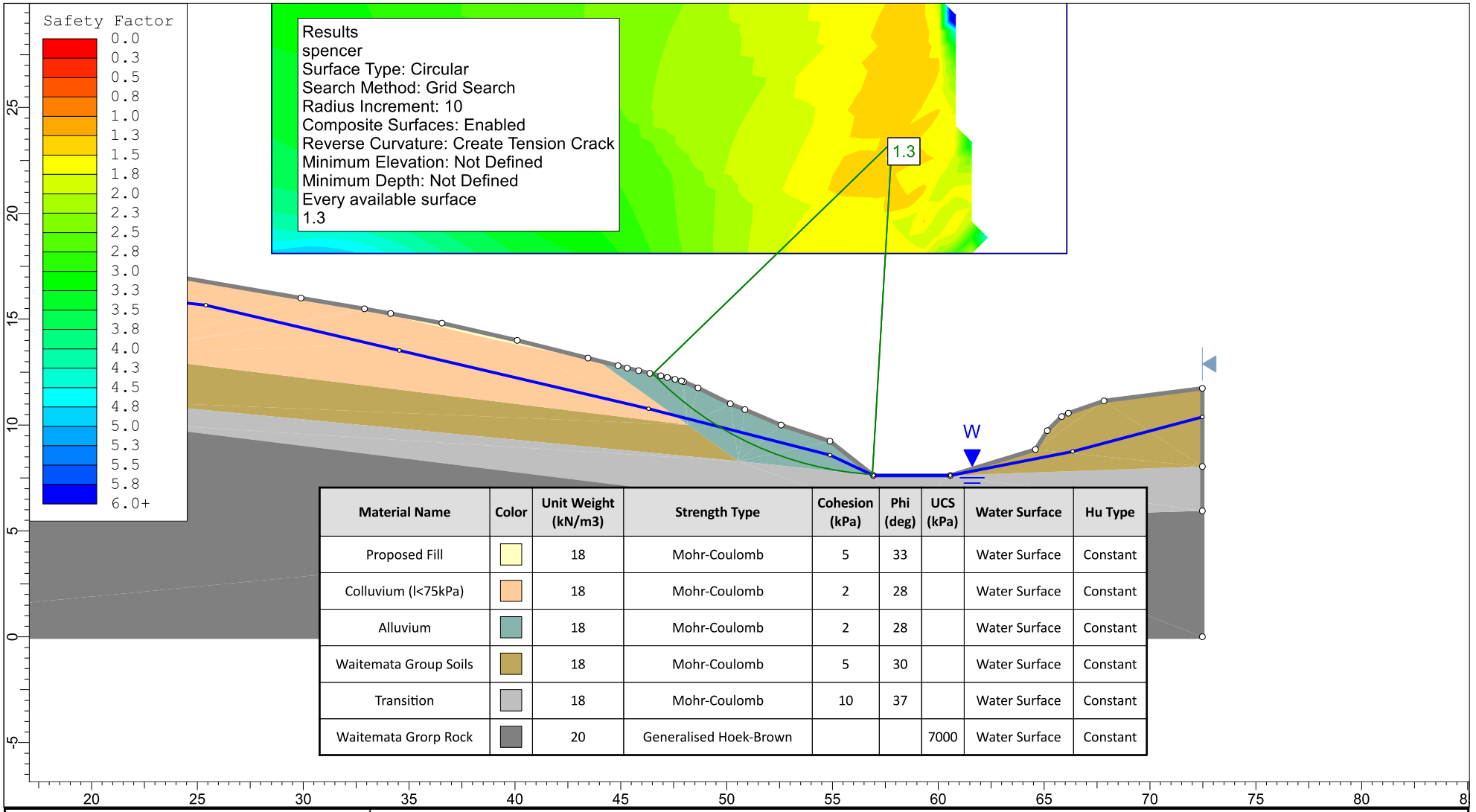
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 1, Section BB - Run 8		
Drawn By	PH	*Scale* 1:300	*Company* KGA Geotechnical
Date	31/08/2015		*File Name* 7464 - S1BB - Run 8.slim



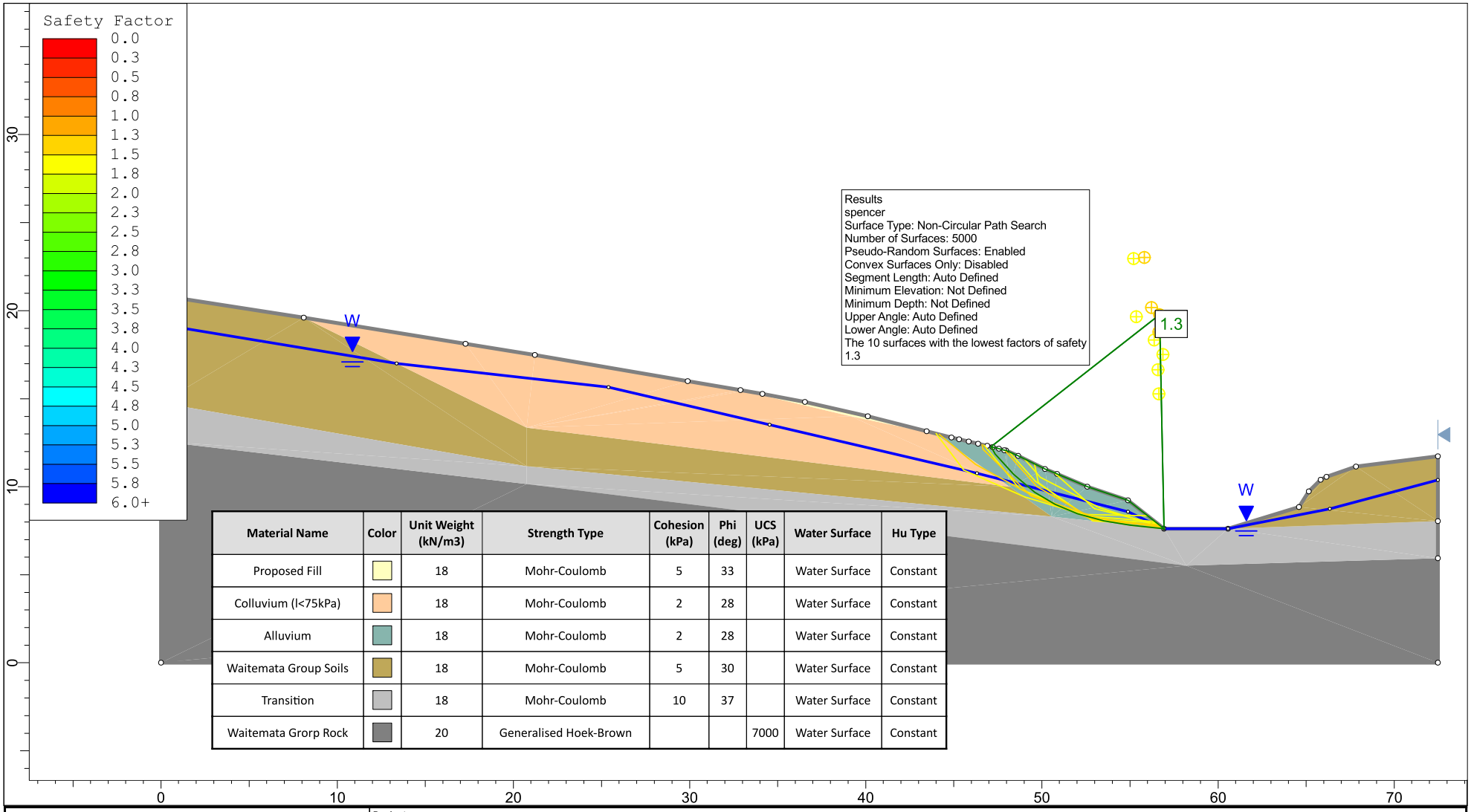
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section BB - Run 10				
Drawn By	PH	Scale	1:250	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1BB - Run 9.slim



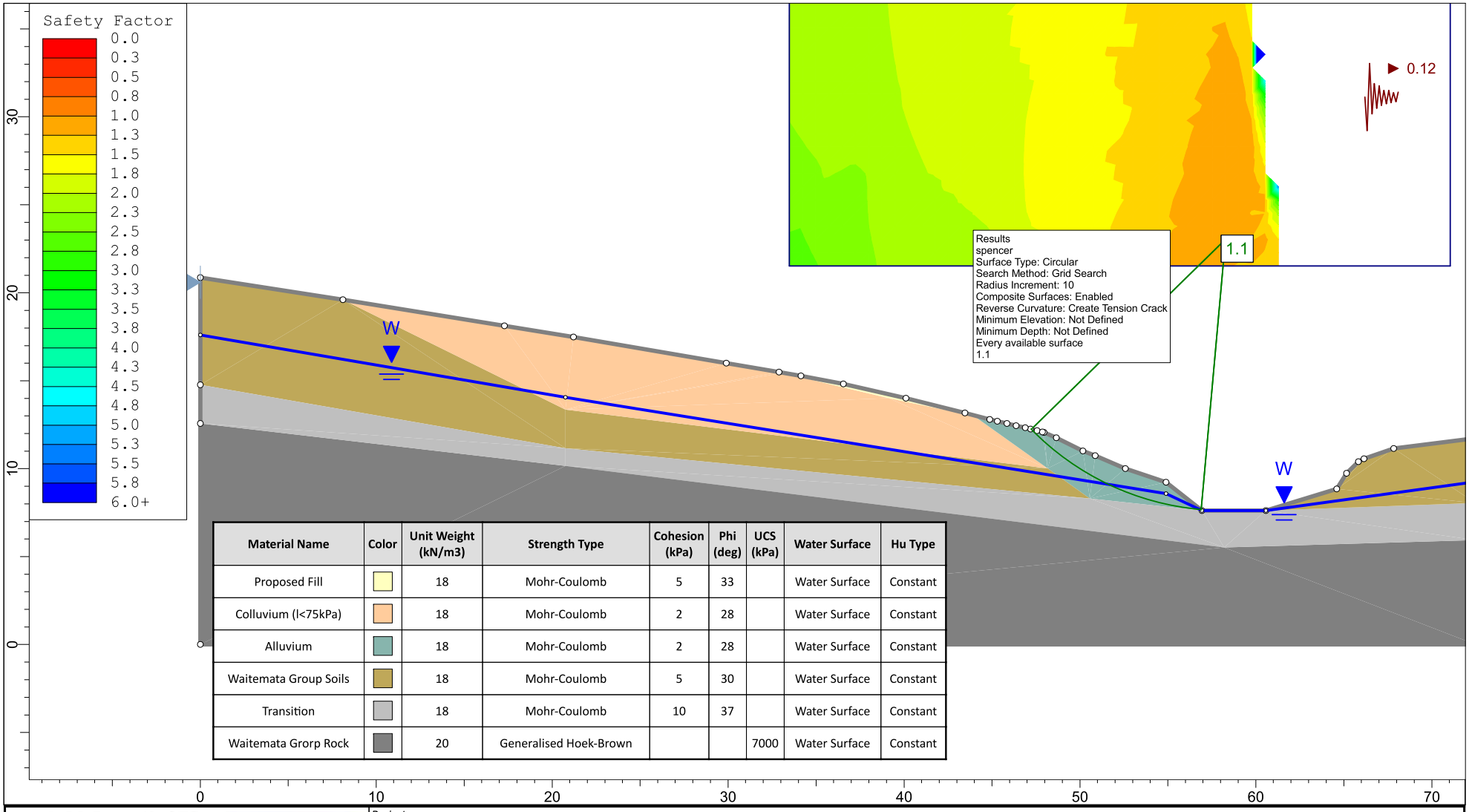
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section BB - Run 10				
Drawn By	PH	*Scale*	1:300	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S1BB - Run 10.slim



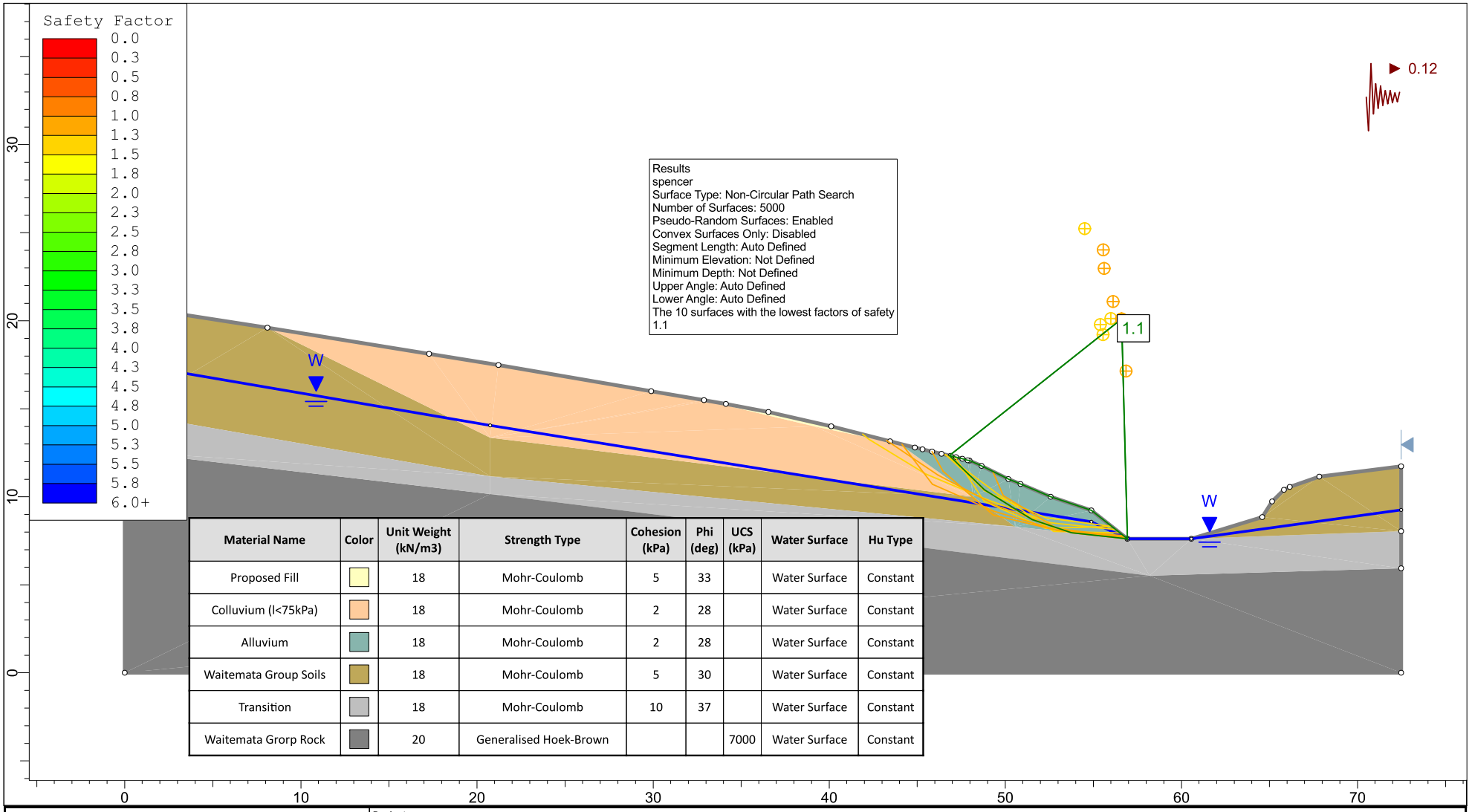
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 1, Section BB - Run 11		
Drawn By	PH	Scale	1:300
Company	KGA Geotechnical		
Date	31/08/2015	File Name	7464 - S1BB - Run 11.slim



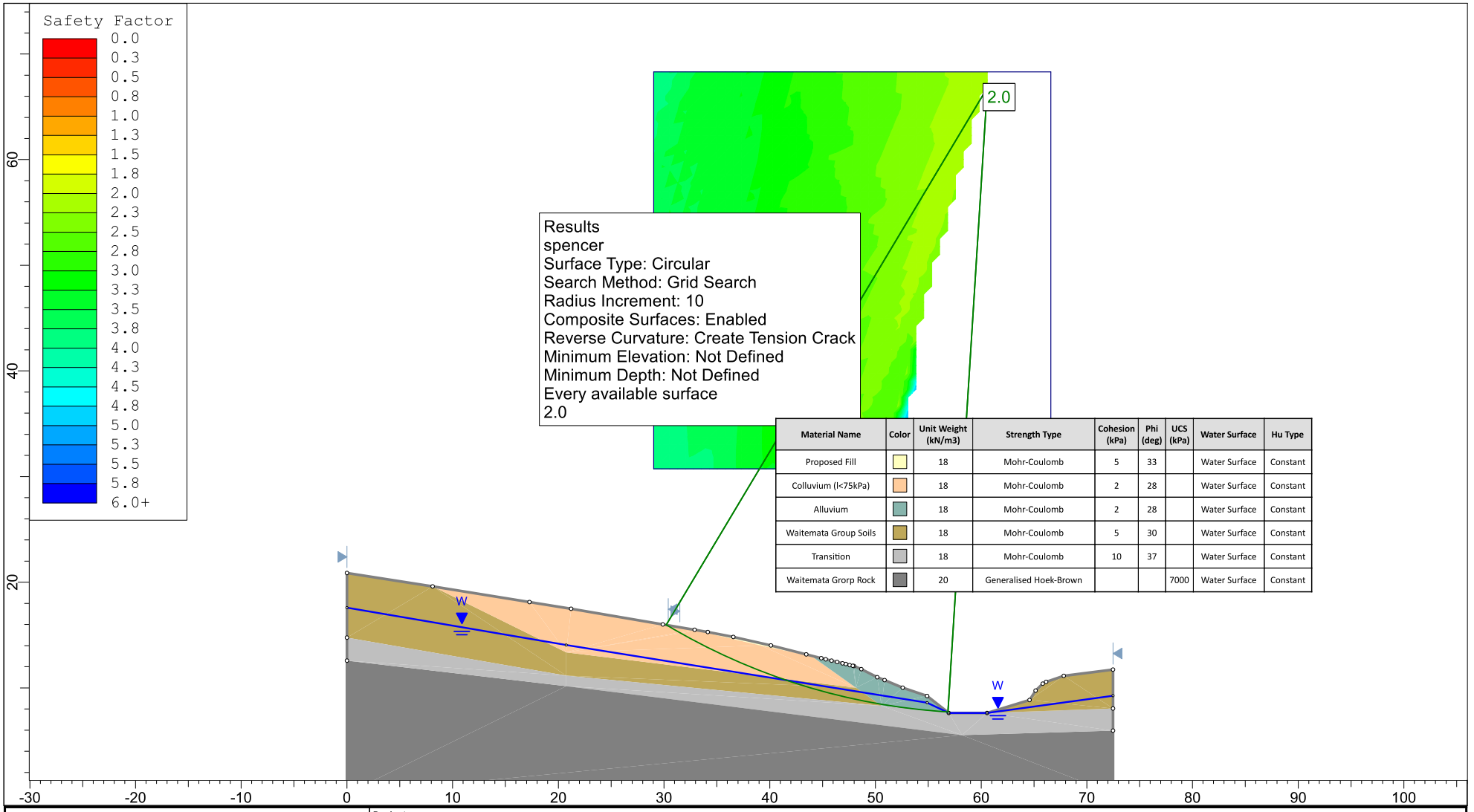
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 1, Section BB - Run 12		
Drawn By	PH	Scale	1:300
Company	KGA Geotechnical		
Date	31/08/2015	File Name	7464 - S1BB - Run 12.slim



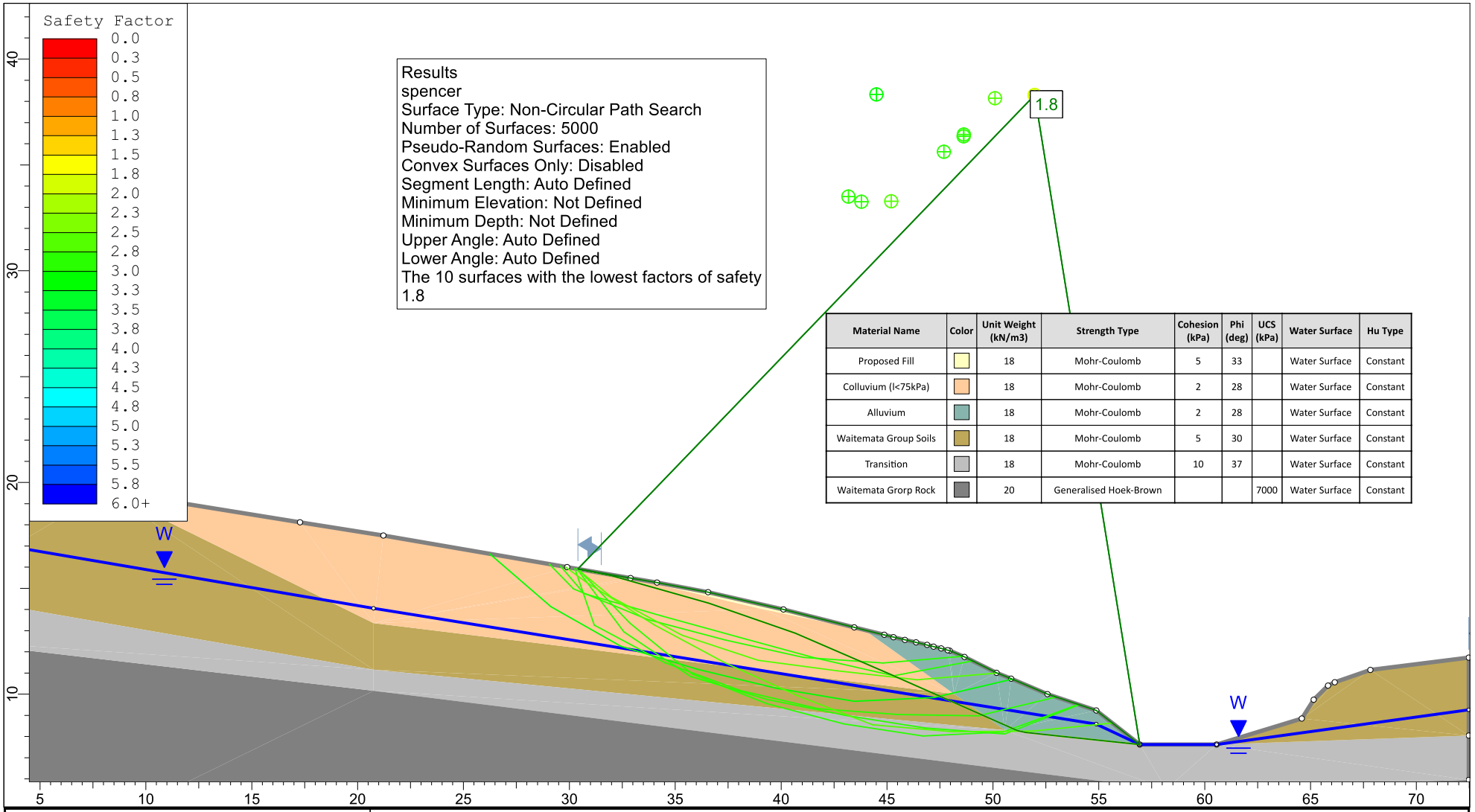
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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SLIDEINTERPRET 6.018

Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section BB - Run 13				
Drawn By	PH	Scale	1:500	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1BB - Run 13.slim



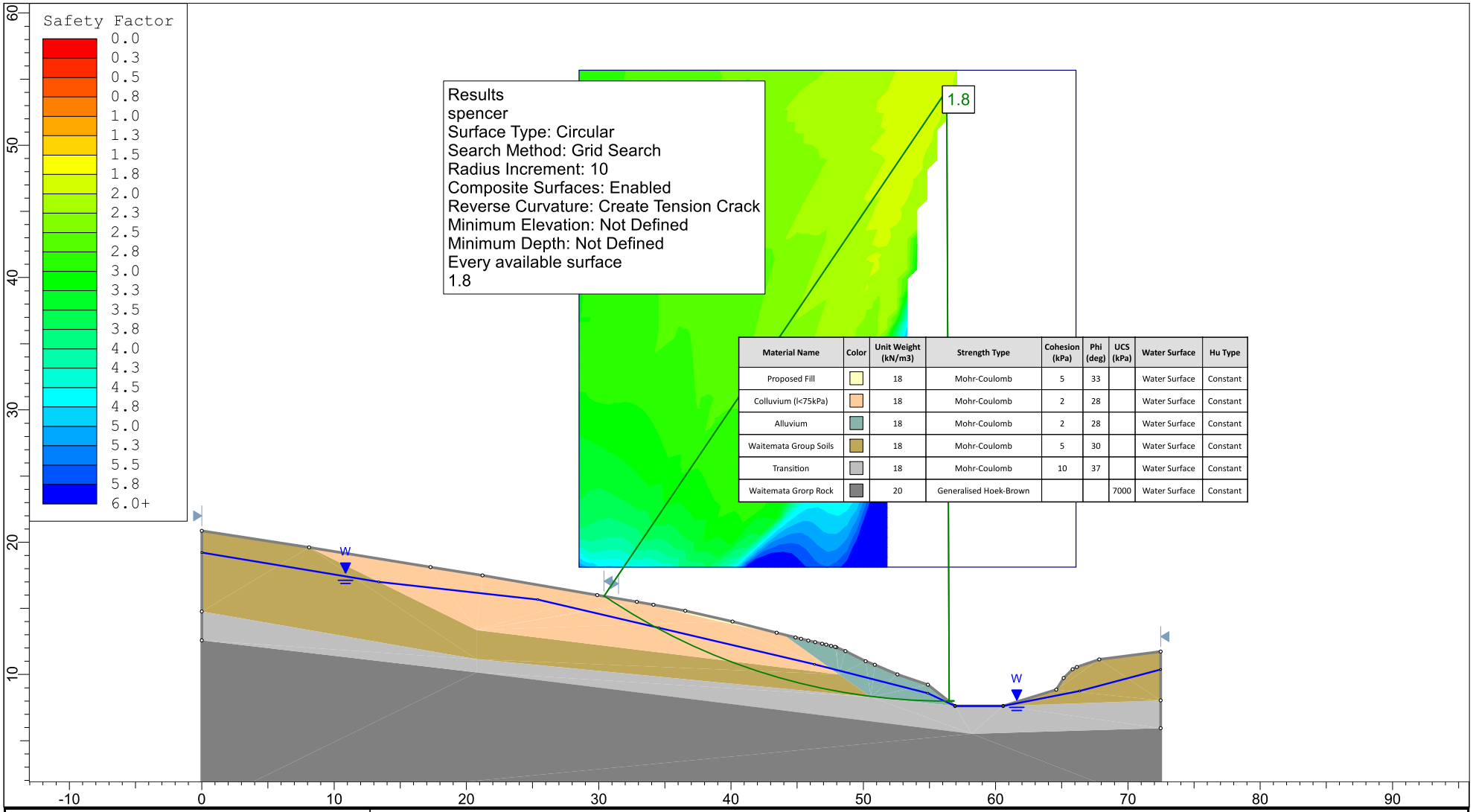
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section BB - Run 14				
Drawn By	PH	Scale	1:250	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1BB - Run 14.slim



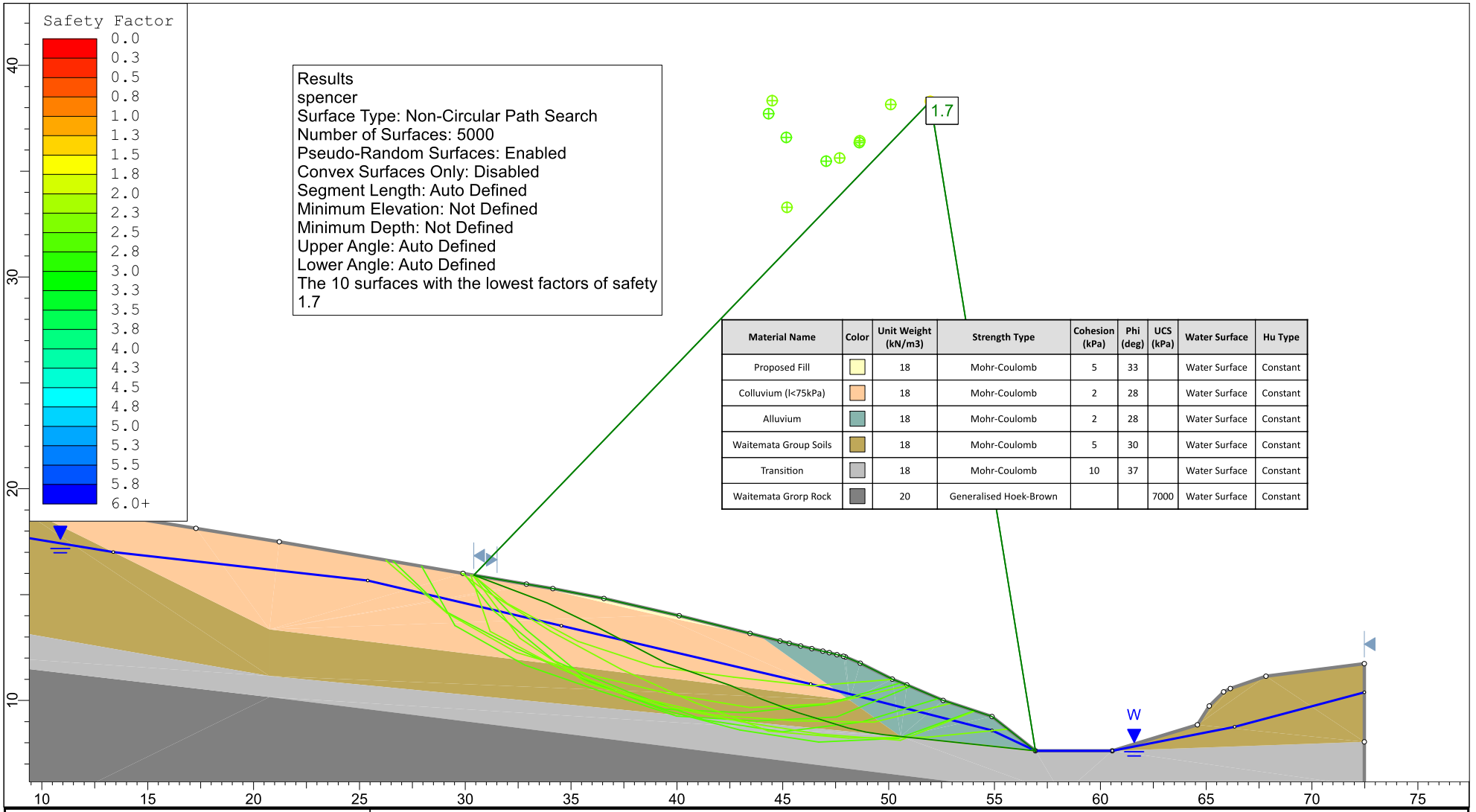
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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SLIDEINTERPRET 6.018

Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section BB - Run 15				
Drawn By	PH	*Scale*	1:400	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S1BB - Run 15.slim



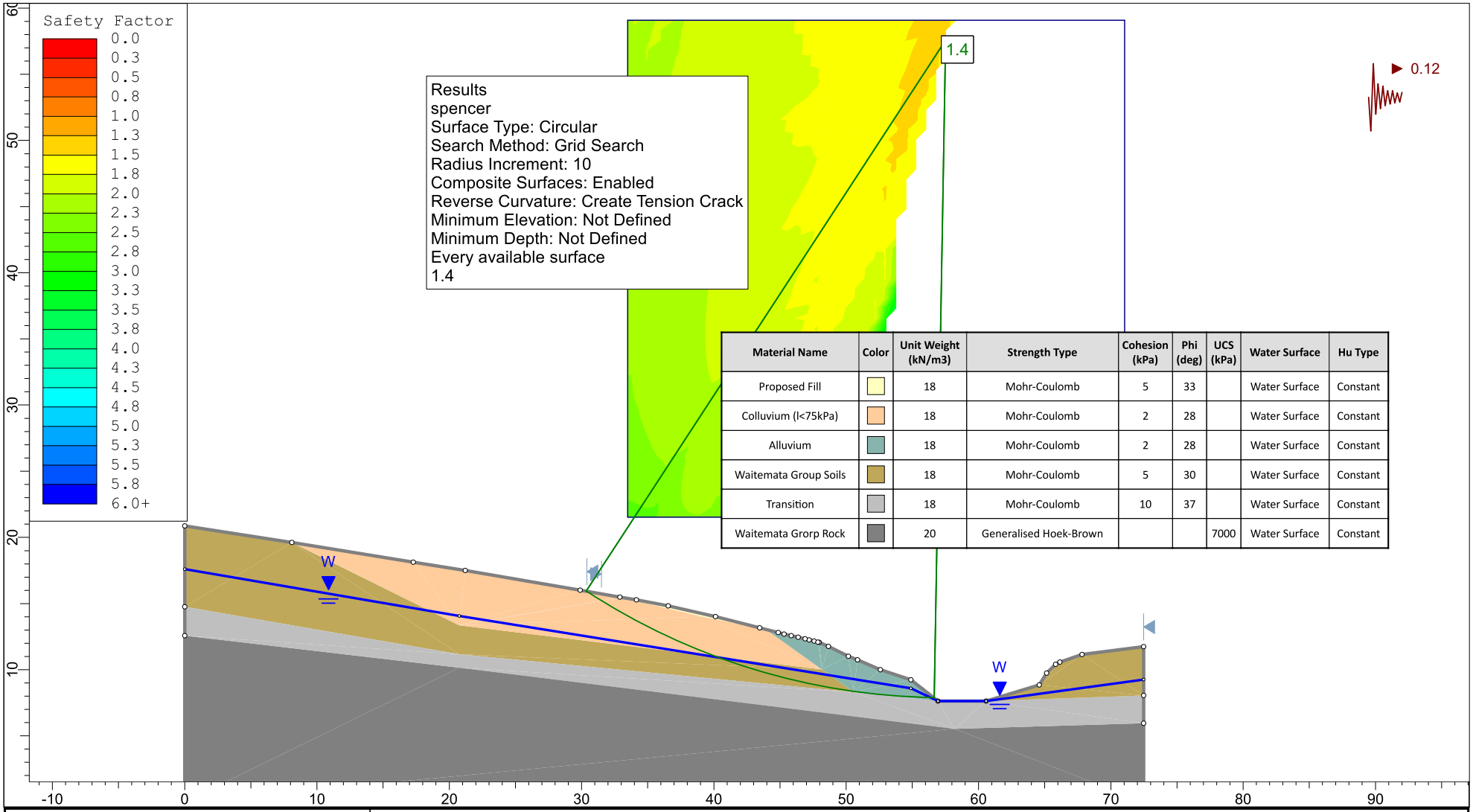
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section BB - Run 16				
Drawn By	PH	*Scale*	1:250	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S1BB - Run 16.slim



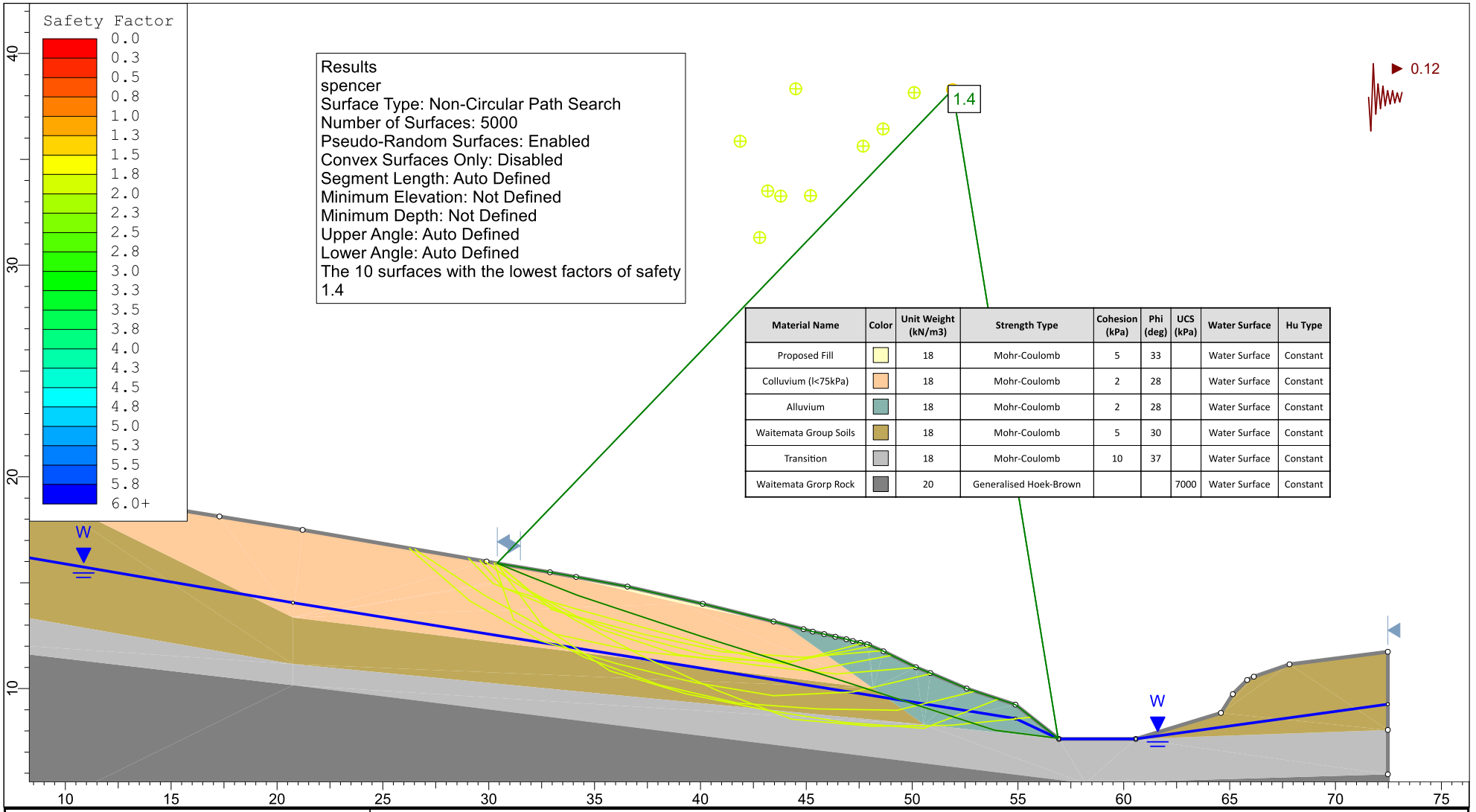
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section BB - Run 17				
Drawn By	PH	Scale	1:400	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1BB - Run 17.slim



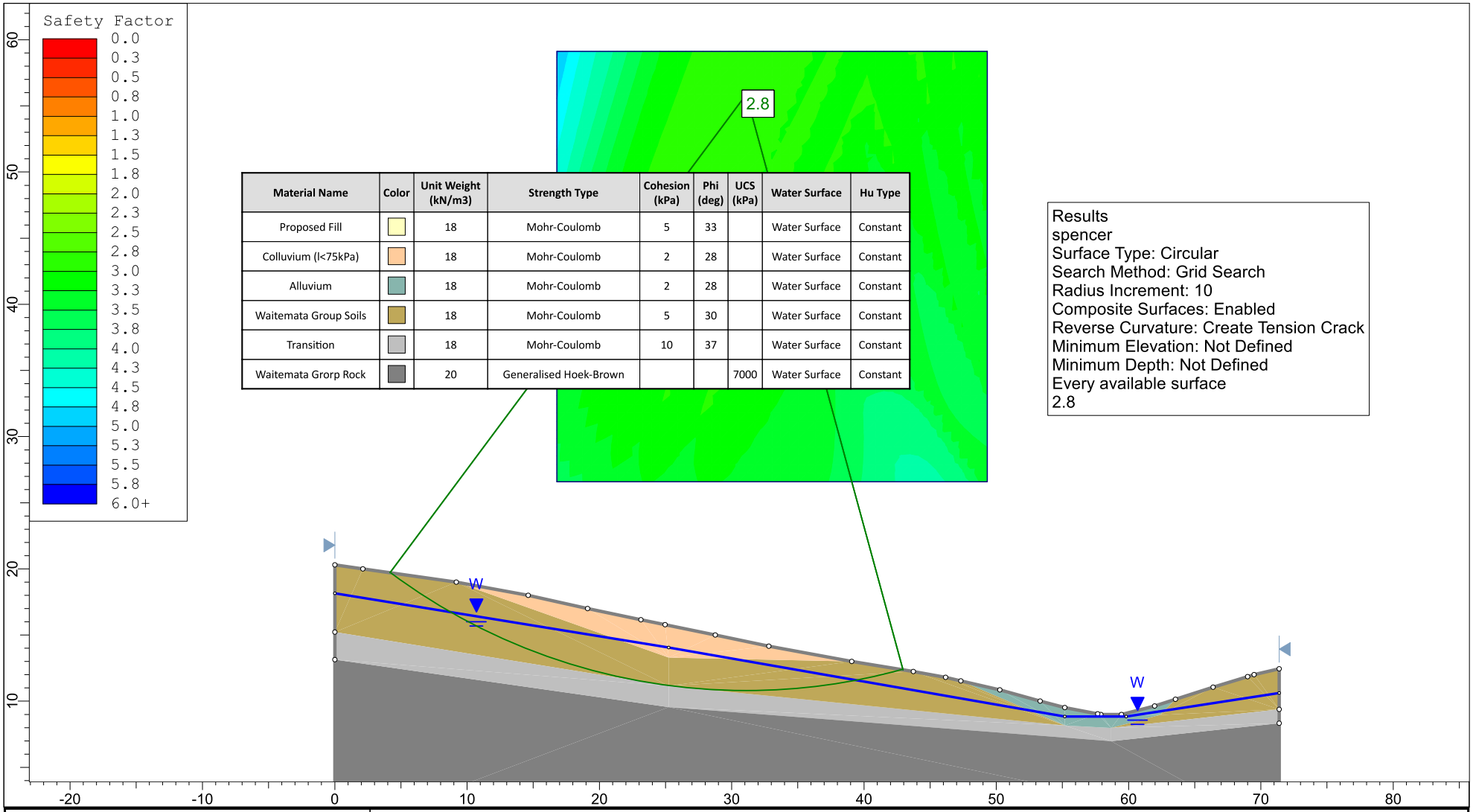
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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SLIDEINTERPRET 6.018

Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section BB - Run 18				
Drawn By	PH	*Scale*	1:250	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S1BB - Run 18.slim



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

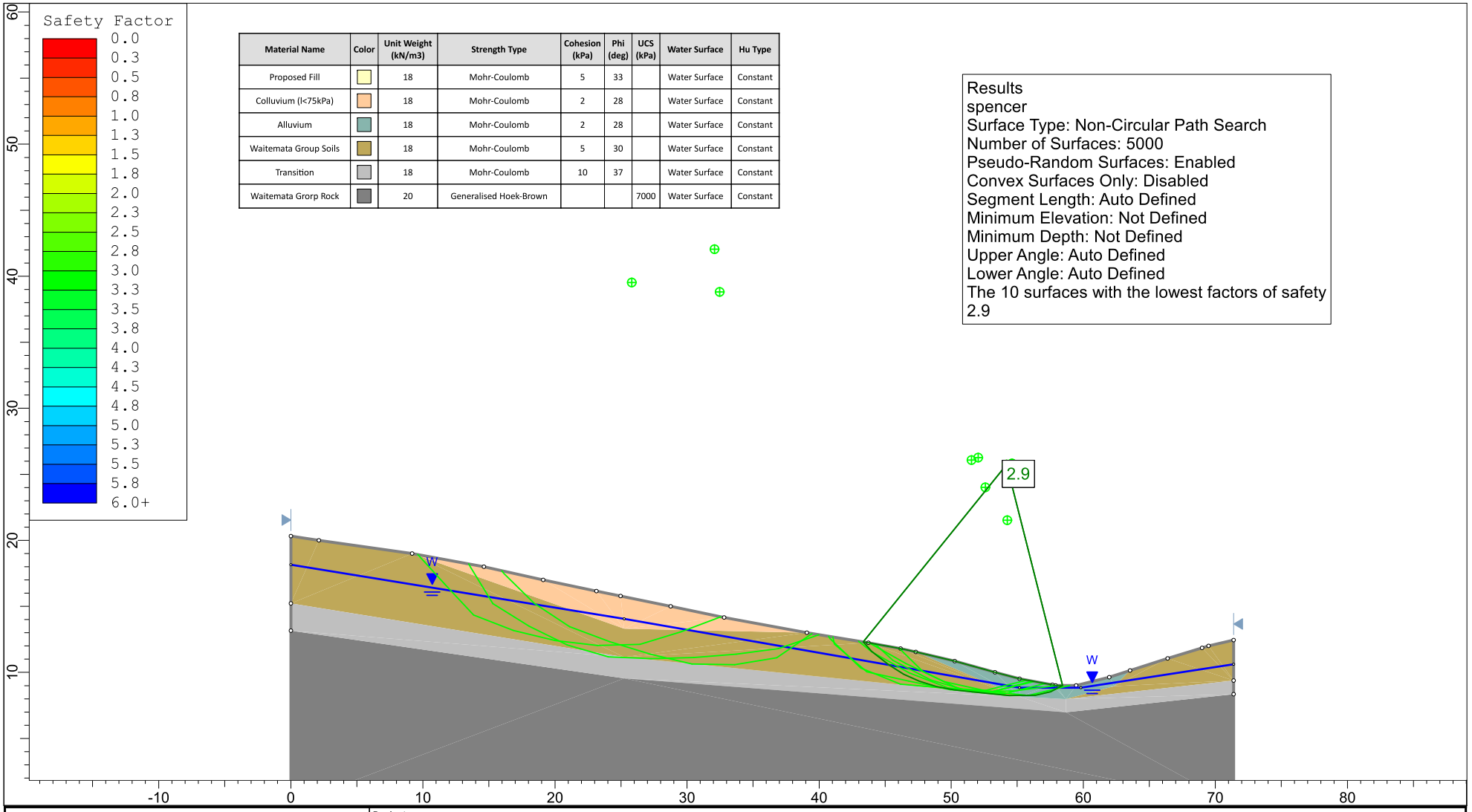
Results
spencer
Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Enabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Every available surface
2.8

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SLIDEINTERPRET 6.018

Project	Proposed Subdivision - Grand View Estate, Orewa			
Analysis Description	Stage 1, Section CC - Run 1			
Drawn By	PH	Scale	1:400	Company: KGA Geotechnical
Date	31/08/2015			File Name: 7464 - S1CC - Run 1.slim



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

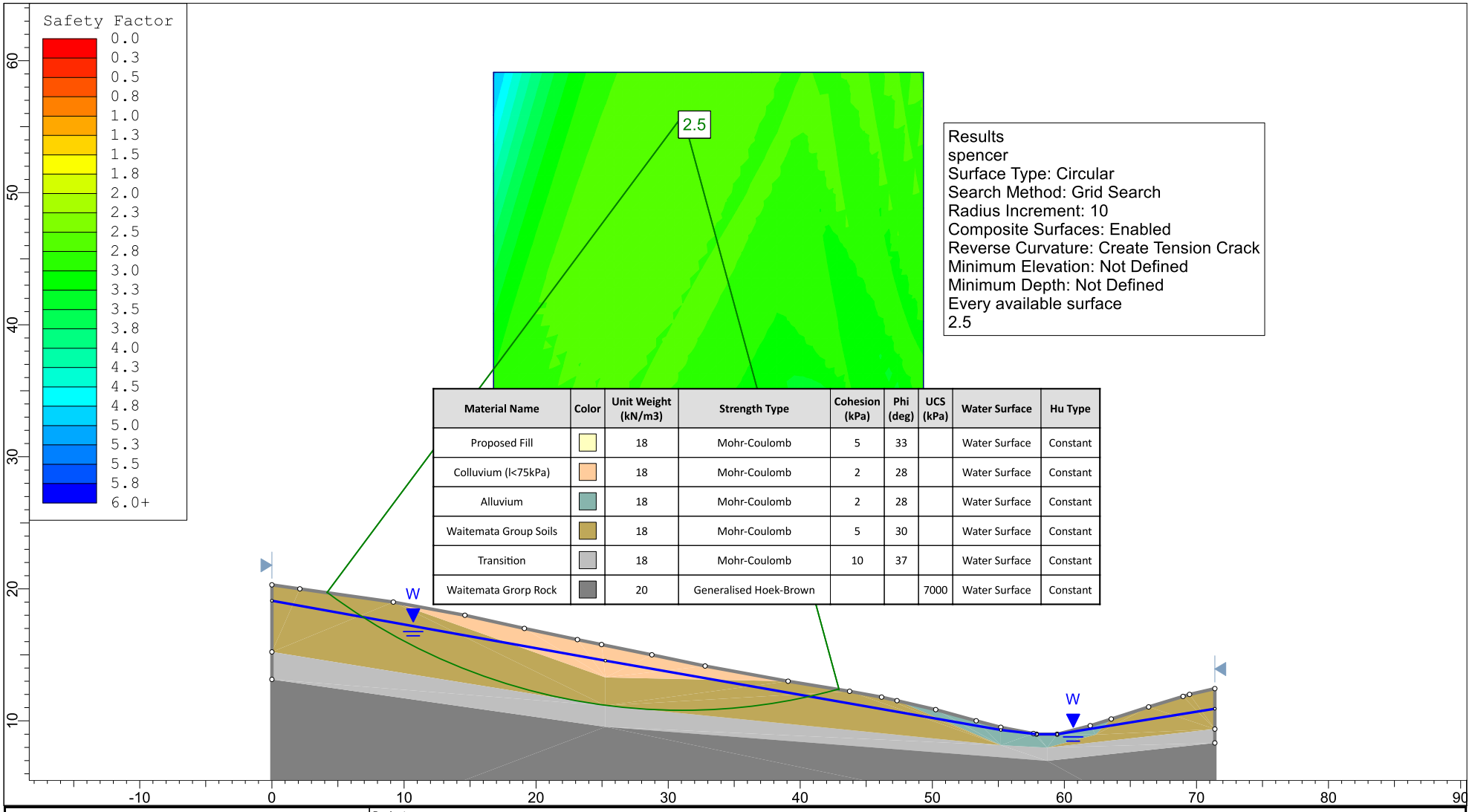
Results
spencer
Surface Type: Non-Circular Path Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Segment Length: Auto Defined
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Upper Angle: Auto Defined
Lower Angle: Auto Defined
The 10 surfaces with the lowest factors of safety
2.9

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section CC - Run 2				
Drawn By	PH	Scale	1:400	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1CC - Run 2.slim



Results
spencer
Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Enabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Every available surface
2.5

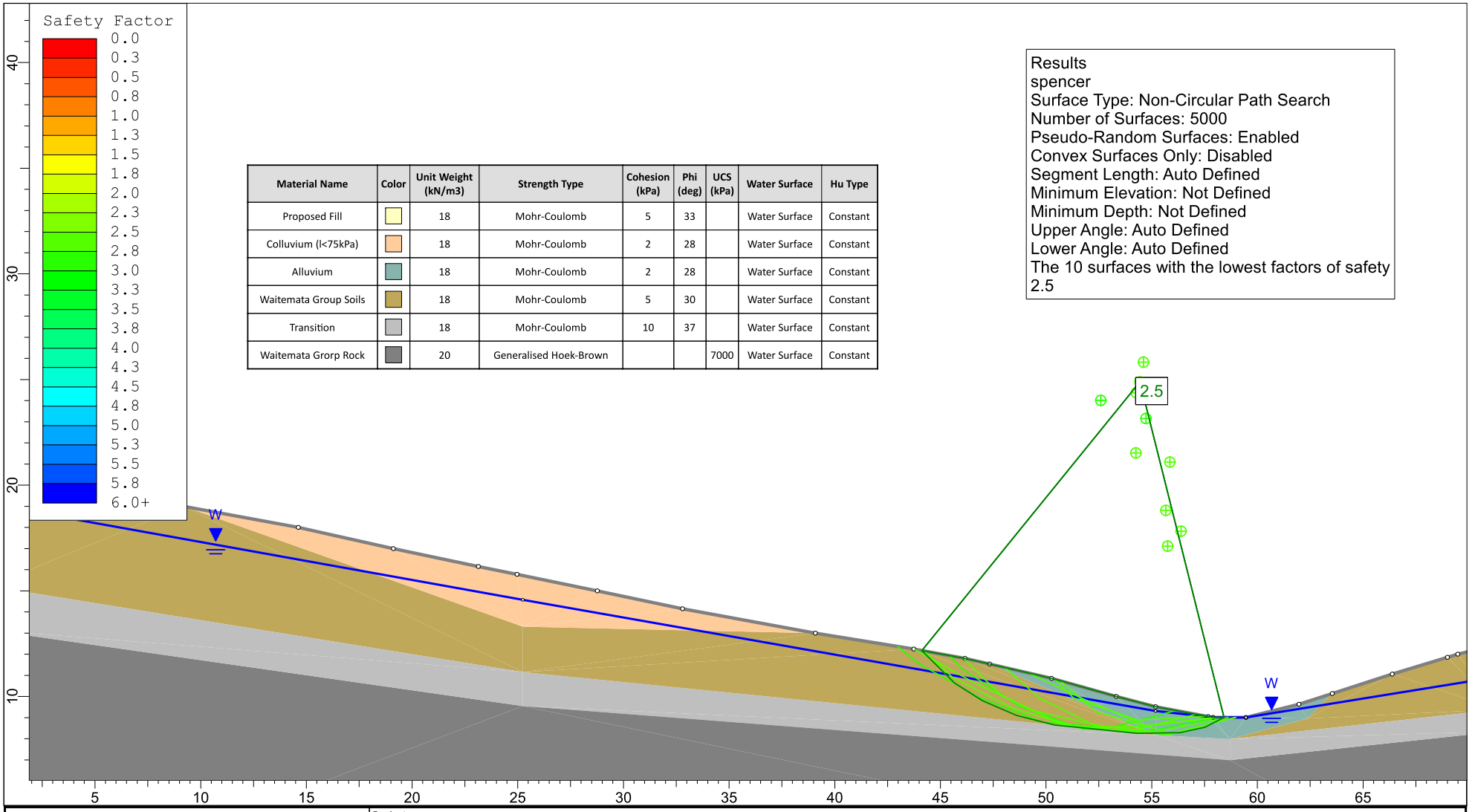
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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SLIDEINTERPRET 6.018

Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section CC - Run 3				
Drawn By	PH	Scale	1:400	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1CC - Run 3.slim



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

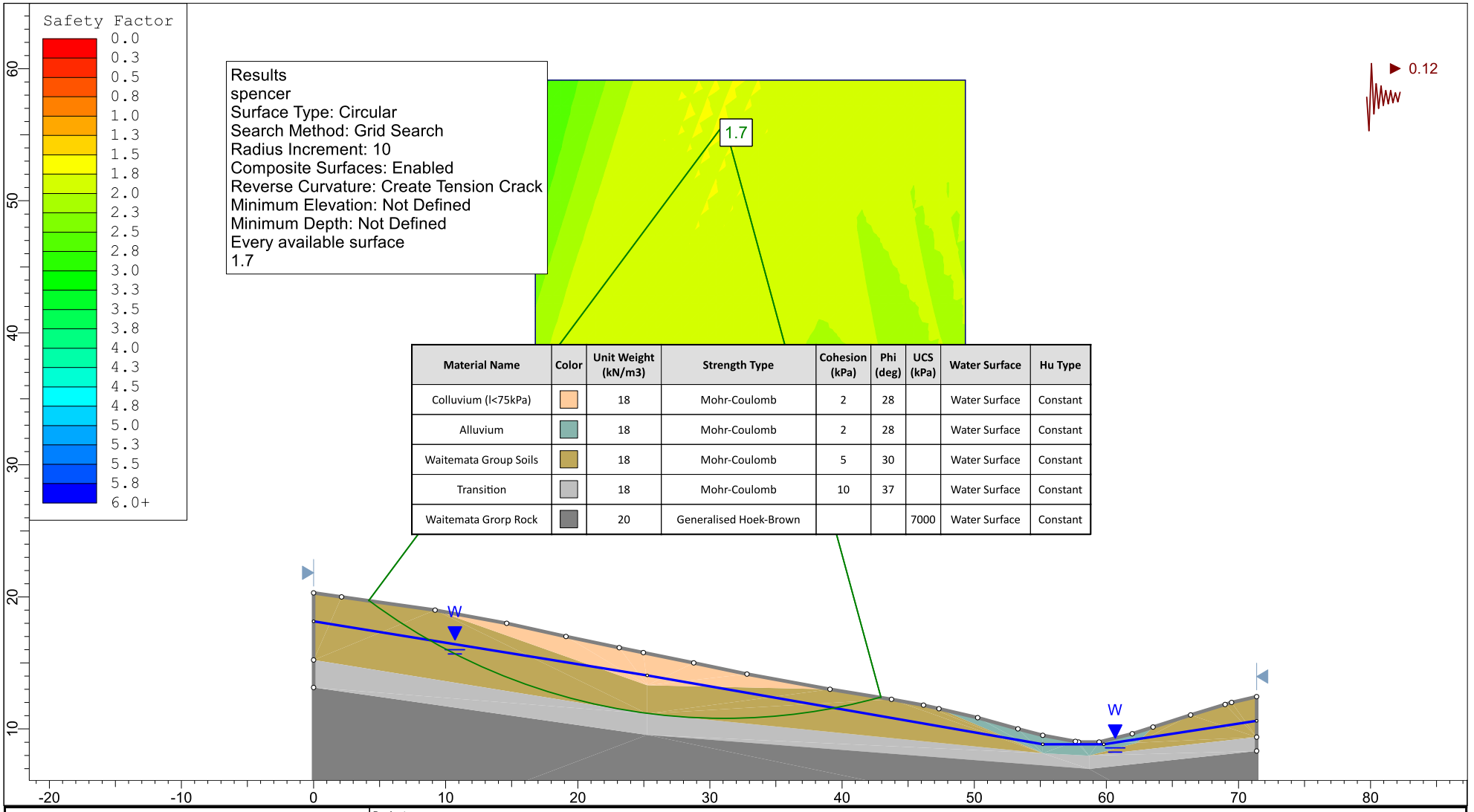
Results
spencer
Surface Type: Non-Circular Path Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Segment Length: Auto Defined
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Upper Angle: Auto Defined
Lower Angle: Auto Defined
The 10 surfaces with the lowest factors of safety
2.5

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section CC - Run 4				
Drawn By	PH	Scale	1:250	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1CC - Run 4.slim



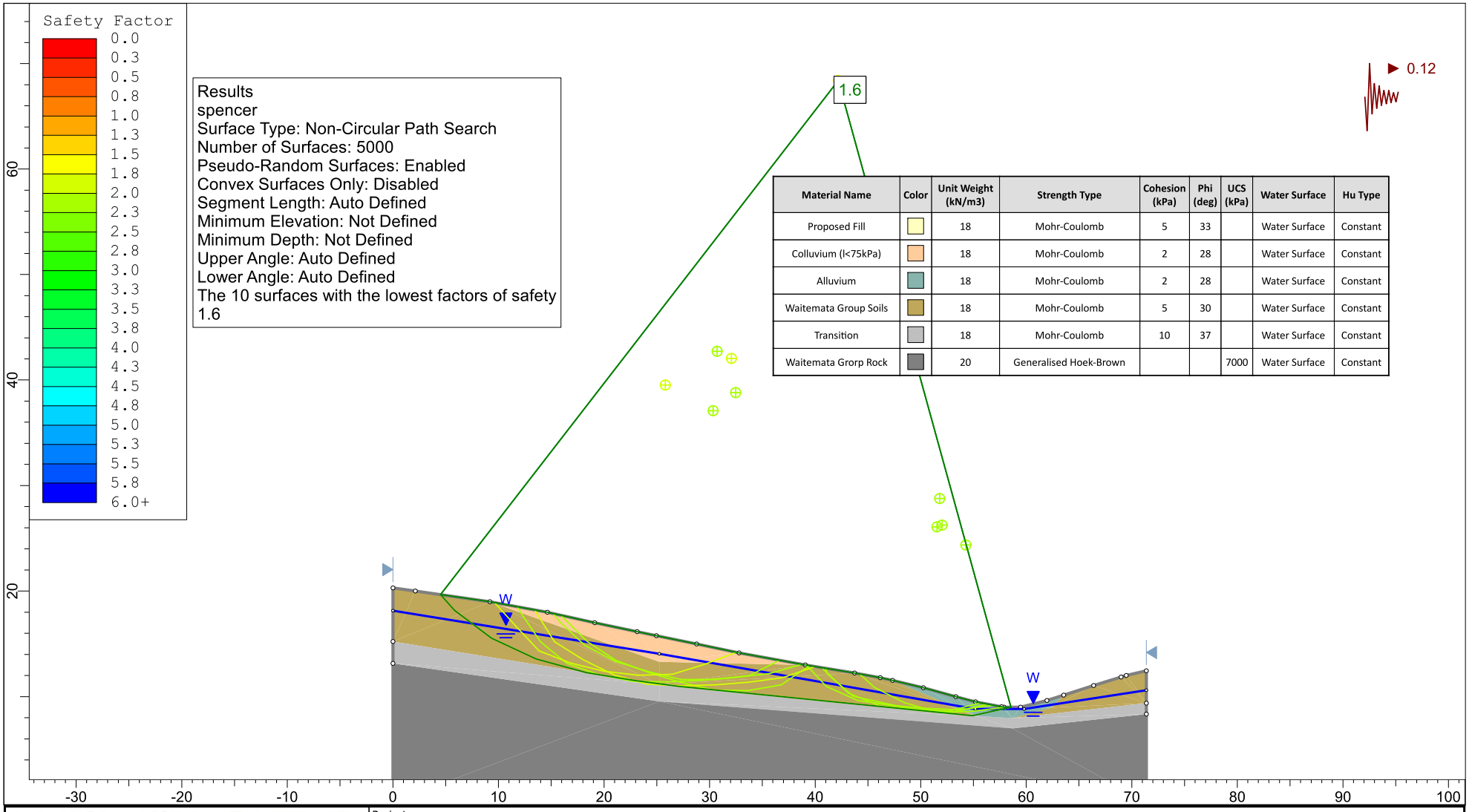
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section CC - Run 5				
Drawn By	PH	Scale	1:400	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1CC - Run 5.slim



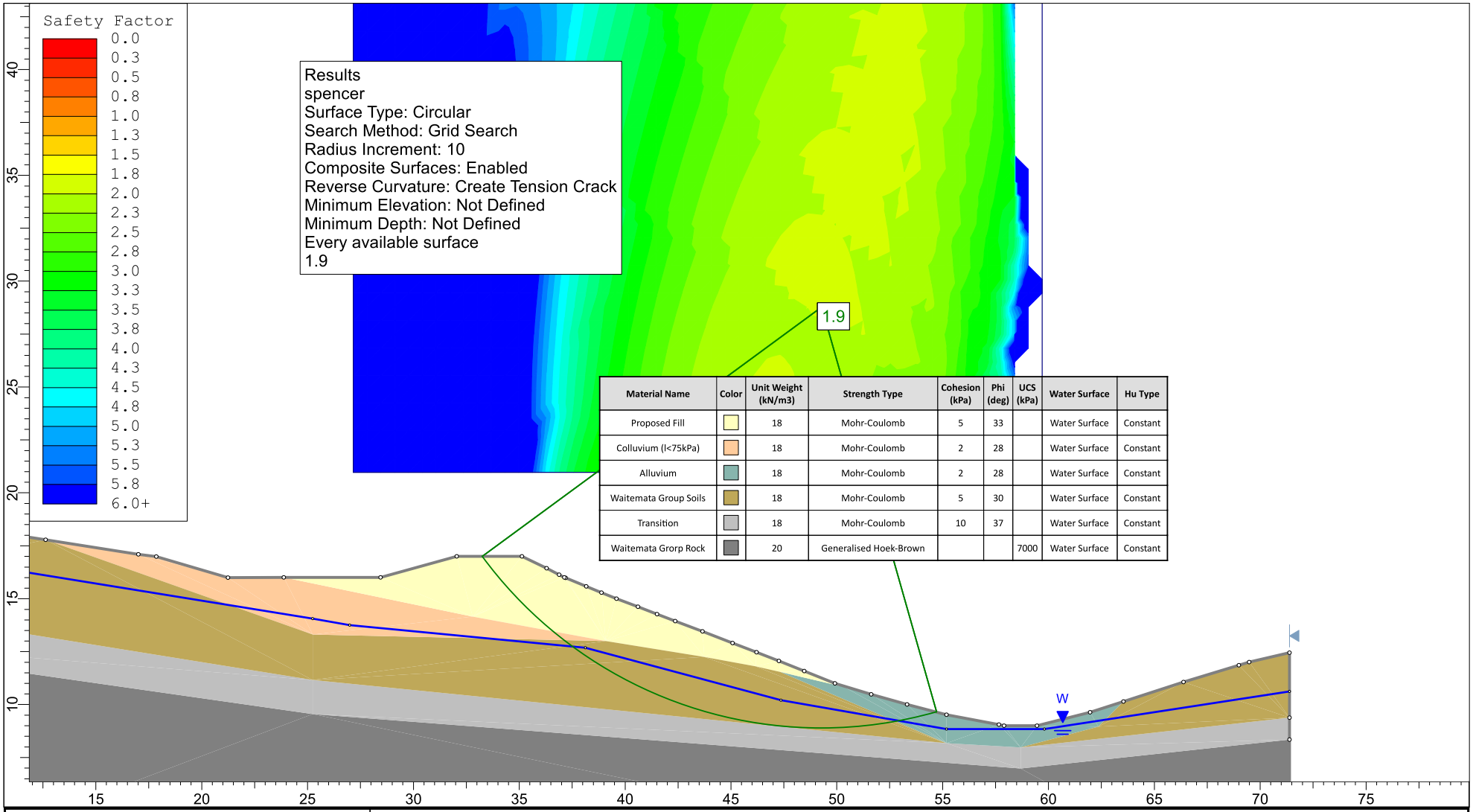
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section CC - Run 6				
Drawn By	PH	Scale	1:500	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1CC - Run 6.slim



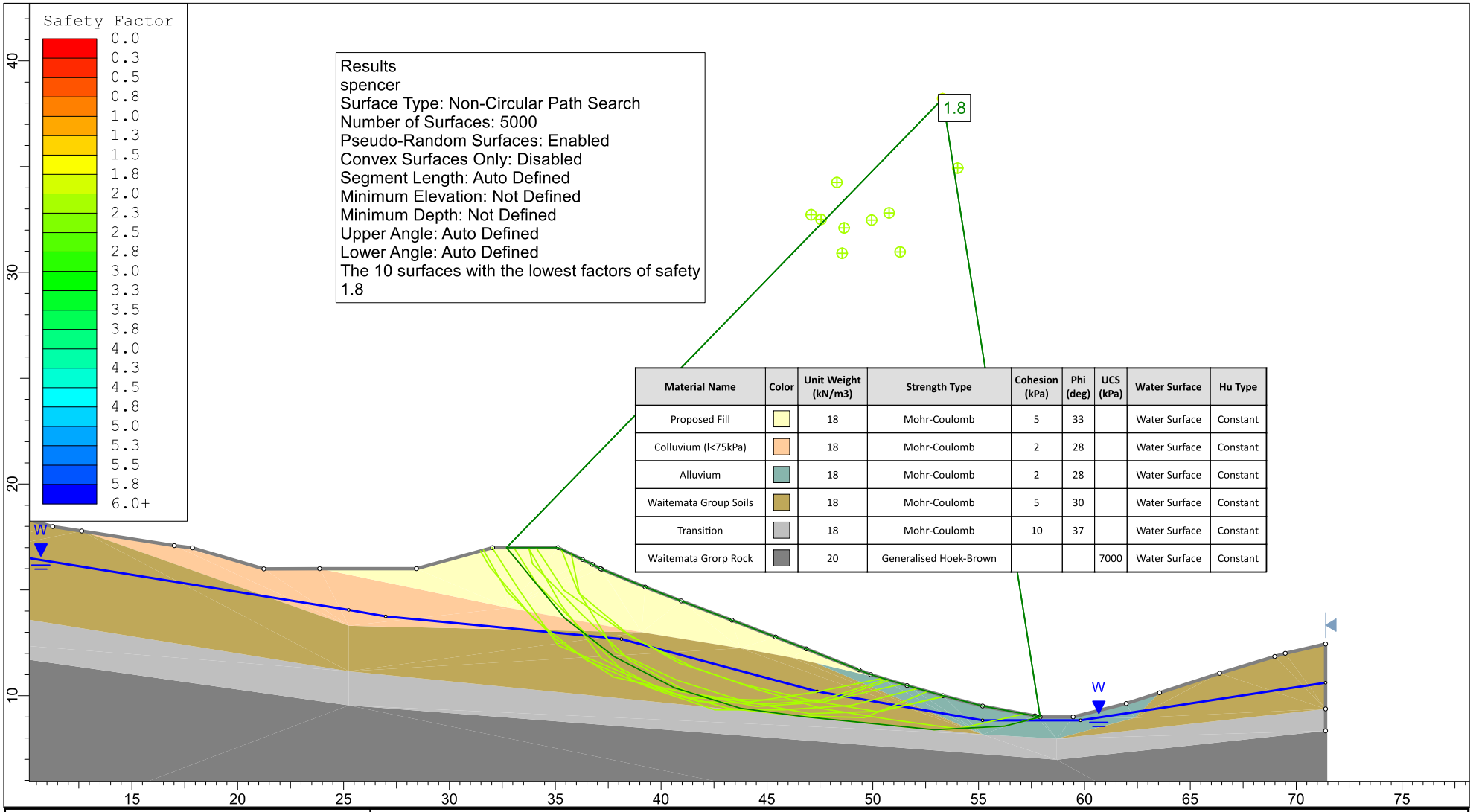
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section CC - Run 7				
Drawn By	PH	*Scale*	1:250	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S1CC - Run 7.slim



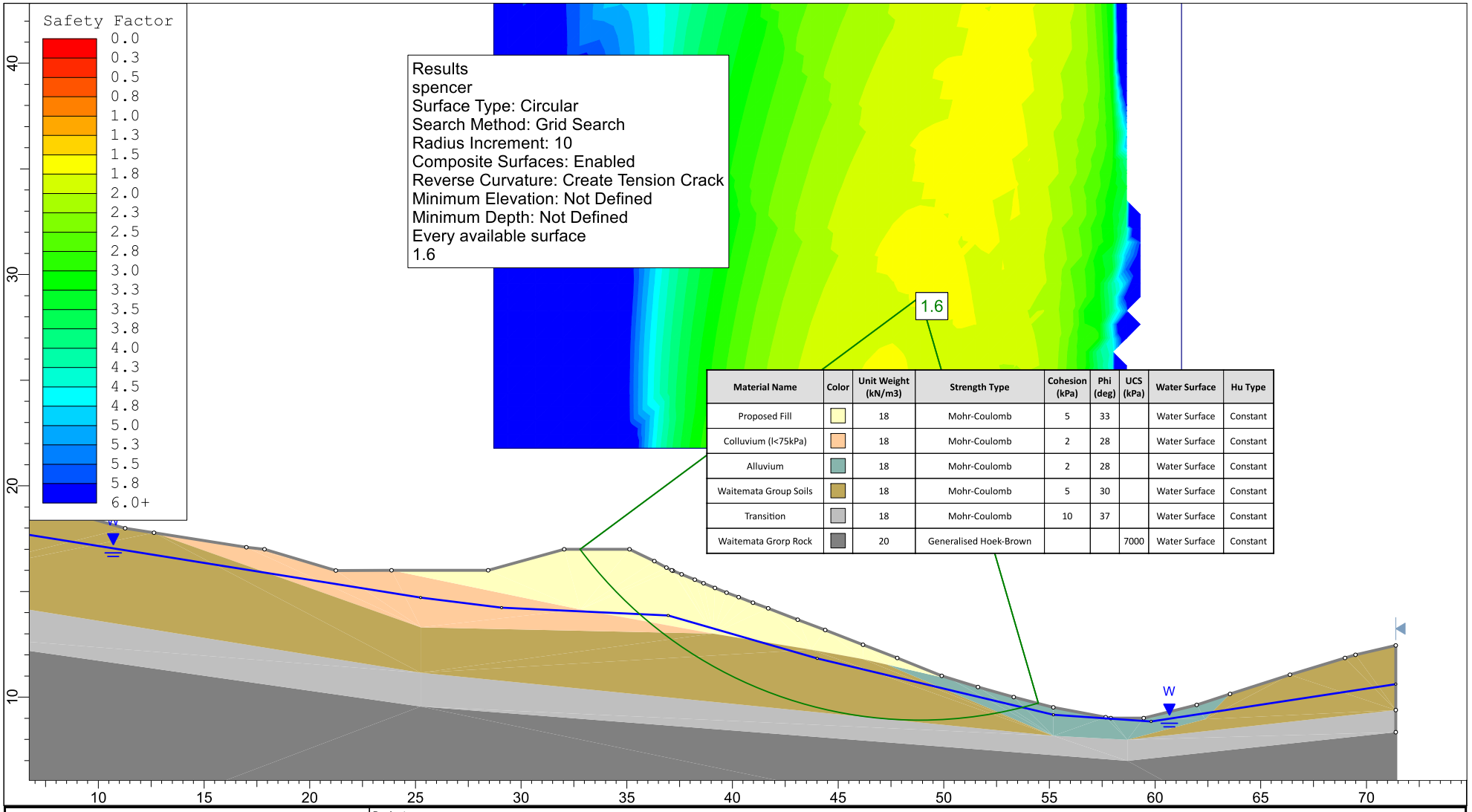
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section CC - Run 8				
Drawn By	PH	*Scale*	1:250	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S1CC - Run 8.slim



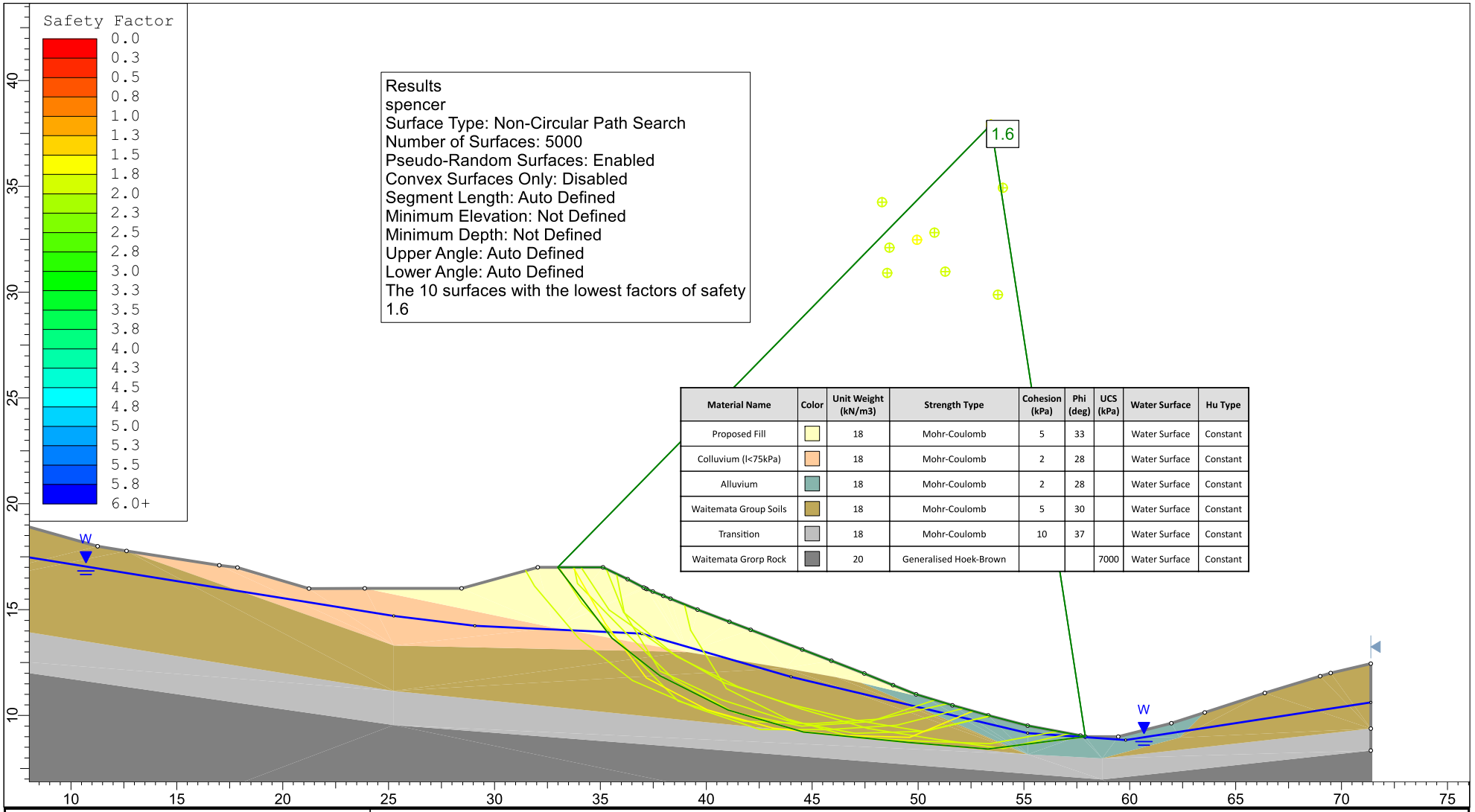
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section CC - Run 9				
Drawn By	PH	*Scale*	1:250	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S1CC - Run 9.slim



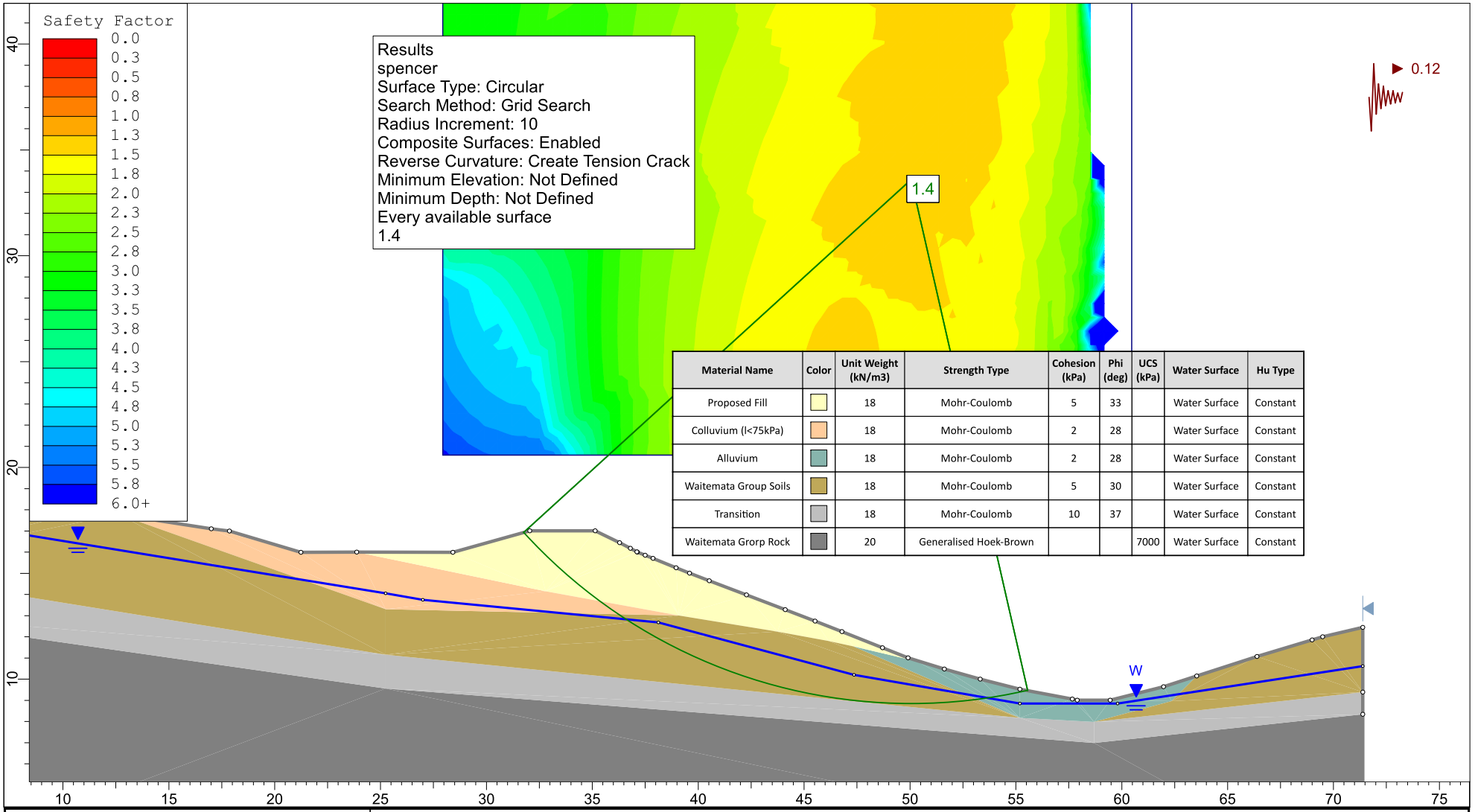
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section CC - Run 10				
Drawn By	PH	*Scale*	1:250	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S1CC - Run 10.slim



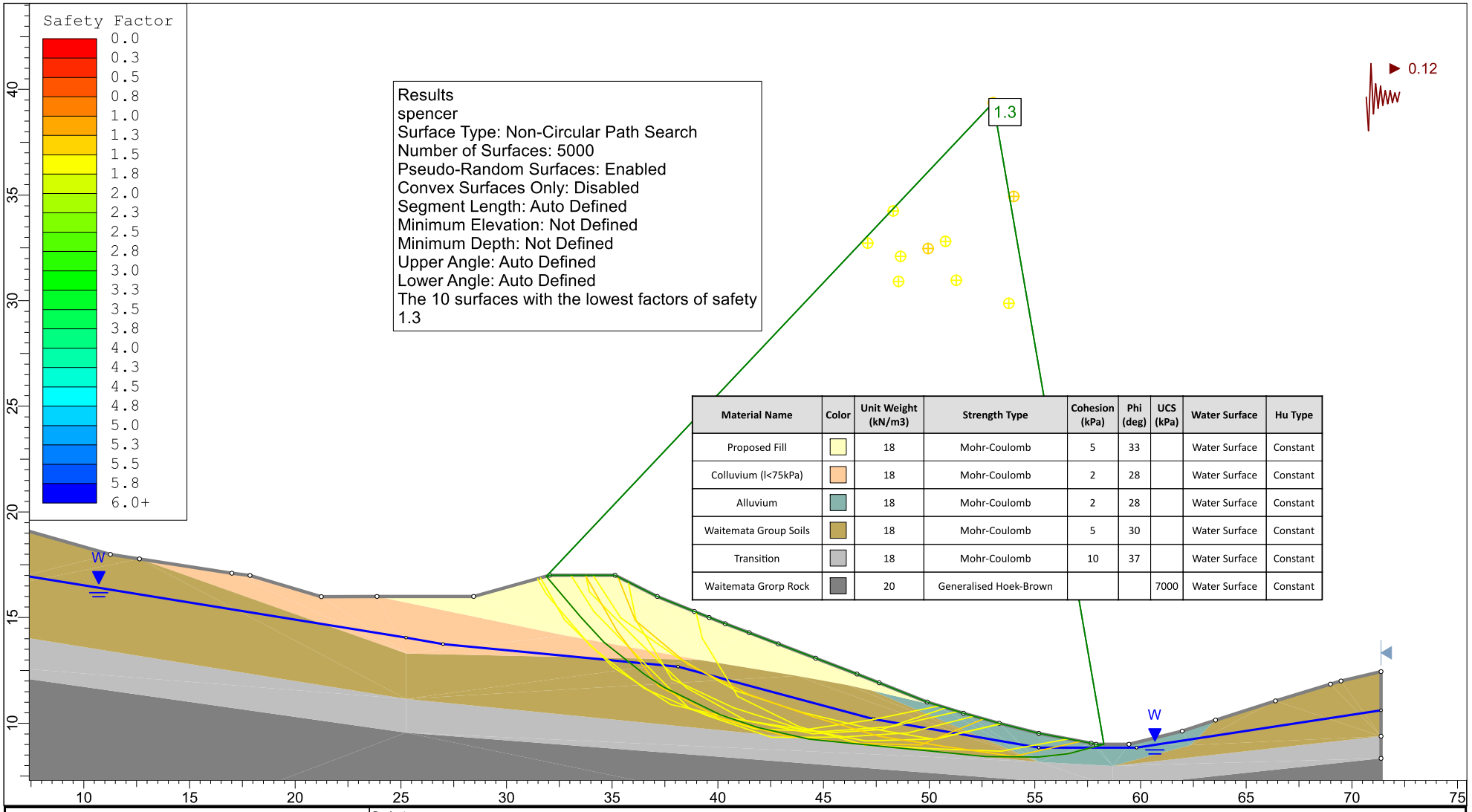
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section CC - Run 11				
Drawn By	PH	Scale	1:250	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1CC - Run 11.slim



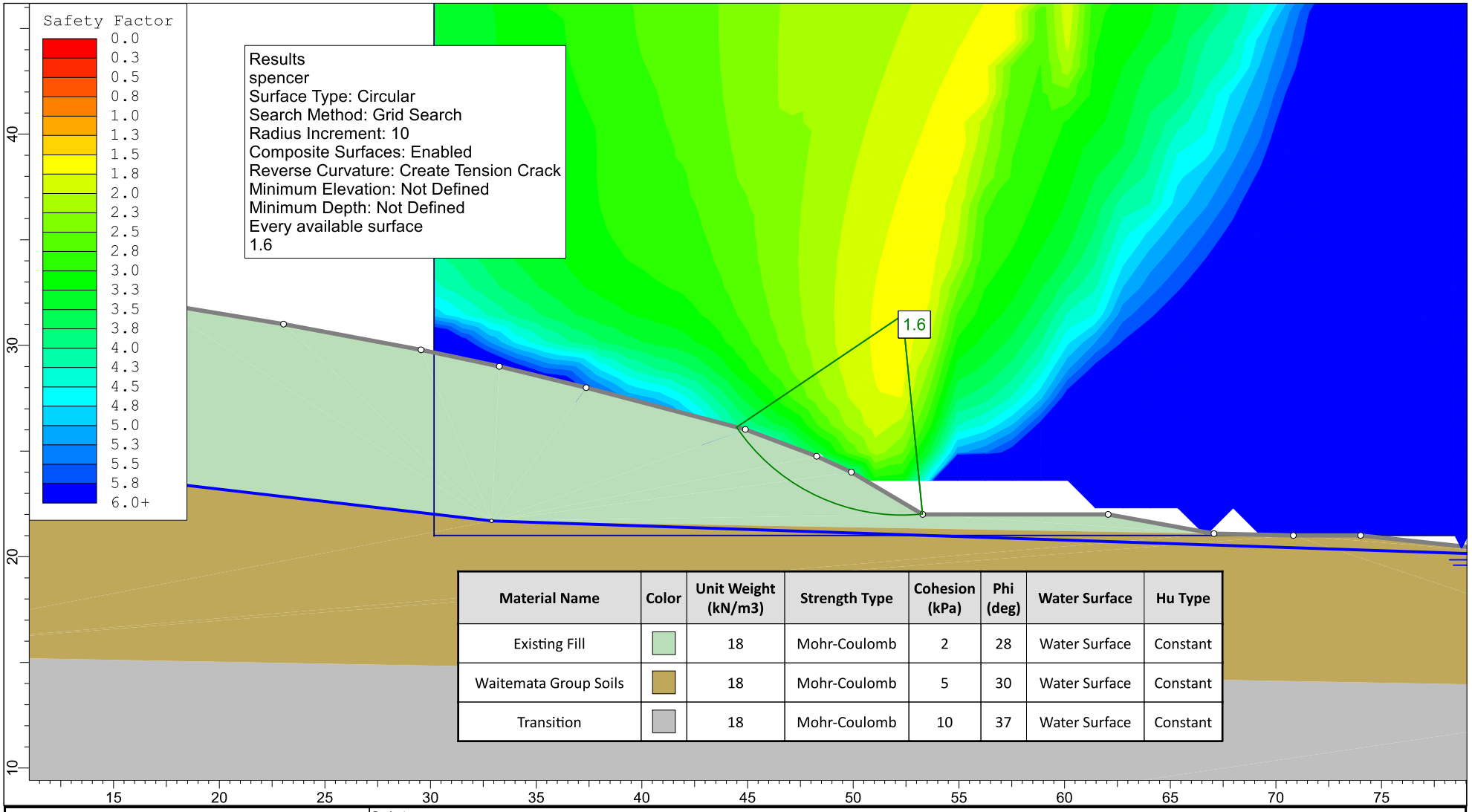
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section CC - Run 12				
Drawn By	PH	*Scale*	1:250	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S1CC - Run 12.slim



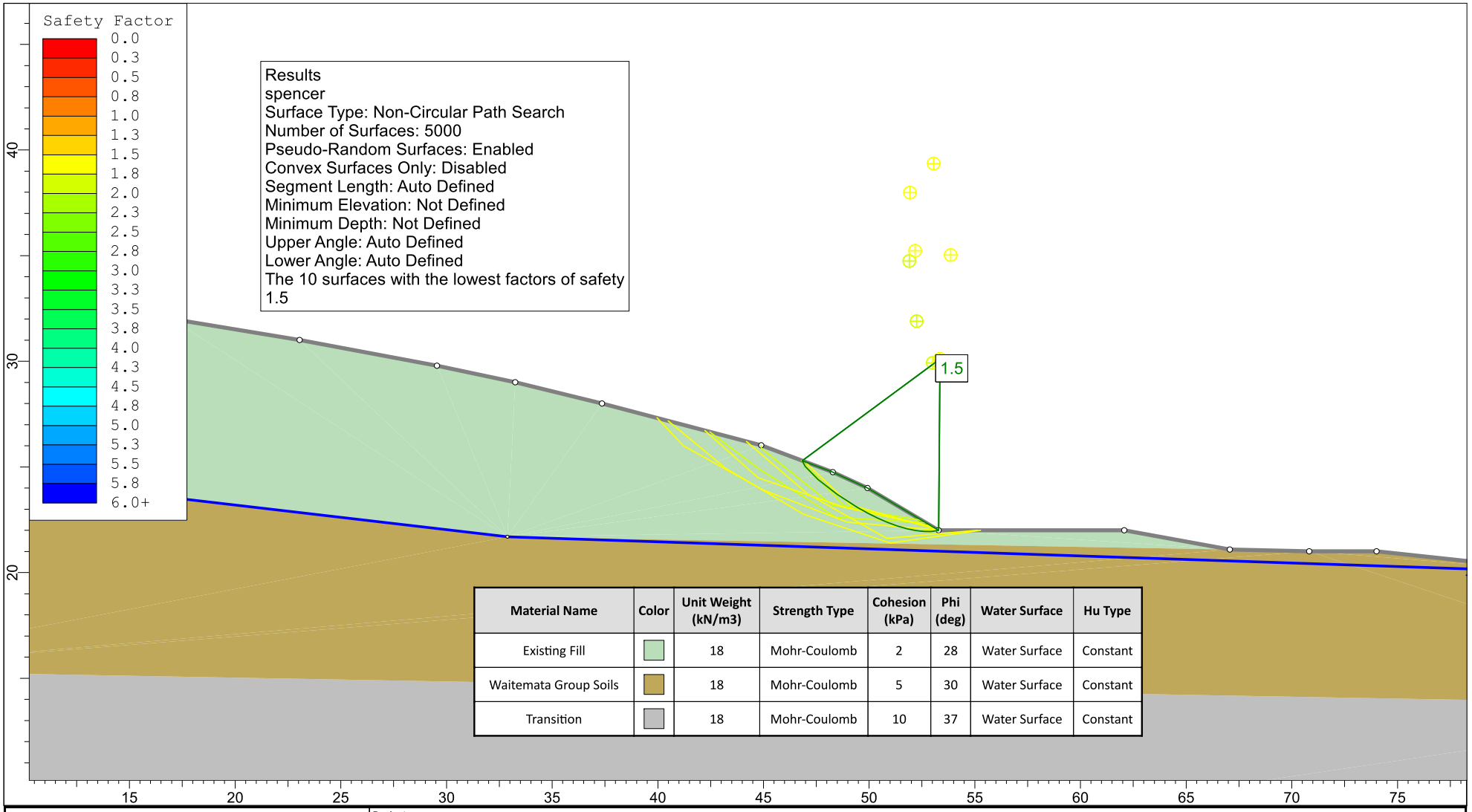
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Existing Fill		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 1, Section DD - Run 1		
Drawn By	PH	Scale	1:250
Company	KGA Geotechnical		
Date	31/08/2015	File Name	7464 - S1DD - Run 1.slim



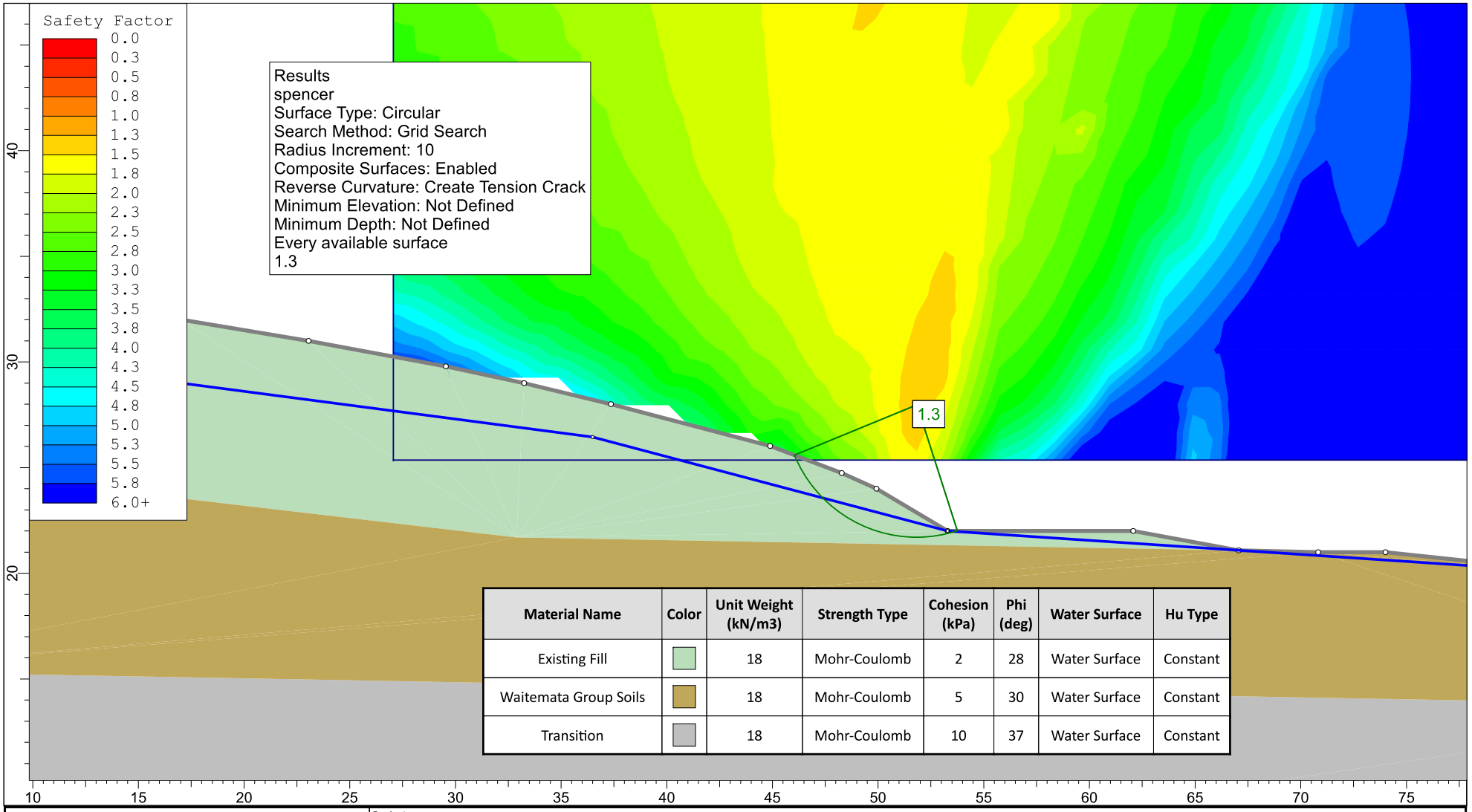
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Existing Fill		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section DD - Run 2				
Drawn By	PH	Scale	1:250	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1DD - Run 2.slim



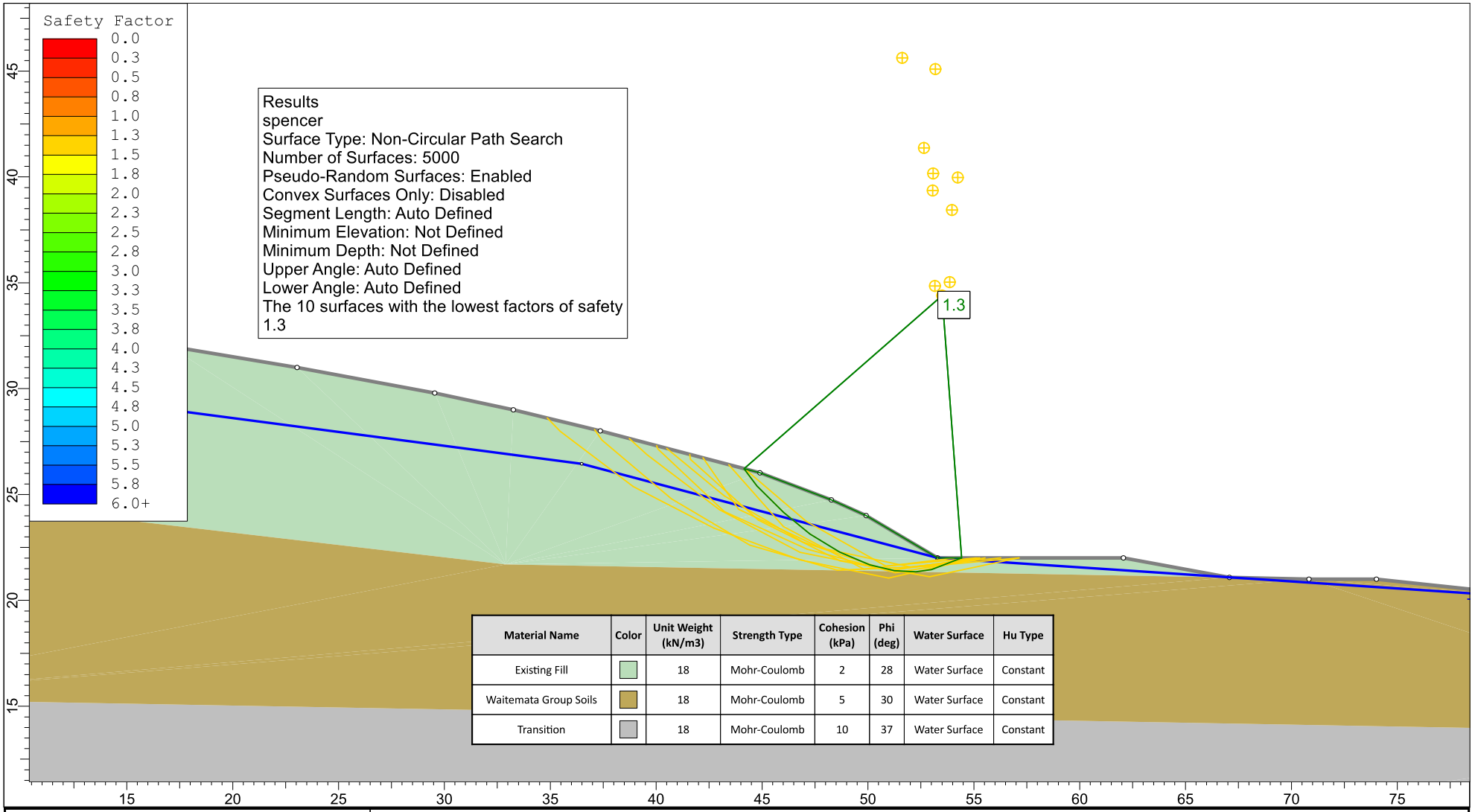
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Existing Fill		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section DD - Run 3				
Drawn By	PH	Scale	1:250	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1DD - Run 3.slim



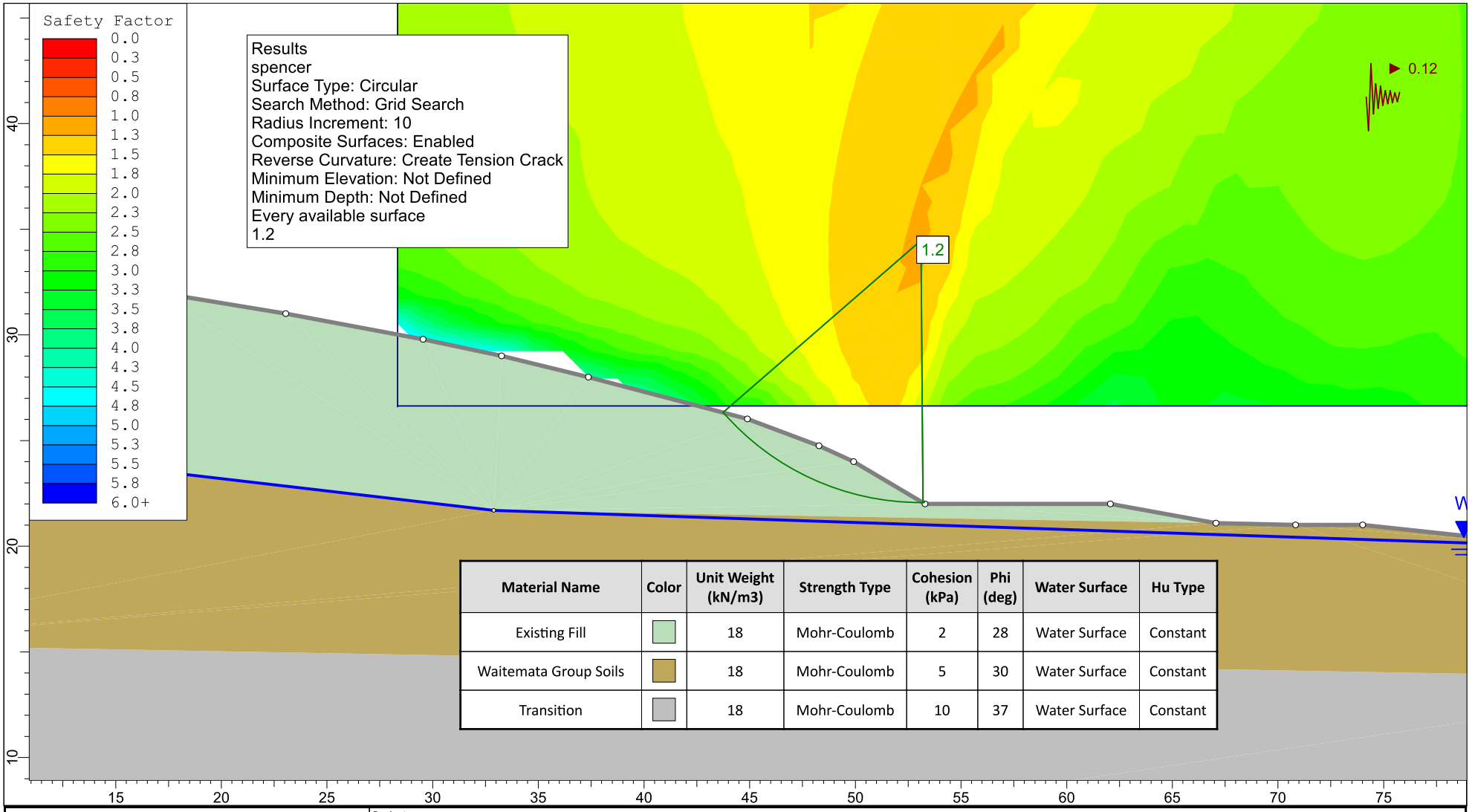
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Existing Fill		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section DD - Run 4				
Drawn By	PH	Scale	1:250	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1DD - Run 4.slim



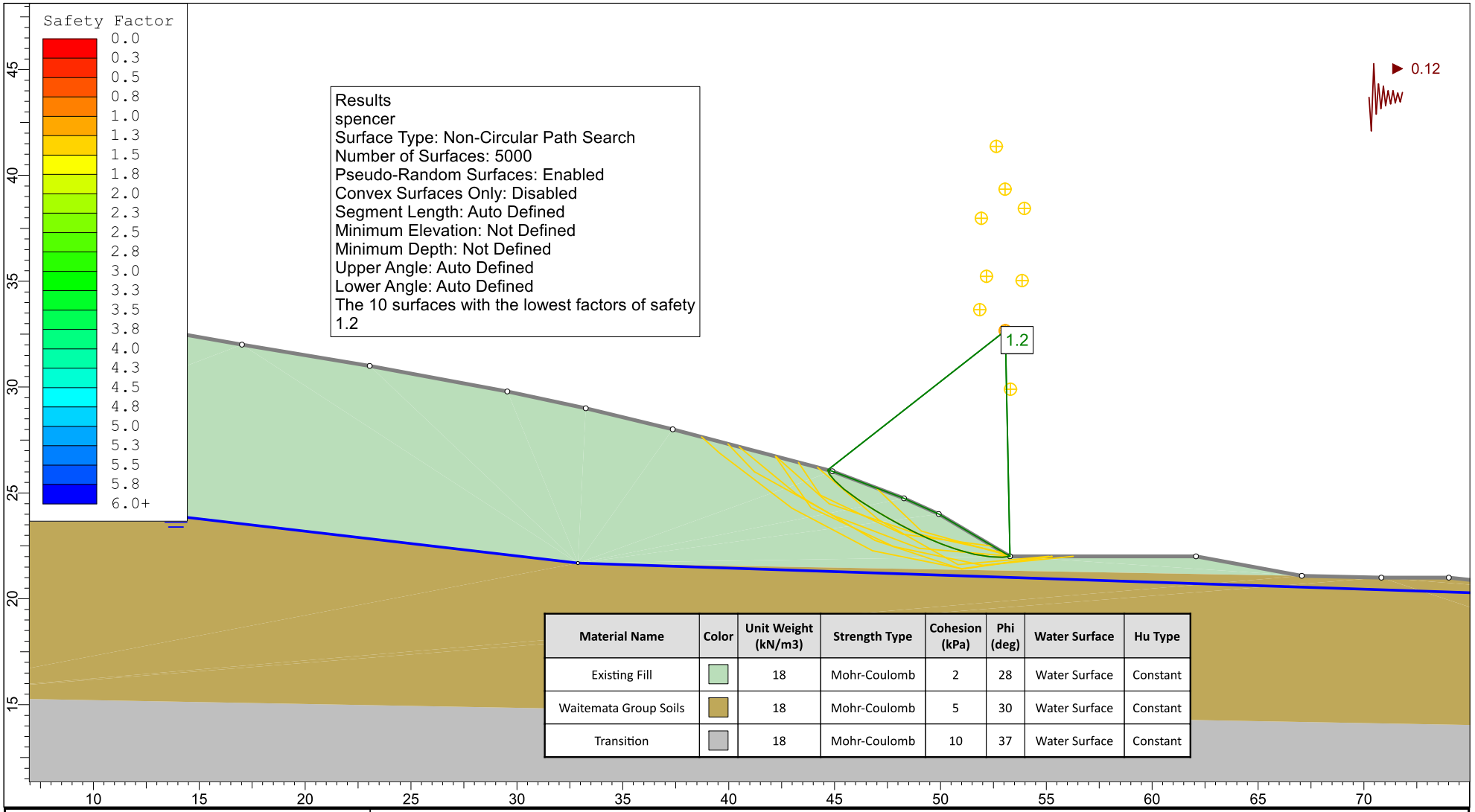
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Existing Fill		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section DD - Run 5				
Drawn By	PH	Scale	1:250	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1DD - Run 5.slim



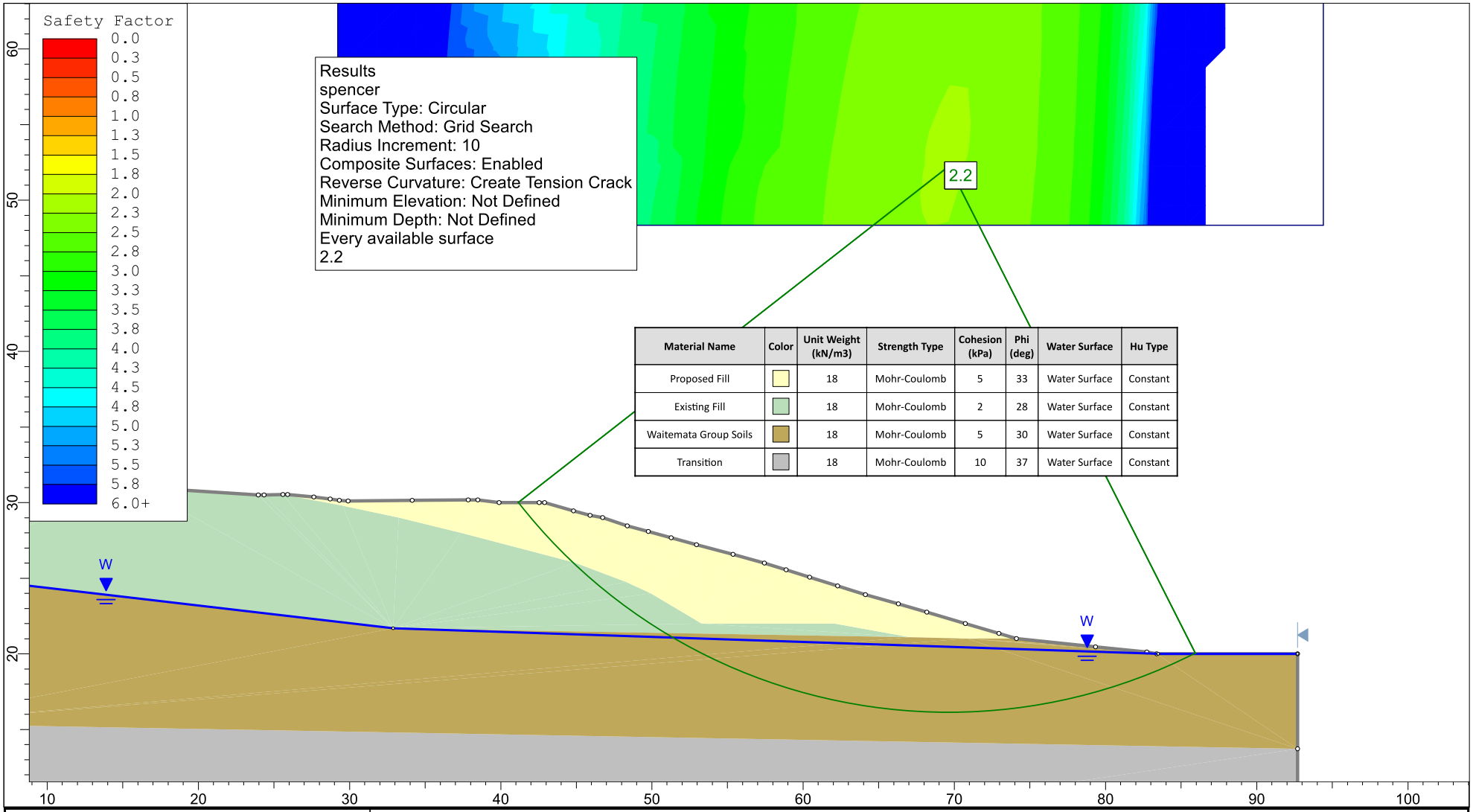
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Existing Fill		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section DD - Run 6				
Drawn By	PH	Scale	1:250	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1DD - Run 6.slim



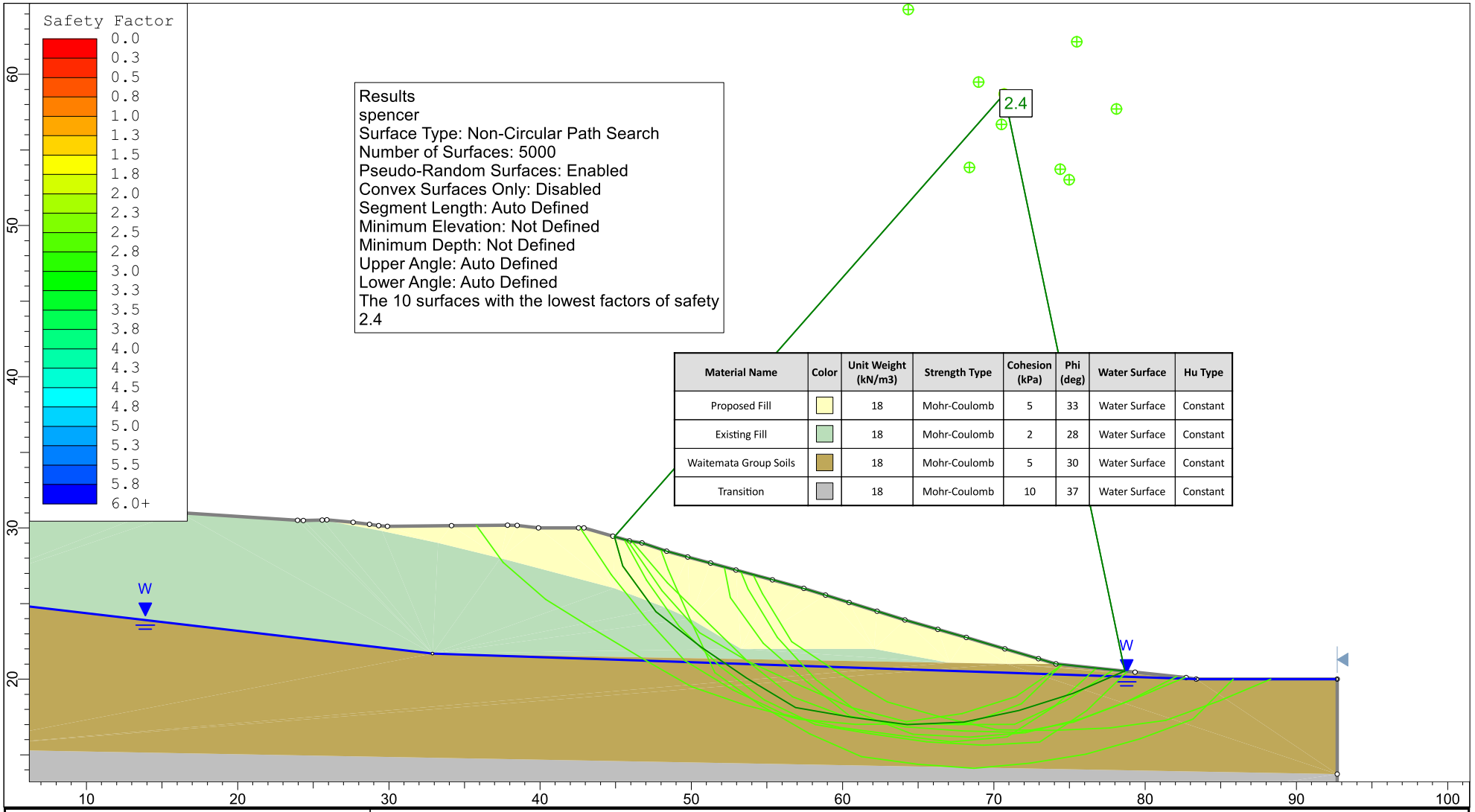
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Existing Fill		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section DD - Run 7				
Drawn By	PH	*Scale*	1:350	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S1DD - Run 7.slim



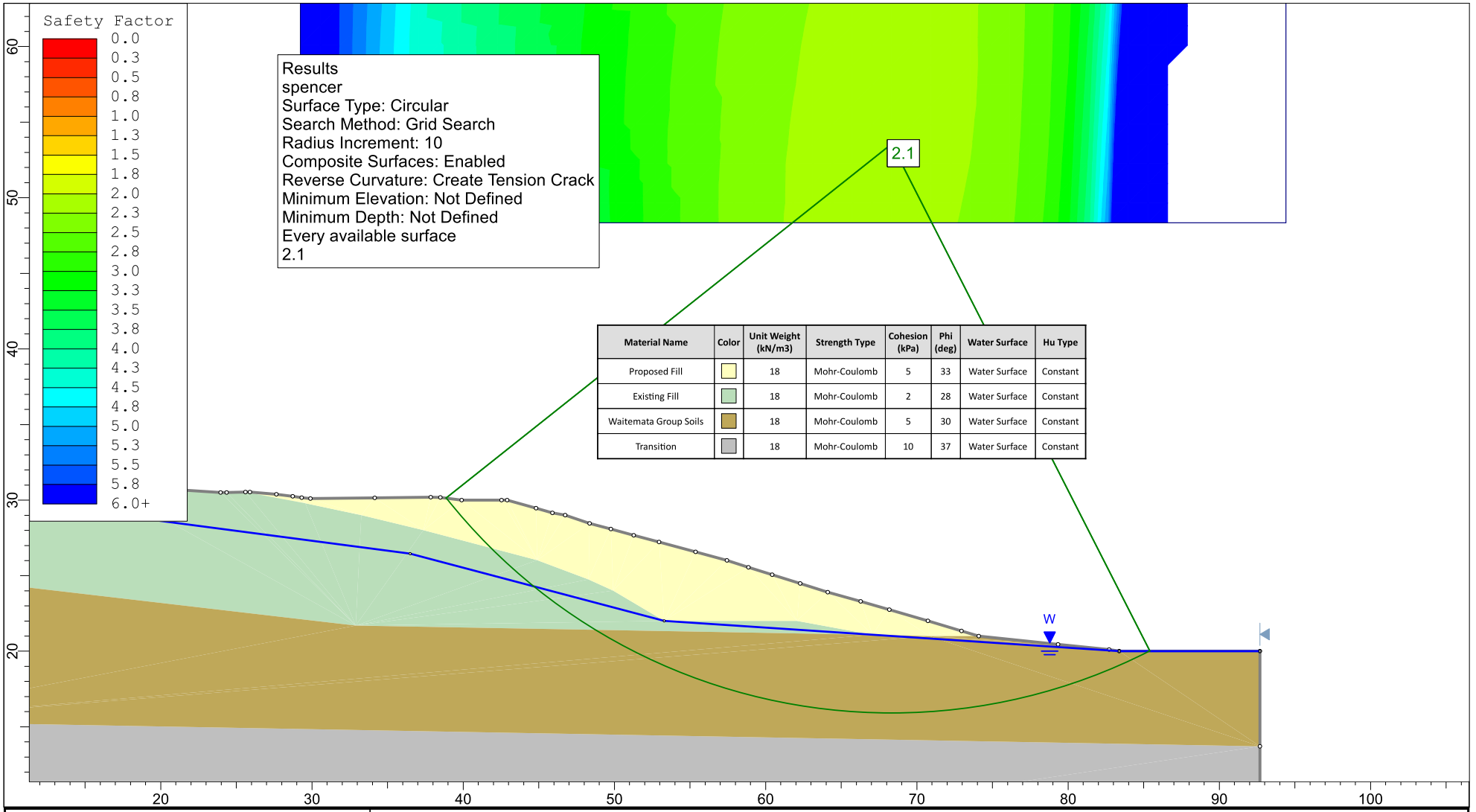
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Existing Fill		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section DD - Run 8				
Drawn By	PH	Scale	1:350	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1DD - Run 8.slim



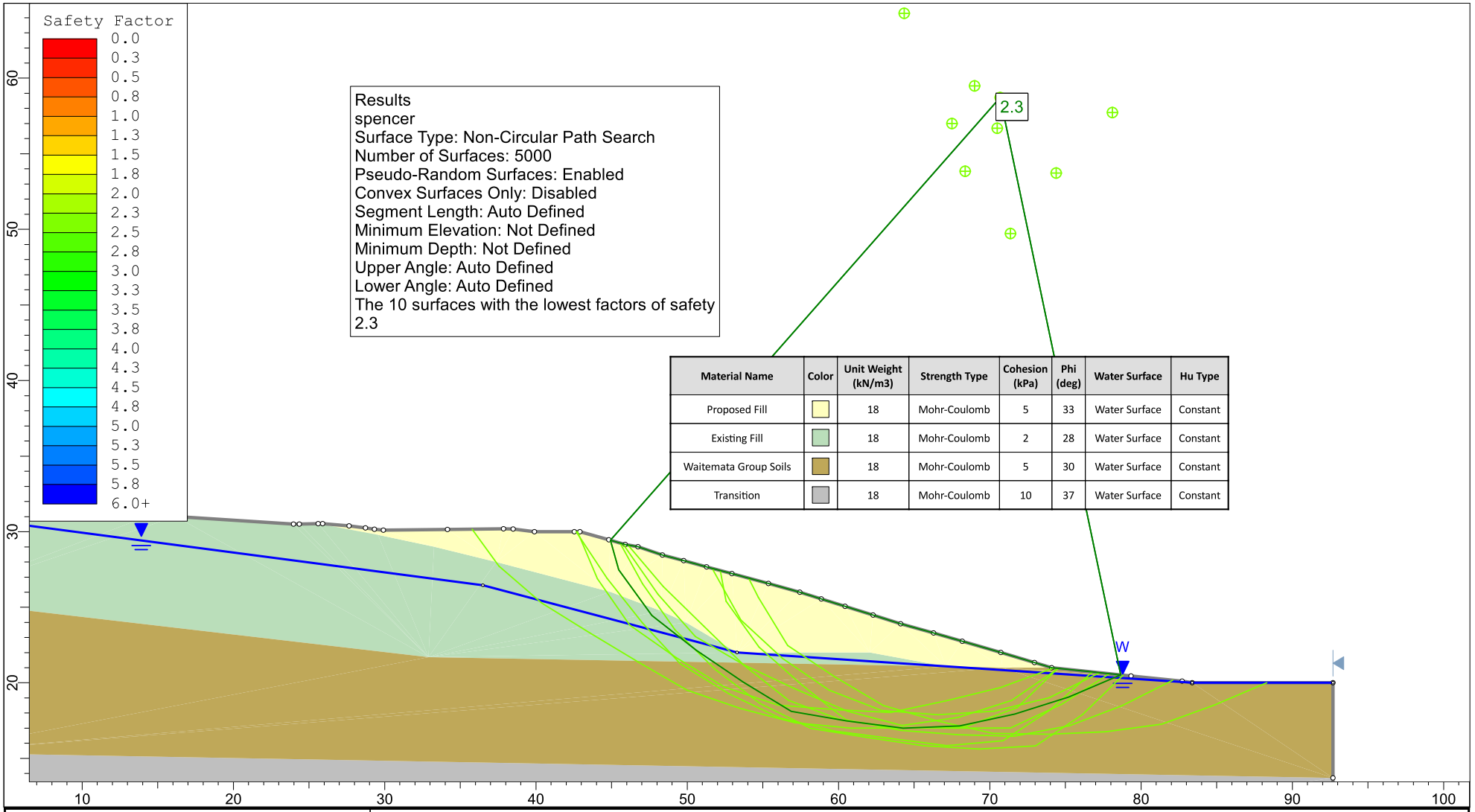
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Existing Fill		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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SLIDEINTERPRET 6.018

Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section DD - Run 9				
Drawn By	PH	*Scale*	1:350	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S1DD - Run 9.slim



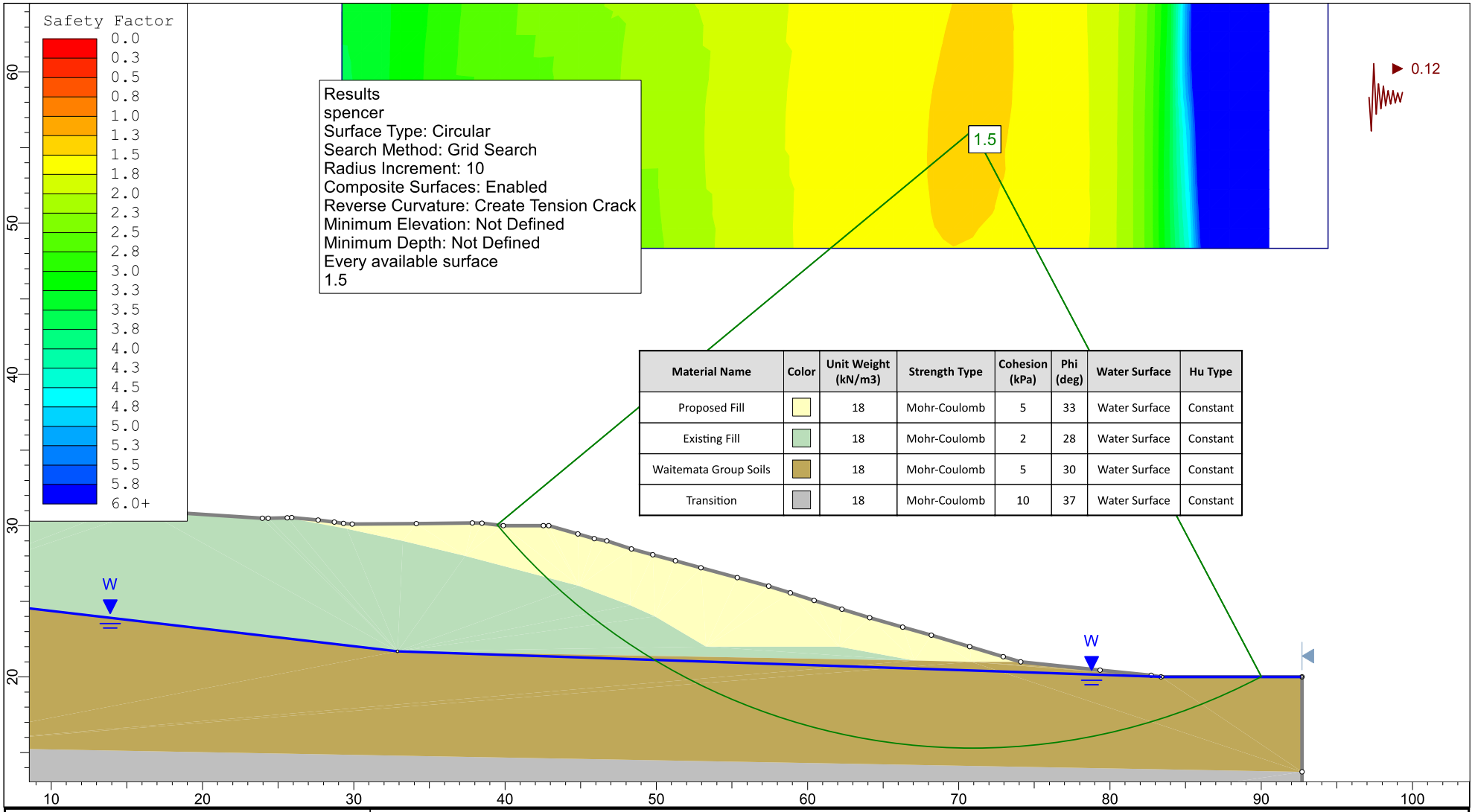
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Existing Fill		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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SLIDEINTERPRET 6.018

Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section DD - Run 10				
Drawn By	PH	*Scale*	1:350	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S1DD - Run 10.slim



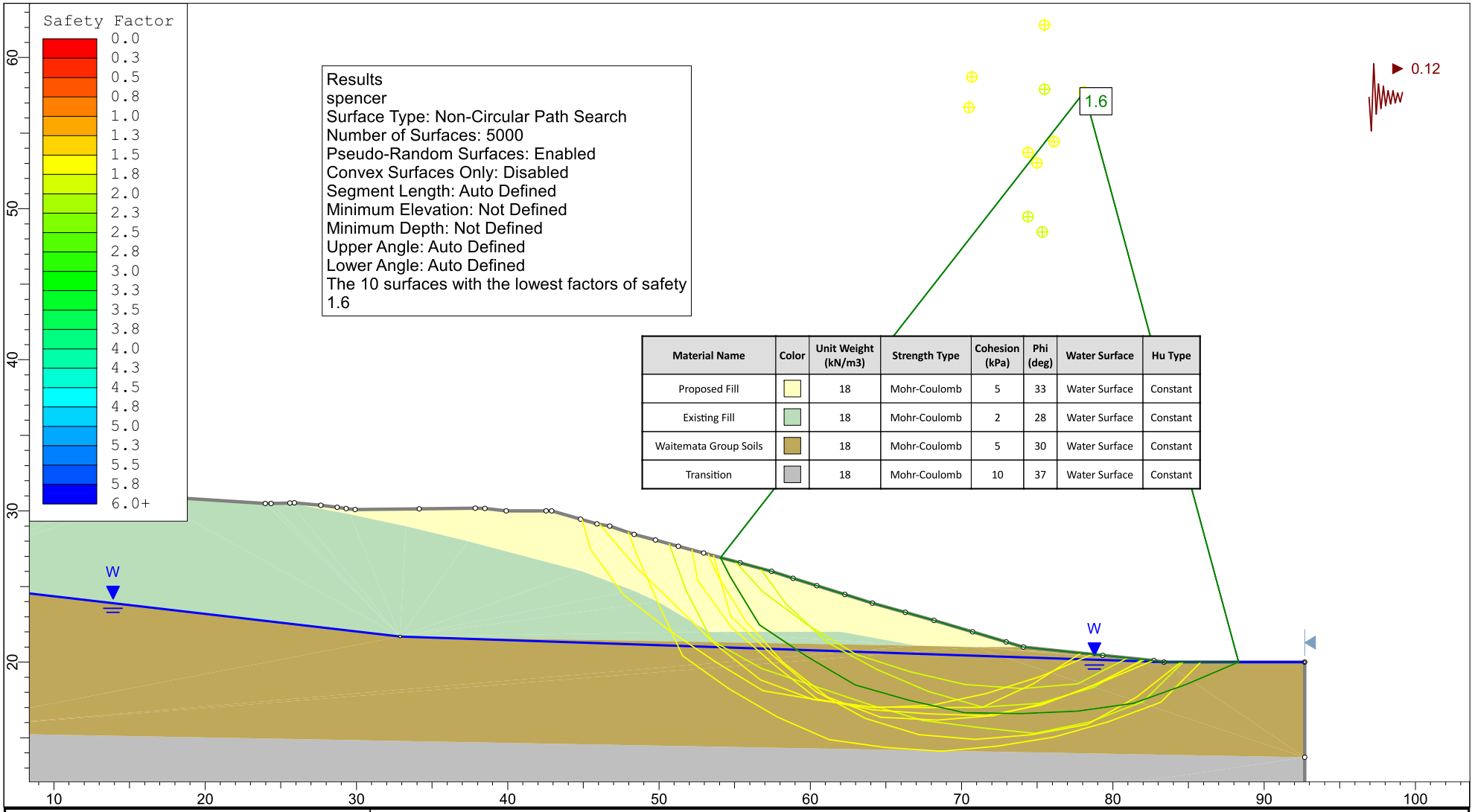
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Existing Fill		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section DD - Run 11				
Drawn By	PH	Scale	1:350	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1DD - Run 11.slim



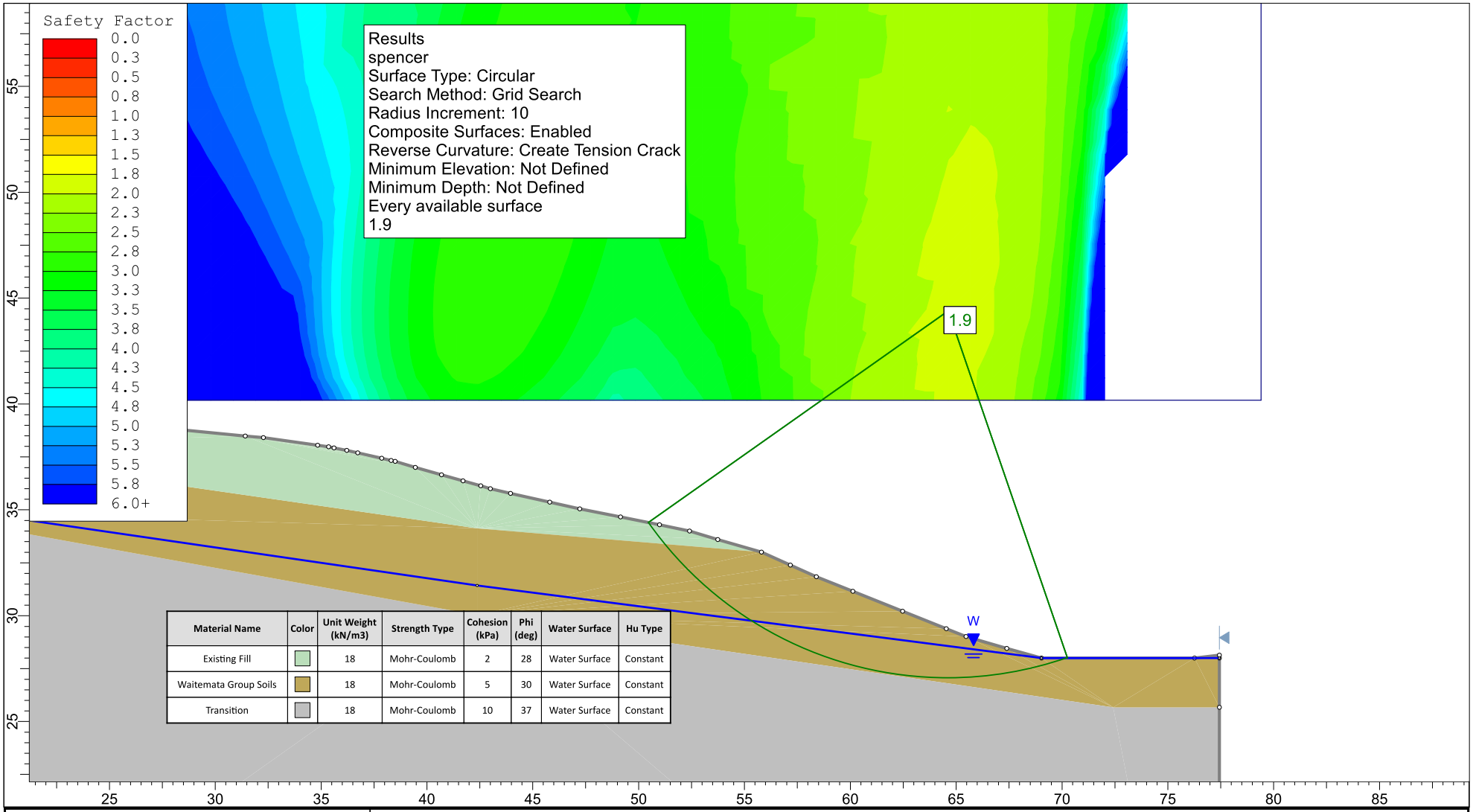
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Existing Fill		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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SLIDEINTERPRET 6.018

Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section DD - Run 12				
Drawn By	PH	Scale	1:350	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1DD - Run 12.slim



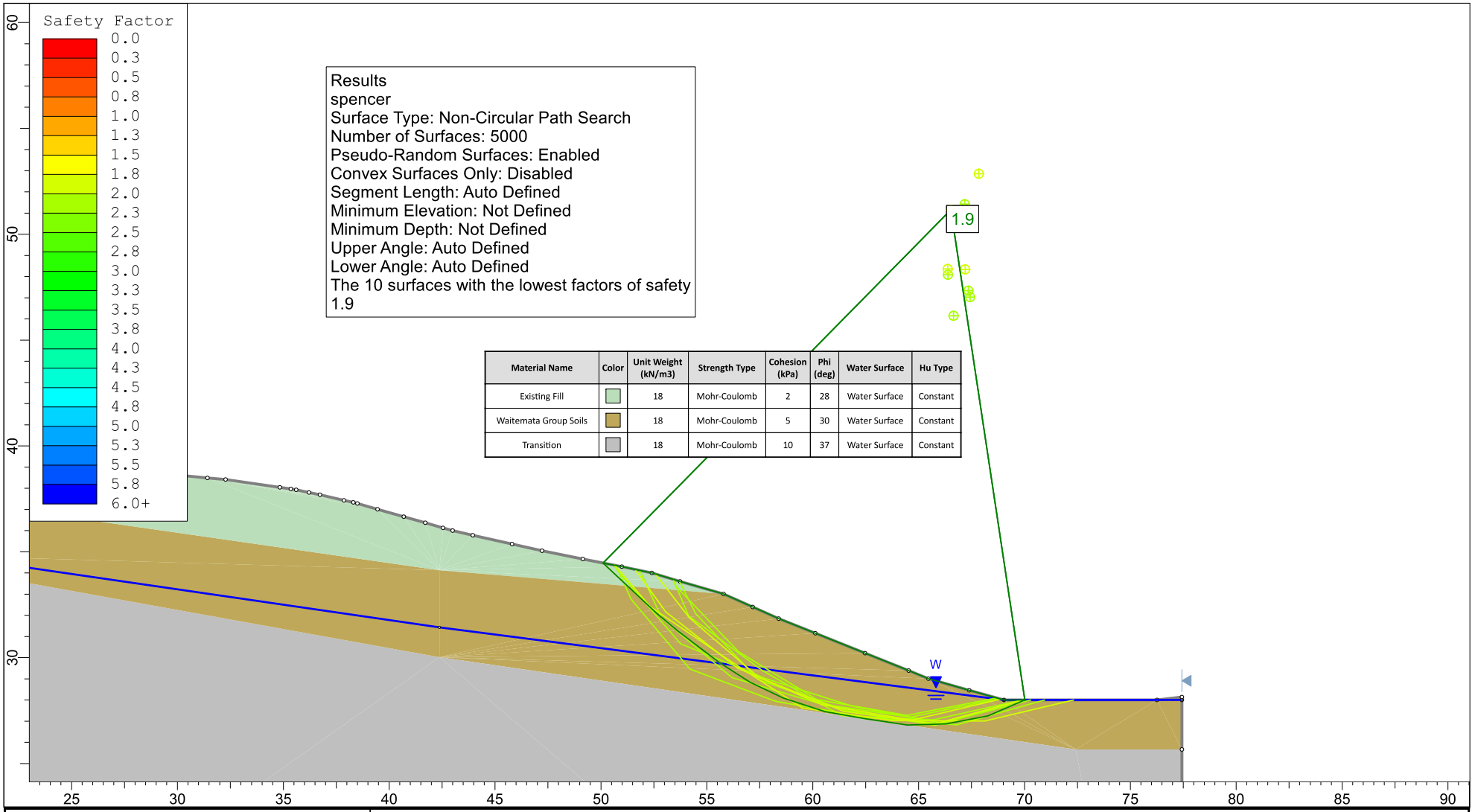
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Existing Fill		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section EE - Run 1				
Drawn By	PH	*Scale*	1:250	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S1EE - Run 1.slim



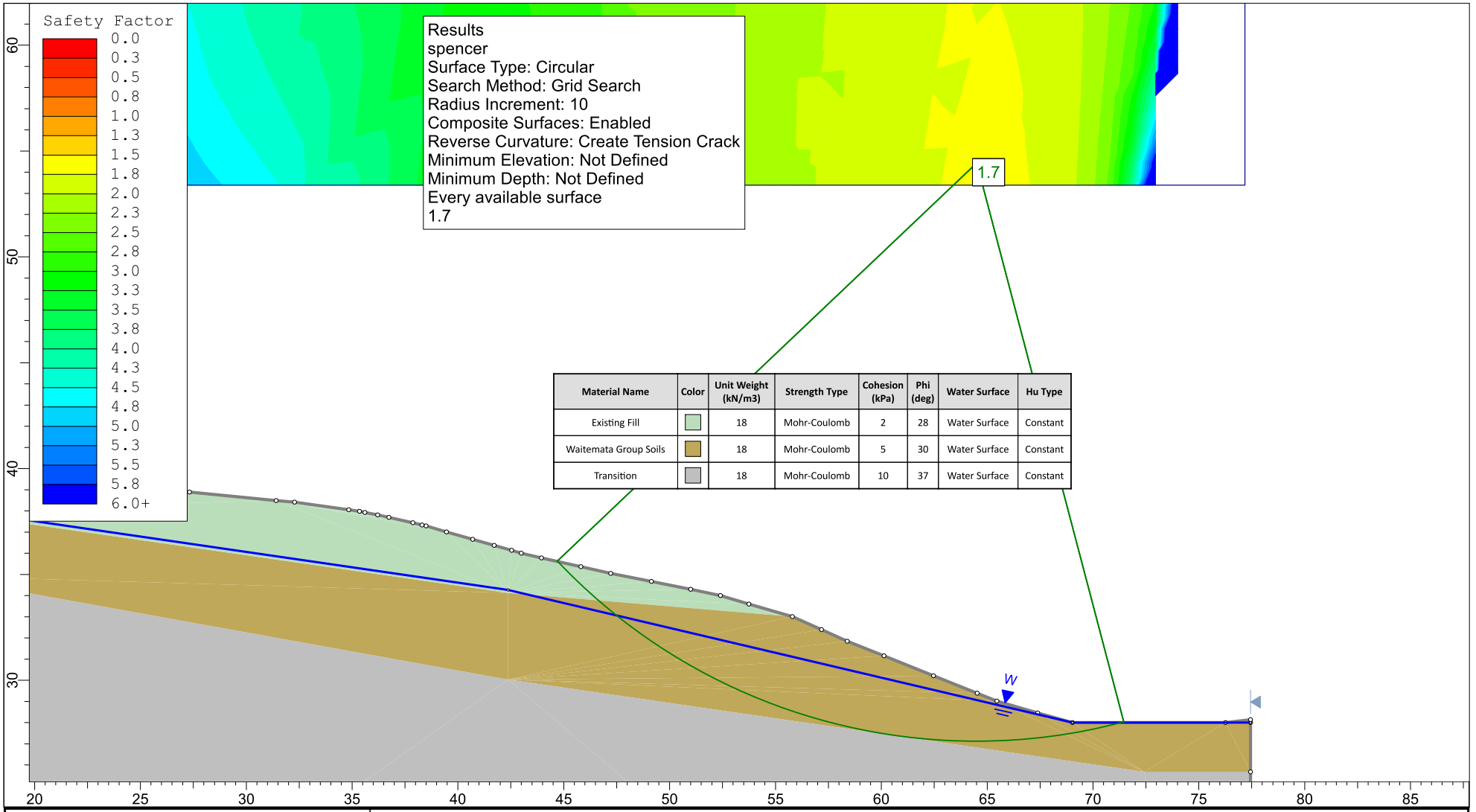
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Existing Fill		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section EE - Run 2				
Drawn By	PH	*Scale*	1:250	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S1EE - Run 2.slim



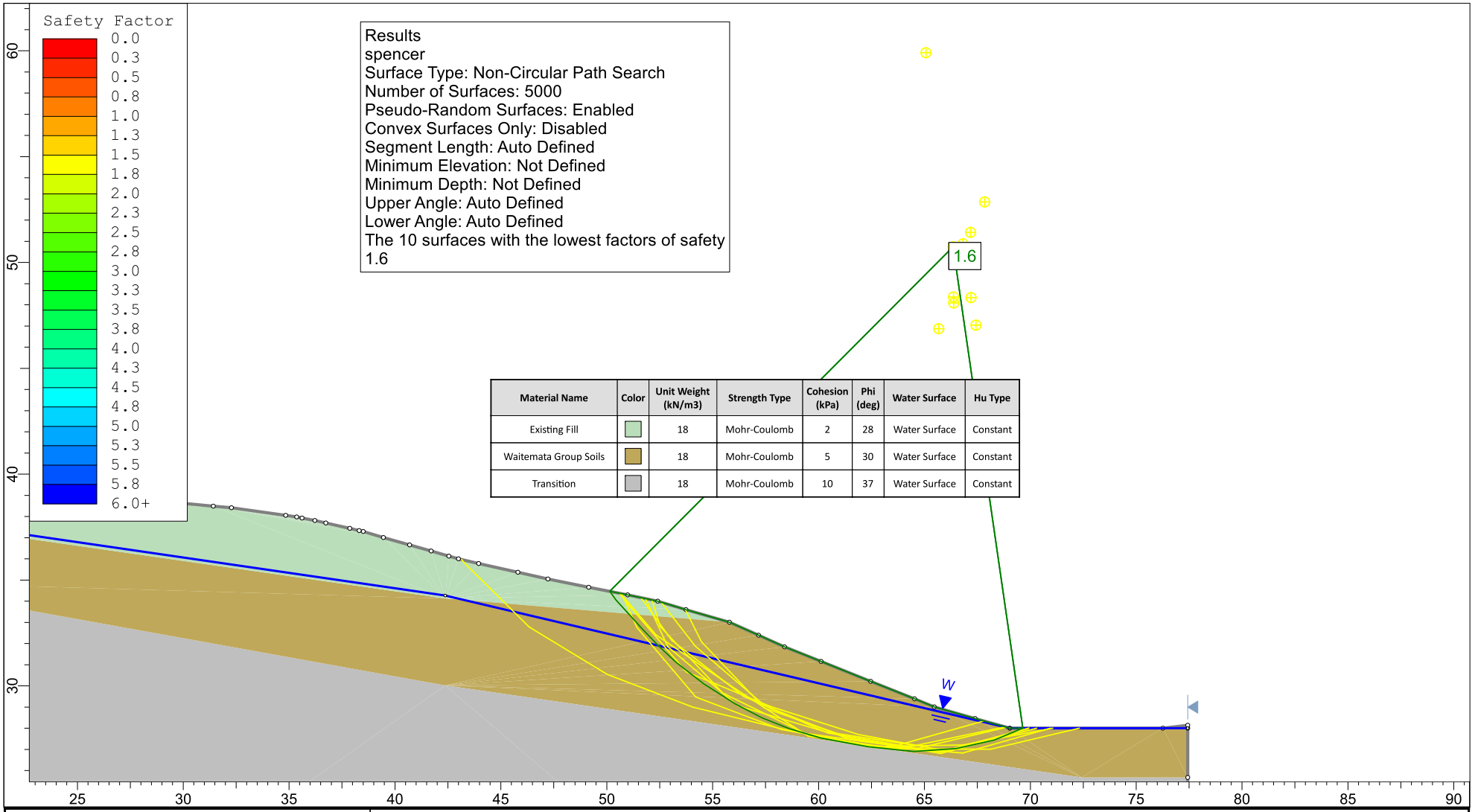
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Existing Fill		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section EE - Run 3				
Drawn By	PH	*Scale*	1:250	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S1EE - Run 3.slim



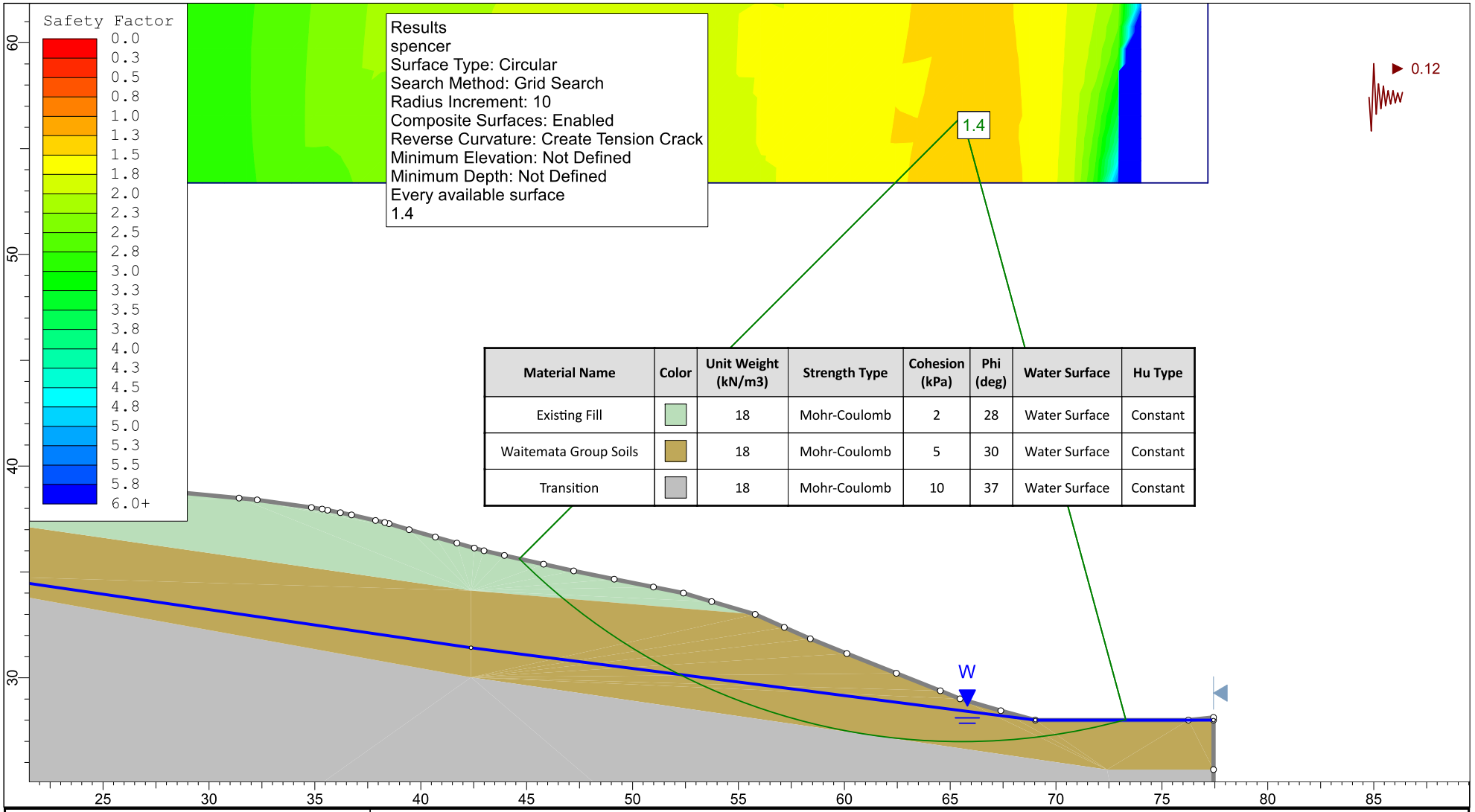
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Existing Fill		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section EE - Run 3				
Drawn By	PH	Scale	1:250	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1EE - Run 4.slim



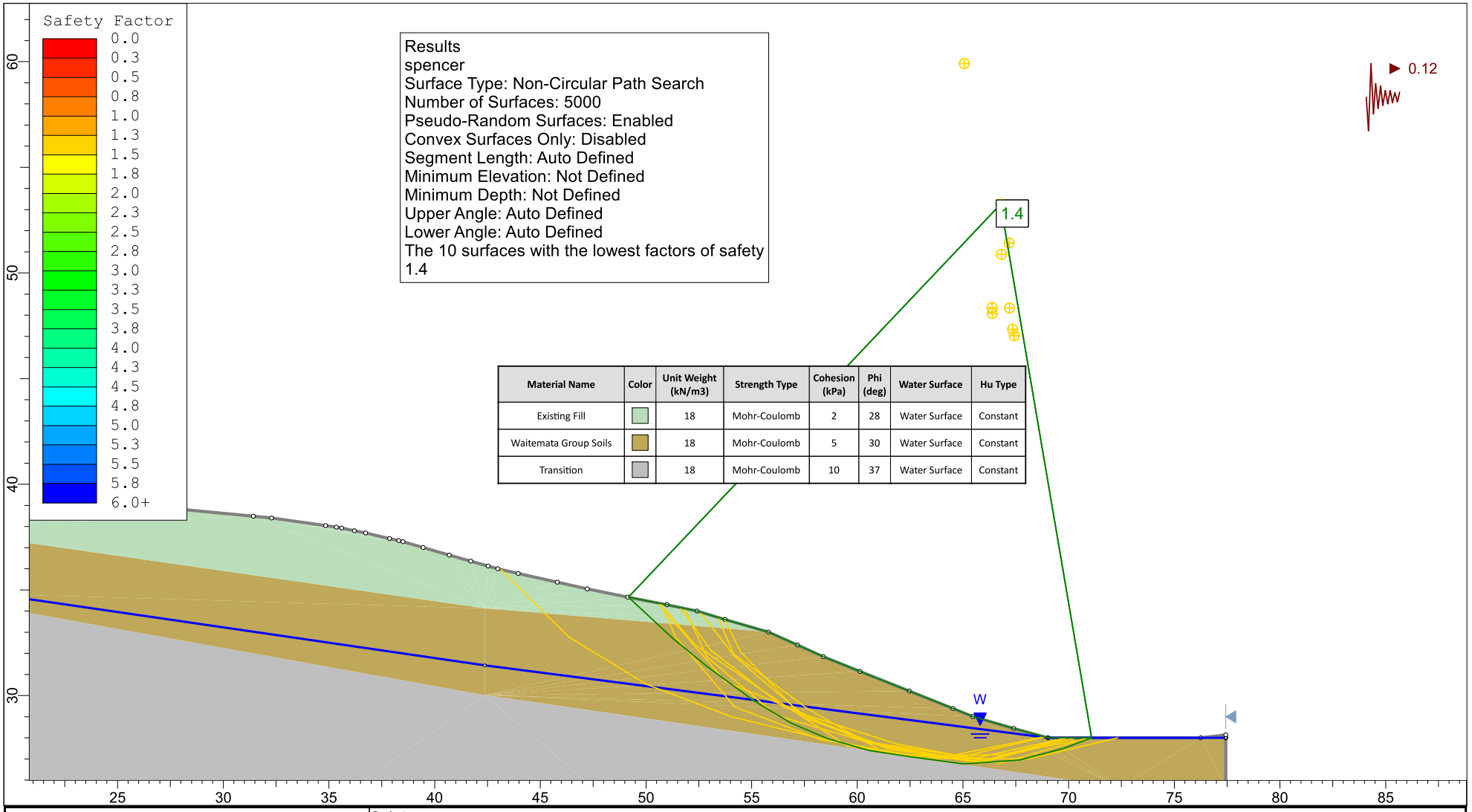
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Existing Fill		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section EE - Run 5				
Drawn By	PH	Scale	1:250	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1EE - Run 5.slim



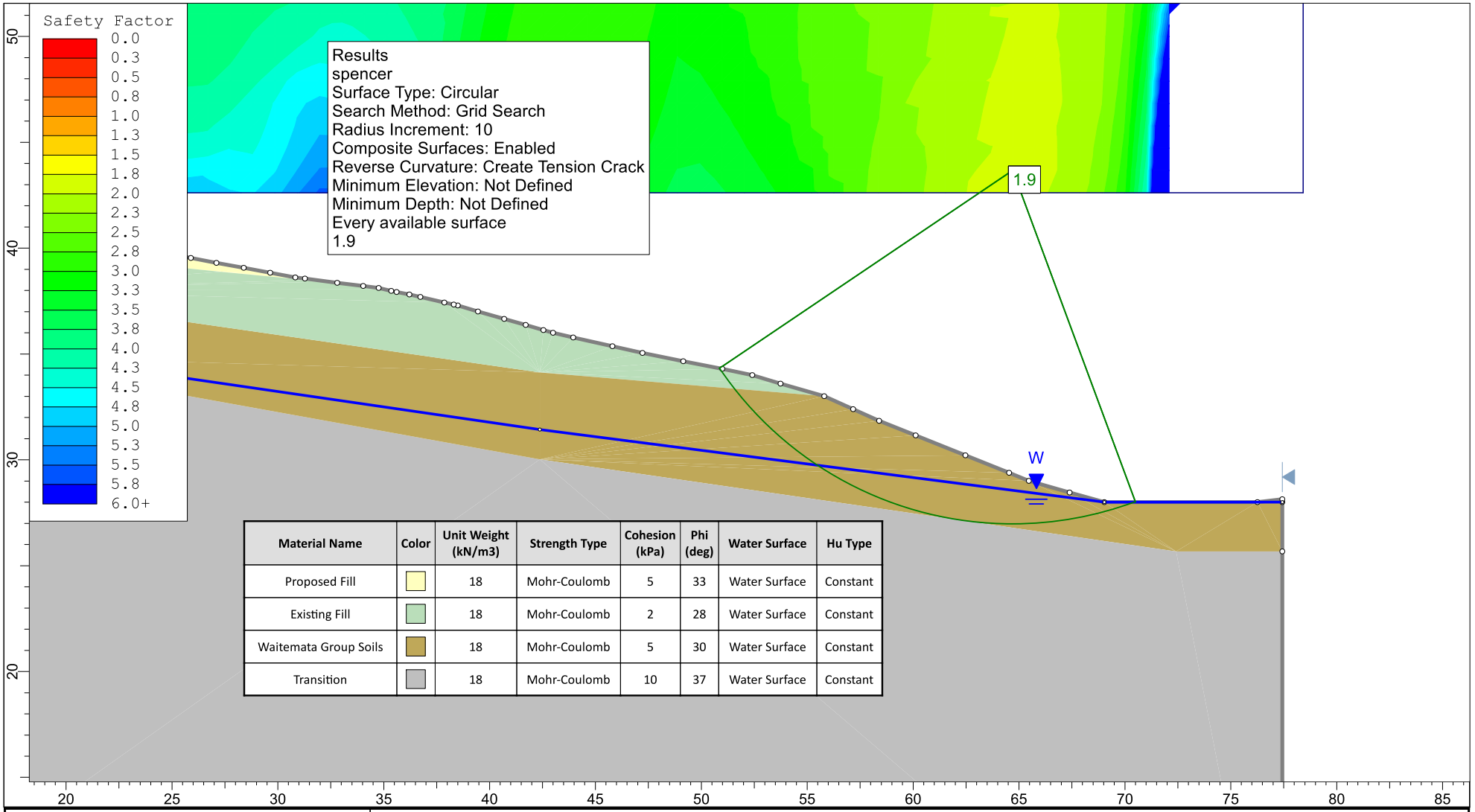
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Existing Fill		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section EE - Run 6				
Drawn By	PH	*Scale*	1:250	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S1EE - Run 6.slim



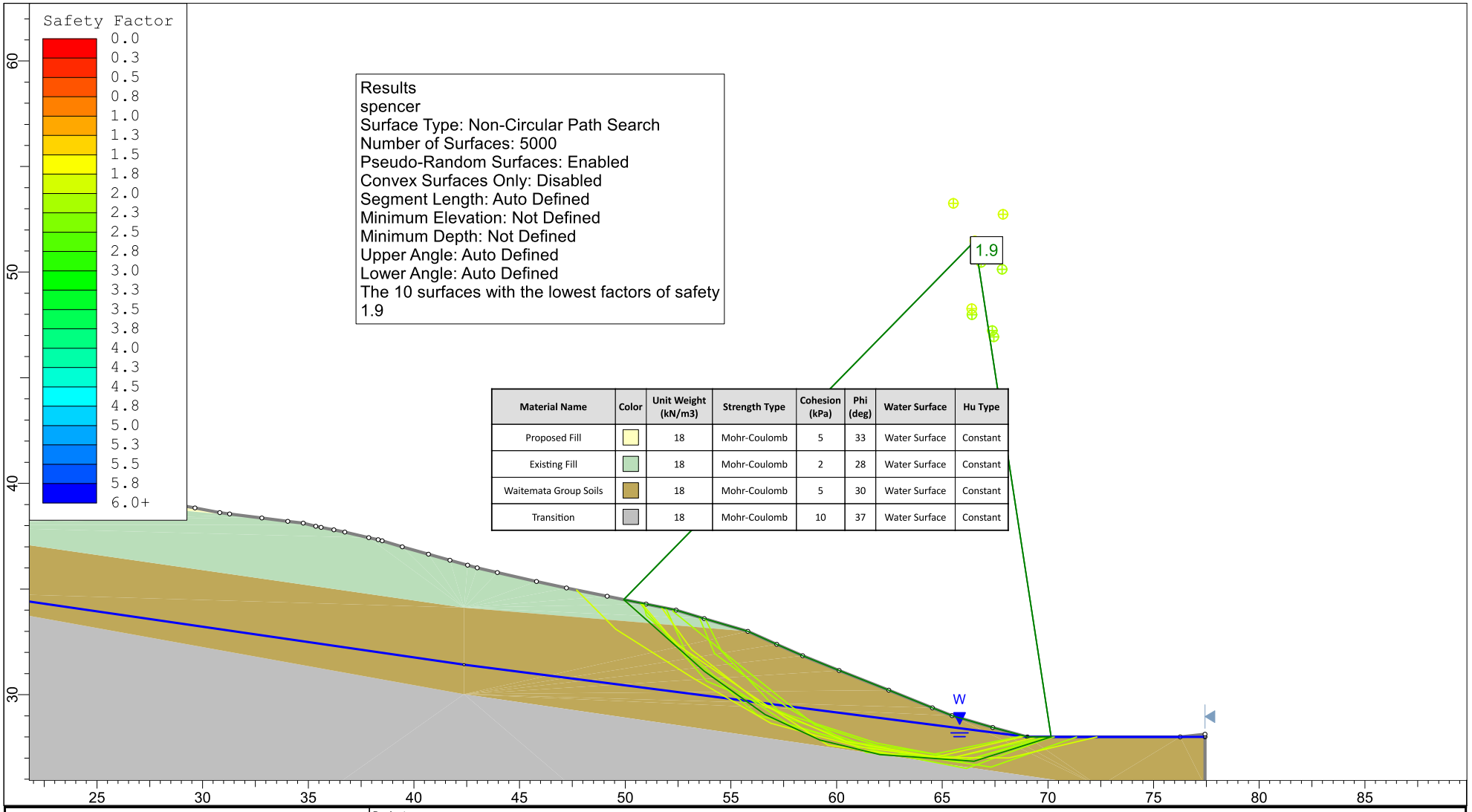
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Existing Fill		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section EE - Run 7				
Drawn By	PH	Scale	1:250	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1EE - Run 7.slim



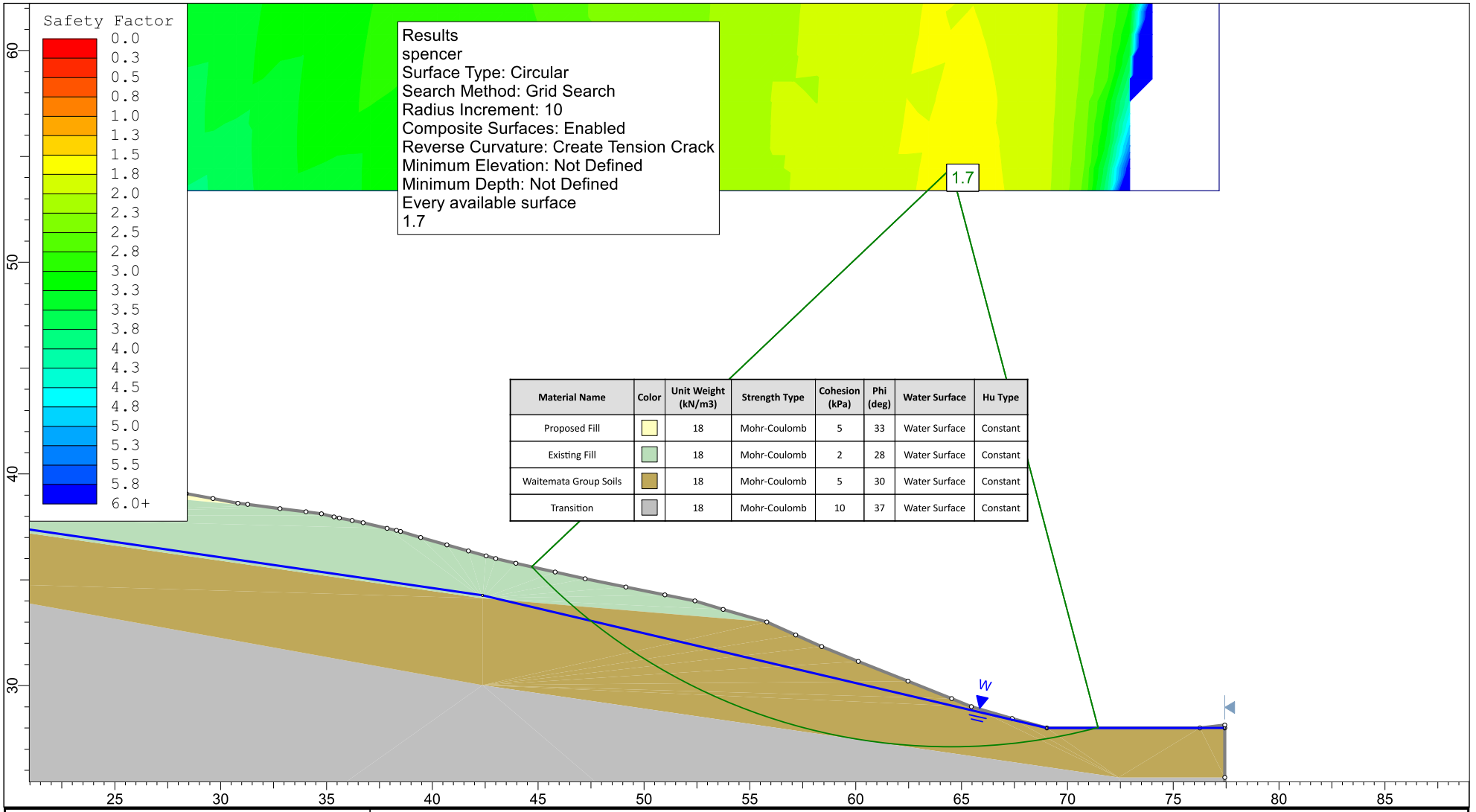
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Existing Fill		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section EE - Run 8				
Drawn By	PH	*Scale*	1:250	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S1EE - Run 8.slim



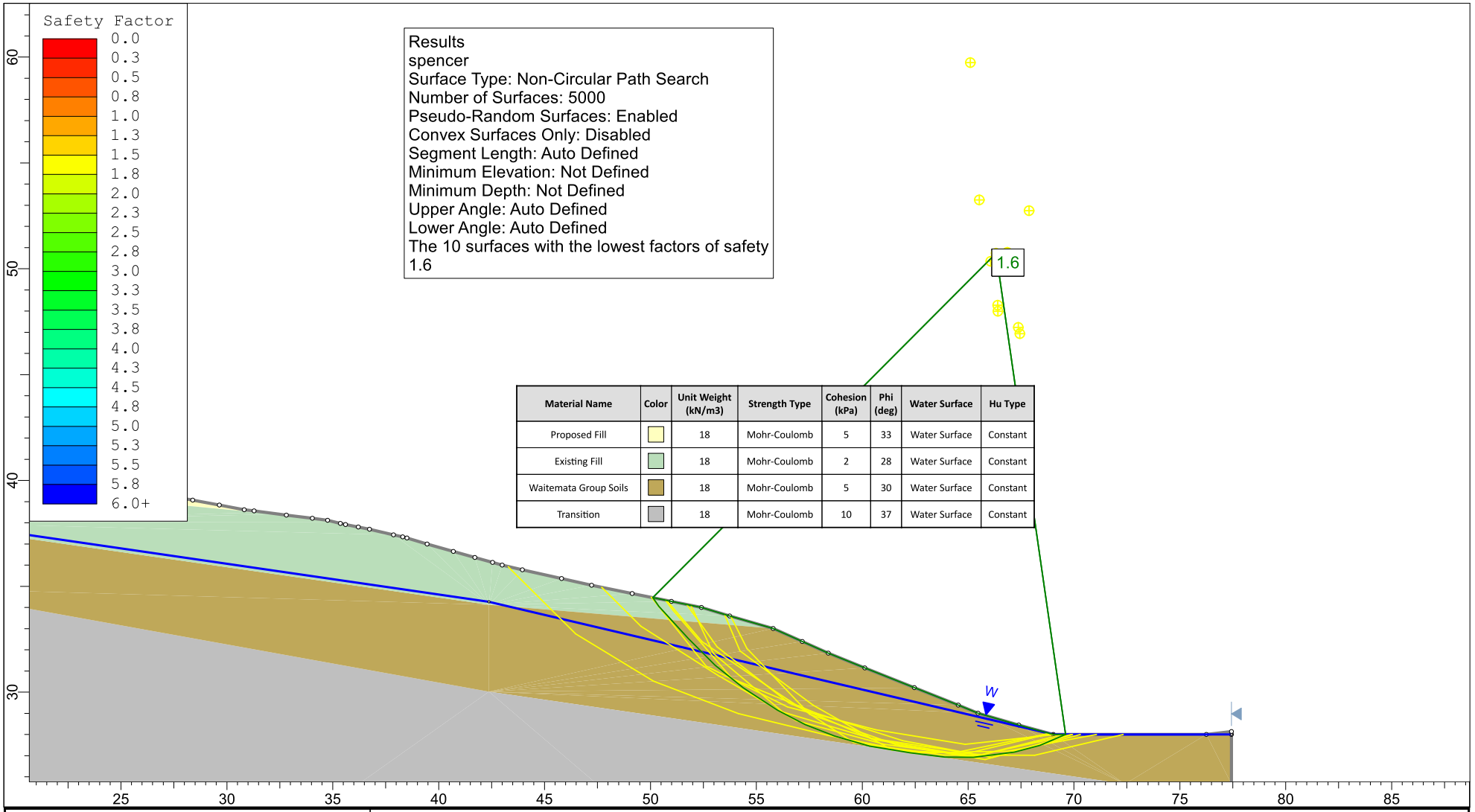
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Existing Fill		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section EE - Run 9				
Drawn By	PH	Scale	1:250	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1EE - Run 9.slim



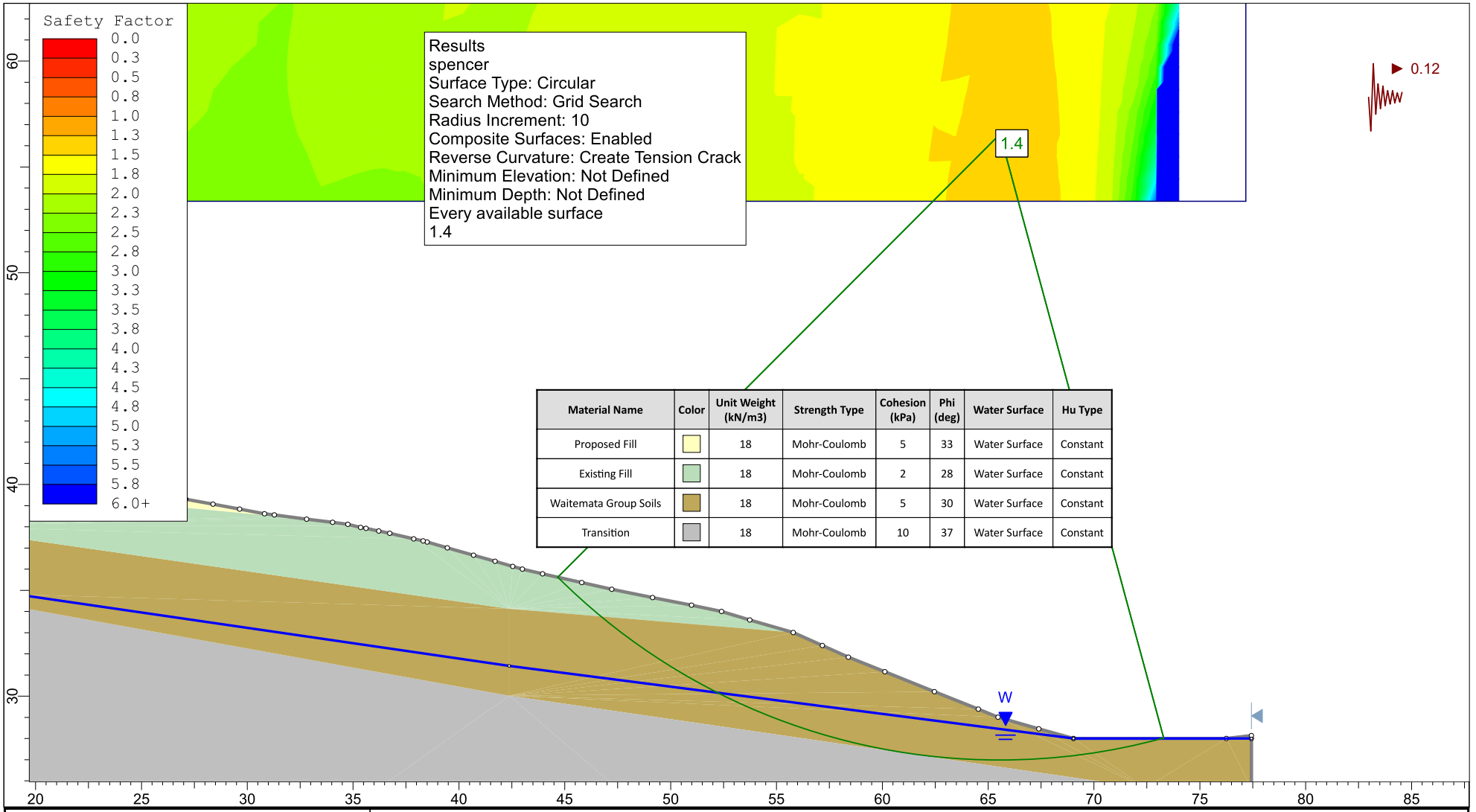
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Existing Fill		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section EE - Run 10				
Drawn By	PH	*Scale*	1:250	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S1EE - Run 10.slim



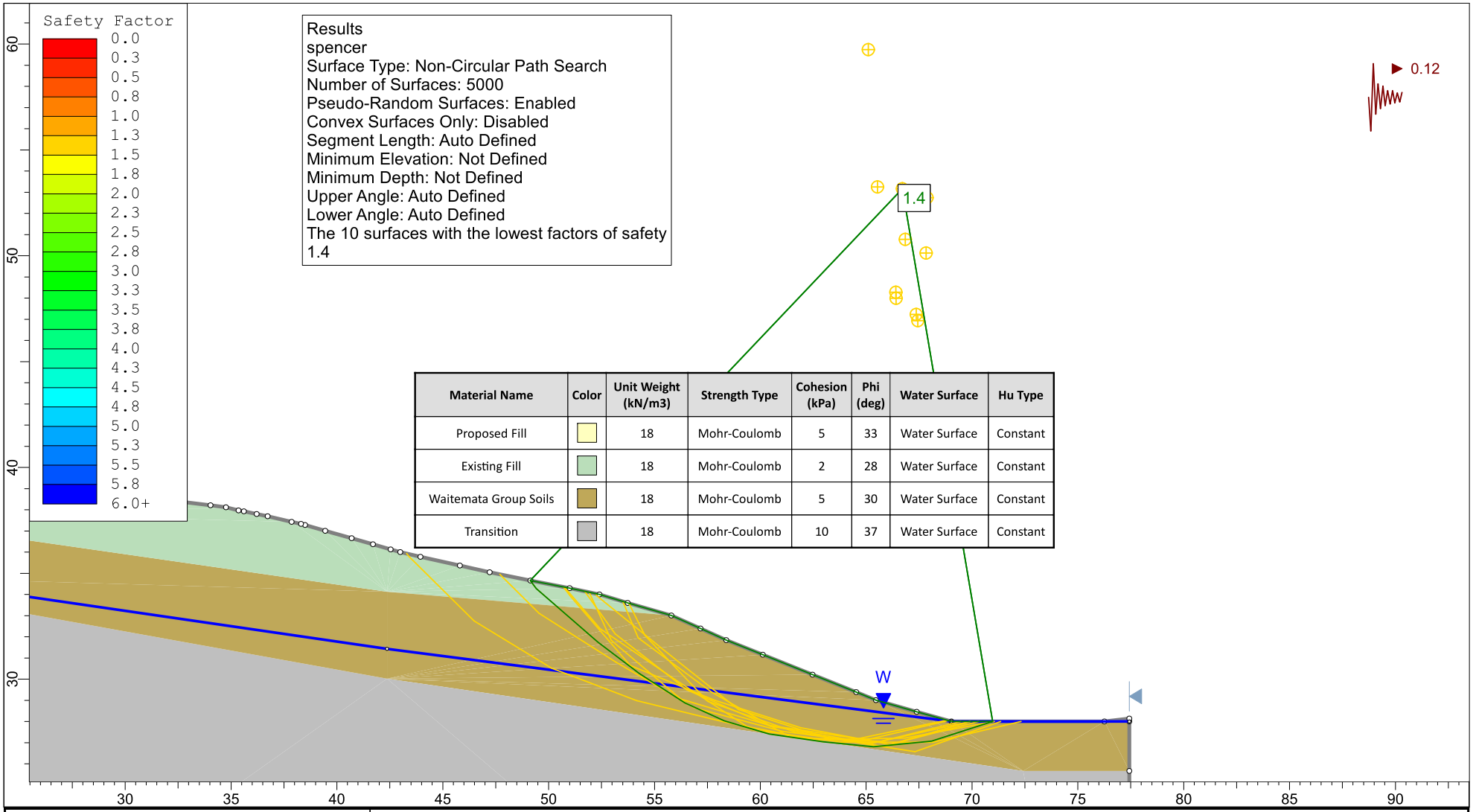
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Existing Fill		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section EE - Run 11				
Drawn By	PH	*Scale*	1:250	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S1EE - Run 11.slim



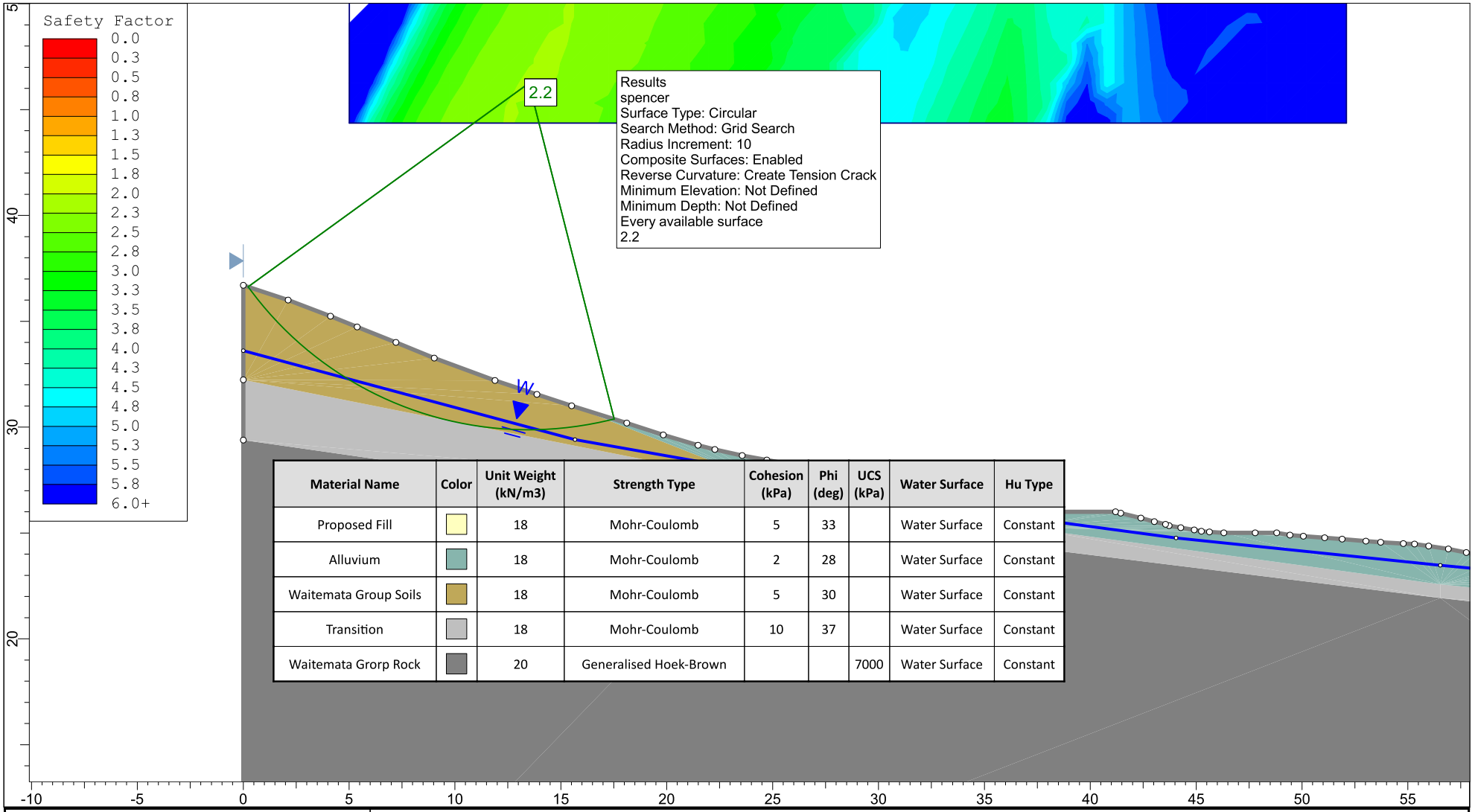
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Existing Fill		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 1, Section EE - Run 12		
Drawn By: PH	Scale: 1:250	Company: KGA Geotechnical	
Date: 31/08/2015		File Name: 7464 - S1EE - Run 12.slim	



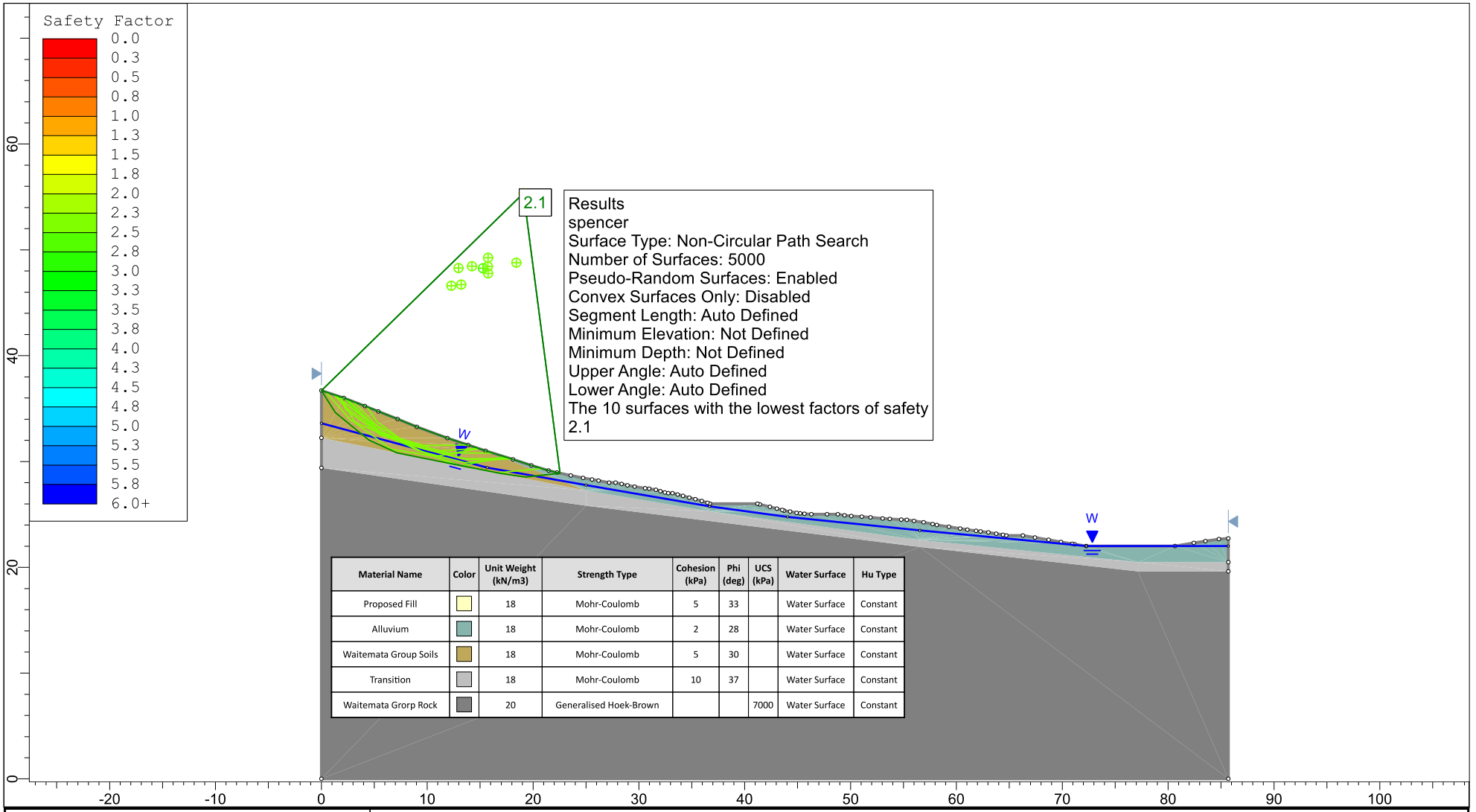
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section FF- Run 1				
Drawn By	PH	Scale	1:250	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1FF - Run 1.slim



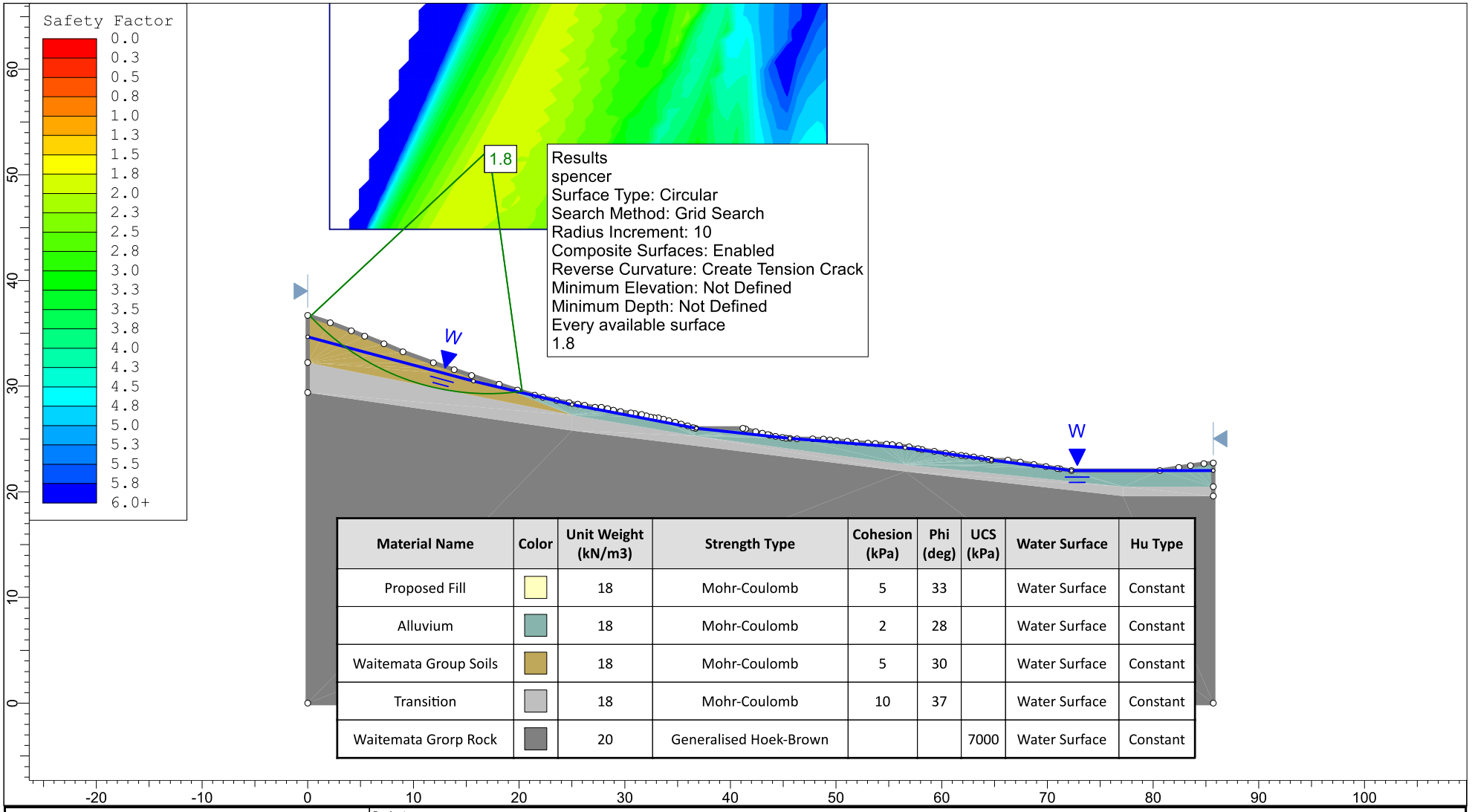
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section FF- Run 2				
Drawn By	PH	Scale	1:500	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1FF - Run 2.slim



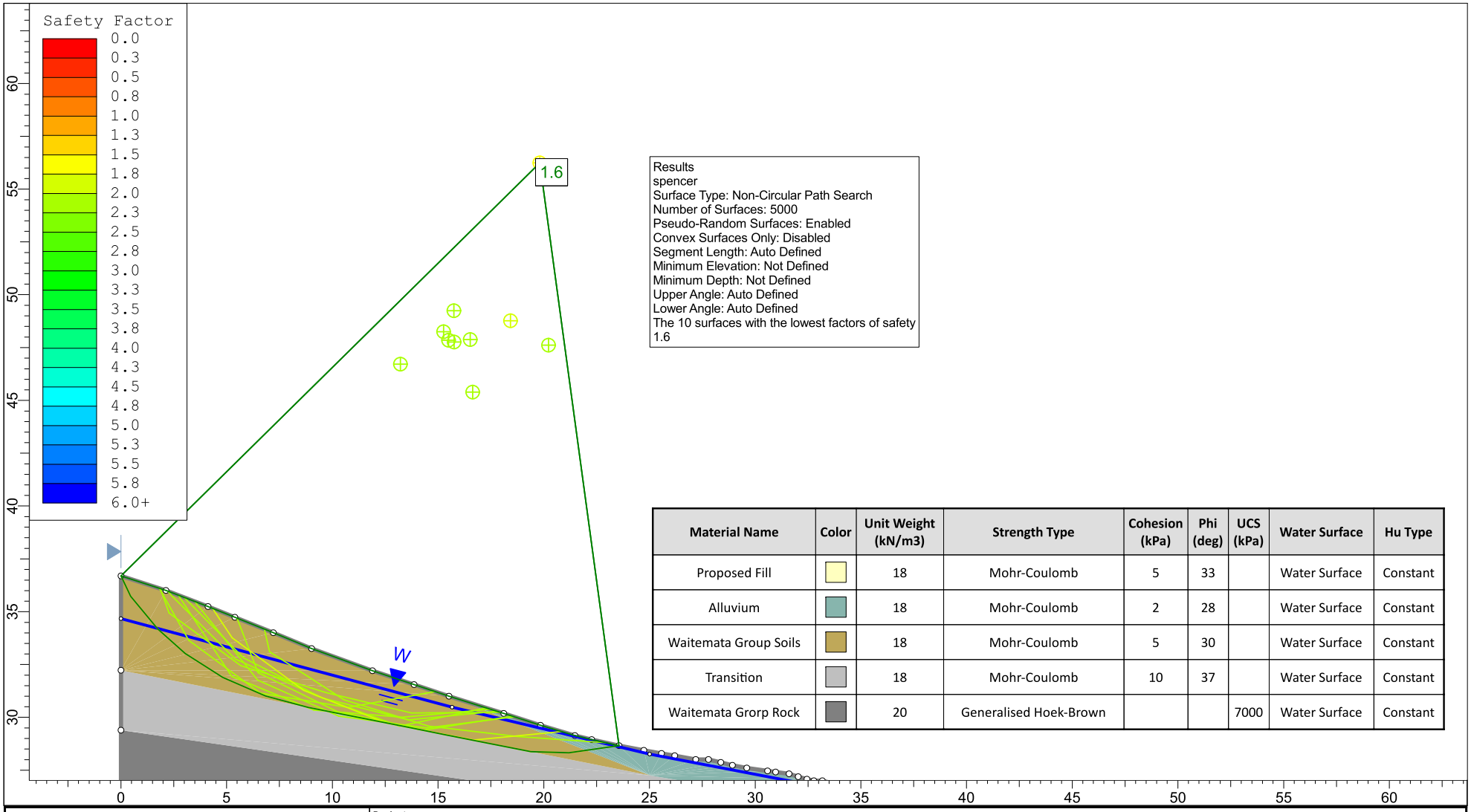
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section FF- Run 3				
Drawn By	PH	Scale	1:500	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1FF - Run 3.slim



Results
spencer
Surface Type: Non-Circular Path Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Segment Length: Auto Defined
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Upper Angle: Auto Defined
Lower Angle: Auto Defined
The 10 surfaces with the lowest factors of safety
1.6

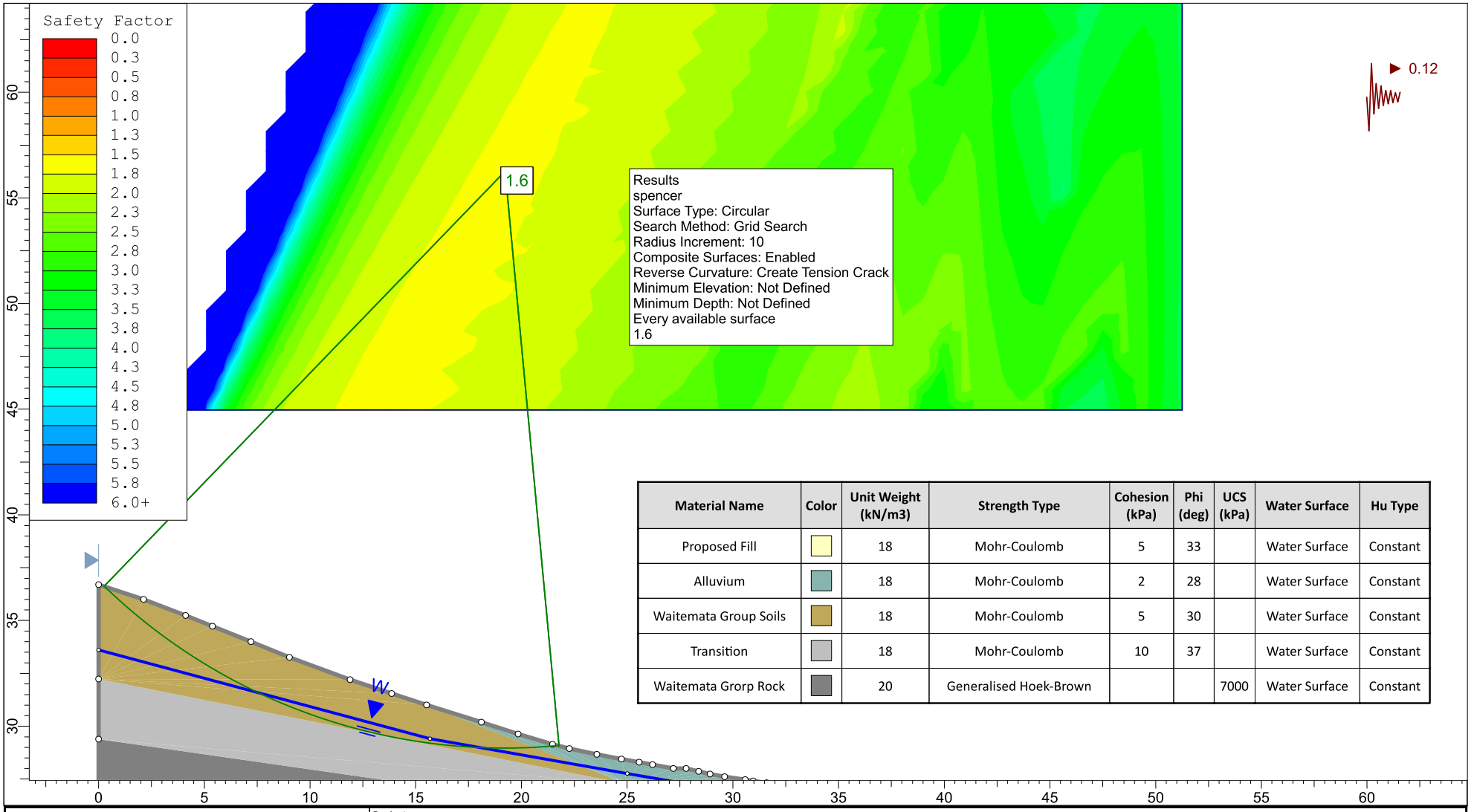
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section FF- Run 4				
Drawn By	PH	Scale	1:250	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1FF - Run 4.slim



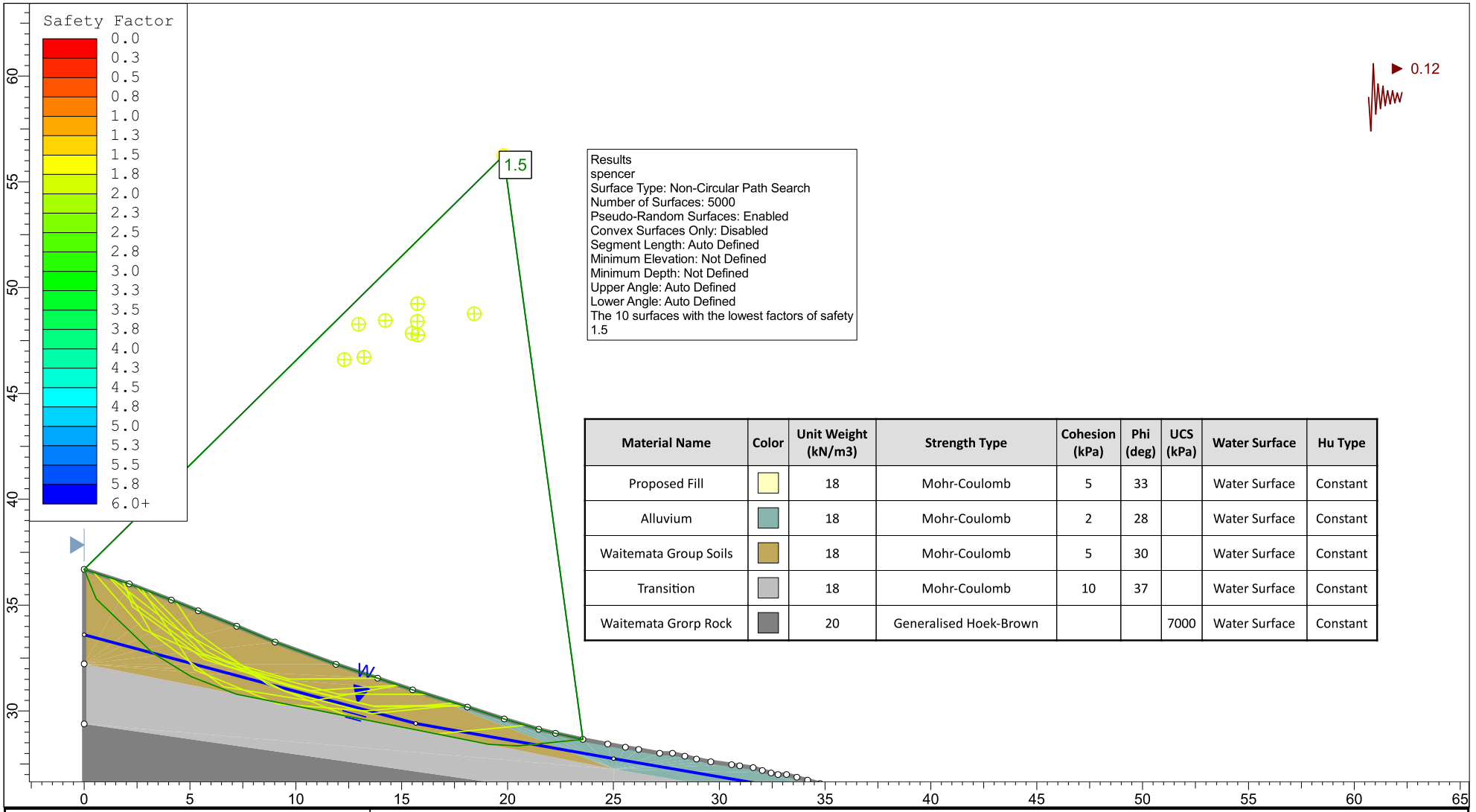
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa			
Analysis Description	Stage 1, Section FF- Run 5			
Drawn By	PH	Scale	1:250	Company: KGA Geotechnical
Date	31/08/2015			File Name: 7464 - S1FF - Run 5.slim



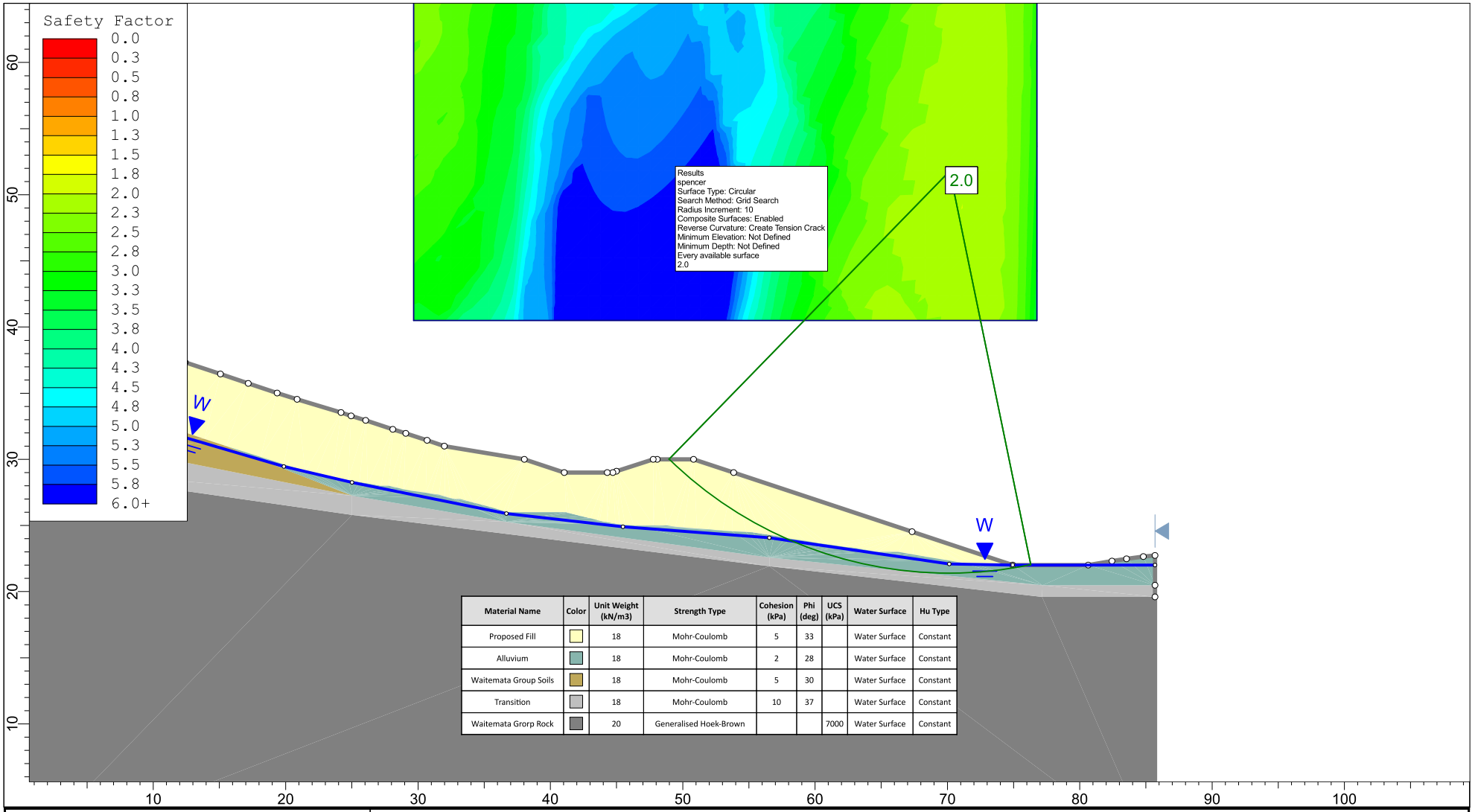
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section FF- Run 6				
Drawn By	PH	Scale	1:250	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1FF - Run 6.slim



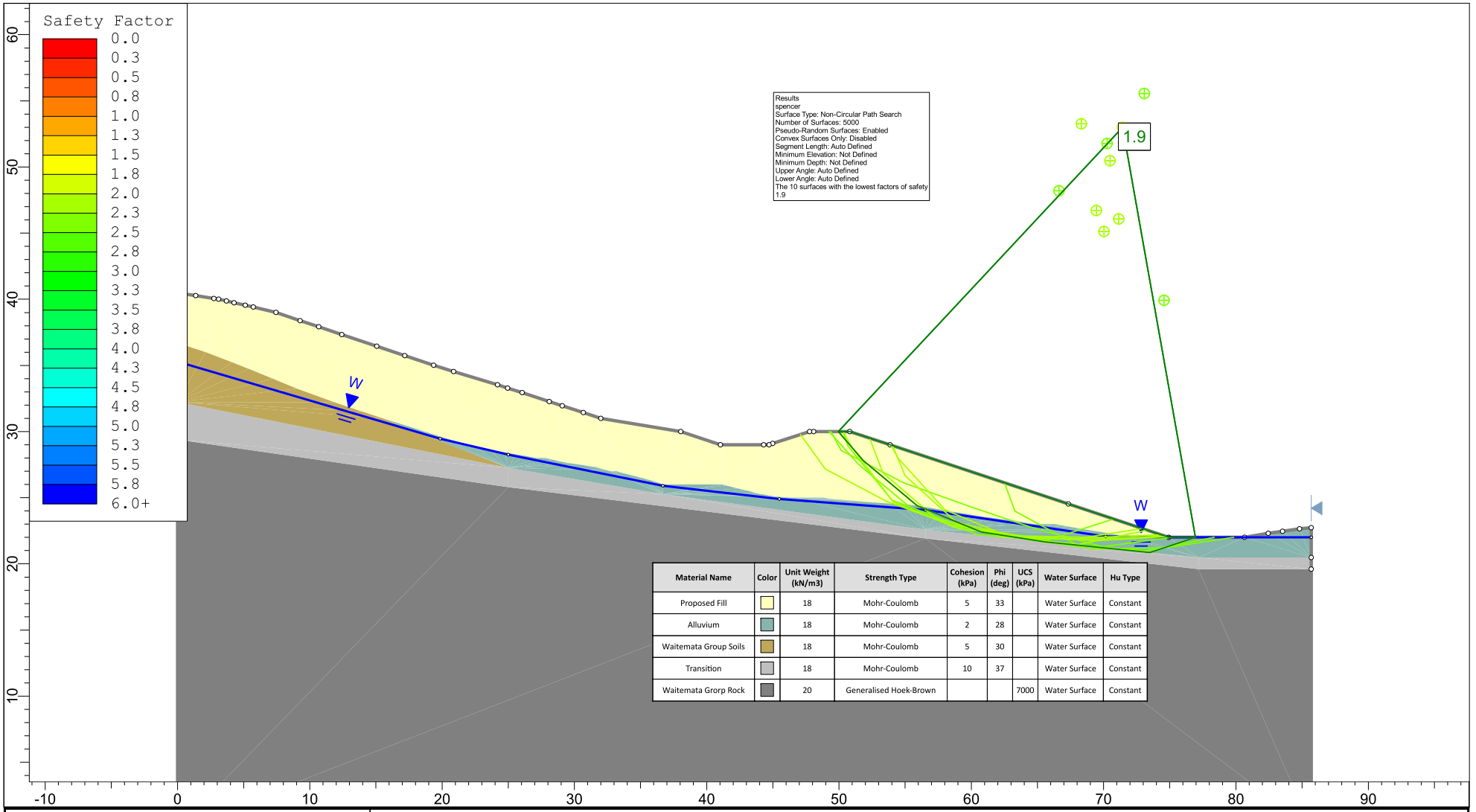
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section FF- Run 7				
Drawn By	PH	*Scale*	1:400	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S1FF - Run 7.slim



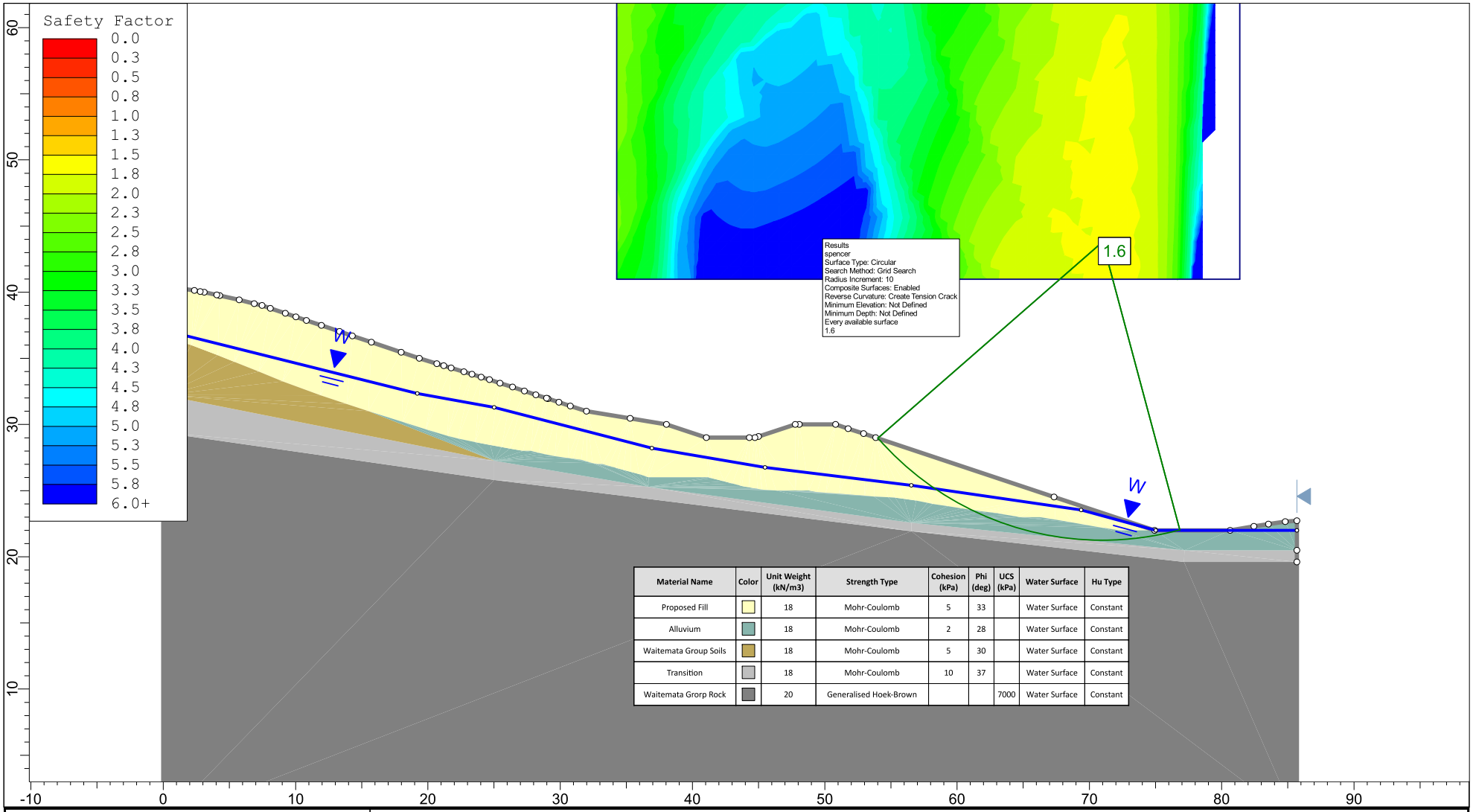
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section FF- Run 8				
Drawn By	PH	*Scale*	1:400	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S1FF - Run 8.slim



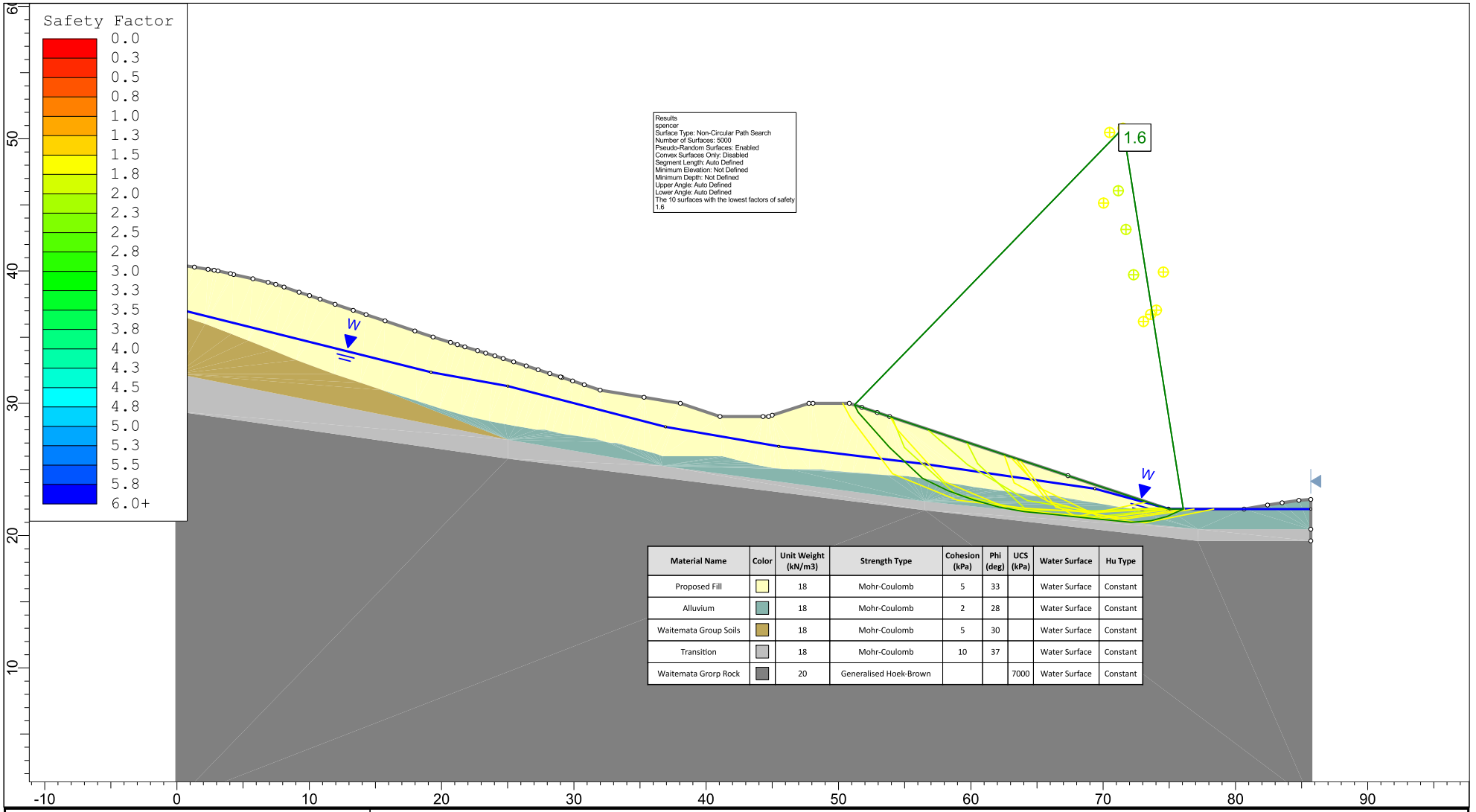
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section FF- Run 9				
Drawn By	PH	*Scale*	1:400	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S1FF - Run 9.slim



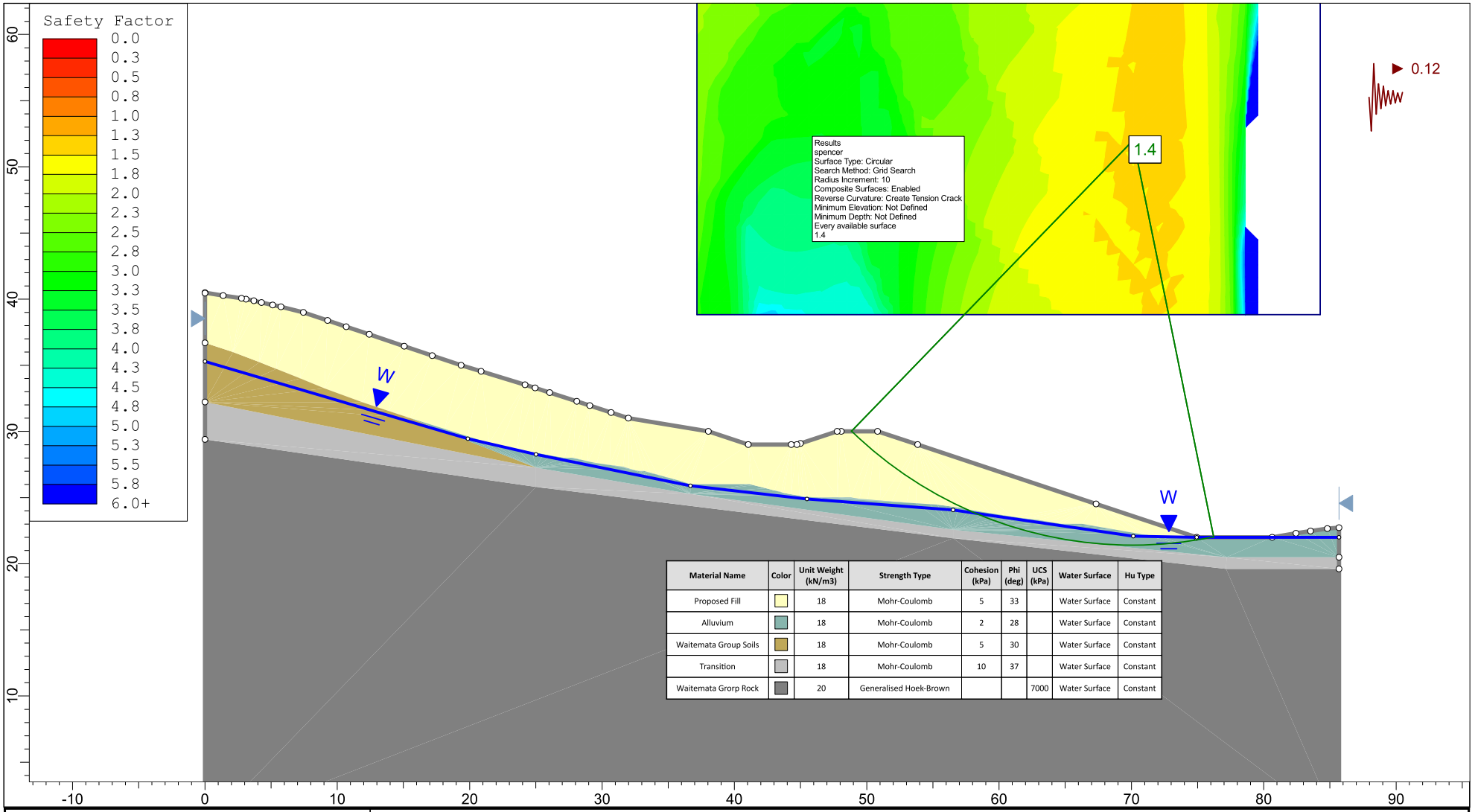
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section FF- Run 10				
Drawn By	PH	*Scale*	1:400	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S1FF - Run 10.slim



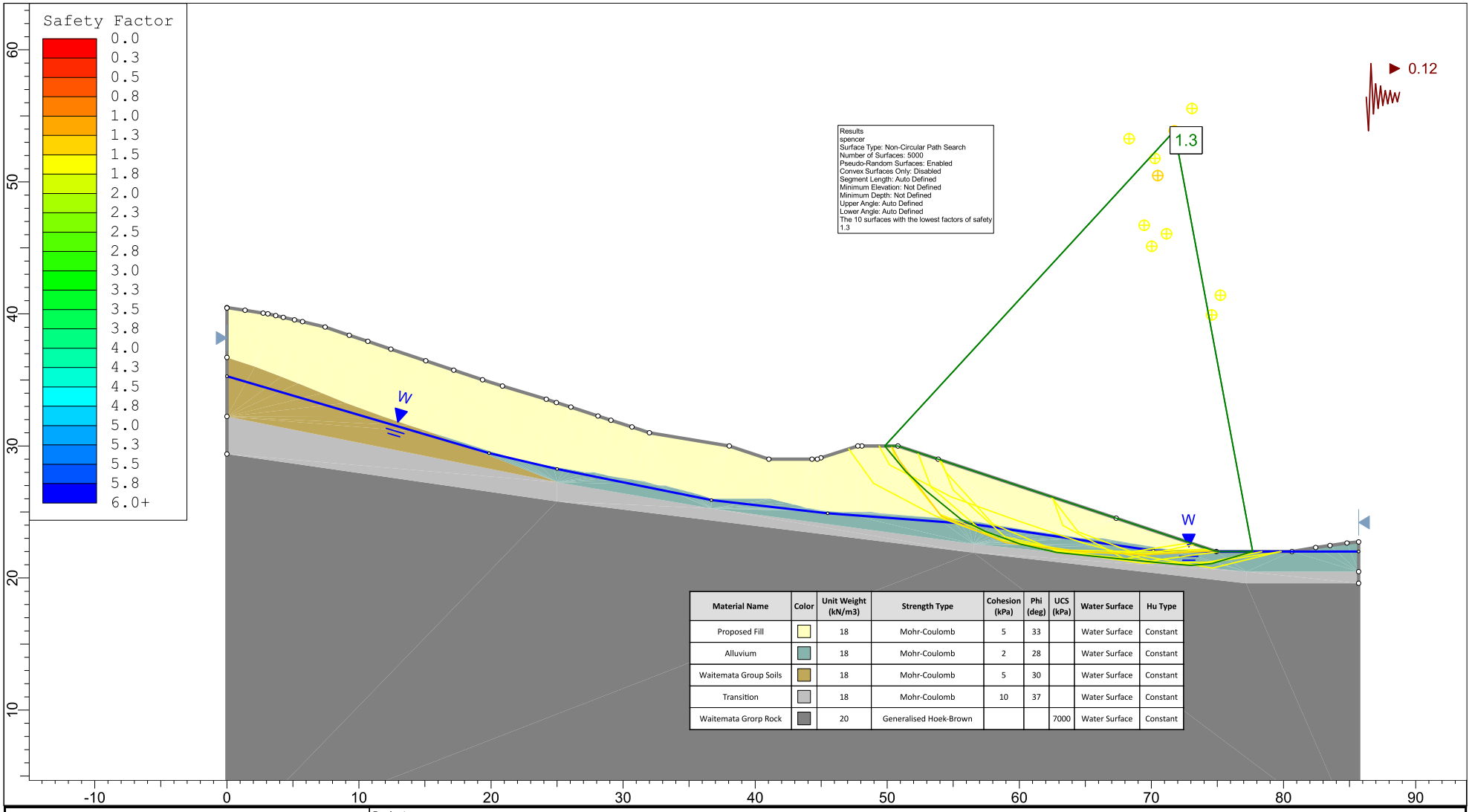
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section FF- Run 11				
Drawn By	PH	Scale	1:400	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1FF - Run 11.slim



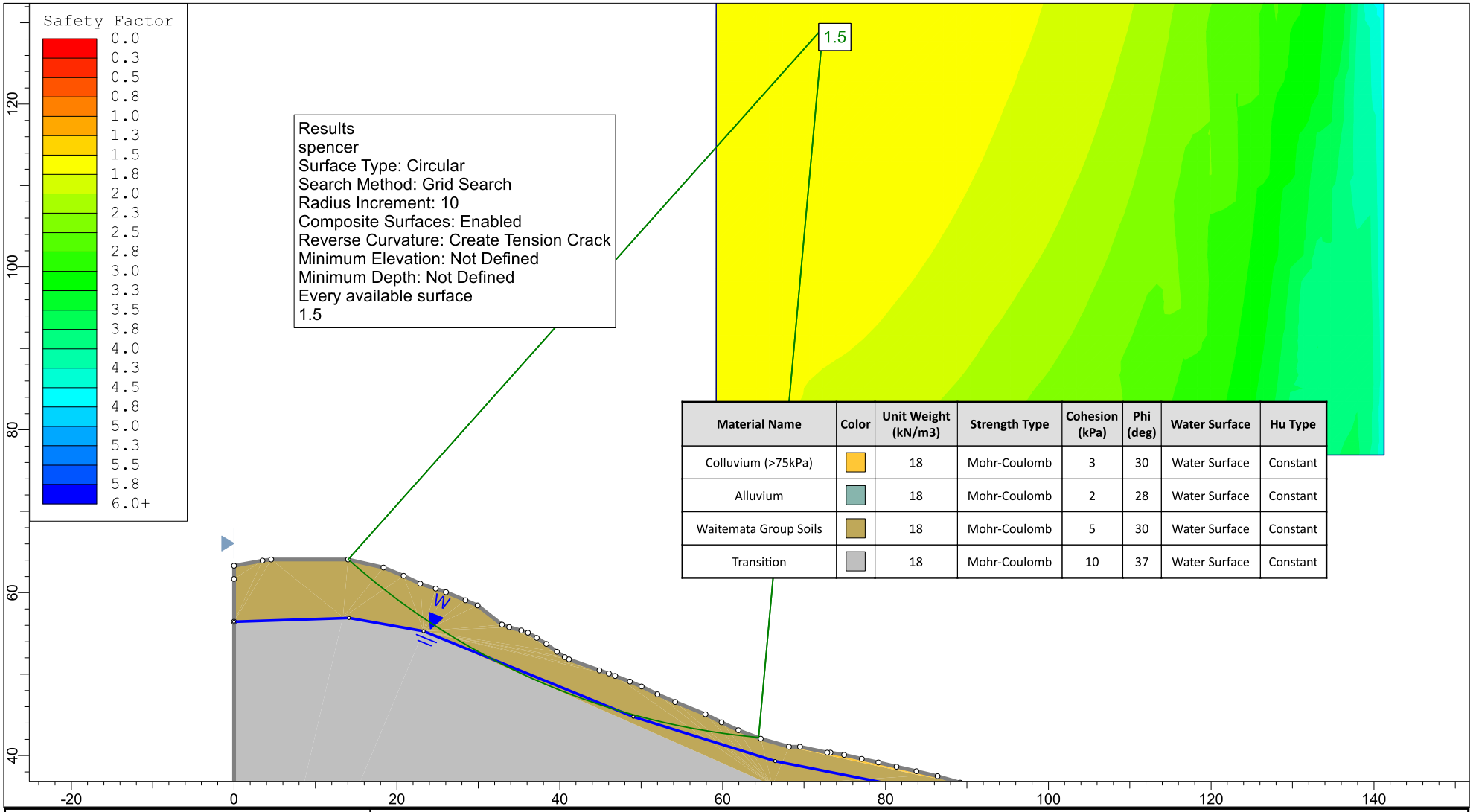
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section FF- Run 12				
Drawn By	PH	*Scale*	1:400	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S1FF - Run 12.slim



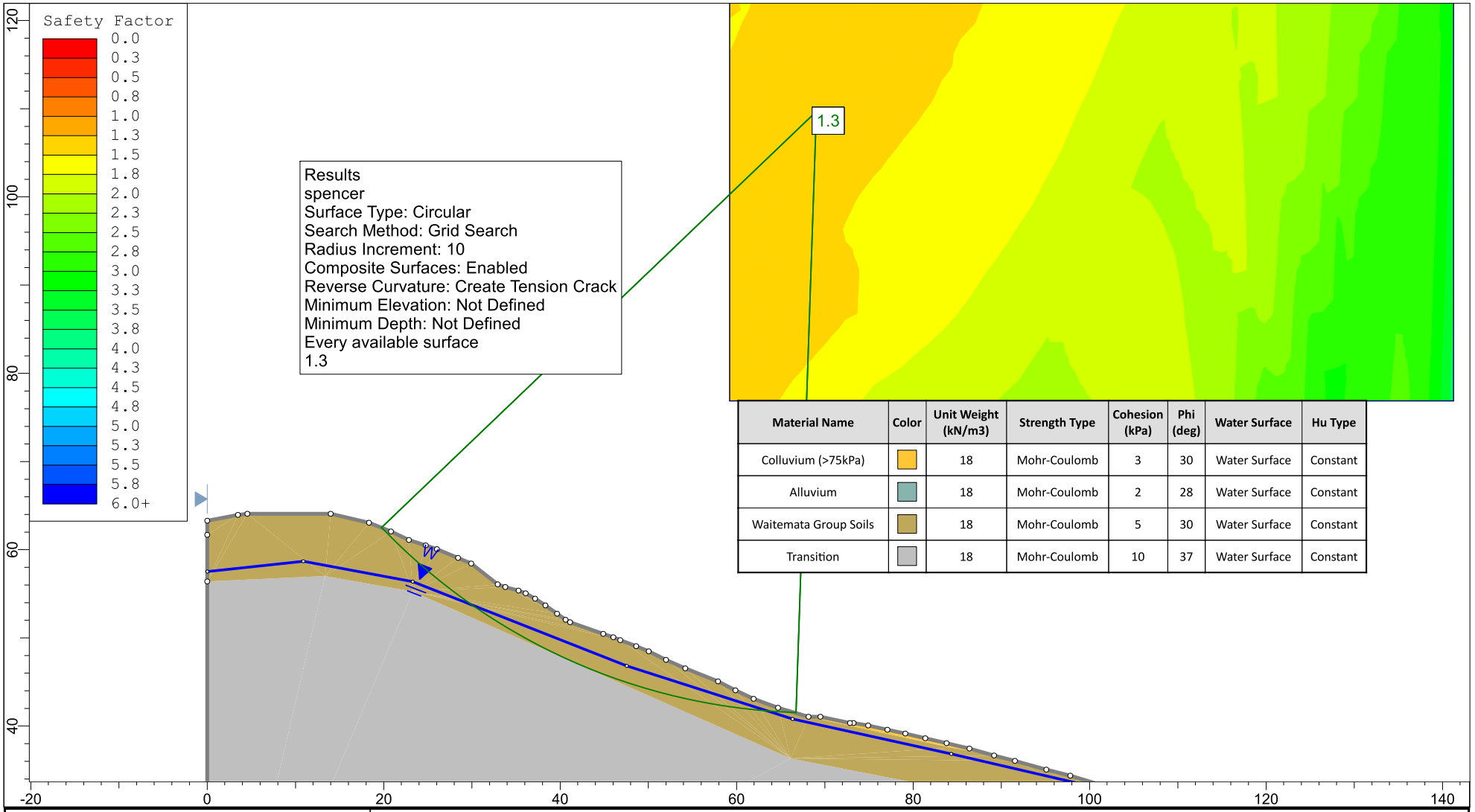
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section GG - Run 1				
Drawn By	PH	Scale	1:650	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1GG - Run 1.slim



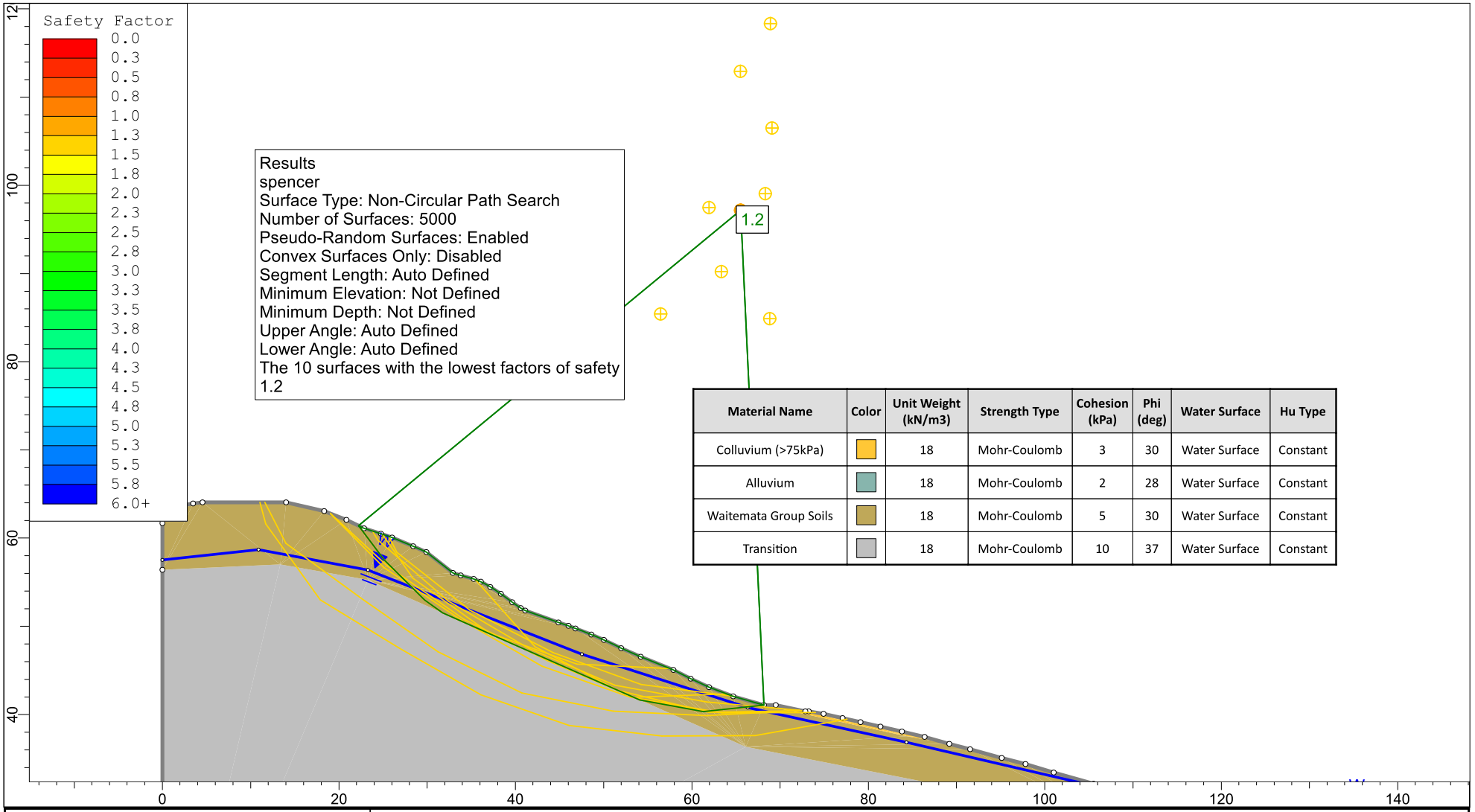
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section GG - Run 3				
Drawn By	PH	Scale	1:600	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1GG - Run 3.slim



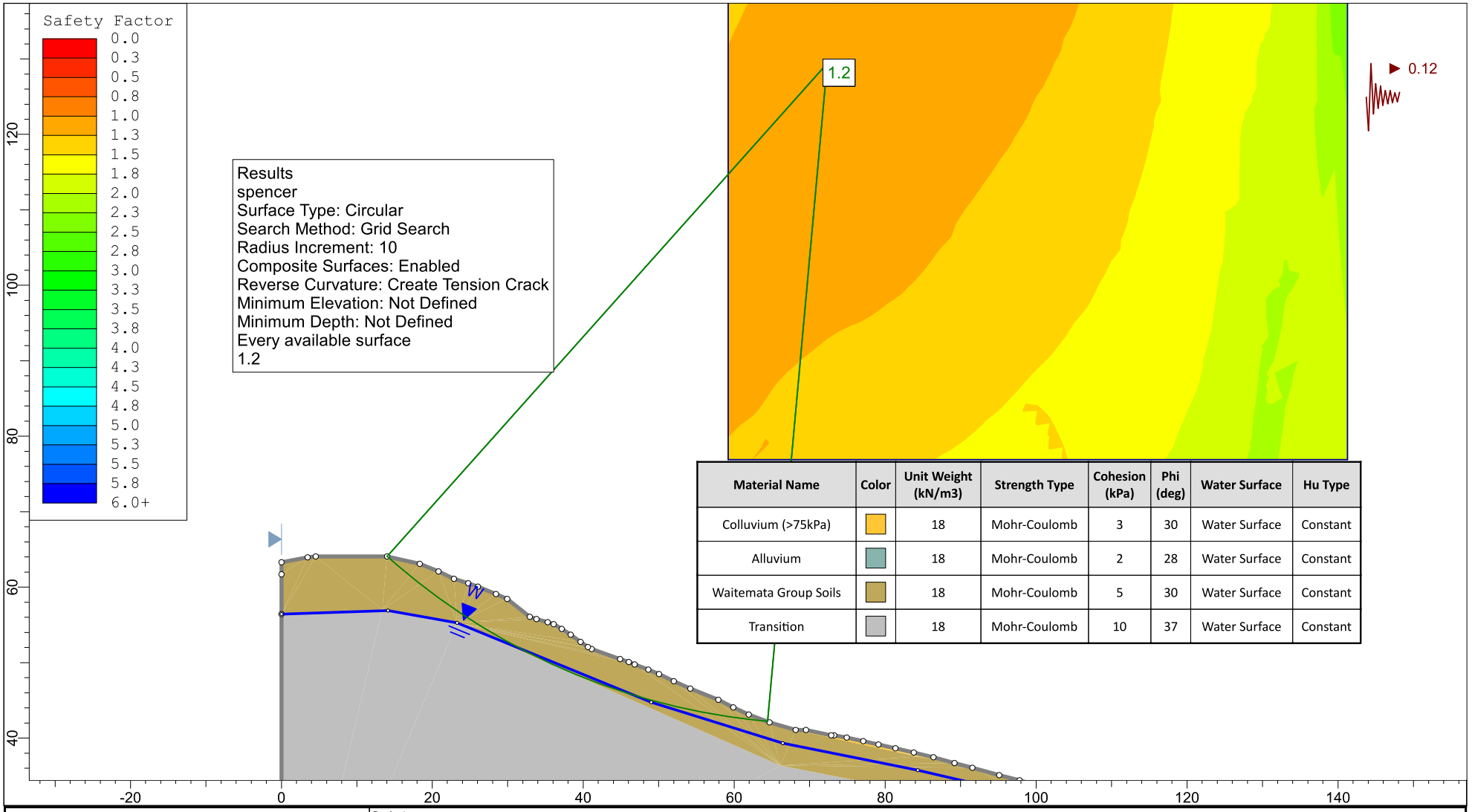
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section GG - Run 4				
Drawn By	PH	Scale	1:600	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1GG - Run 4.slim



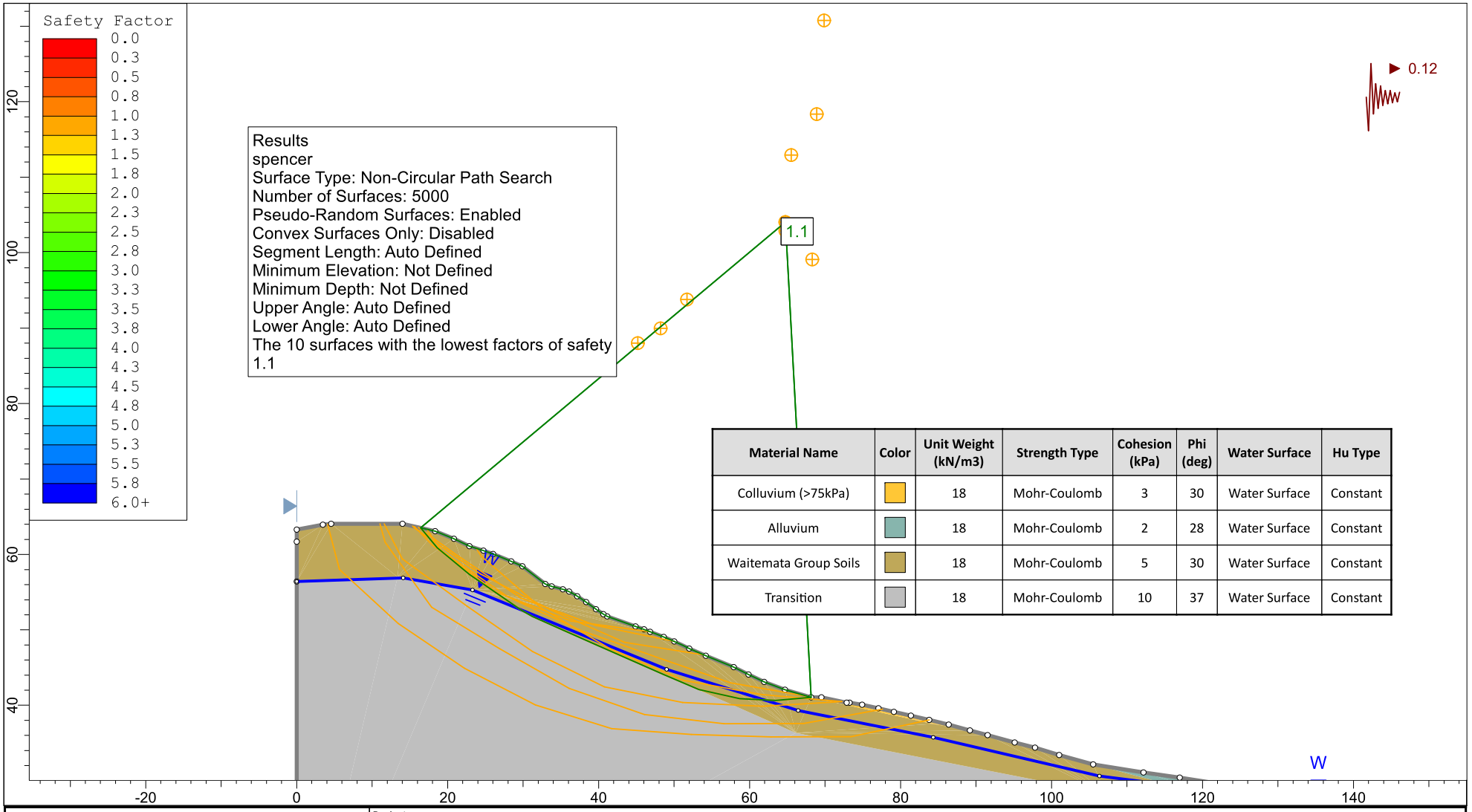
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section GG - Run 5				
Drawn By	PH	Scale	1:700	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1GG - Run 5.slim



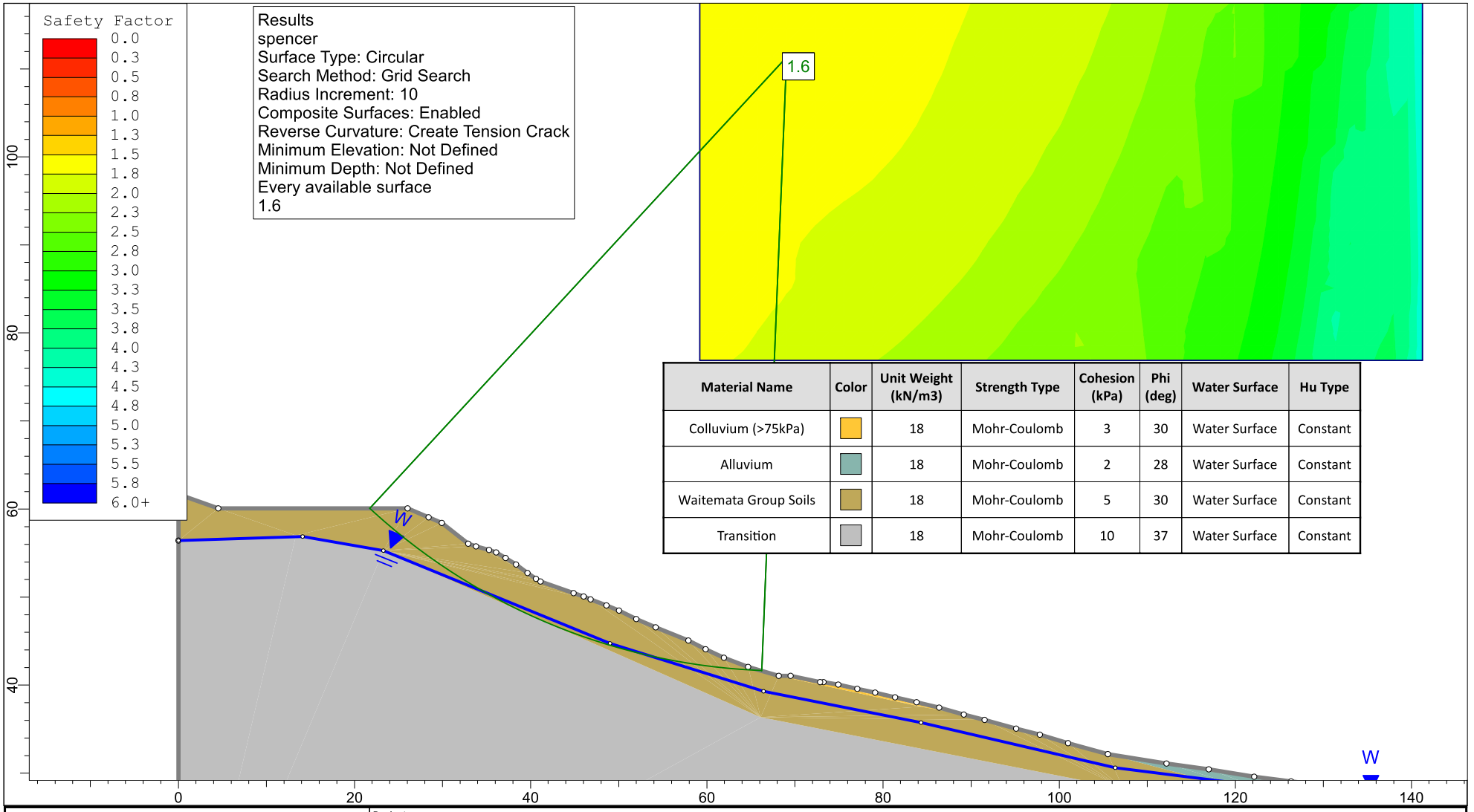
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section GG - Run 6				
Drawn By	PH	Scale	1:700	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1GG - Run 6.slim



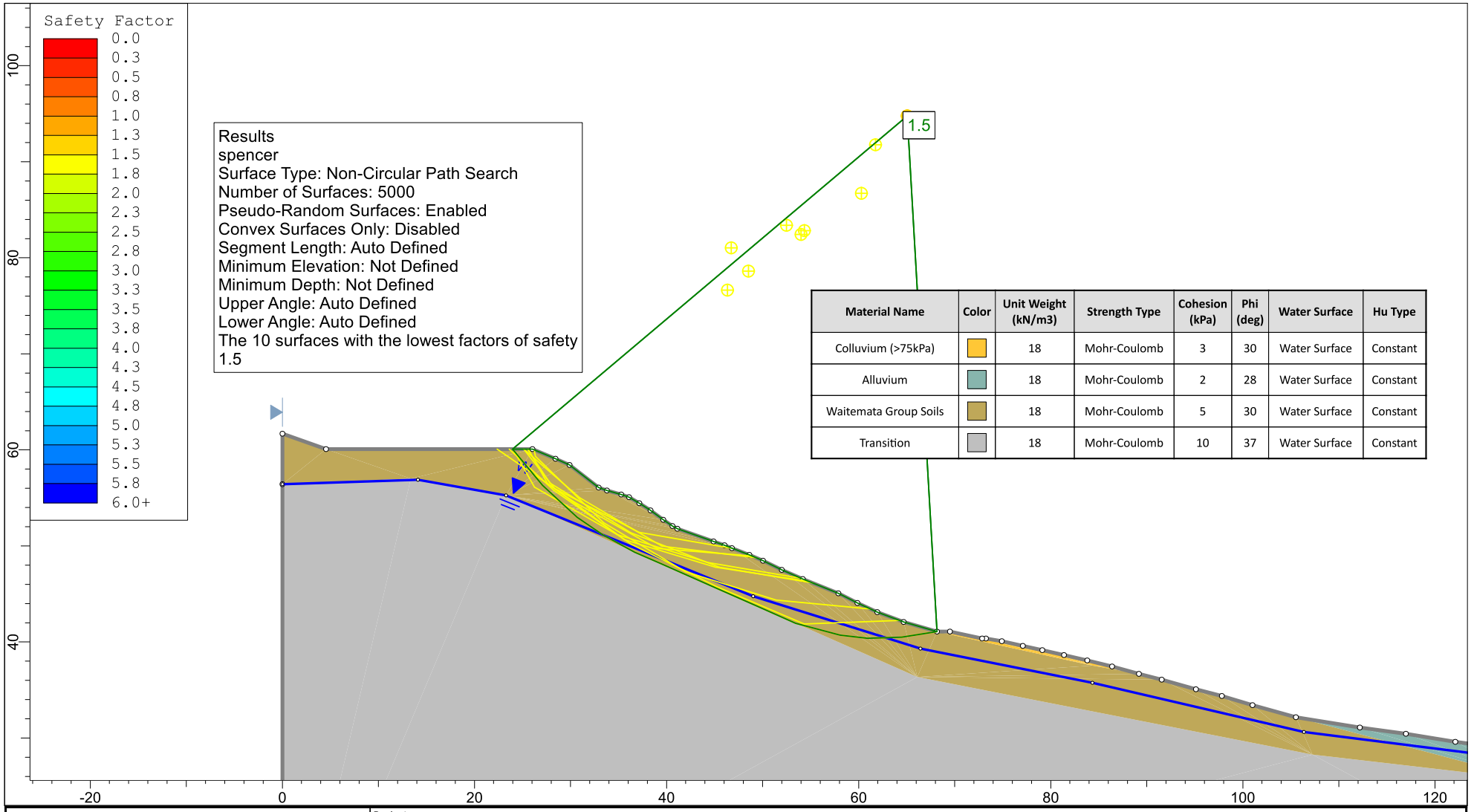
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section GG - Run 7				
Drawn By	PH	Scale	1:600	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1GG - Run 7.slim



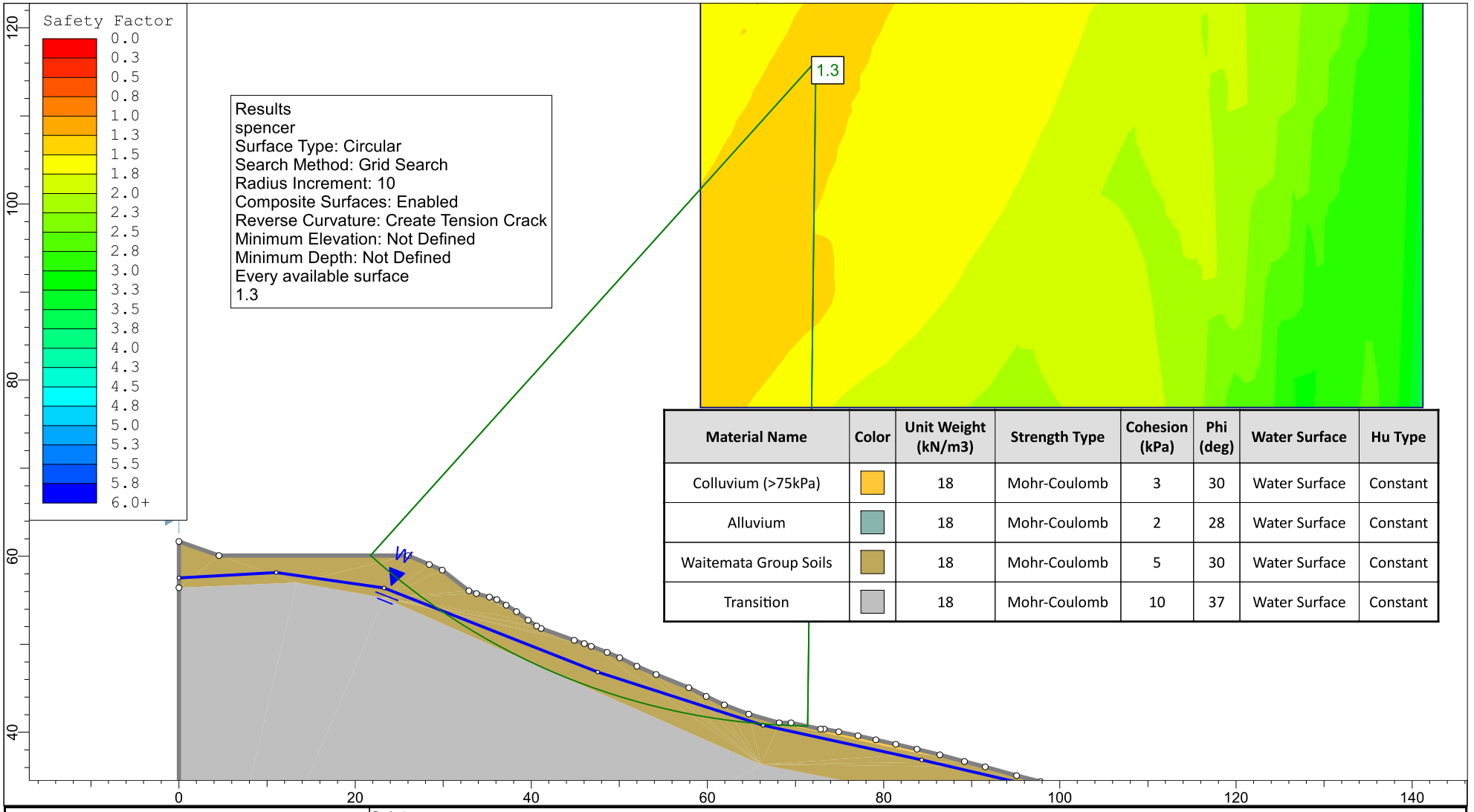
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section GG - Run 8				
Drawn By	PH	Scale	1:550	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1GG - Run 8.slim



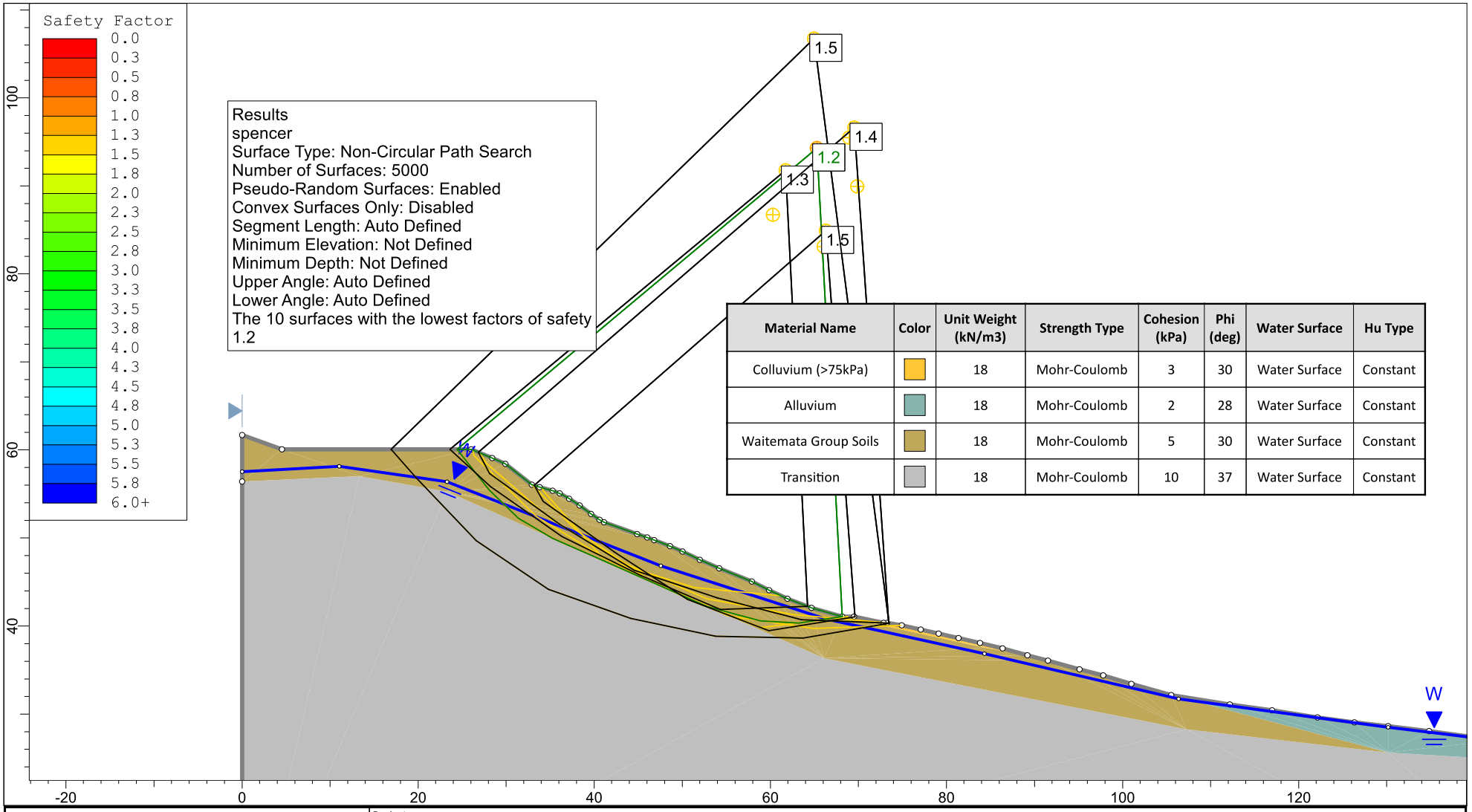
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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SLIDEINTERPRET 6.018

Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section GG - Run 9				
Drawn By	PH	Scale	1:600	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1GG - Run 9.slim

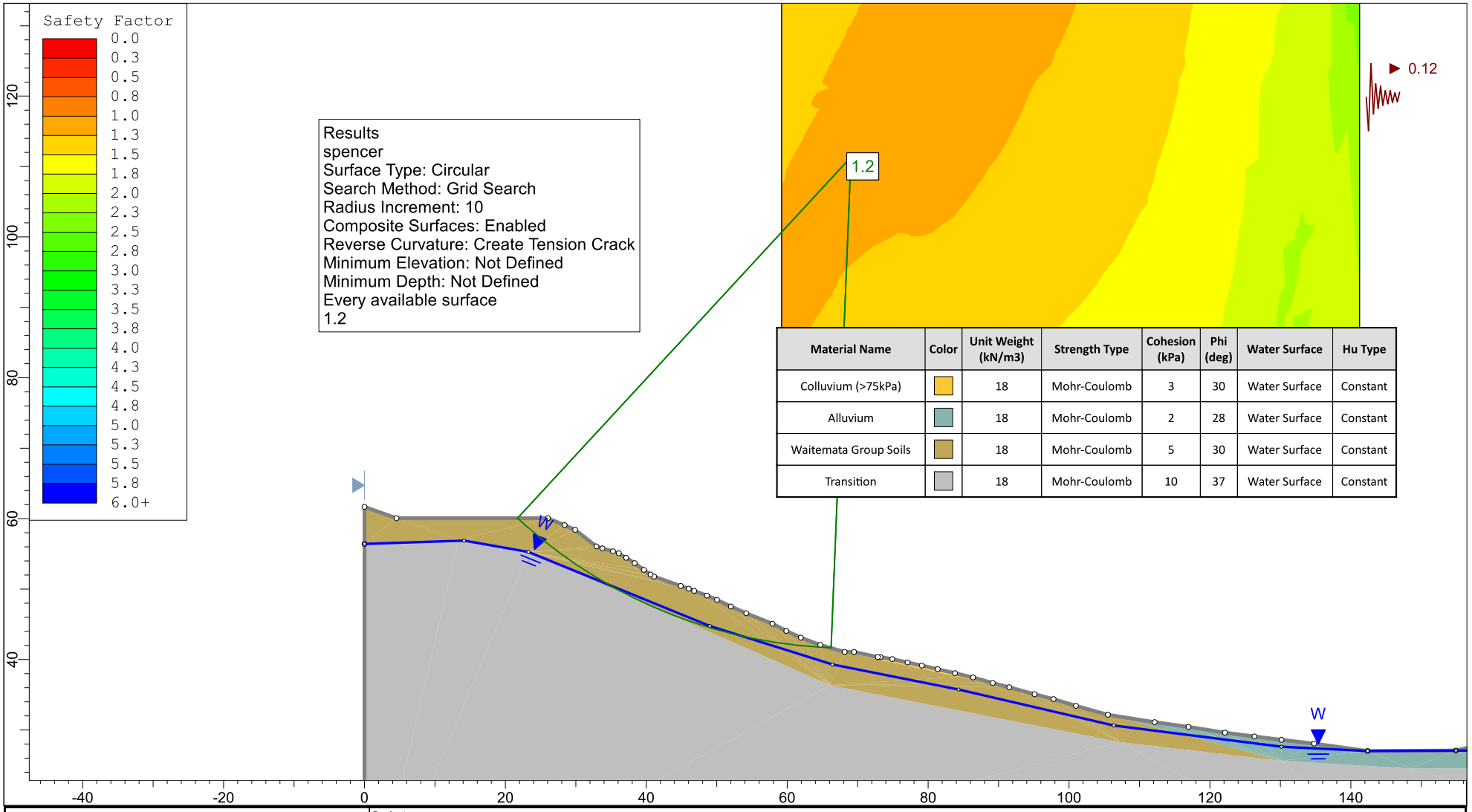


Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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SLIDEINTERPRET 6.018

Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section GG - Run 10				
Drawn By	PH	Scale	1:600	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1GG - Run 10.slim



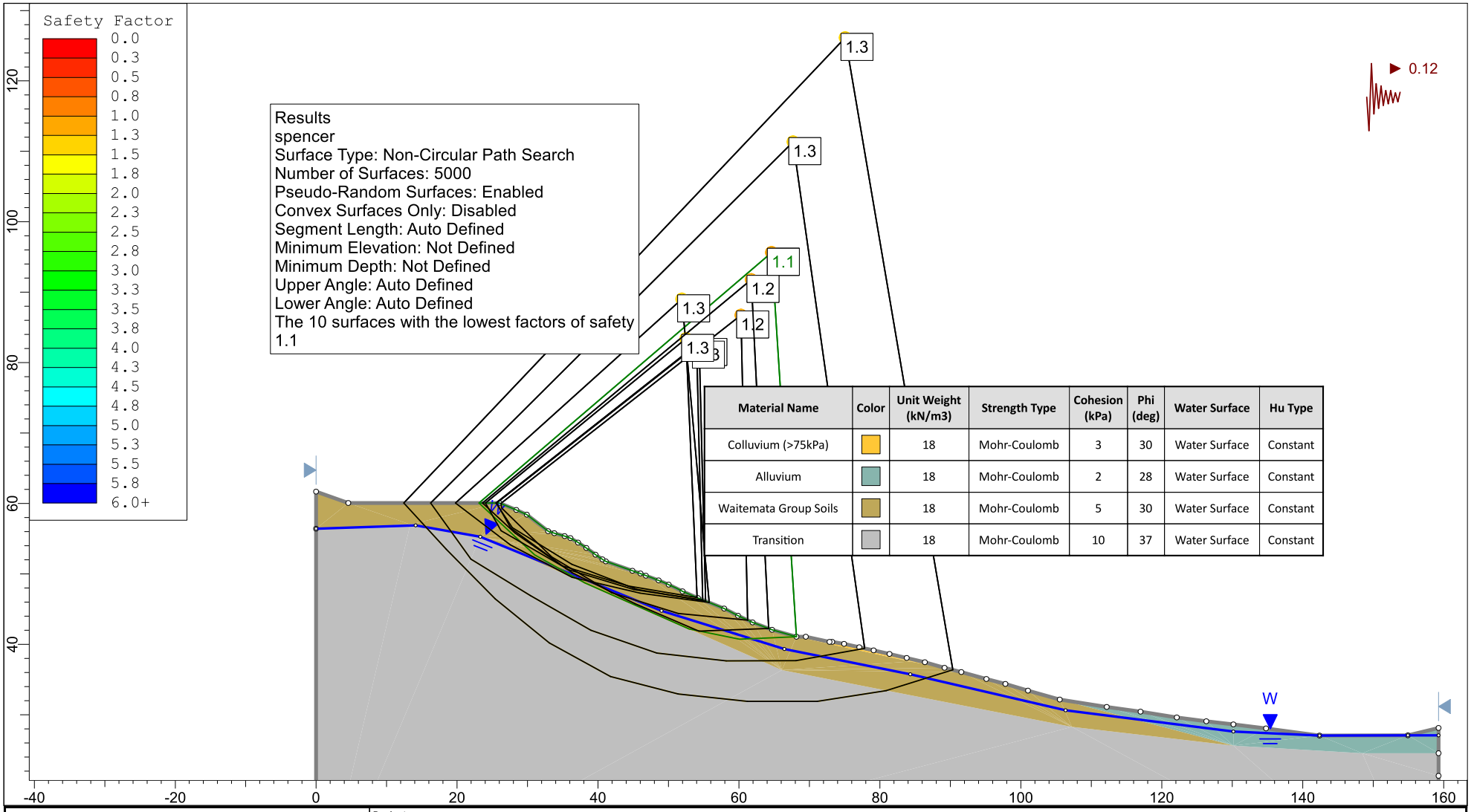
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section GG - Run 11				
Drawn By	PH	Scale	1:750	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S1GG - Run 11.slim



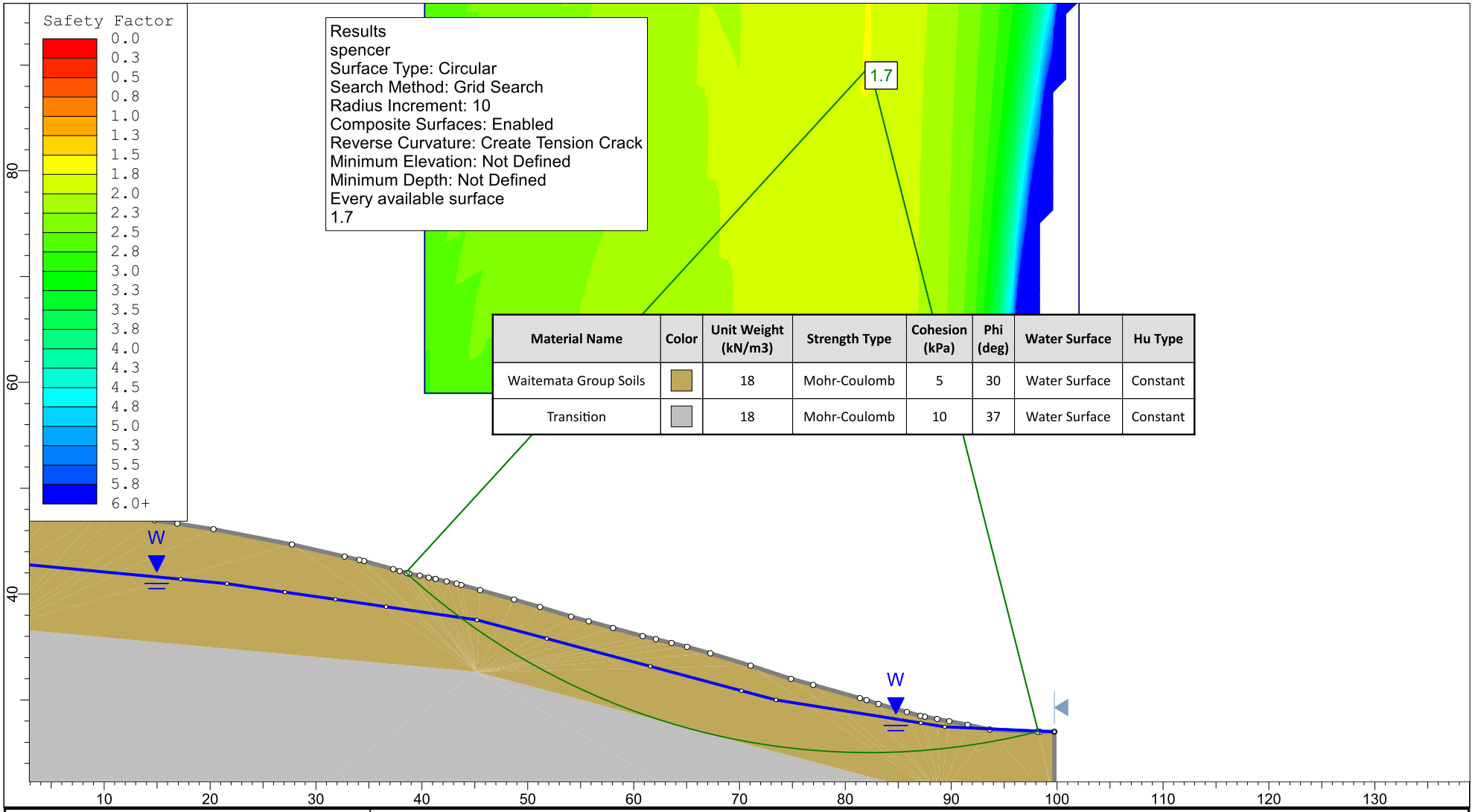
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 1, Section GG - Run 12				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S1GG - Run 12.slim



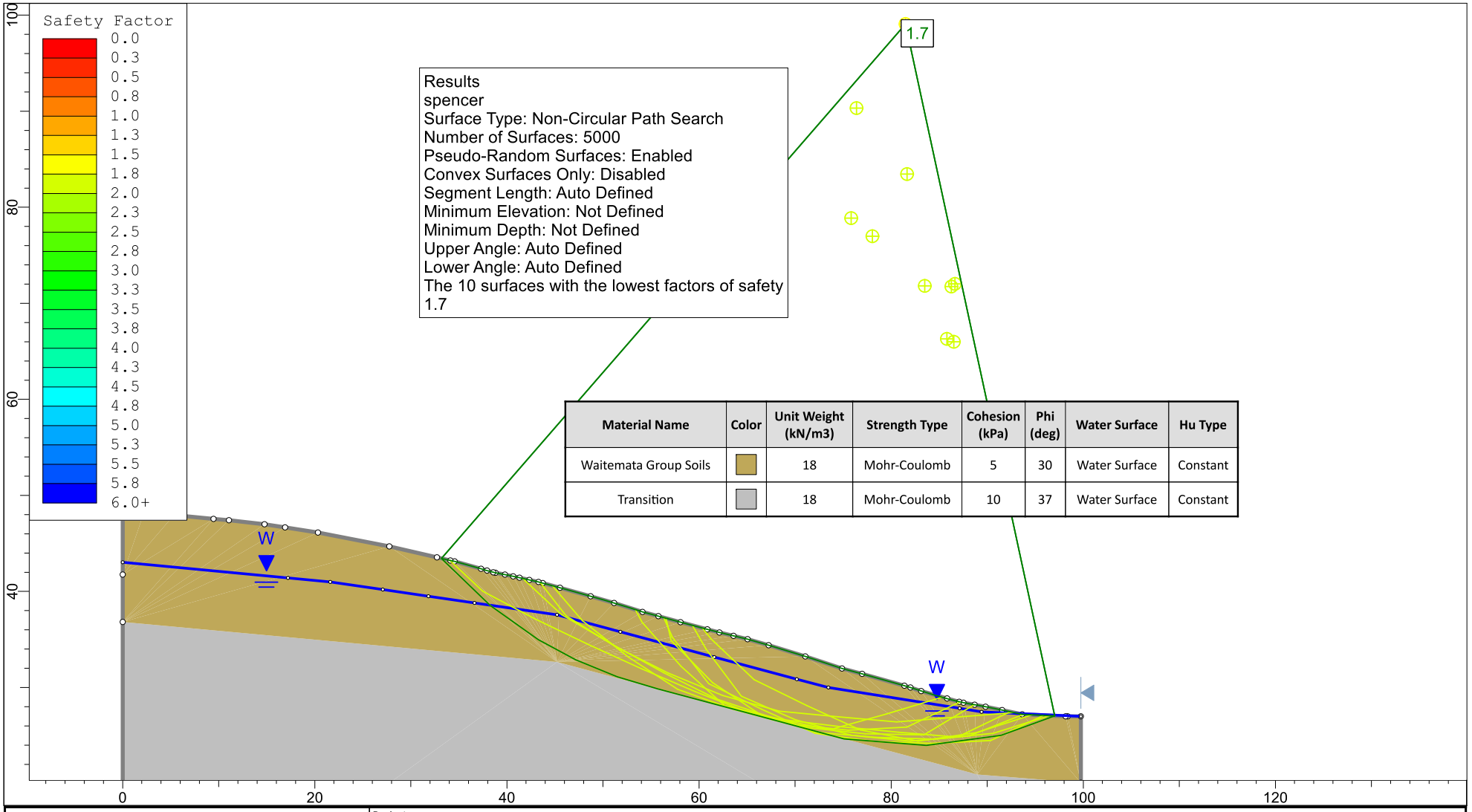
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section AA - Run 1				
Drawn By	PH	Scale	1:500	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S2AA - Run 1.slim



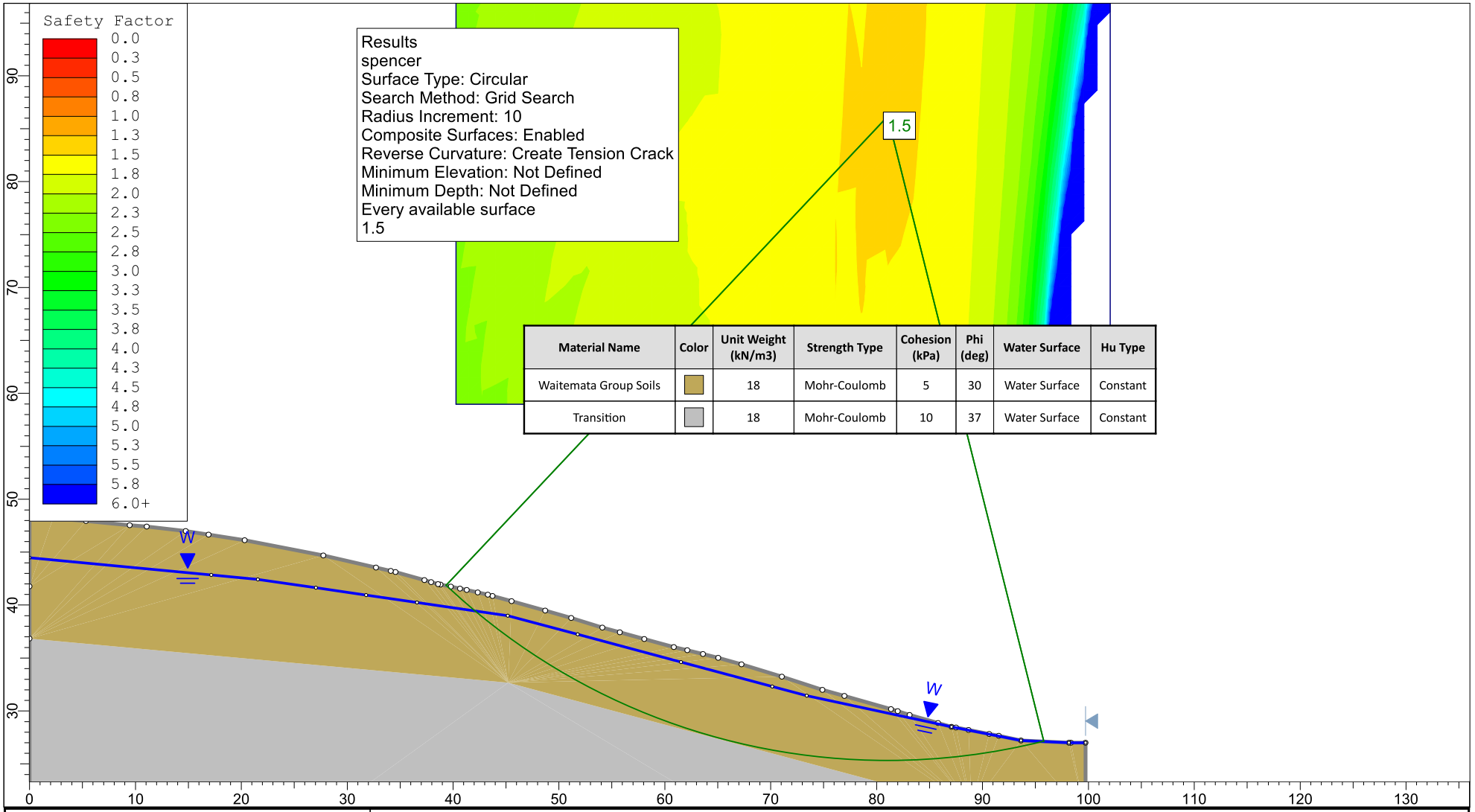
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section AA - Run 2				
Drawn By	PH	Scale	1:550	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S2AA - Run 2.slim



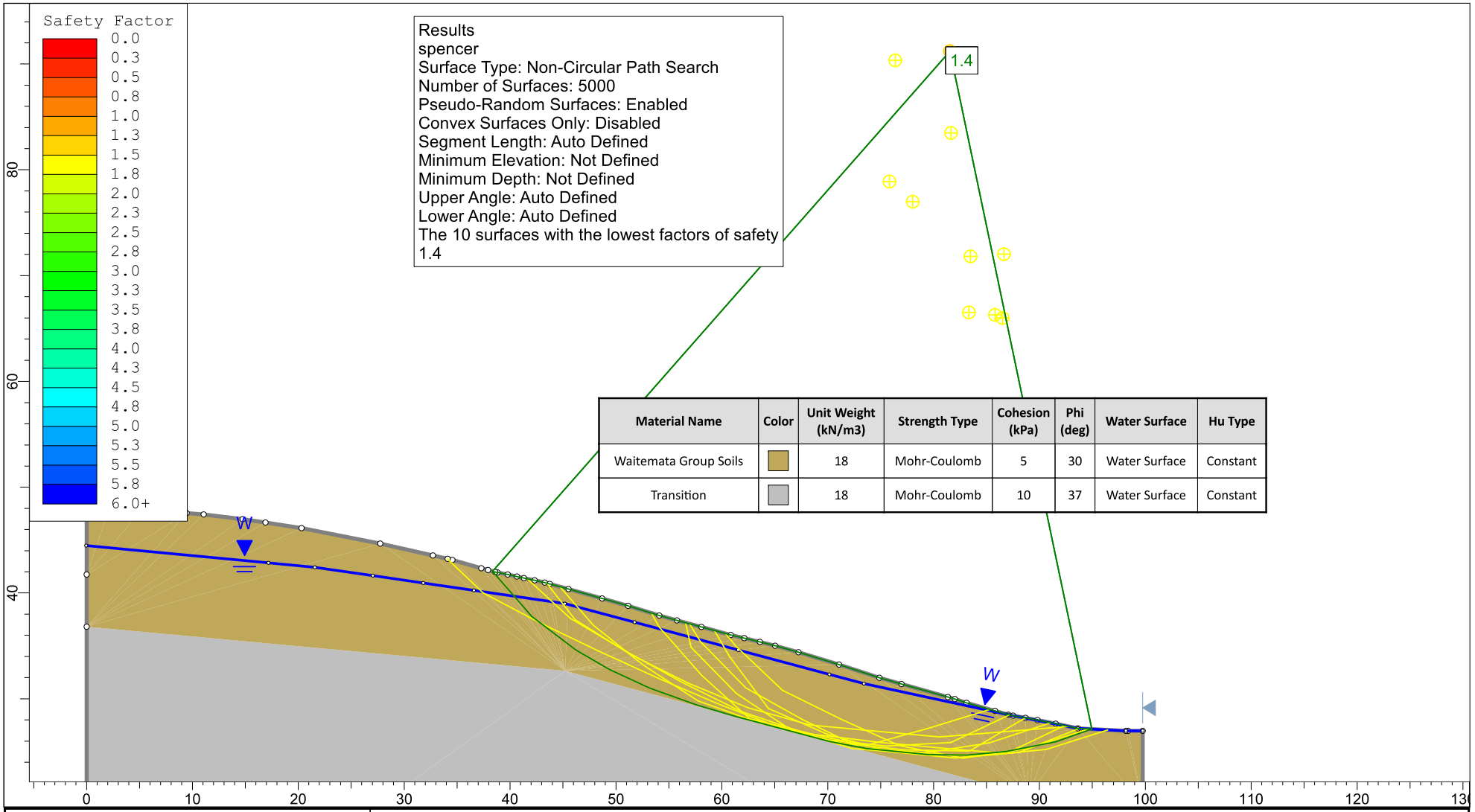
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section AA - Run 3				
Drawn By	PH	Scale	1:500	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S2AA - Run 3.slim



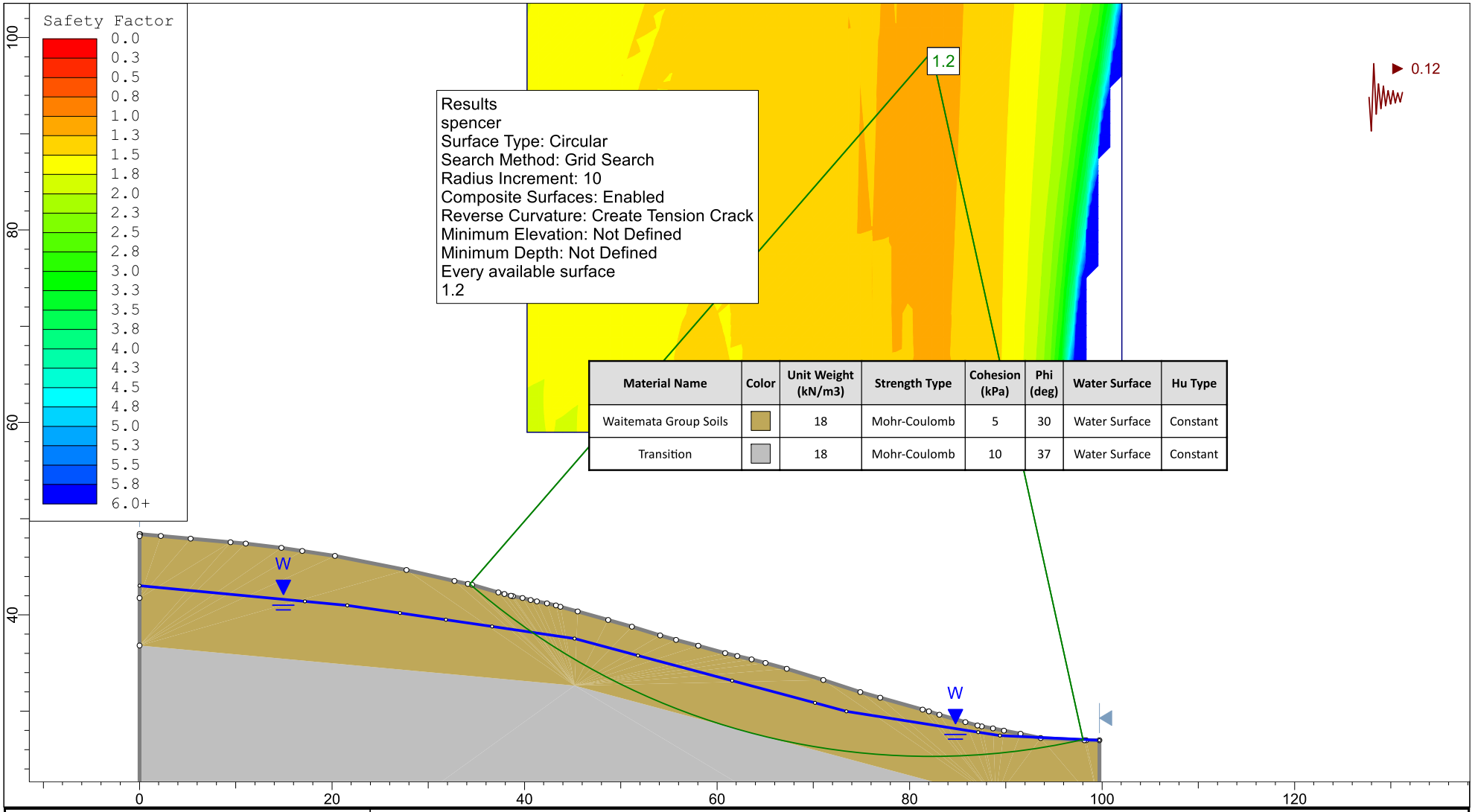
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section AA - Run 4				
Drawn By	PH	Scale	1:500	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S2AA - Run 4.slim



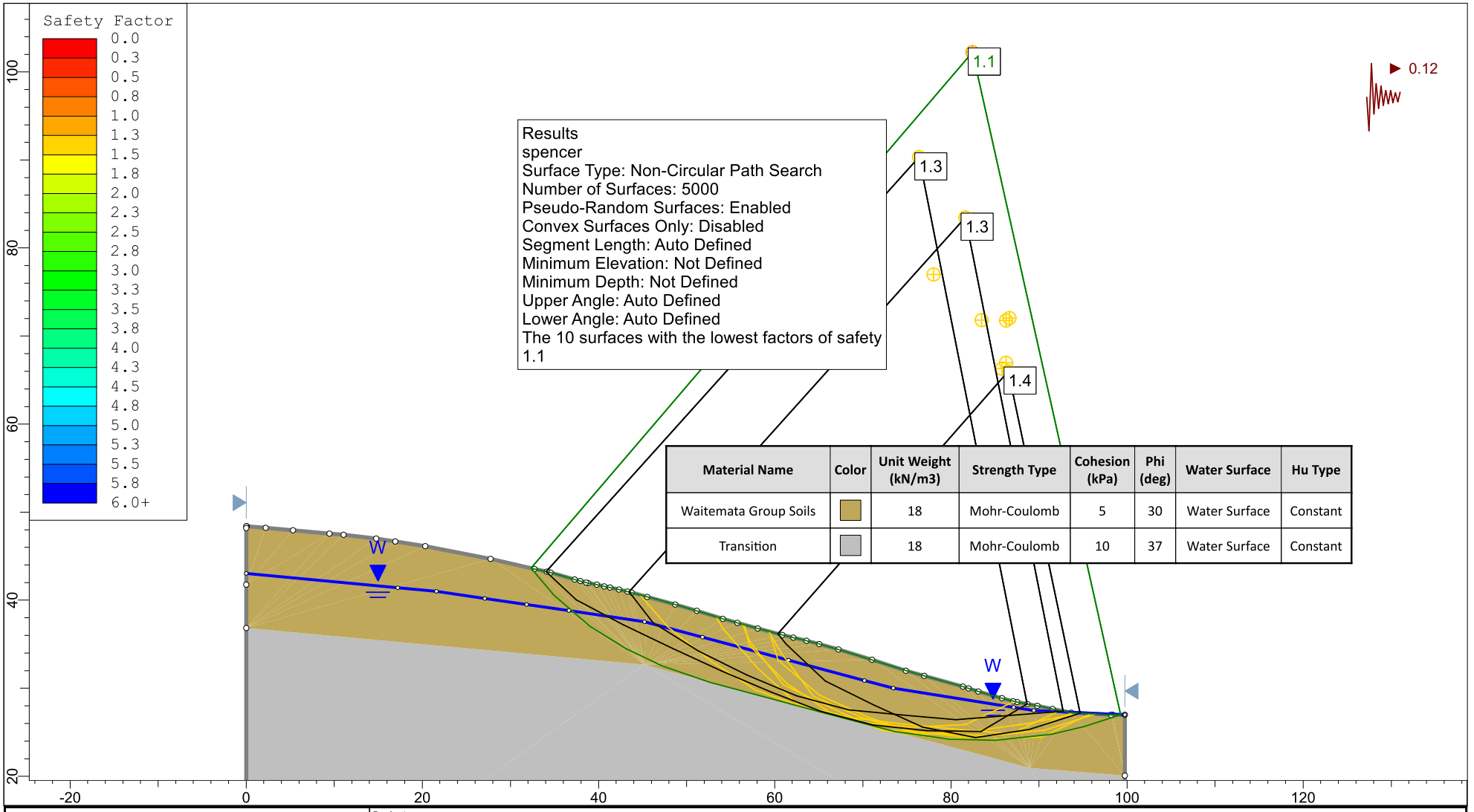
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section AA - Run 5				
Drawn By	PH	Scale	1:550	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S2AA - Run 5.slim



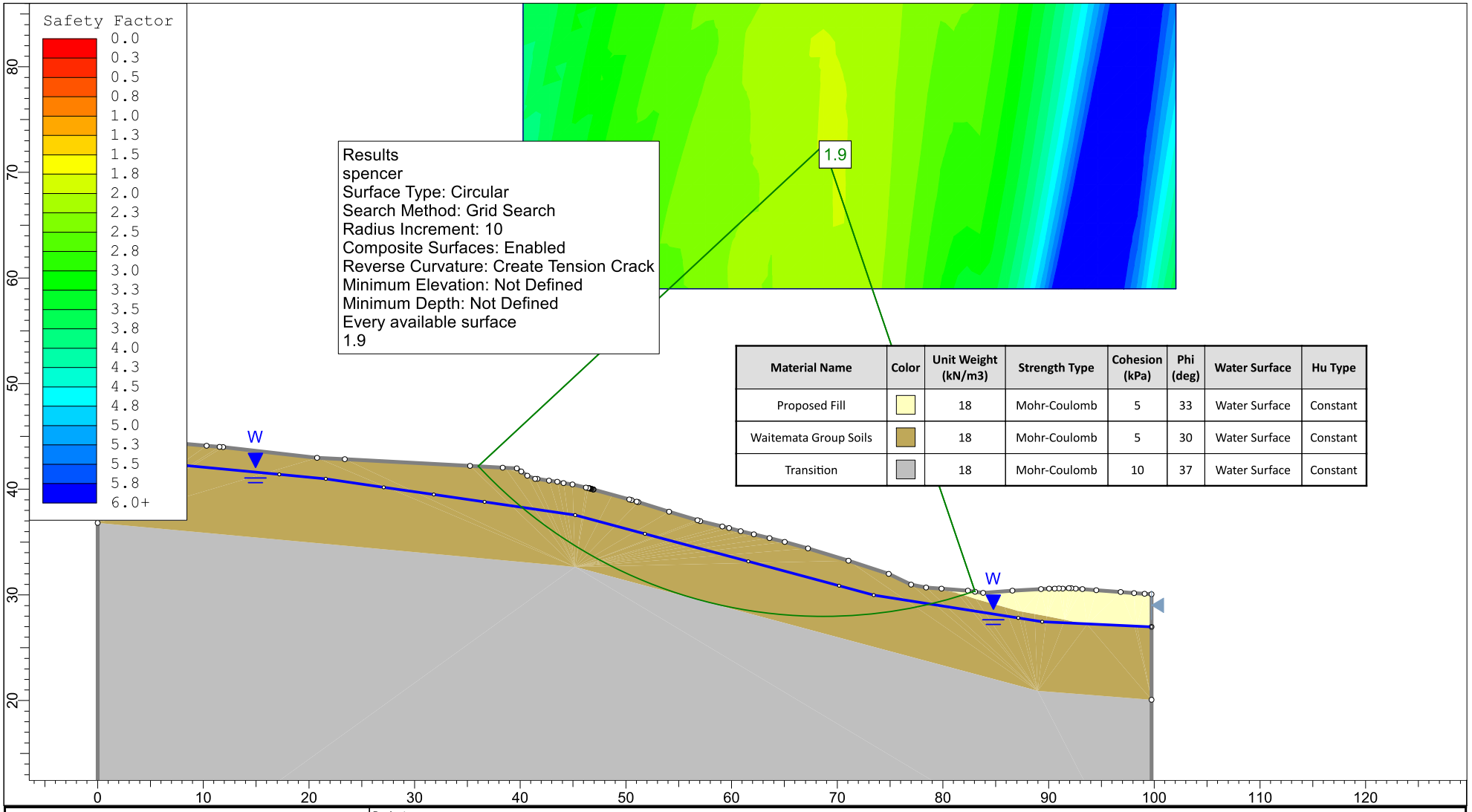
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section AA - Run 6				
Drawn By	PH	Scale	1:600	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S2AA - Run 6.slim



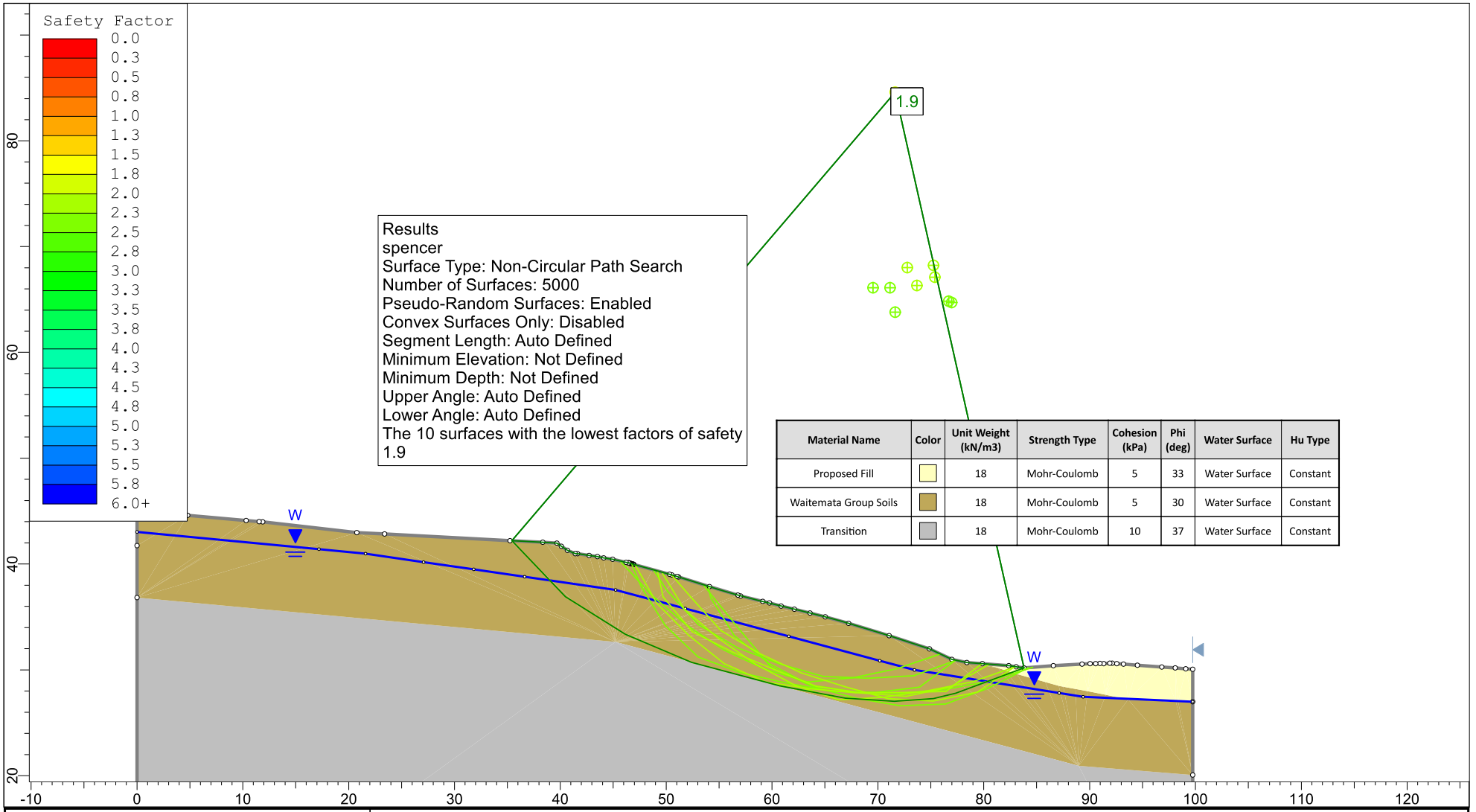
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section AA - Run 7				
Drawn By	PH	Scale	1:500	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S2AA - Run 7.slim



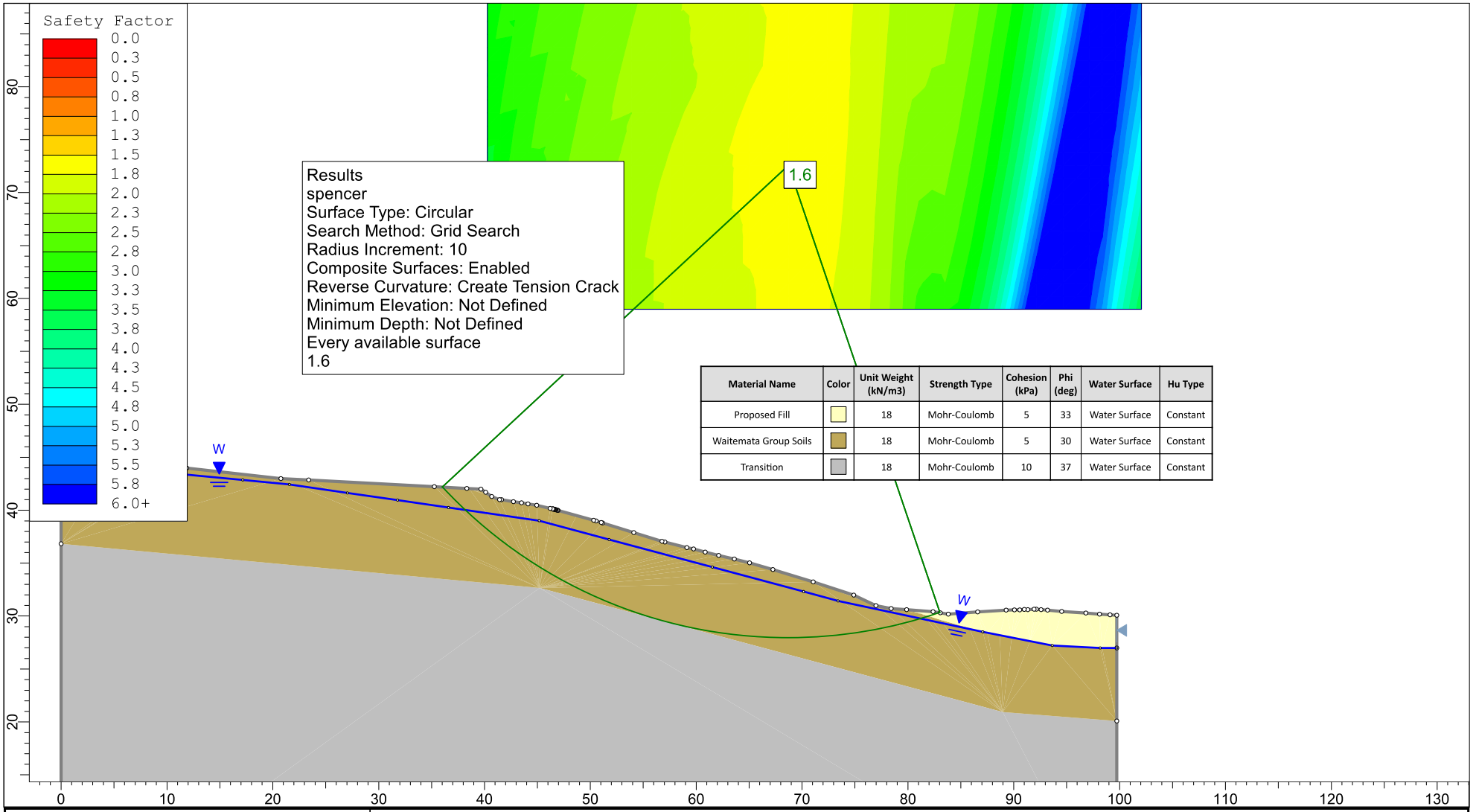
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section AA - Run 8				
Drawn By	PH	Scale	1:500	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S2AA - Run 8.slim



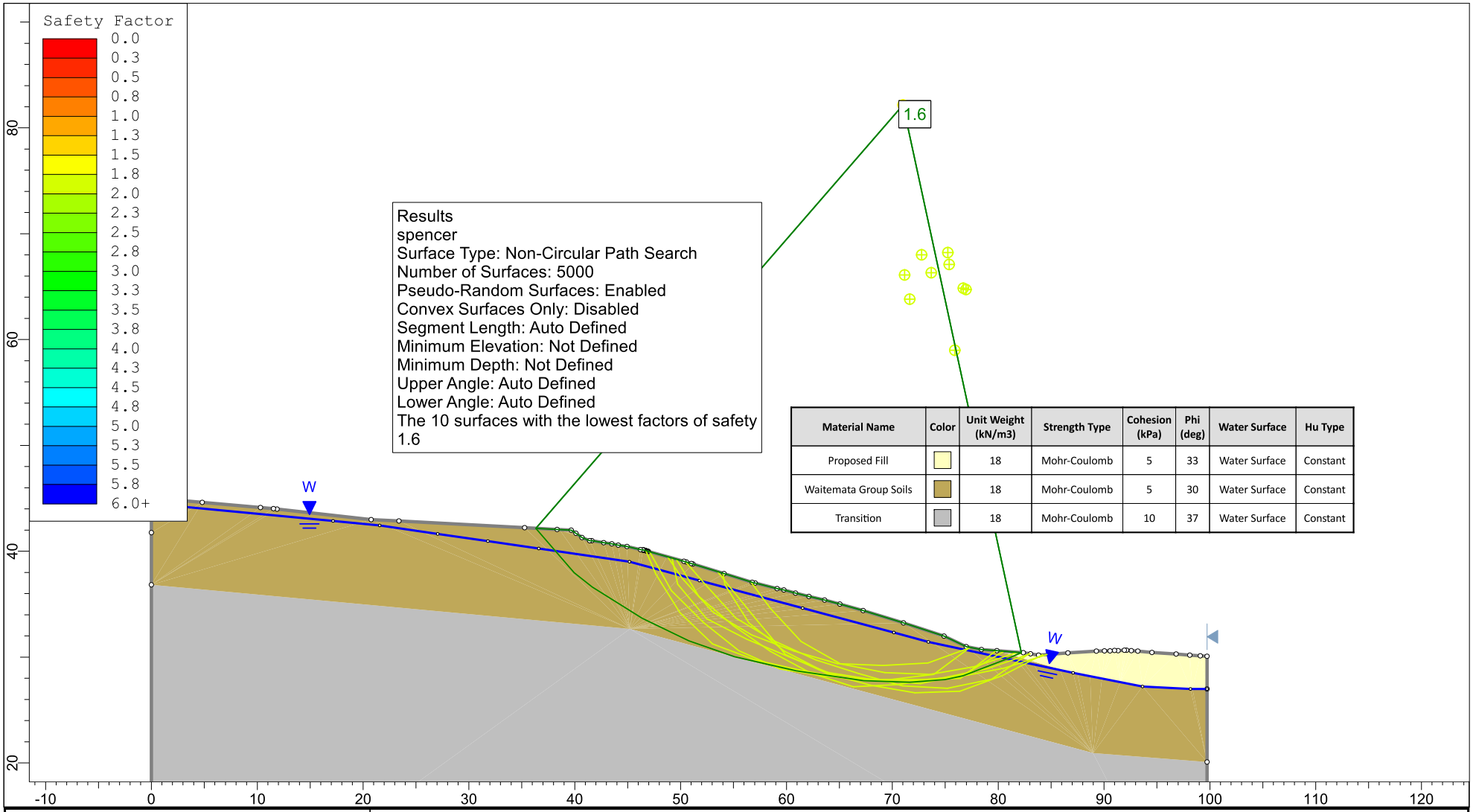
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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SLIDEINTERPRET 6.018

Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section AA - Run 9				
Drawn By	PH	*Scale*	1:500	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S2AA - Run 9.slim



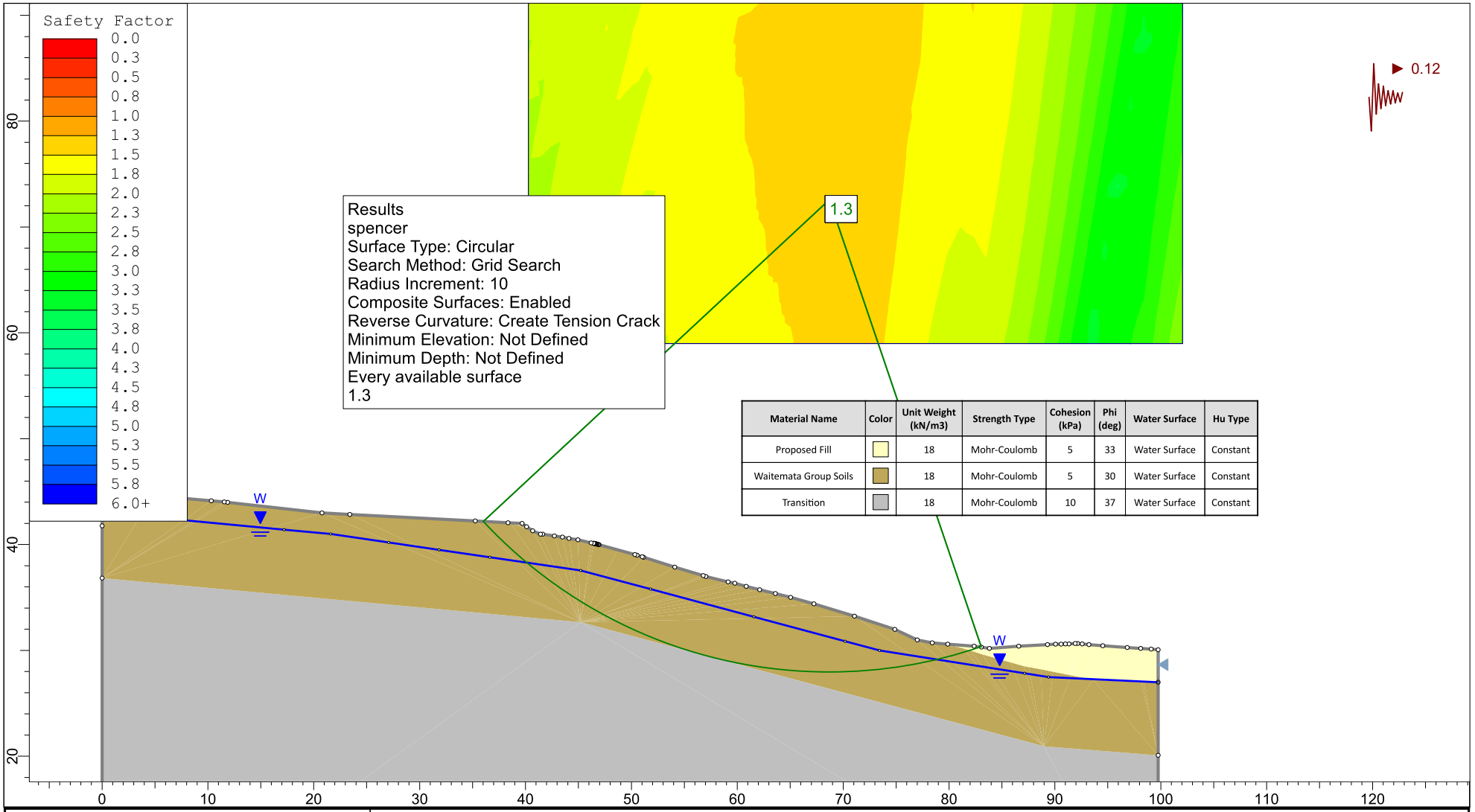
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section AA - Run 10				
Drawn By	PH	Scale	1:500	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S2AA - Run 10.slim



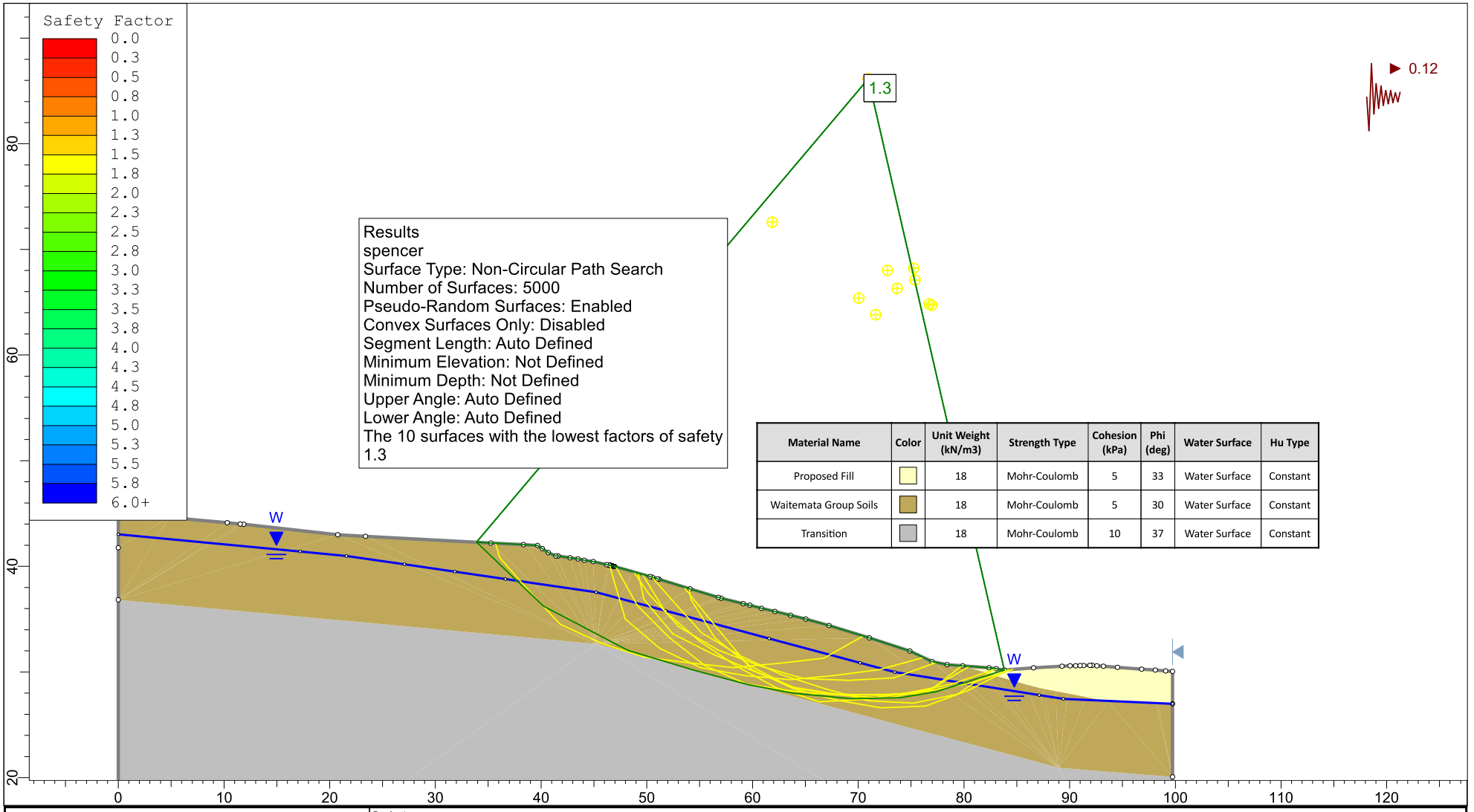
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section AA - Run 11				
Drawn By	PH	Scale	1:500	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S2AA - Run 11.slim



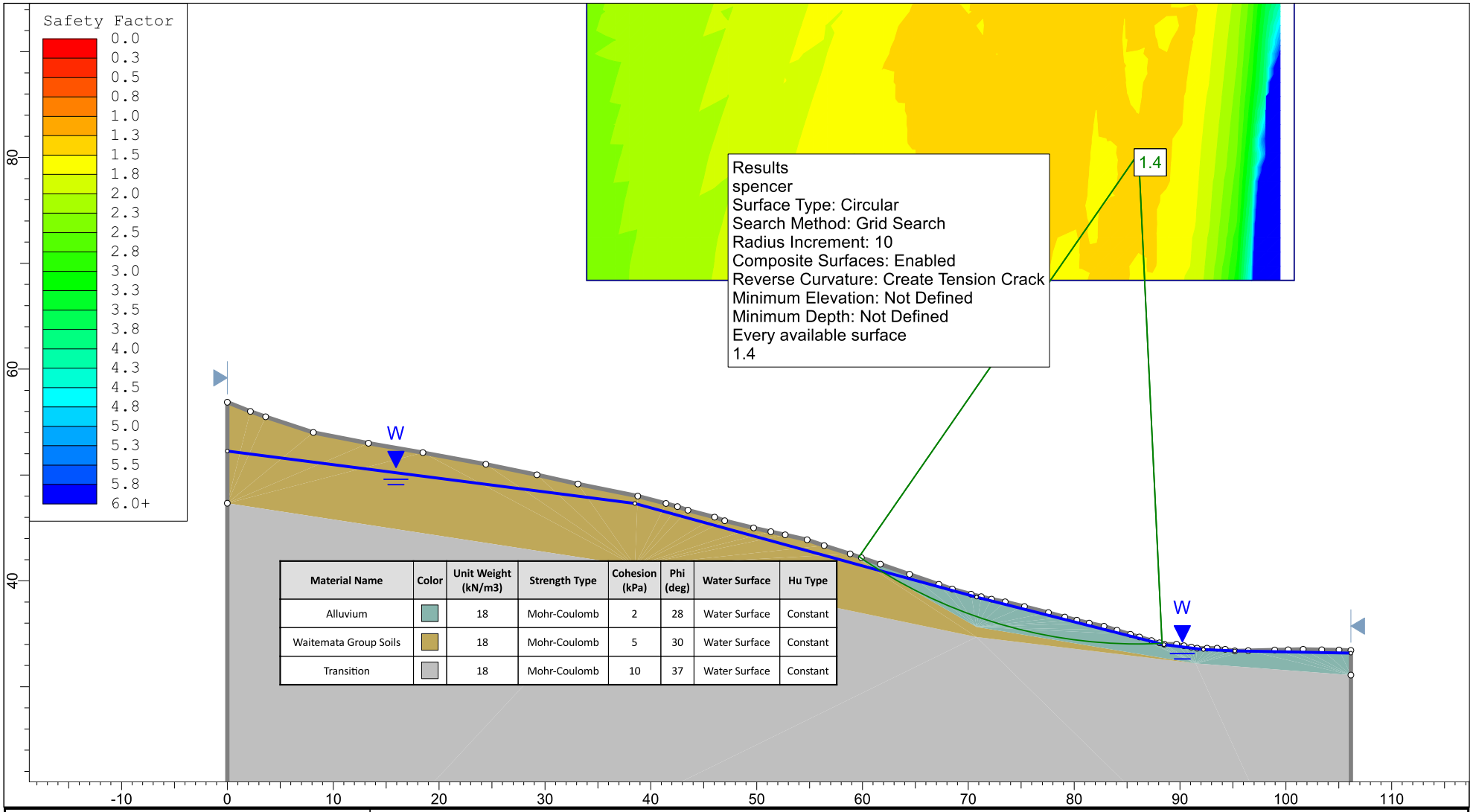
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section AA - Run 12				
Drawn By	PH	Scale	1:500	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S2AA - Run 12.slim



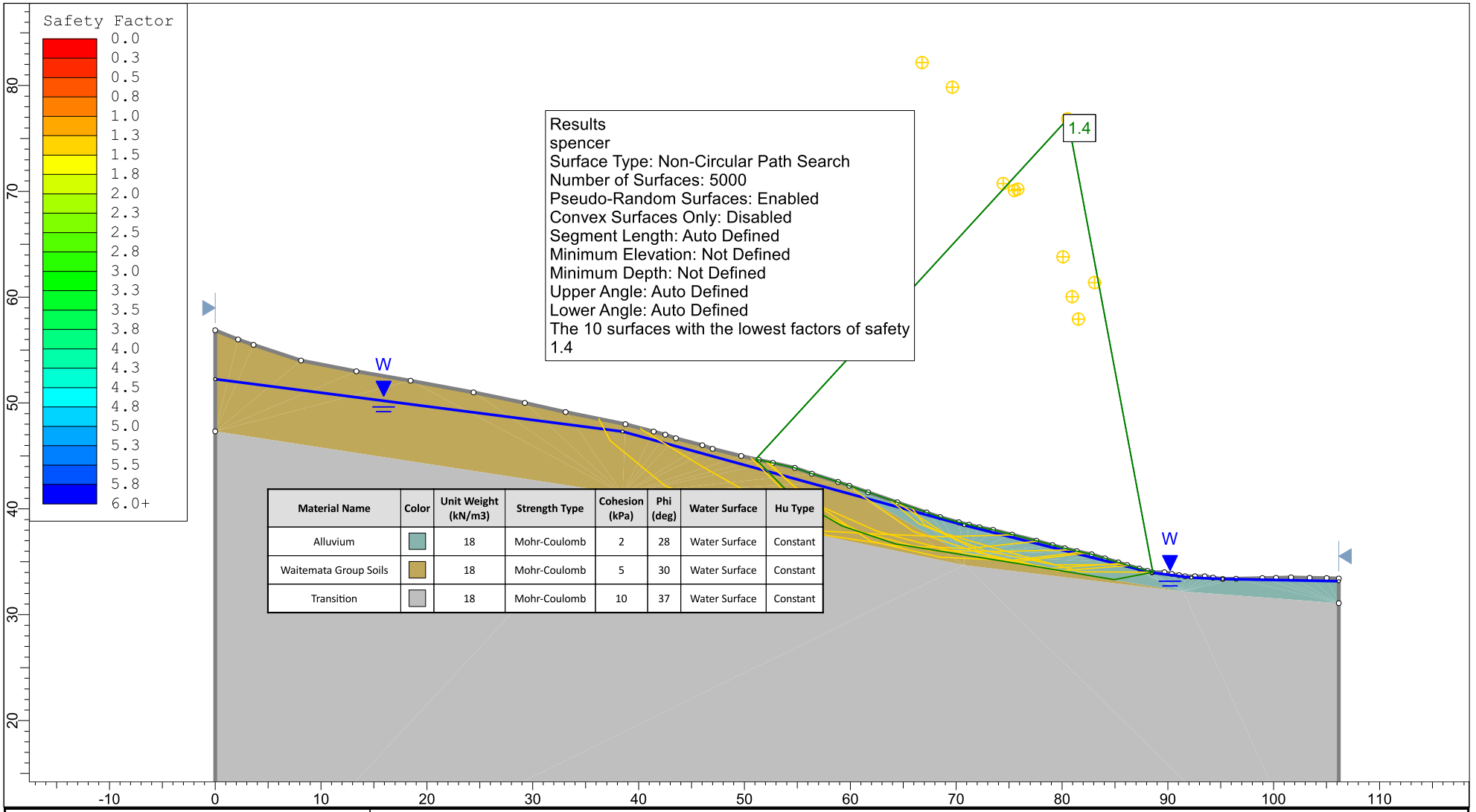
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 2, Section BB - Run 1		
Drawn By	PH	Scale 1:500	Company KGA Geotechnical
Date	31/08/2015		File Name 7464 - S2BB - Run 1.slim



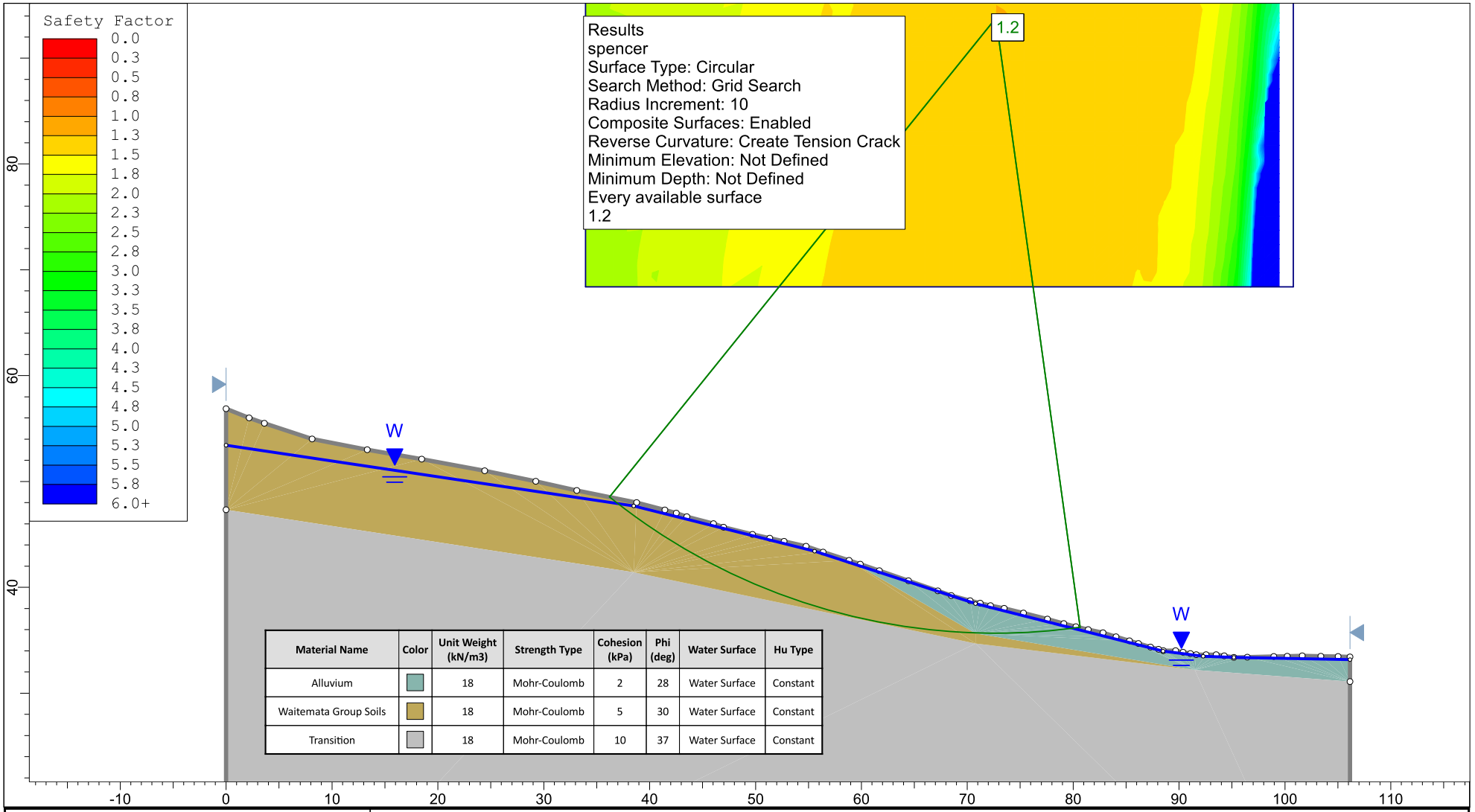
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section BB - Run 2				
Drawn By	PH	Scale	1:500	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S2BB - Run 2.slim



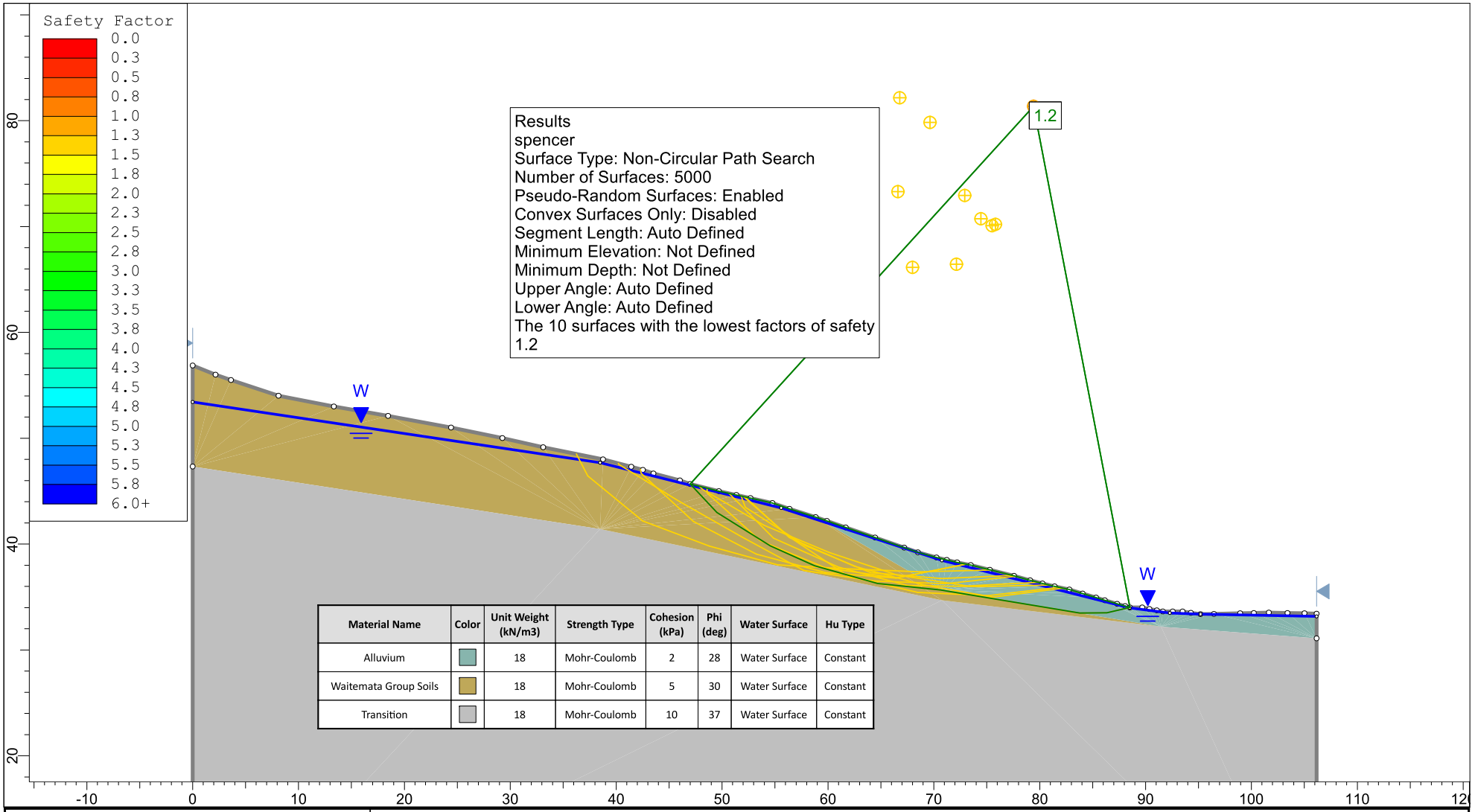
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section BB - Run 3				
Drawn By	PH	*Scale*	1:500	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S2BB - Run 3.slim



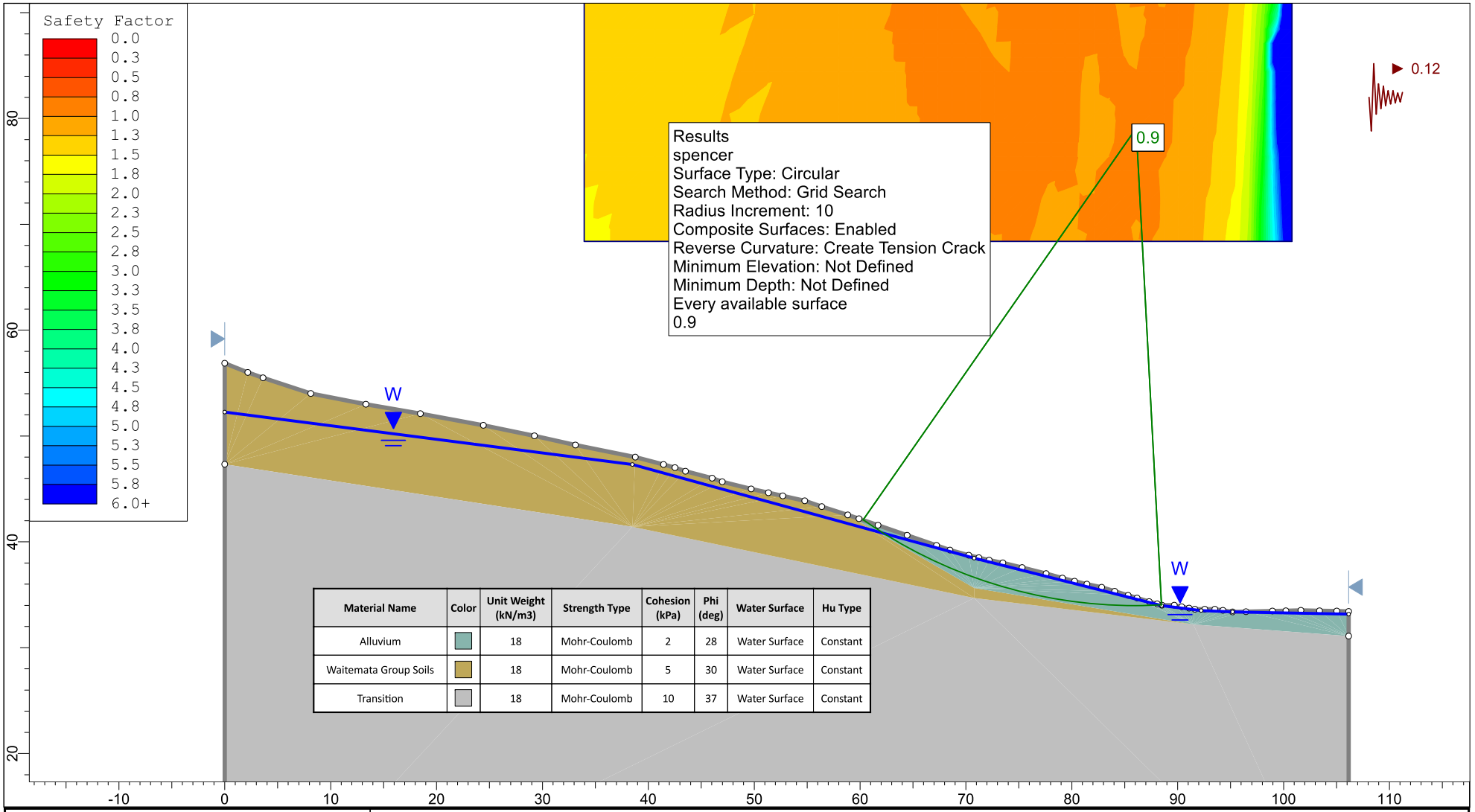
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section BB - Run 4				
Drawn By	PH	*Scale*	1:500	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S2BB - Run 4.slim



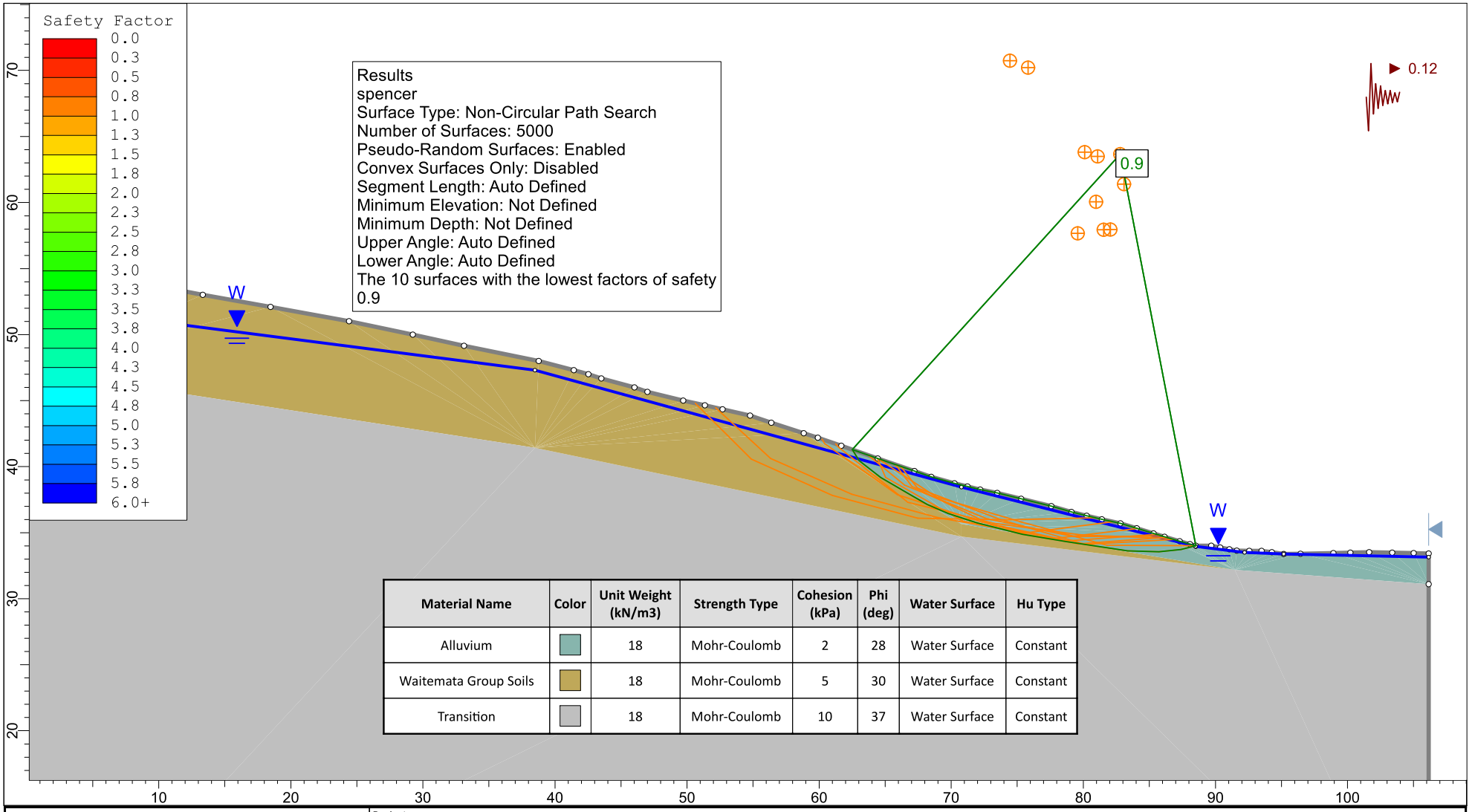
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 2, Section BB - Run 5		
Drawn By	PH	Scale 1:500	Company KGA Geotechnical
Date	31/08/2015		File Name 7464 - S2BB - Run 5.slim



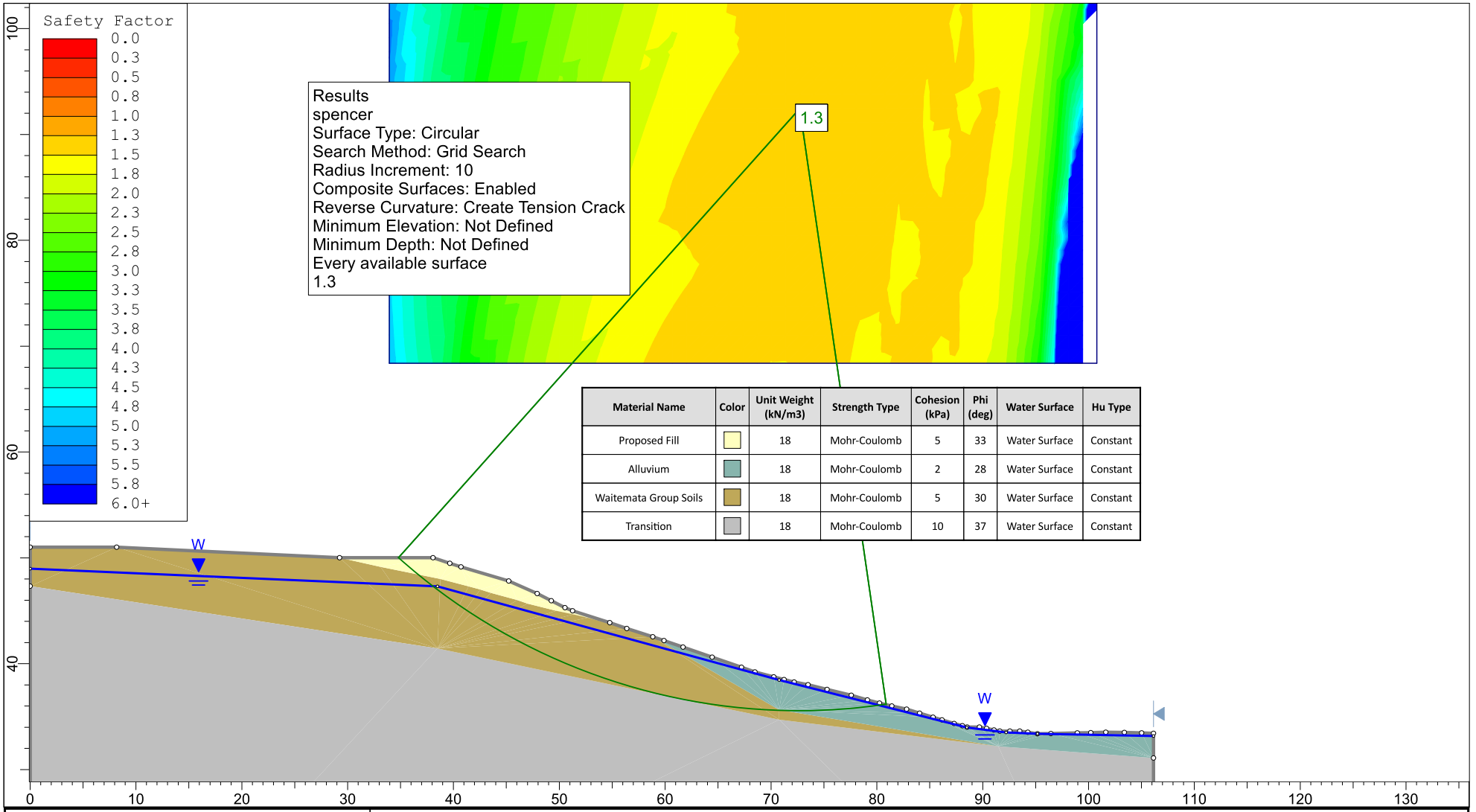
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section BB - Run 6				
Drawn By	PH	Scale	1:400	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S2BB - Run 6.slim



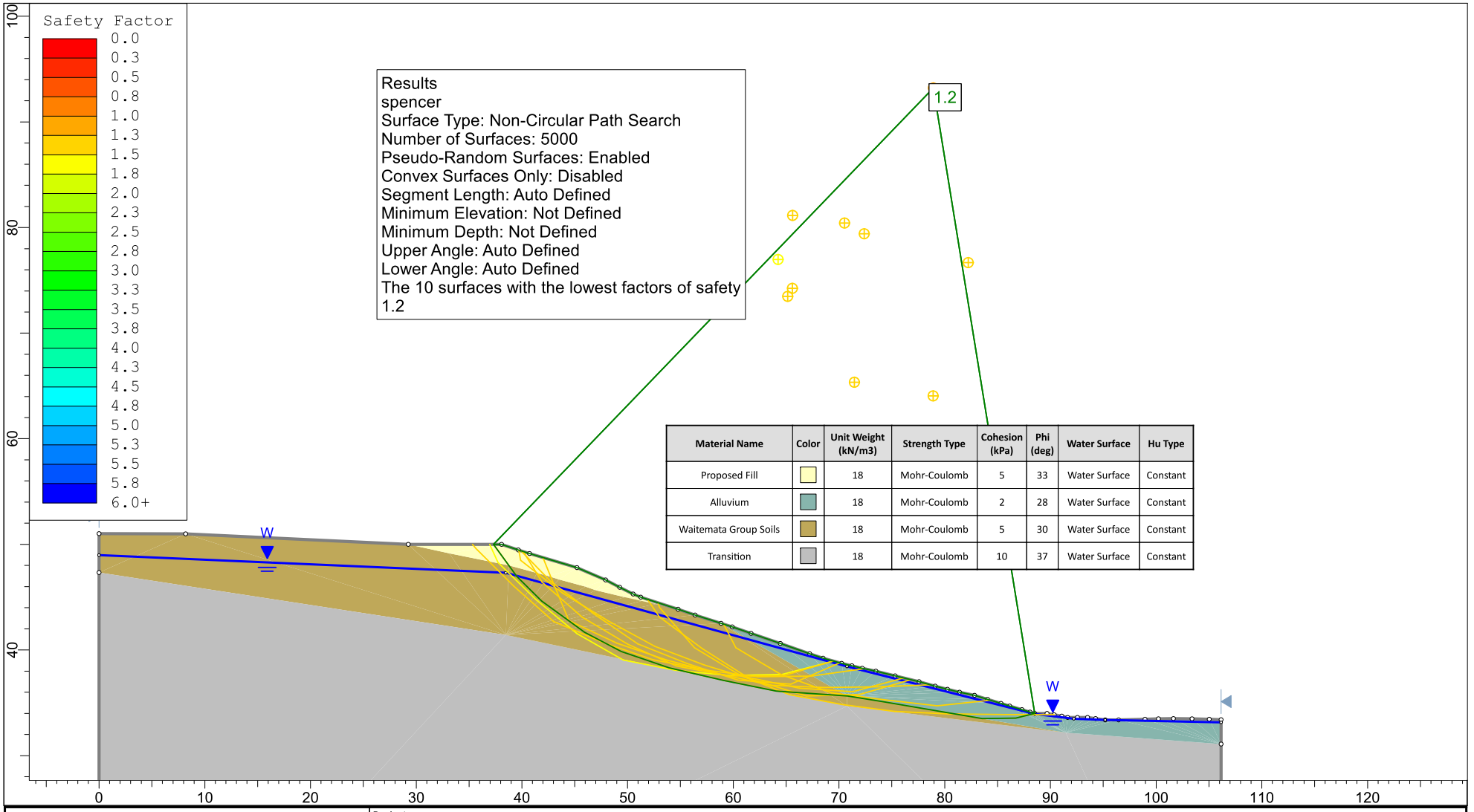
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section BB - Run 7				
Drawn By	PH	*Scale*	1:500	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S2BB - Run 7.slim



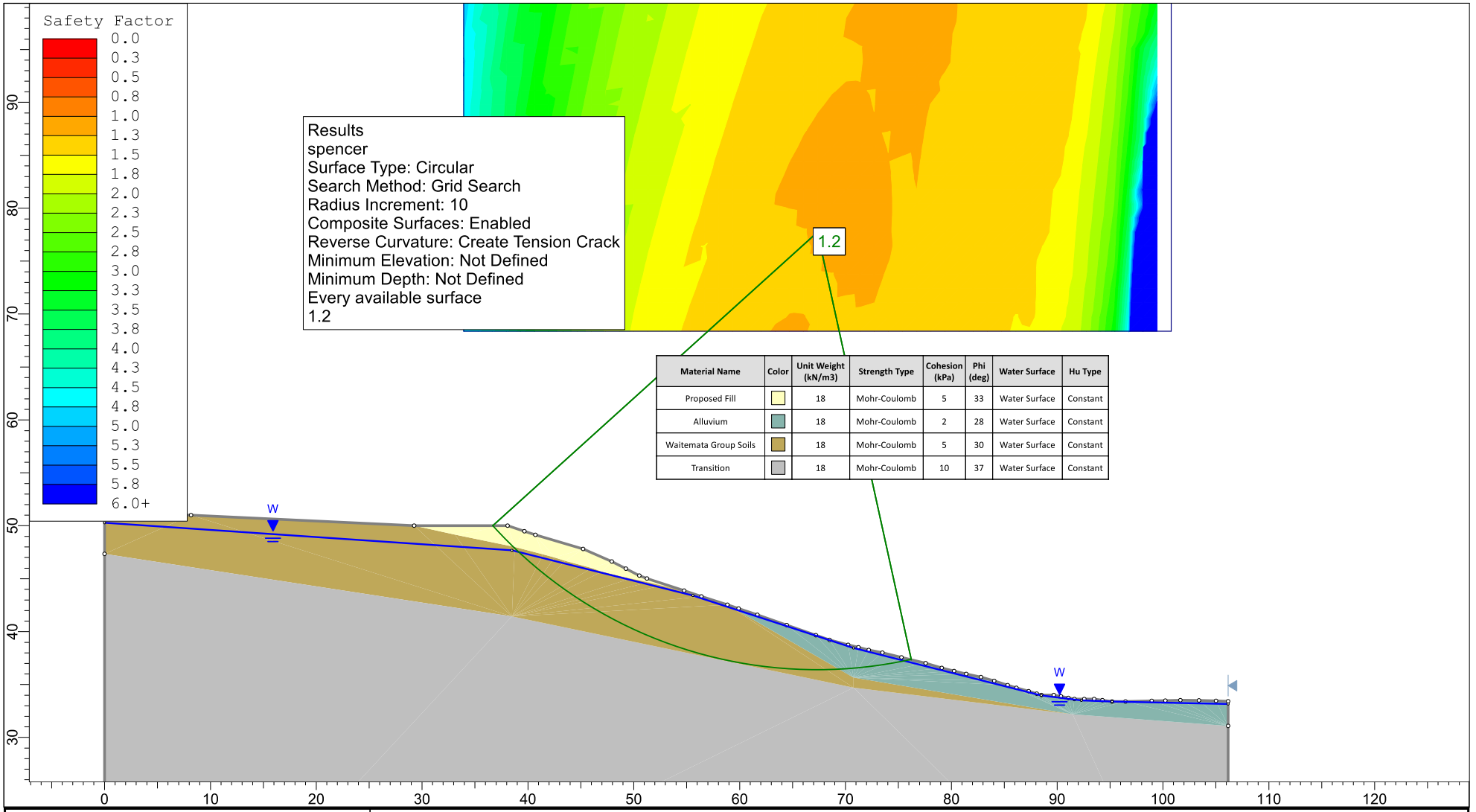
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section BB - Run 8				
Drawn By	PH	*Scale*	1:500	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S2BB - Run 8.slim



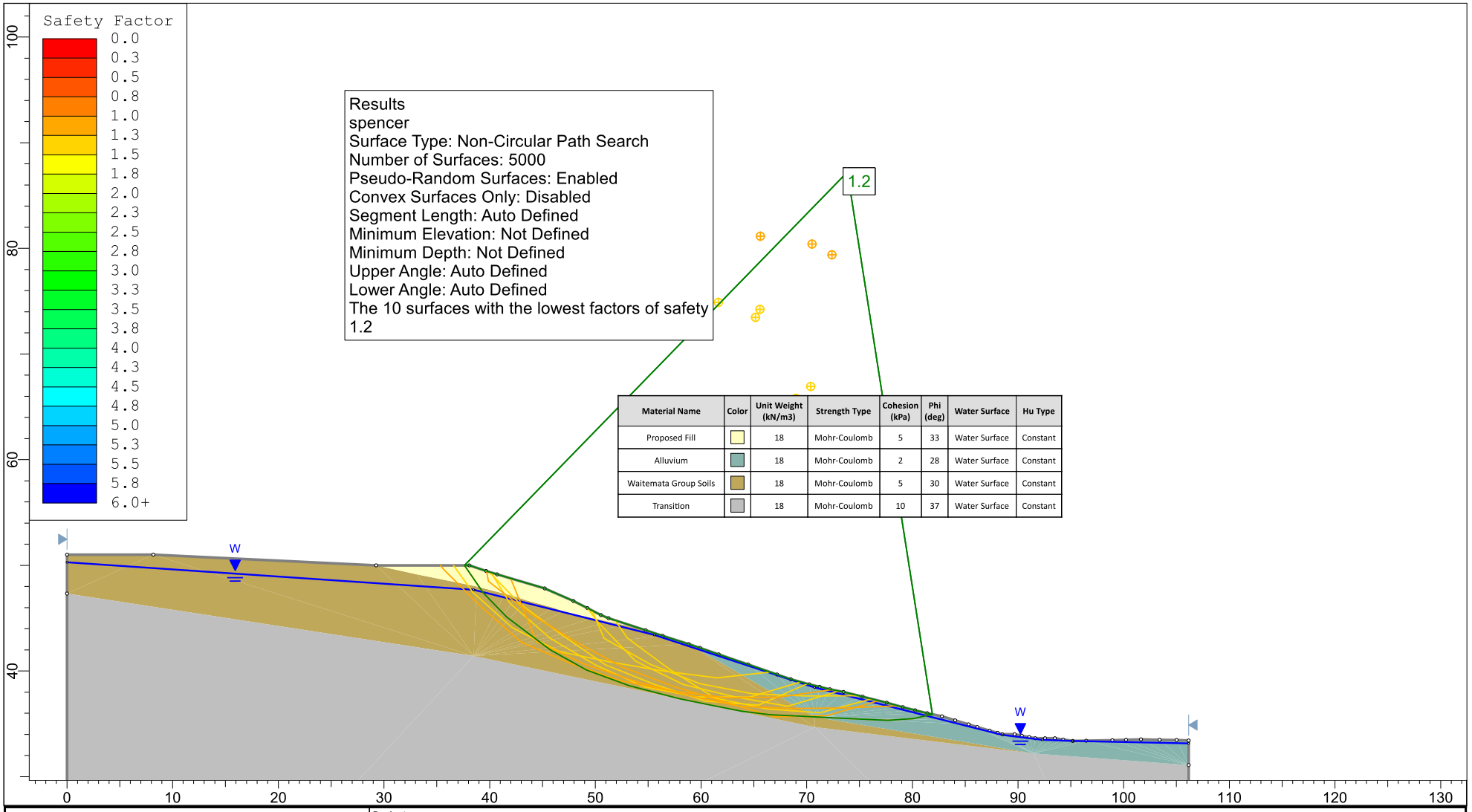
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section BB - Run 9				
Drawn By	PH	*Scale*	1:500	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S2BB - Run 9.slim



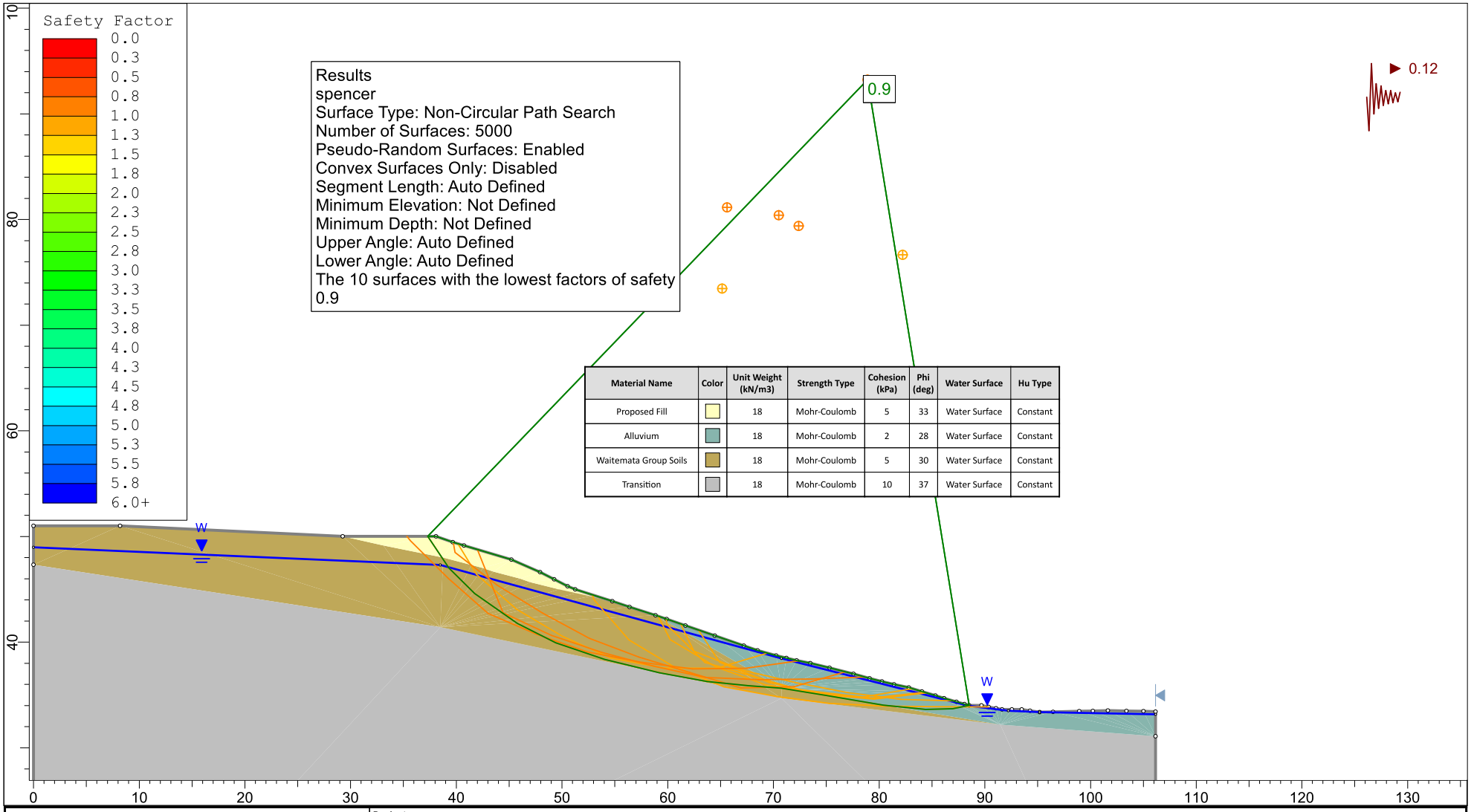
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section BB - Run 10				
Drawn By	PH	*Scale*	1:500	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S2BB - Run 10.slim



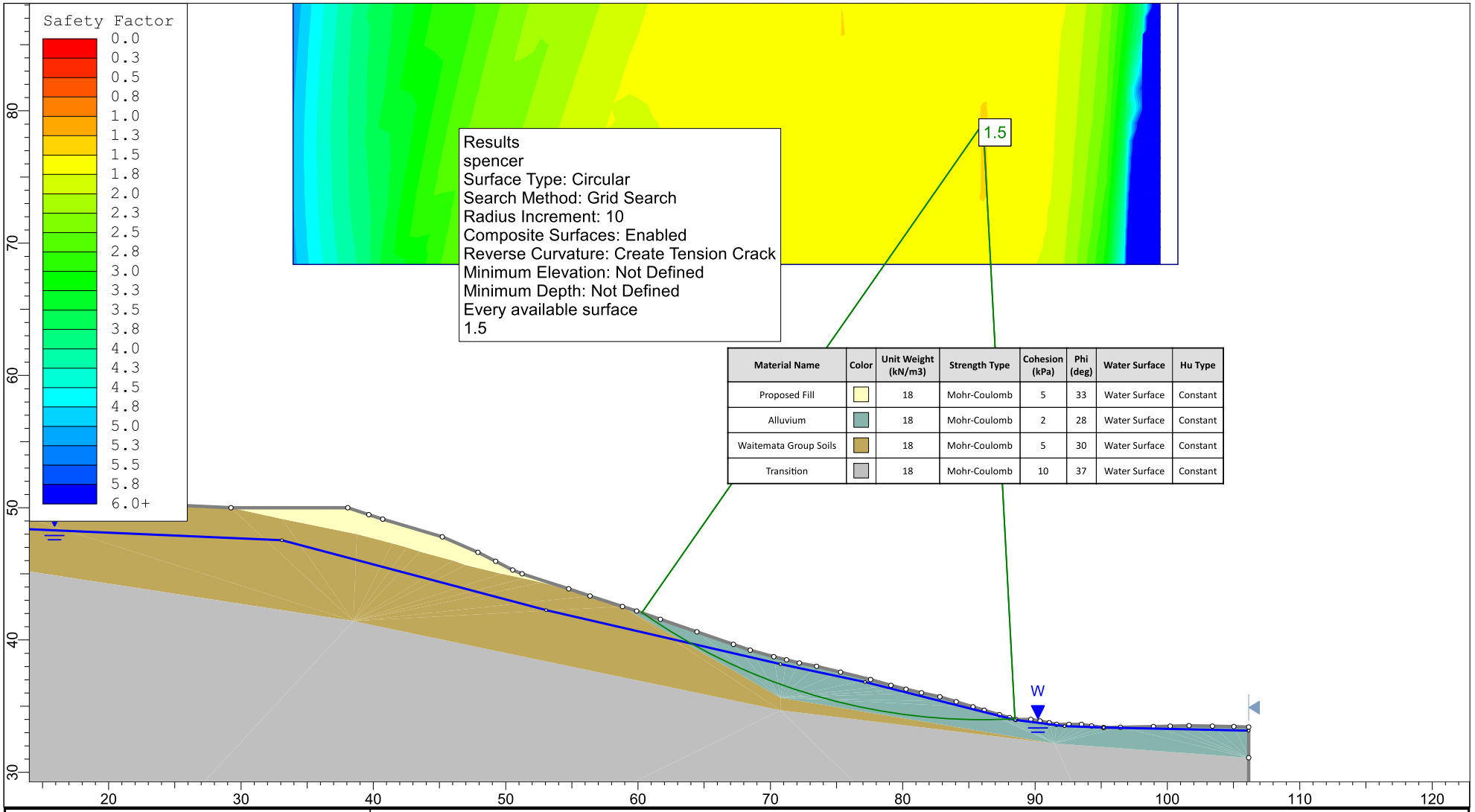
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section BB - Run 12				
Drawn By	PH	*Scale*	1:500	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S2BB - Run 12.slim



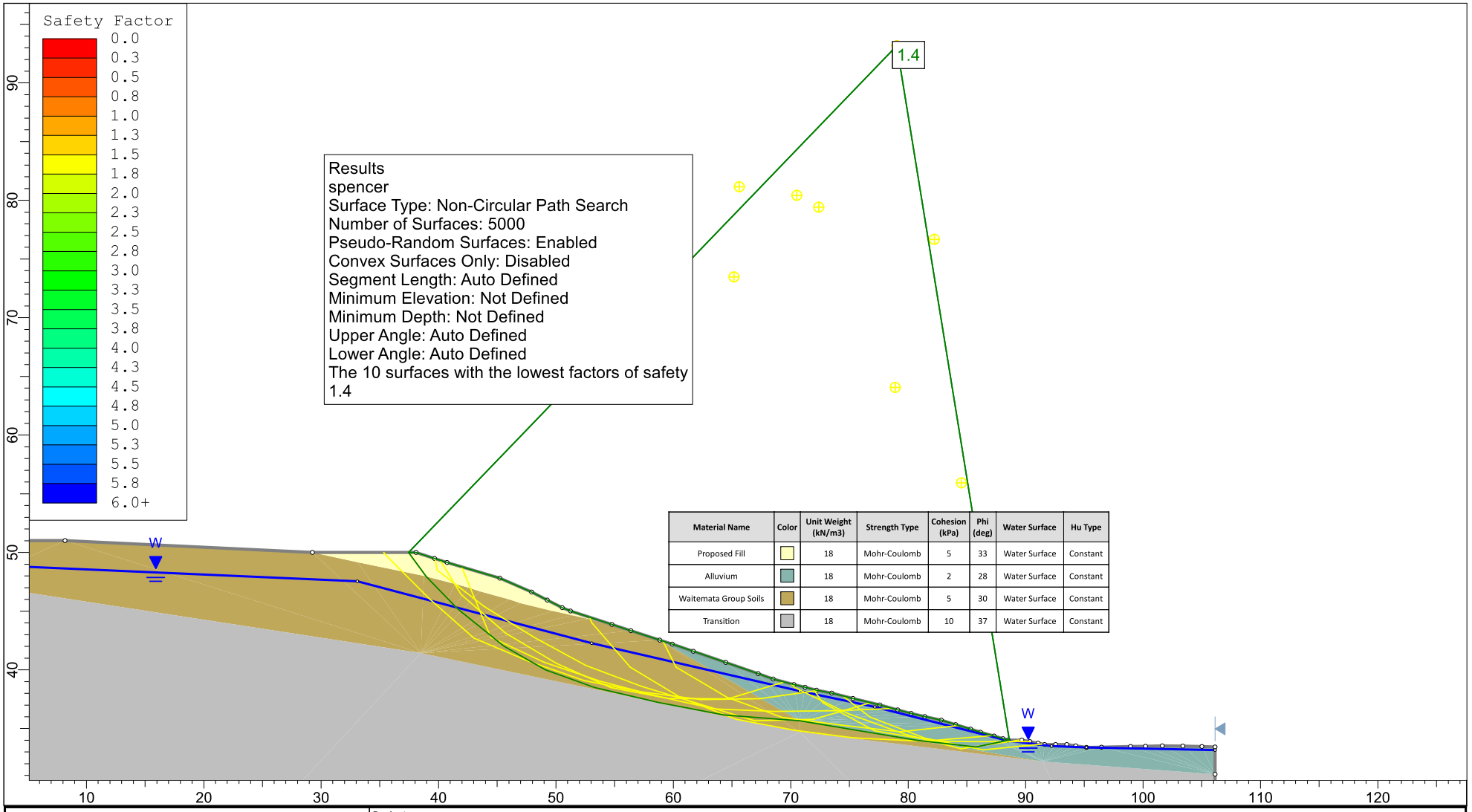
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section BB - Run 13 (Drainage Installed)				
Drawn By	PH	*Scale*	1:400	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S2BB - Run 13.slim



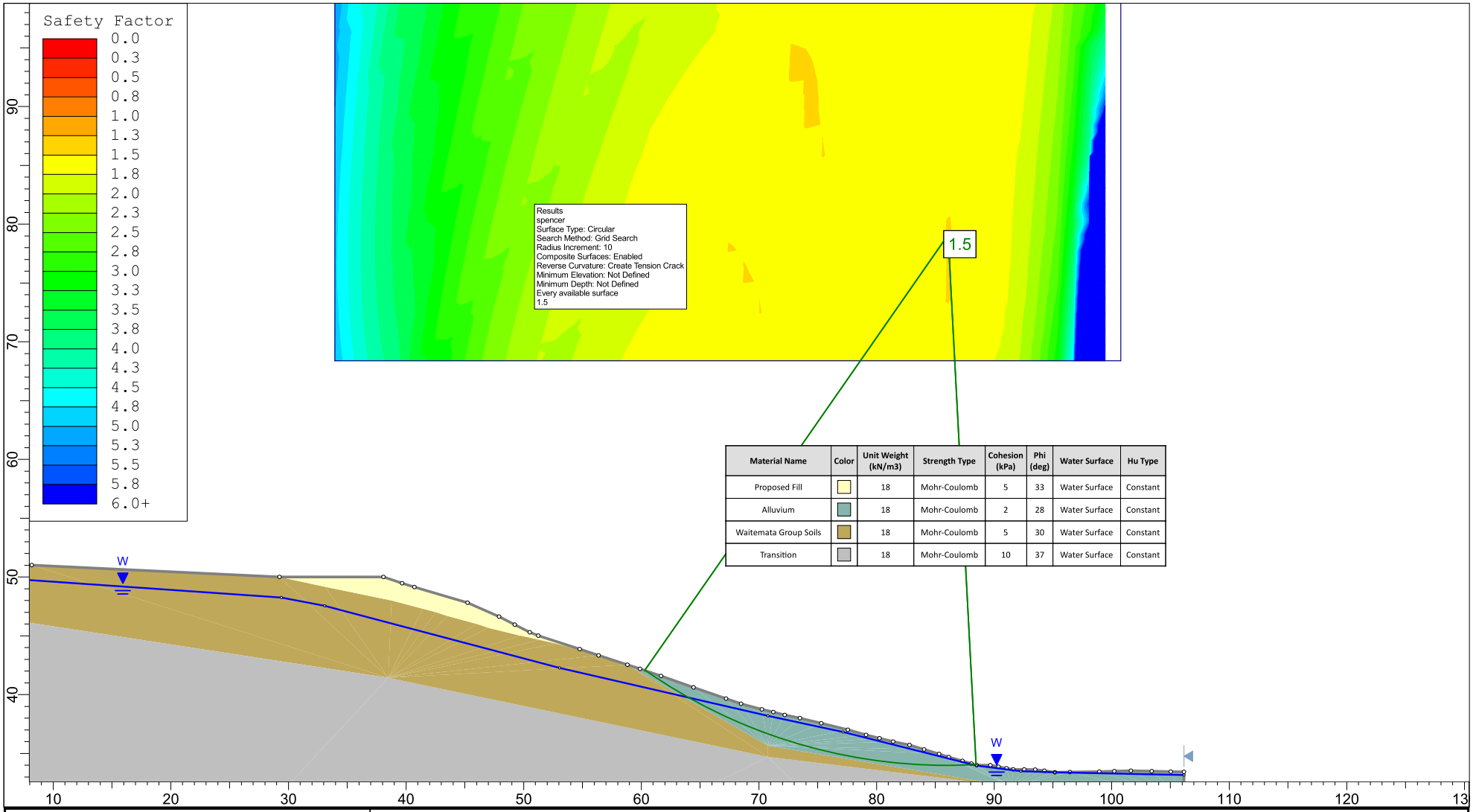
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section BB - Run 14 (Drainage Installed)				
Drawn By	PH	*Scale*	1:450	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S2BB - Run 14.slim



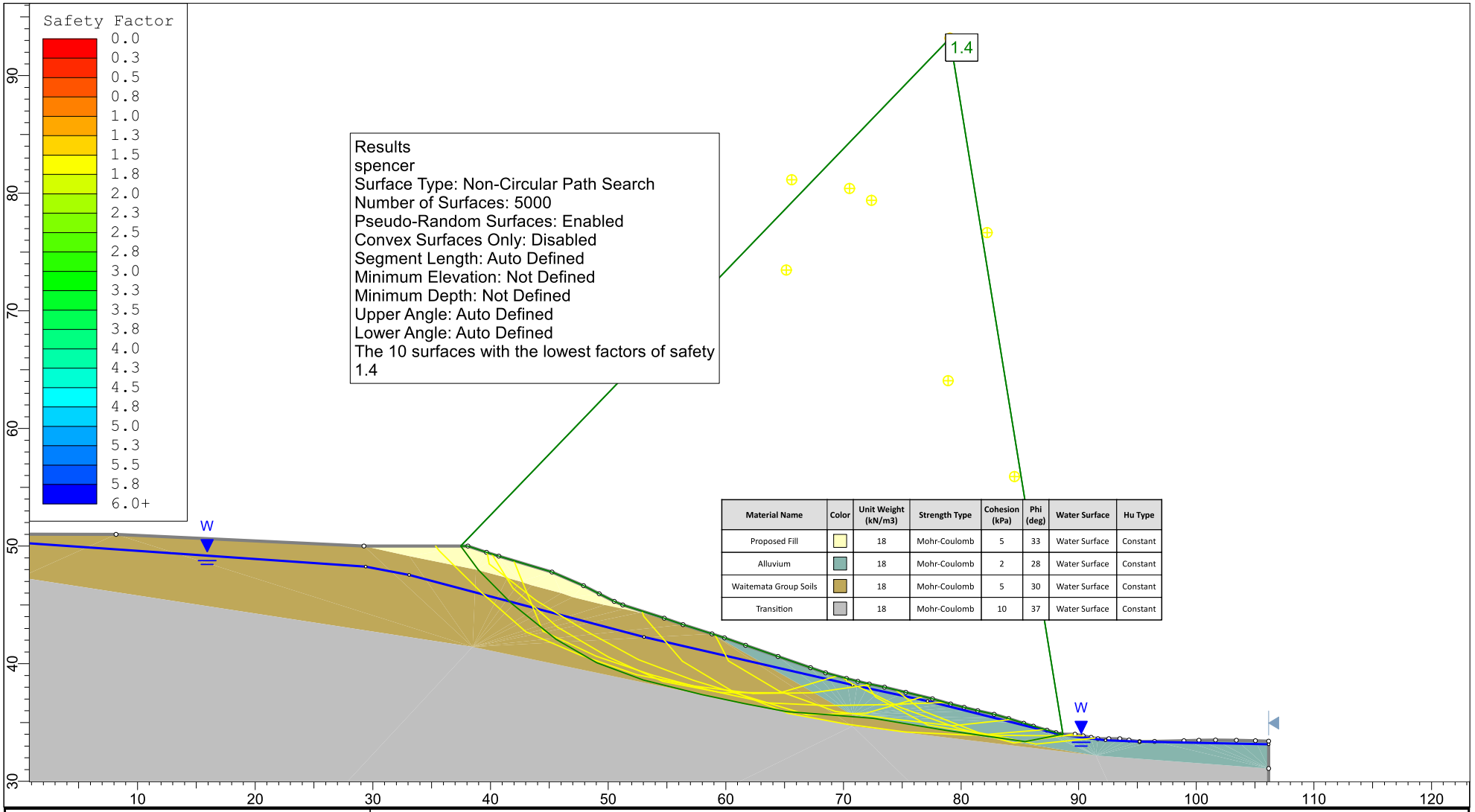
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section BB - Run 15 (Drainage Installed)				
Drawn By	PH	*Scale*	1:450	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S2BB - Run 15.slim



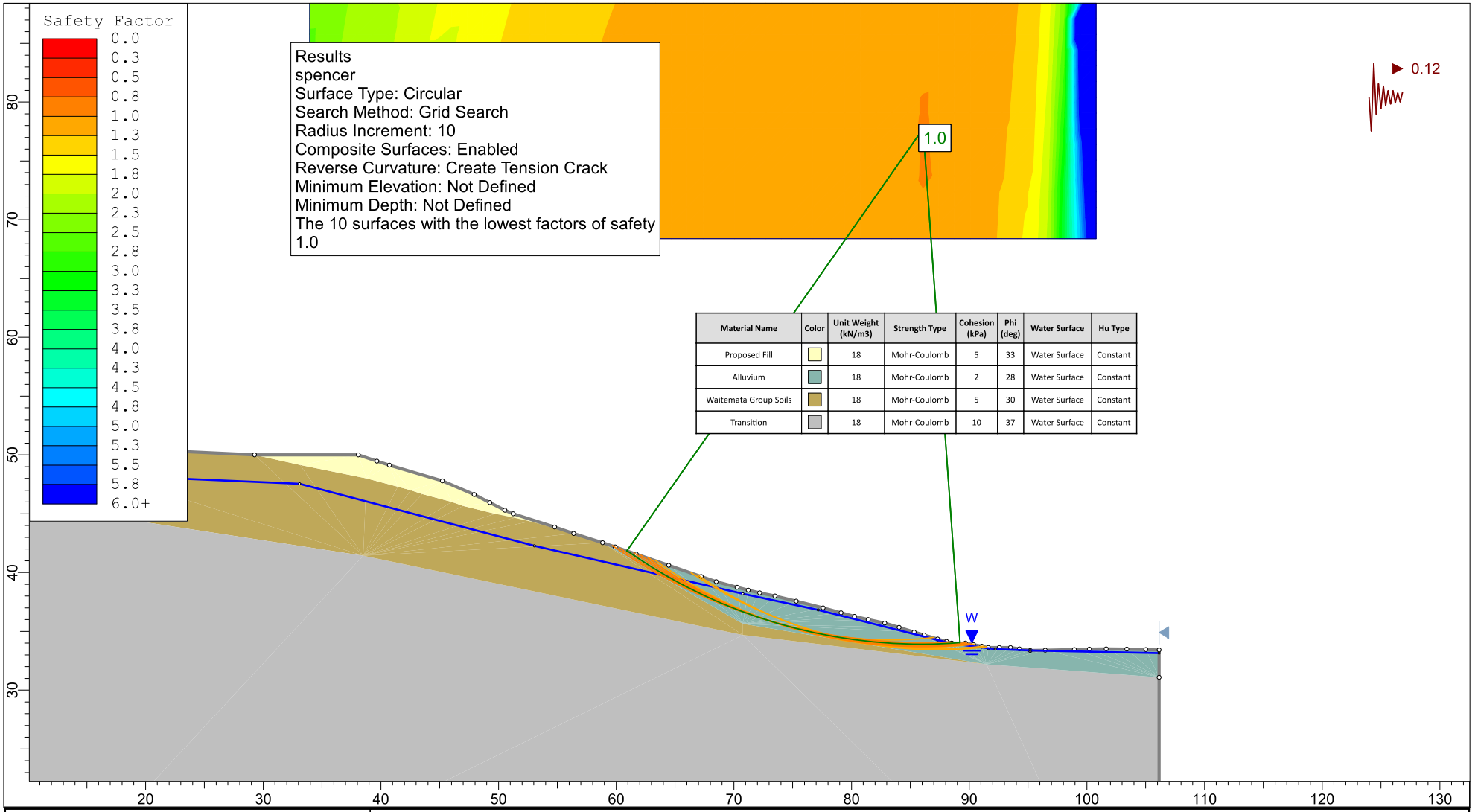
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section BB - Run 16 (Drainage Installed)				
Drawn By	PH	*Scale*	1:450	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S2BB - Run 16.slim



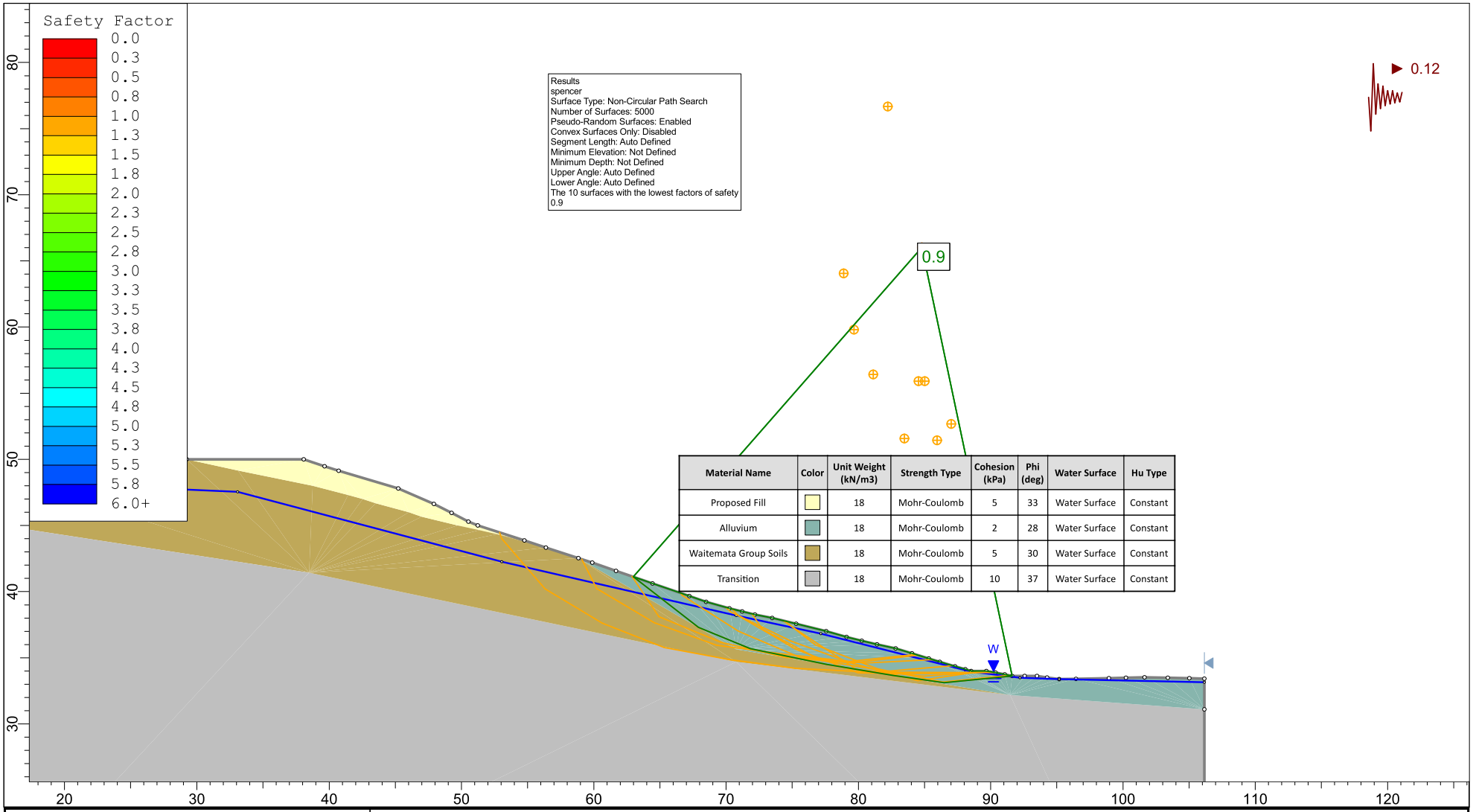
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section BB - Run 17 (Drainage Installed)				
Drawn By	PH	*Scale*	1:450	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S2BB - Run 17.slim



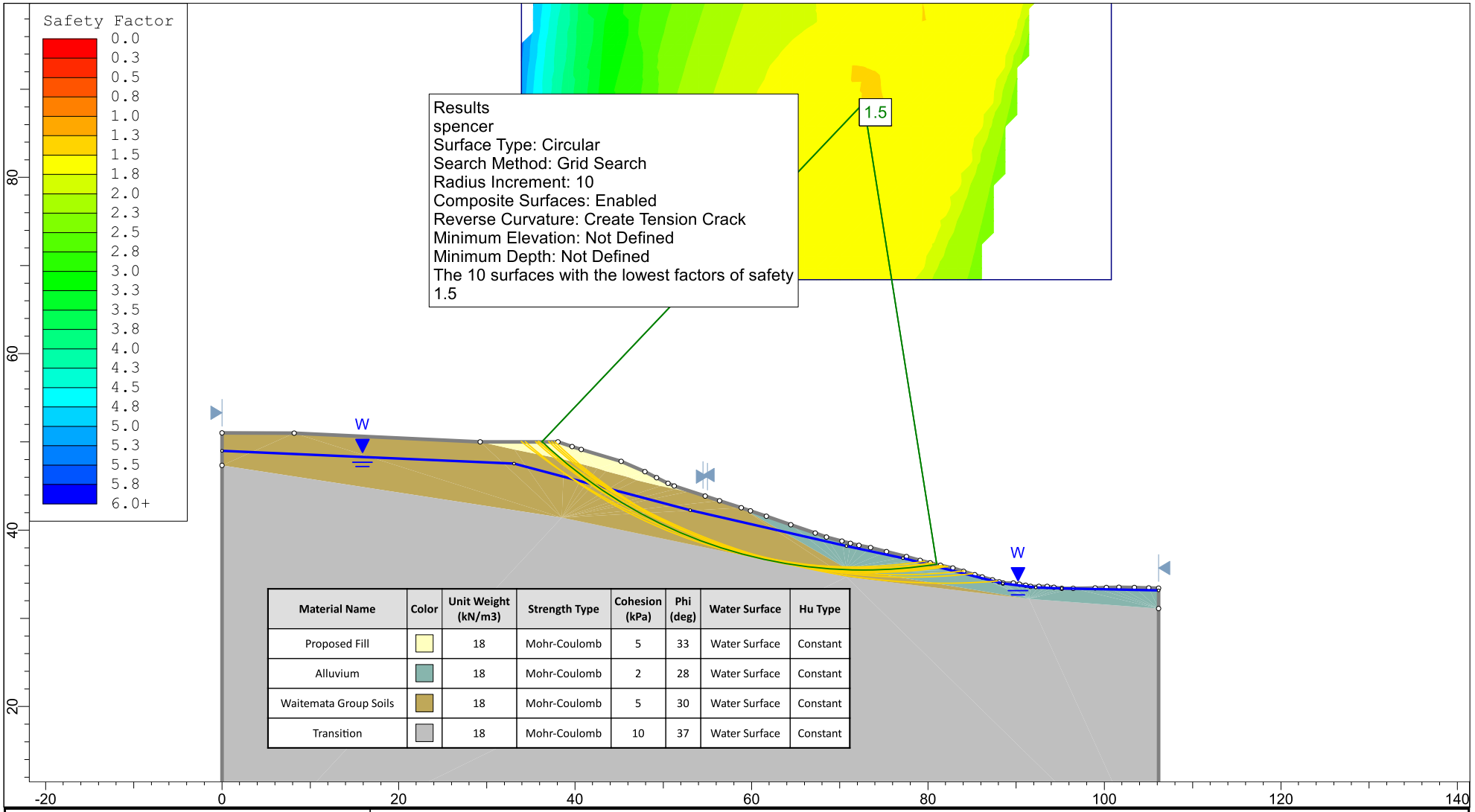
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section BB - Run 18 (Drainage Installed)				
Drawn By	PH	*Scale*	1:400	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S2BB - Run 18.slim



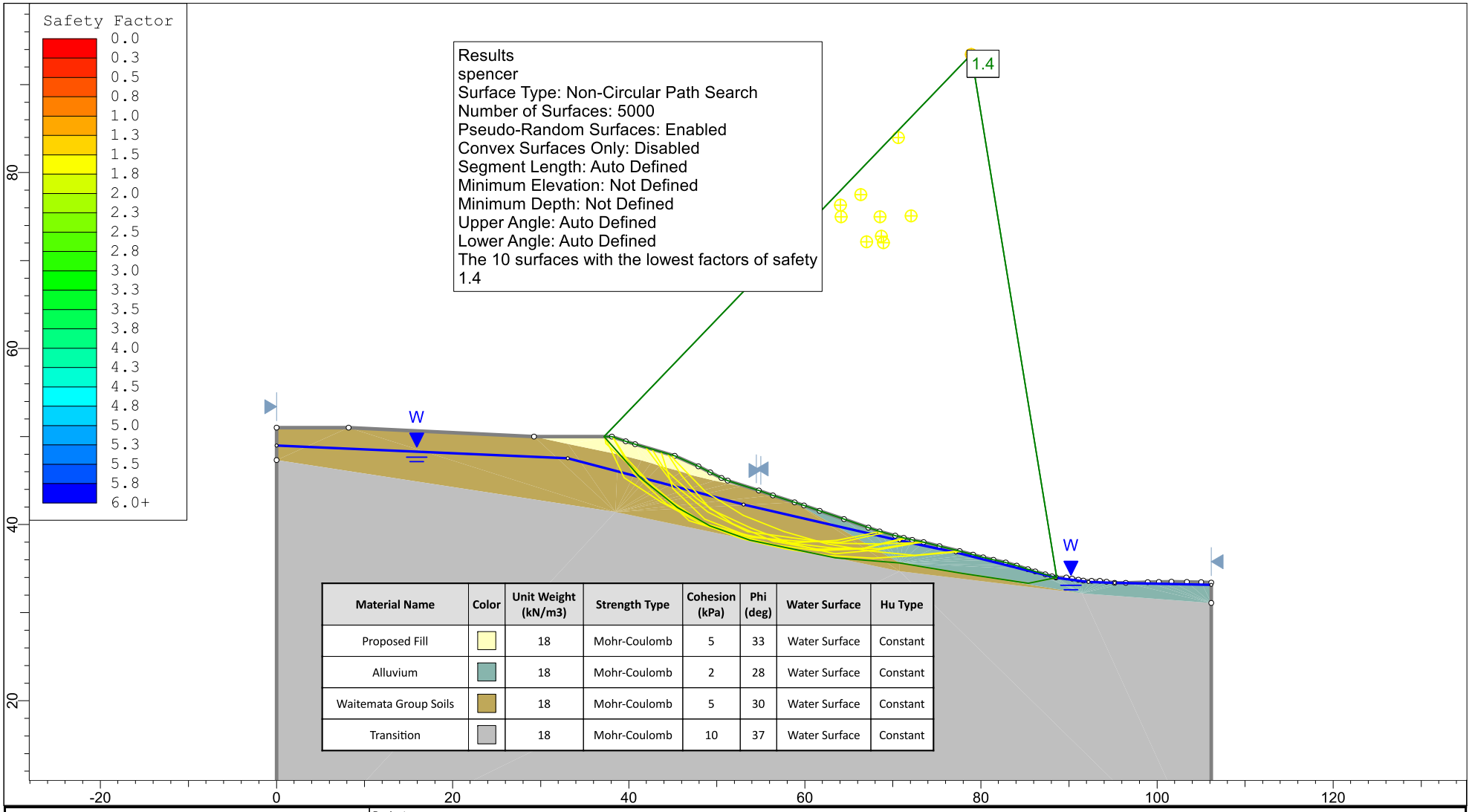
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section BB - Run 19 (Drainage Installed - AL)				
Drawn By	PH	*Scale*	1:600	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S2BB - Run 19.slim



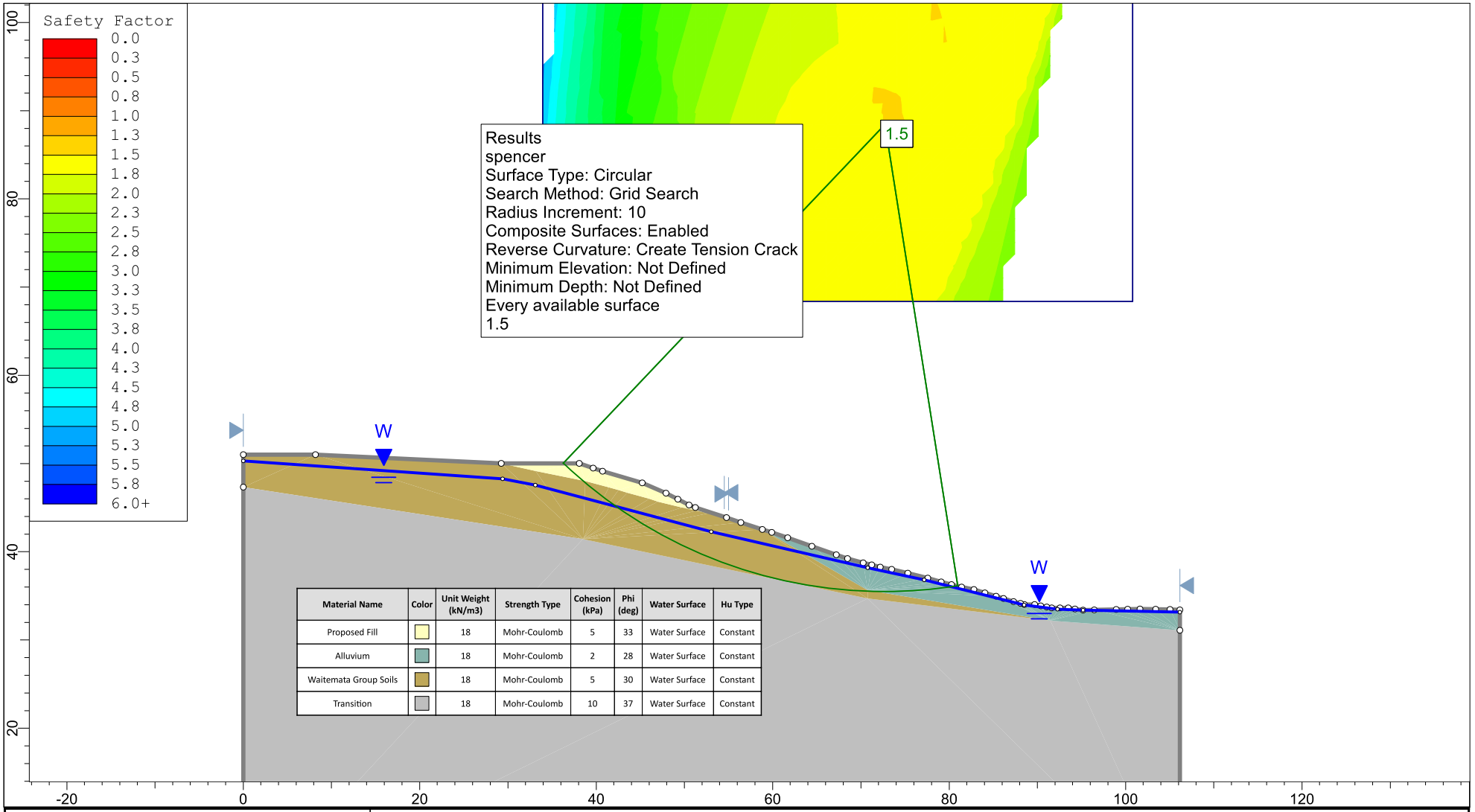
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section BB - Run 20 (Drainage Installed - AL)				
Drawn By	PH	*Scale*	1:600	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S2BB - Run 20.slim



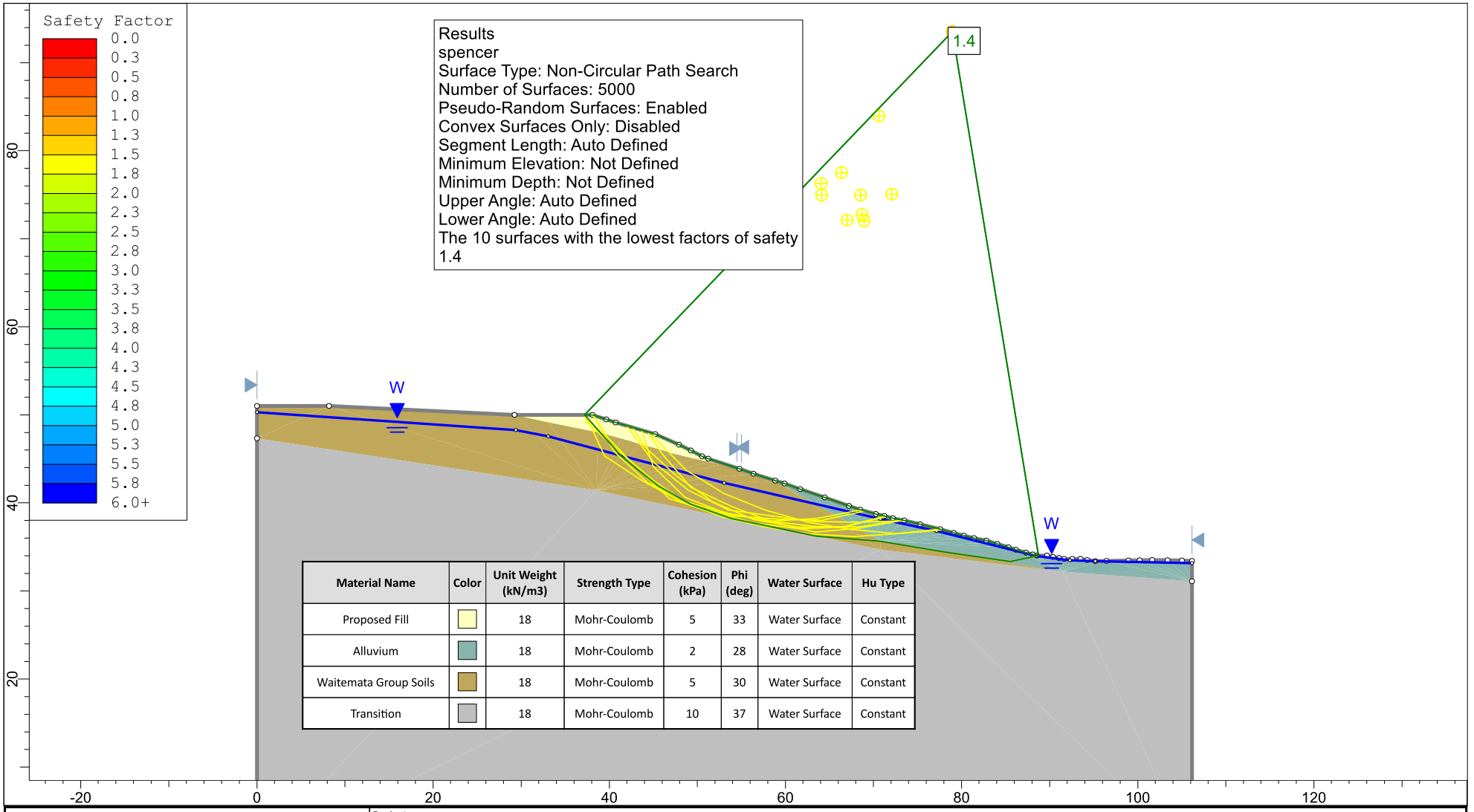
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section BB - Run 21 (Drainage Installed - AL)				
Drawn By	PH	*Scale*	1:600	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S2BB - Run 21.slim



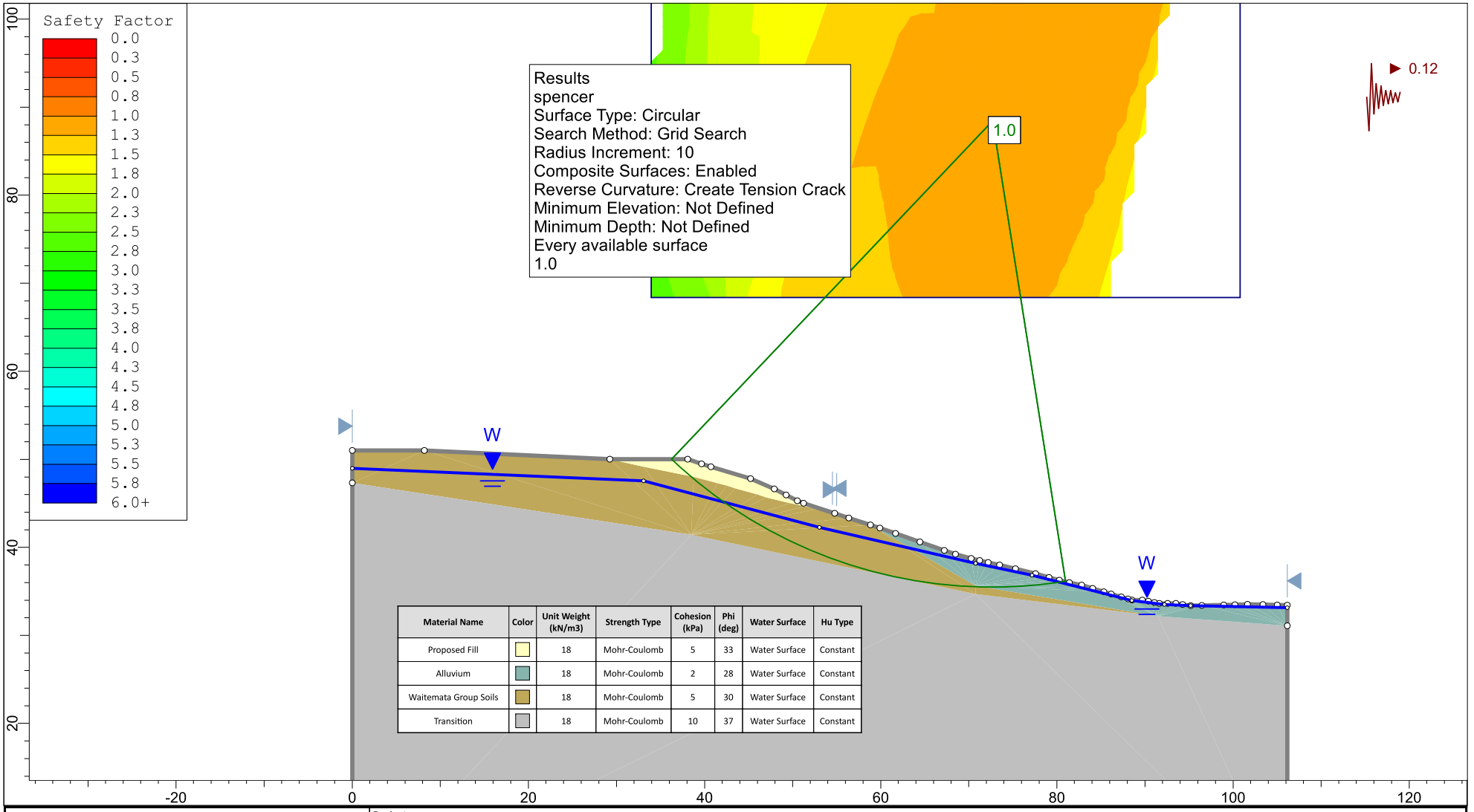
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section BB - Run 22 (Drainage Installed - AL)				
Drawn By	PH	*Scale*	1:600	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S2BB - Run 22.slim



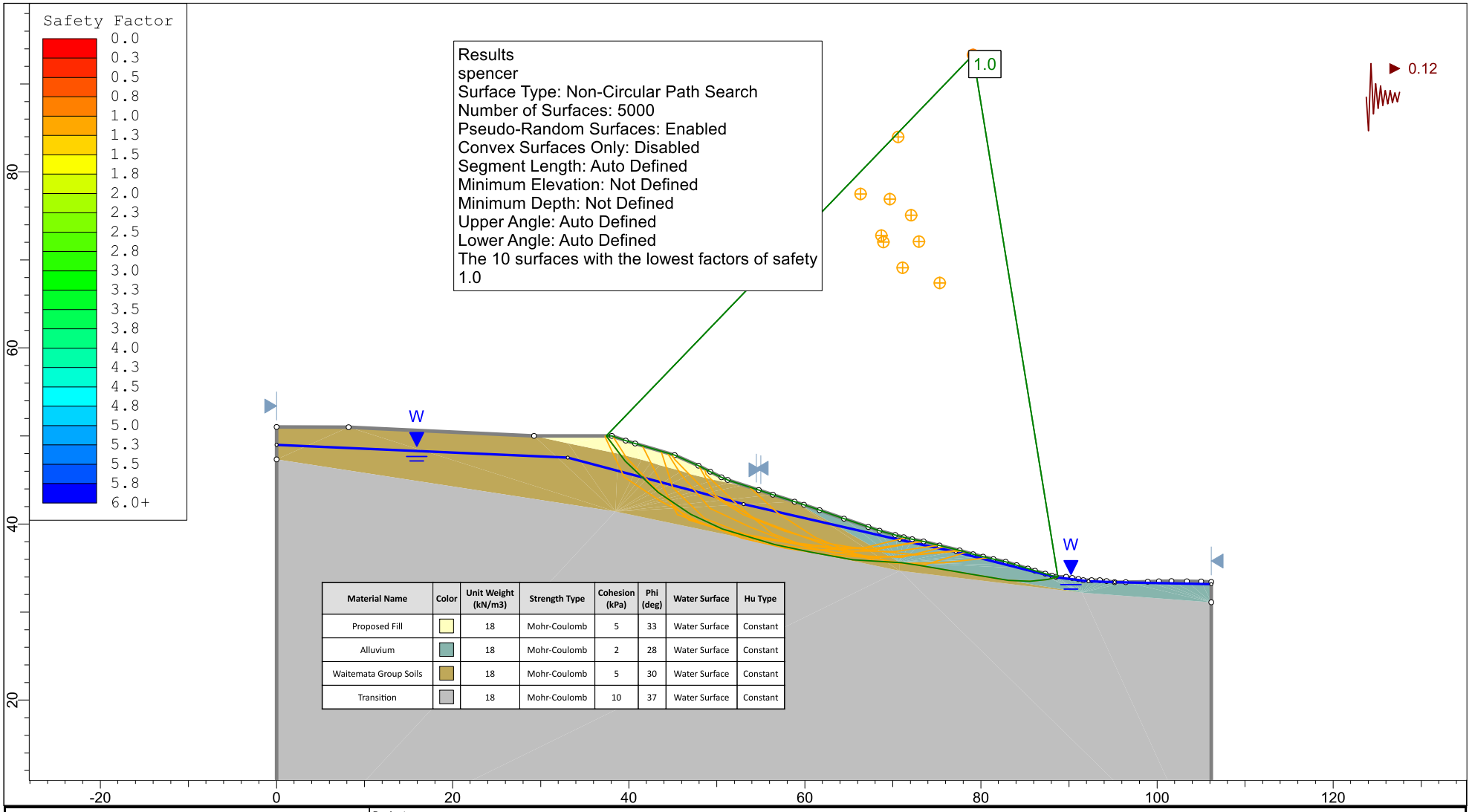
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 2, Section BB - Run 23 (Drainage Installed - AL)		
Drawn By	PH	*Scale* 1:600	*Company* KGA Geotechnical
Date	31/08/2015		*File Name* 7464 - S2BB - Run 23.slim

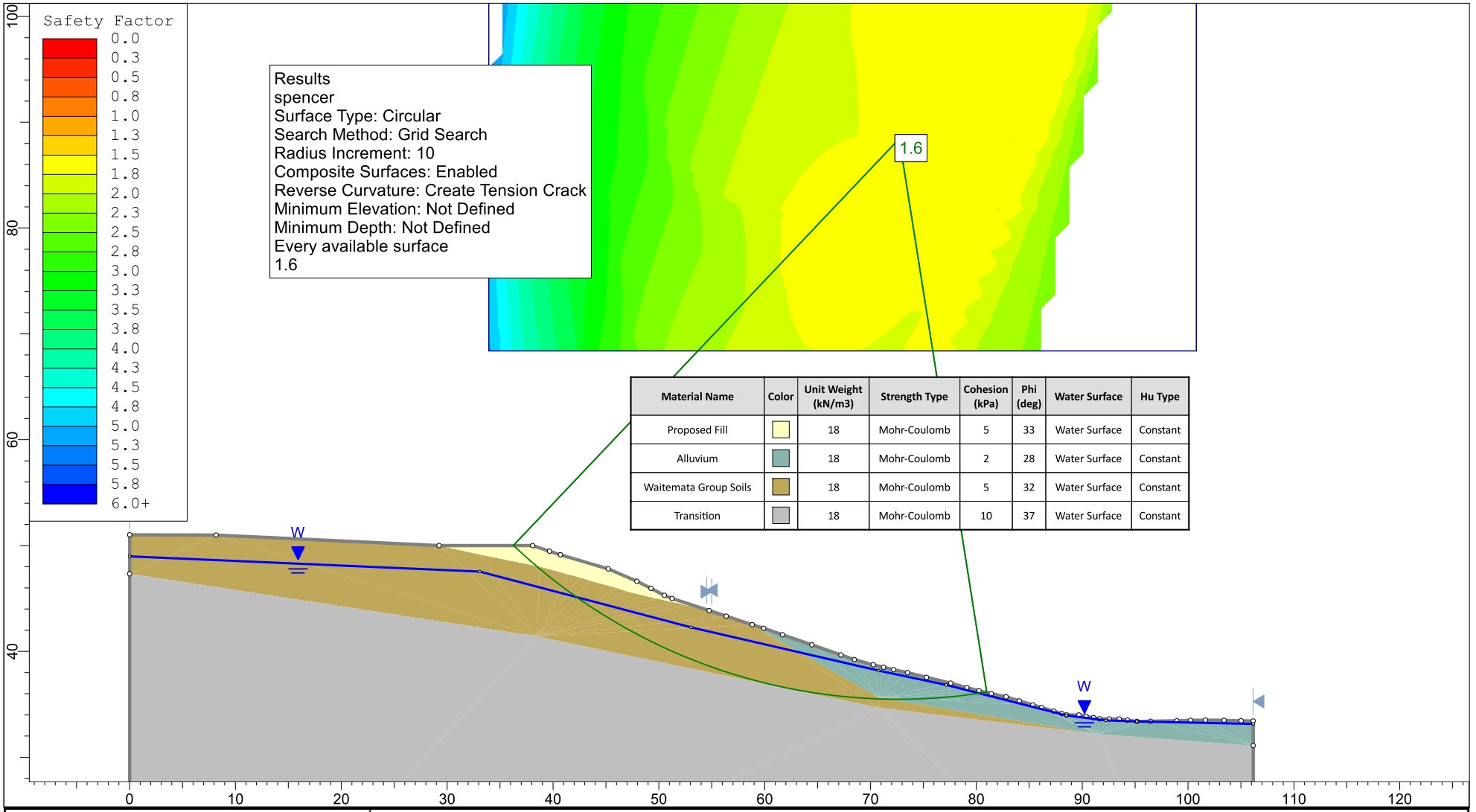


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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 2, Section BB - Run 24 (Drainage Installed - AL)		
Drawn By	PH	*Scale* 1:600	*Company* KGA Geotechnical
Date	31/08/2015		*File Name* 7464 - S2BB - Run 24.slim



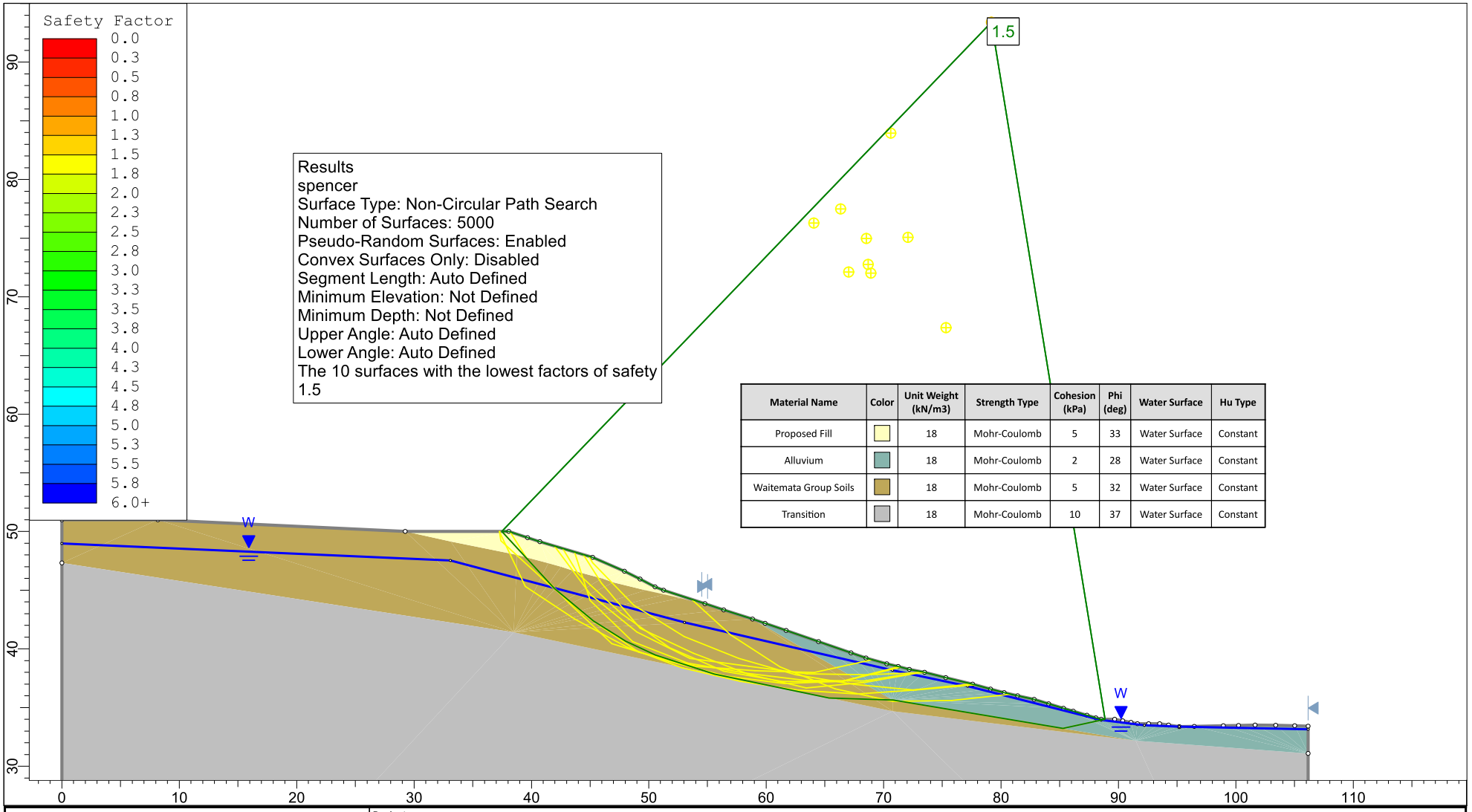
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	32	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section BB - Run 25 (Drainage Installed - AL - AP)				
Drawn By	PH	Scale	1:500	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S2BB - Run 25.slim



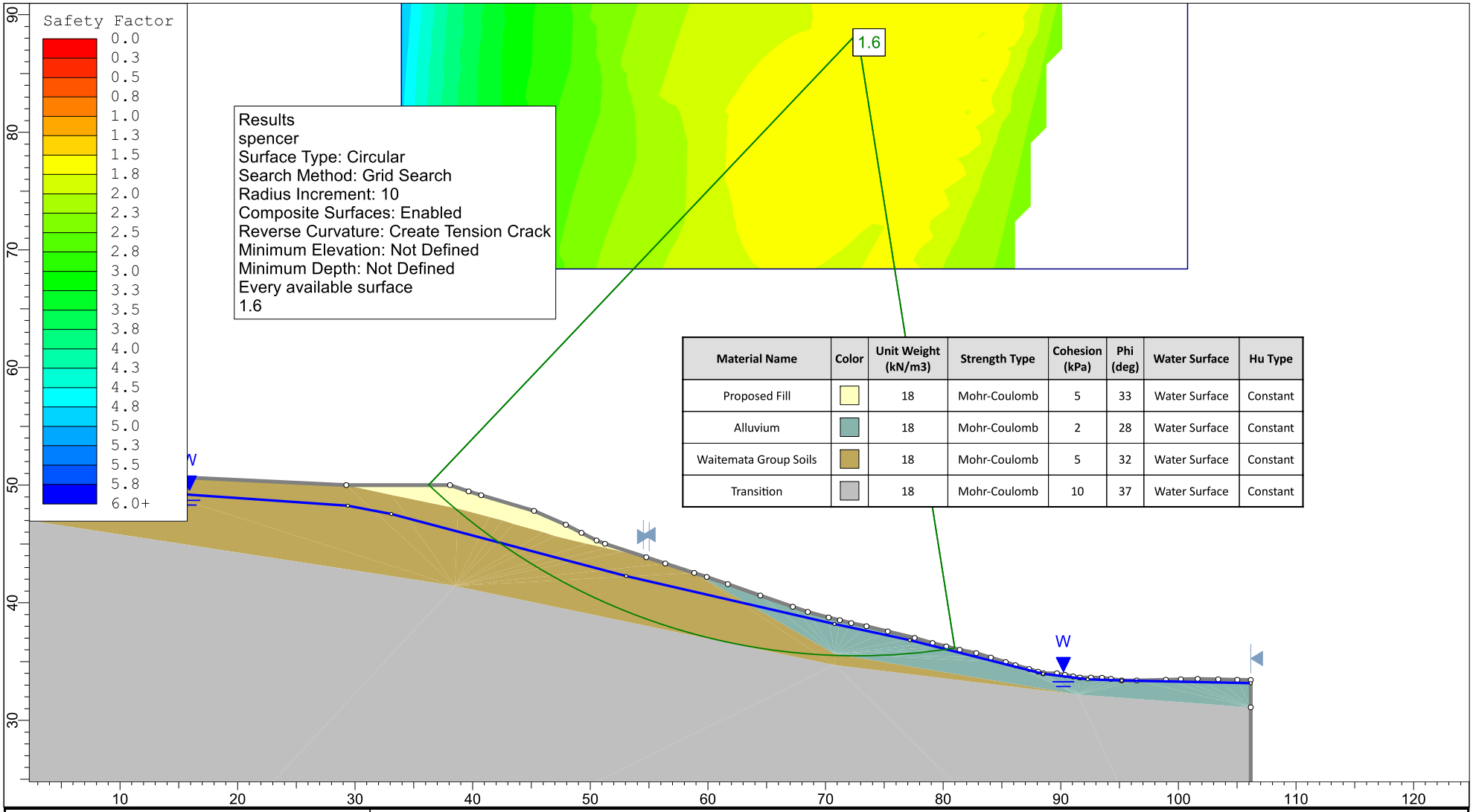
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	32	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section BB - Run 26 (Drainage Installed - AL - AP)				
Drawn By	PH	*Scale*	1:450	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S2BB - Run 26.slim



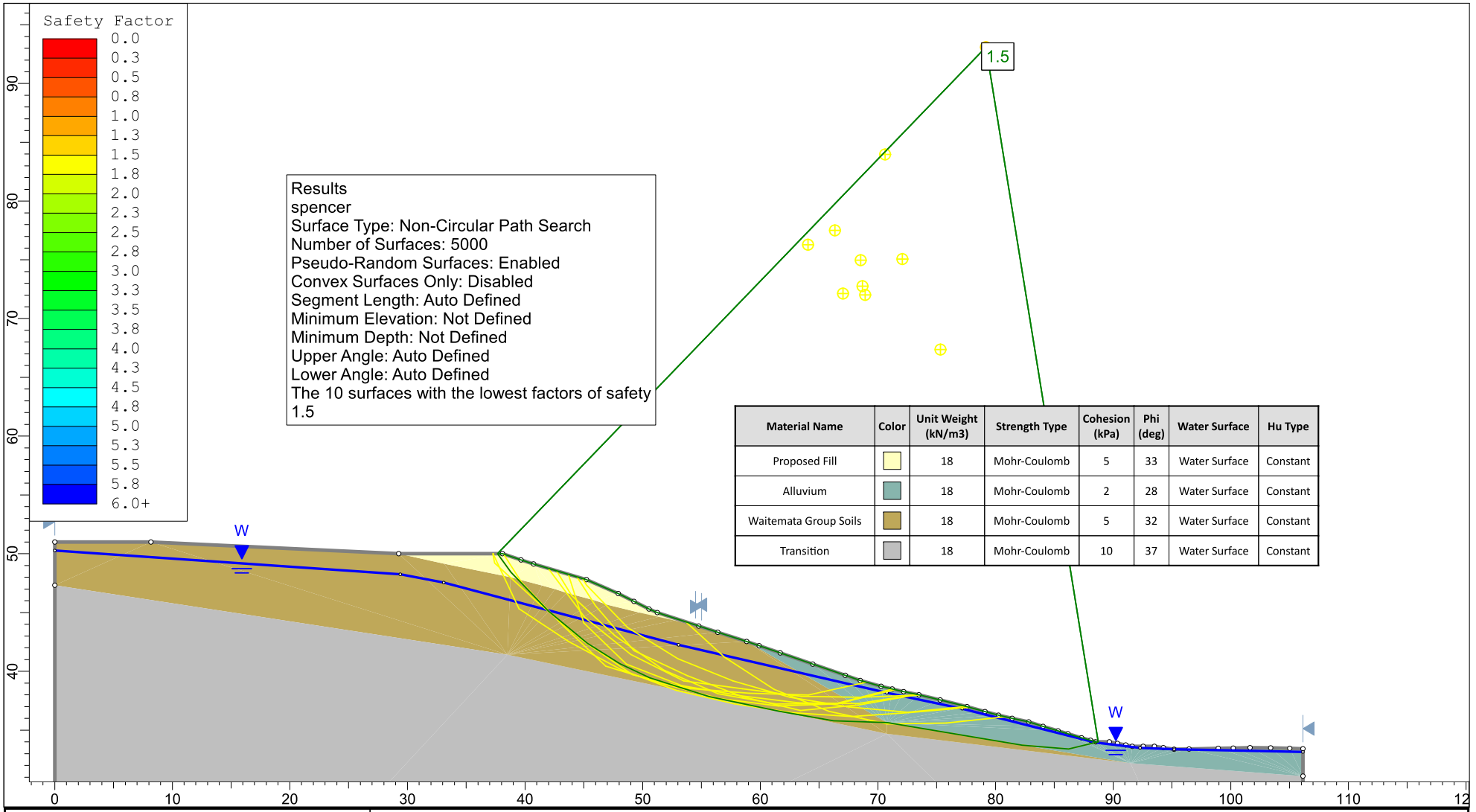
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	32	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section BB - Run 27 (Drainage Installed - AL - AP)				
Drawn By	PH	Scale	1:450	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S2BB - Run 27.slim



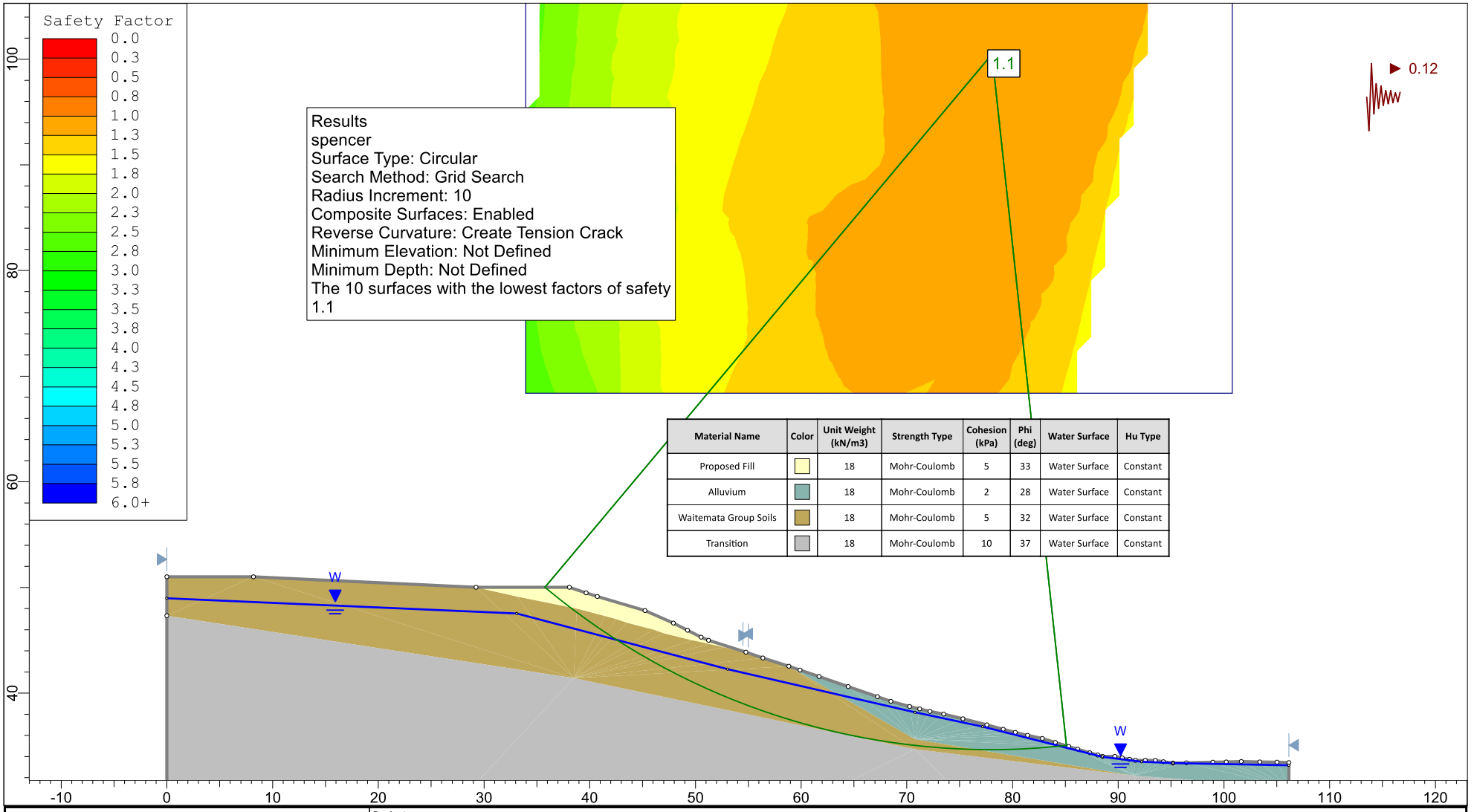
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	32	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section BB - Run 28 (Drainage Installed - AL - AP)				
Drawn By	PH	Scale	1:450	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S2BB - Run 28.slim



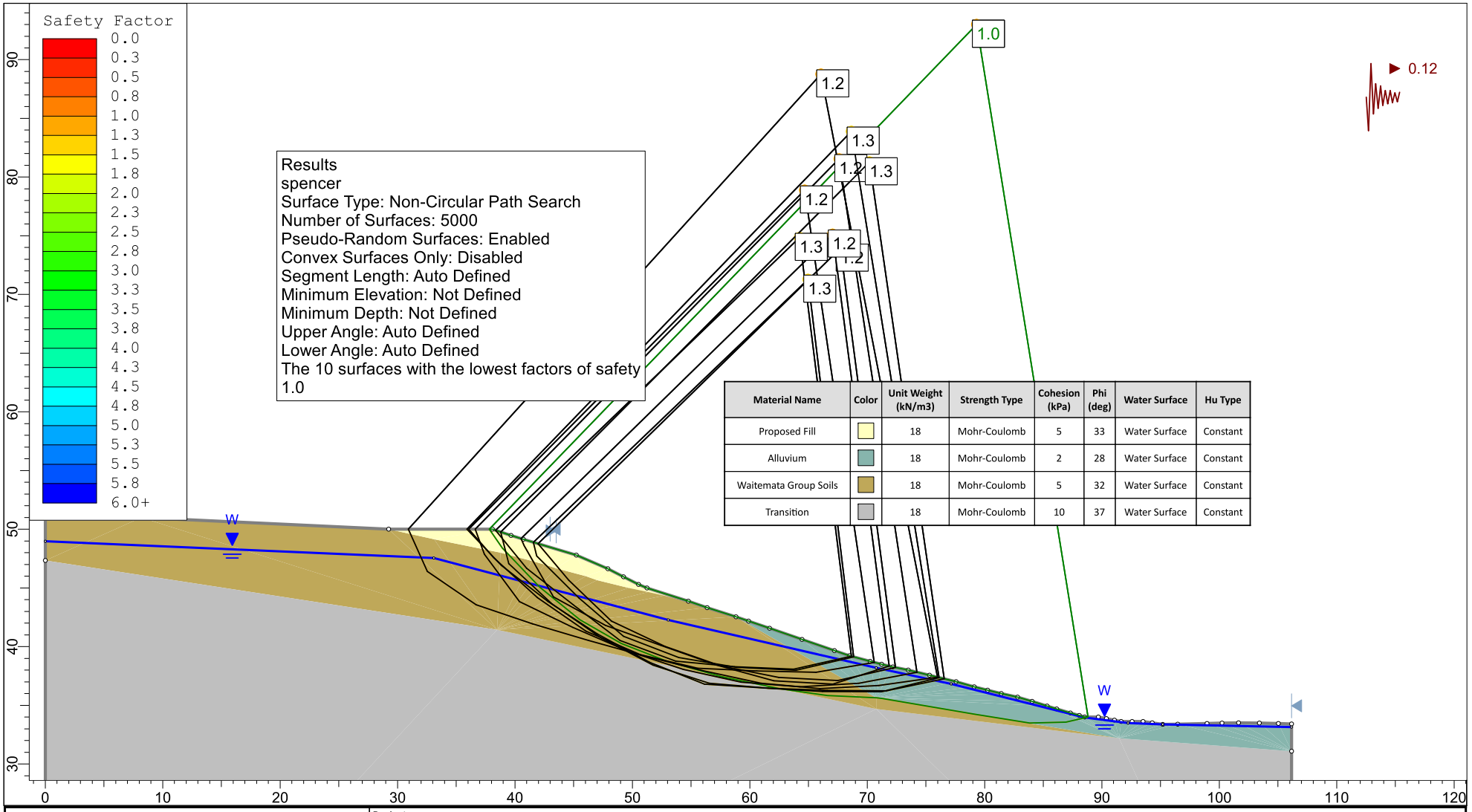
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	32	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section BB - Run 29 (Drainage Installed - AL - AP)				
Drawn By	PH	Scale	1:500	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S2BB - Run 29.slim



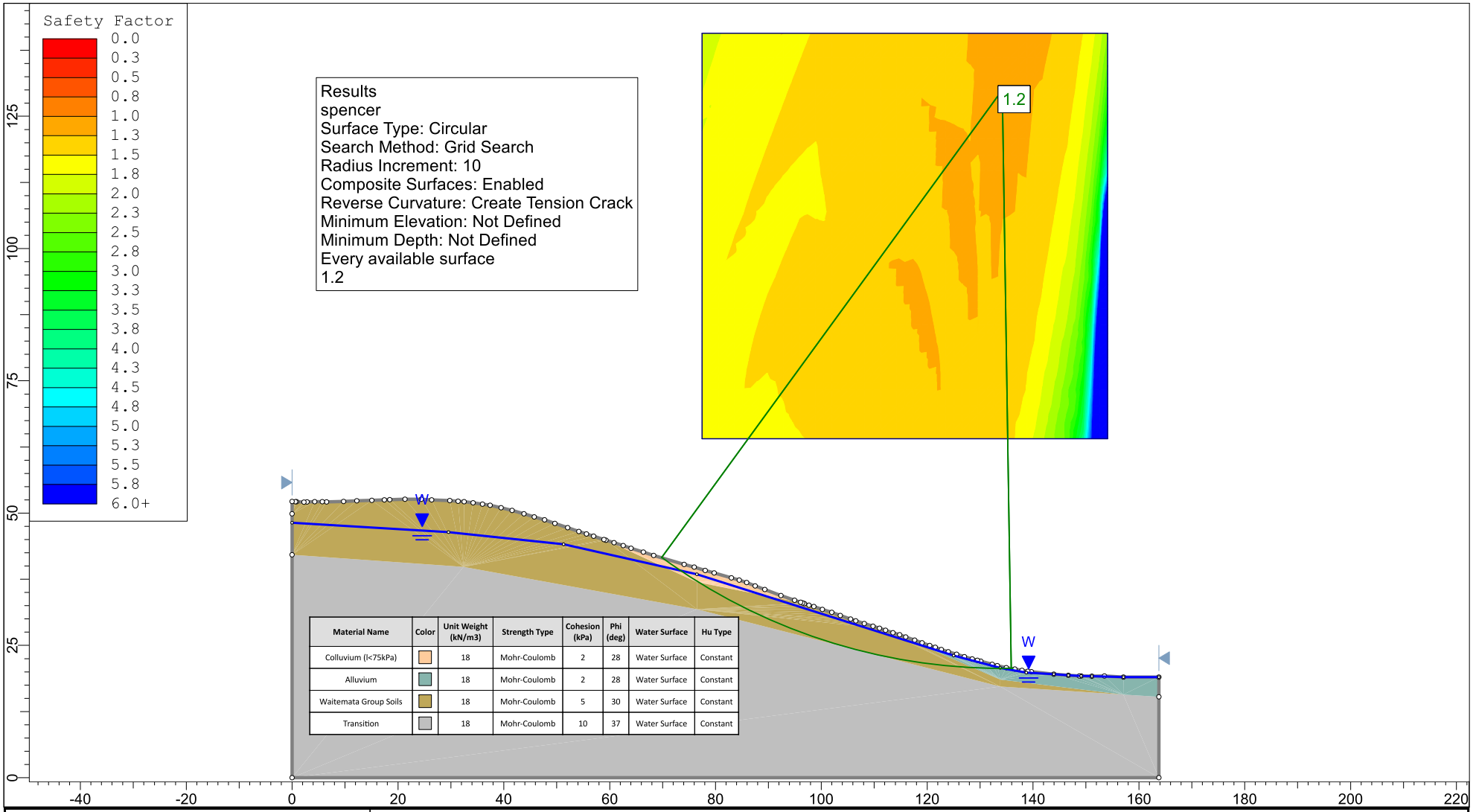
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	32	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section BB - Run 30 (Drainage Installed - AL - AP)				
Drawn By	PH	Scale	1:450	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S2BB - Run 30.slim

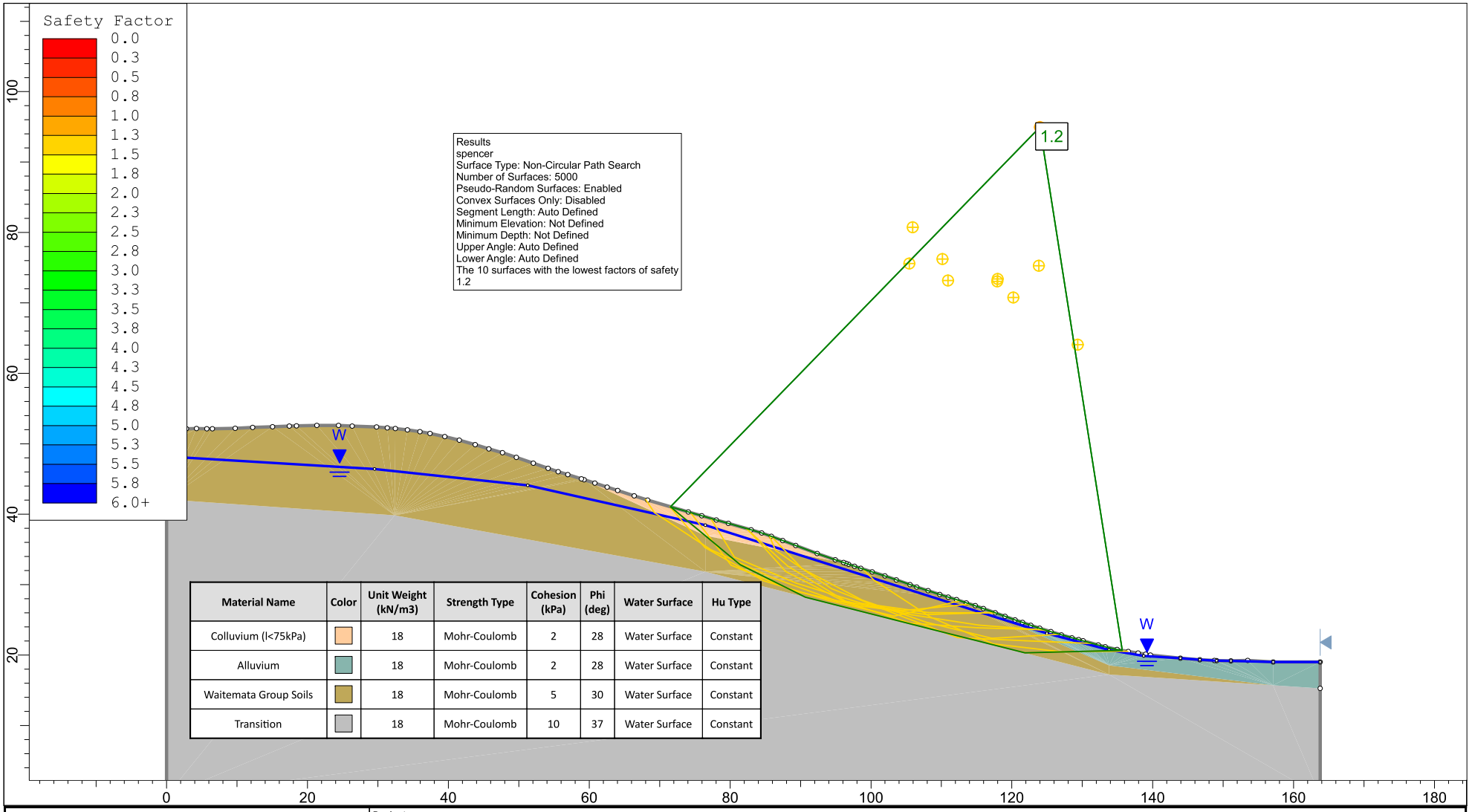


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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section CC - Run 1				
Drawn By	PH	*Scale*	1:1000	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S2CC - Run 1.slim



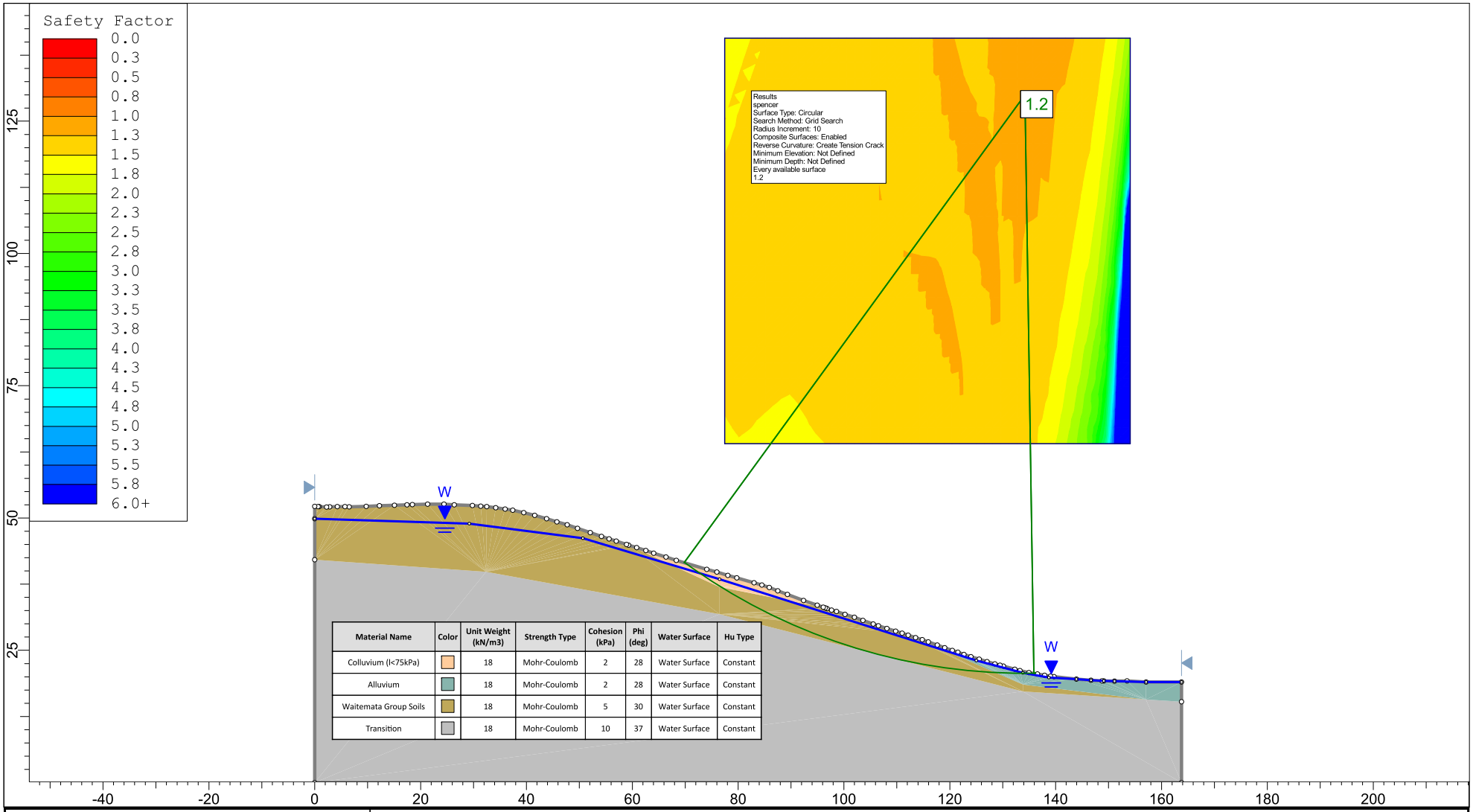
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section CC - Run 2				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S2CC - Run 2.slim



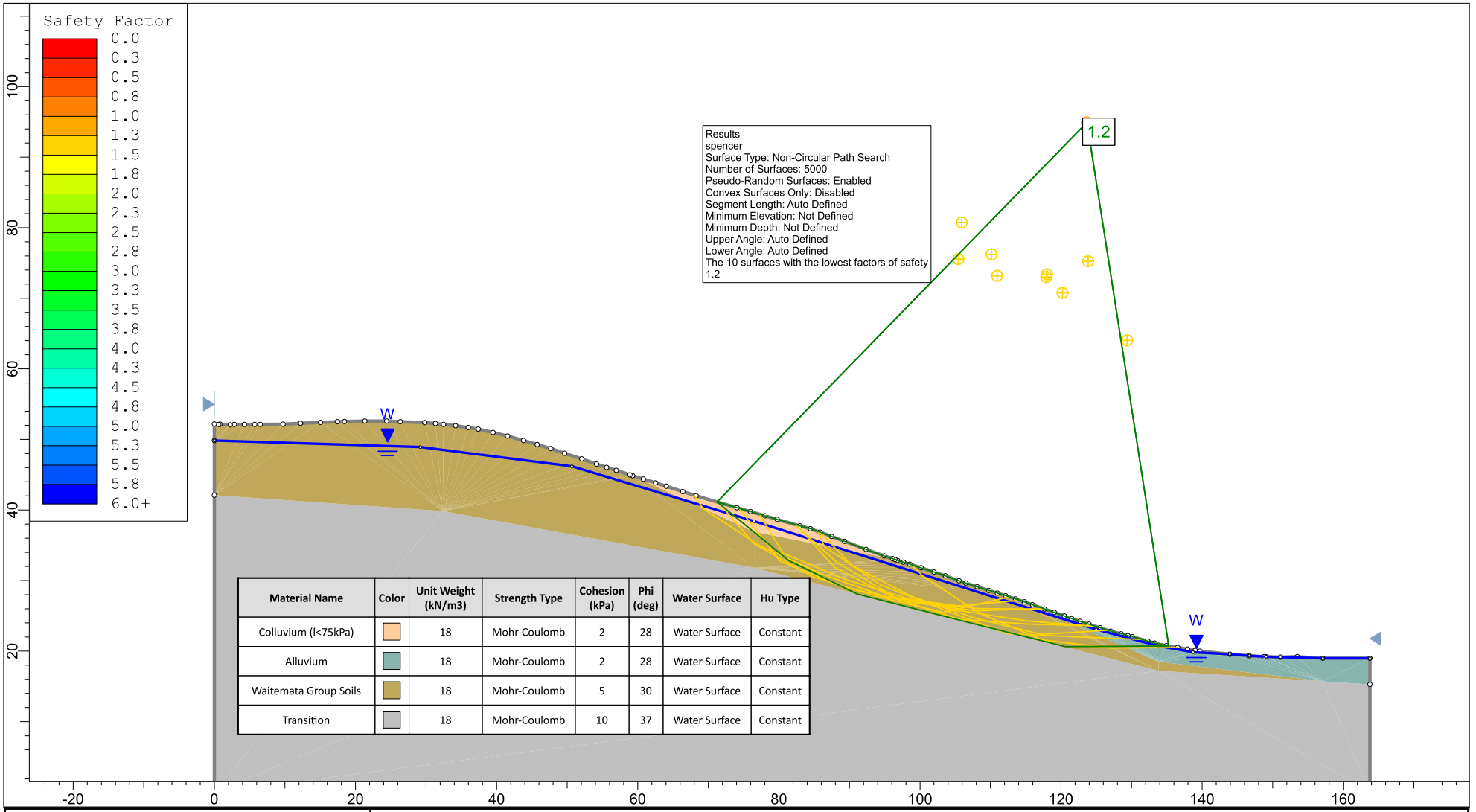
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section CC - Run 3				
Drawn By	PH	*Scale*	1:1000	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S2CC - Run 3.slim



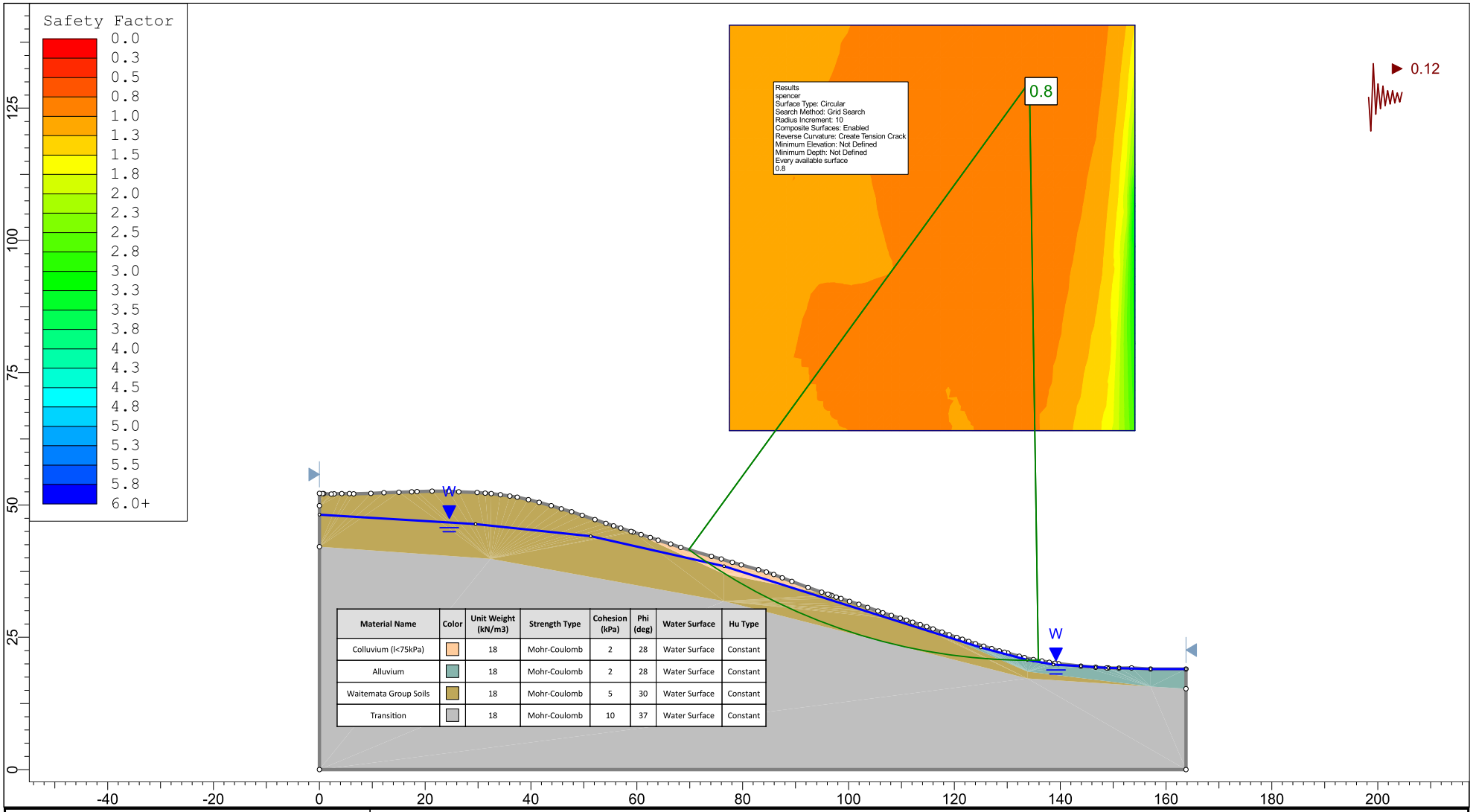
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 2, Section CC - Run 4		
Drawn By	PH	Scale 1:750	Company KGA Geotechnical
Date	31/08/2015		File Name 7464 - S2CC - Run 4.slim

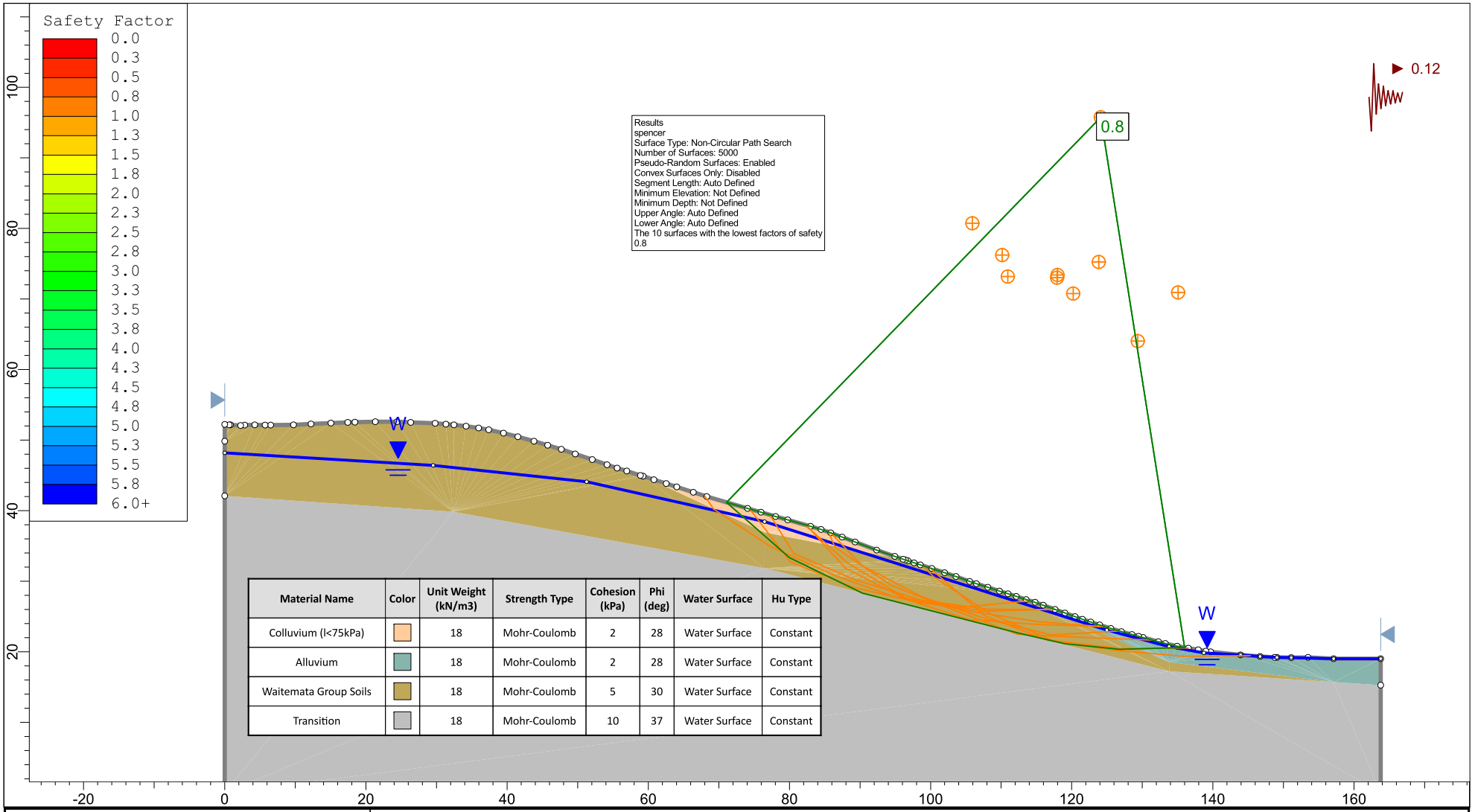


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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section CC - Run 5				
Drawn By	PH	*Scale*	1:1000	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S2CC - Run 5.slim



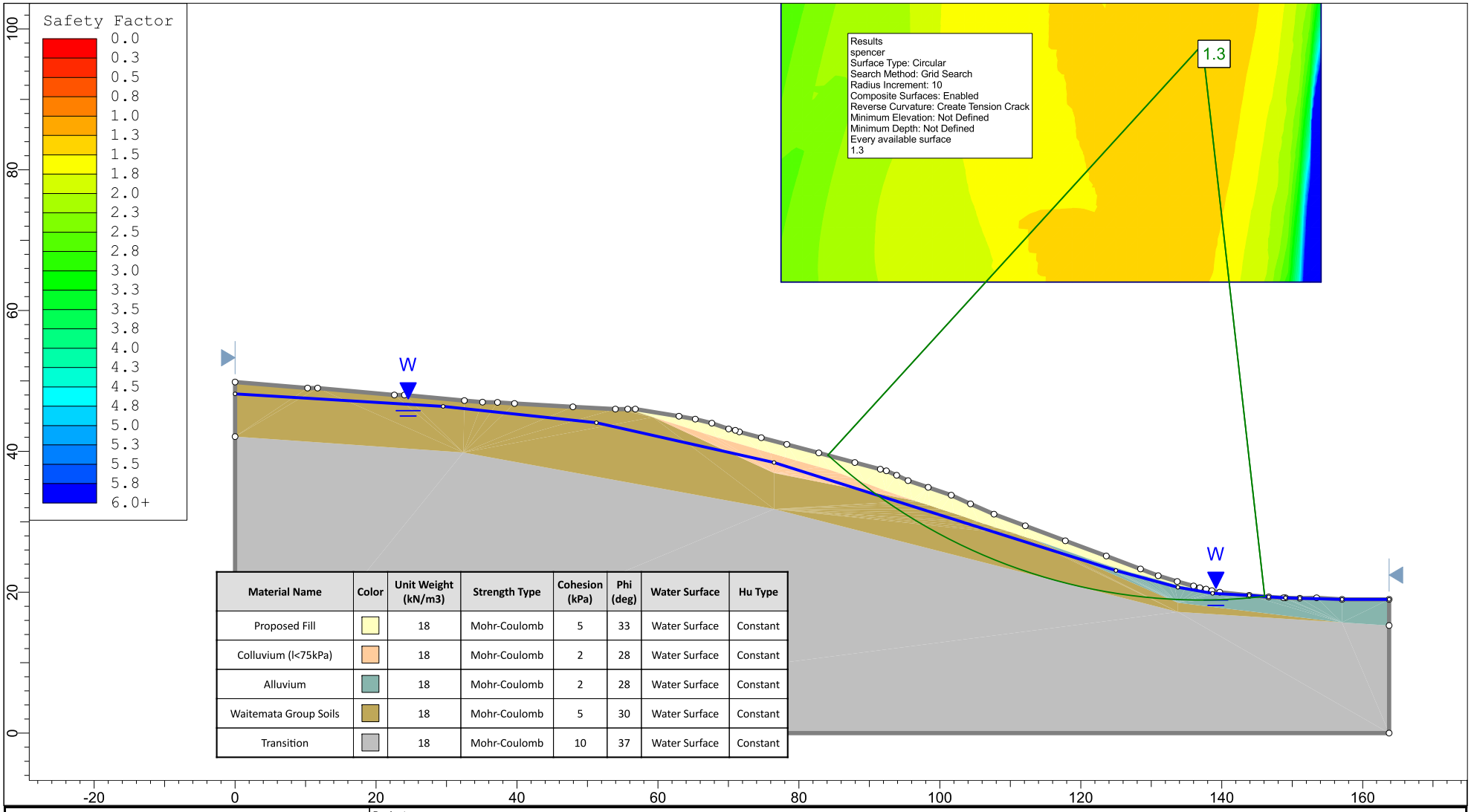
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section CC - Run 6				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S2CC - Run 6.slim



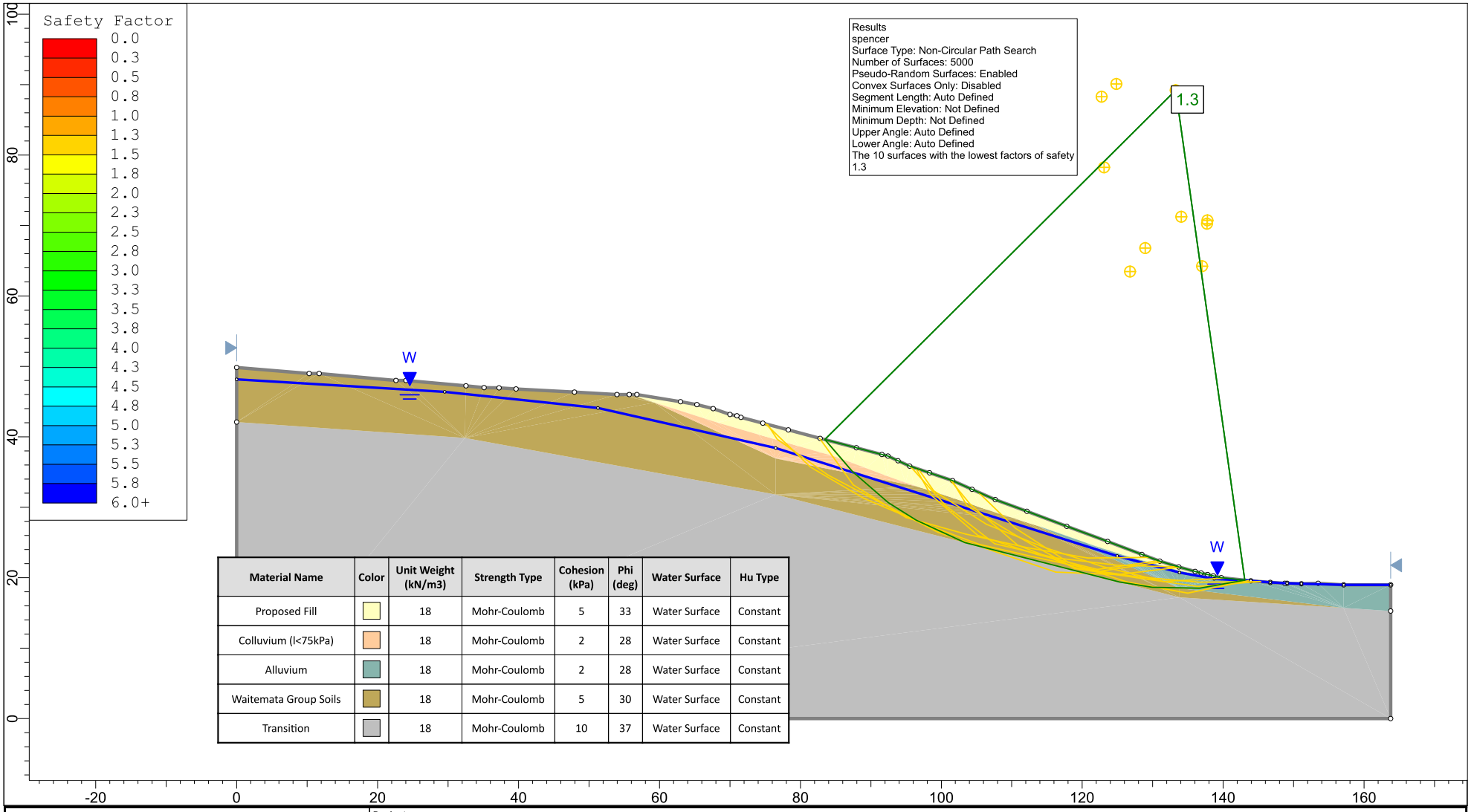
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section CC - Run 7				
Drawn By	PH	Scale	1:750	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S2CC - Run 7.slim



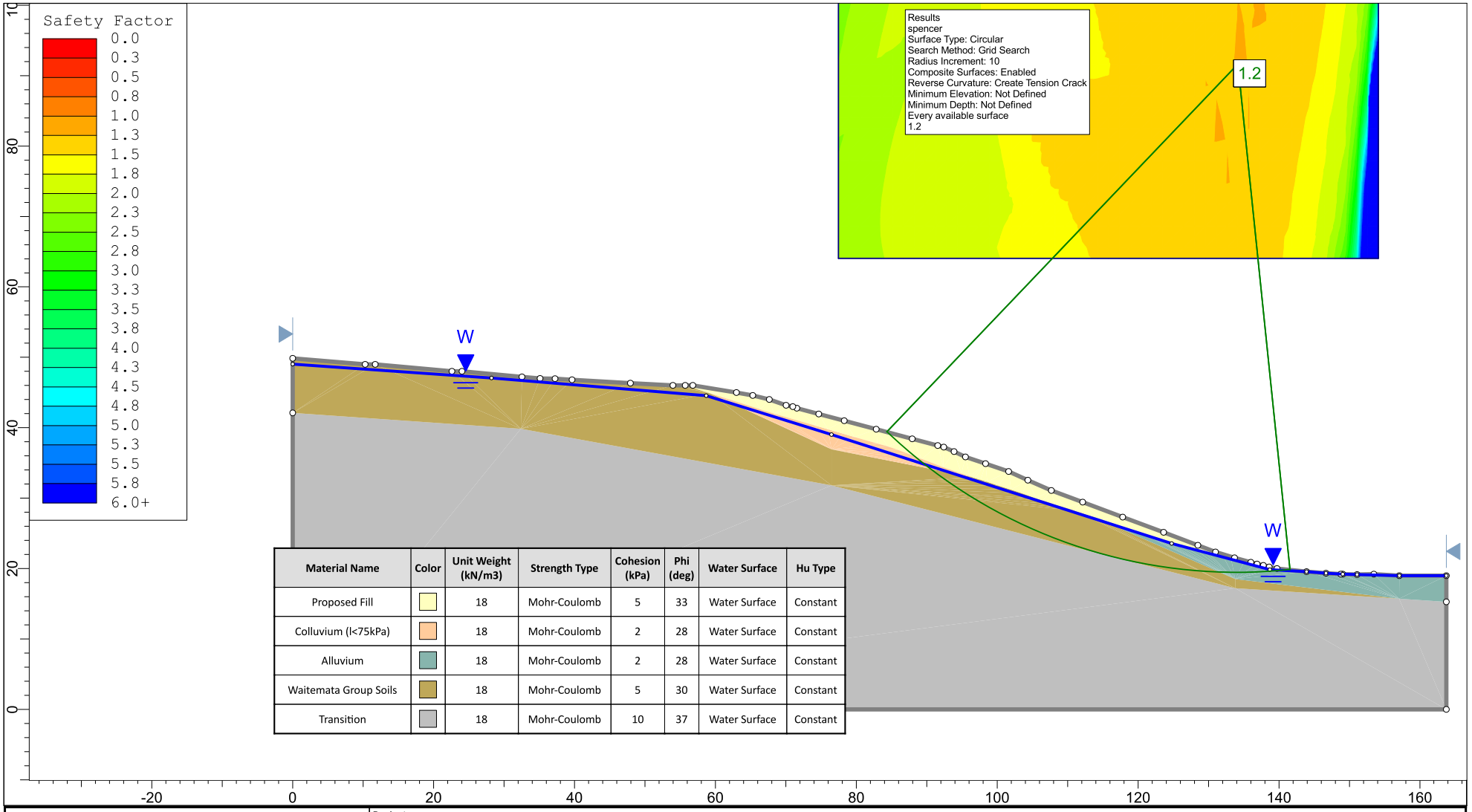
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section CC - Run 8				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S2CC - Run 8.slim



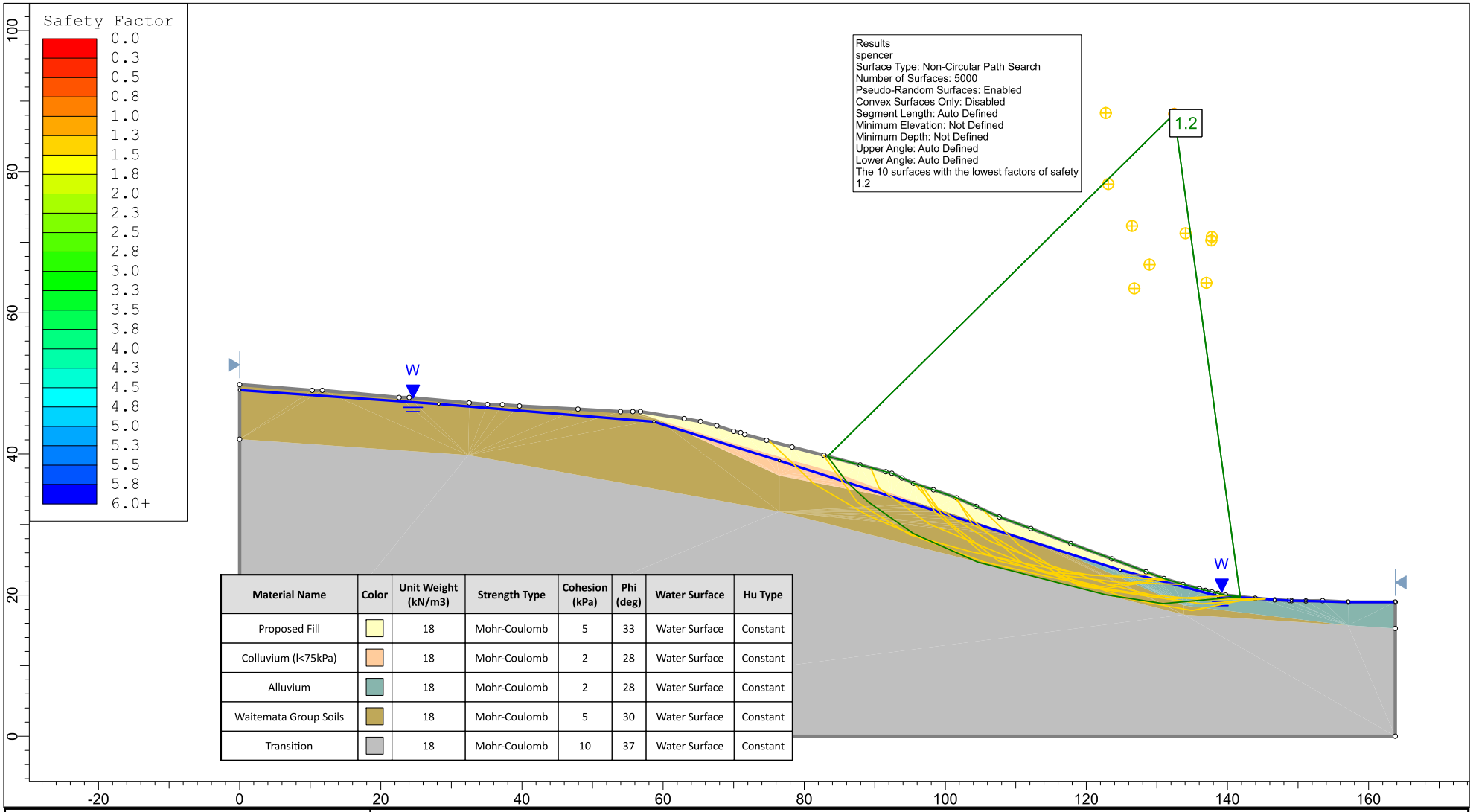
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section CC - Run 9				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S2CC - Run 9.slim



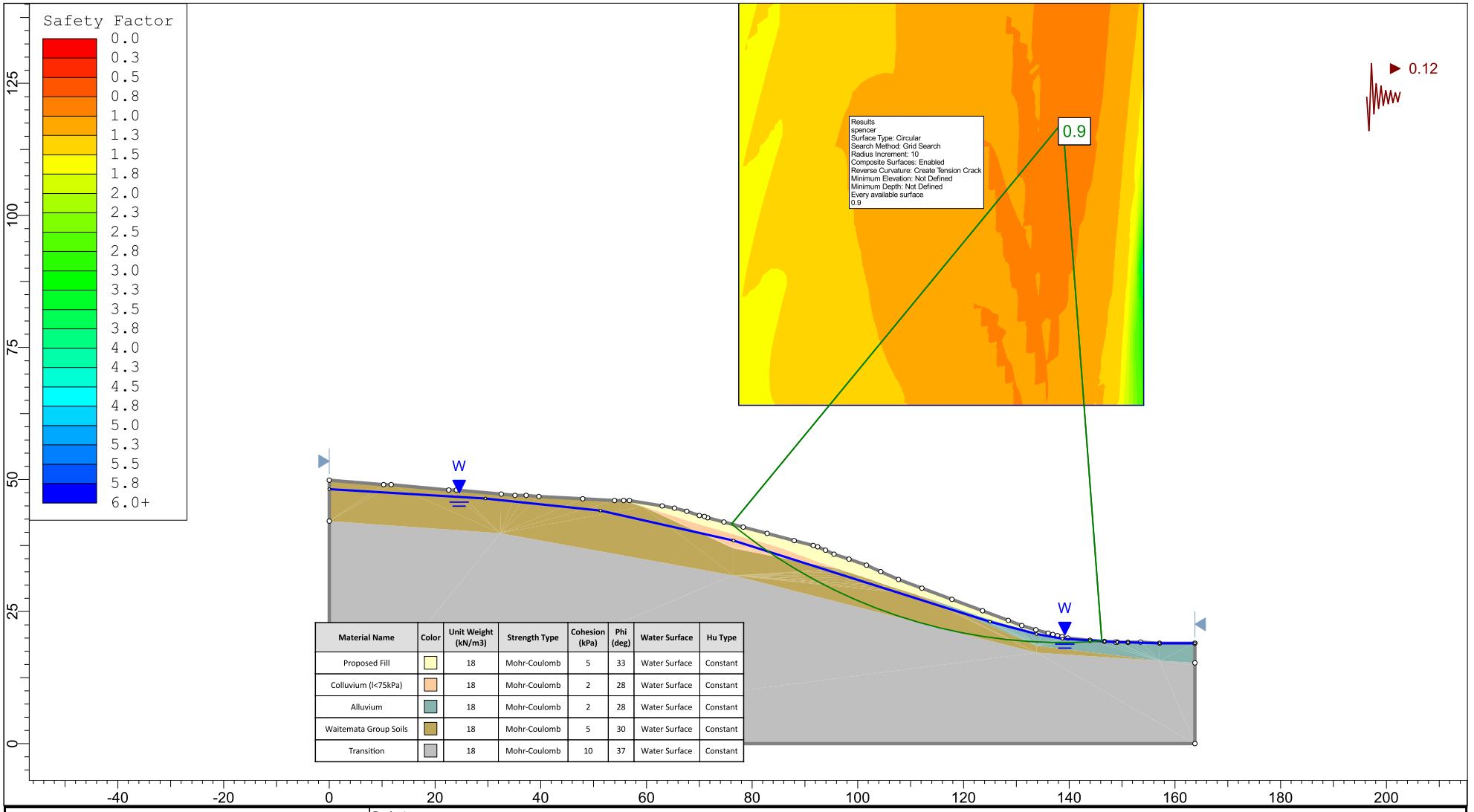
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section CC - Run 10				
Drawn By	PH	Scale	1:750	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S2CC - Run 10.slim

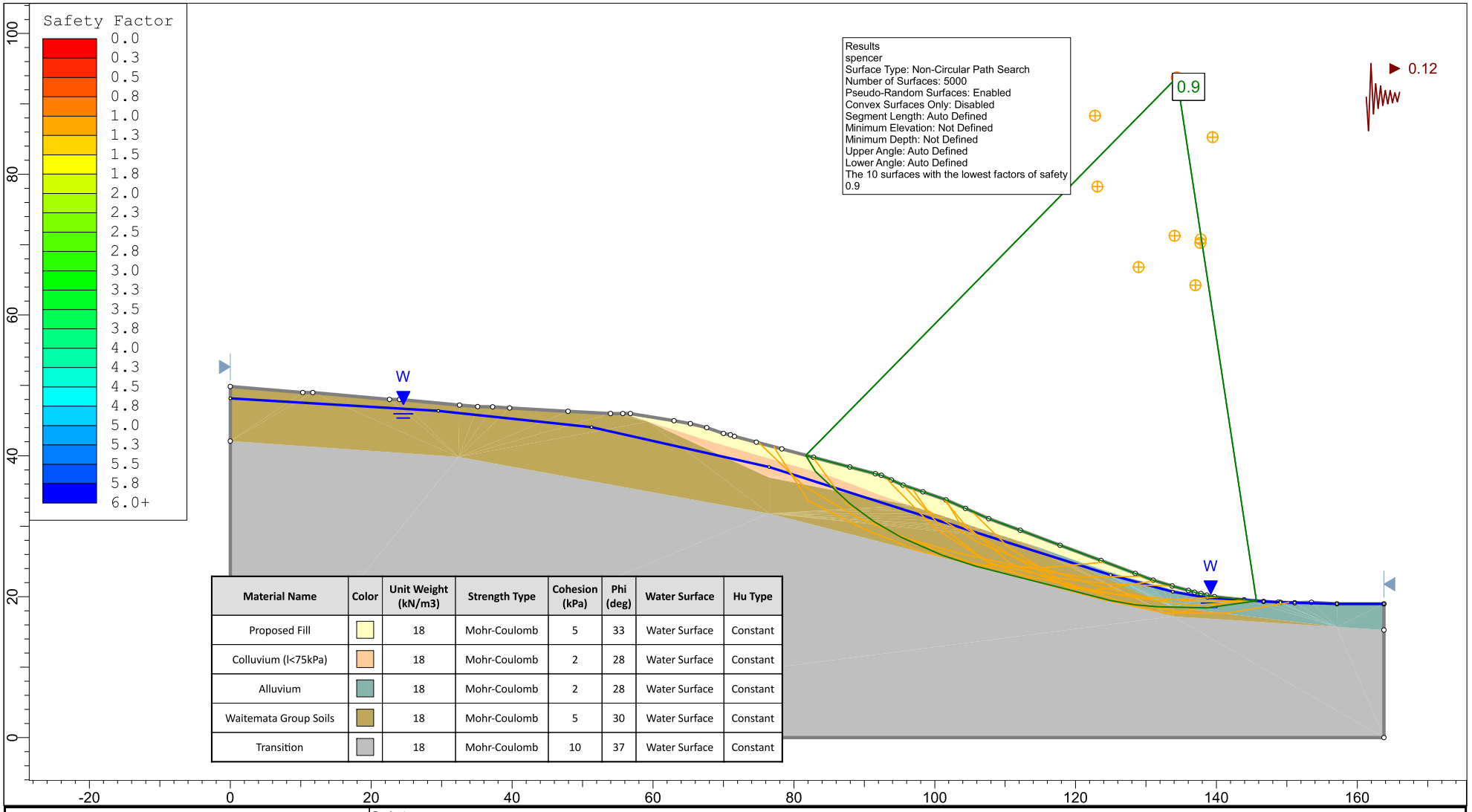


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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section CC - Run 11				
Drawn By	PH	*Scale*	1:1000	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S2CC - Run 11.slim



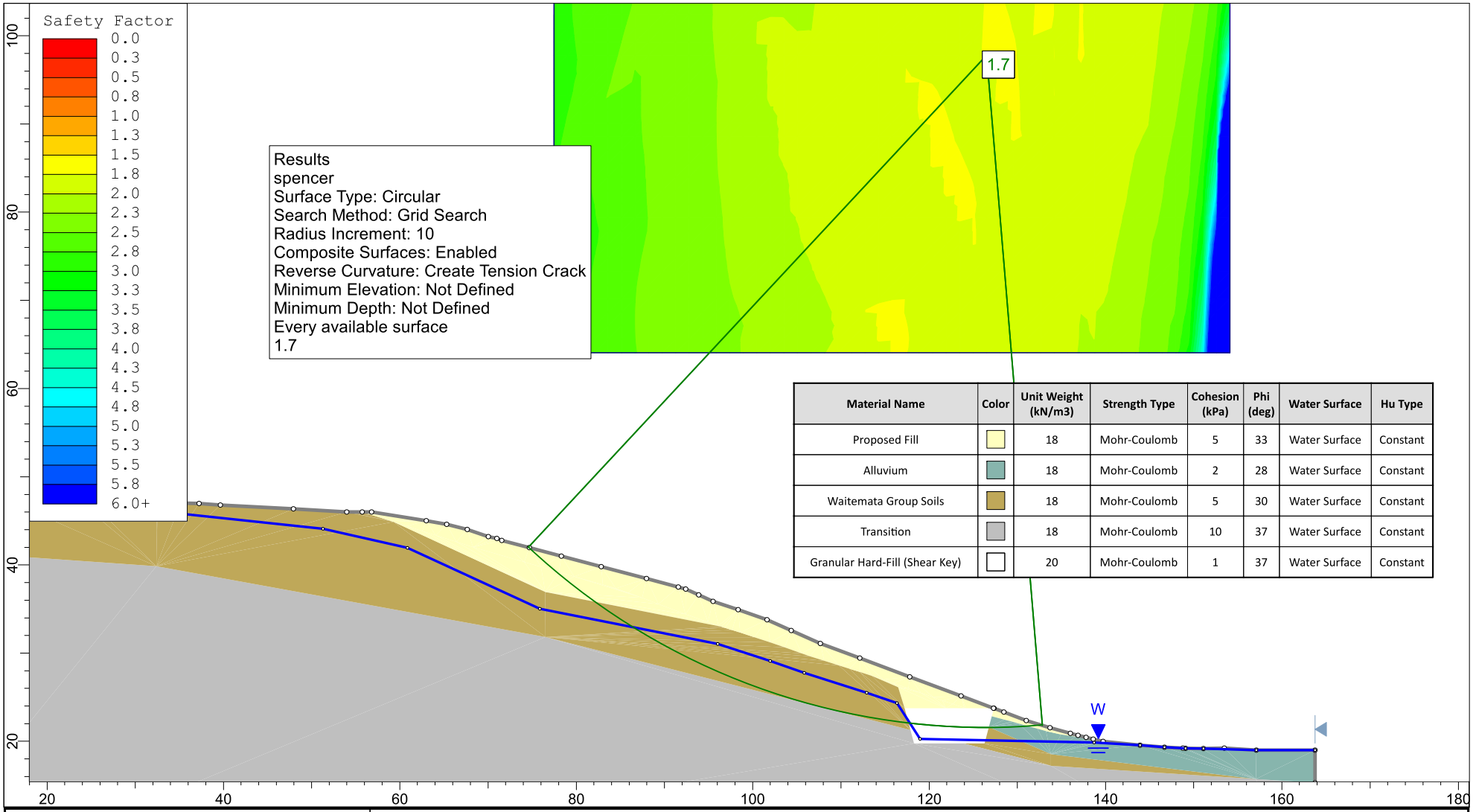
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section CC - Run 12				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S2CC - Run 12.slim



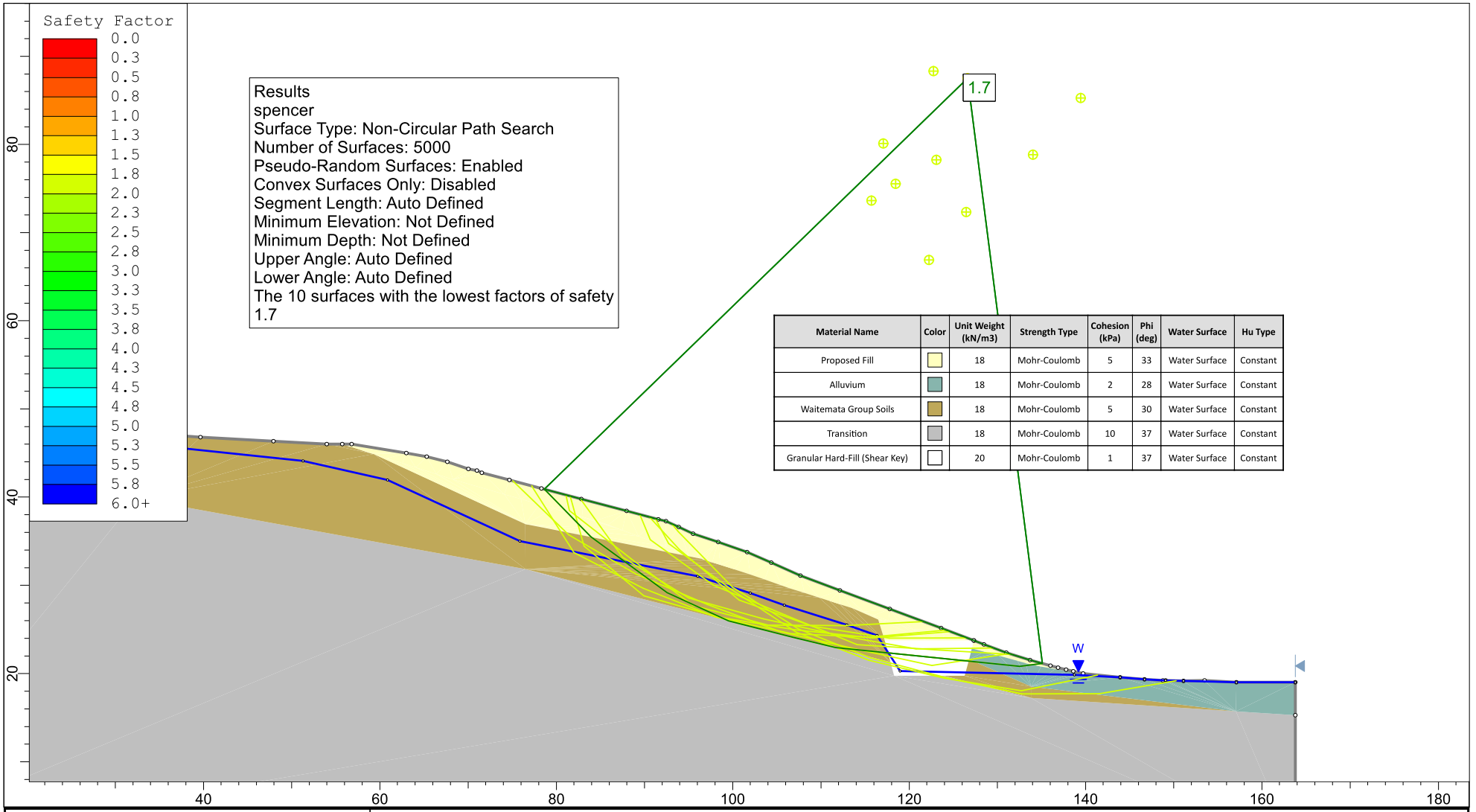
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant
Granular Hard-Fill (Shear Key)		20	Mohr-Coulomb	1	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section CC - Run 19 (shear key & deep drainage)				
Drawn By	PH	Scale	1:600	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S2CC - Run 19.slim



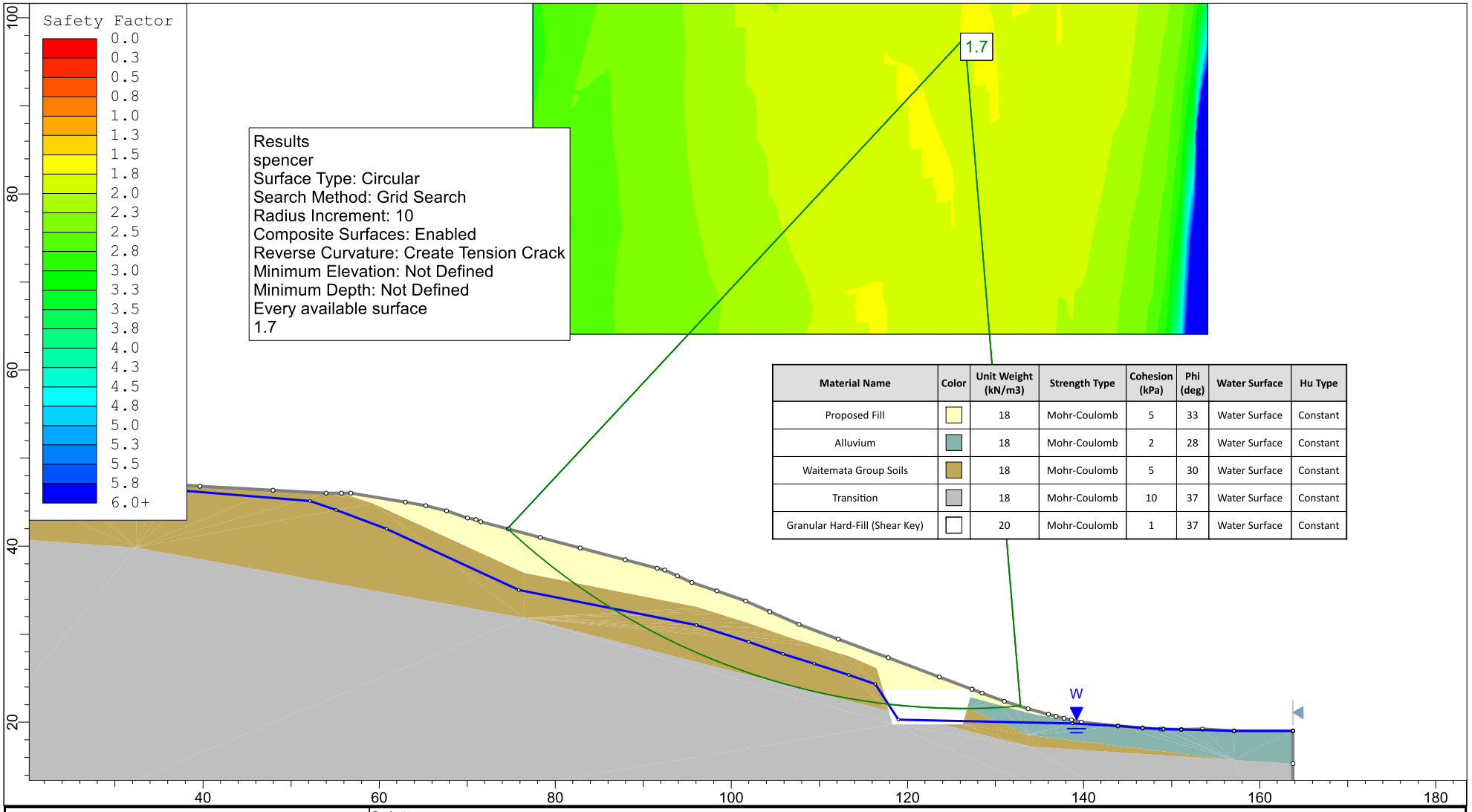
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant
Granular Hard-Fill (Shear Key)		20	Mohr-Coulomb	1	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section CC - Run 24 (shear key & deep drainage)				
Drawn By	PH	Scale	1:600	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S2CC - Run 20.slim



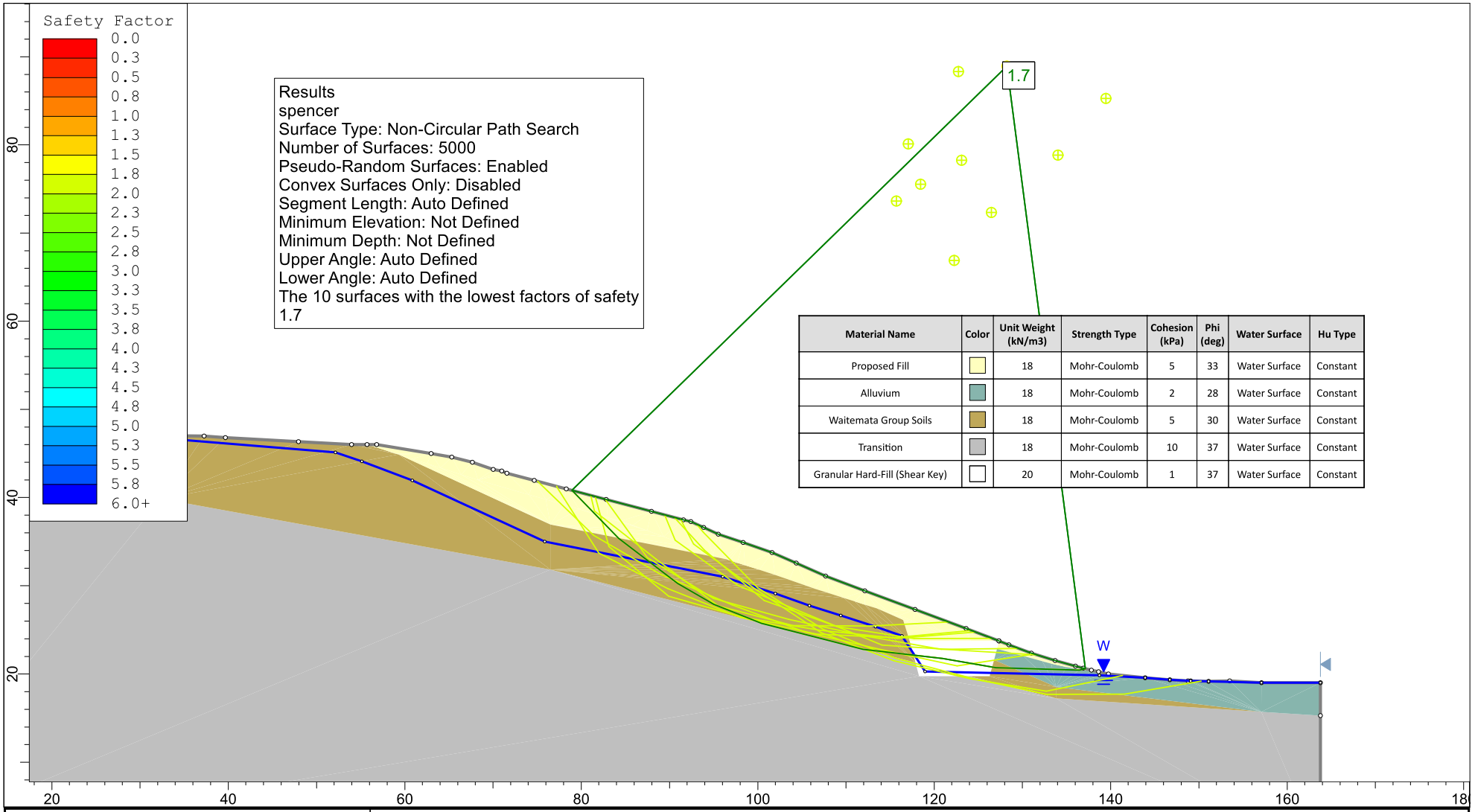
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant
Granular Hard-Fill (Shear Key)		20	Mohr-Coulomb	1	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section CC - Run 21 (shear key & deep drainage)				
Drawn By	PH	Scale	1:600	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S2CC - Run 21.slim



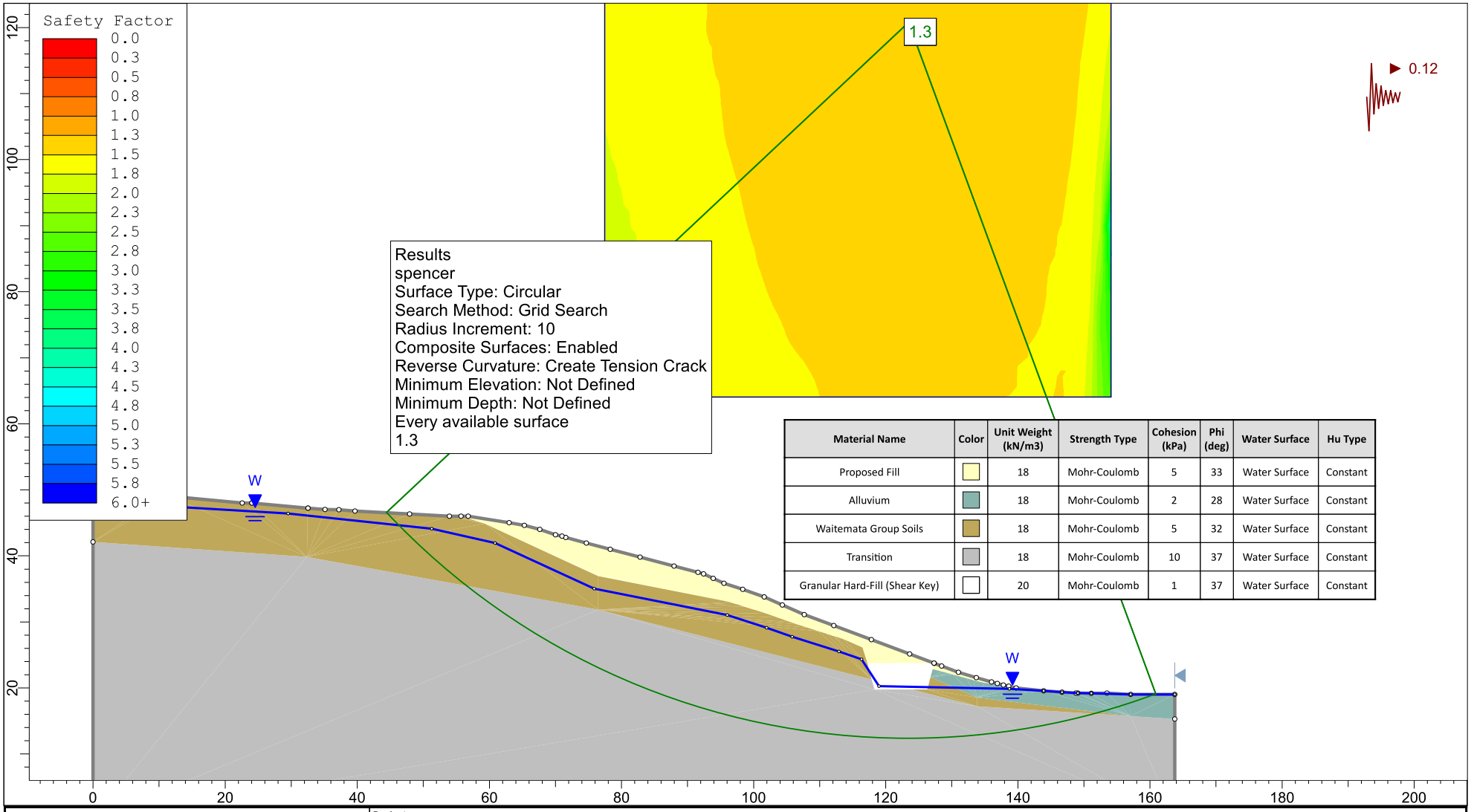
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant
Granular Hard-Fill (Shear Key)		20	Mohr-Coulomb	1	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section CC - Run 23 (shear key & deep drainage)				
Drawn By	PH	*Scale*	1:600	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S2CC - Run 22.slim



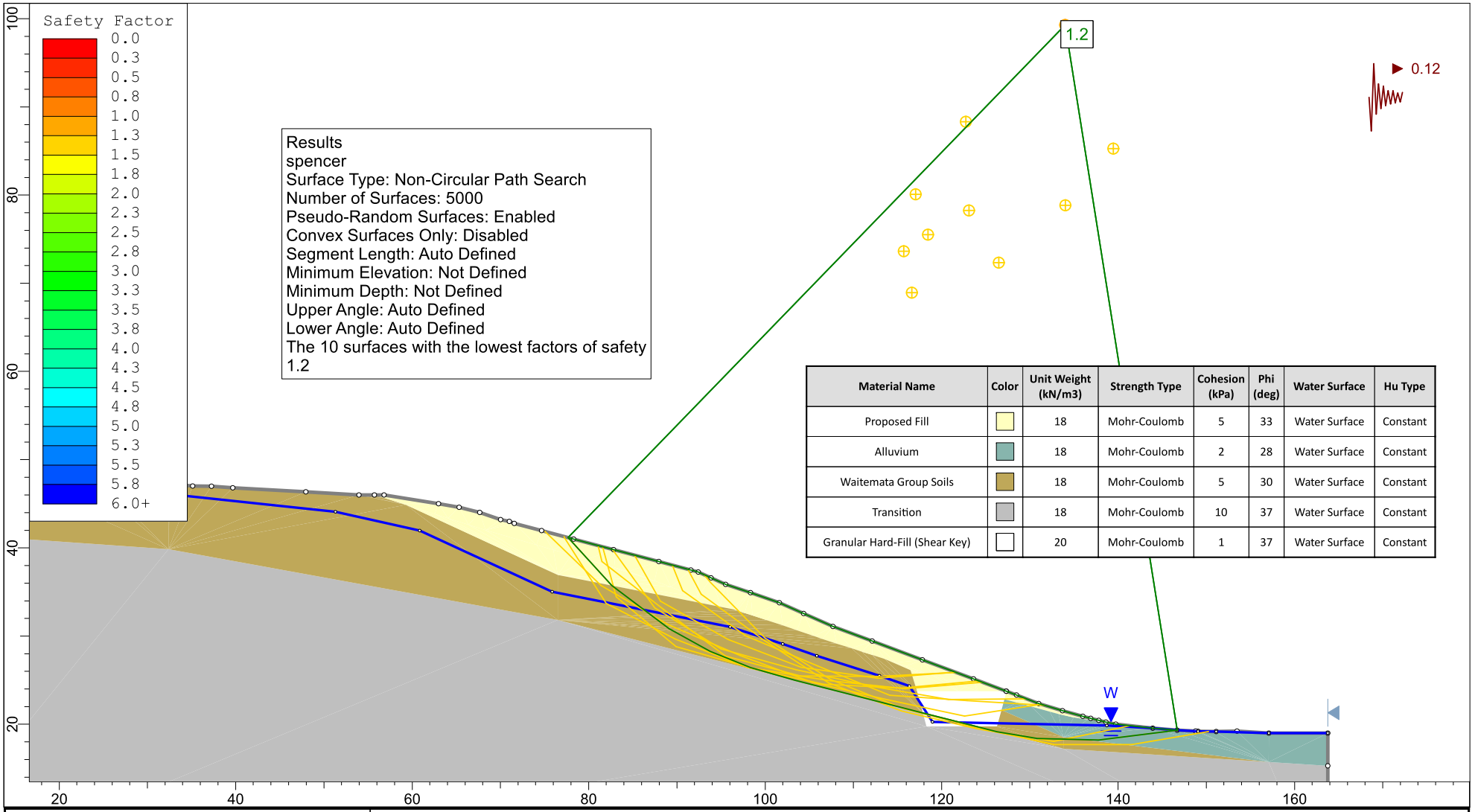
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	32	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant
Granular Hard-Fill (Shear Key)		20	Mohr-Coulomb	1	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section CC - Run 17 (shear key & drainage)				
Drawn By	PH	*Scale*	1:800	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S2CC - Run 23.slim



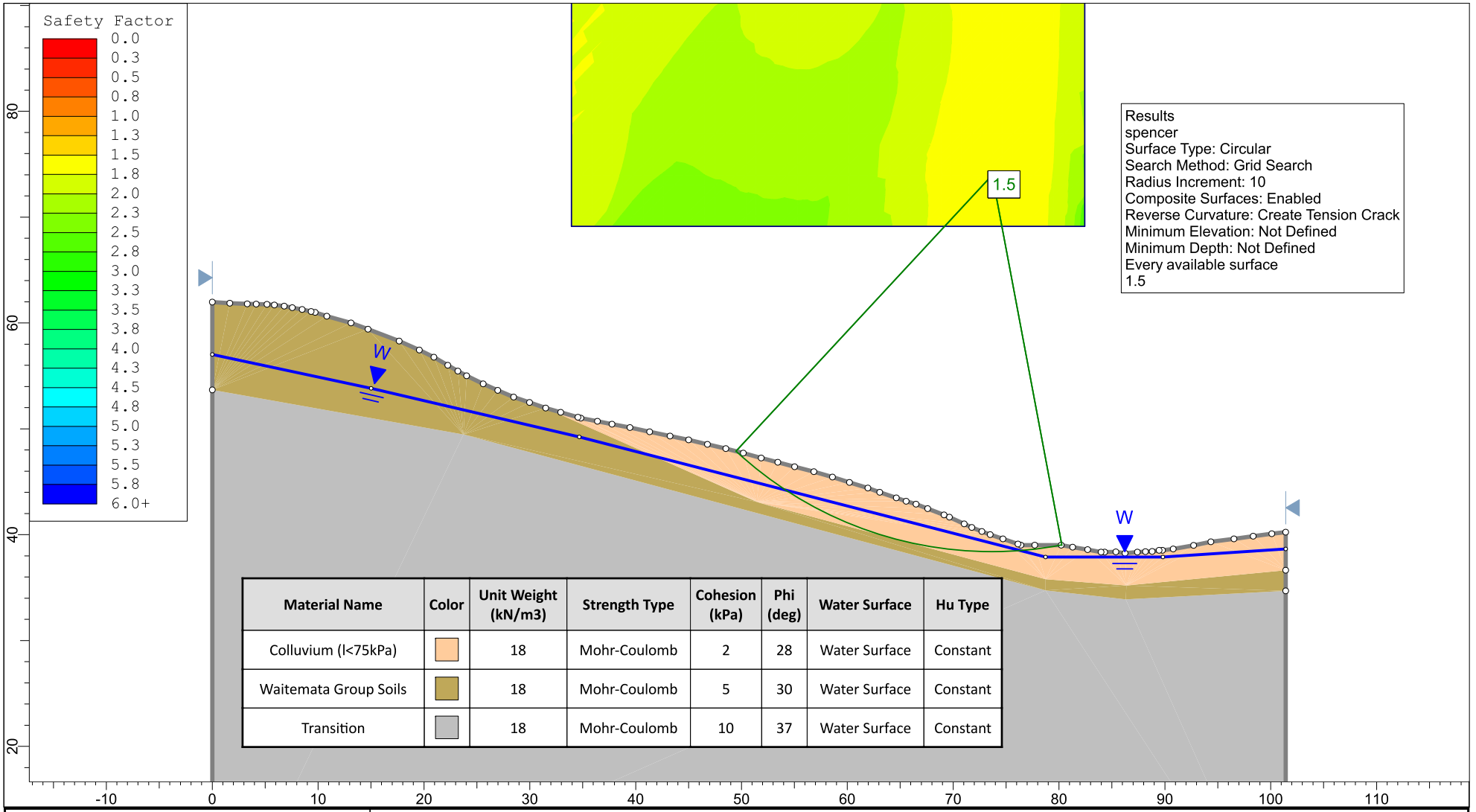
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant
Granular Hard-Fill (Shear Key)		20	Mohr-Coulomb	1	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 2, Section CC - Run 24 (shear key & deep drainage)				
Drawn By	PH	Scale	1:600	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S2CC - Run 24.slim



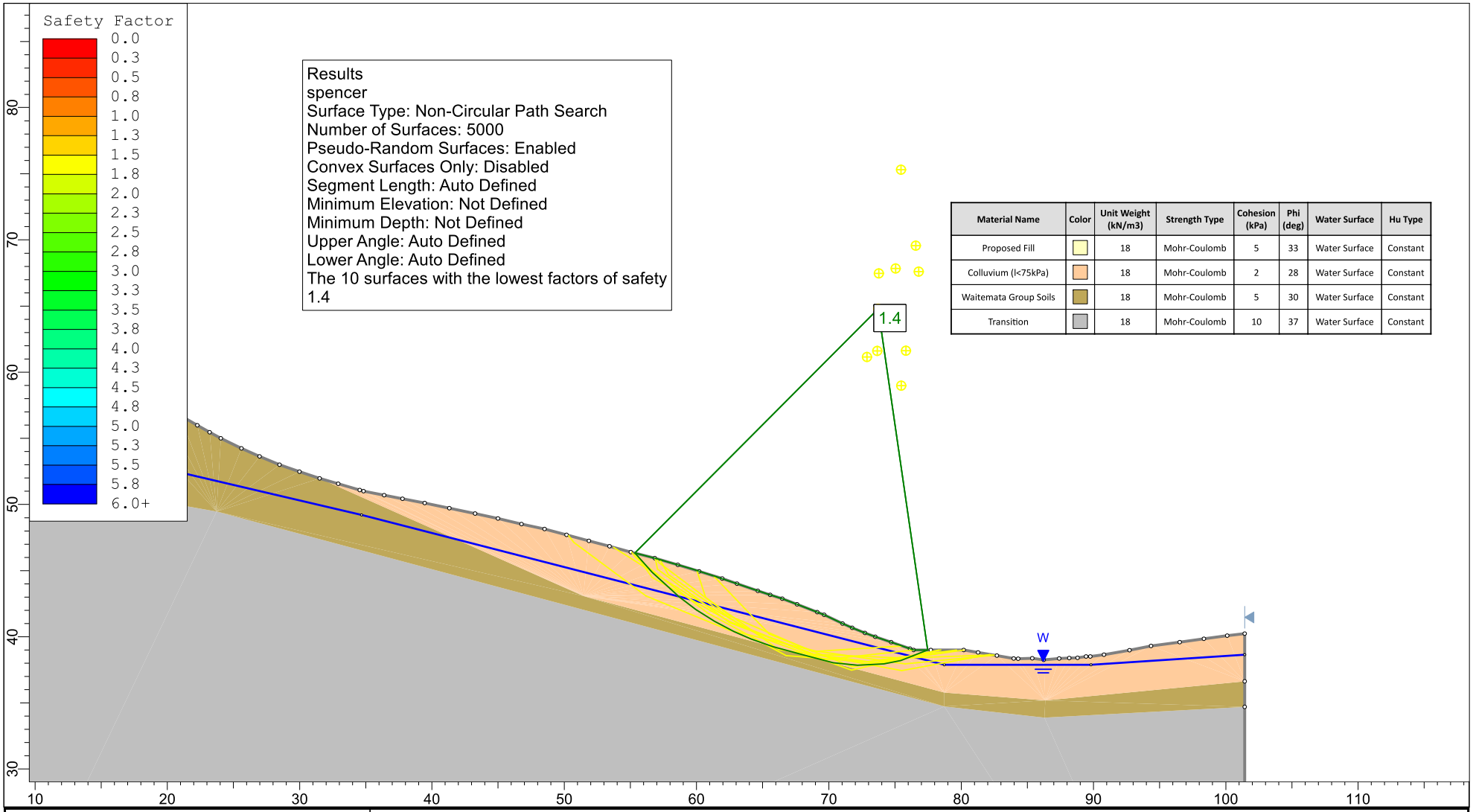
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section AA - Run 1				
Drawn By	PH	Scale	1:500	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S3AA - Run 1.slim



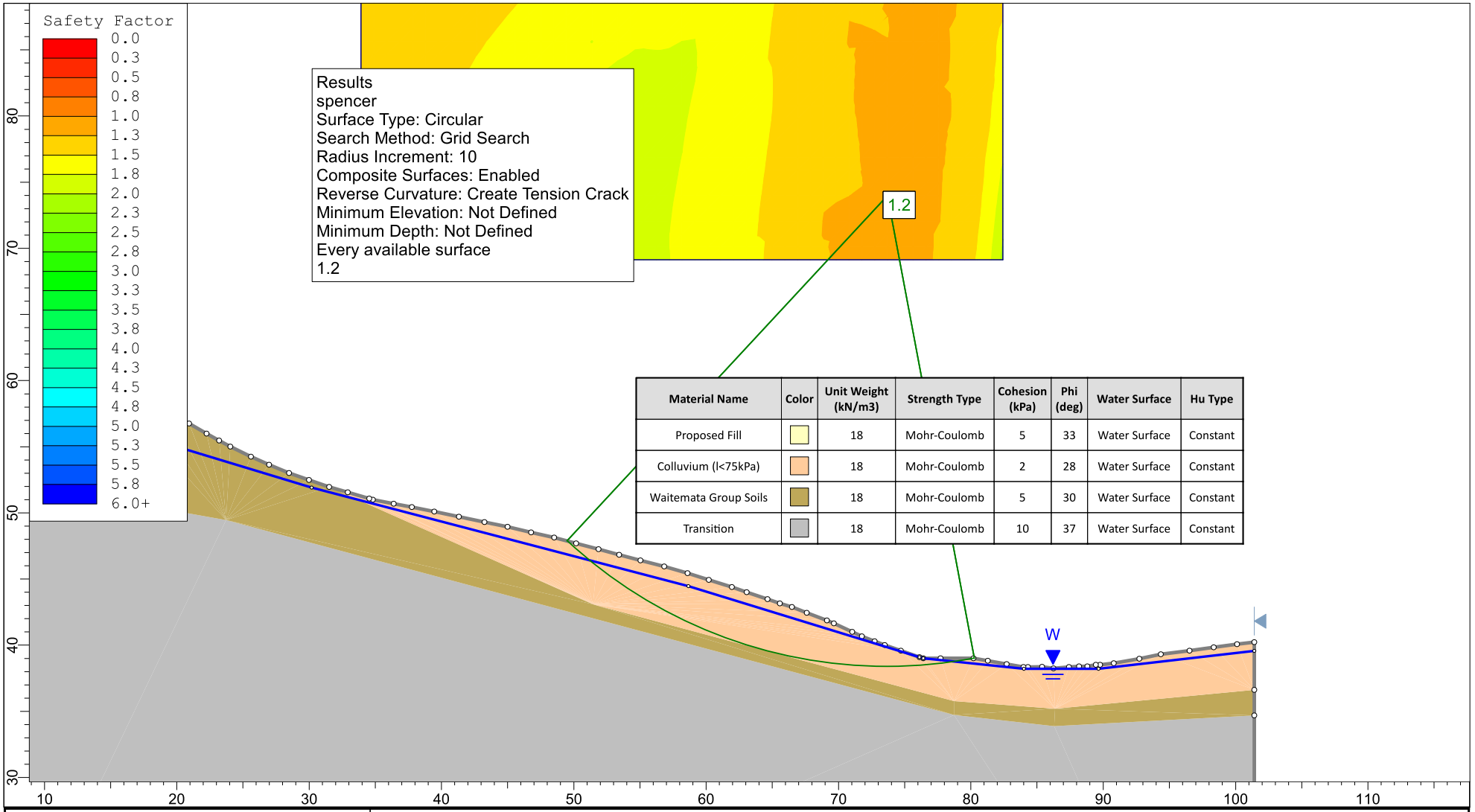
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section AA - Run 2				
Drawn By	PH	Scale	1:400	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S3AA - Run 2.slim



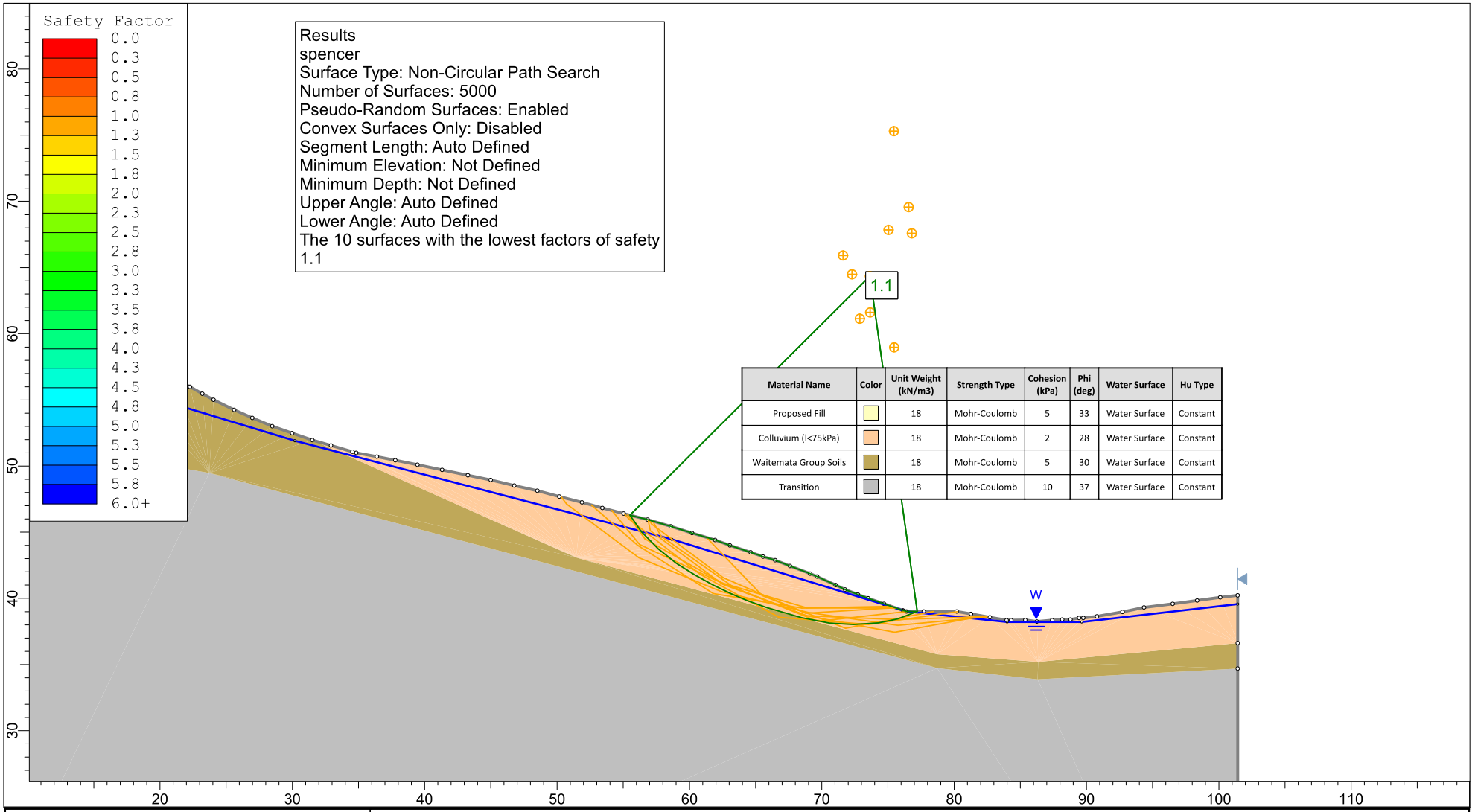
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section AA - Run 3				
Drawn By	PH	Scale	1:400	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S3AA - Run 3.slim



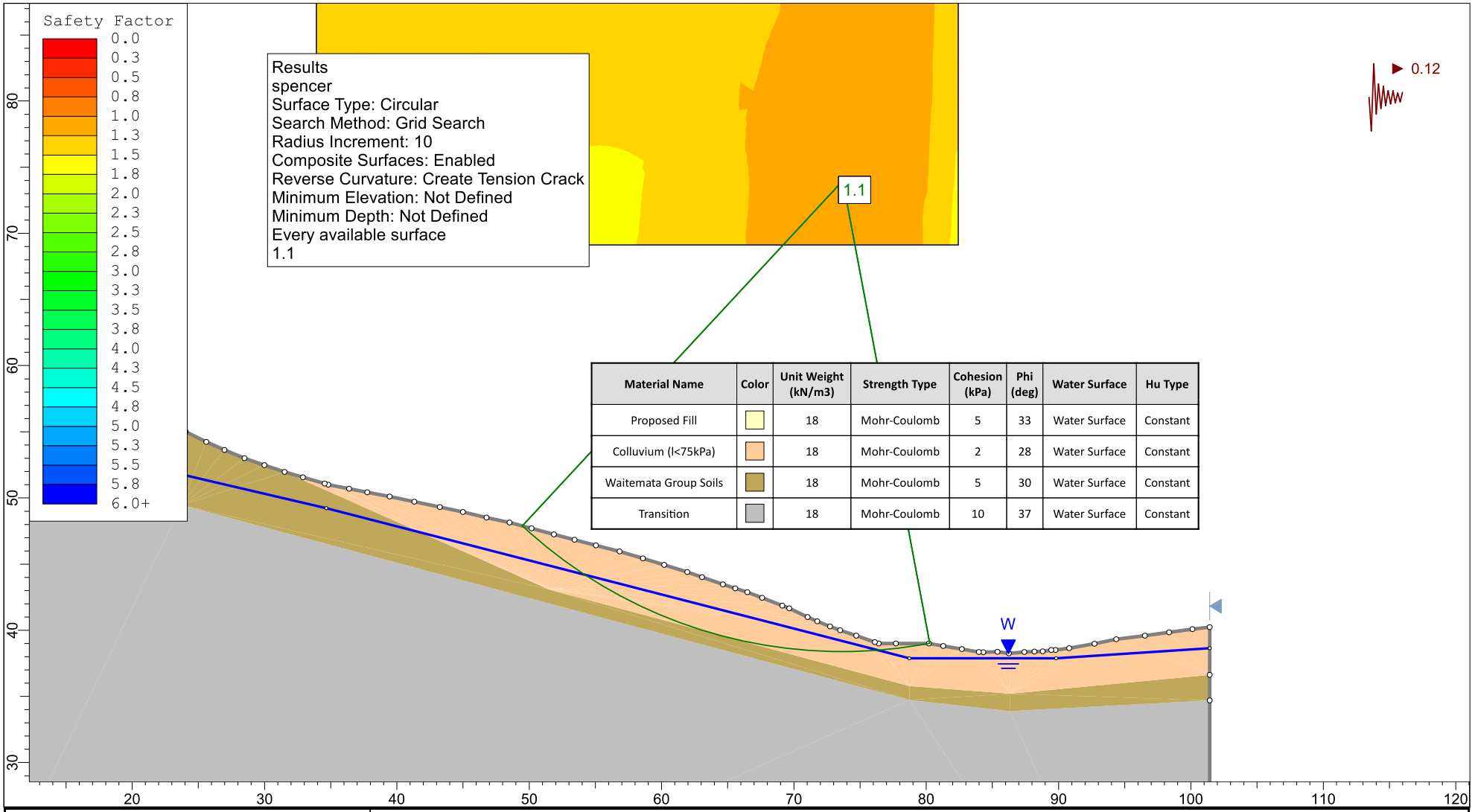
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section AA - Run 4				
Drawn By	PH	*Scale*	1:400	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S3AA - Run 4.slim



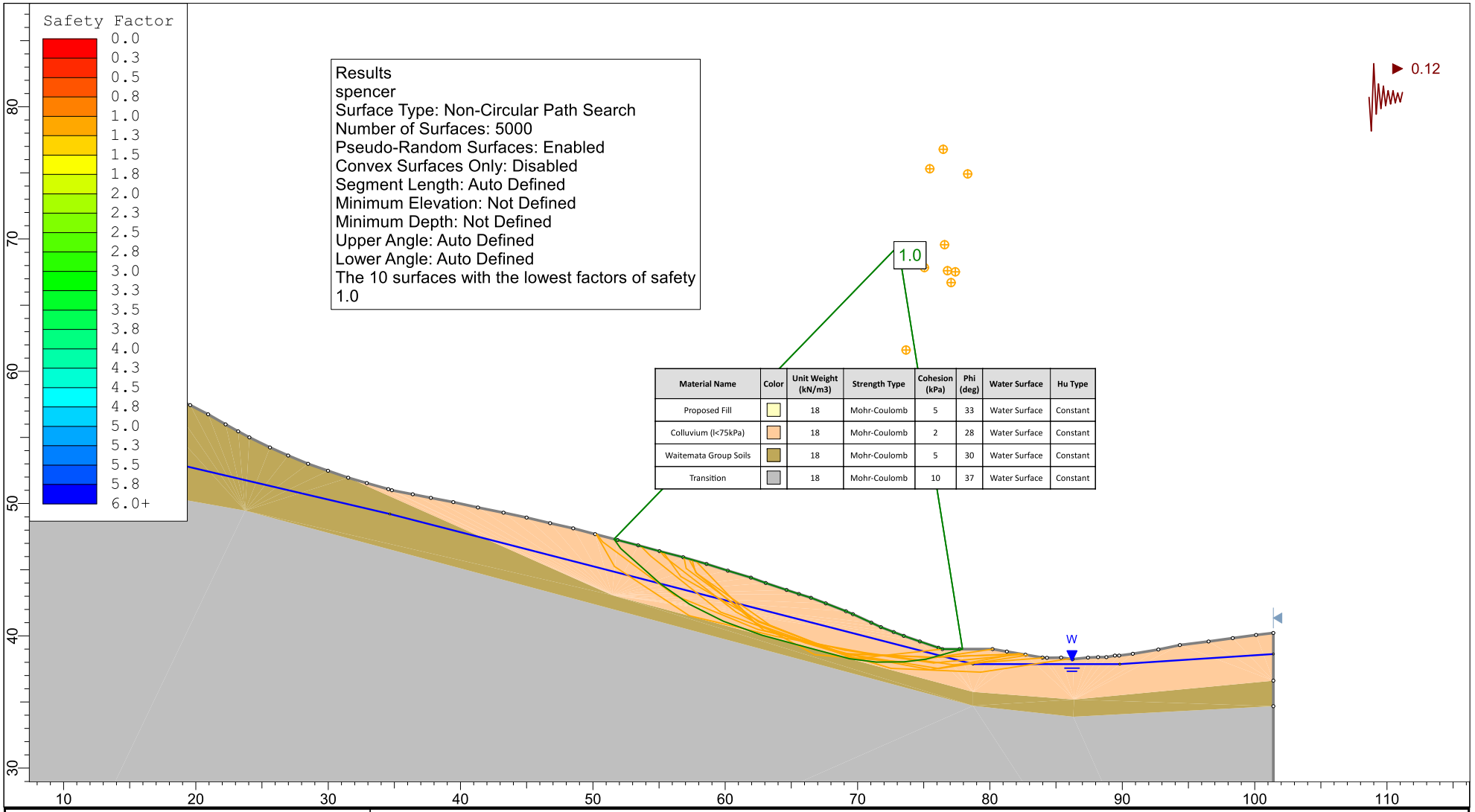
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section AA - Run 5				
Drawn By	PH	Scale	1:400	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S3AA - Run 5.slim



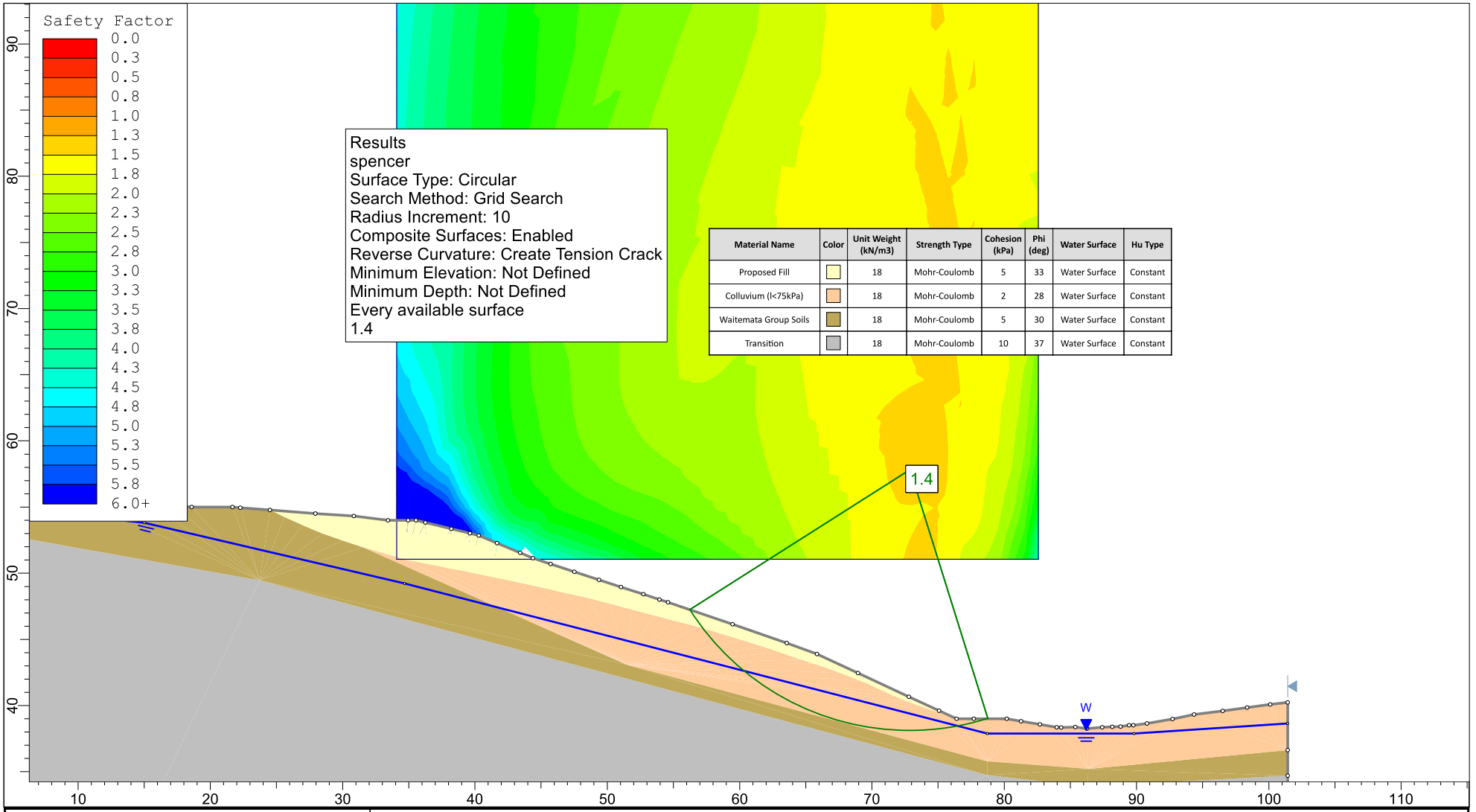
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section AA - Run 6				
Drawn By	PH	*Scale*	1:400	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S3AA - Run 6.slim



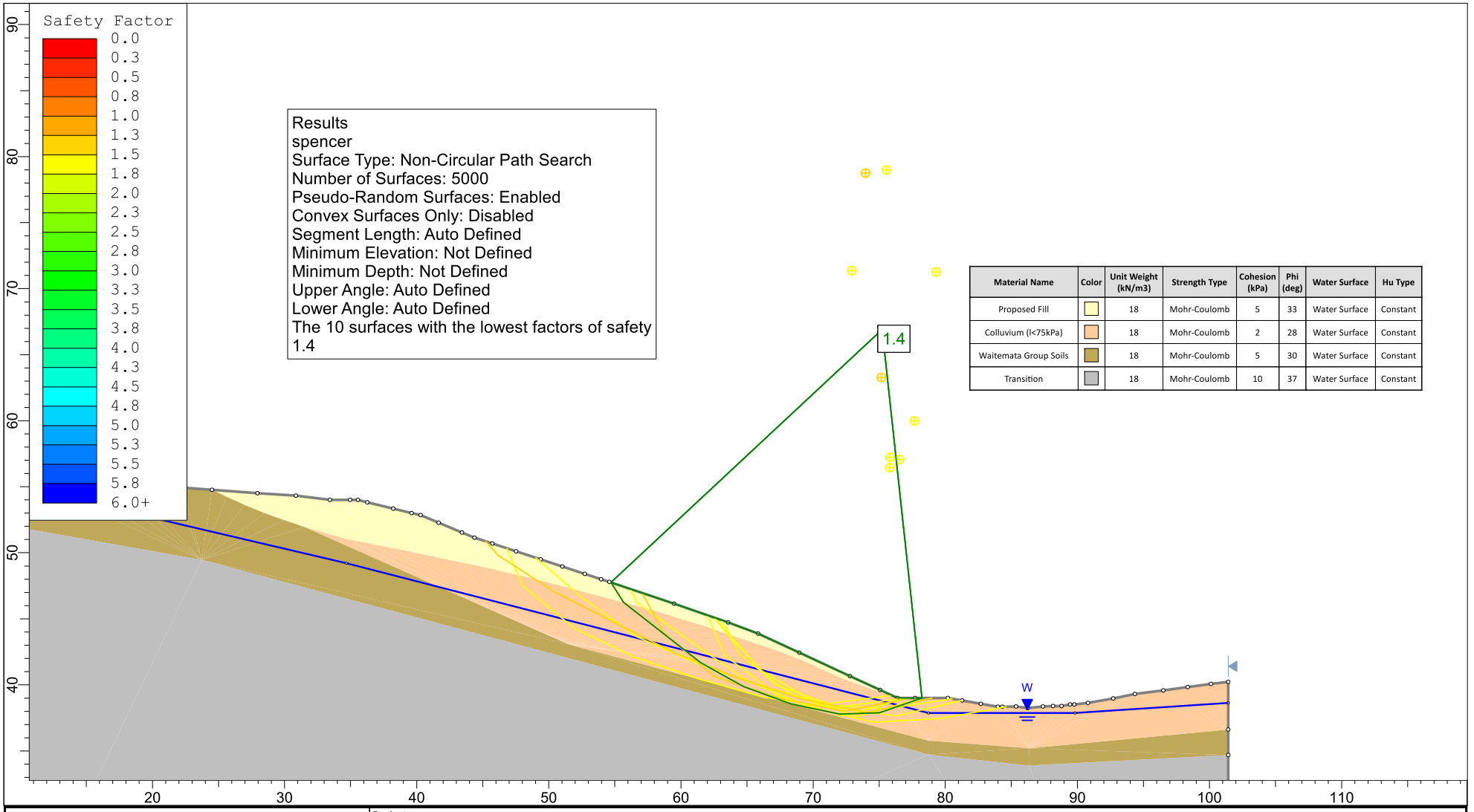
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section AA - Run 7				
Drawn By	PH	Scale	1:400	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S3AA - Run 7.slim



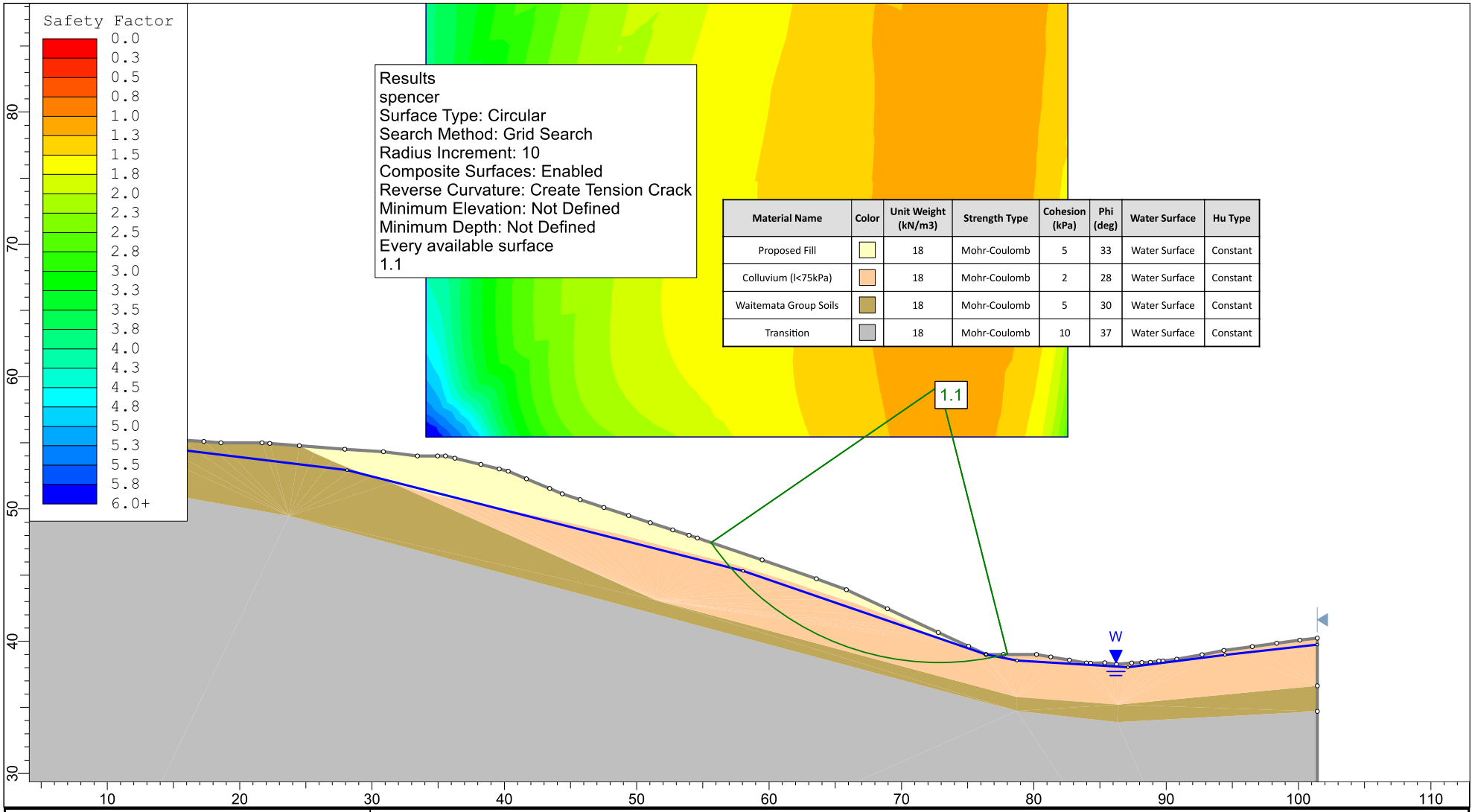
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section AA - Run 8				
Drawn By	PH	Scale	1:400	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S3AA - Run 8.slim



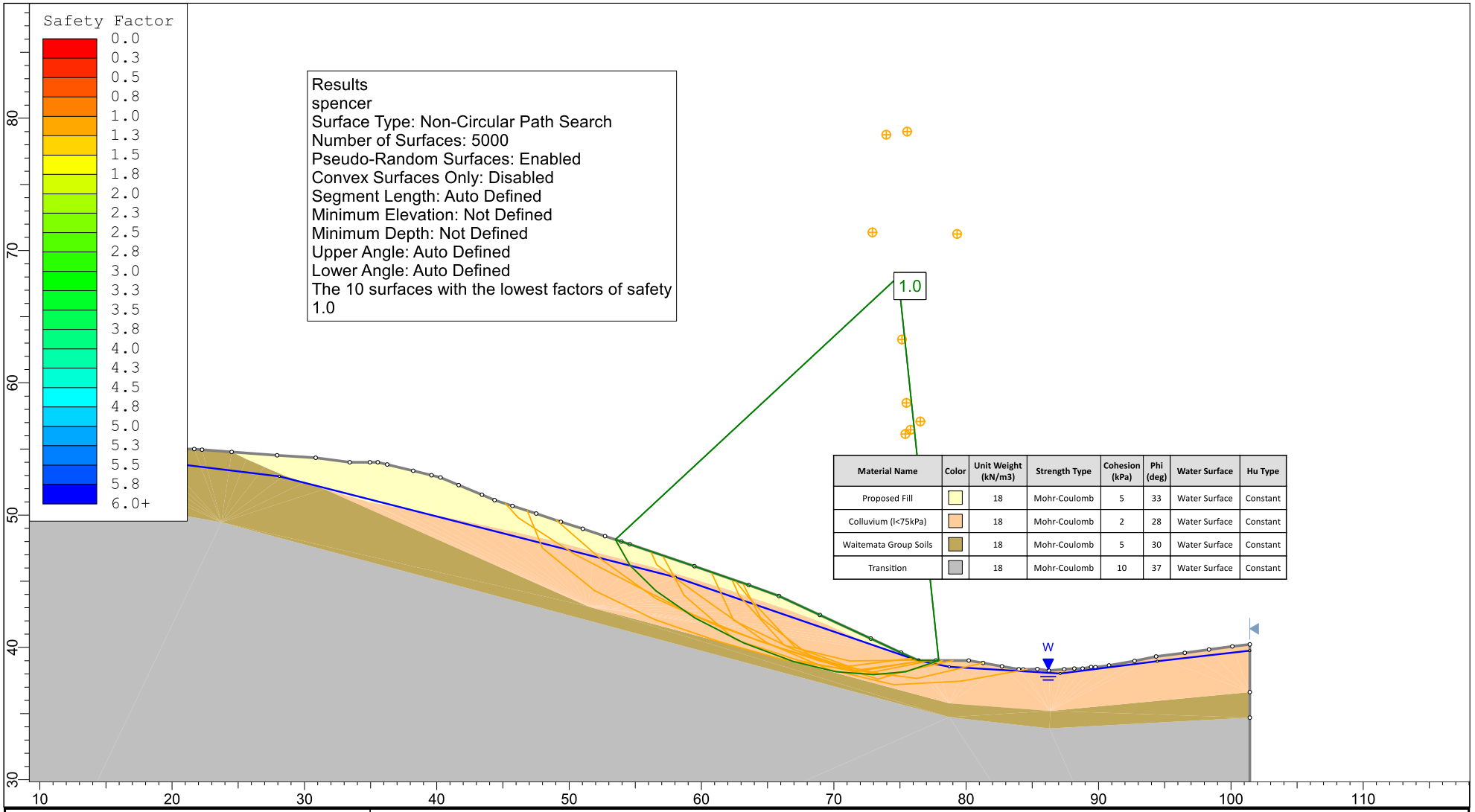
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section AA - Run 9				
Drawn By	PH	Scale	1:400	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S3AA - Run 9.slim



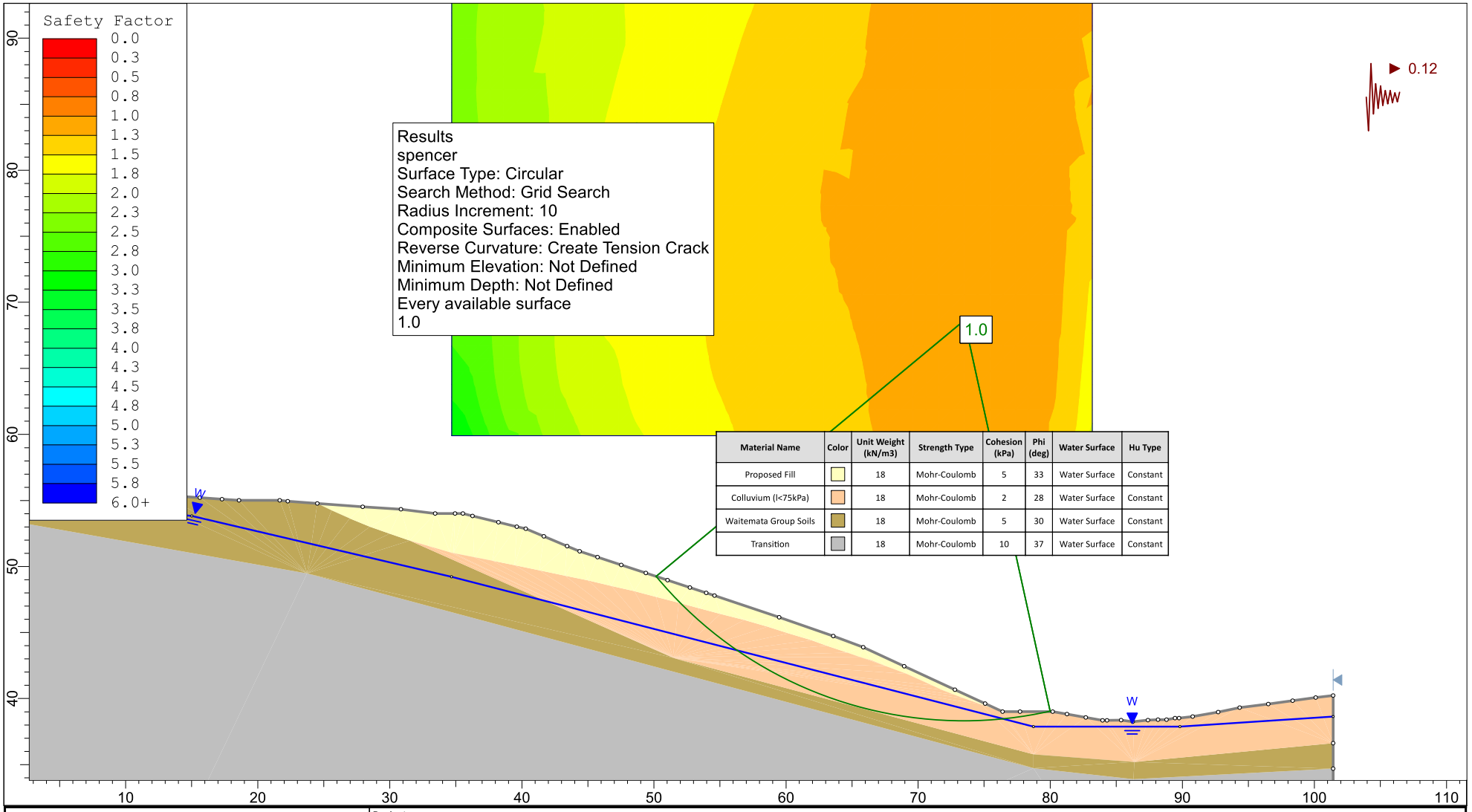
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section AA - Run 10				
Drawn By	PH	*Scale*	1:400	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S3AA - Run 10.slim



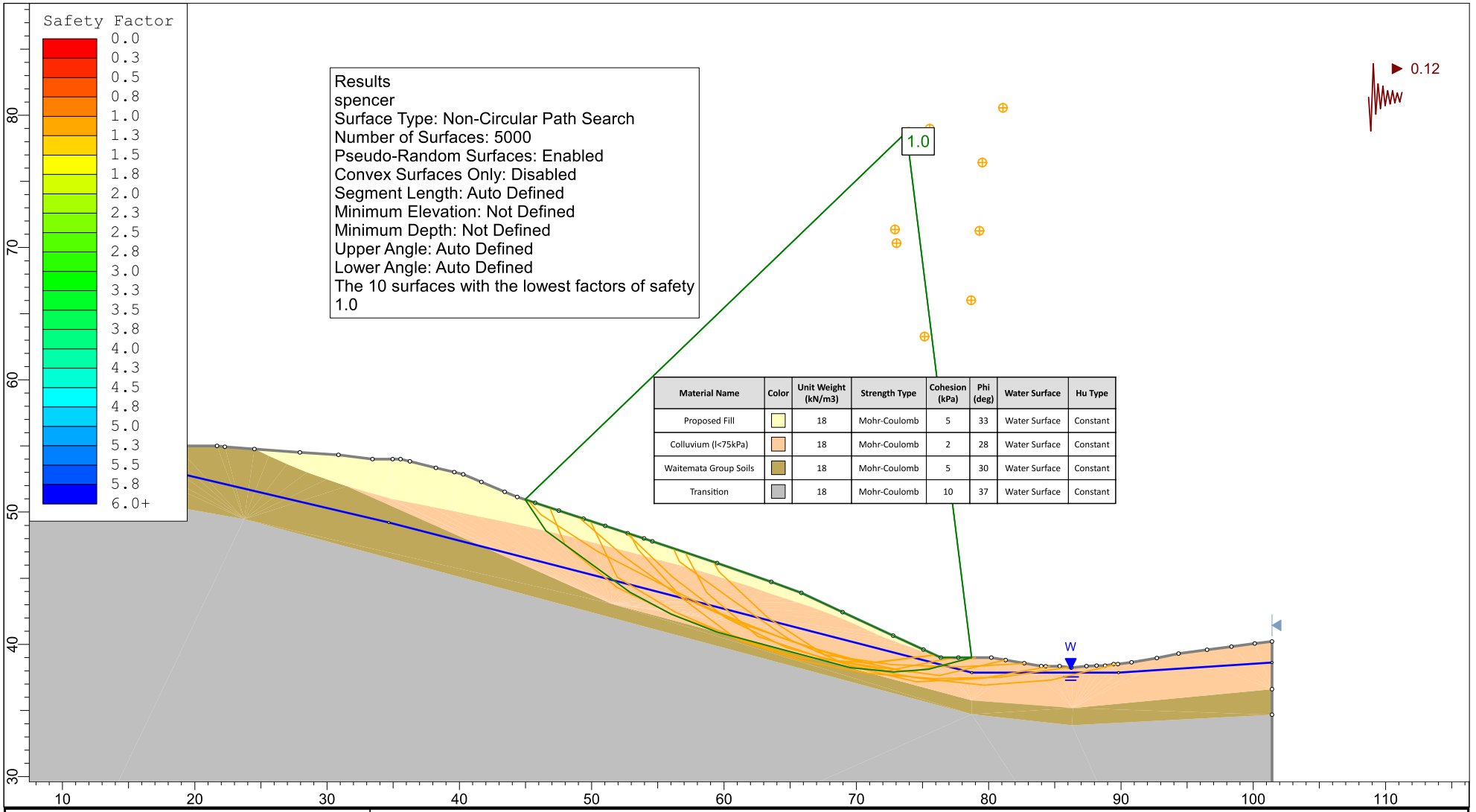
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section AA - Run 11				
Drawn By	PH	Scale	1:400	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S3AA - Run 11.slim



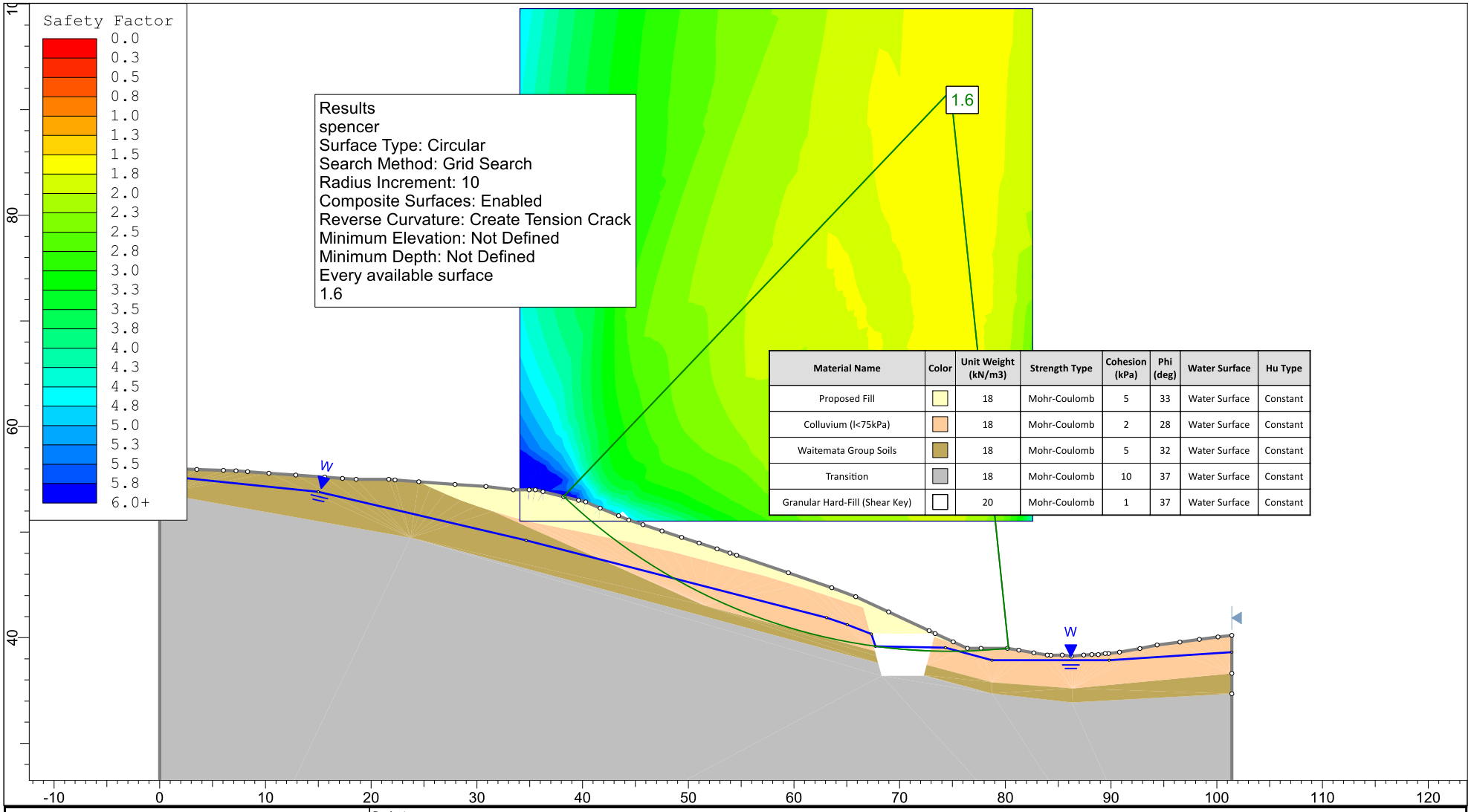
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section AA - Run 12				
Drawn By	PH	*Scale*	1:400	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S3AA - Run 12.slim



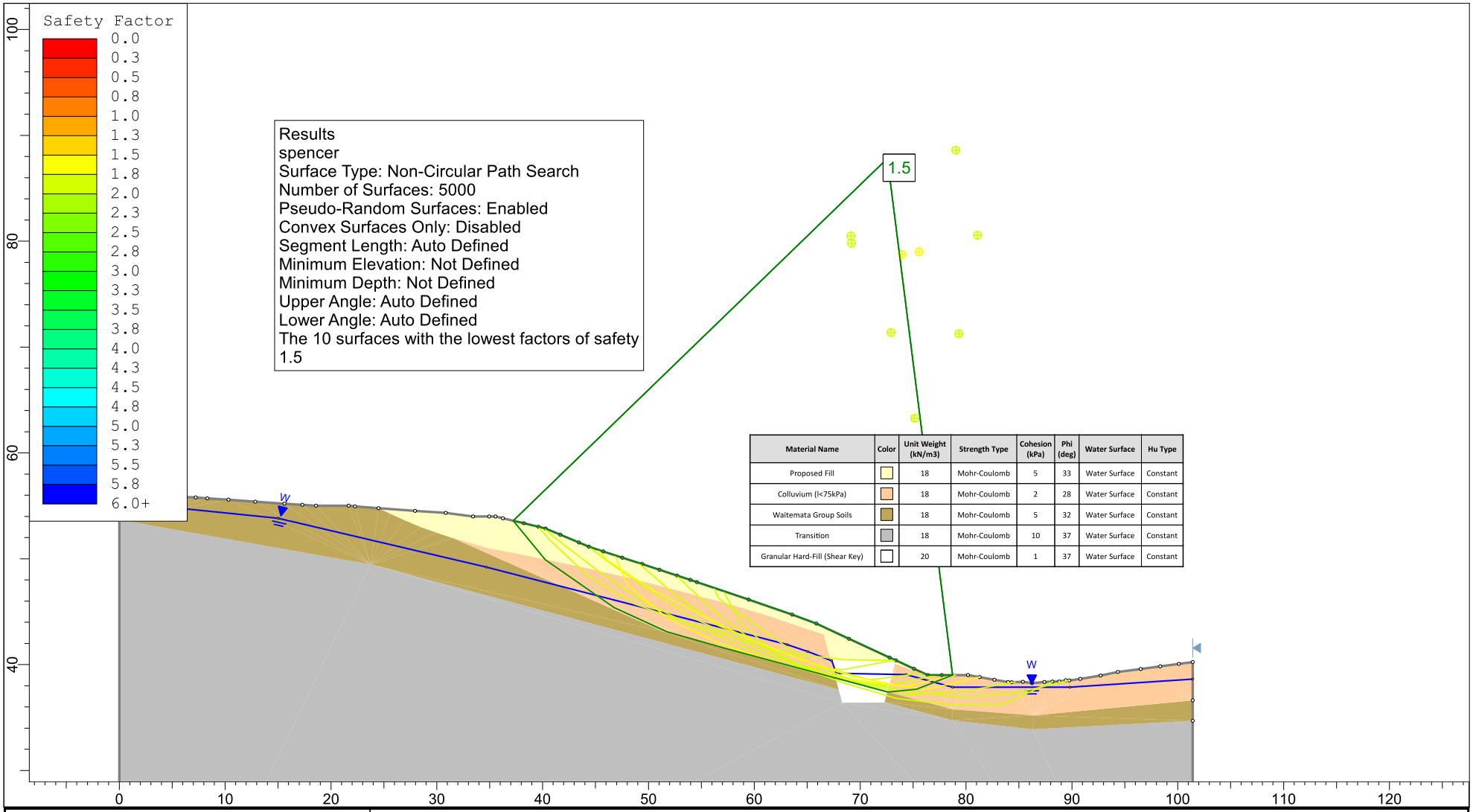
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	32	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant
Granular Hard-Fill (Shear Key)		20	Mohr-Coulomb	1	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section AA - Run 13 (drainage & shear key)				
Drawn By	PH	Scale	1:500	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S3AA - Run 13.slim



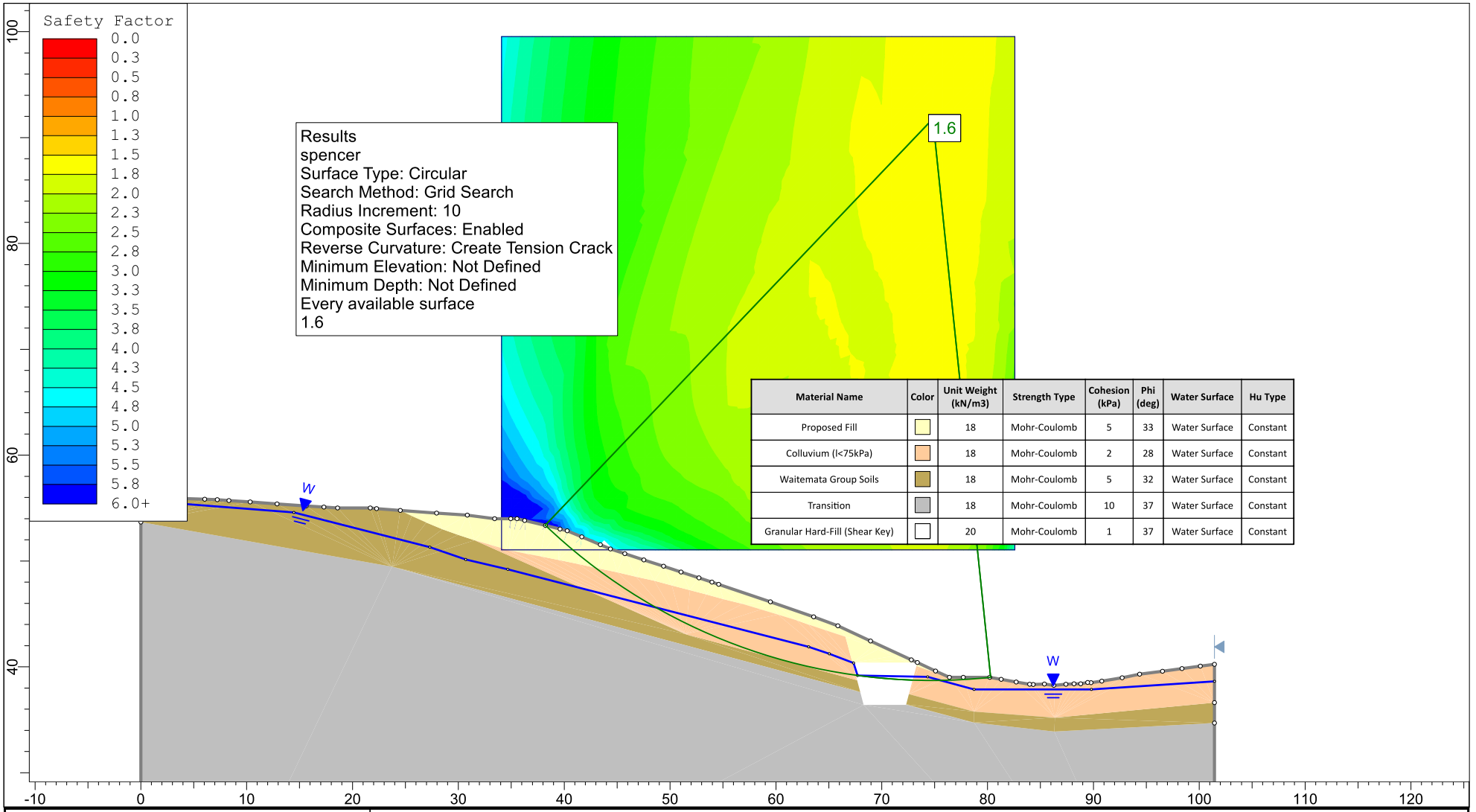
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	32	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant
Granular Hard-Fill (Shear Key)		20	Mohr-Coulomb	1	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section AA - Run 14 (drainage & shear key)				
Drawn By	PH	Scale	1:500	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S3AA - Run 14.slim



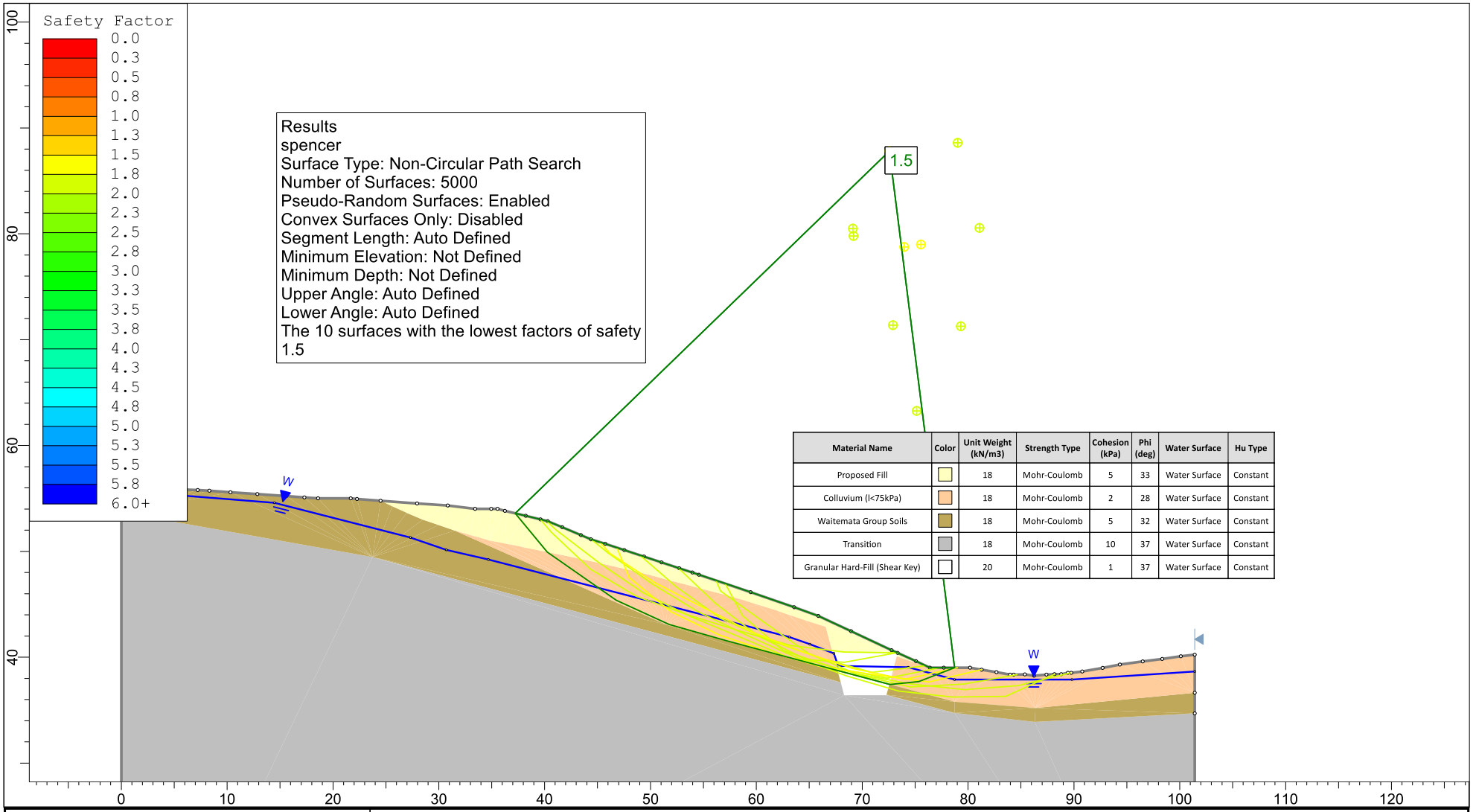
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	32	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant
Granular Hard-Fill (Shear Key)		20	Mohr-Coulomb	1	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section AA - Run 15 (drainage & shear key)				
Drawn By	PH	Scale	1:500	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S3AA - Run 15.slim



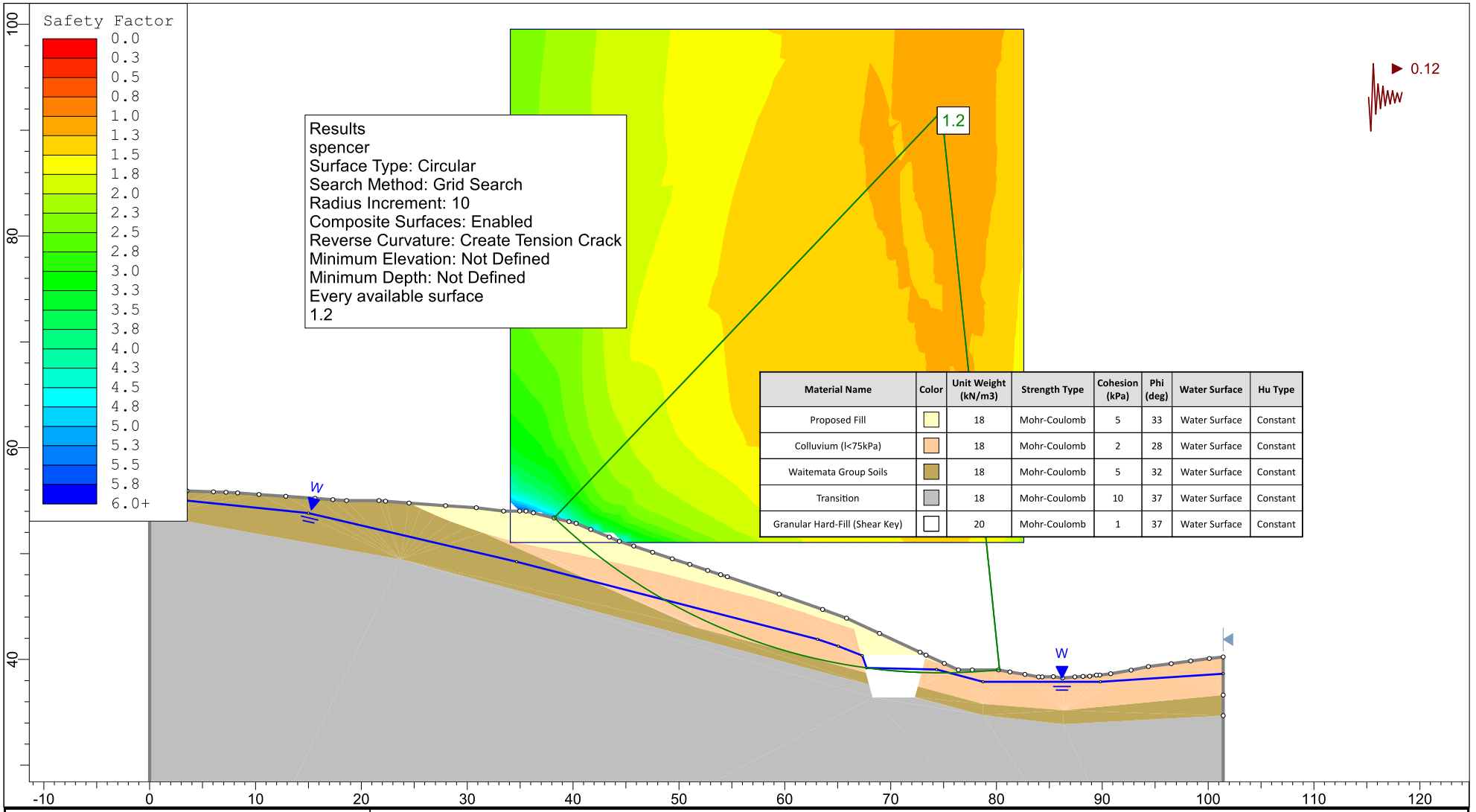
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	32	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant
Granular Hard-Fill (Shear Key)		20	Mohr-Coulomb	1	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section AA - Run 16 (drainage & shear key)				
Drawn By	PH	Scale	1:500	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S3AA - Run 16.slim



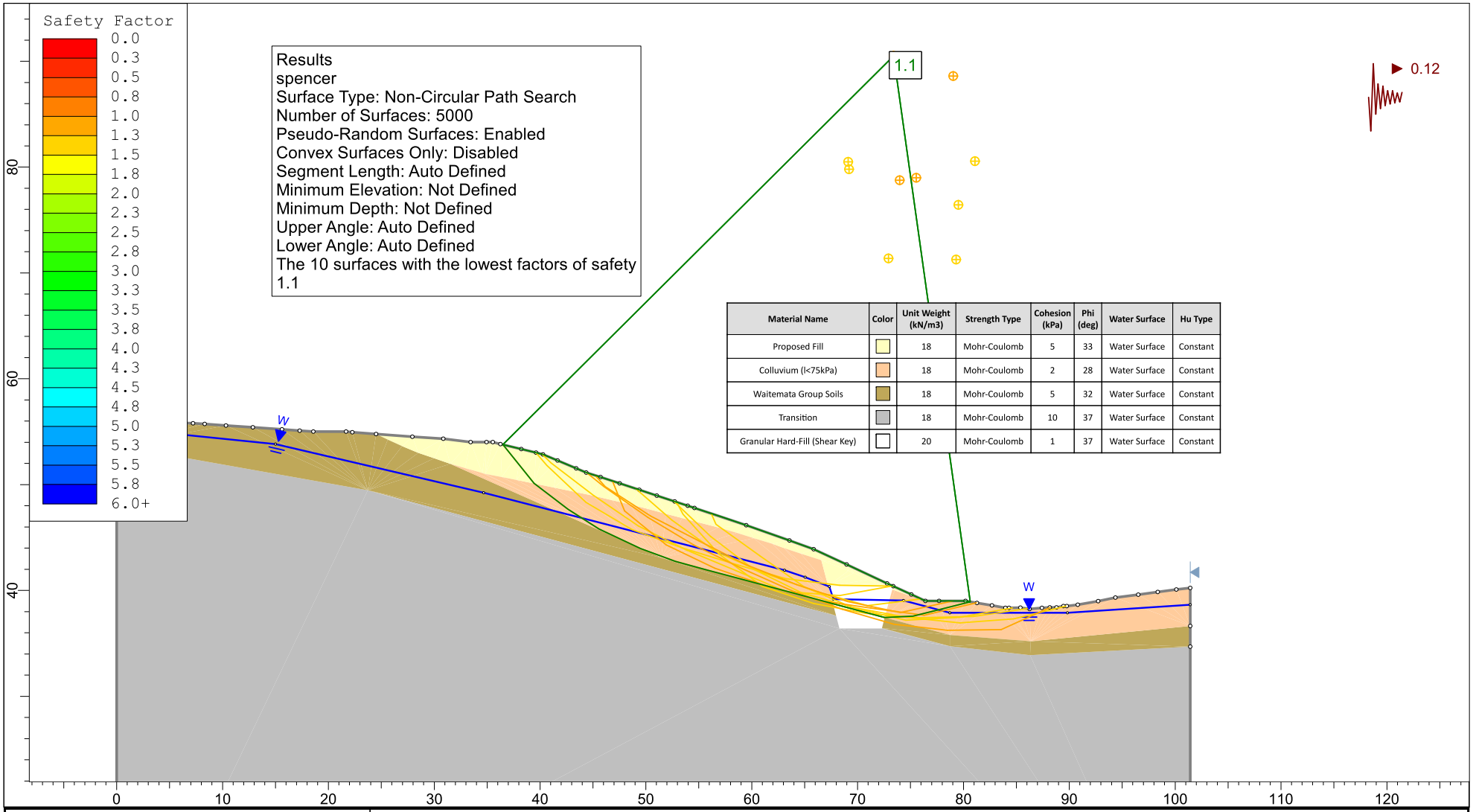
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	32	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant
Granular Hard-Fill (Shear Key)		20	Mohr-Coulomb	1	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section AA - Run 17 (drainage & shear key)				
Drawn By	PH	Scale	1:500	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S3AA - Run 17.slim



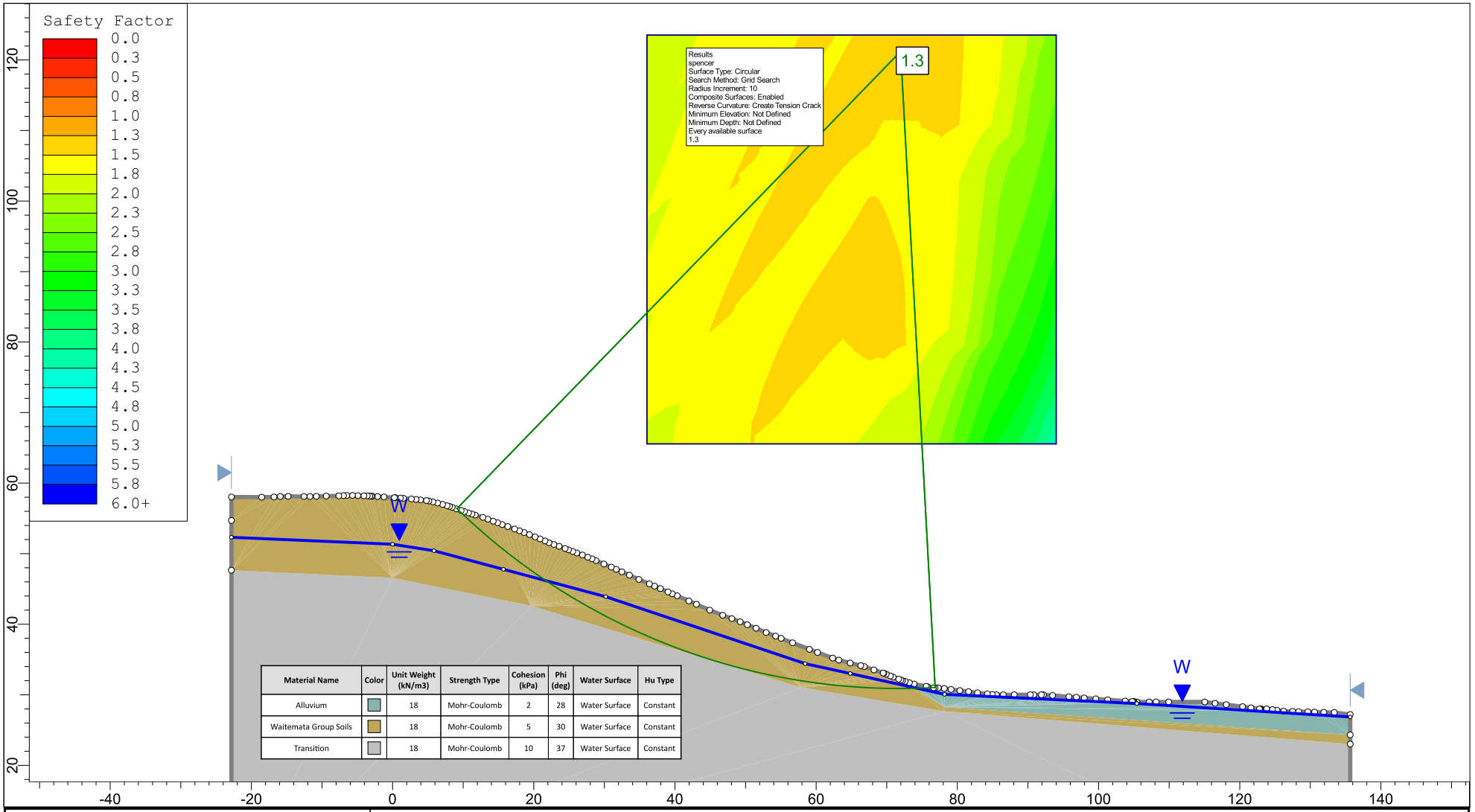
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	32	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant
Granular Hard-Fill (Shear Key)		20	Mohr-Coulomb	1	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section AA - Run 18 (drainage & shear key)				
Drawn By	PH	*Scale*	1:500	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S3AA - Run 18.slim

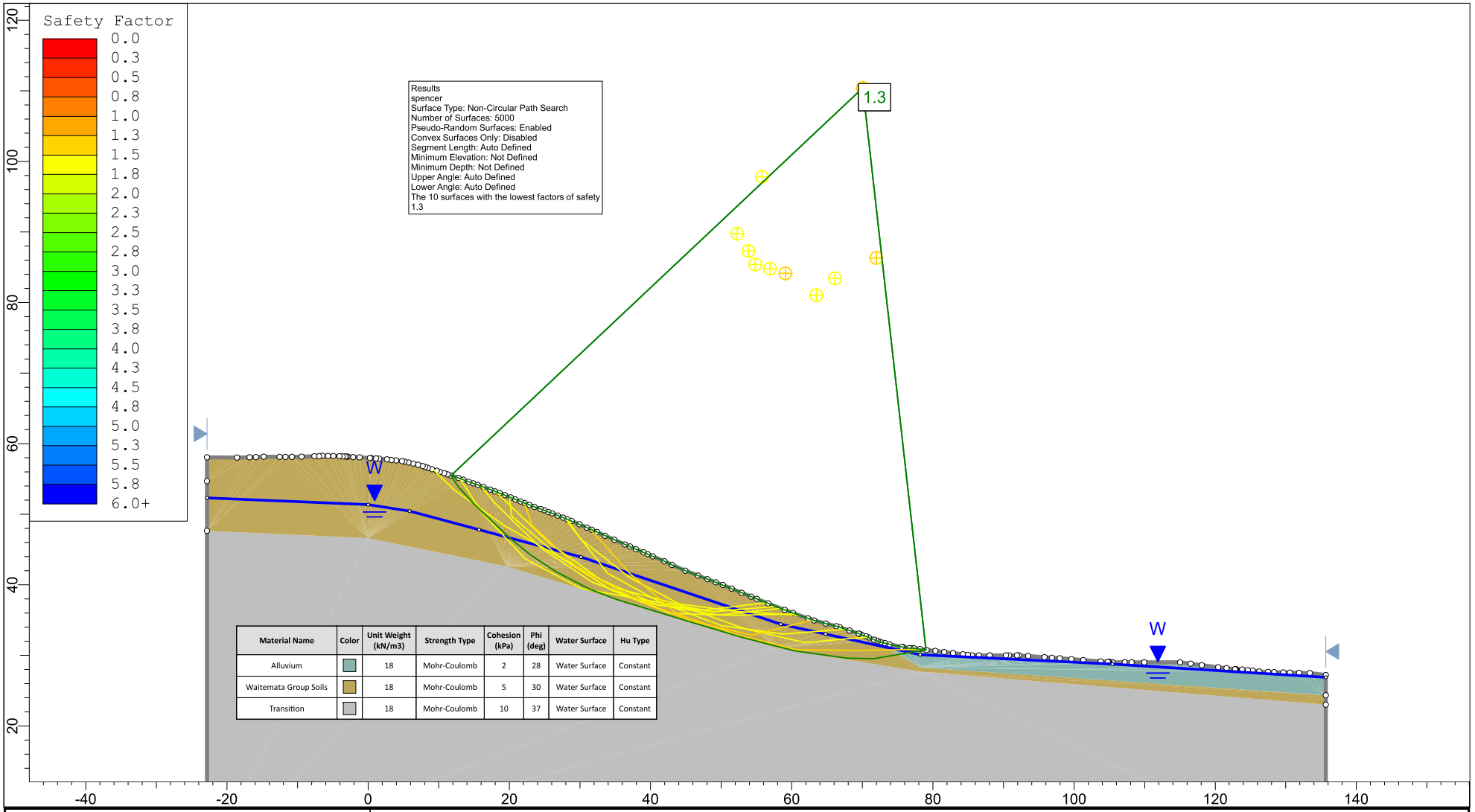


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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section BB - Run 1				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S3BB - Run 1.slim



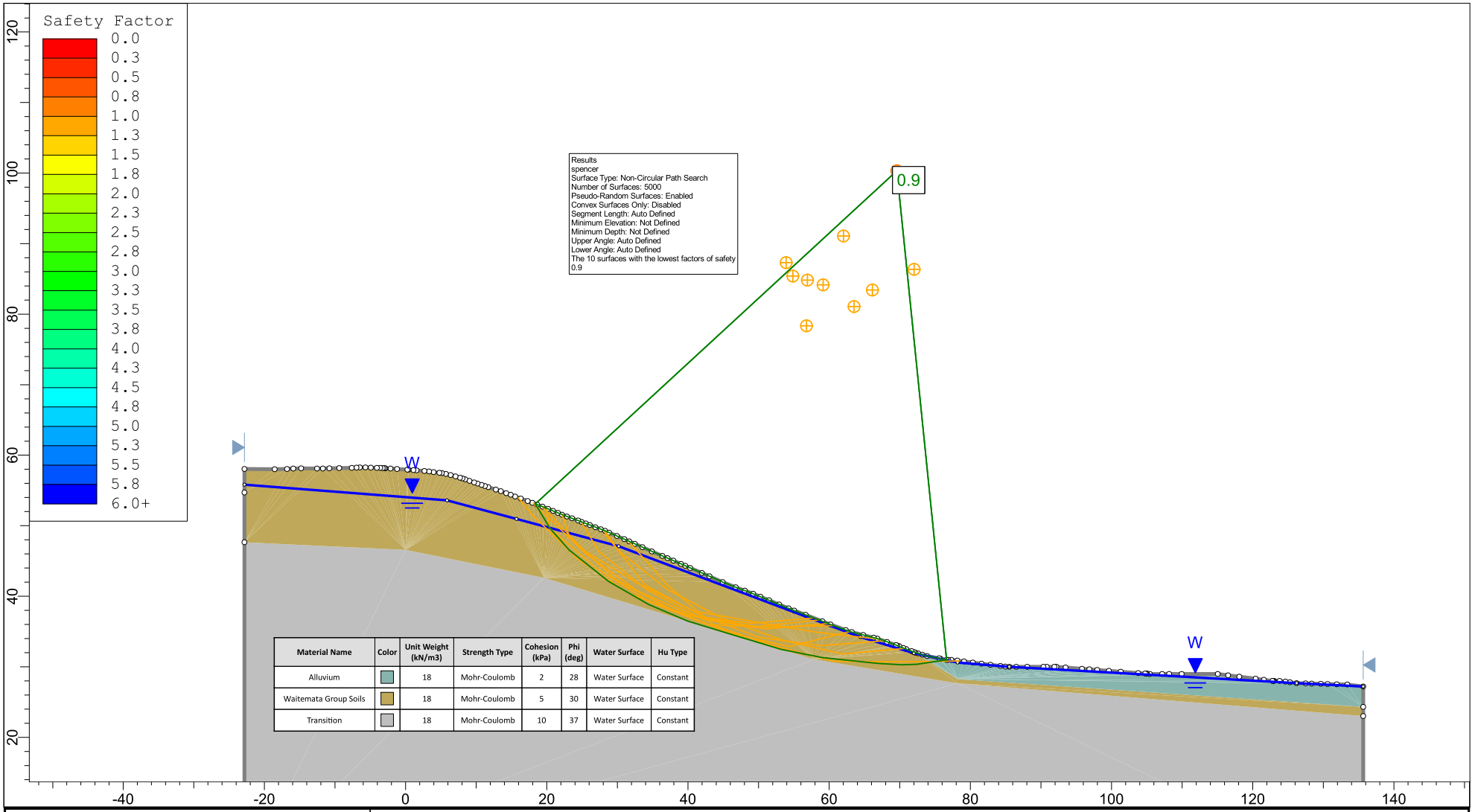
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section BB - Run 2				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S3BB - Run 2.slim



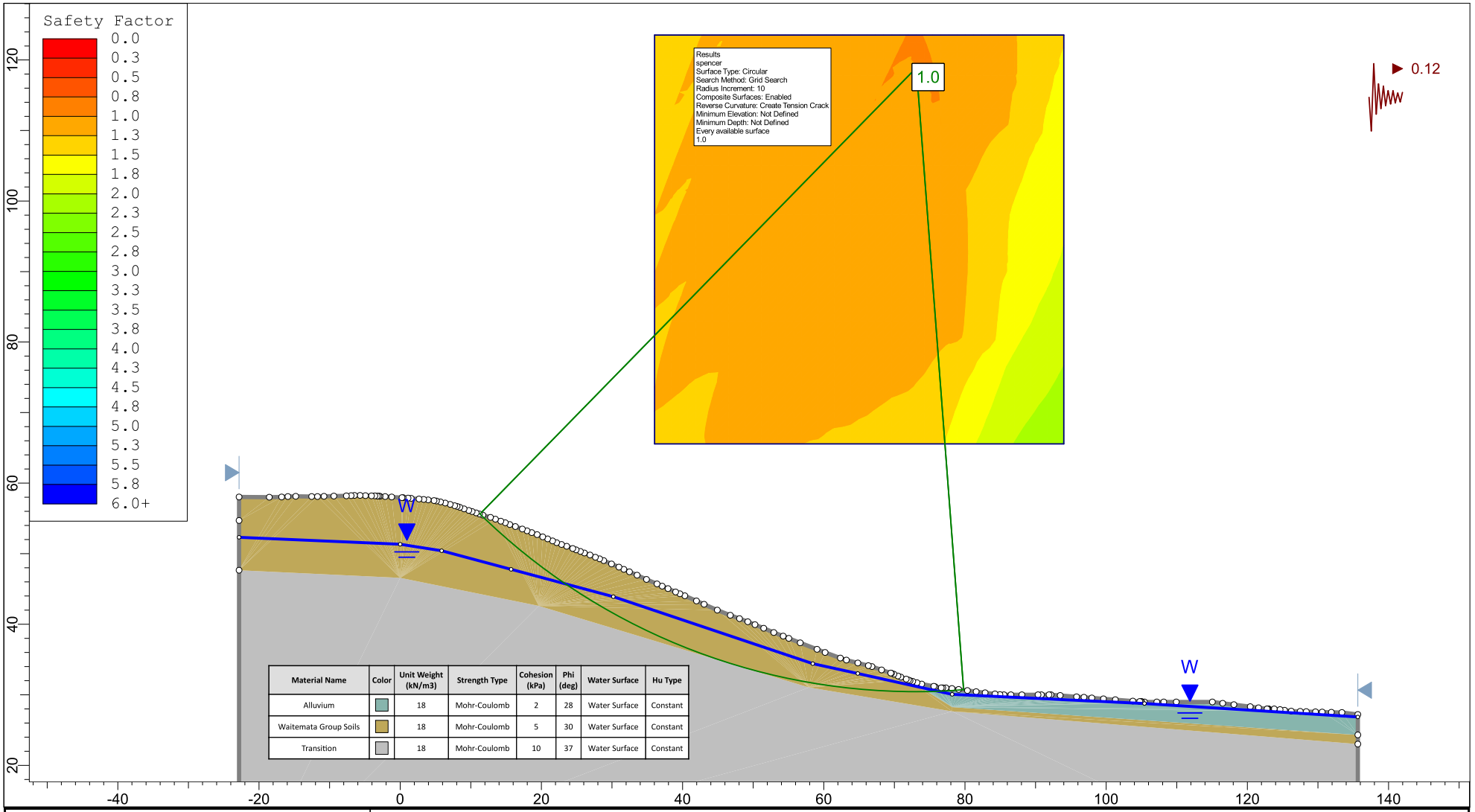
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section BB - Run 4				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S3BB - Run 4.slim

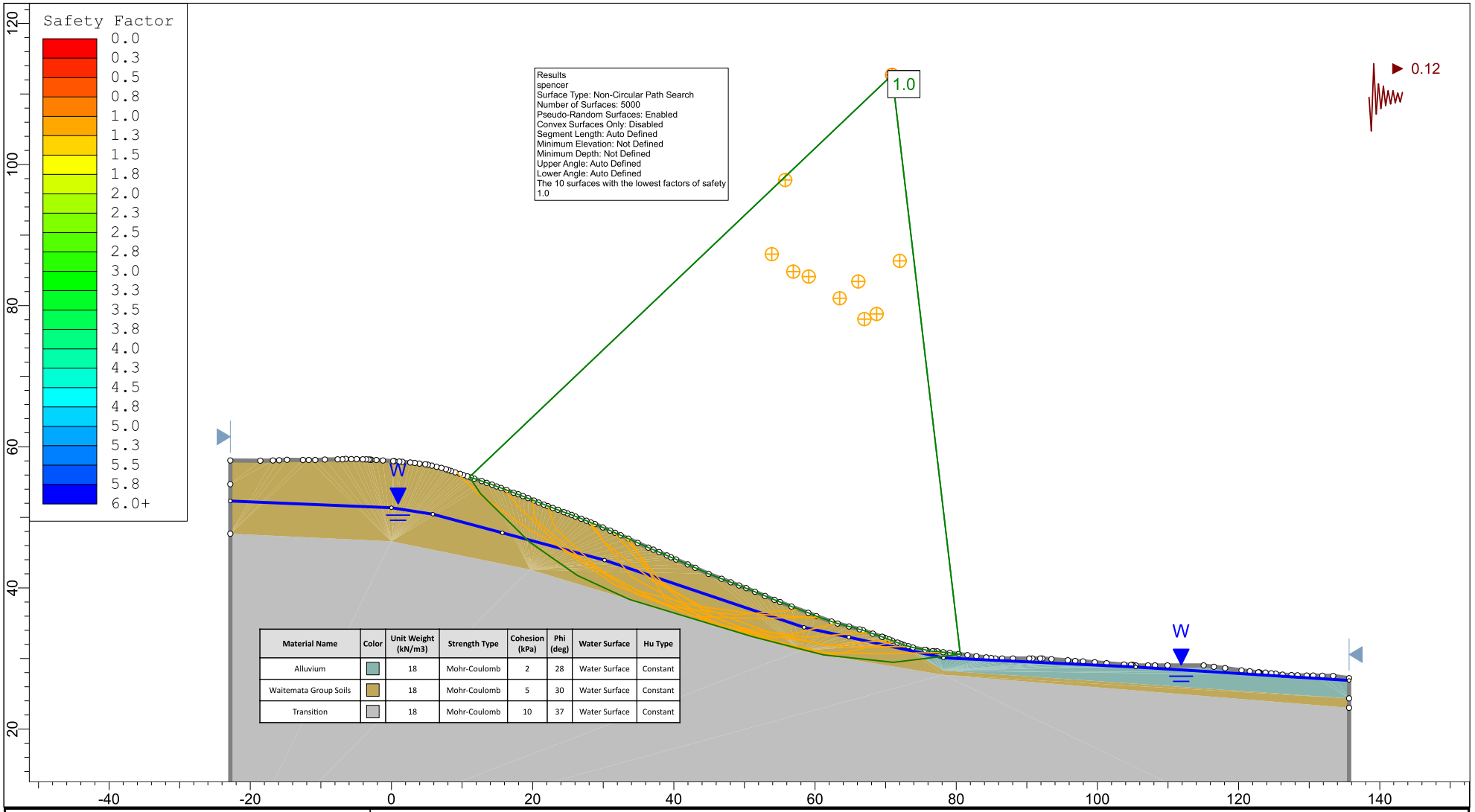


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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section BB - Run 5				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S3BB - Run 5.slim

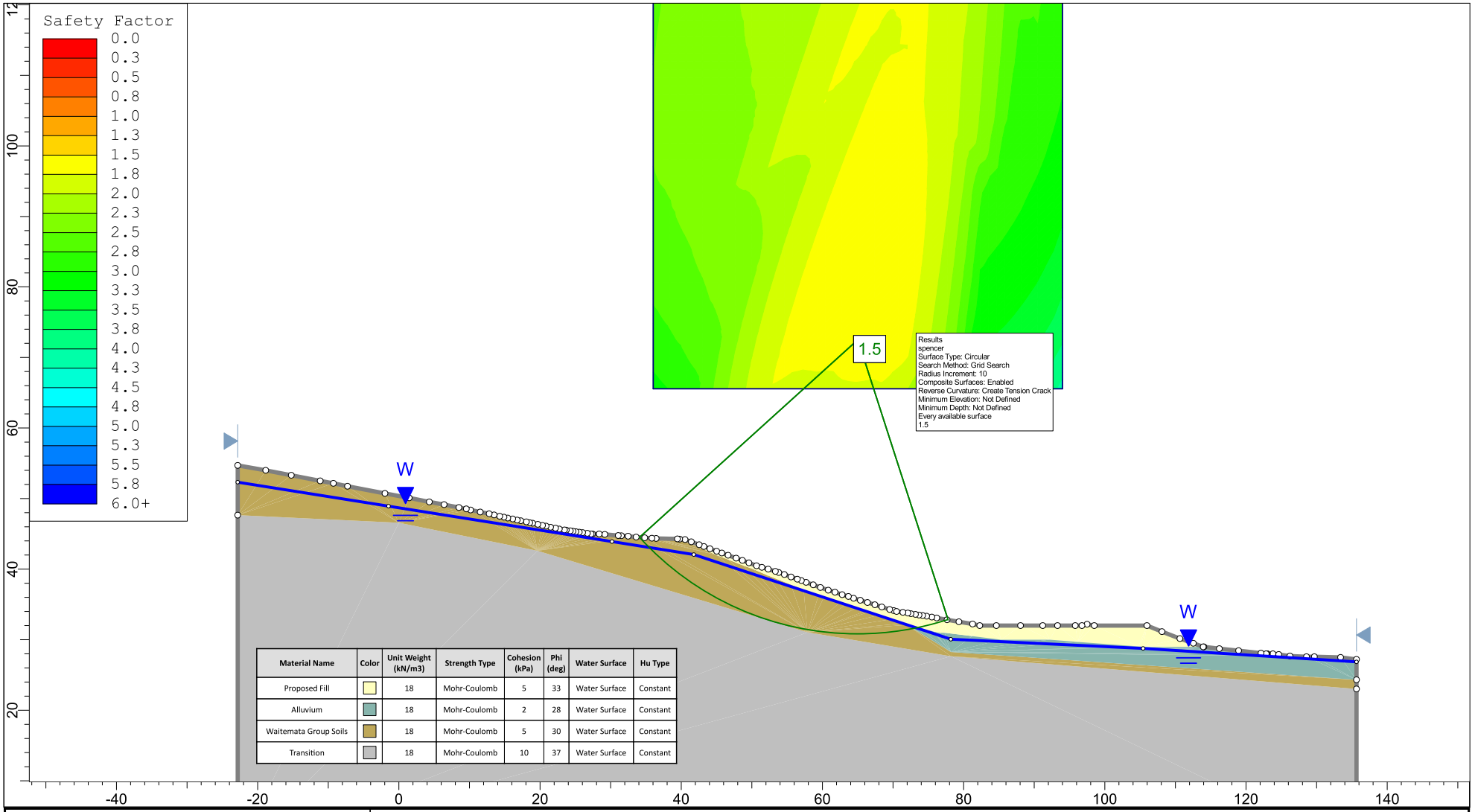


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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section BB - Run 6				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S3BB - Run 6.slim



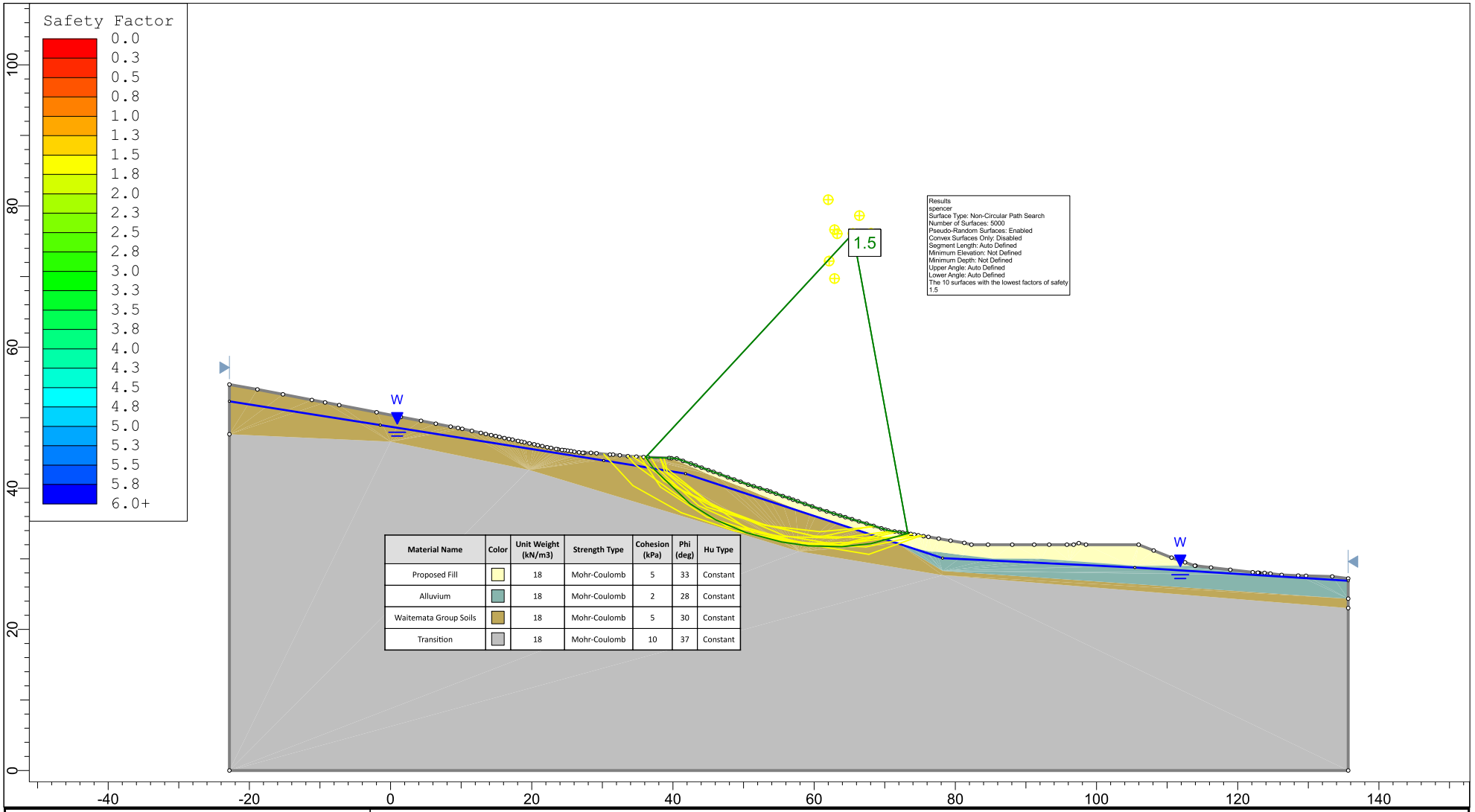
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section BB - Run 7				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S3BB - Run 7.slim



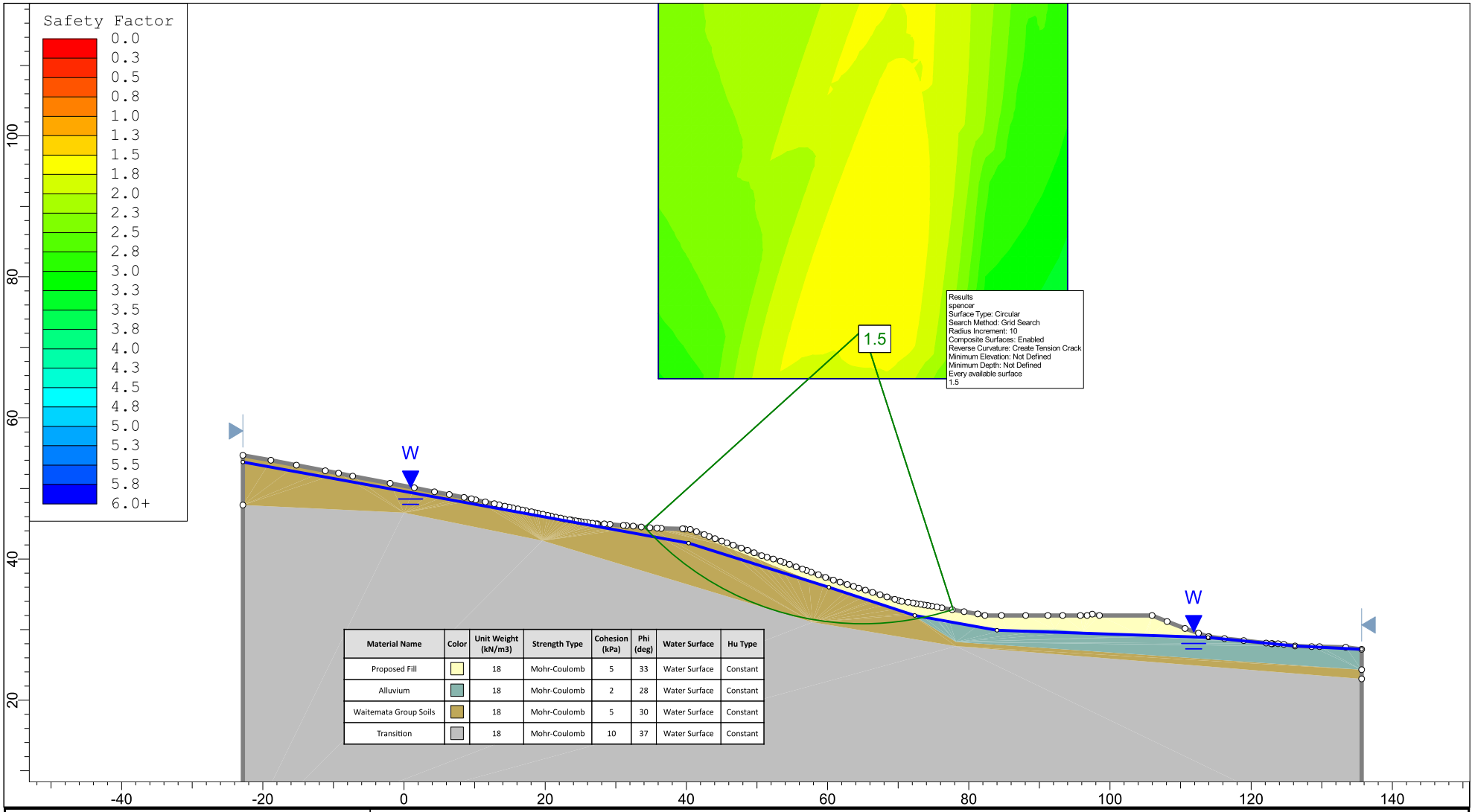
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Constant
Alluvium		18	Mohr-Coulomb	2	28	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Constant
Transition		18	Mohr-Coulomb	10	37	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section BB - Run 8				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S3BB - Run 8.slim



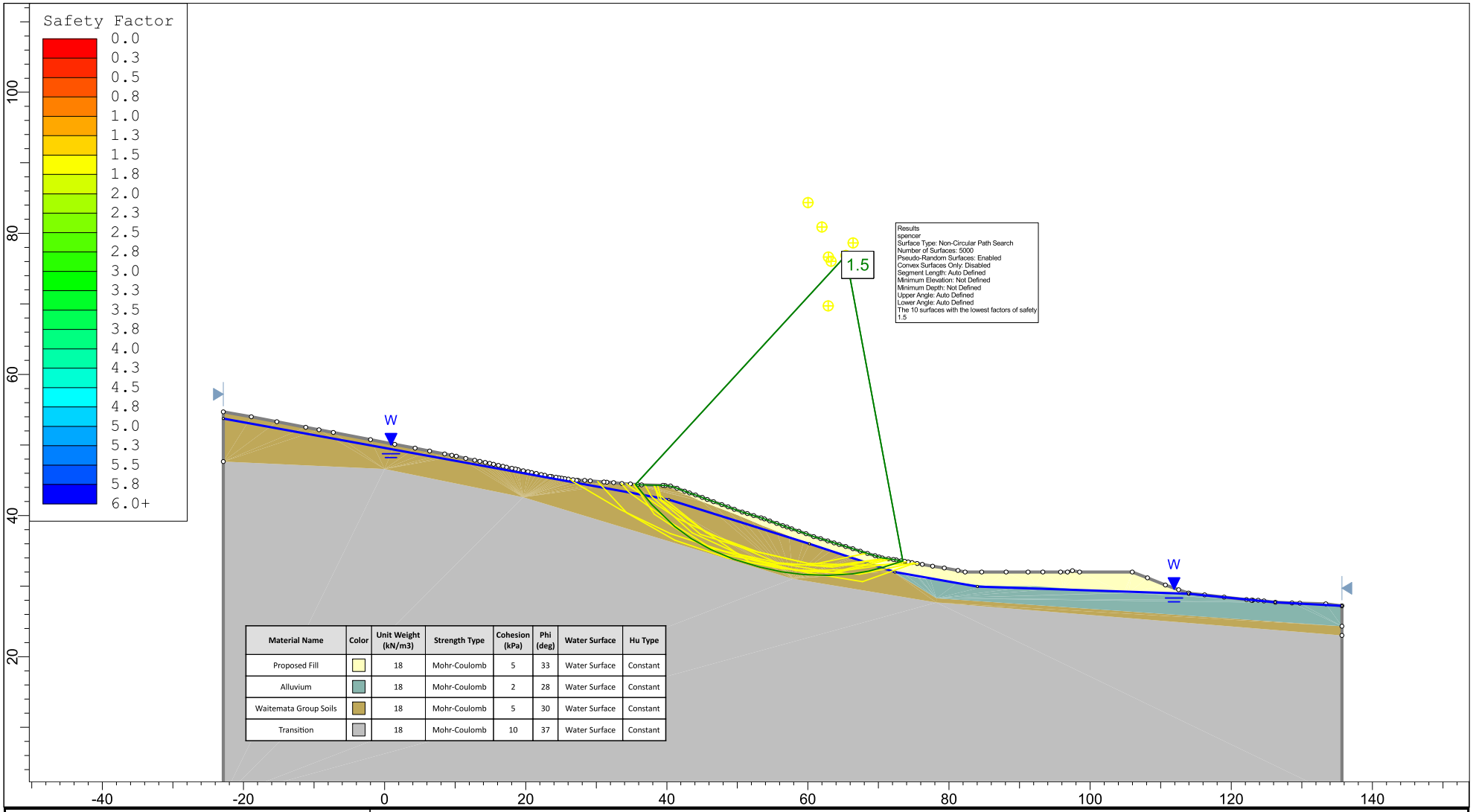
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section BB - Run 9				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S3BB - Run 9.slim



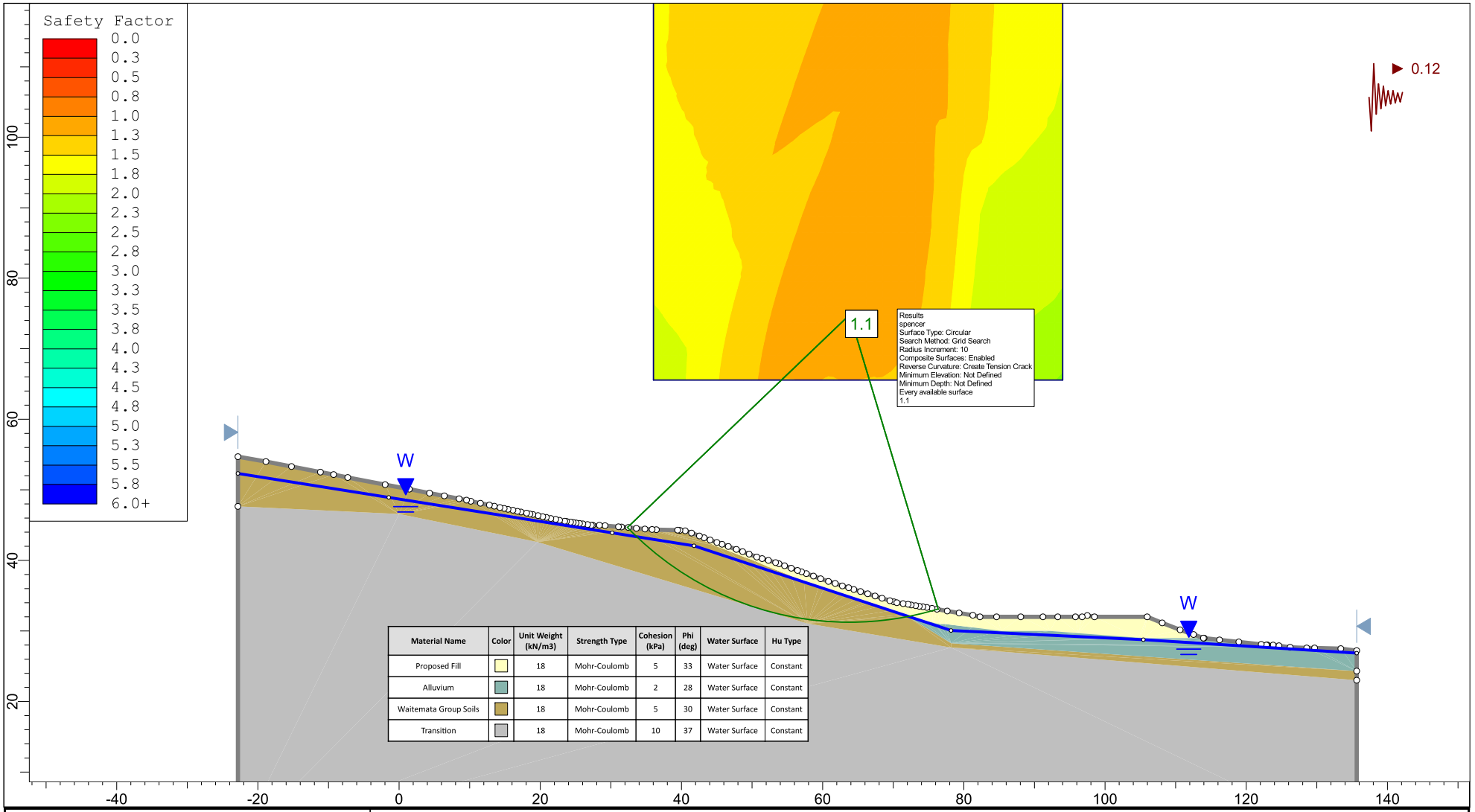
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section BB - Run 10				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S3BB - Run 10.slim



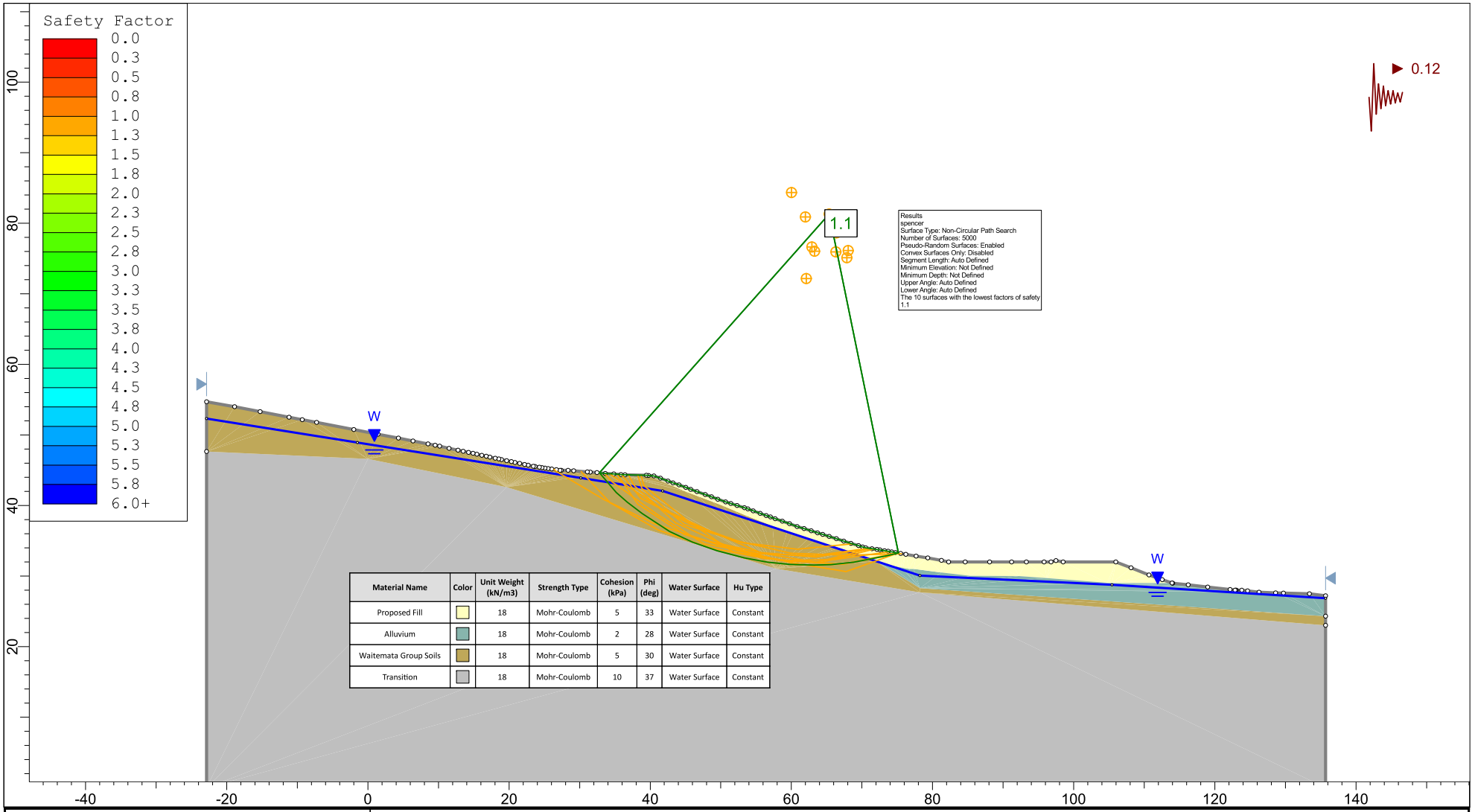
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section BB - Run 11				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S3BB - Run 11.slim



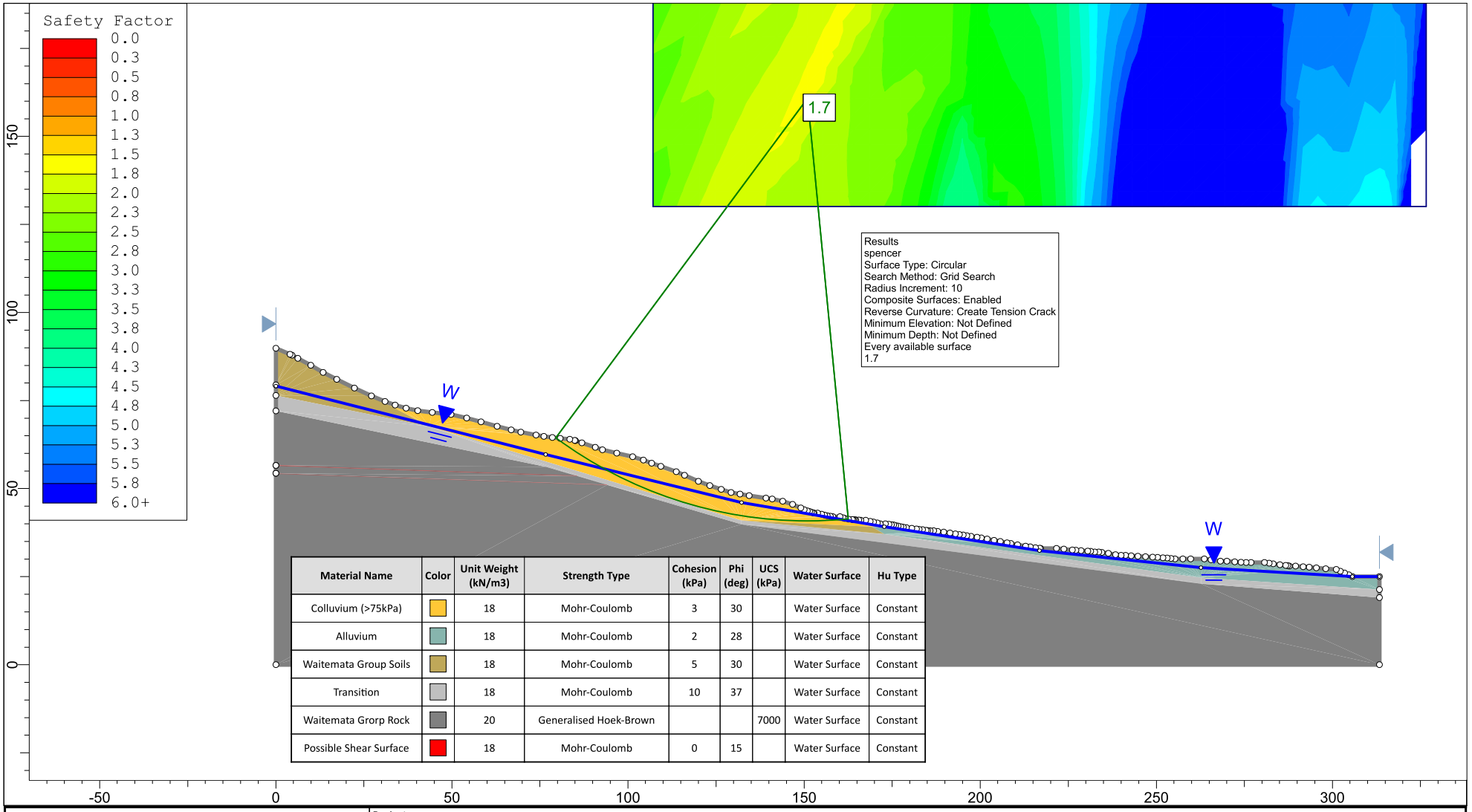
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section BB - Run 12				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S3BB - Run 12.slim



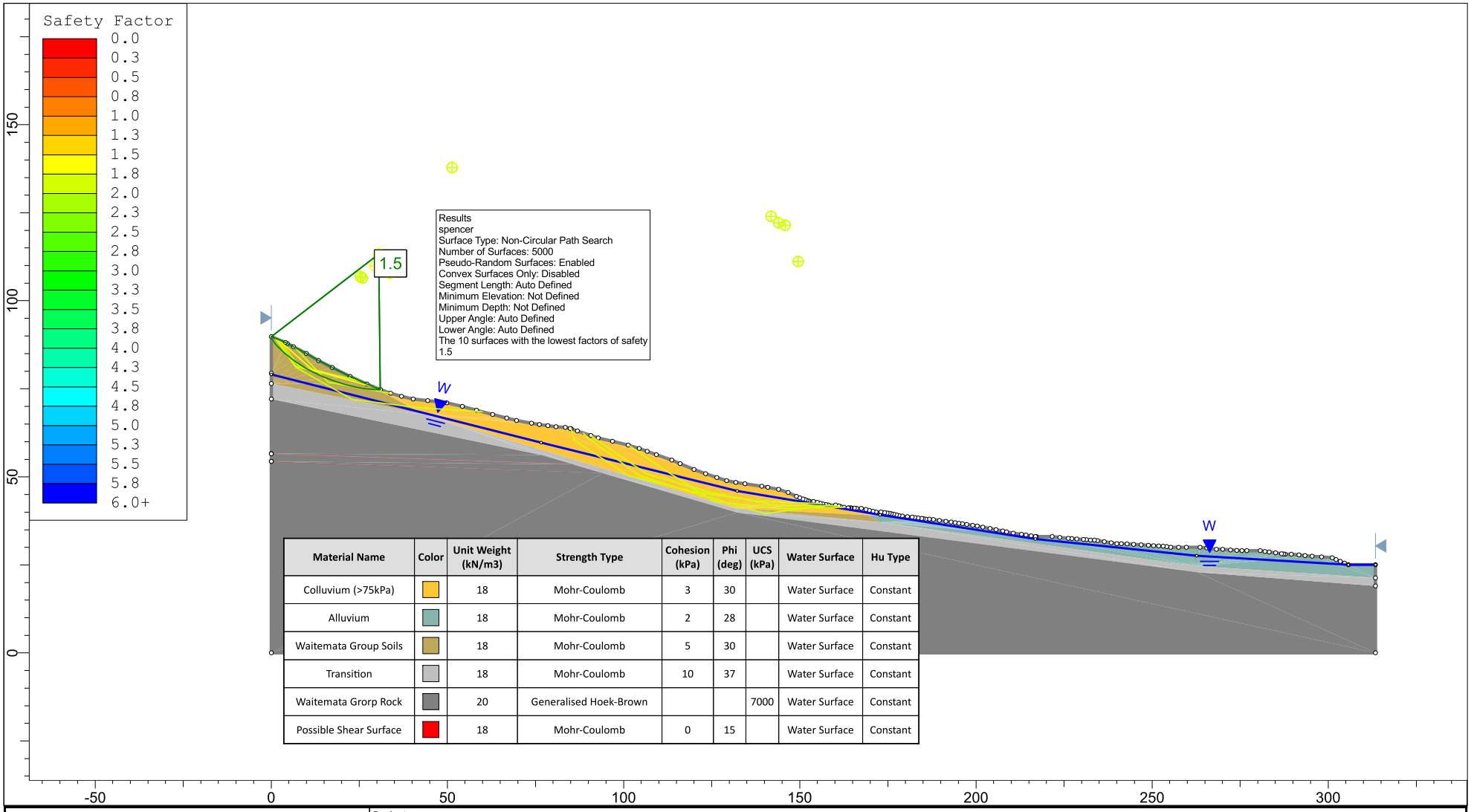
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section CC - Run 1				
Drawn By	PH	*Scale*	1:1500	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S3CC - Run 1.slim



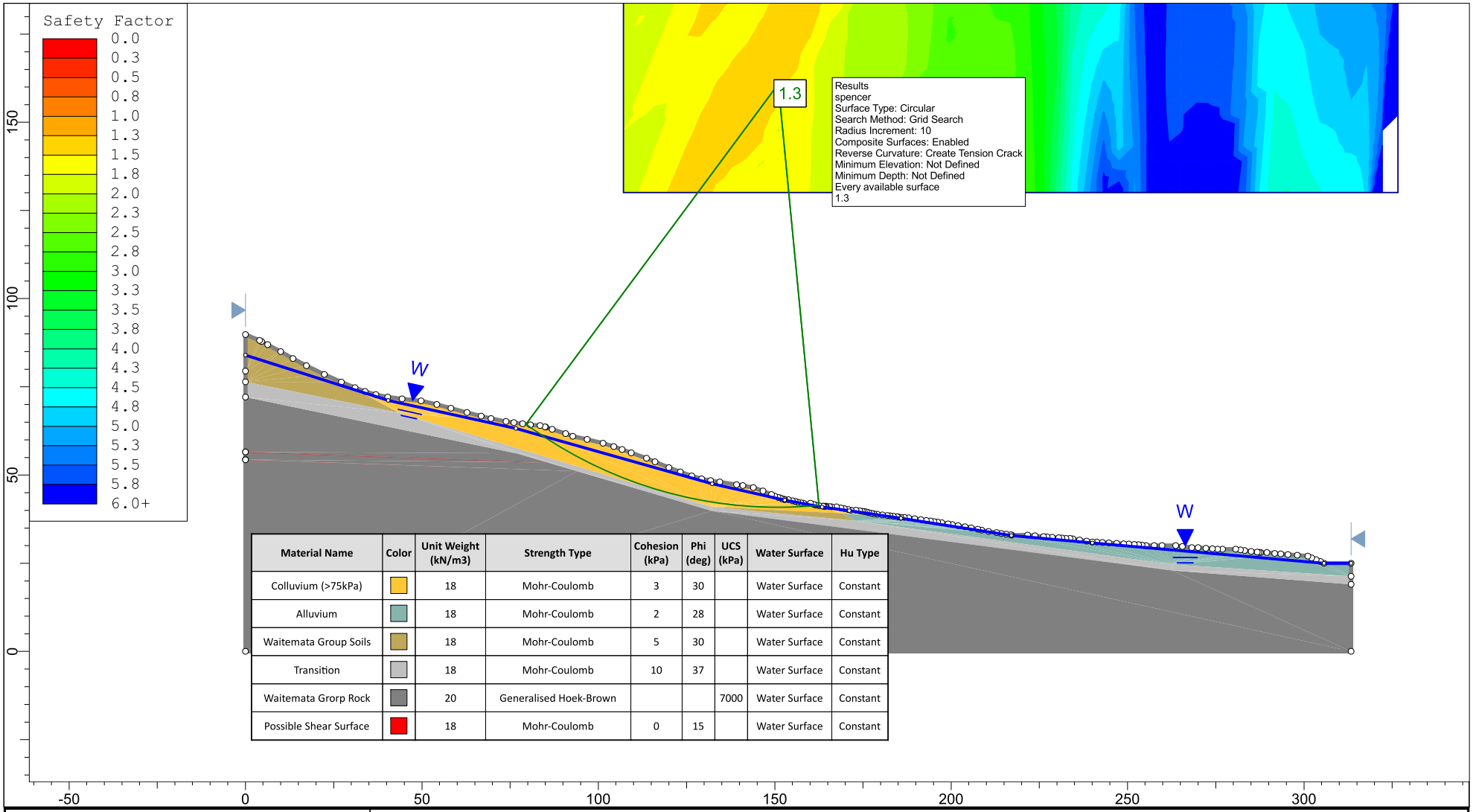
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 3, Section CC - Run 2		
Drawn By	PH	*Scale* 1:1500	*Company* KGA Geotechnical
Date	31/08/2015		*File Name* 7464 - S3CC - Run 2.slim



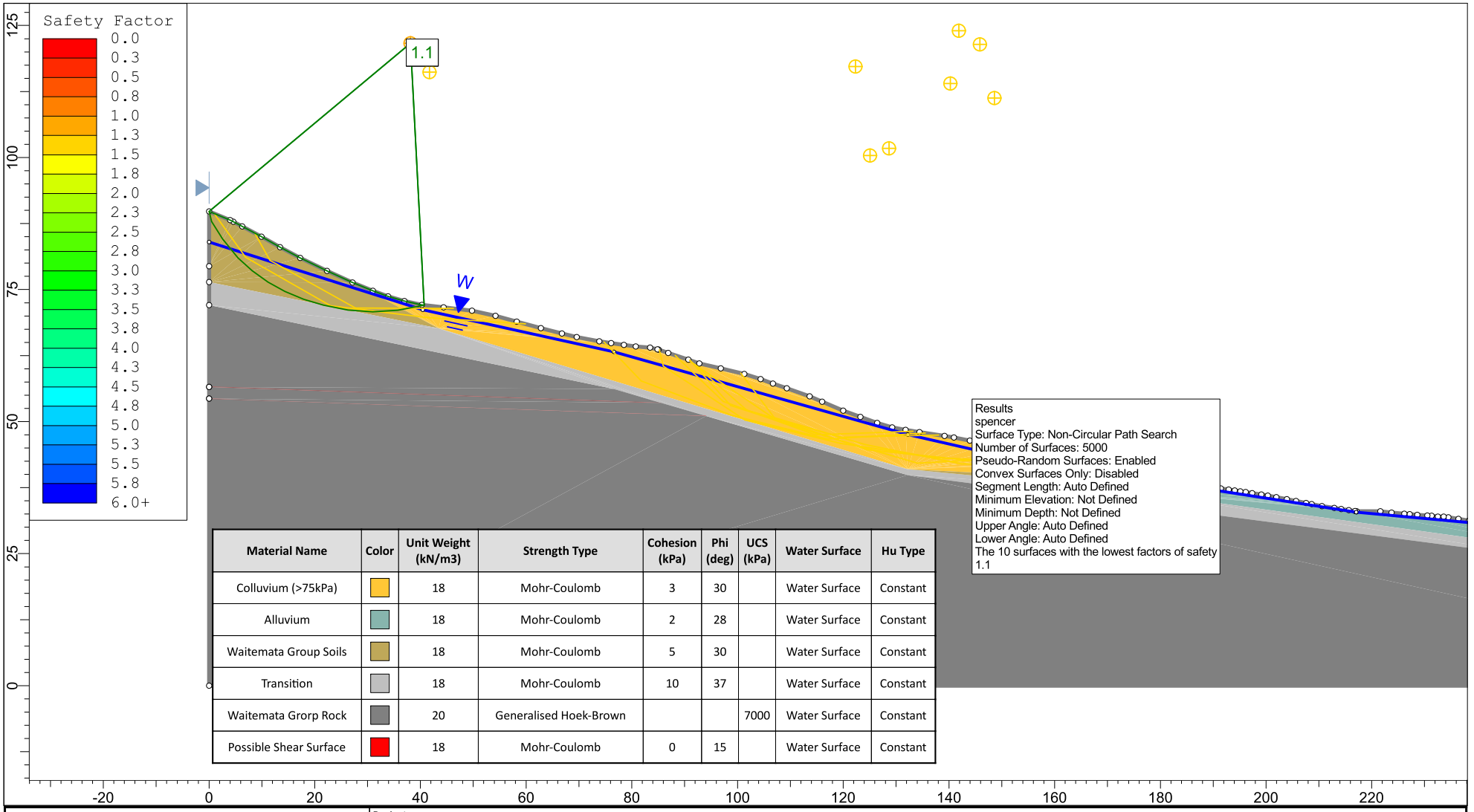
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 3, Section CC - Run 3		
Drawn By	PH	*Scale* 1:1500	*Company* KGA Geotechnical
Date	31/08/2015		*File Name* 7464 - S3CC - Run 3.slim



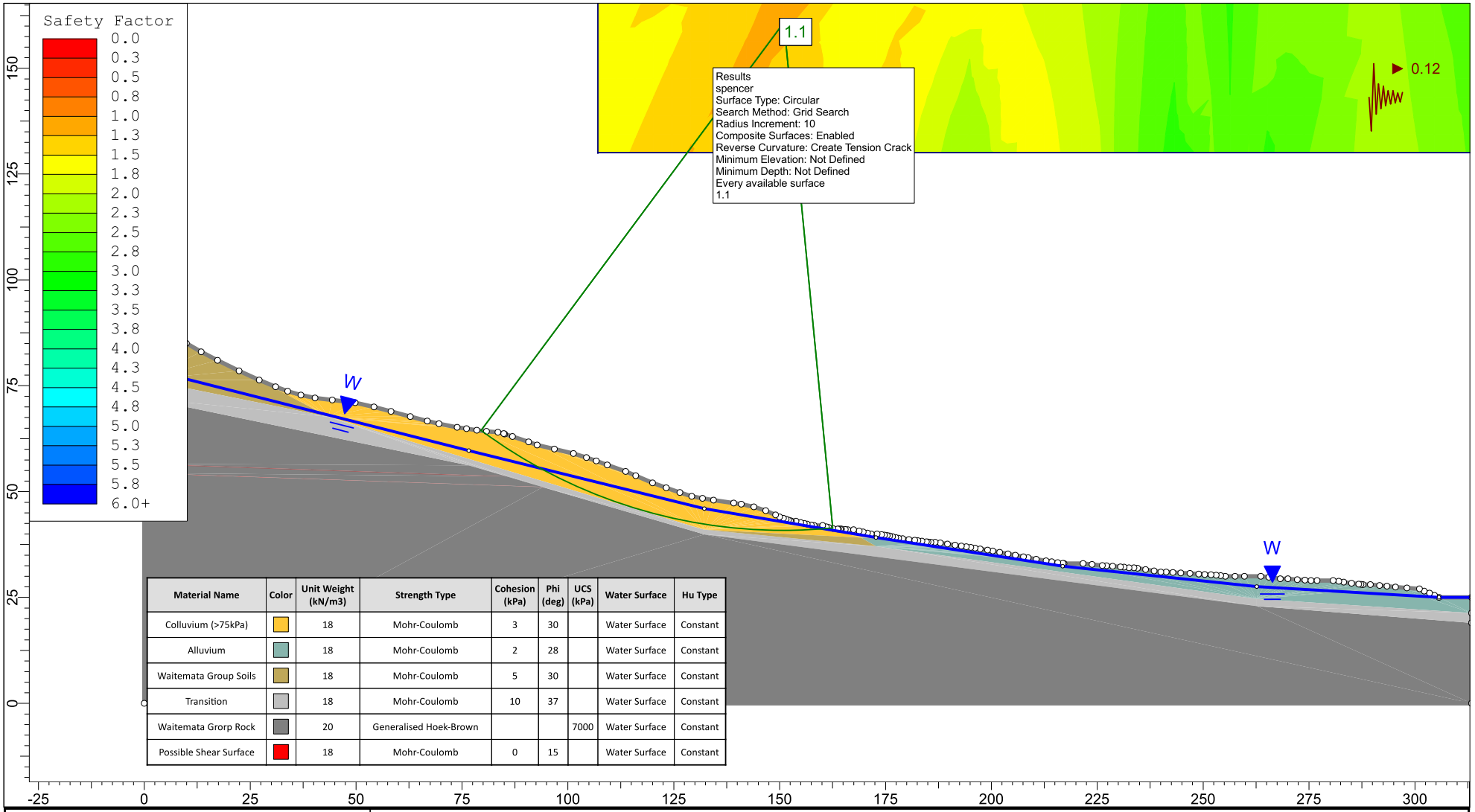
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 3, Section CC - Run 4		
Drawn By	PH	*Scale* 1:1000	*Company* KGA Geotechnical
Date	31/08/2015		*File Name* 7464 - S3CC - Run 4.slim



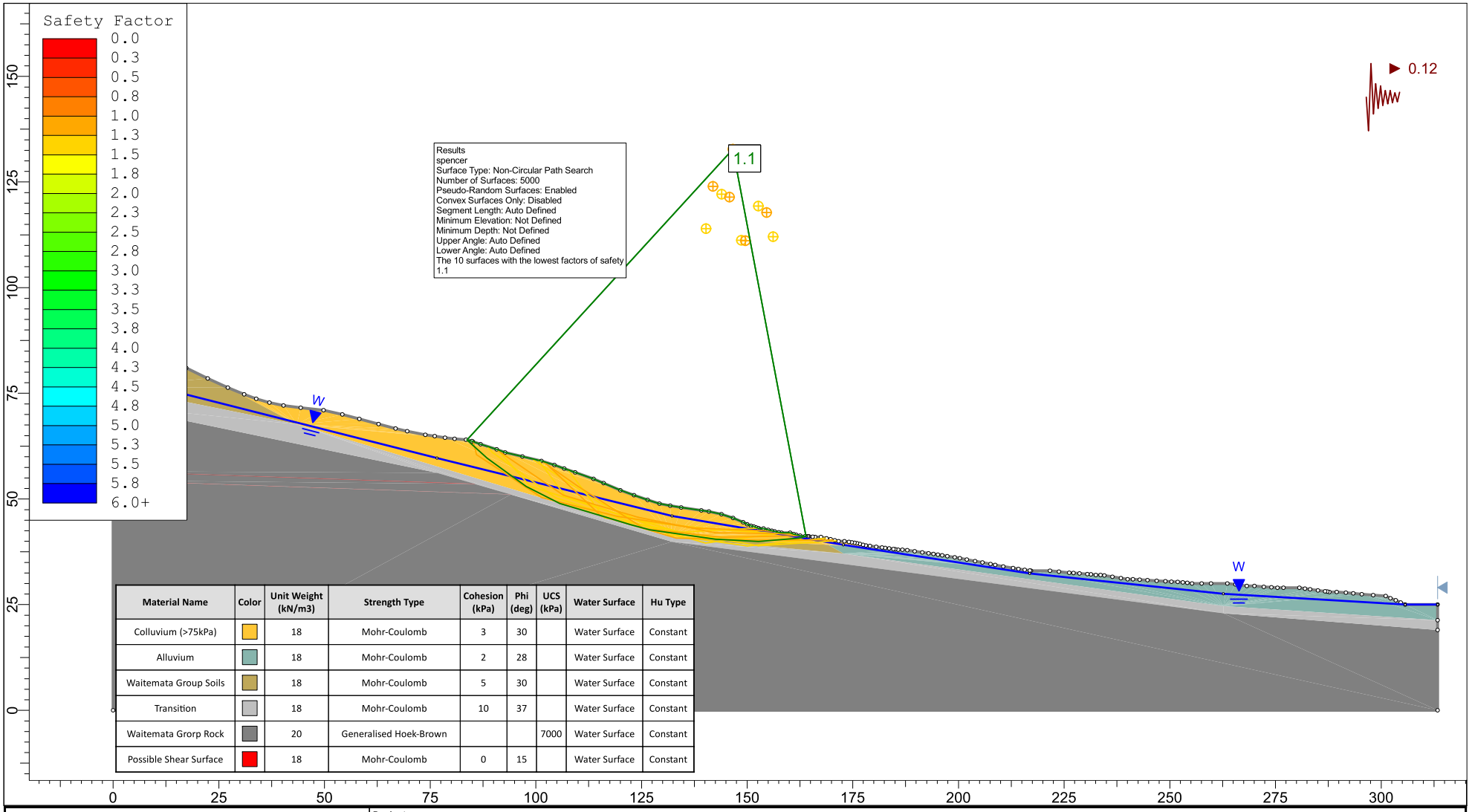
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

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SLIDEINTERPRET 6.018

Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 3, Section CC - Run 5		
Drawn By	PH	*Scale* 1:1250	*Company* KGA Geotechnical
Date	31/08/2015		*File Name* 7464 - S3CC - Run 5.slim



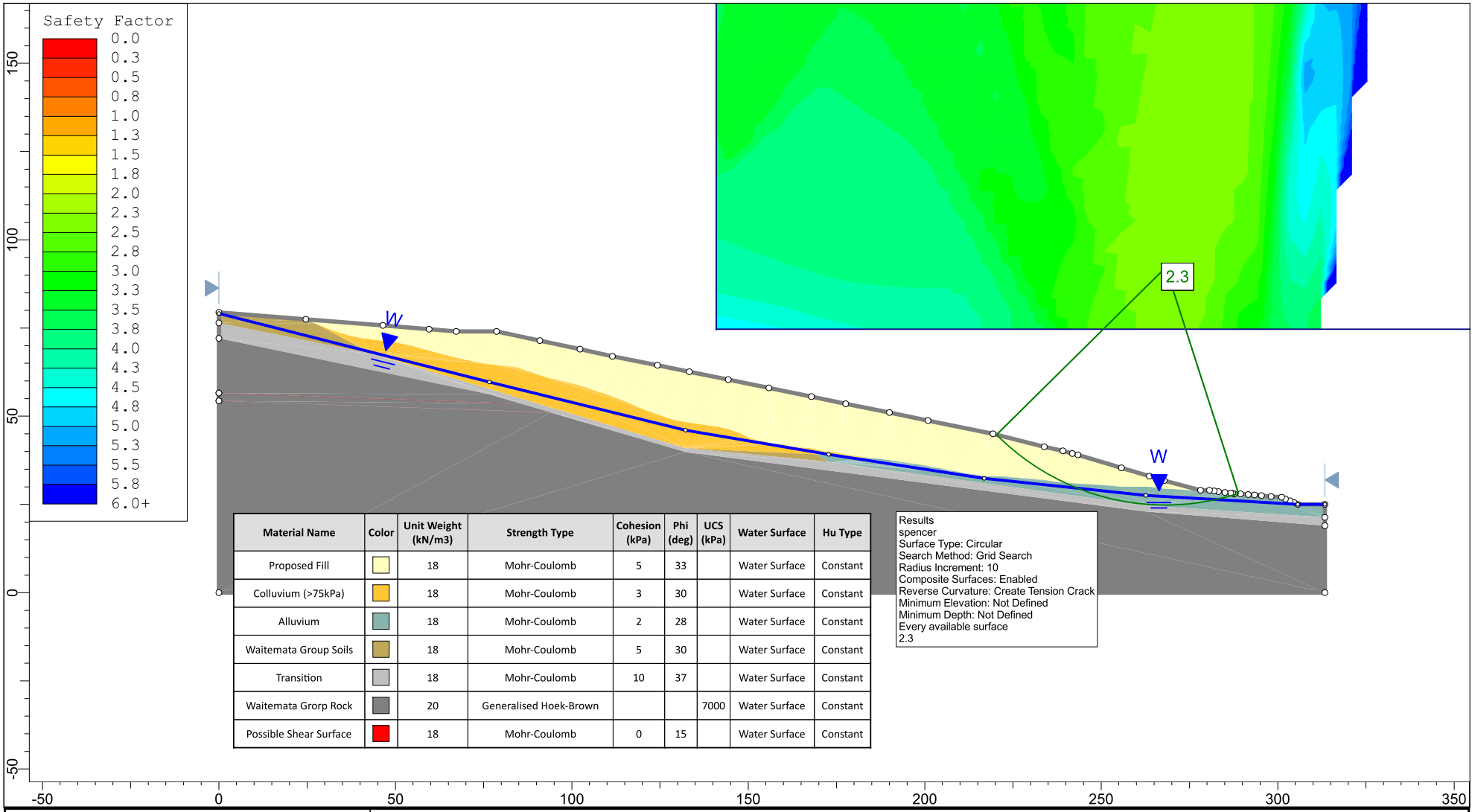
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 3, Section CC - Run 6		
Drawn By	PH	*Scale* 1:1250	*Company* KGA Geotechnical
Date	31/08/2015		*File Name* 7464 - S3CC - Run 6.slim



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

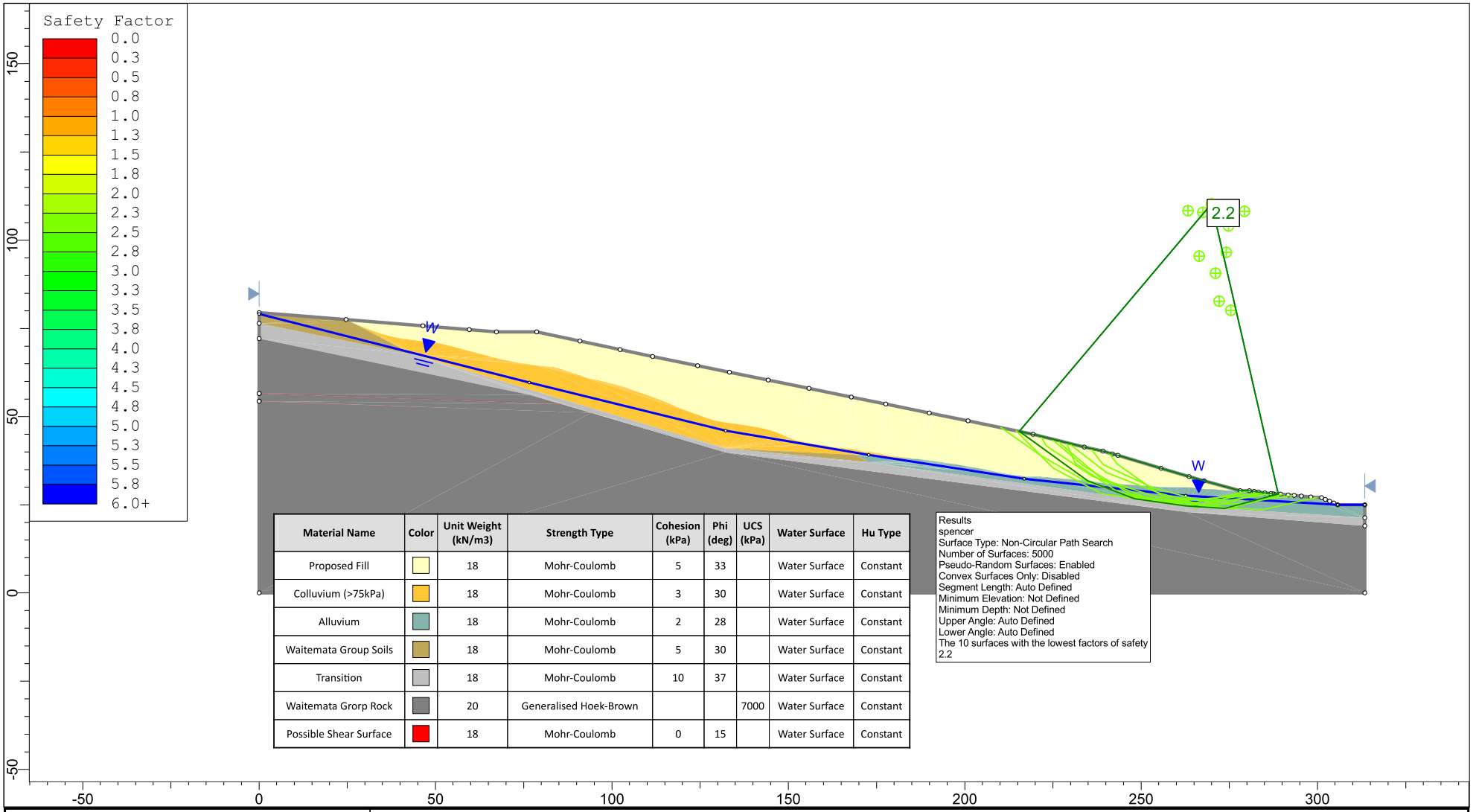
Results
spencer
Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Enabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Every available surface
2.3

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section CC - Run 7				
Drawn By	PH	*Scale*	1:1500	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S3CC - Run 7.slim



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

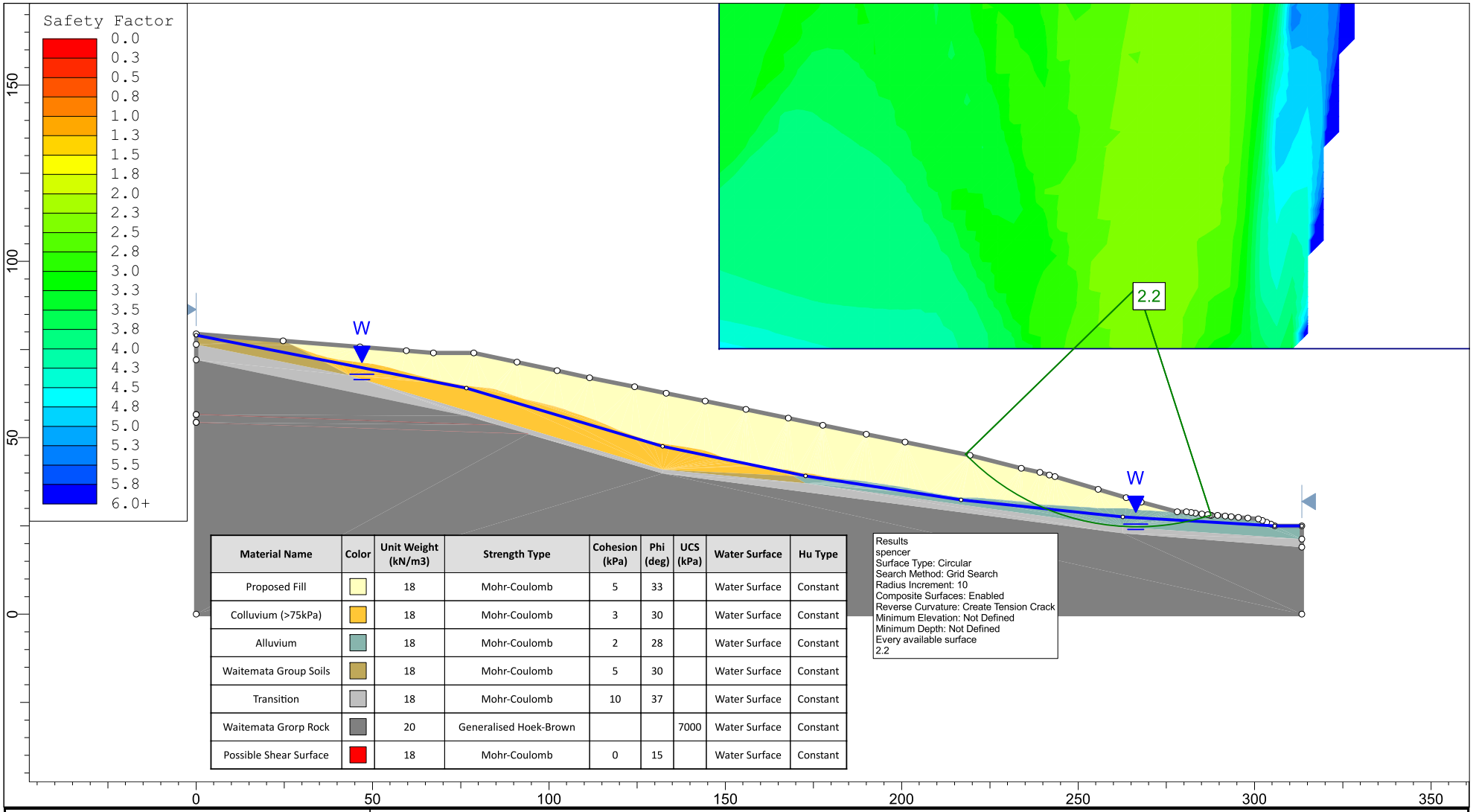
Results
spencer
Surface Type: Non-Circular Path Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Segment Length: Auto Defined
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Upper Angle: Auto Defined
Lower Angle: Auto Defined
The 10 surfaces with the lowest factors of safety
2.2

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section CC - Run 8				
Drawn By	PH	*Scale*	1:1500	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S3CC - Run 8.slim



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

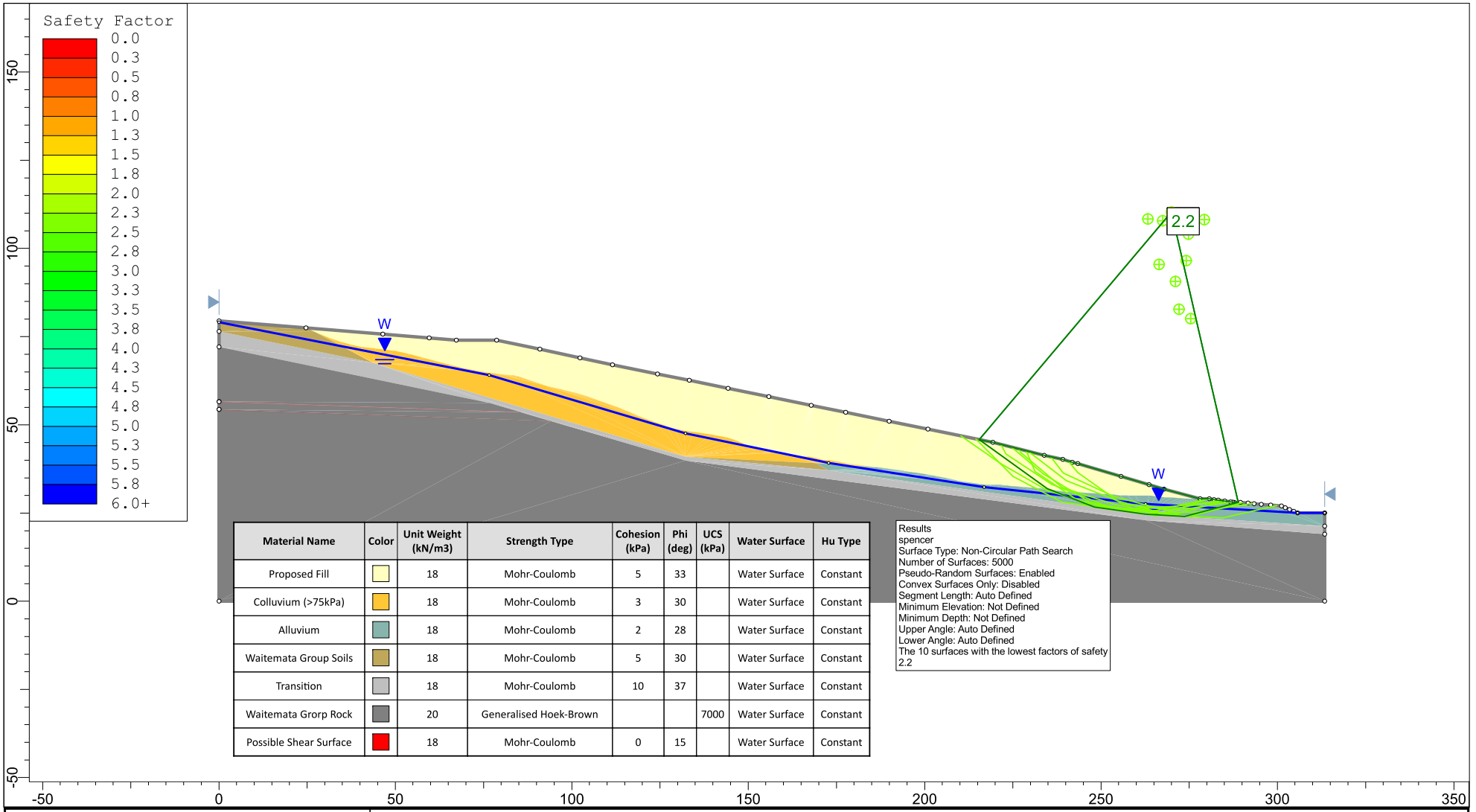
Results
spencer
Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Enabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Every available surface
2.2

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 3, Section CC - Run 9		
Drawn By	PH	*Scale* 1:1500	*Company* KGA Geotechnical
Date	31/08/2015		*File Name* 7464 - S3CC - Run 9.slim



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

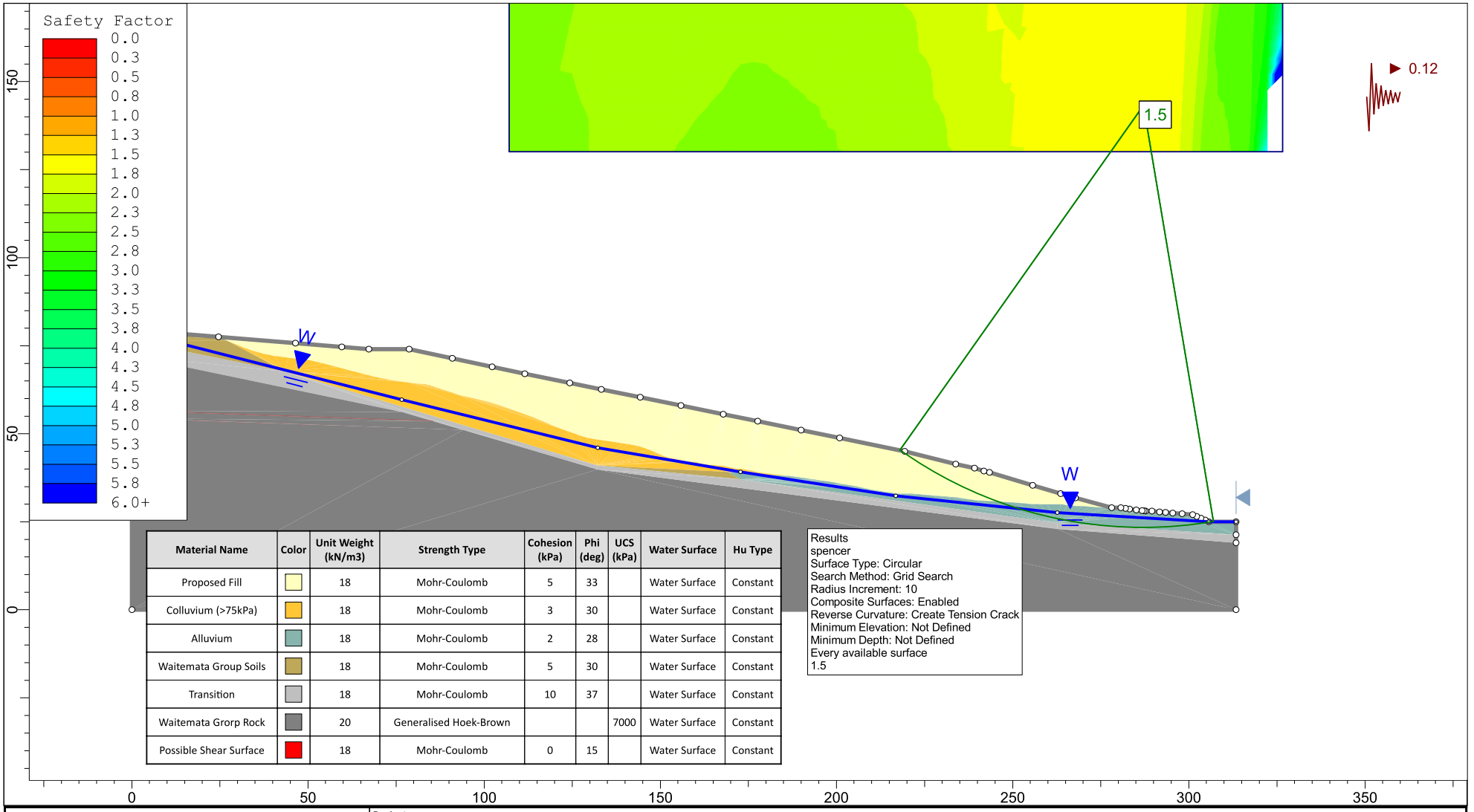
Results
spencer
Surface Type: Non-Circular Path Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Segment Length: Auto Defined
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Upper Angle: Auto Defined
Lower Angle: Auto Defined
The 10 surfaces with the lowest factors of safety
2.2

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 3, Section CC - Run 10		
Drawn By	PH	*Scale* 1:1500	*Company* KGA Geotechnical
Date	31/08/2015		*File Name* 7464 - S3CC - Run 10.slim



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

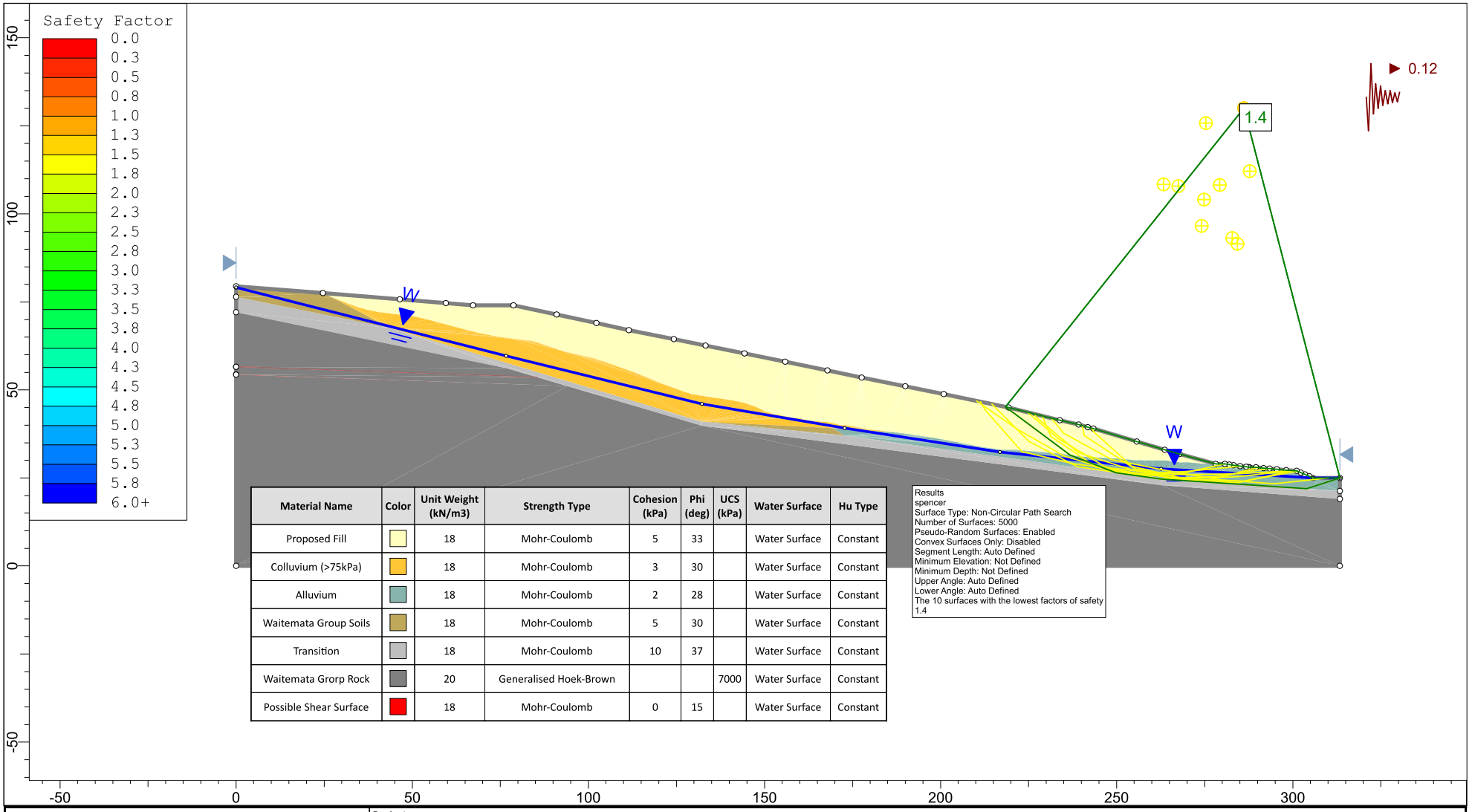
Results
spencer
Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Enabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Every available surface
1.5

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section CC - Run 11				
Drawn By	PH	*Scale*	1:1500	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S3CC - Run 11.slim



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

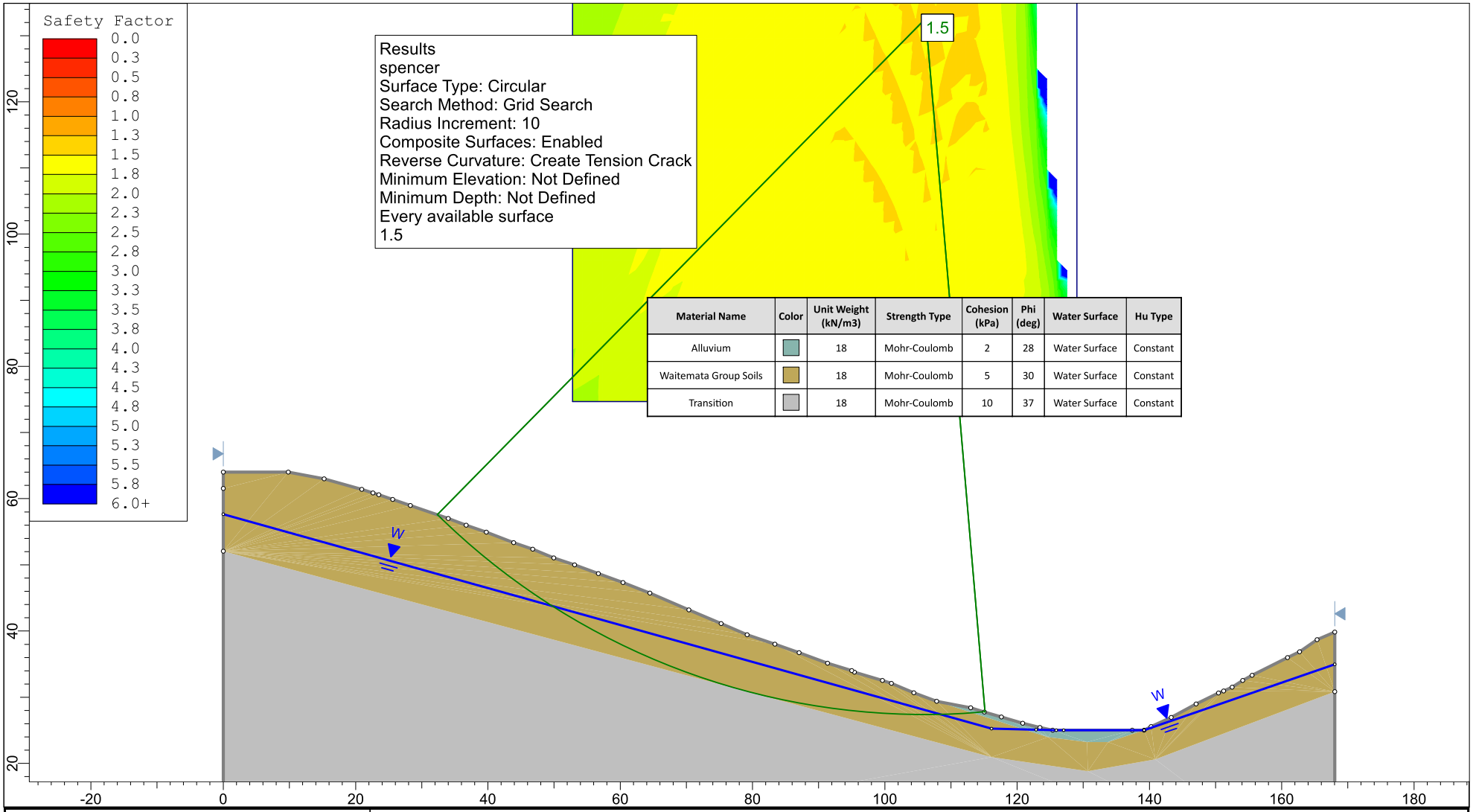
Results
spencer
Surface Type: Non-Circular Path Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Segment Length: Auto Defined
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Upper Angle: Auto Defined
Lower Angle: Auto Defined
The 10 surfaces with the lowest factors of safety
1.4

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 3, Section CC - Run 12		
Drawn By	PH	Scale	1:1500
Company	KGA Geotechnical		
Date	31/08/2015	File Name	7464 - S3CC - Run 12.slim



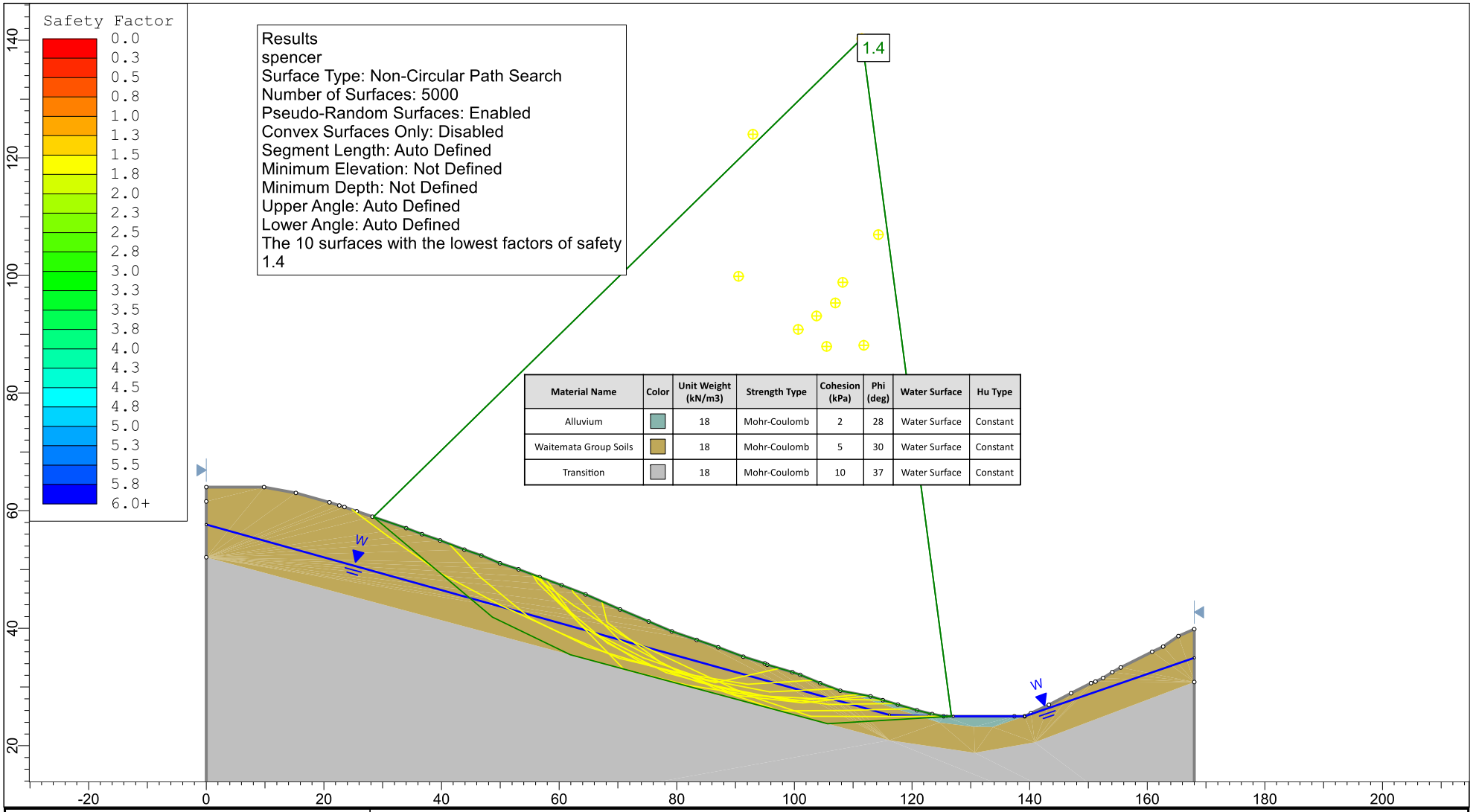
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section DD - Run 1				
Drawn By	PH	Scale	1:800	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S3DD - Run 1.slim



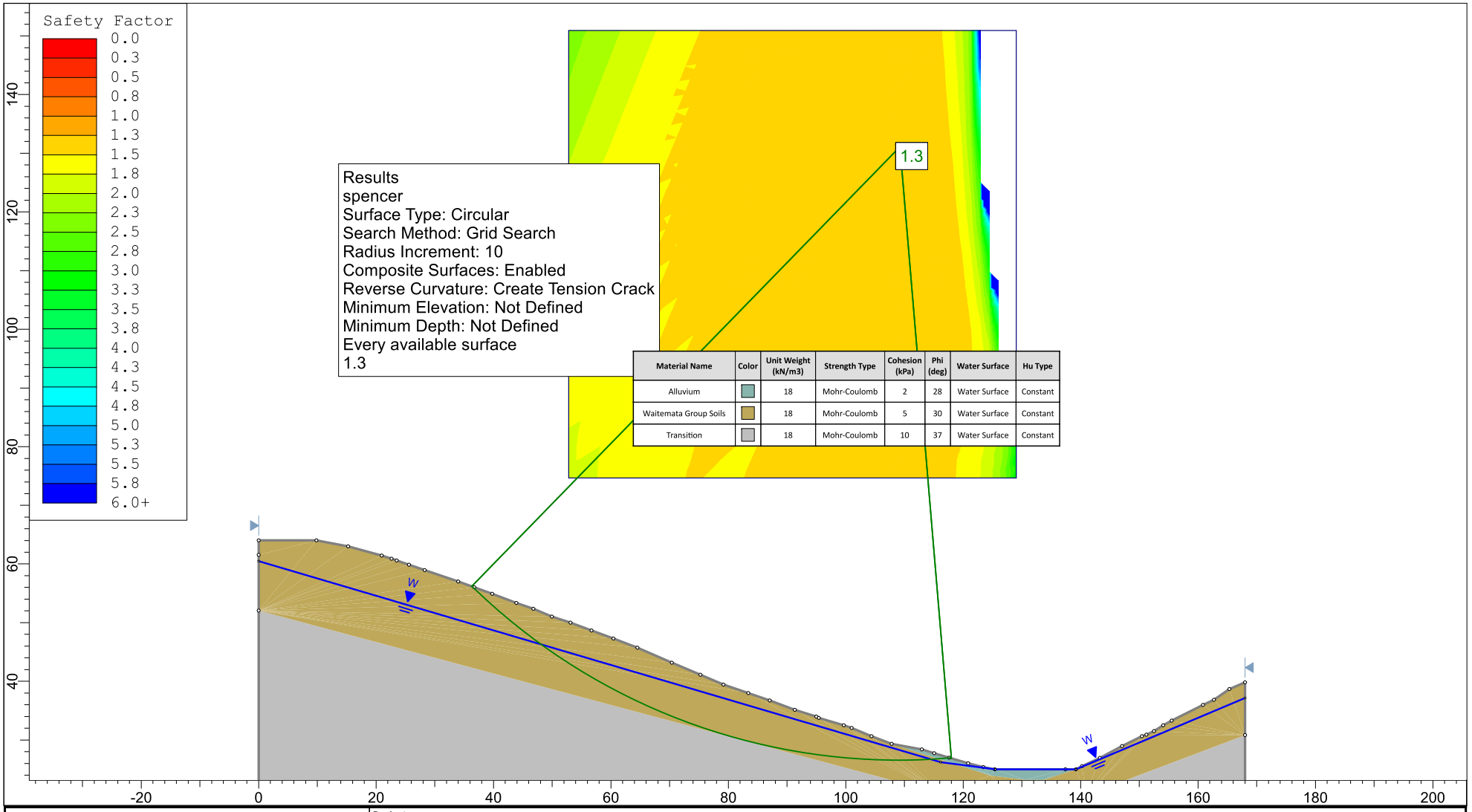
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section DD - Run 2				
Drawn By	PH	*Scale*	1:900	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S3DD - Run 2.slim

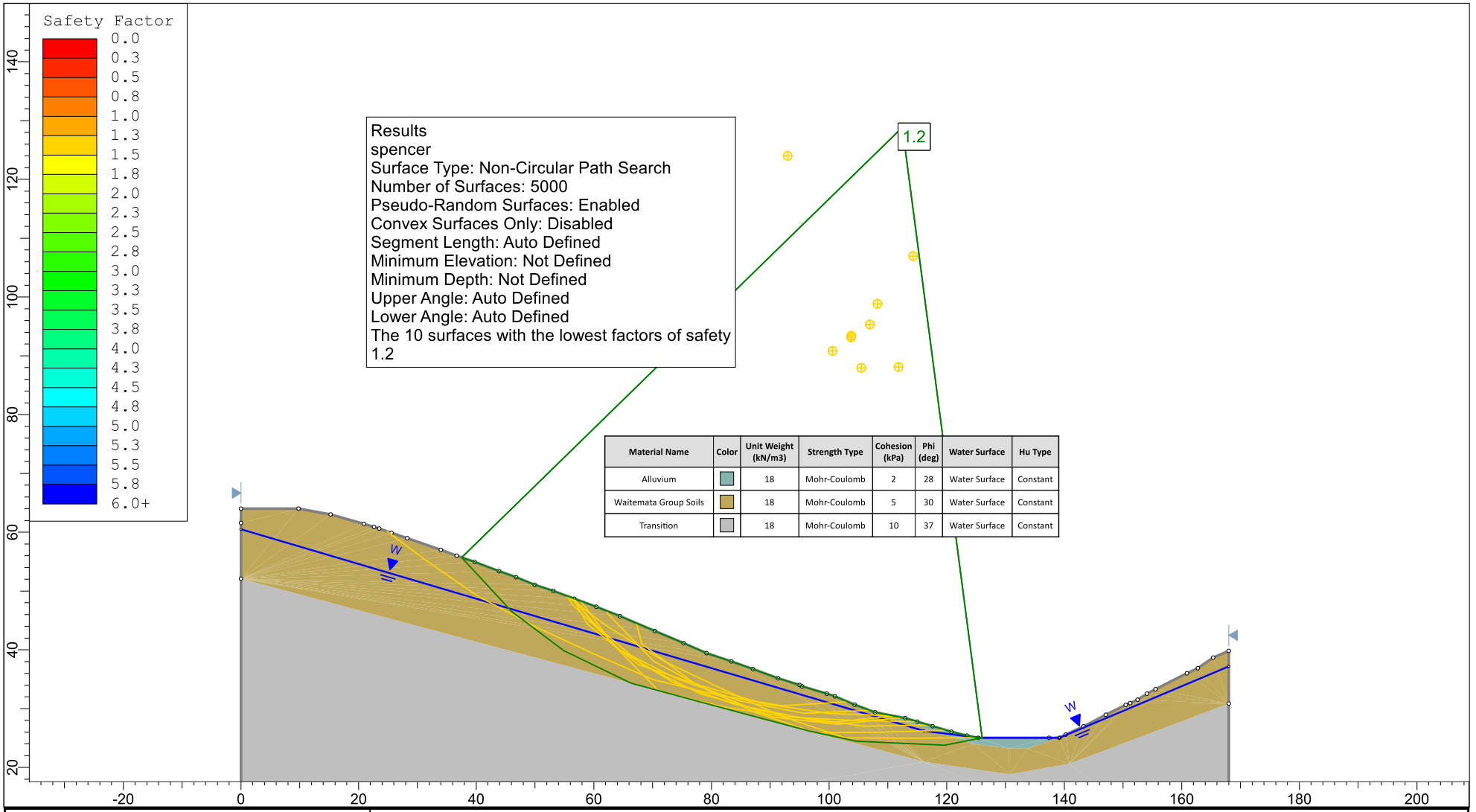


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Project	Proposed Subdivision - Grand View Estate, Orewa			
Analysis Description	Stage 3, Section DD - Run 3			
Drawn By	PH	*Scale*	1:900	*Company* KGA Geotechnical
Date	31/08/2015			*File Name* 7464 - S3DD - Run 3.slim



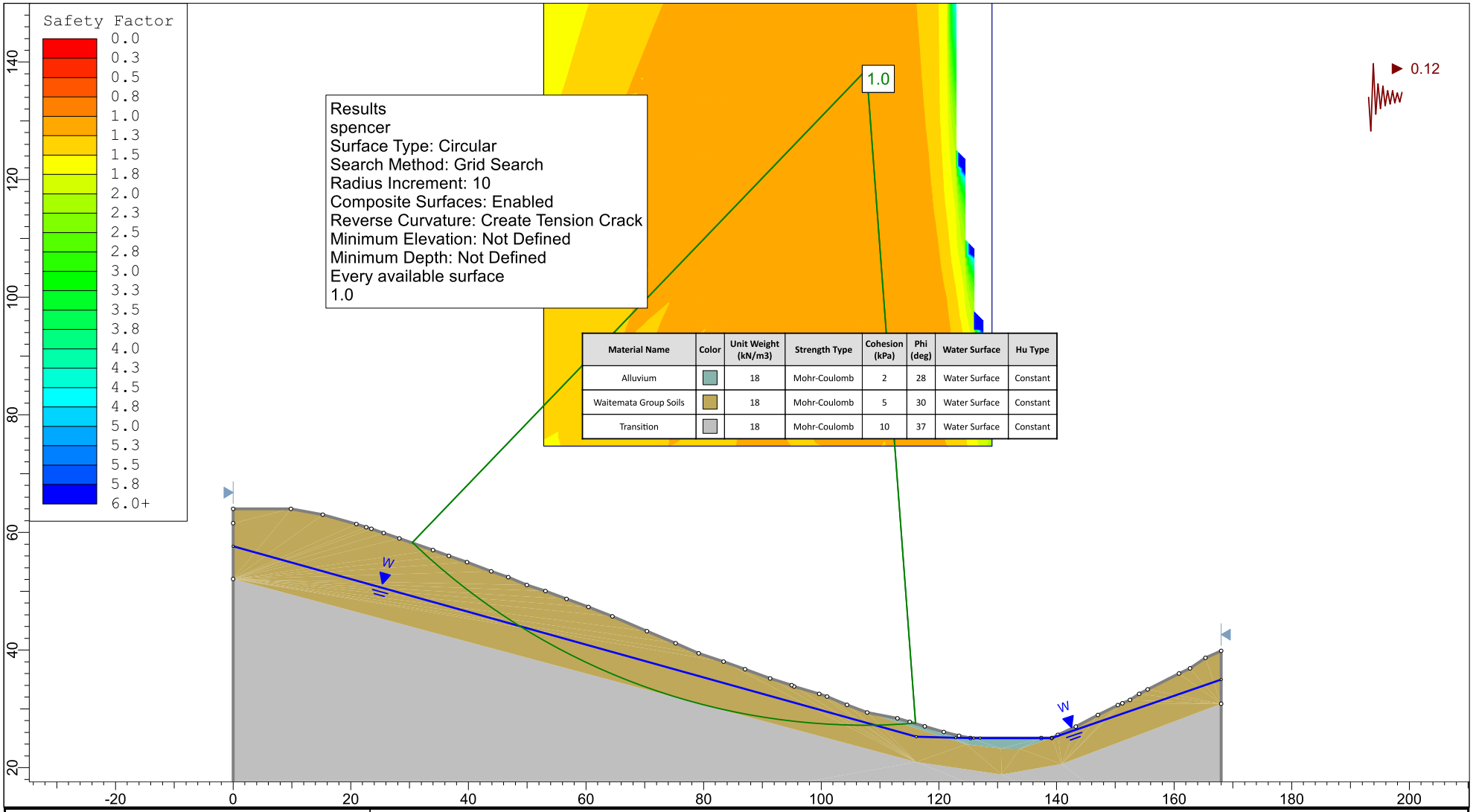
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section DD - Run 4				
Drawn By	PH	*Scale*	1:900	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S3DD - Run 4.slim



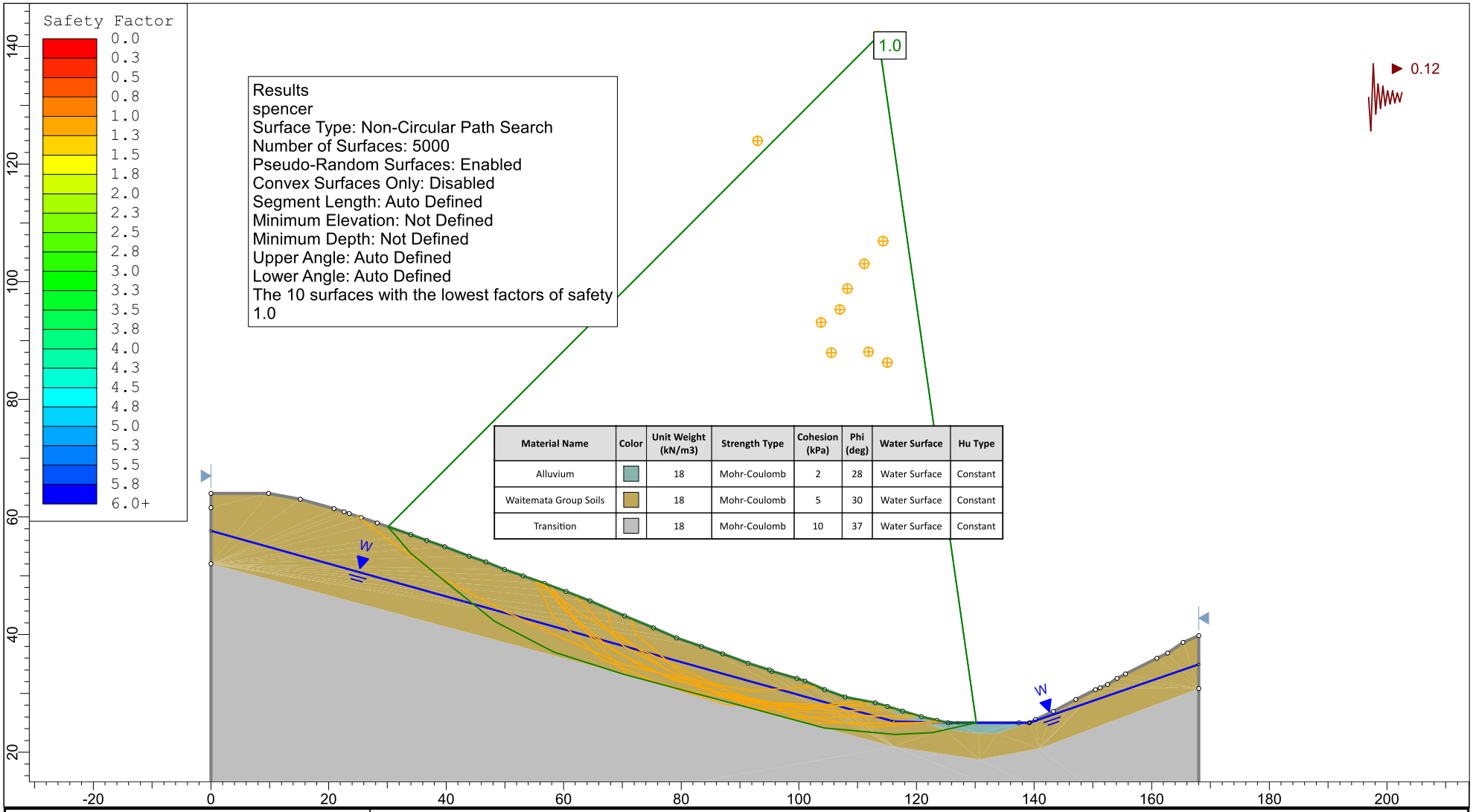
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section DD - Run 5				
Drawn By	PH	Scale	1:900	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S3DD - Run 5.slim



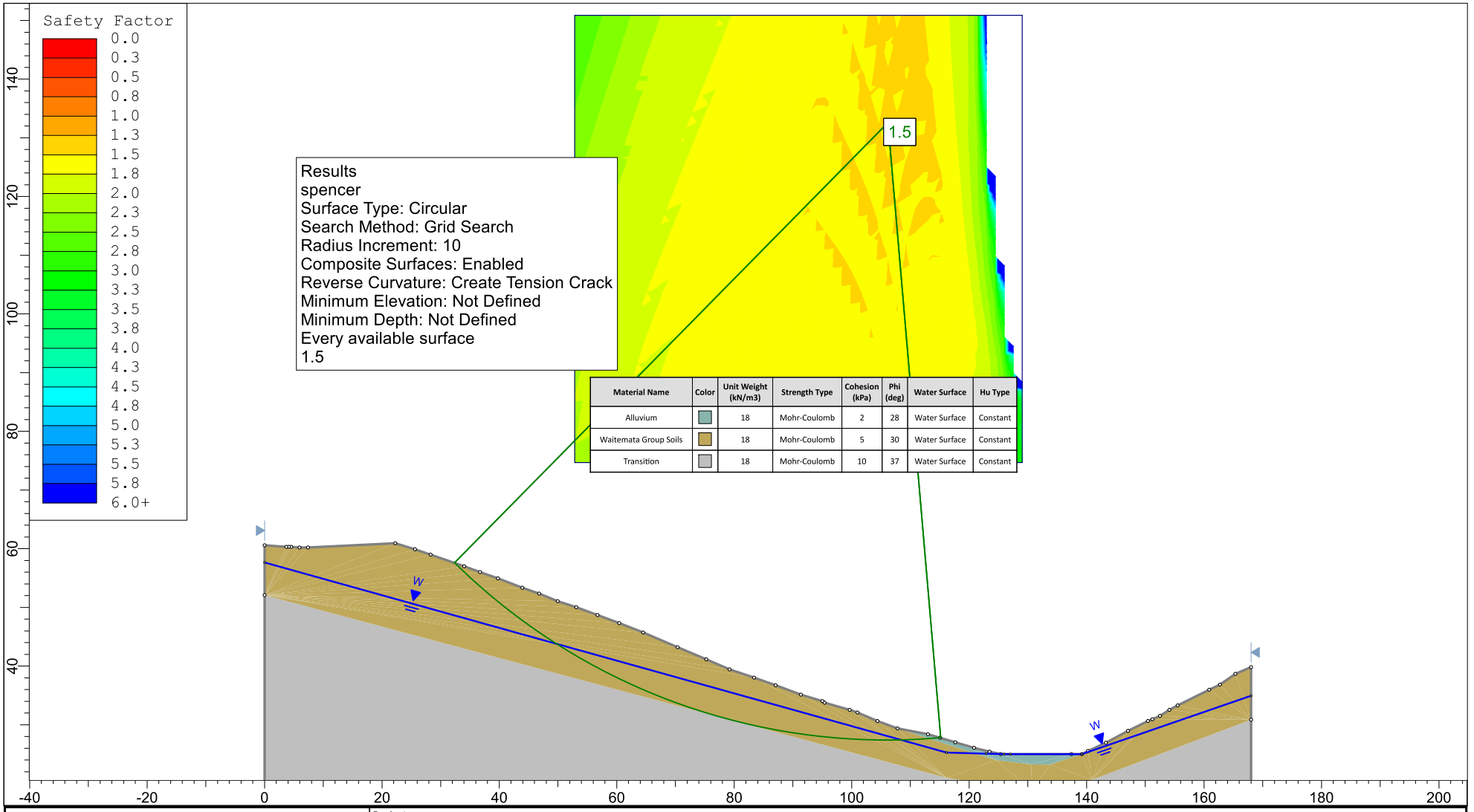
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section DD - Run 6				
Drawn By	PH	*Scale*	1:900	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S3DD - Run 6.slim

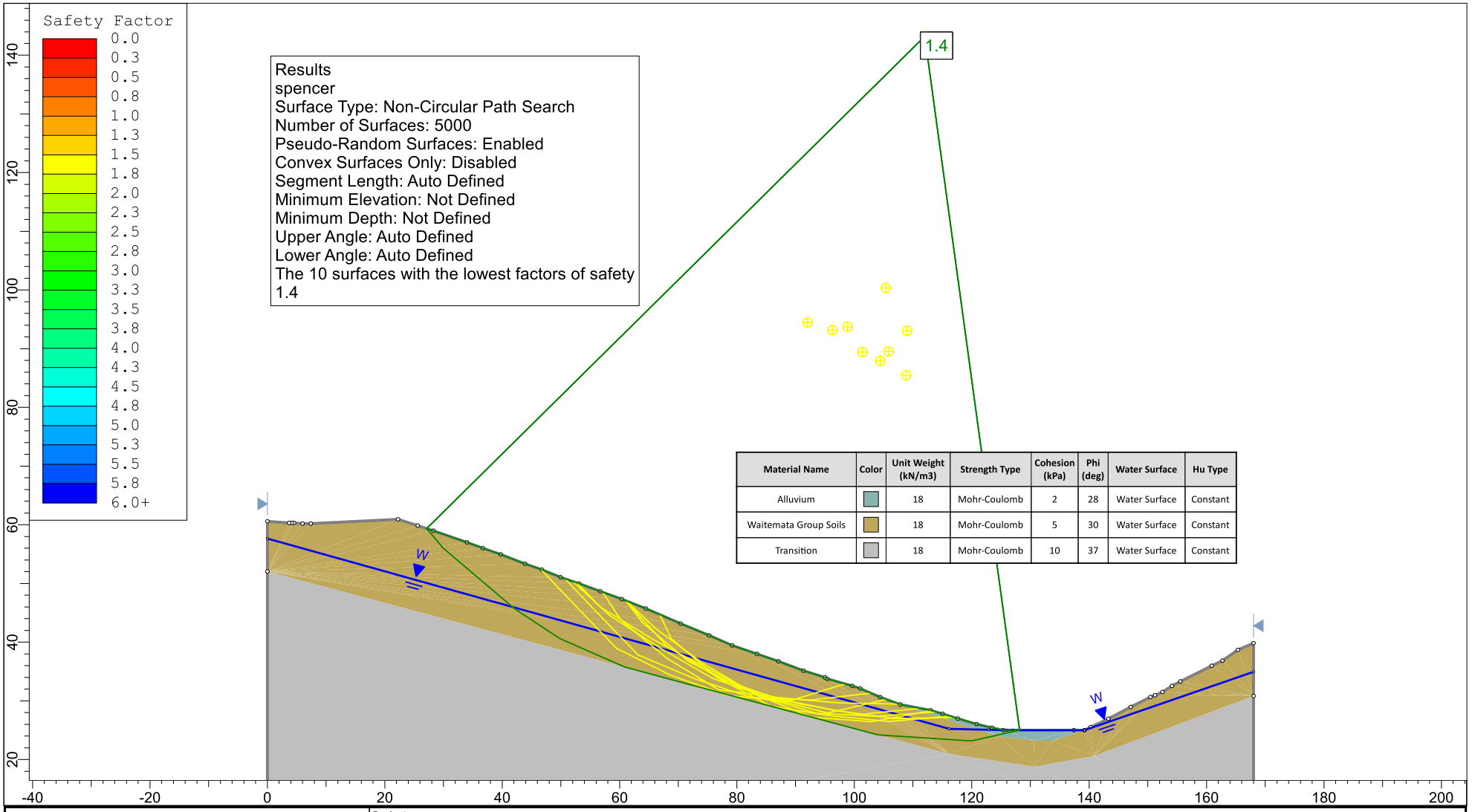


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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section DD - Run 7				
Drawn By	PH	*Scale*	1:900	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S3DD - Run 7.slim



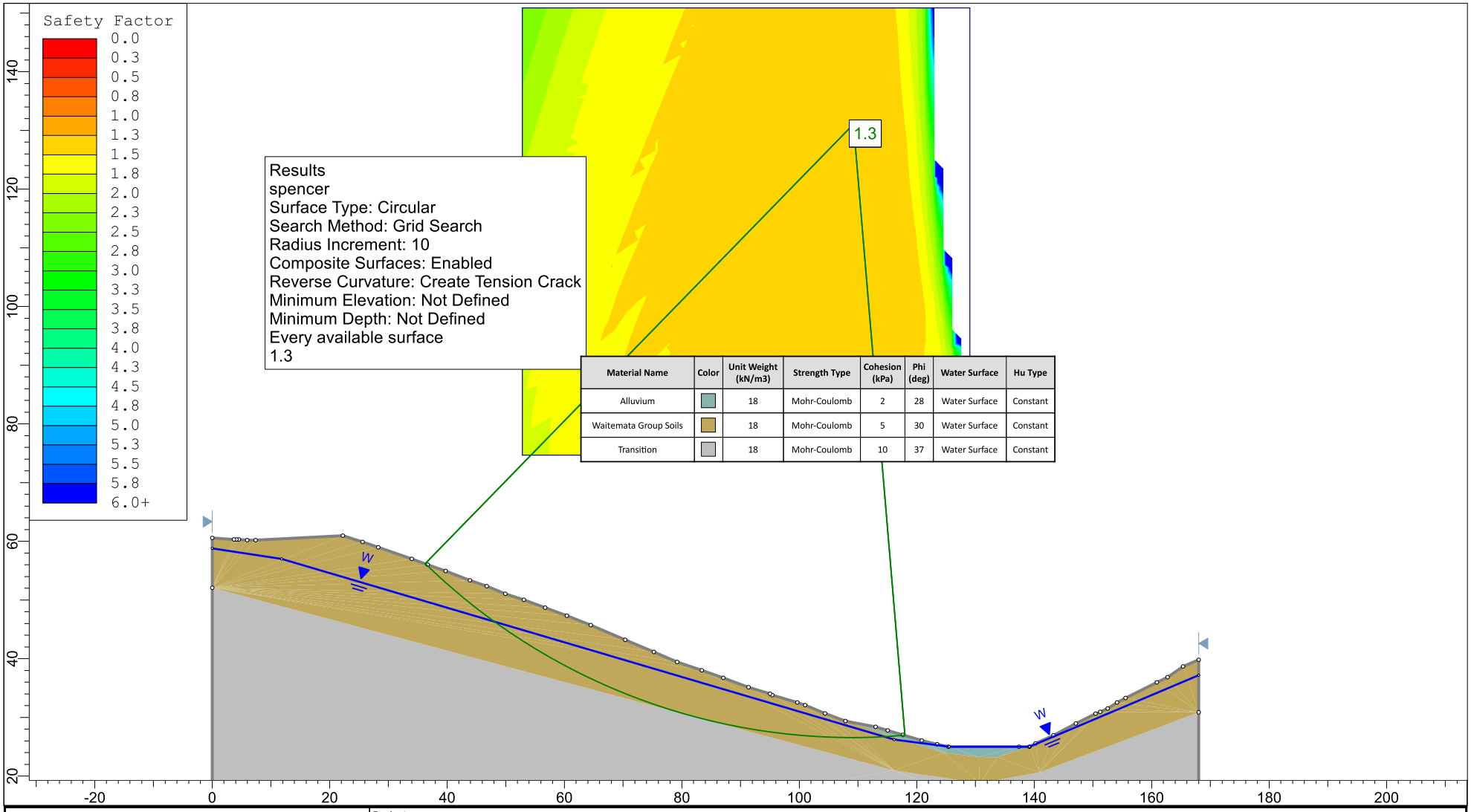
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section DD - Run 8				
Drawn By	PH	Scale	1:900	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S3DD - Run 8.slim



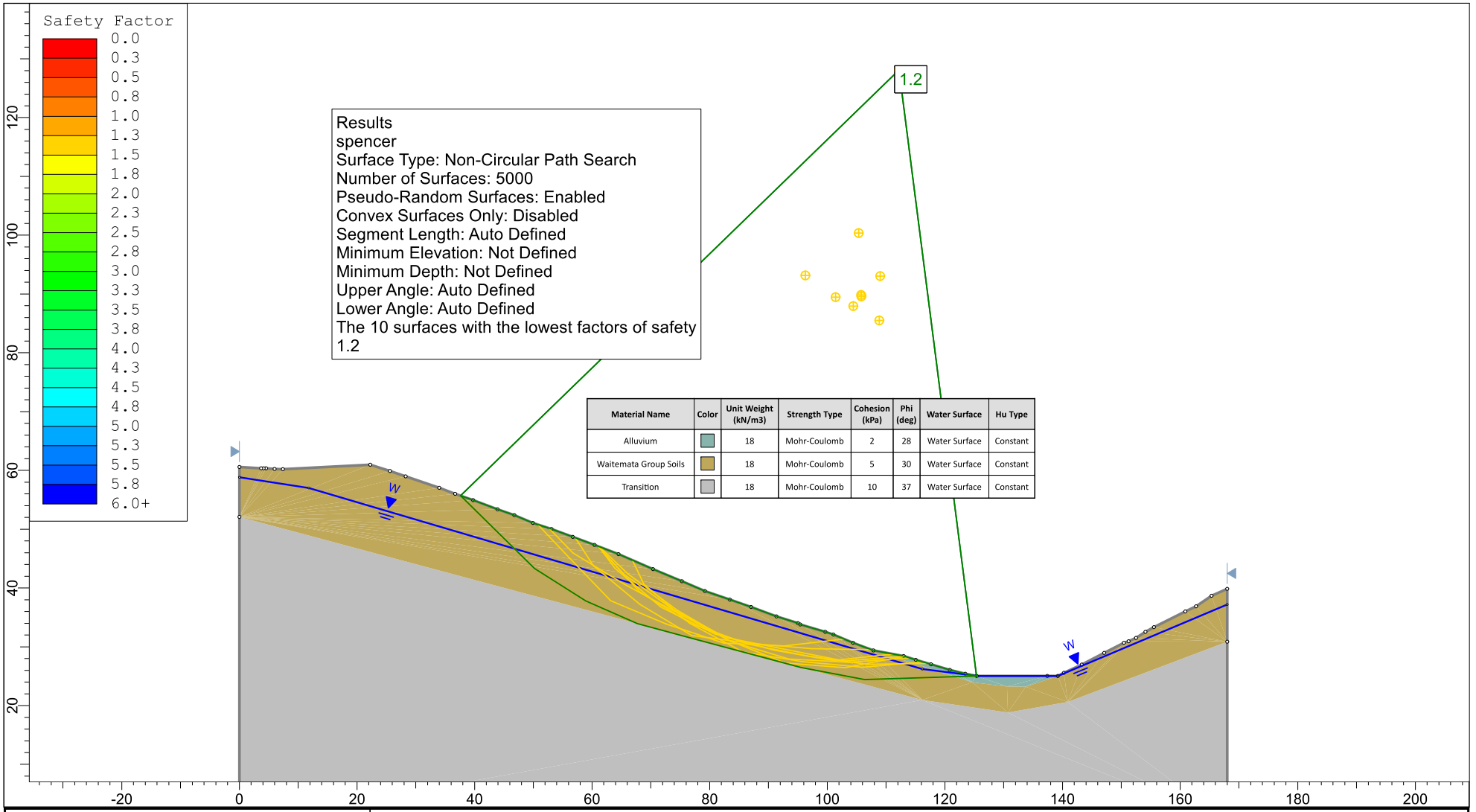
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section DD - Run 9				
Drawn By	PH	*Scale*	1:900	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S3DD - Run 9.slim



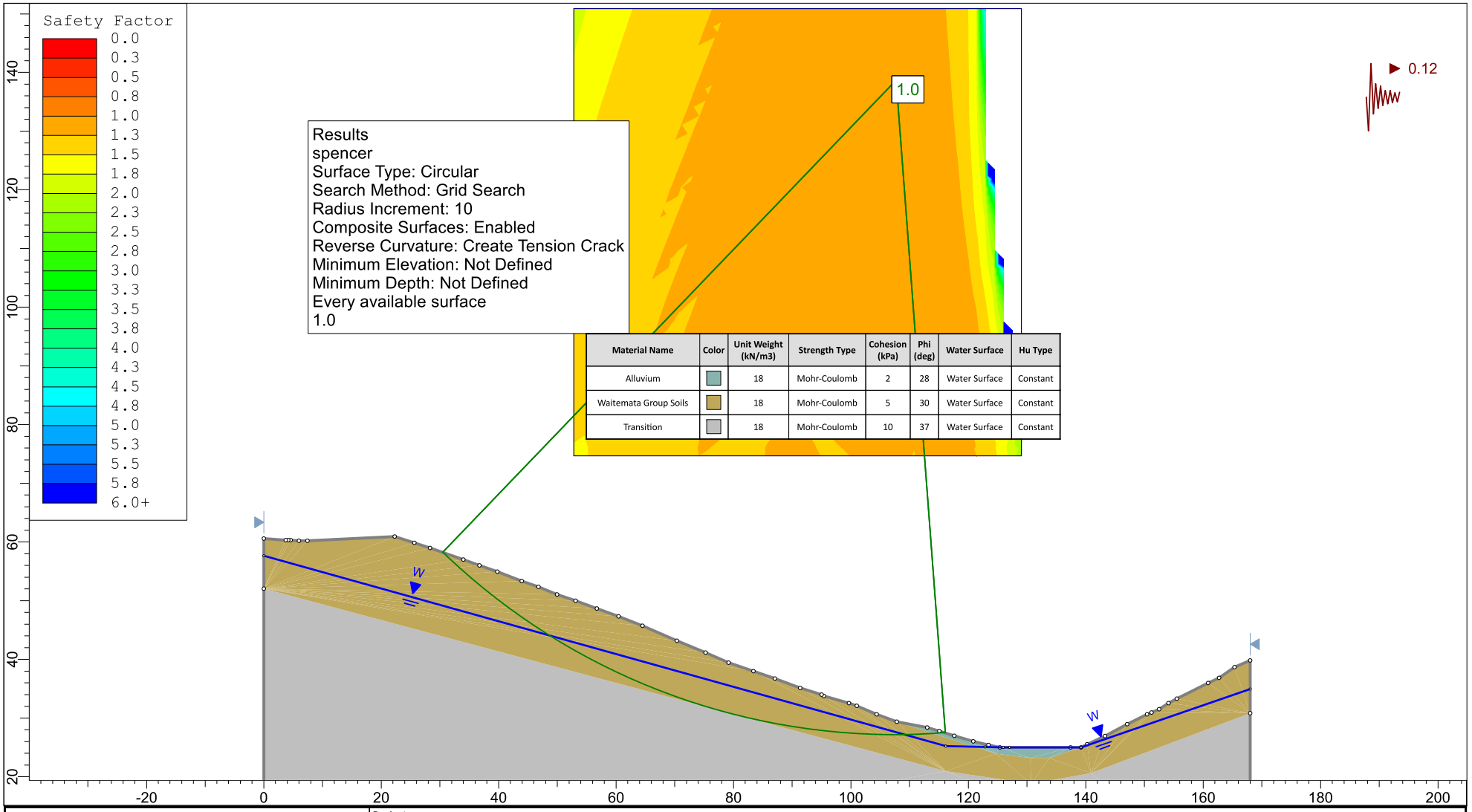
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section DD - Run 10				
Drawn By	PH	*Scale*	1:900	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S3DD - Run 10.slim



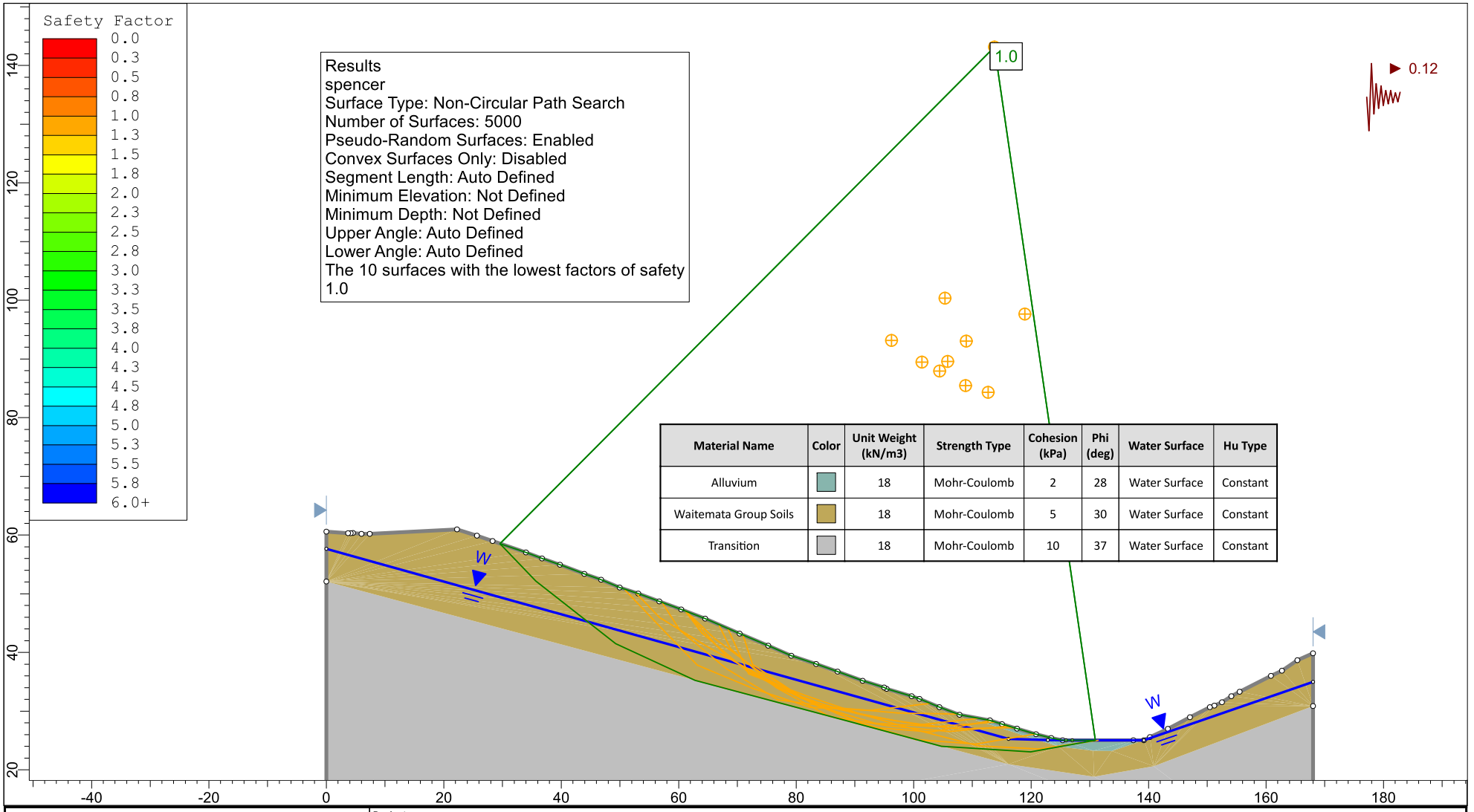
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section DD - Run 11				
Drawn By	PH	Scale	1:900	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S3DD - Run 11.slim



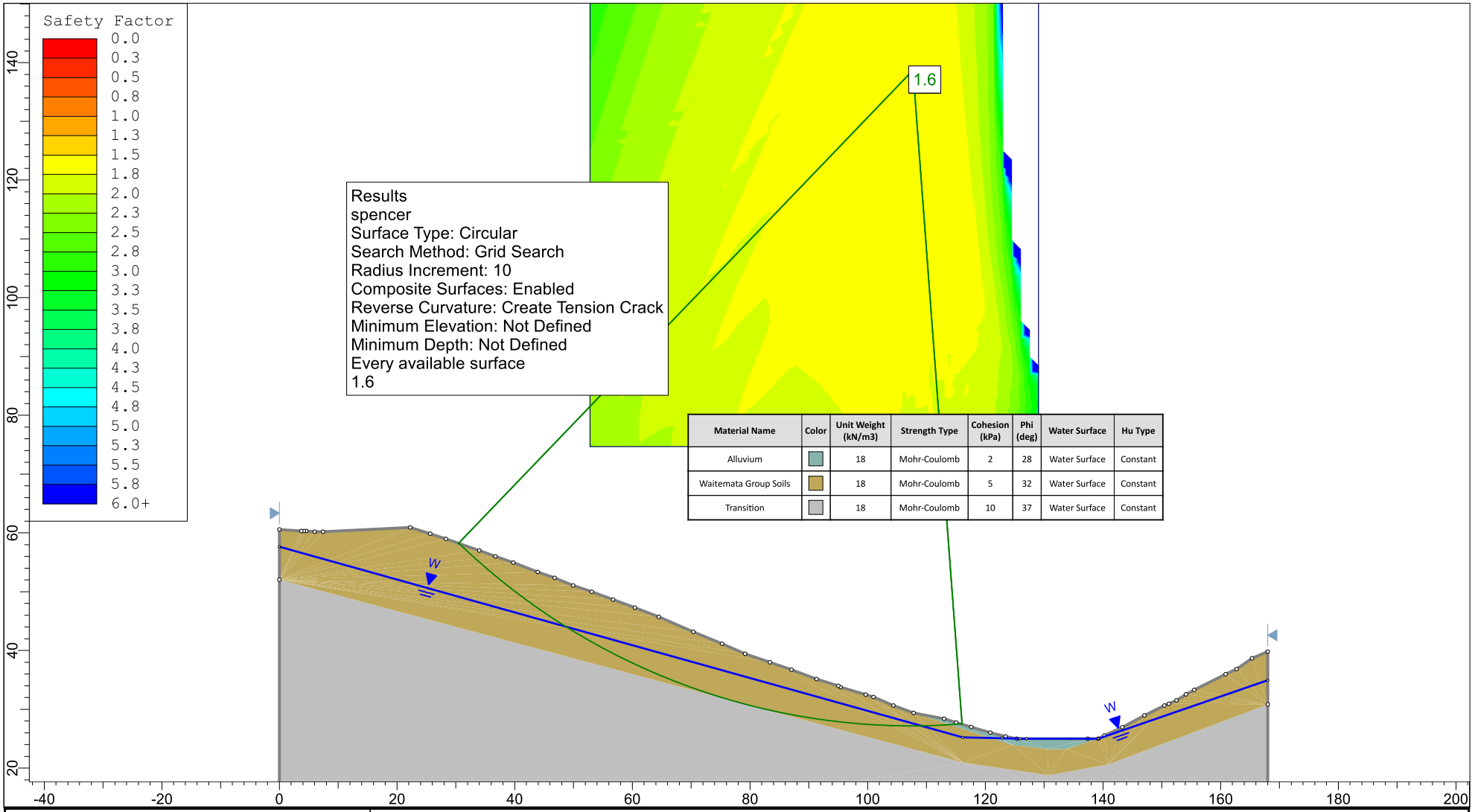
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section DD - Run 12				
Drawn By	PH	Scale	1:900	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S3DD - Run 12.slim



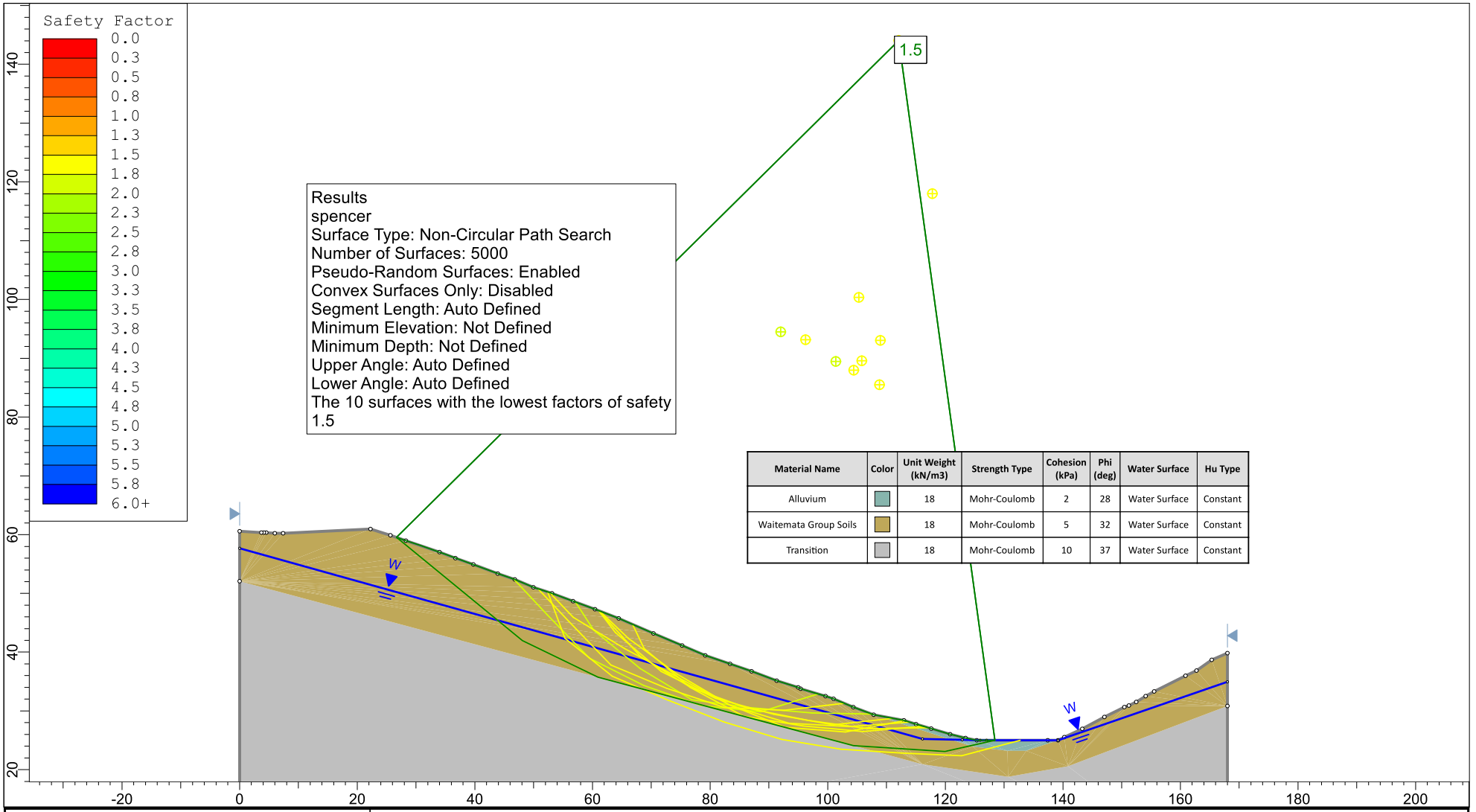
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	32	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section DD - Run 13				
Drawn By	PH	*Scale*	1:900	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S3DD - Run 13.slim



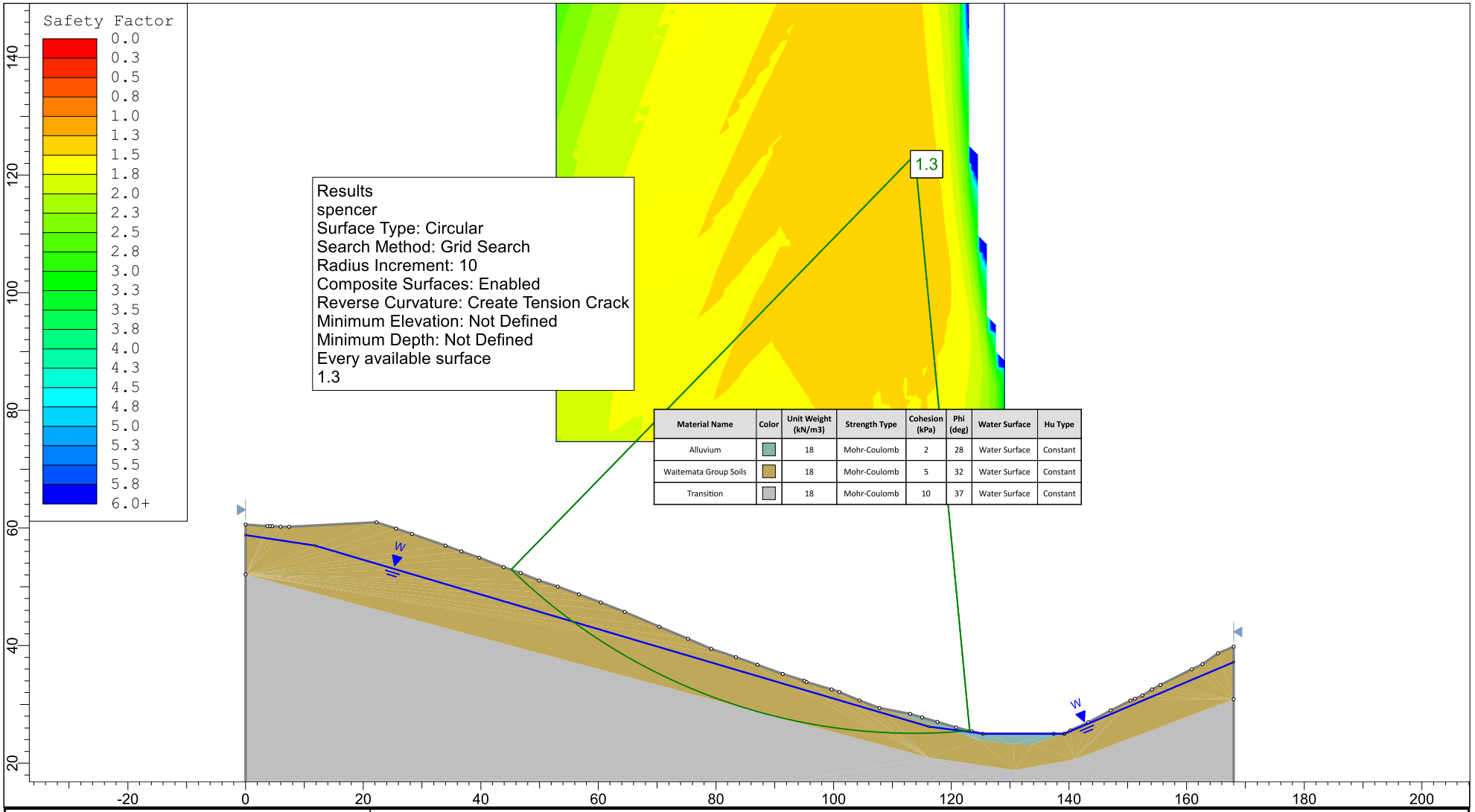
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	32	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section DD - Run 14				
Drawn By	PH	Scale	1:900	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S3DD - Run 14.slim

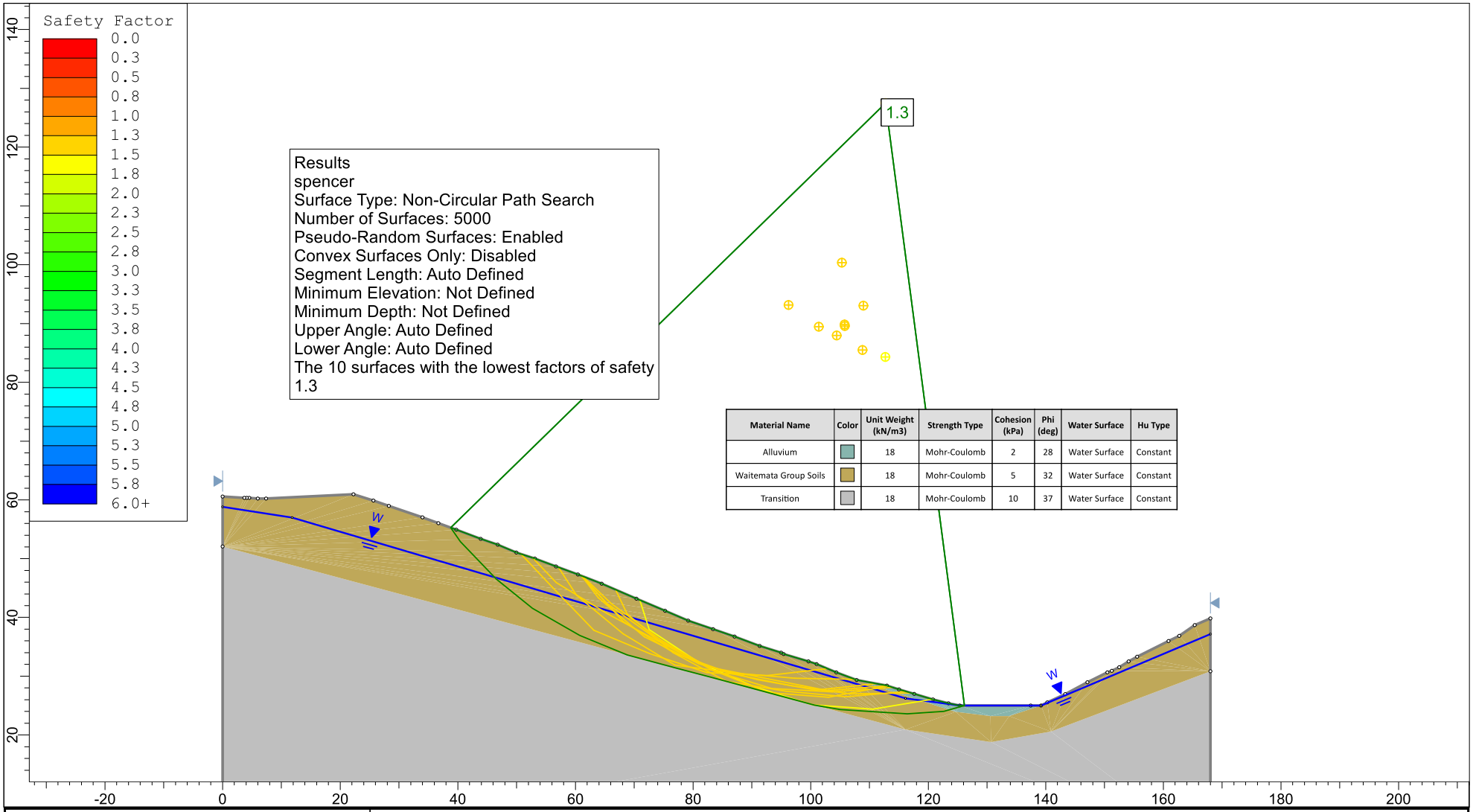


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Project	Proposed Subdivision - Grand View Estate, Orewa			
Analysis Description	Stage 3, Section DD - Run 15			
Drawn By	PH	*Scale*	1:900	*Company* KGA Geotechnical
Date	31/08/2015			*File Name* 7464 - S3DD - Run 15.slim



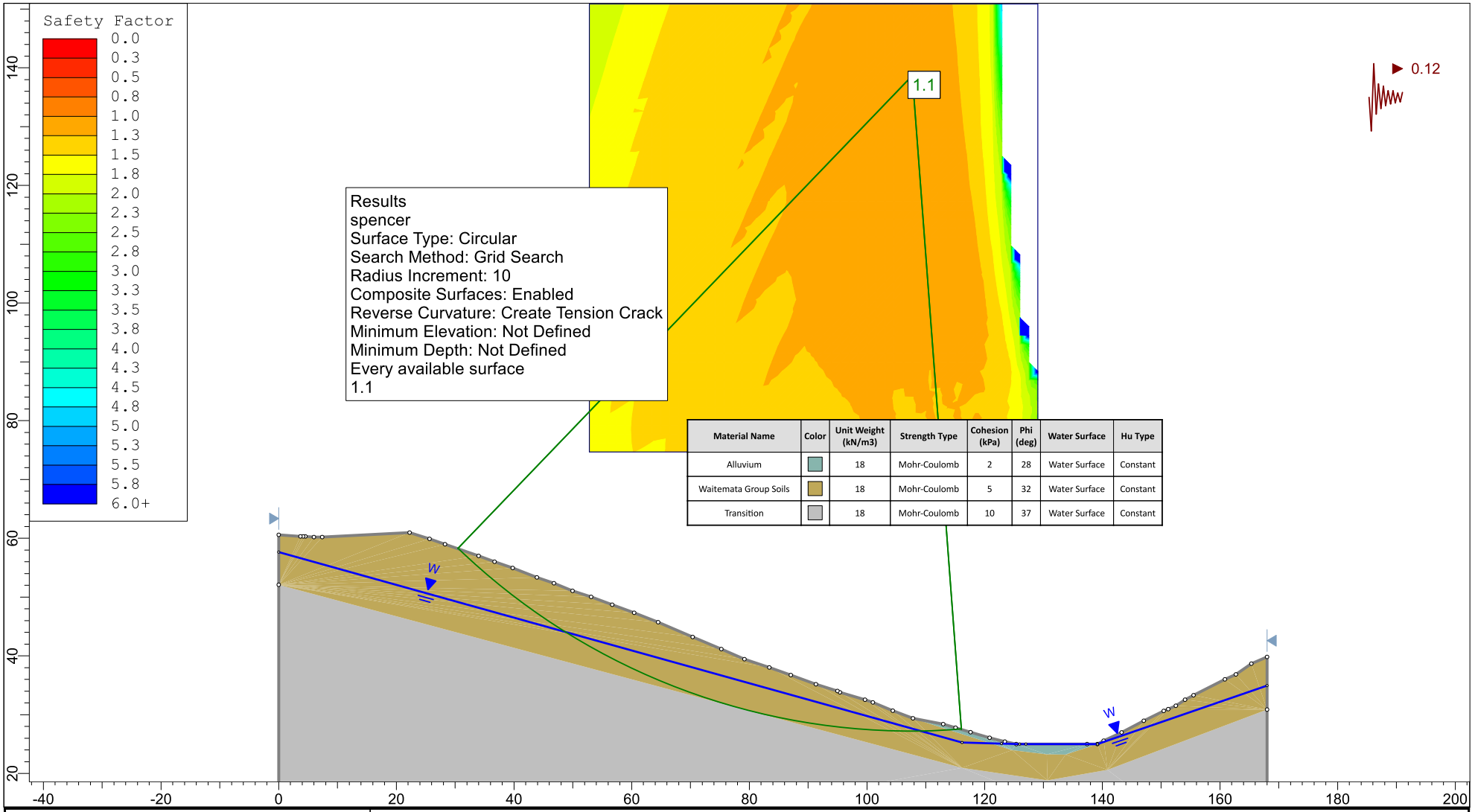
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	32	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section DD - Run 16				
Drawn By	PH	Scale	1:900	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S3DD - Run 16.slim



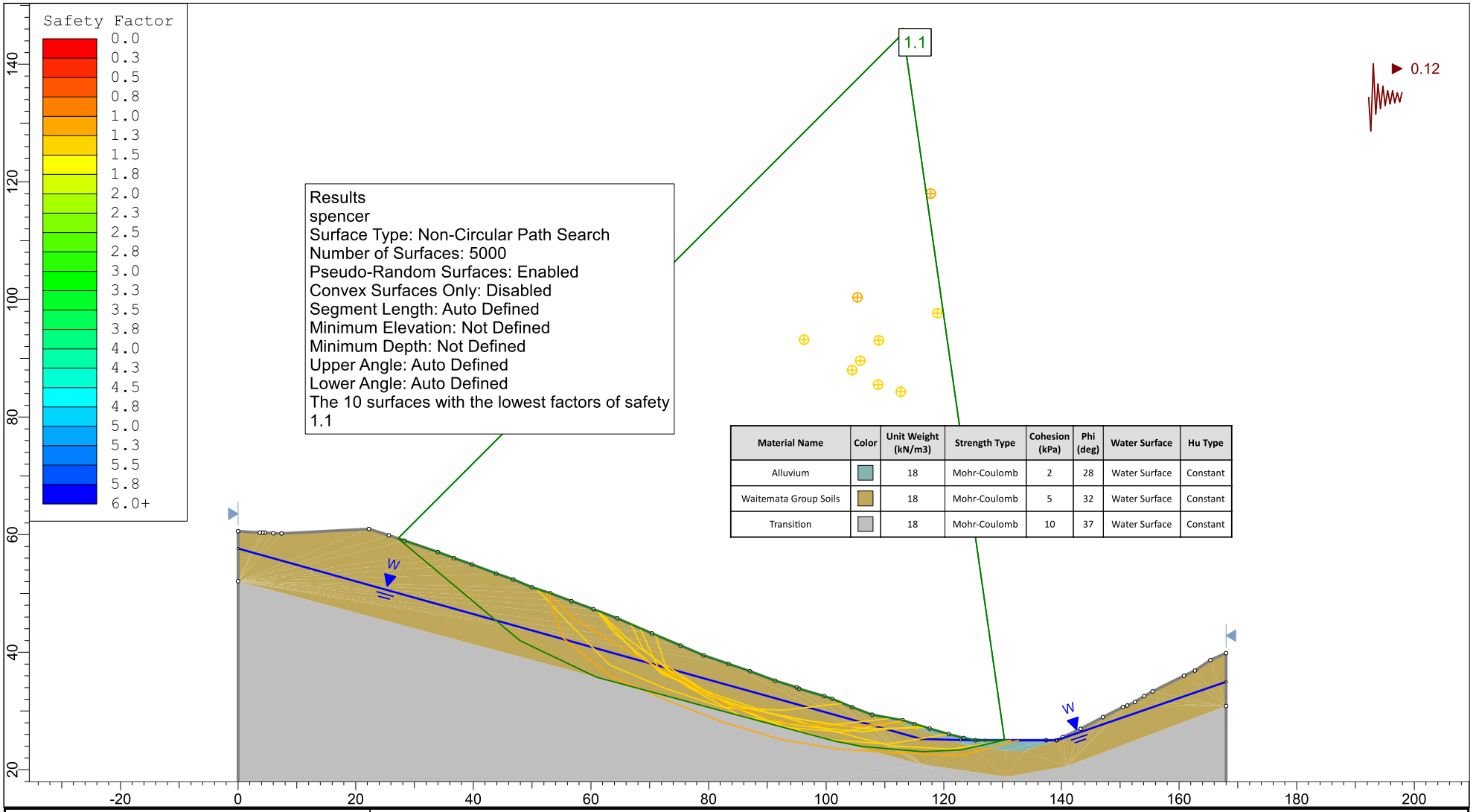
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	32	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section DD - Run 17				
Drawn By	PH	*Scale*	1:900	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S3DD - Run 17.slim



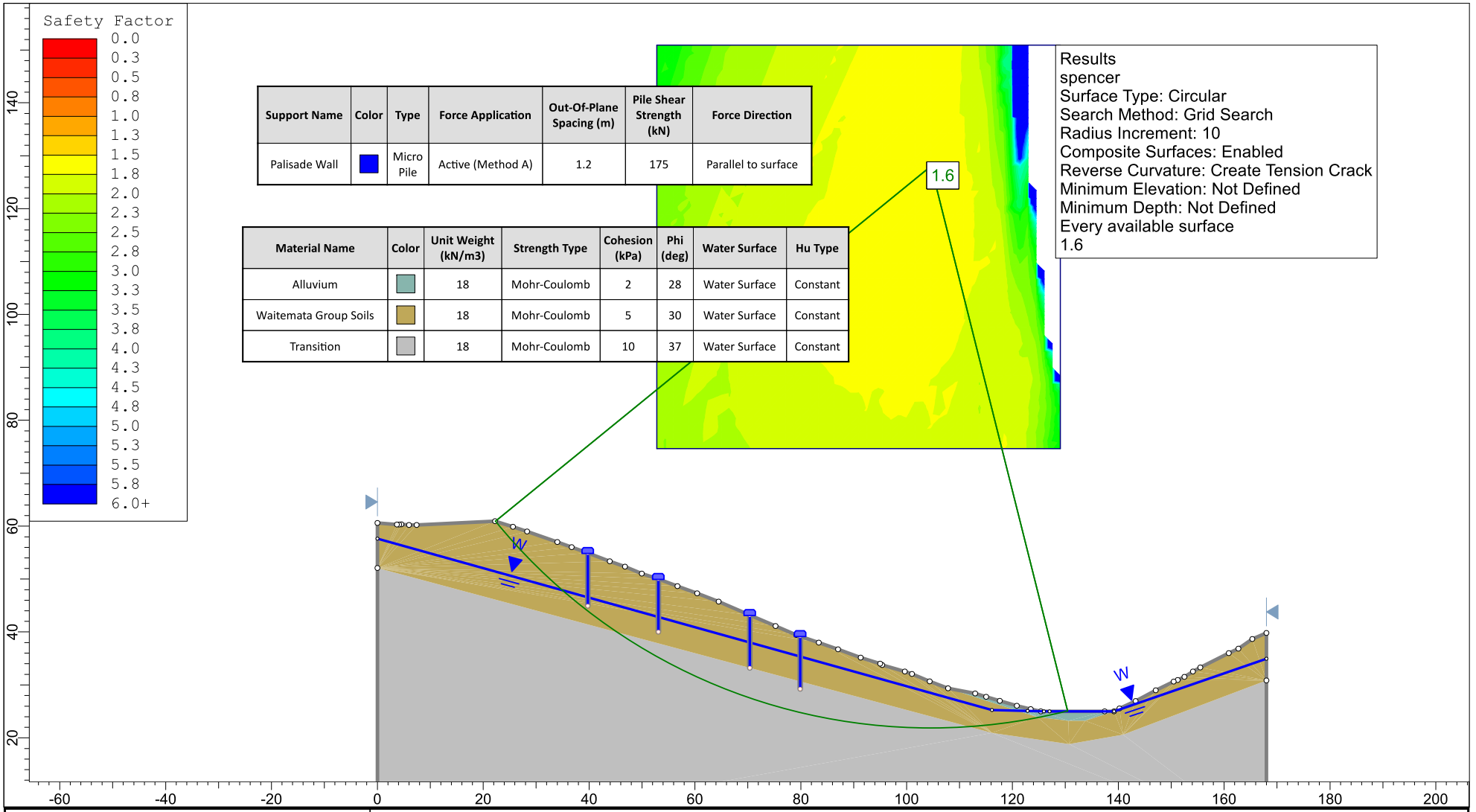
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	32	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section DD - Run 18				
Drawn By	PH	Scale	1:900	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S3DD - Run 18.slim



Support Name	Color	Type	Force Application	Out-Of-Plane Spacing (m)	Pile Shear Strength (kN)	Force Direction
Palisade Wall		Micro Pile	Active (Method A)	1.2	175	Parallel to surface

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

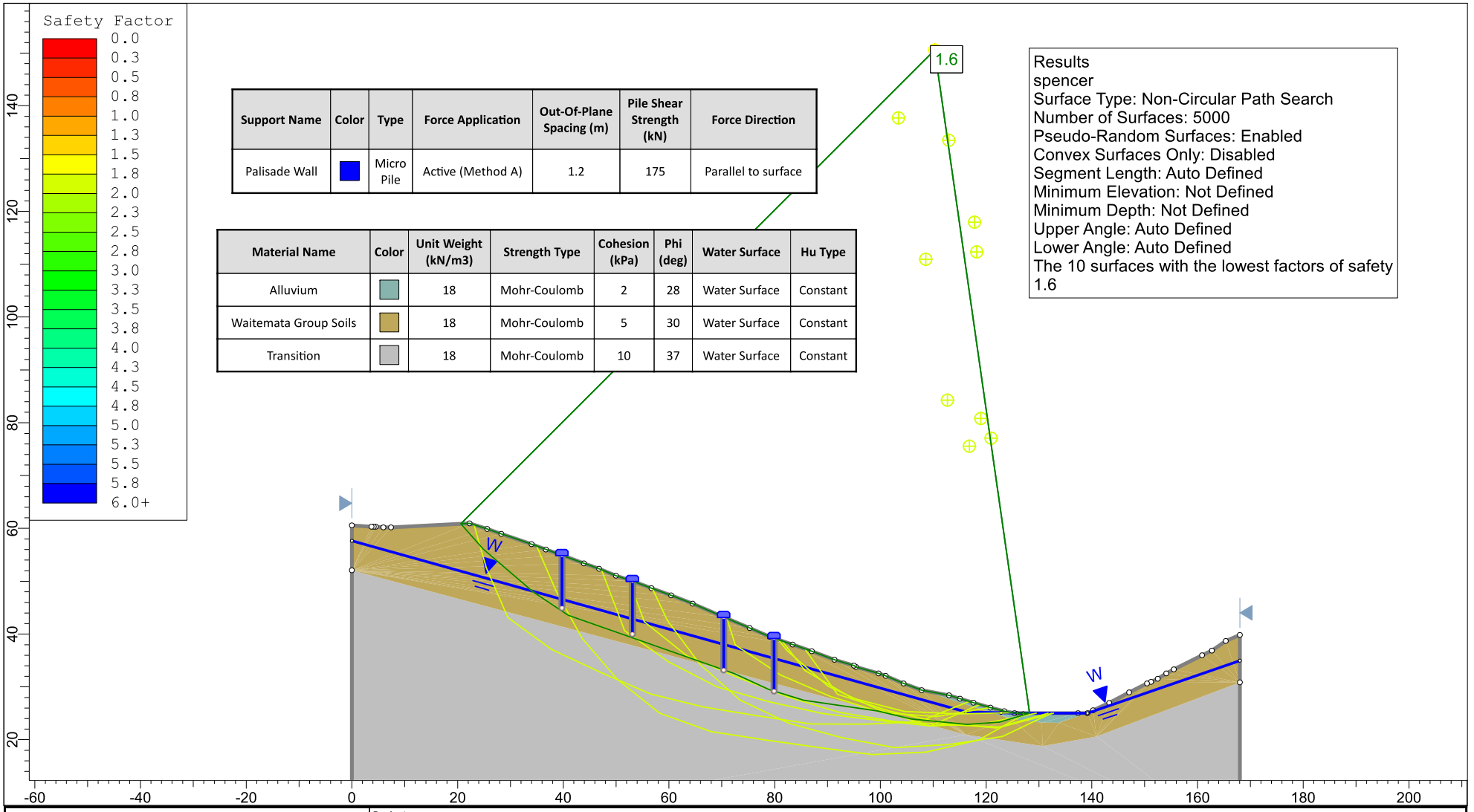
Results
spencer
Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Enabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Every available surface
1.6

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 3, Section DD - Run 19 (palisade walls)		
Drawn By	PH	Scale 1:1000	Company KGA Geotechnical
Date	31/08/2015		File Name 7464 - S3DD - Run 19.slim



Support Name	Color	Type	Force Application	Out-Of-Plane Spacing (m)	Pile Shear Strength (kN)	Force Direction
Palisade Wall		Micro Pile	Active (Method A)	1.2	175	Parallel to surface

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

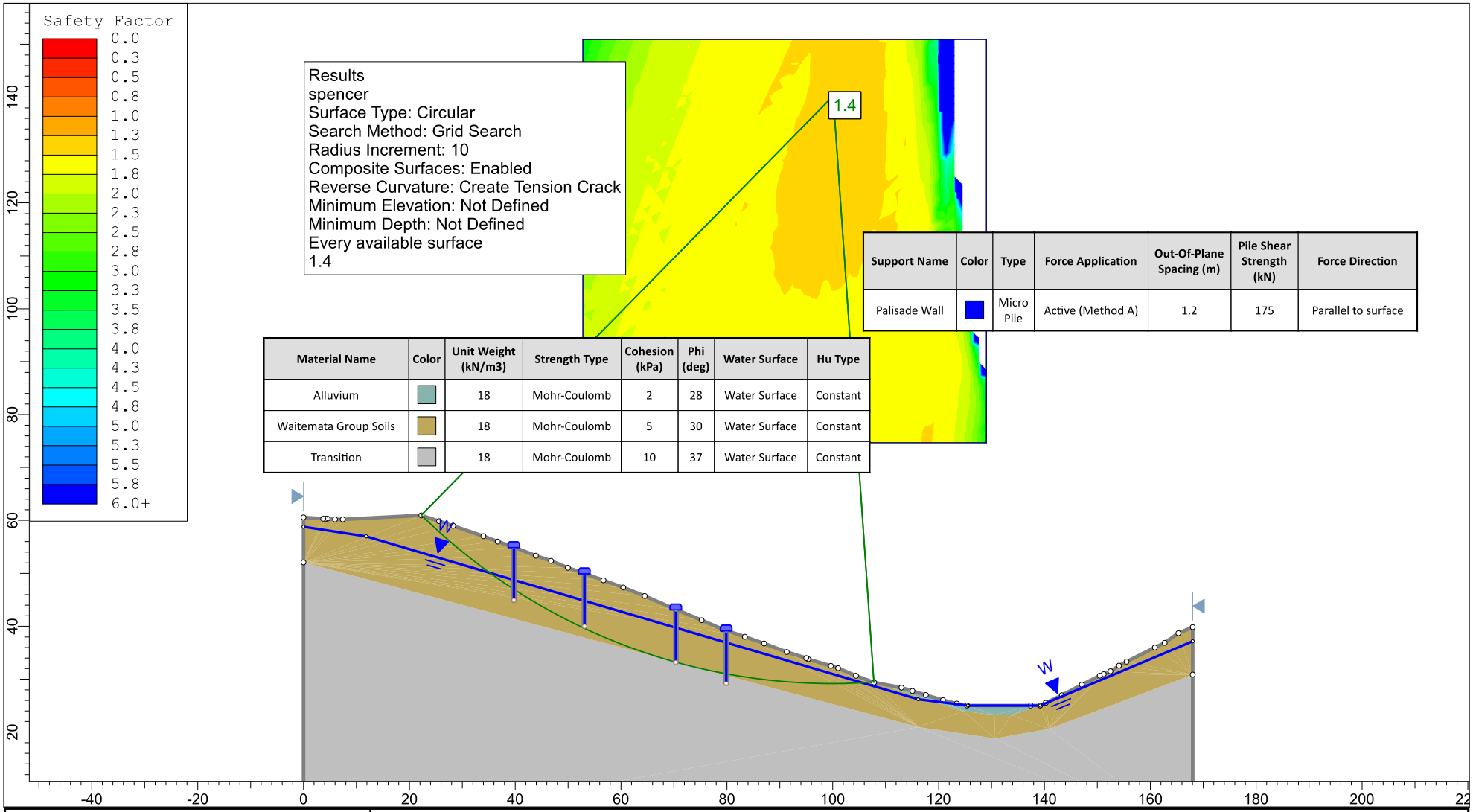
Results
spencer
Surface Type: Non-Circular Path Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Segment Length: Auto Defined
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Upper Angle: Auto Defined
Lower Angle: Auto Defined
The 10 surfaces with the lowest factors of safety
1.6

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Project	Proposed Subdivision - Grand View Estate, Orewa			
Analysis Description	Stage 3, Section DD - Run 20 (palisade walls)			
Drawn By	PH	Scale	1:1000	Company: KGA Geotechnical
Date	31/08/2015			File Name: 7464 - S3DD - Run 20.slim



Support Name	Color	Type	Force Application	Out-Of-Plane Spacing (m)	Pile Shear Strength (kN)	Force Direction
Palisade Wall		Micro Pile	Active (Method A)	1.2	175	Parallel to surface

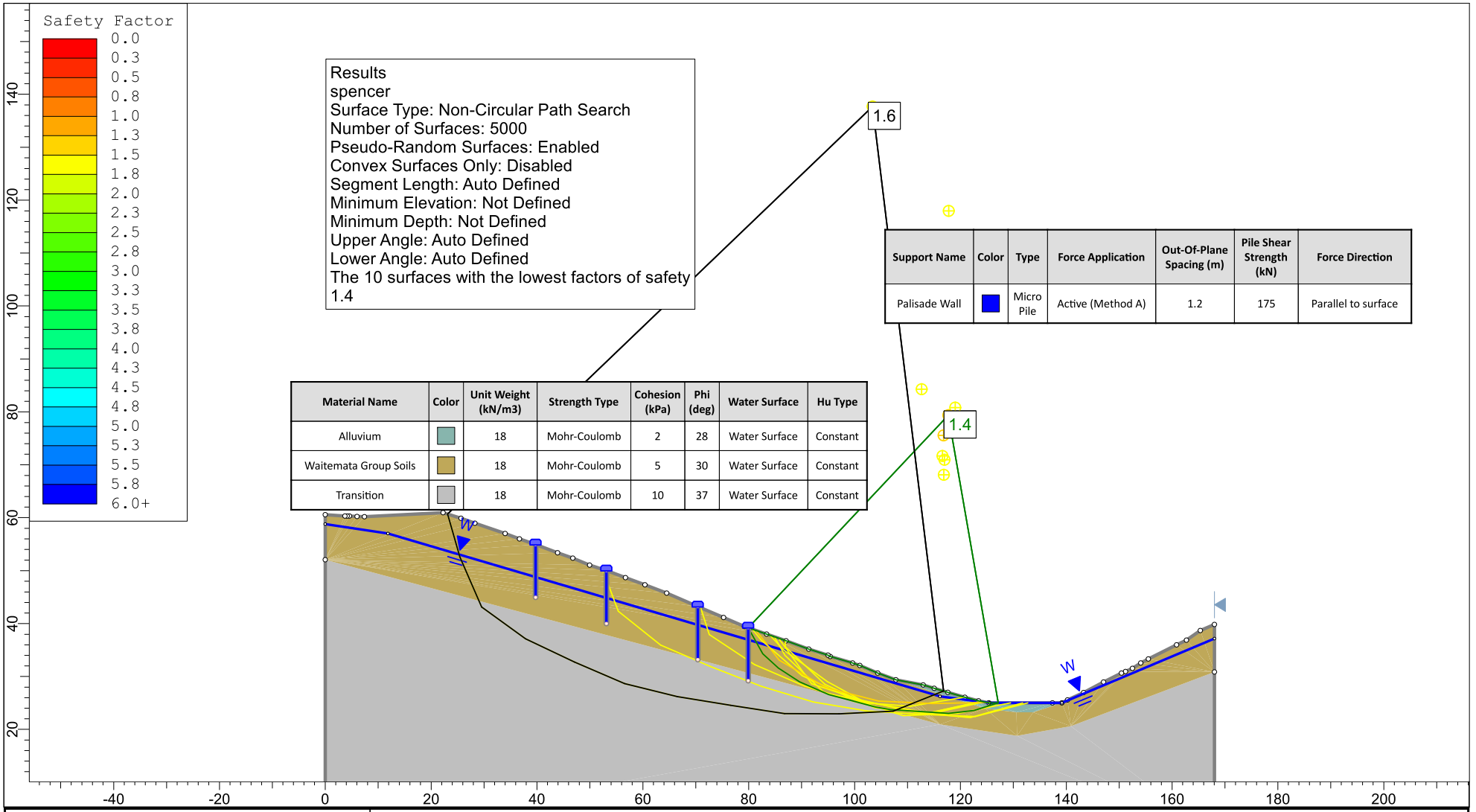
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 3, Section DD - Run 21 (palisade walls)		
Drawn By	PH	Scale 1:1000	Company KGA Geotechnical
Date	31/08/2015		File Name 7464 - S3DD - Run 21.slim



Support Name	Color	Type	Force Application	Out-Of-Plane Spacing (m)	Pile Shear Strength (kN)	Force Direction
Palisade Wall		Micro Pile	Active (Method A)	1.2	175	Parallel to surface

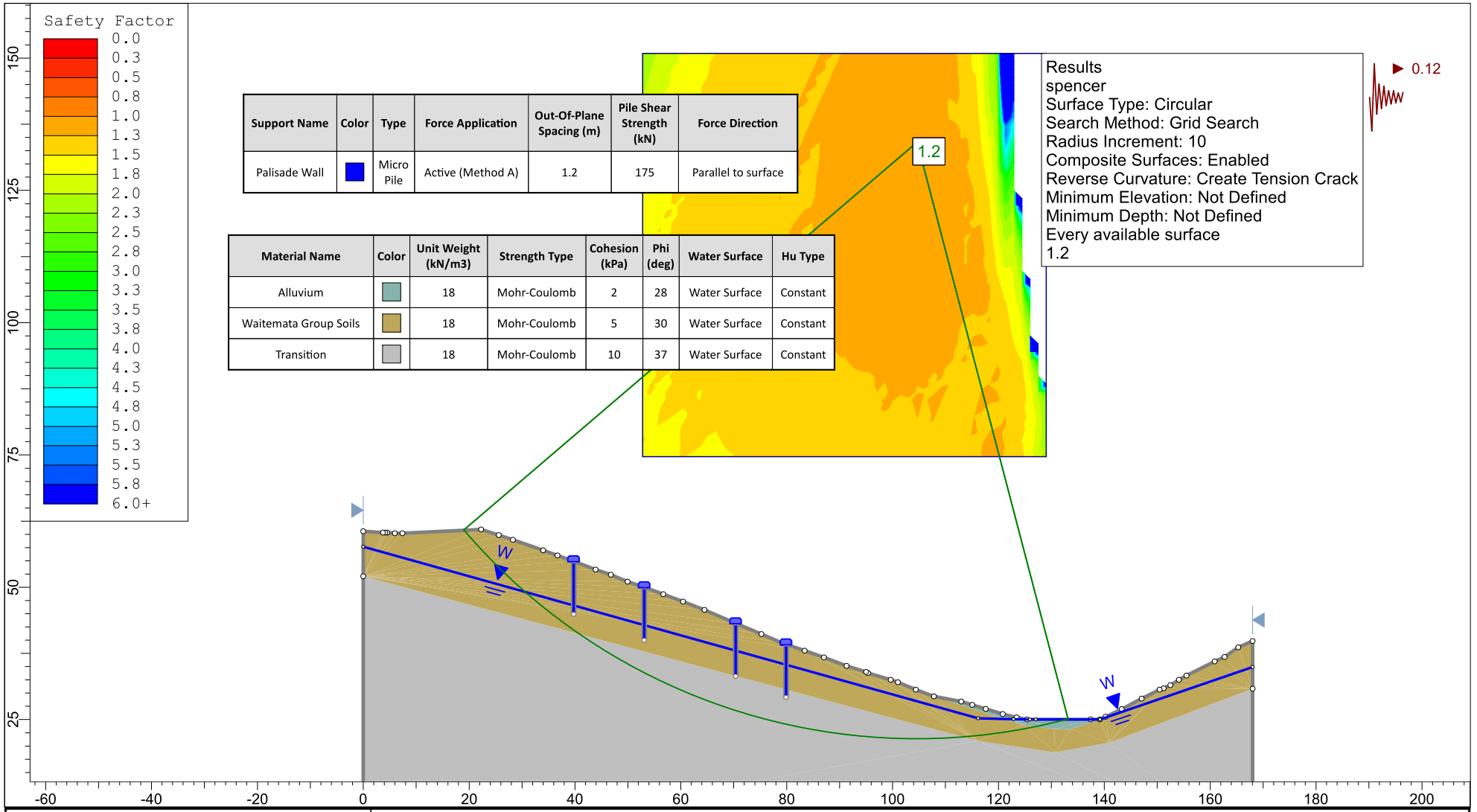
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 3, Section DD - Run 22 (palisade walls)		
Drawn By	PH	Scale 1:1000	Company KGA Geotechnical
Date	31/08/2015		File Name 7464 - S3DD - Run 22.slim



Support Name	Color	Type	Force Application	Out-Of-Plane Spacing (m)	Pile Shear Strength (kN)	Force Direction
Palisade Wall		Micro Pile	Active (Method A)	1.2	175	Parallel to surface

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

Results
spencer
Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Enabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Every available surface
1.2

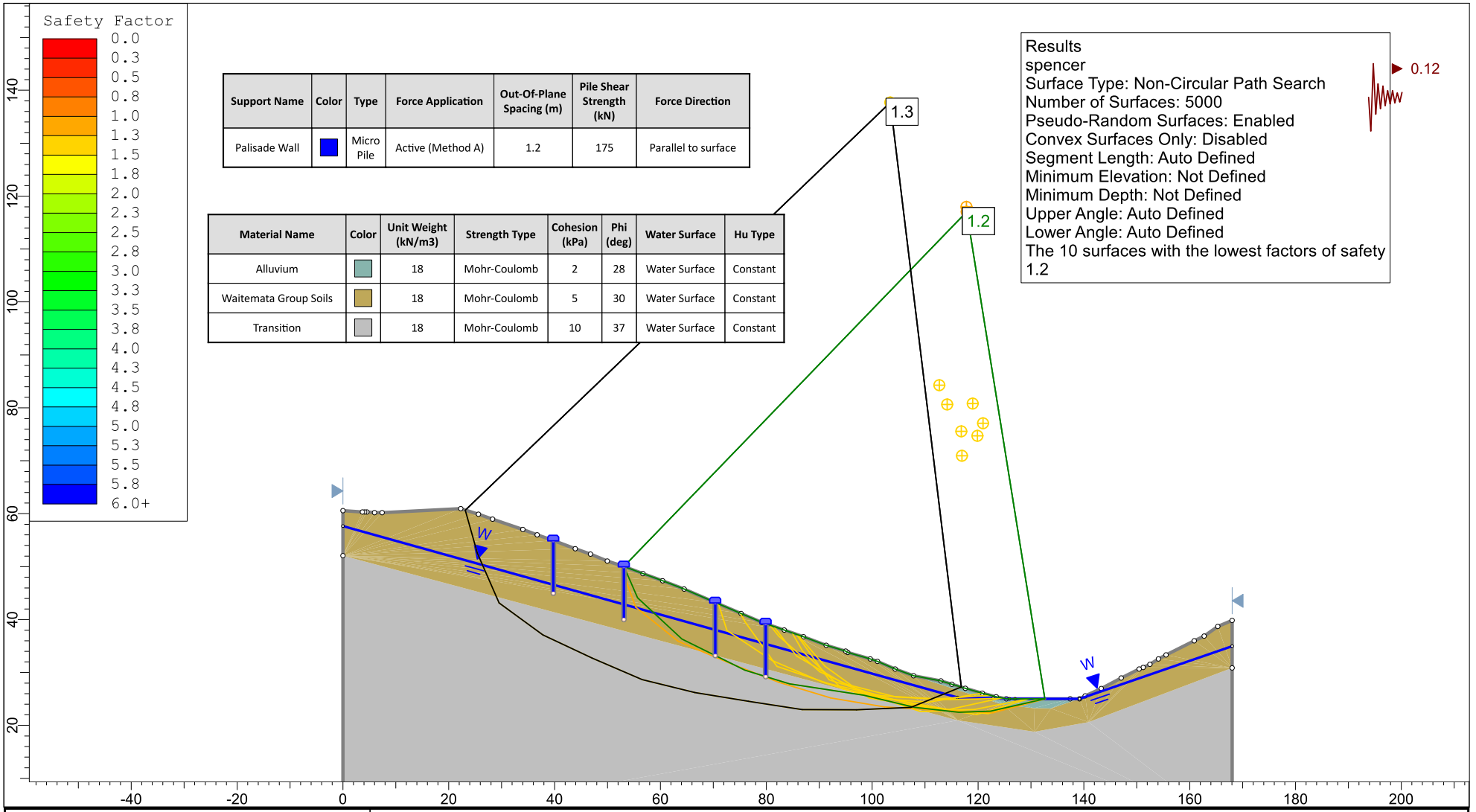
▶ 0.12

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 3, Section DD - Run 23 (palisade walls)		
Drawn By	PH	Scale 1:1000	Company KGA Geotechnical
Date	31/08/2015		File Name 7464 - S3DD - Run 23.slim



Support Name	Color	Type	Force Application	Out-Of-Plane Spacing (m)	Pile Shear Strength (kN)	Force Direction
Palisade Wall		Micro Pile	Active (Method A)	1.2	175	Parallel to surface

Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

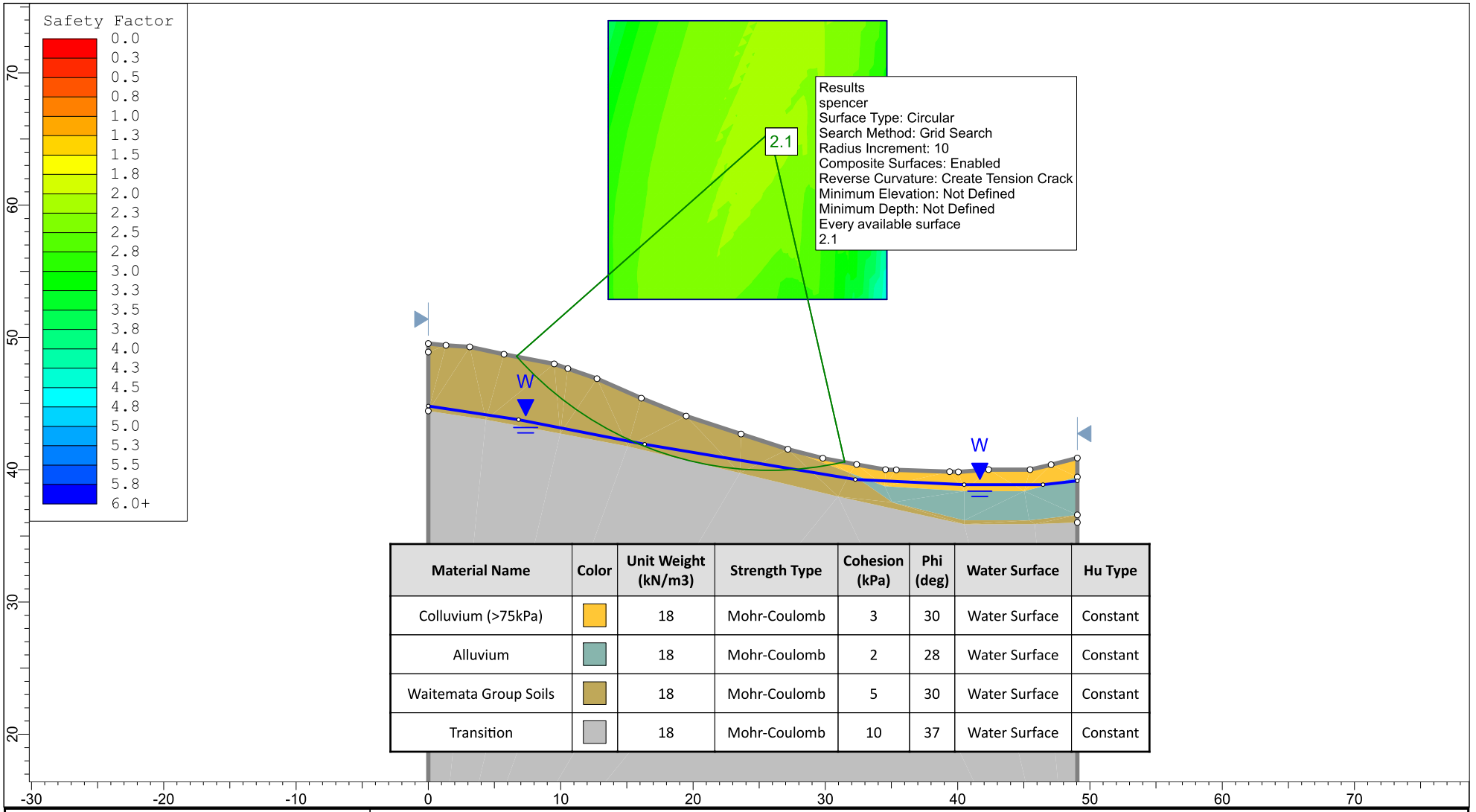
Results
spencer
Surface Type: Non-Circular Path Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Segment Length: Auto Defined
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Upper Angle: Auto Defined
Lower Angle: Auto Defined
The 10 surfaces with the lowest factors of safety
1.2

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 3, Section DD - Run 24 (palisade walls)				
Drawn By	PH	Scale	1:1000	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S3DD - Run 24.slim

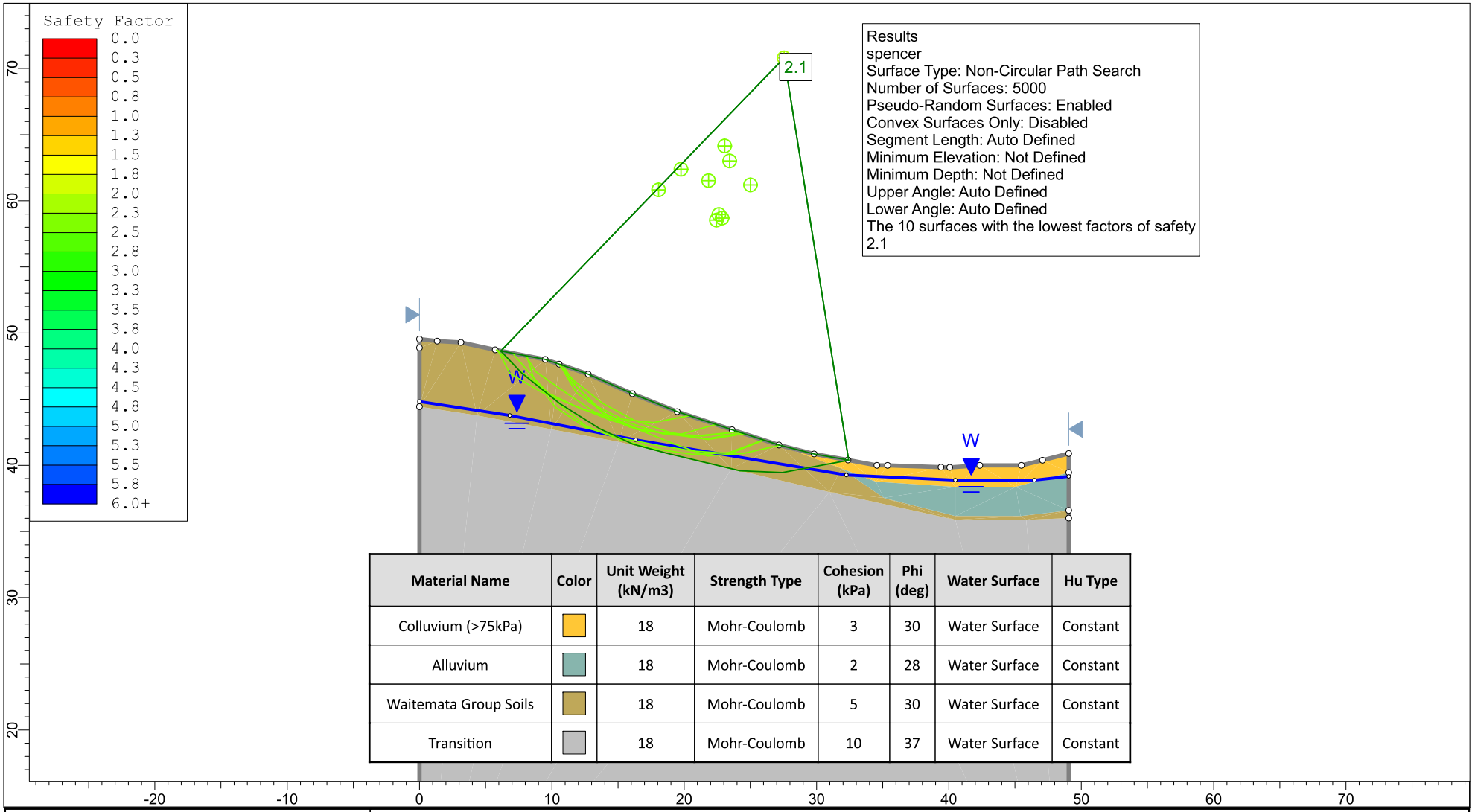


Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 4, Section AA - Run 1		
Drawn By	PH	Scale 1:400	Company KGA Geotechnical
Date	31/08/2015		File Name 7464 - S4AA - Run 1.slim



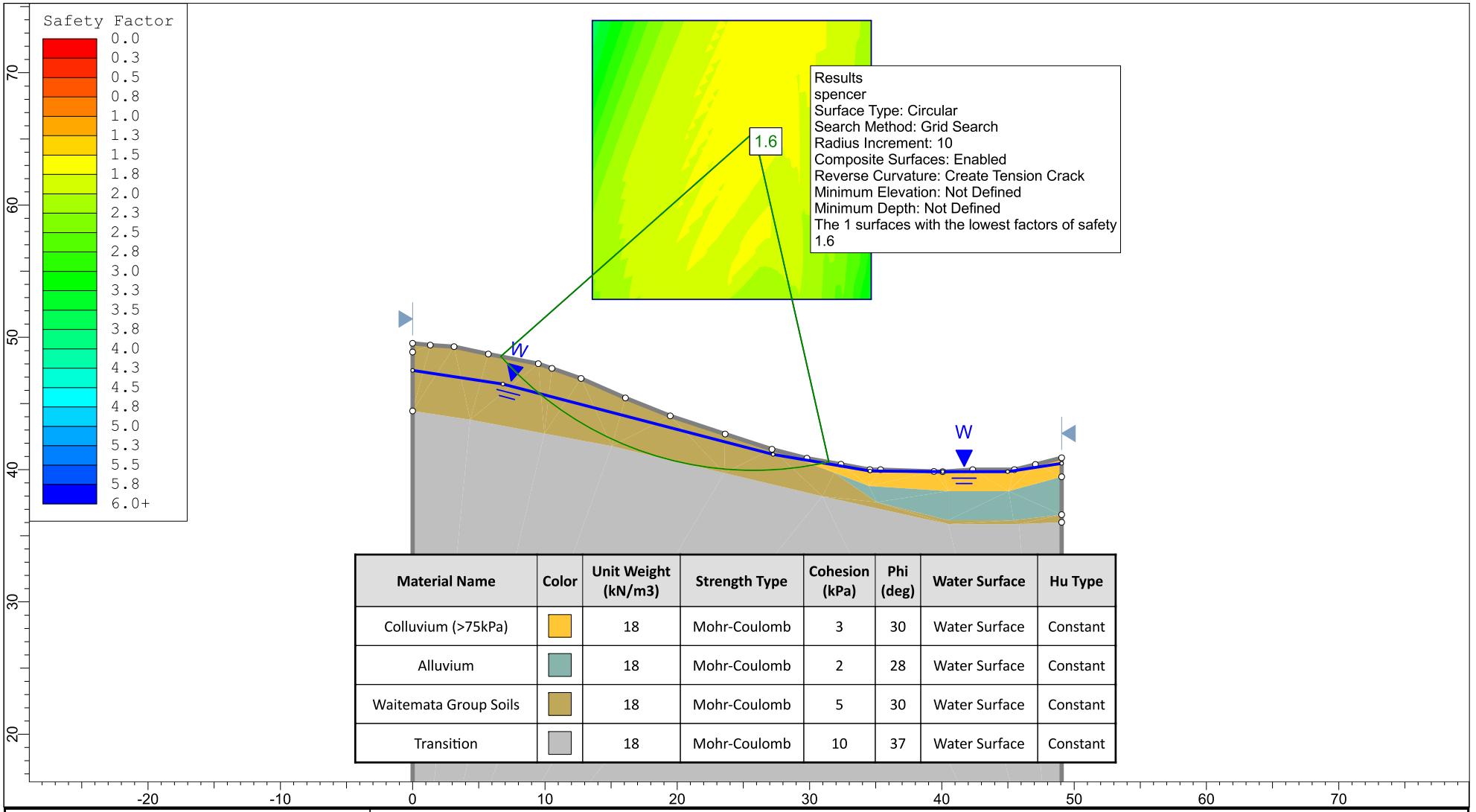
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 4, Section AA - Run 1				
Drawn By	PH	*Scale*	1:400	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S4AA - Run 2.slim



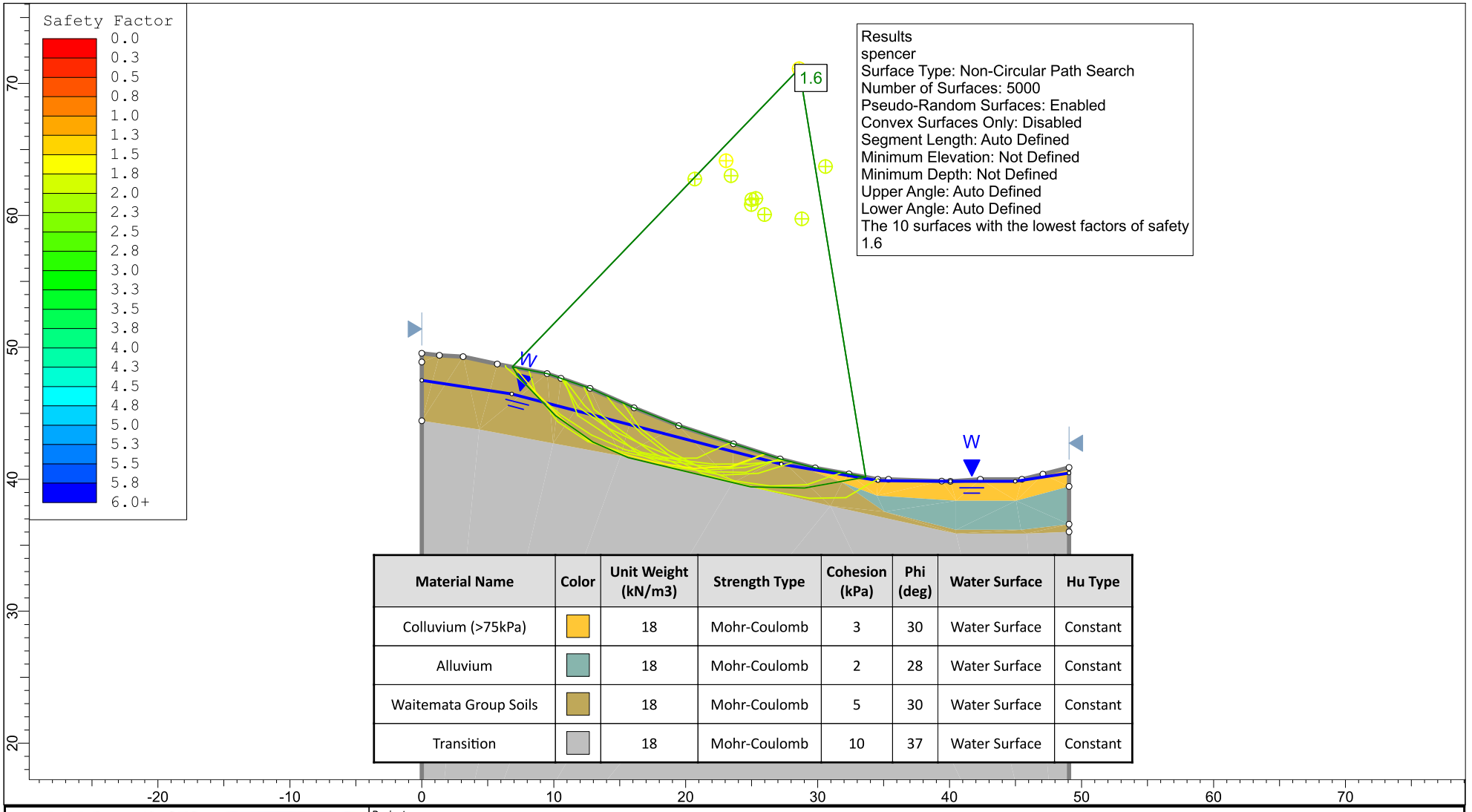
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 4, Section AA - Run 3				
Drawn By	PH	Scale	1:400	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S4AA - Run 3.slim



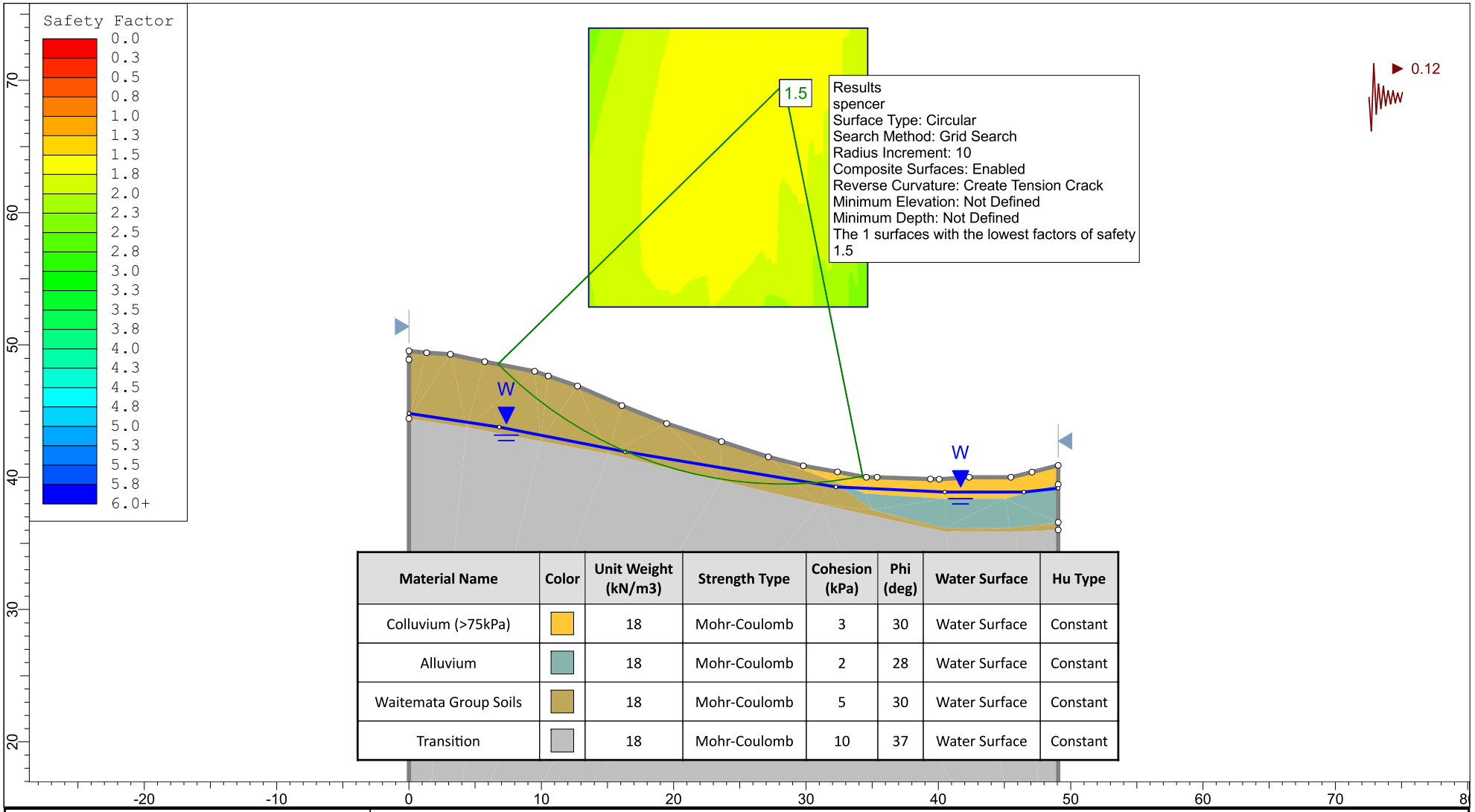
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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SLIDEINTERPRET 6.018

Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 4, Section AA - Run 4				
Drawn By	PH	Scale	1:400	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S4AA - Run 4.slim



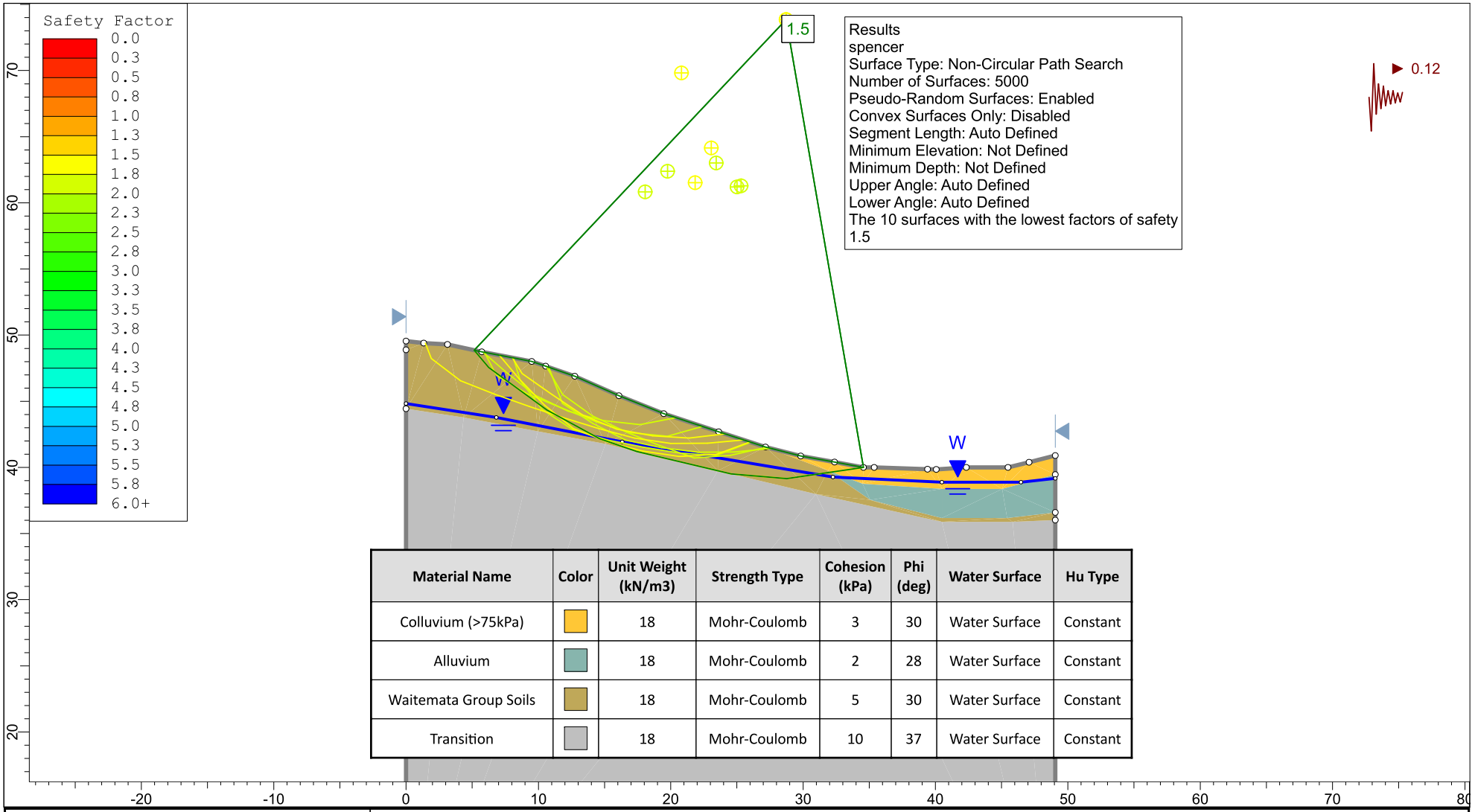
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 4, Section AA - Run 5				
Drawn By	PH	Scale	1:400	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S4AA - Run 5.slim



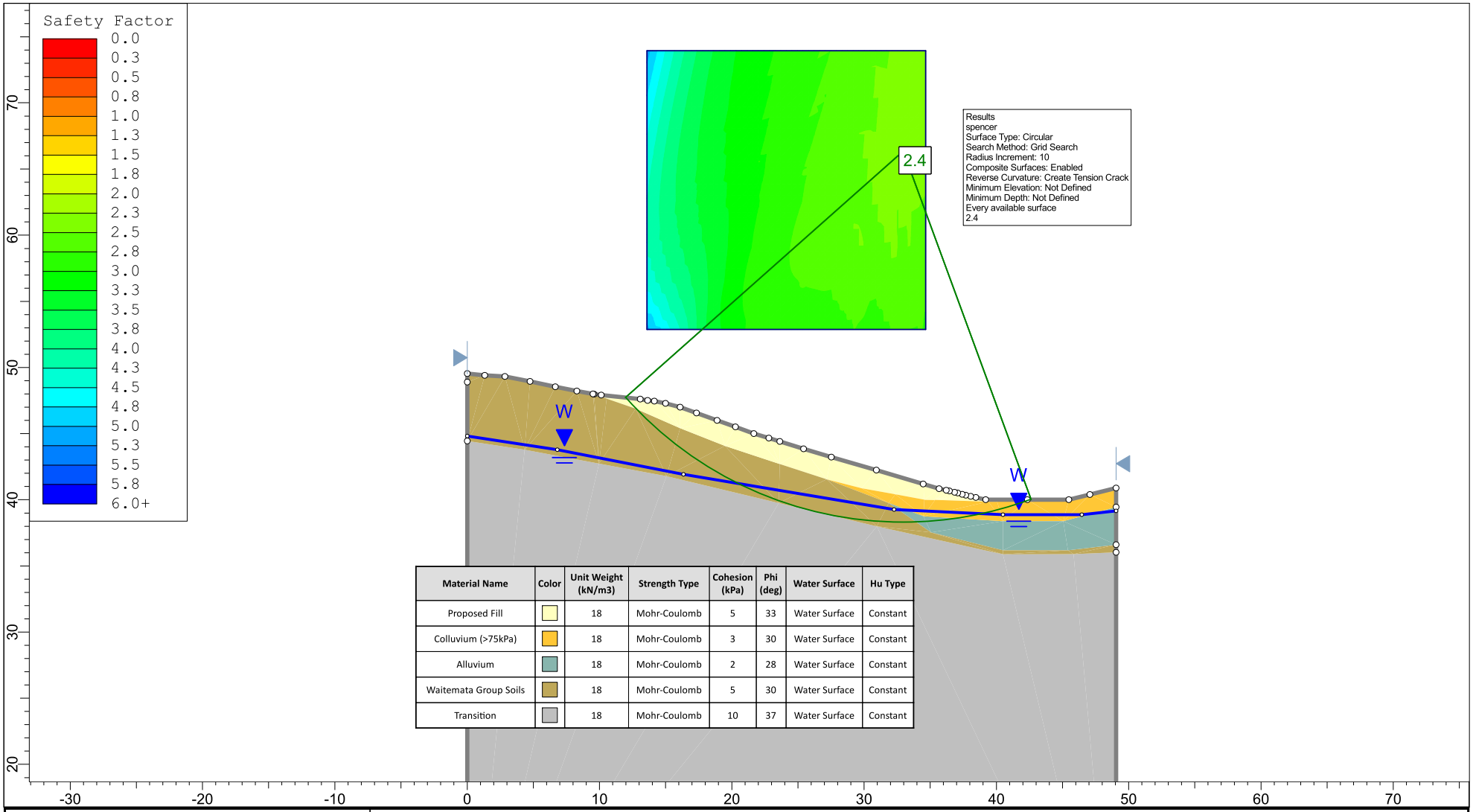
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 4, Section AA - Run 6				
Drawn By	PH	Scale	1:400	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S4AA - Run 6.slim



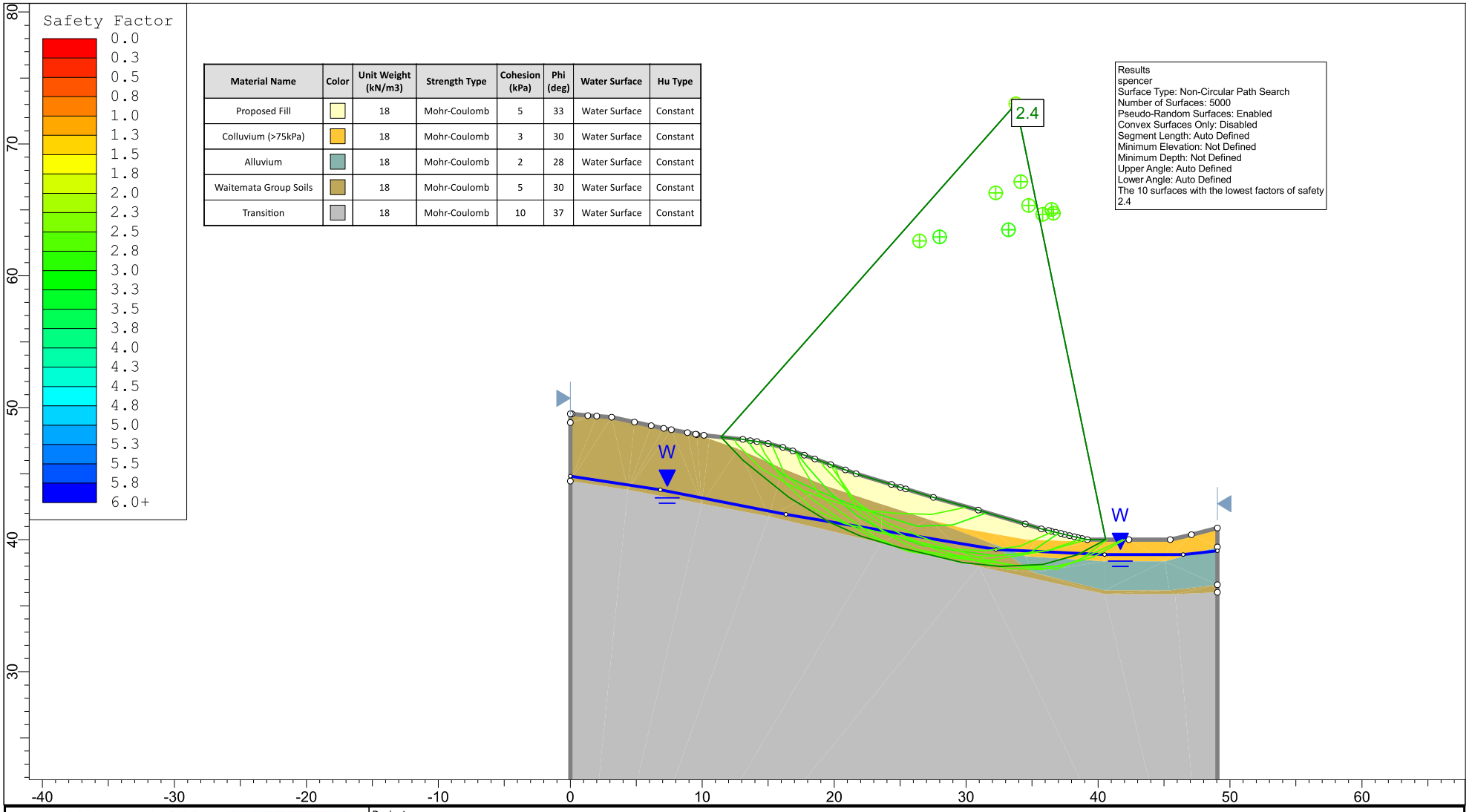
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 4, Section AA - Run 7				
Drawn By	PH	*Scale*	1:400	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S4AA - Run 7.slim



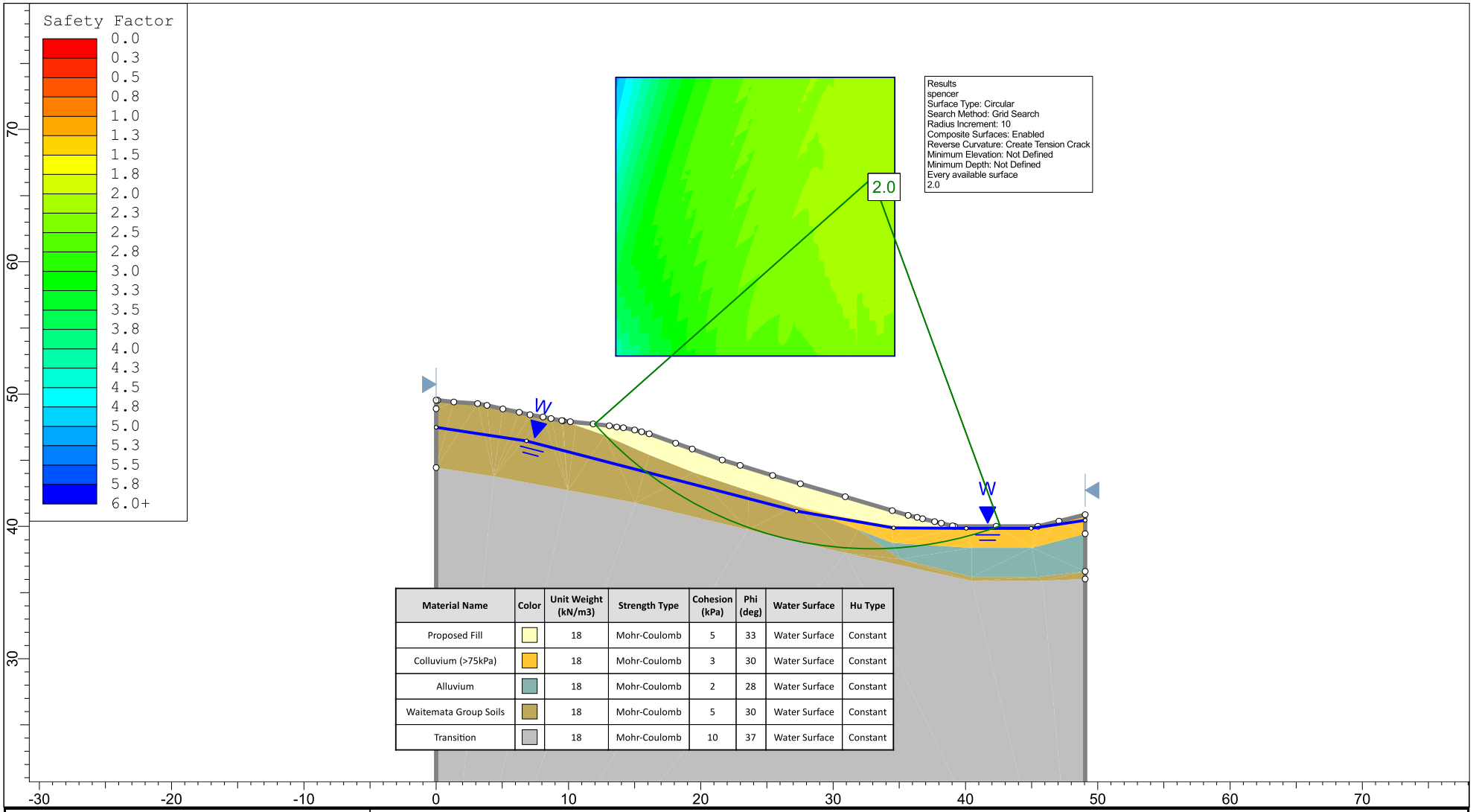
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 4, Section AA - Run 8				
Drawn By	PH	*Scale*	1:400	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S4AA - Run 8.slim



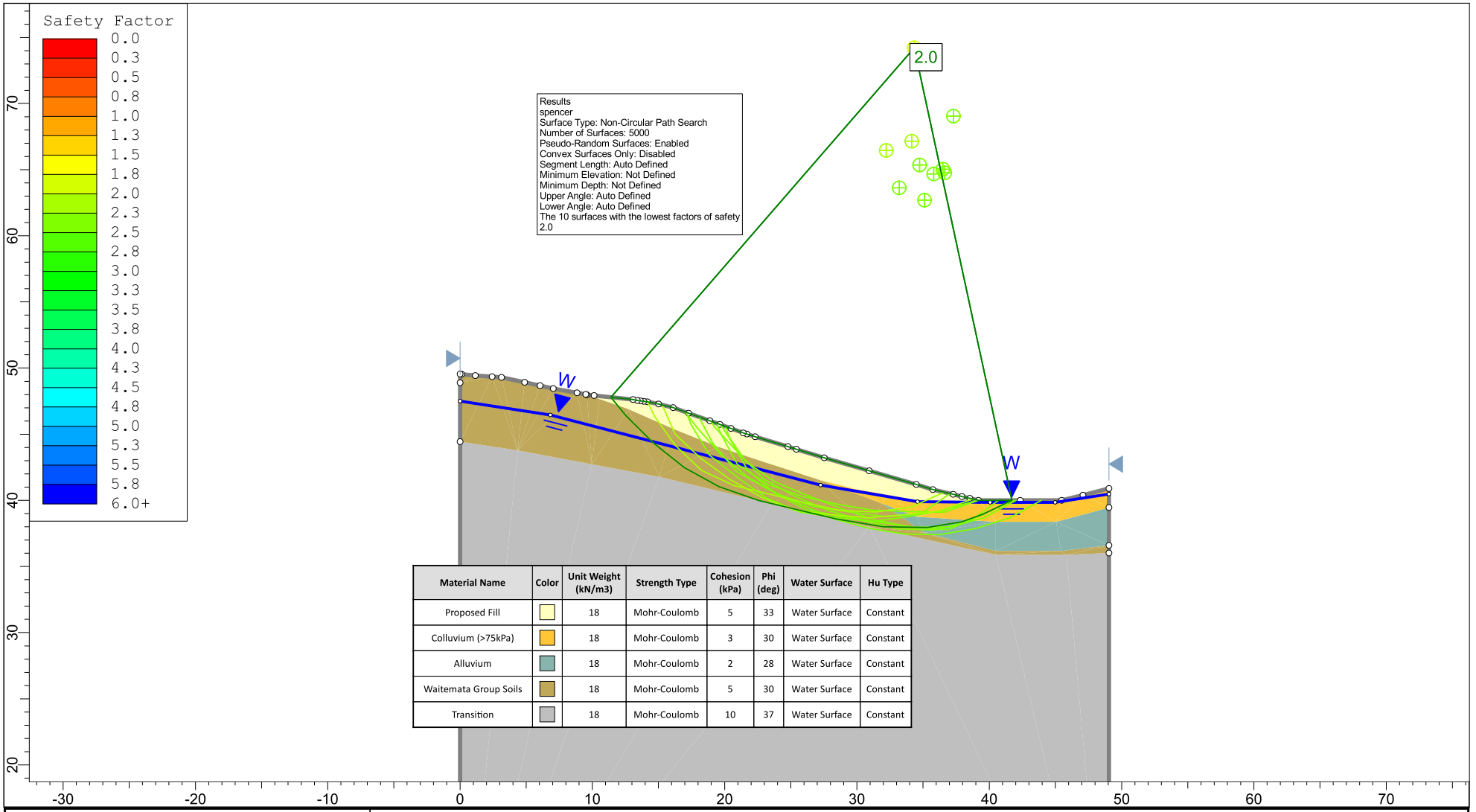
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 4, Section AA - Run 9				
Drawn By	PH	*Scale*	1:400	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S4AA - Run 9.slim



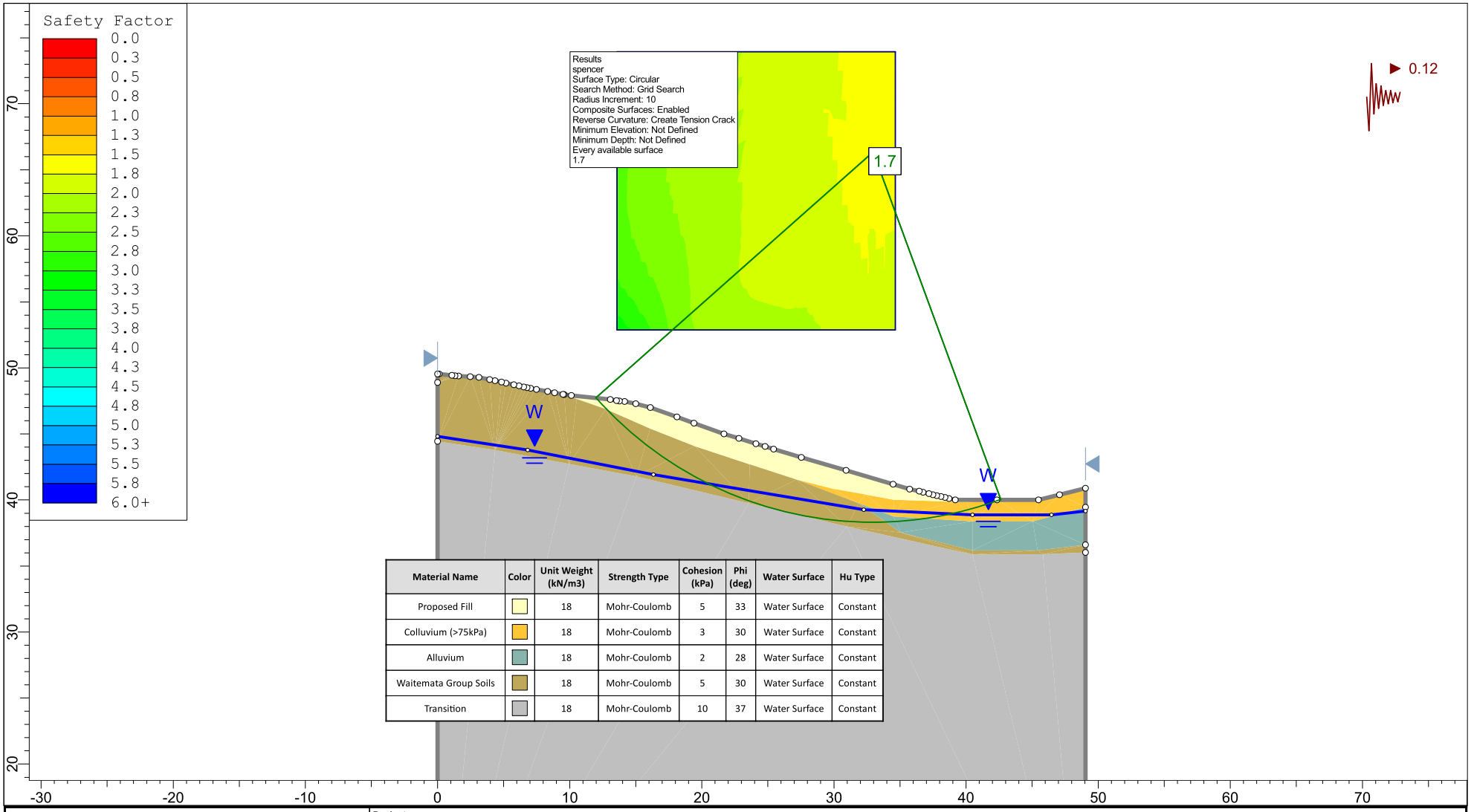
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 4, Section AA - Run 10				
Drawn By	PH	*Scale*	1:400	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S4AA - Run 10.slim



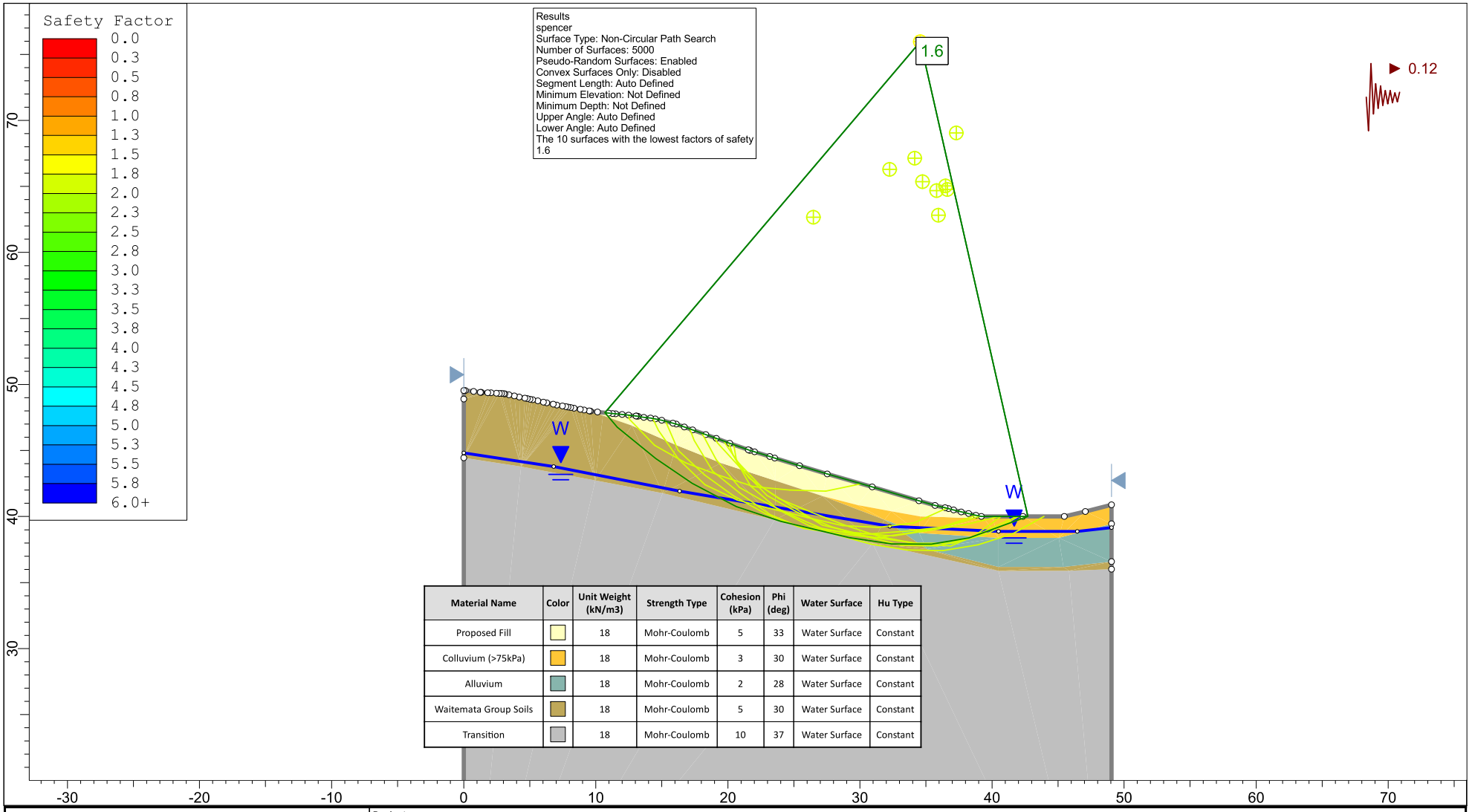
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 4, Section AA - Run 11				
Drawn By	PH	*Scale*	1:400	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S4AA - Run 11.slim



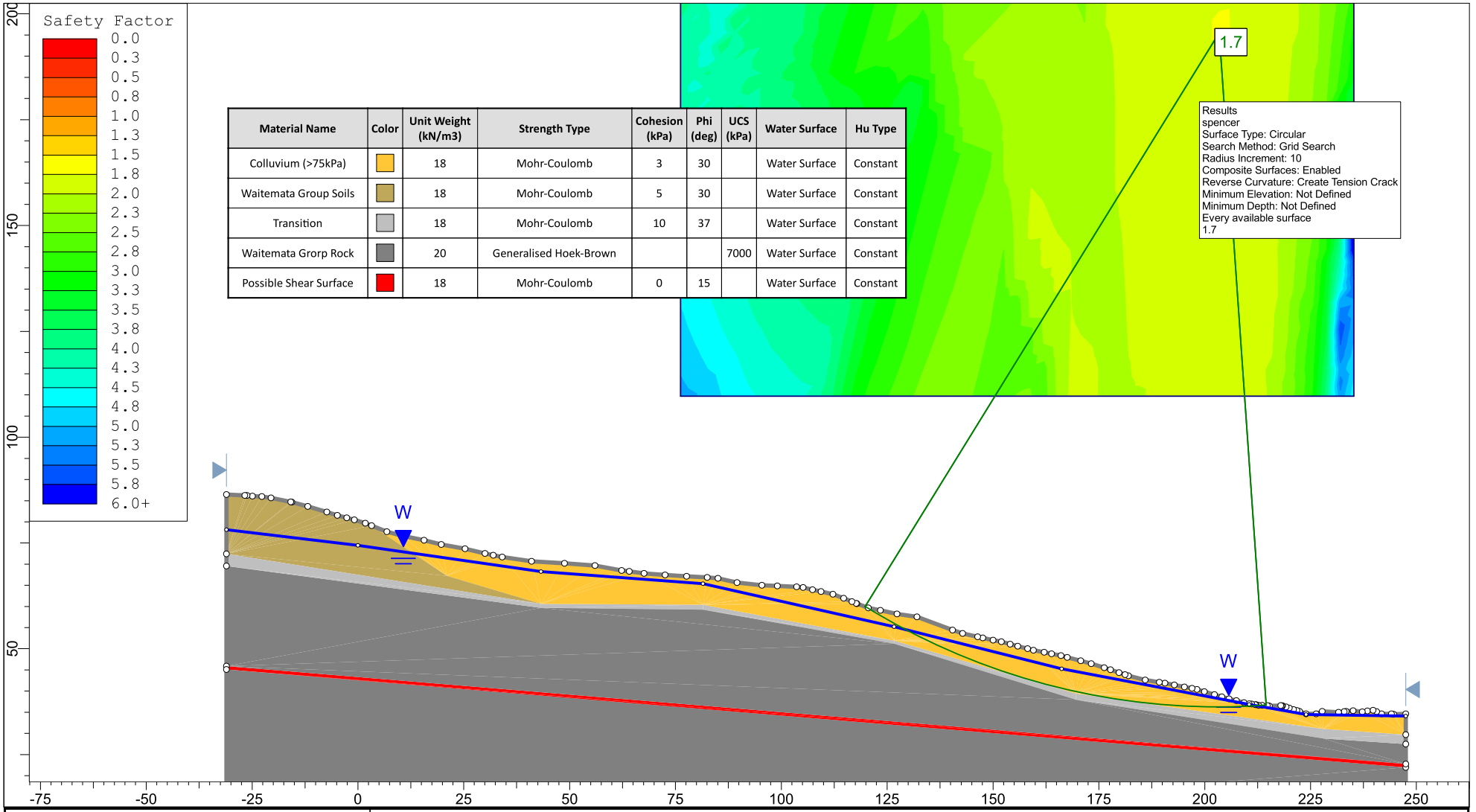
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 4, Section AA - Run 12				
Drawn By	PH	*Scale*	1:400	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S4AA - Run 12.slim



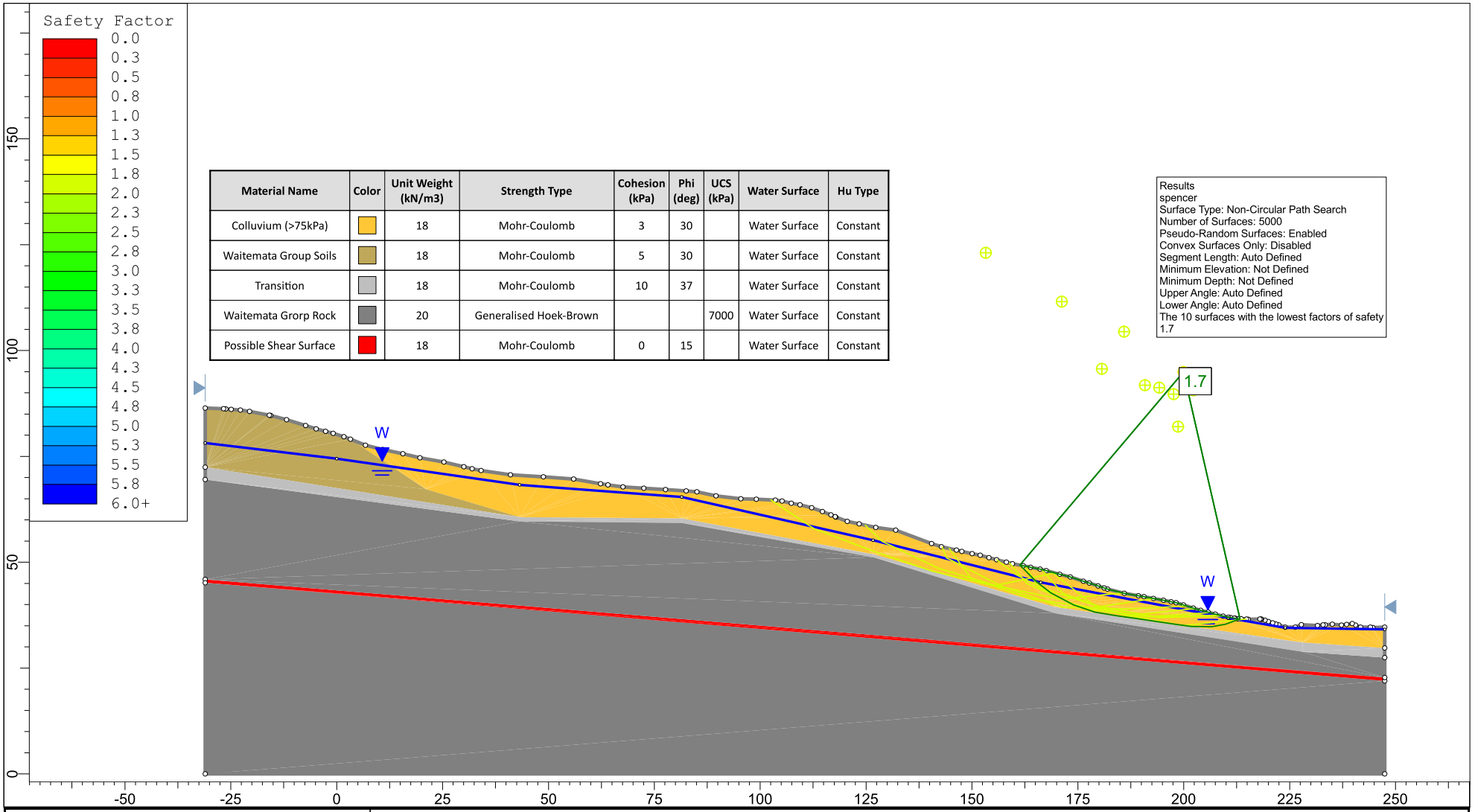
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 4, Section BB - Run 1				
Drawn By	PH	Scale	1:1250	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S4BB - Run 1.slim



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

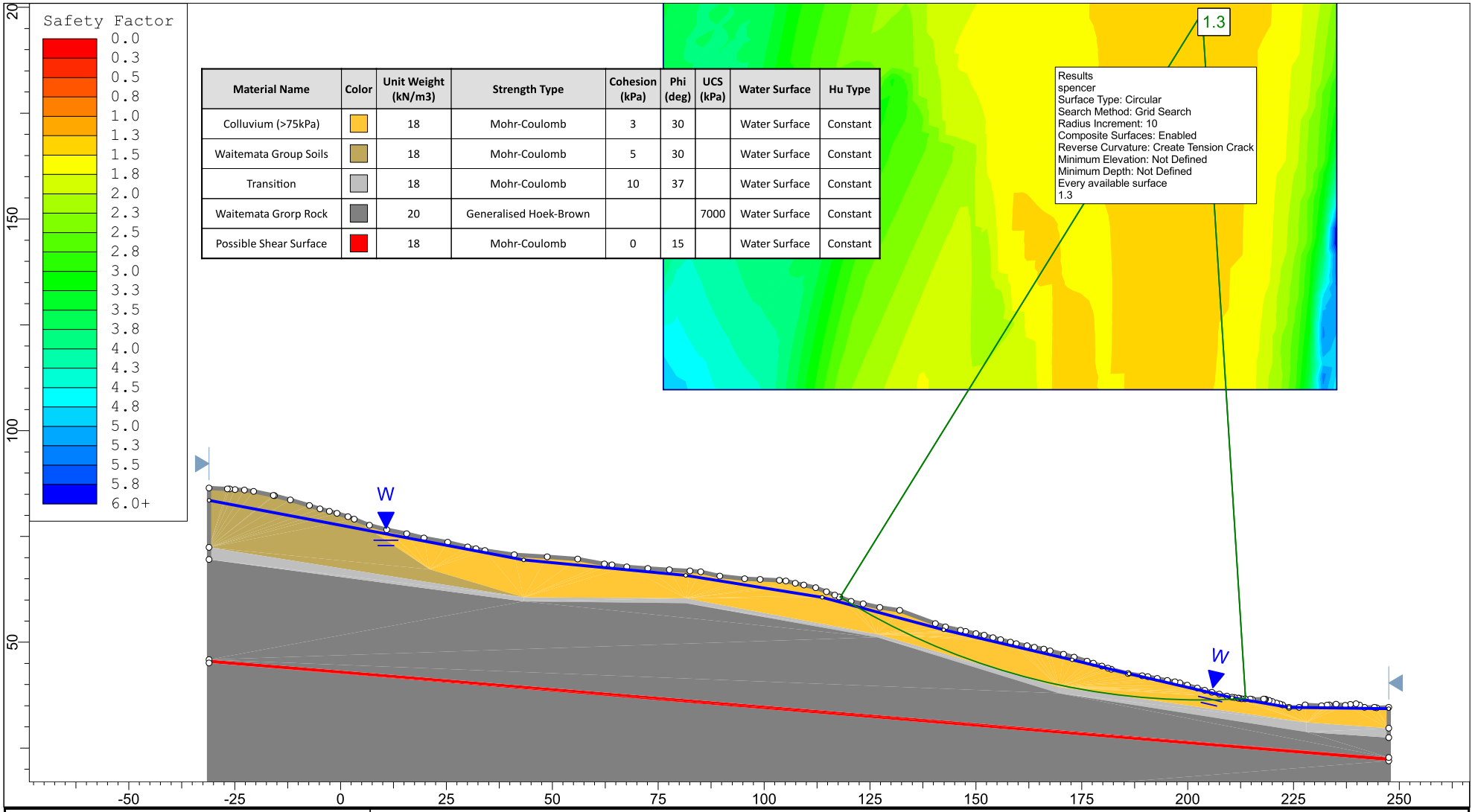
Results
spencer
Surface Type: Non-Circular Path Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Segment Length: Auto Defined
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Upper Angle: Auto Defined
Lower Angle: Auto Defined
The 10 surfaces with the lowest factors of safety
1.7

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SLIDEINTERPRET 6.018

Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 4, Section BB - Run 2				
Drawn By	PH	*Scale*	1:1250	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S4BB - Run 2.slim



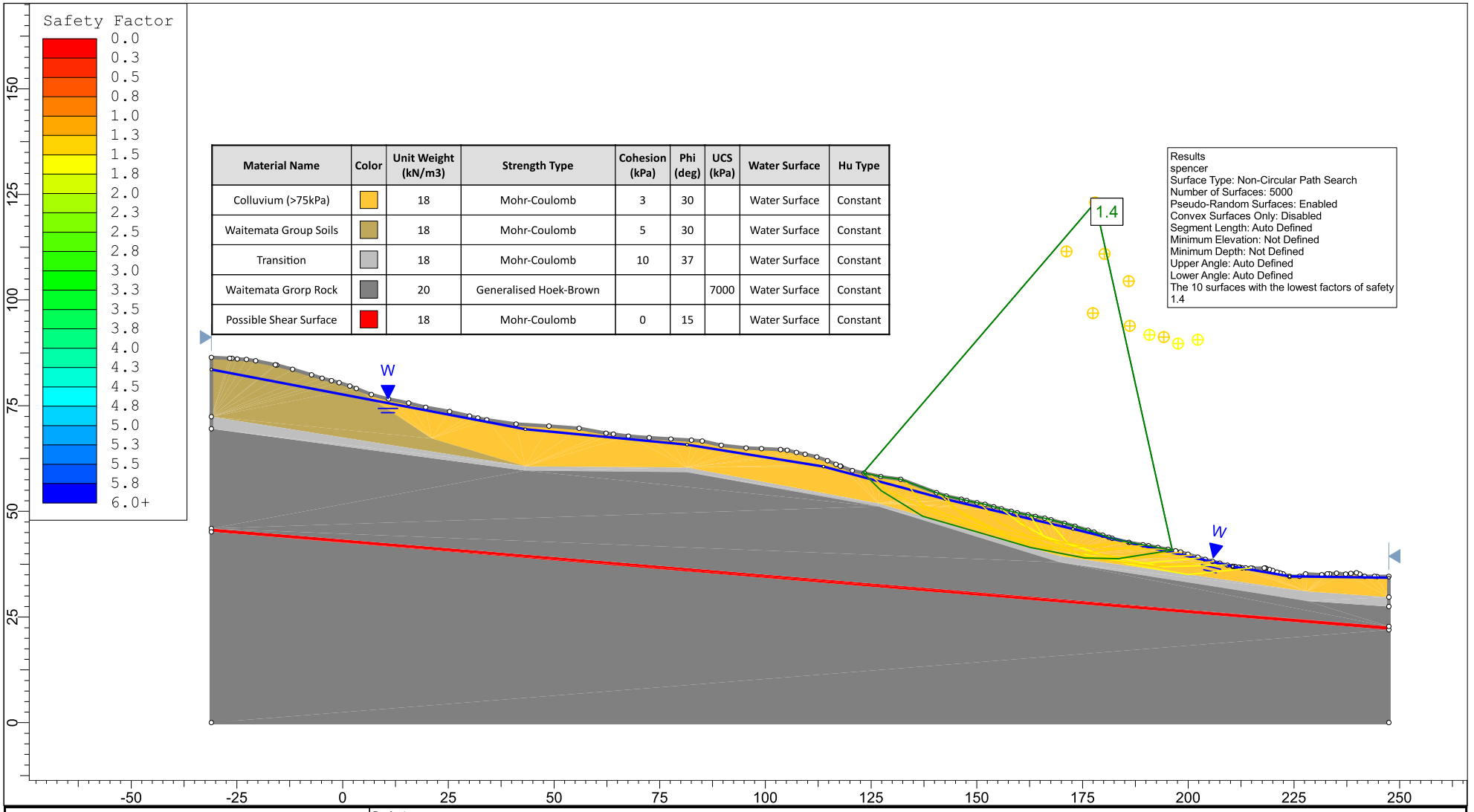
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 4, Section BB - Run 3				
Drawn By	PH	*Scale*	1:1250	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S4BB - Run 3.slim



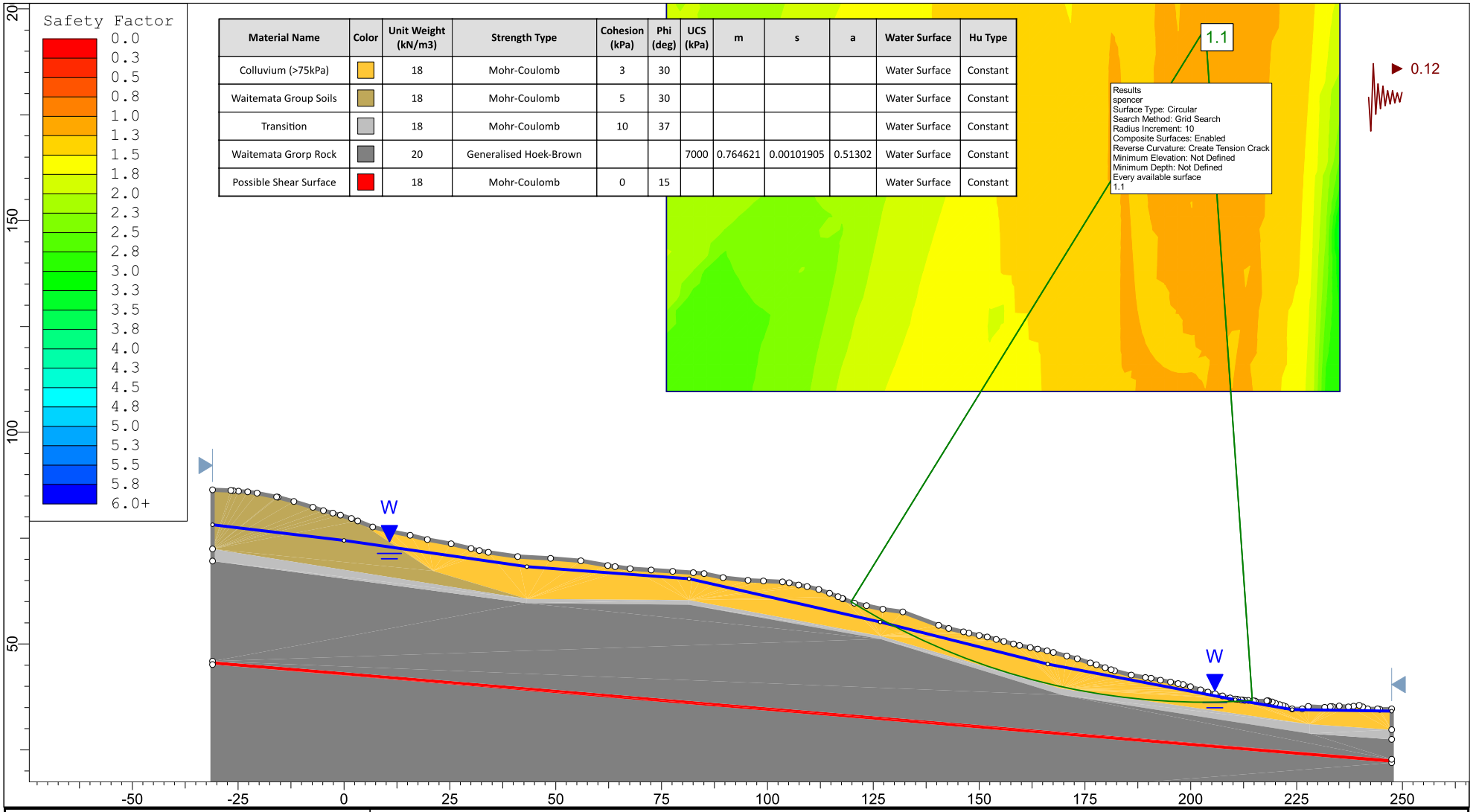
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 4, Section BB - Run 4				
Drawn By	PH	Scale	1:1250	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S4BB - Run 4.slim



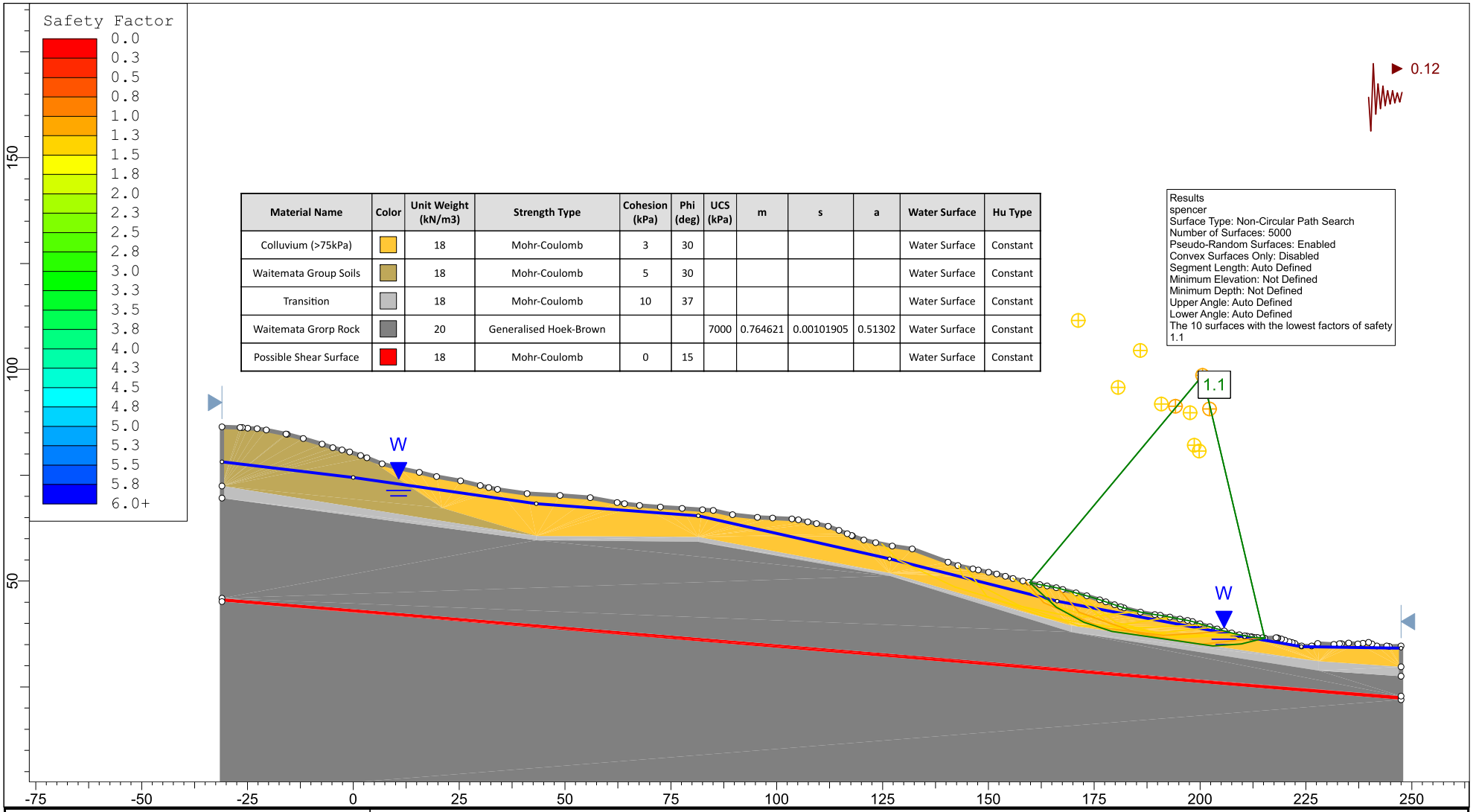
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	m	s	a	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30					Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30					Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37					Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	0.764621	0.00101905	0.51302	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15					Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa			
Analysis Description	Stage 4, Section BB - Run 5			
Drawn By	PH	*Scale*	1:1250	*Company* KGA Geotechnical
Date	31/08/2015			*File Name* 7464 - S4BB - Run 5.slim



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	m	s	a	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30					Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30					Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37					Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	0.764621	0.00101905	0.51302	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15					Water Surface	Constant

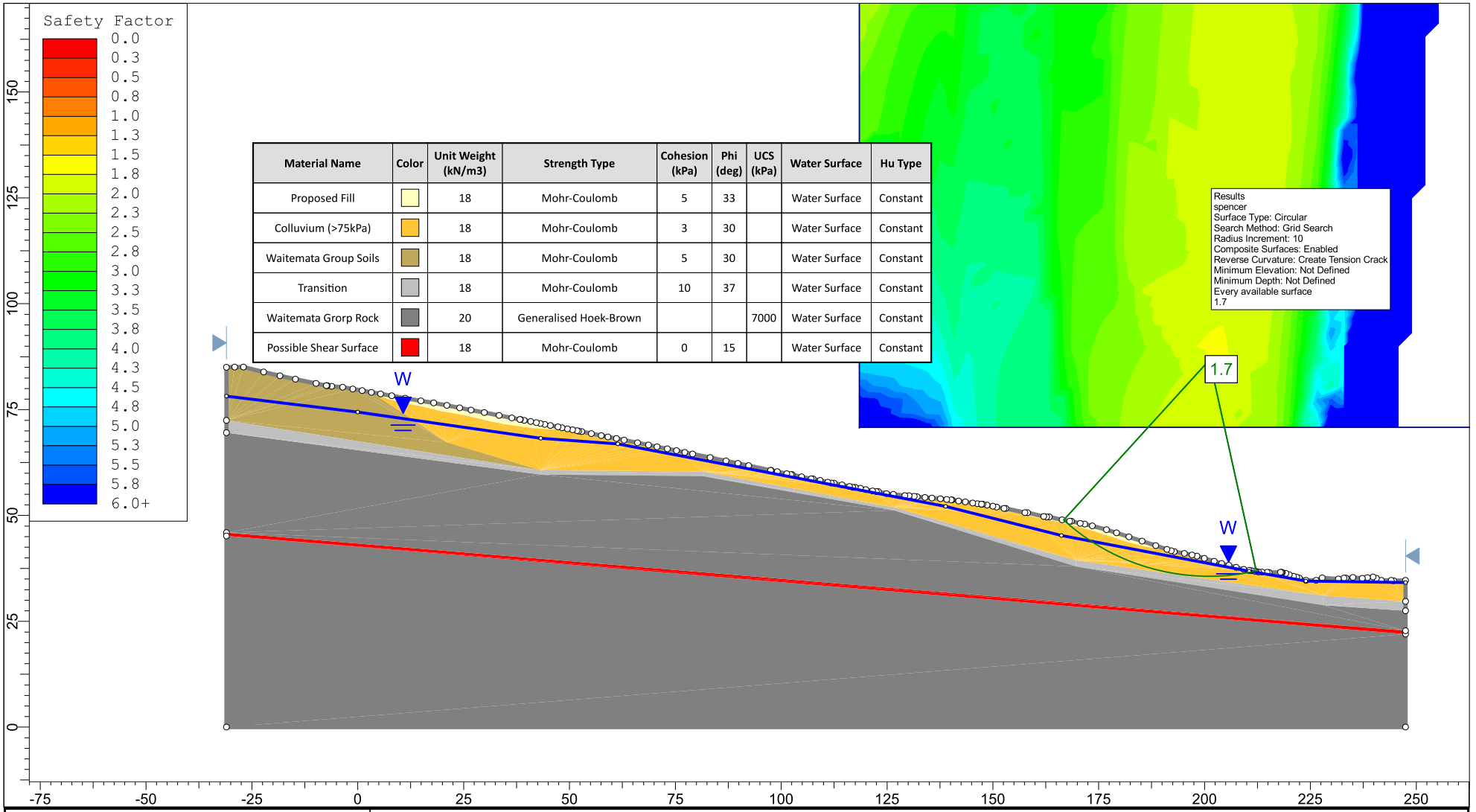
Results
spencer
Surface Type: Non-Circular Path Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Segment Length: Auto Defined
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Upper Angle: Auto Defined
Lower Angle: Auto Defined
The 10 surfaces with the lowest factors of safety
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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 4, Section BB - Run 6				
Drawn By	PH	Scale	1:1250	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S4BB - Run 6.slim



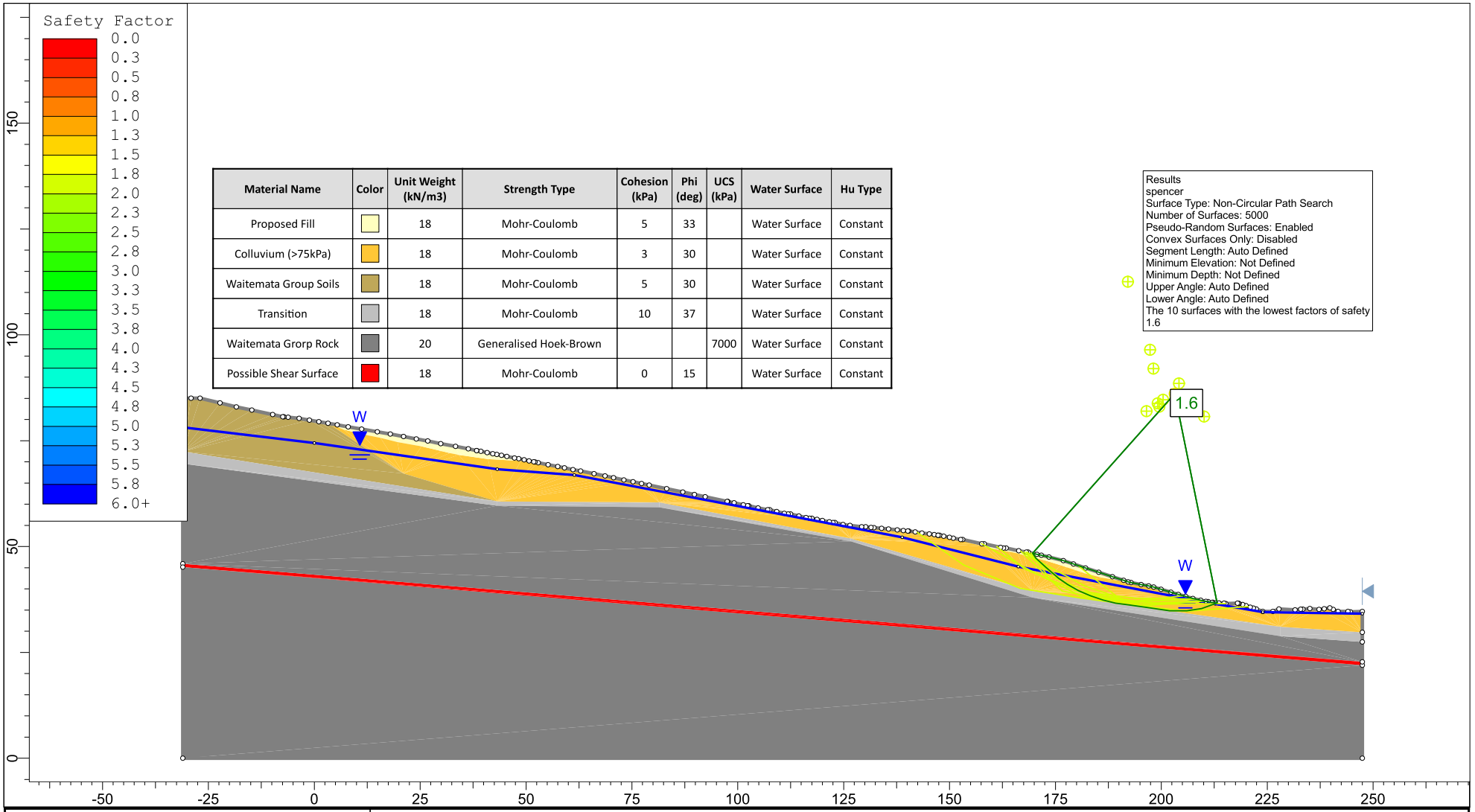
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 4, Section BB - Run 7				
Drawn By	PH	Scale	1:1250	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S4BB - Run 7.slim



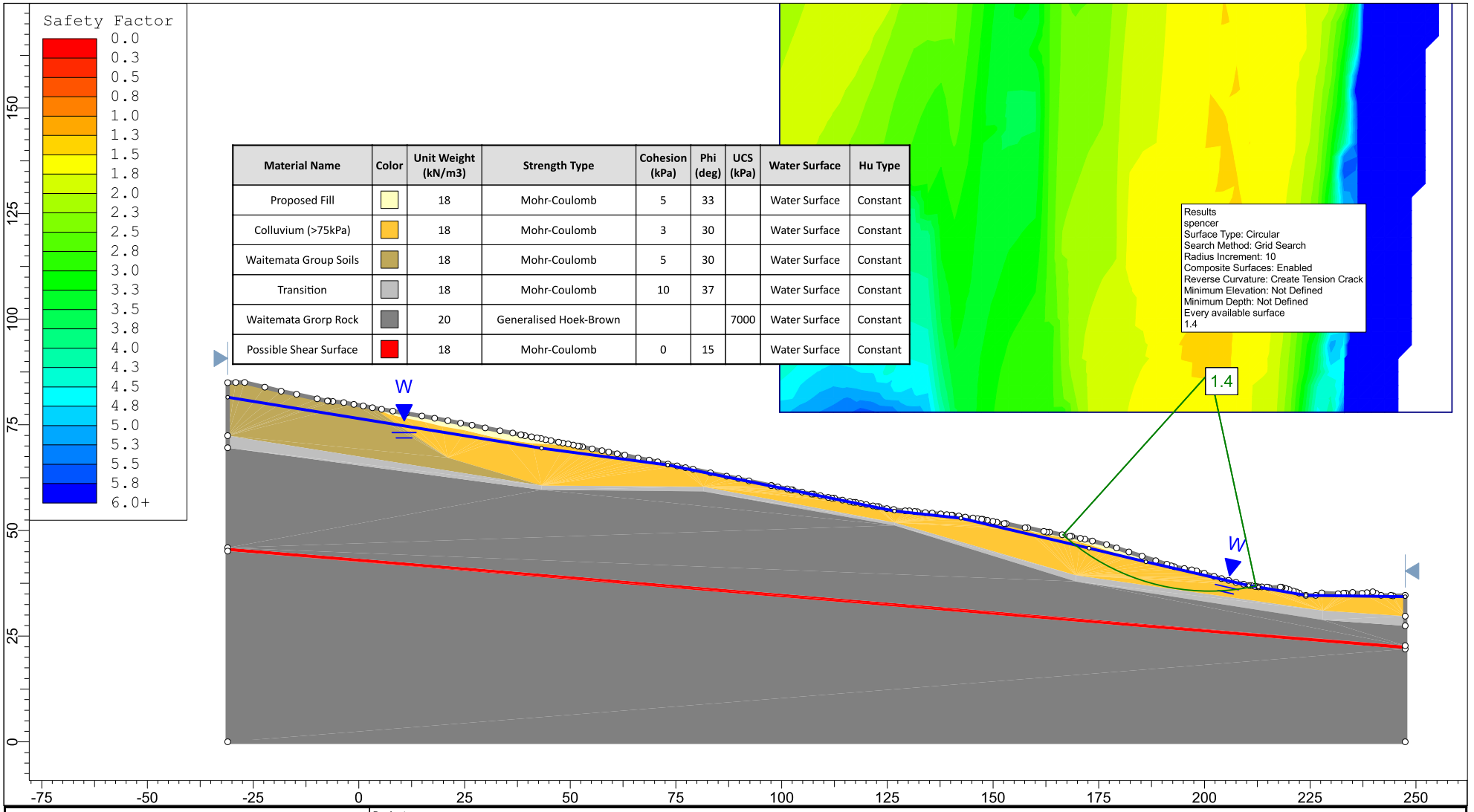
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 4, Section BB - Run 8				
Drawn By	PH	Scale	1:1250	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S4BB - Run 8.slim



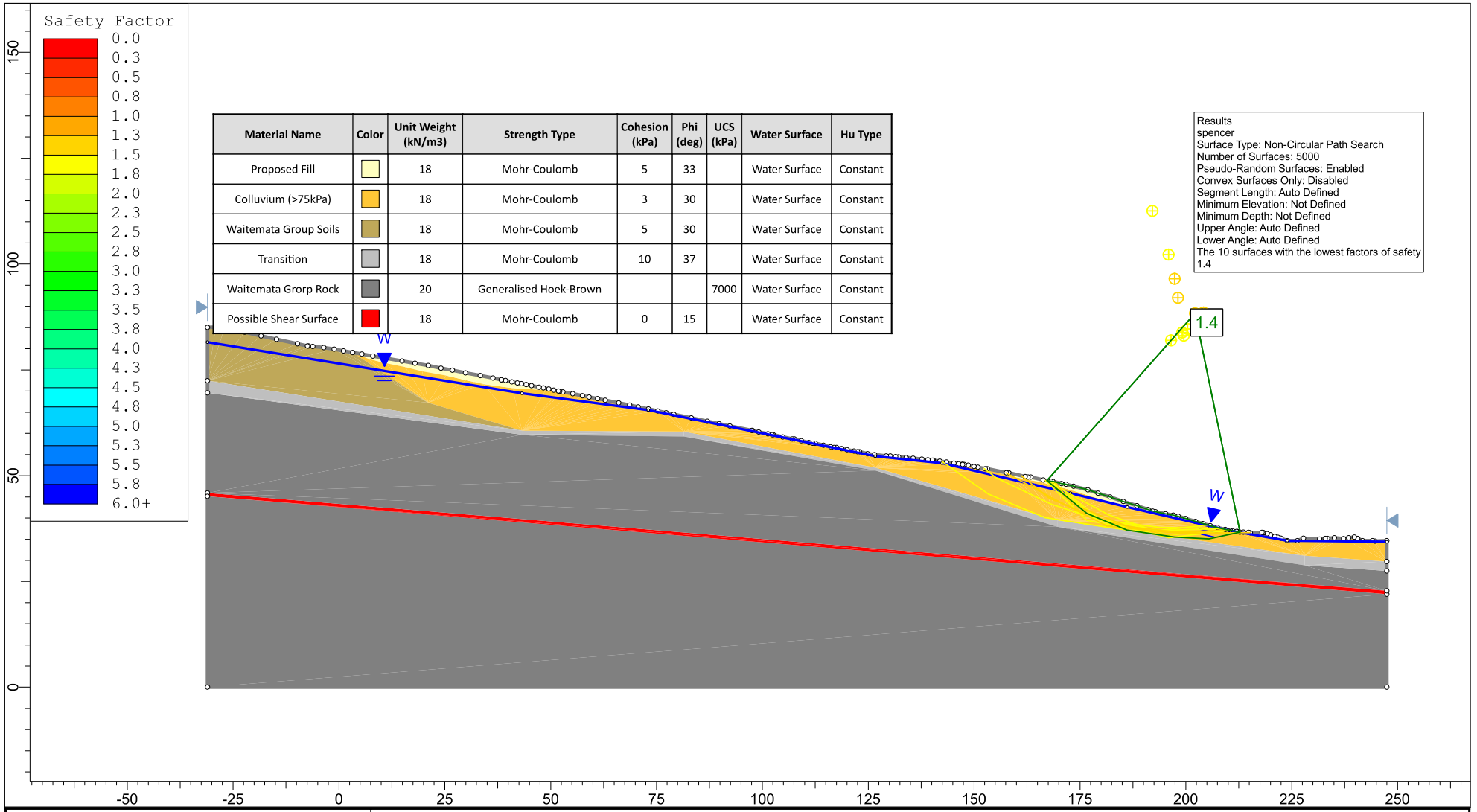
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 4, Section BB - Run 9				
Drawn By	PH	Scale	1:1250	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S4BB - Run 9.slim



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

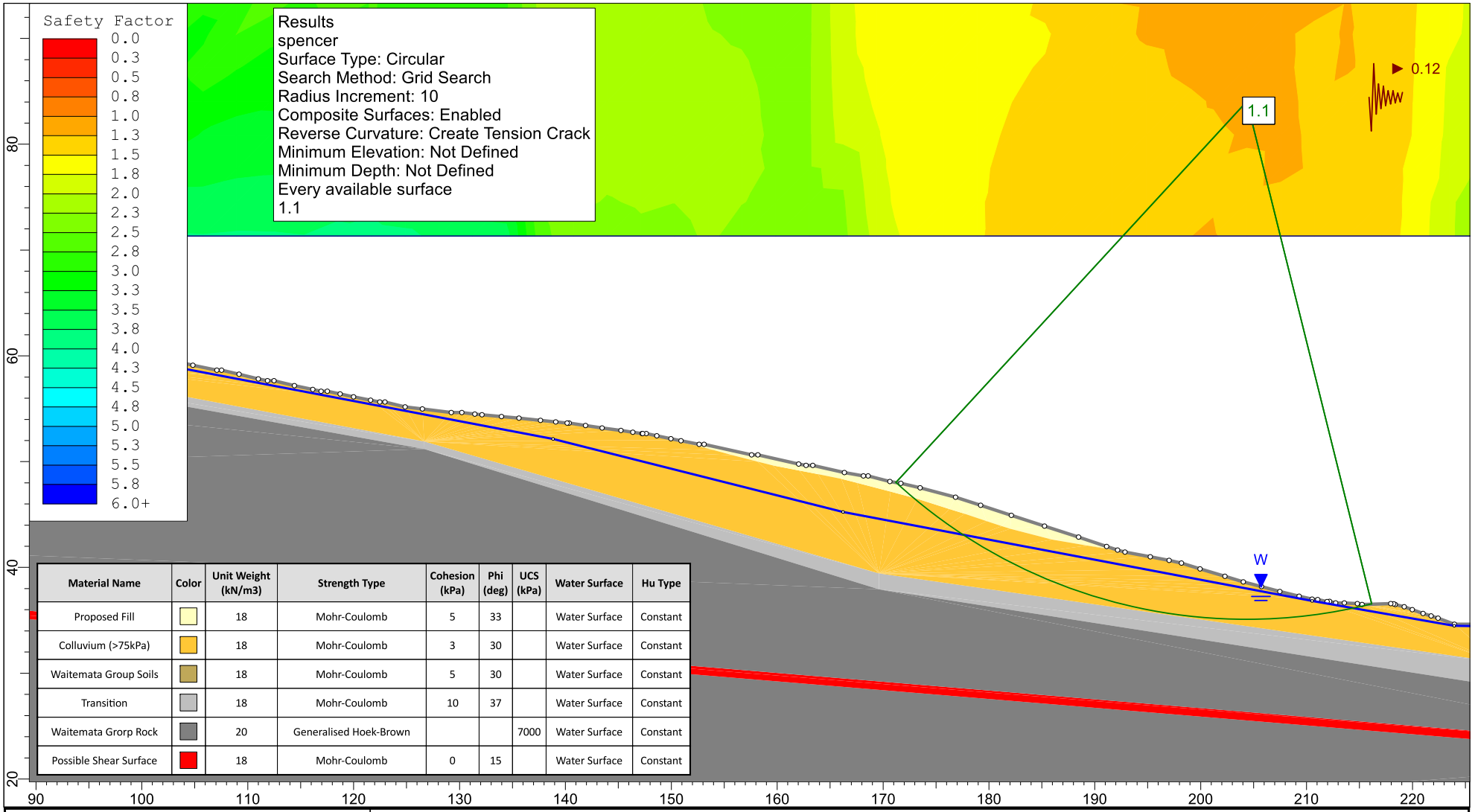
Results
spencer
Surface Type: Non-Circular Path Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Segment Length: Auto Defined
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Upper Angle: Auto Defined
Lower Angle: Auto Defined
The 10 surfaces with the lowest factors of safety
1.4

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 4, Section BB - Run 10				
Drawn By	PH	Scale	1:1250	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S4BB - Run 10.slim



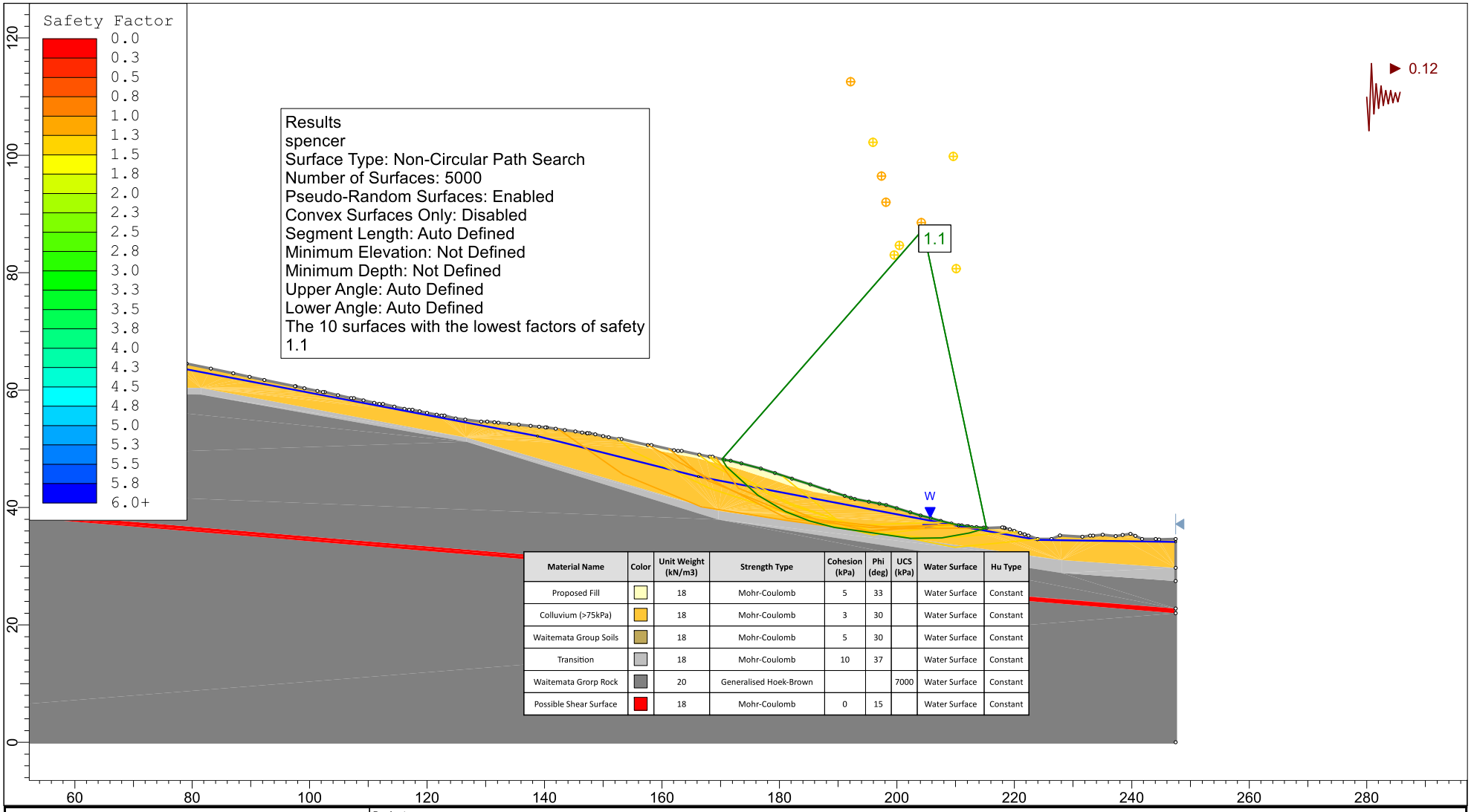
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 4, Section BB - Run 11				
Drawn By	PH	*Scale*	1:500	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S4BB - Run 11.slim



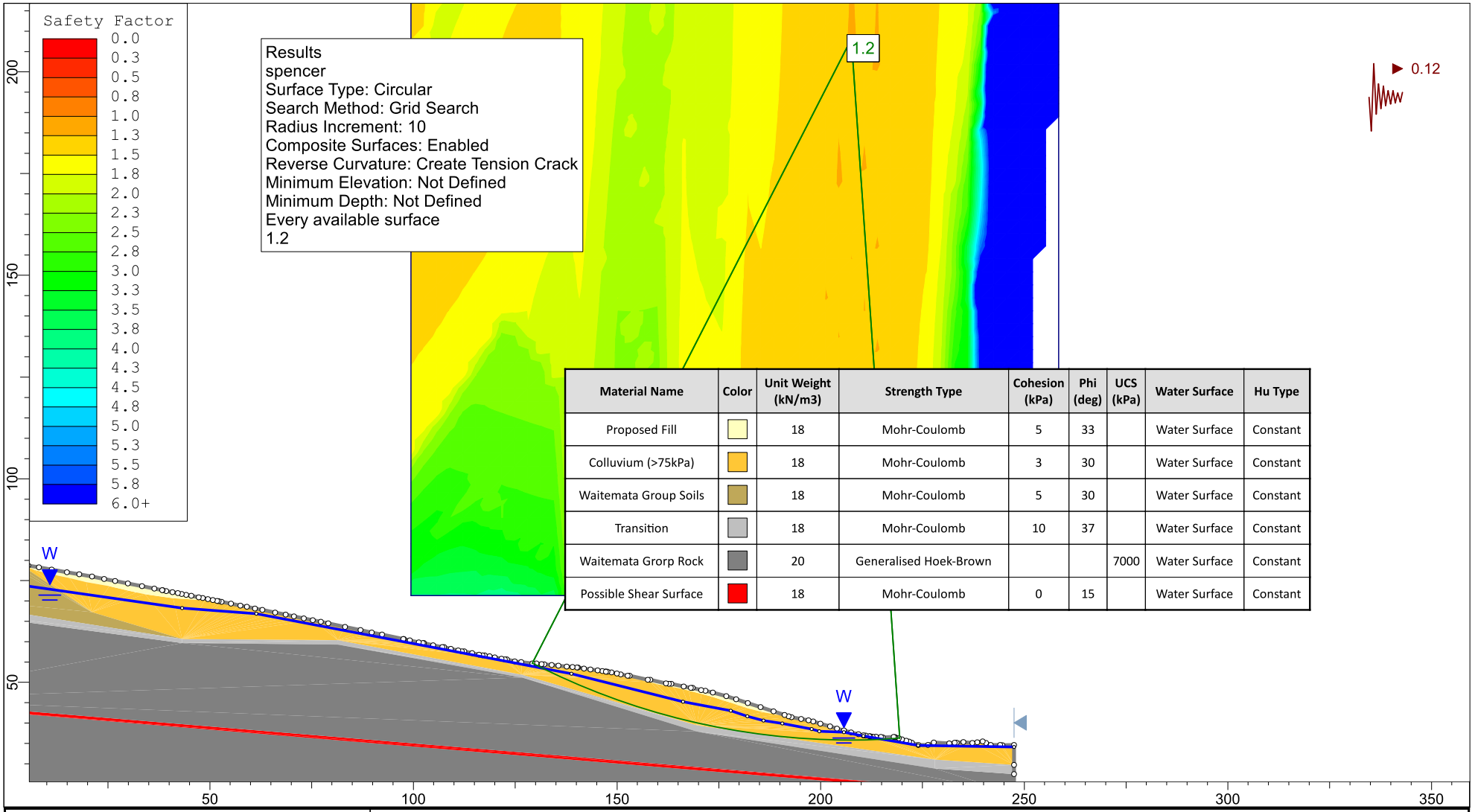
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 4, Section BB - Run 12				
Drawn By	PH	Scale	1:900	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S4BB - Run 12.slim



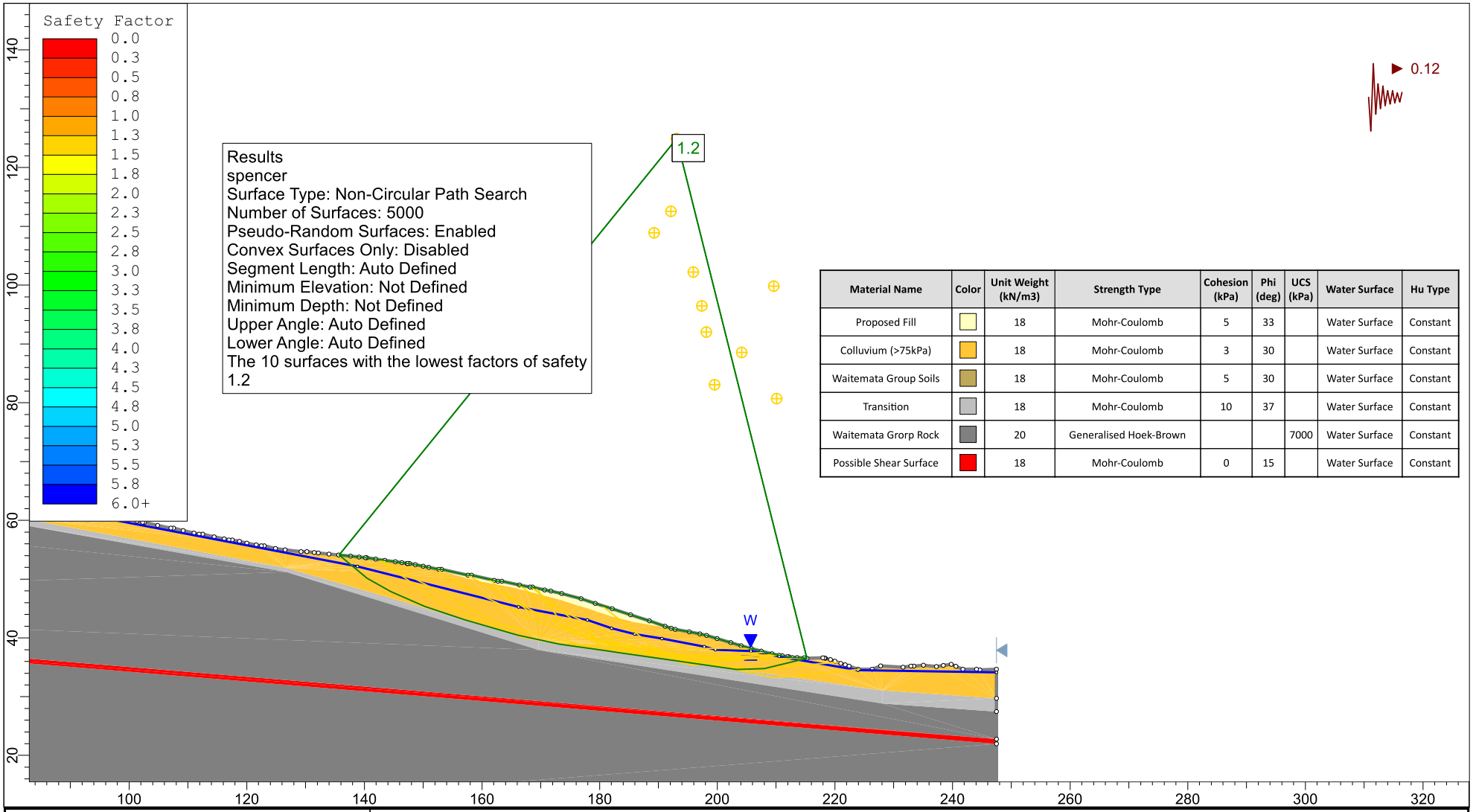
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 4, Section BB - Run 13				
Drawn By	PH	Scale	1:1300	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S4BB - Run 13.slim



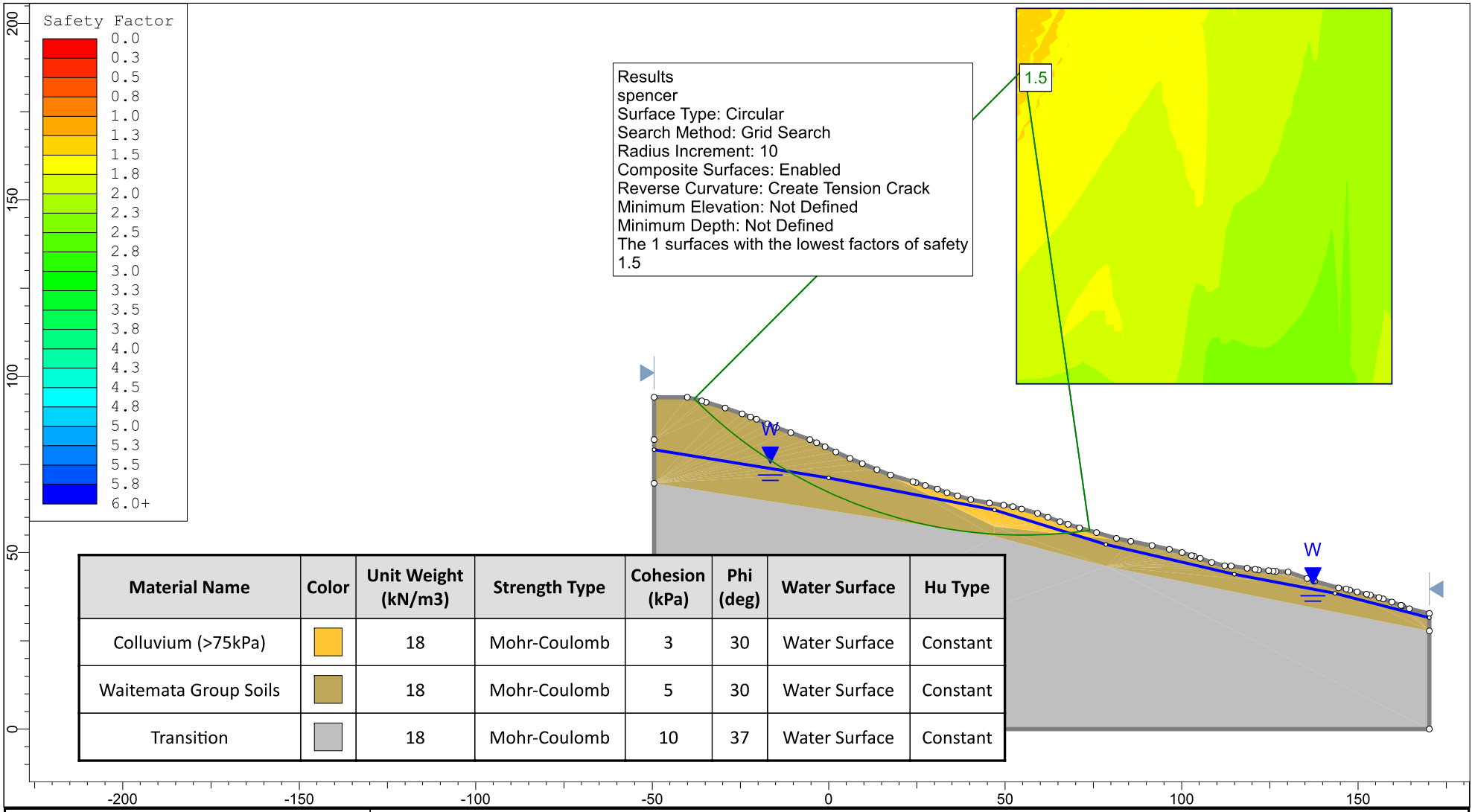
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 4, Section BB - Run 14				
Drawn By	PH	Scale	1:900	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S4BB - Run 14.slim



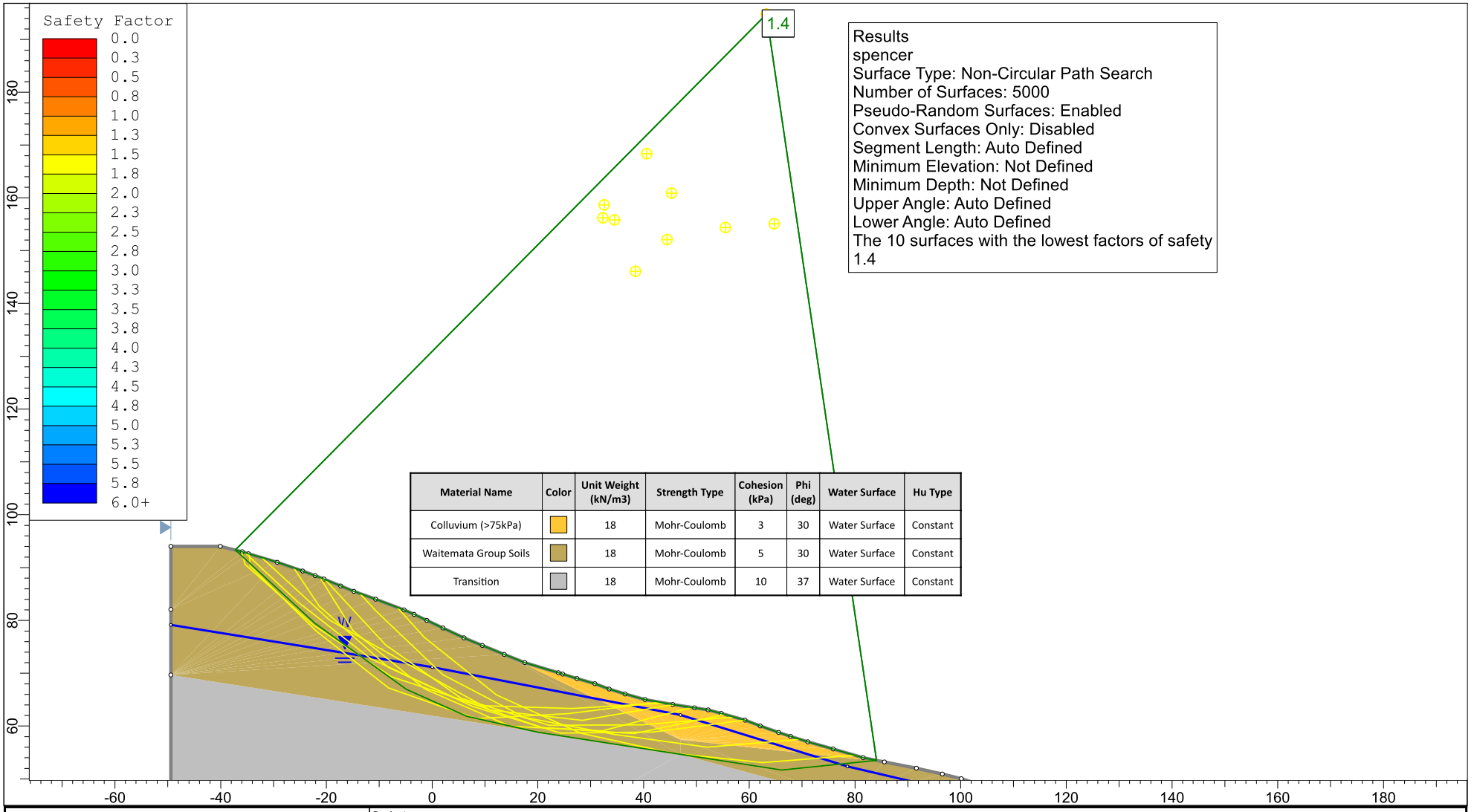
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section AA - Run 1				
Drawn By	PH	Scale	1:1500	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S5AA - Run 1.slim



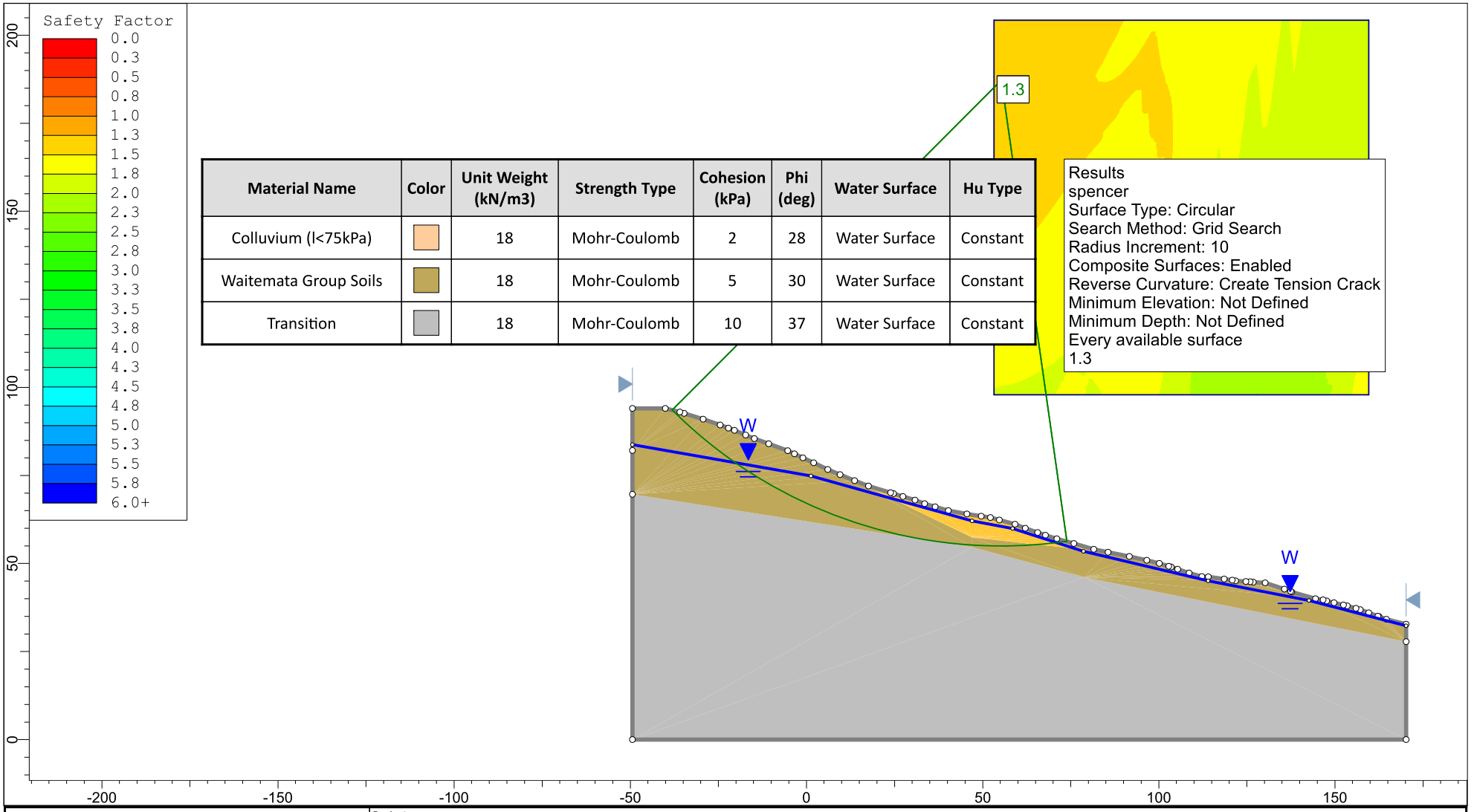
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section AA - Run 2				
Drawn By	PH	*Scale*	1:1000	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5AA - Run 2.slim



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

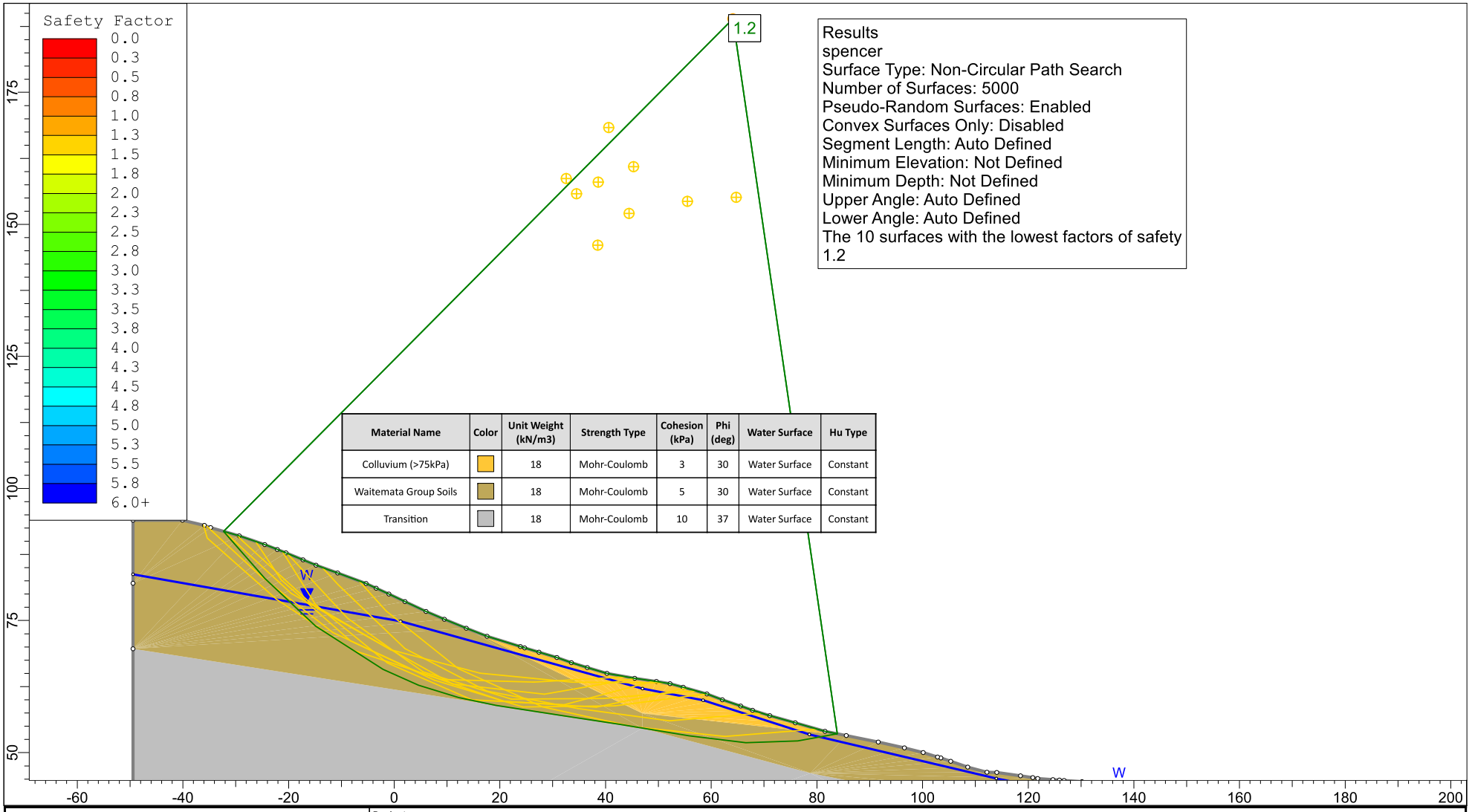
Results
spencer
Surface Type: Circular
Search Method: Grid Search
Radius Increment: 10
Composite Surfaces: Enabled
Reverse Curvature: Create Tension Crack
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Every available surface
1.3

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section AA - Run 3				
Drawn By	PH	Scale	1:1500	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S5AA - Run 3.slim



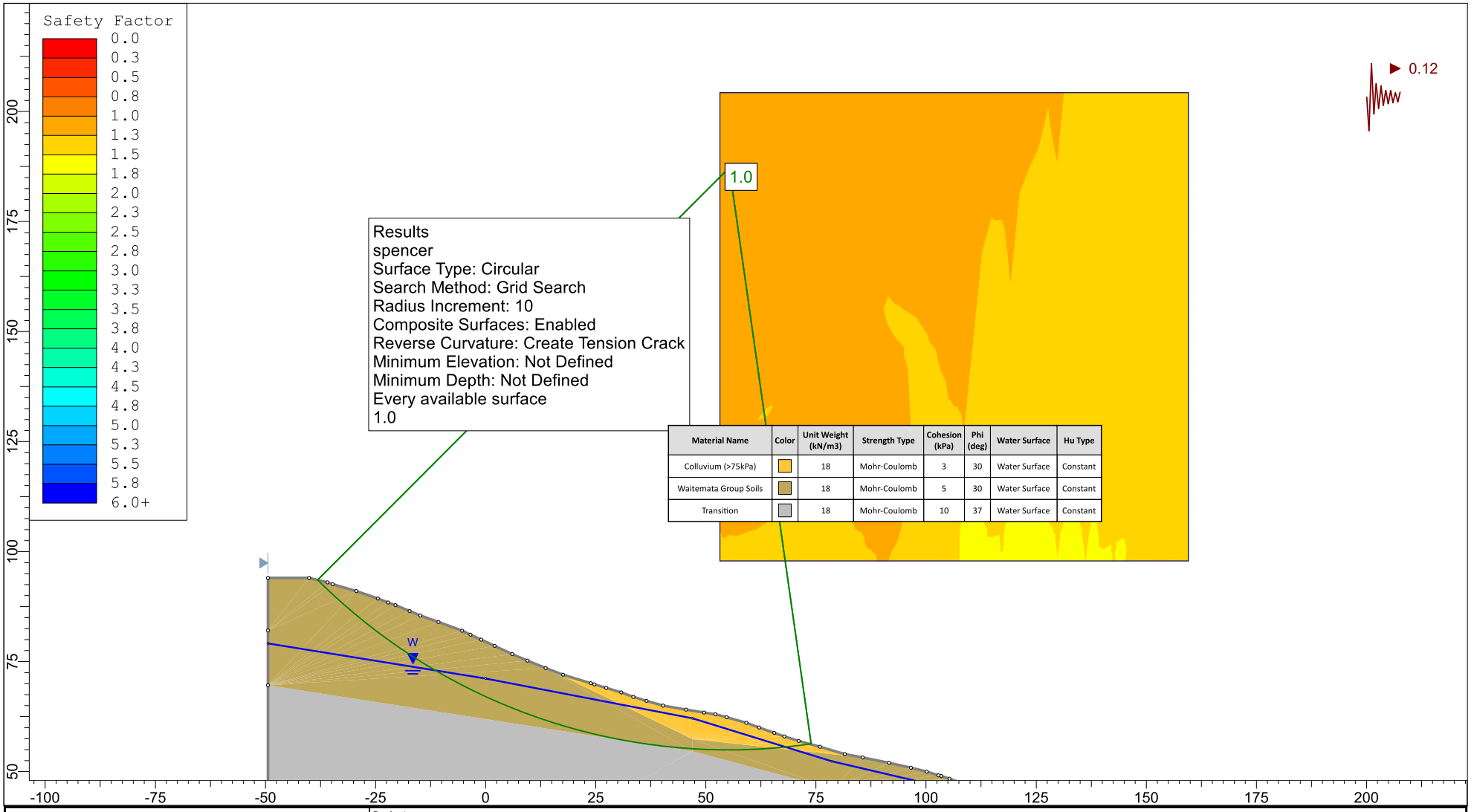
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section AA - Run 4				
Drawn By	PH	Scale	1:1000	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S5AA - Run 4.slim



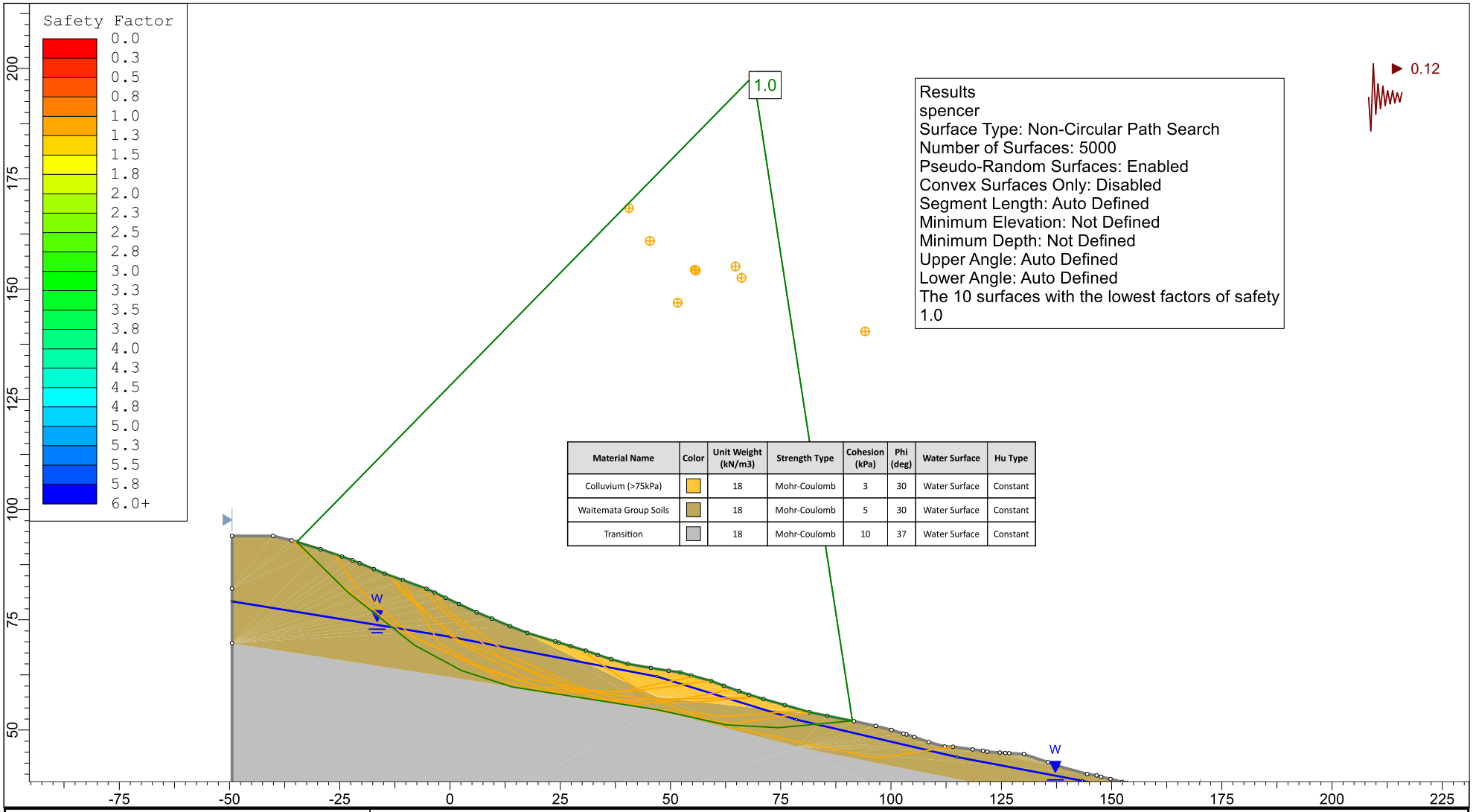
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section AA - Run 5				
Drawn By	PH	*Scale*	1:1200	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5AA - Run 5.slim



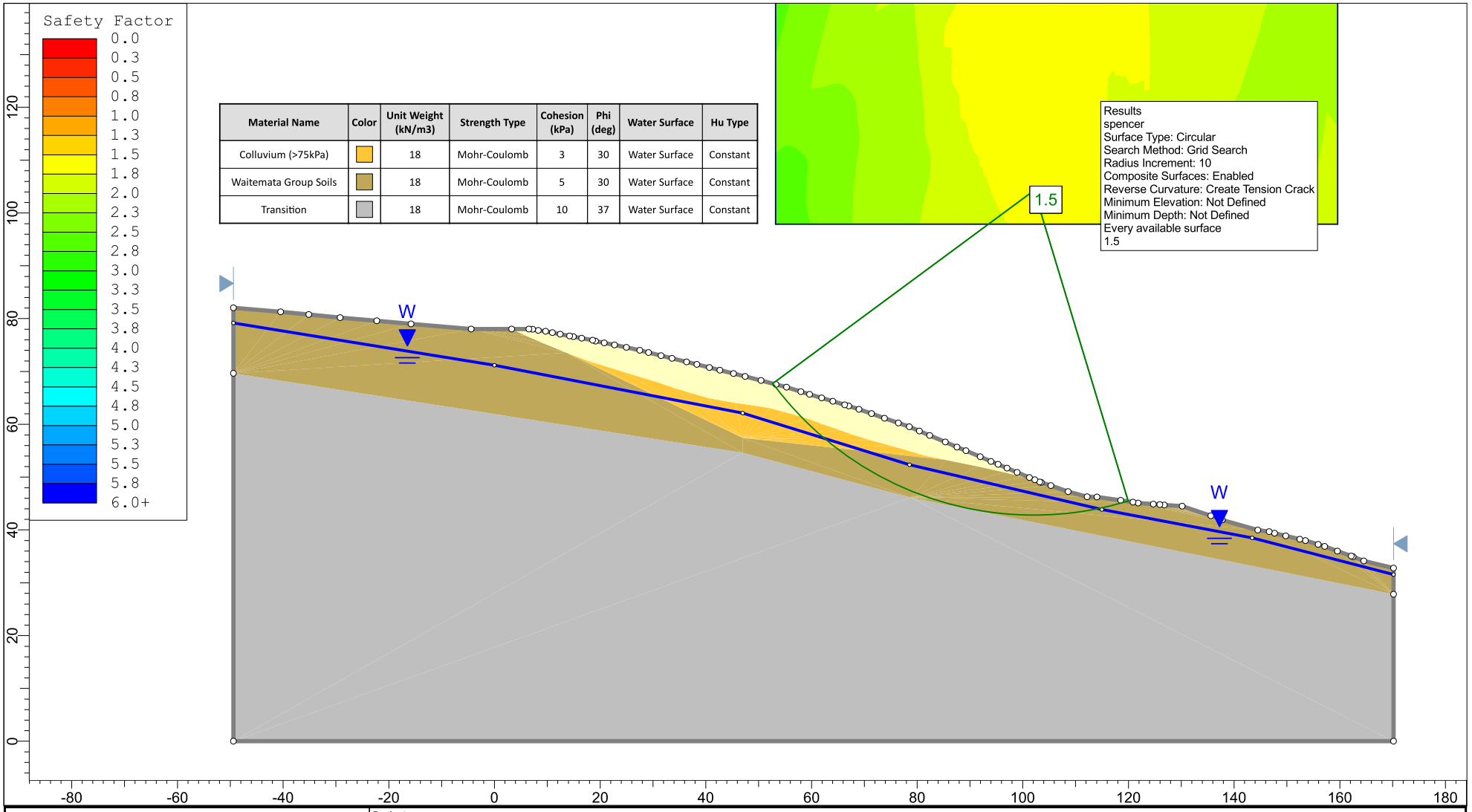
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section AA - Run 6				
Drawn By	PH	*Scale*	1:1200	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5AA - Run 6.slim

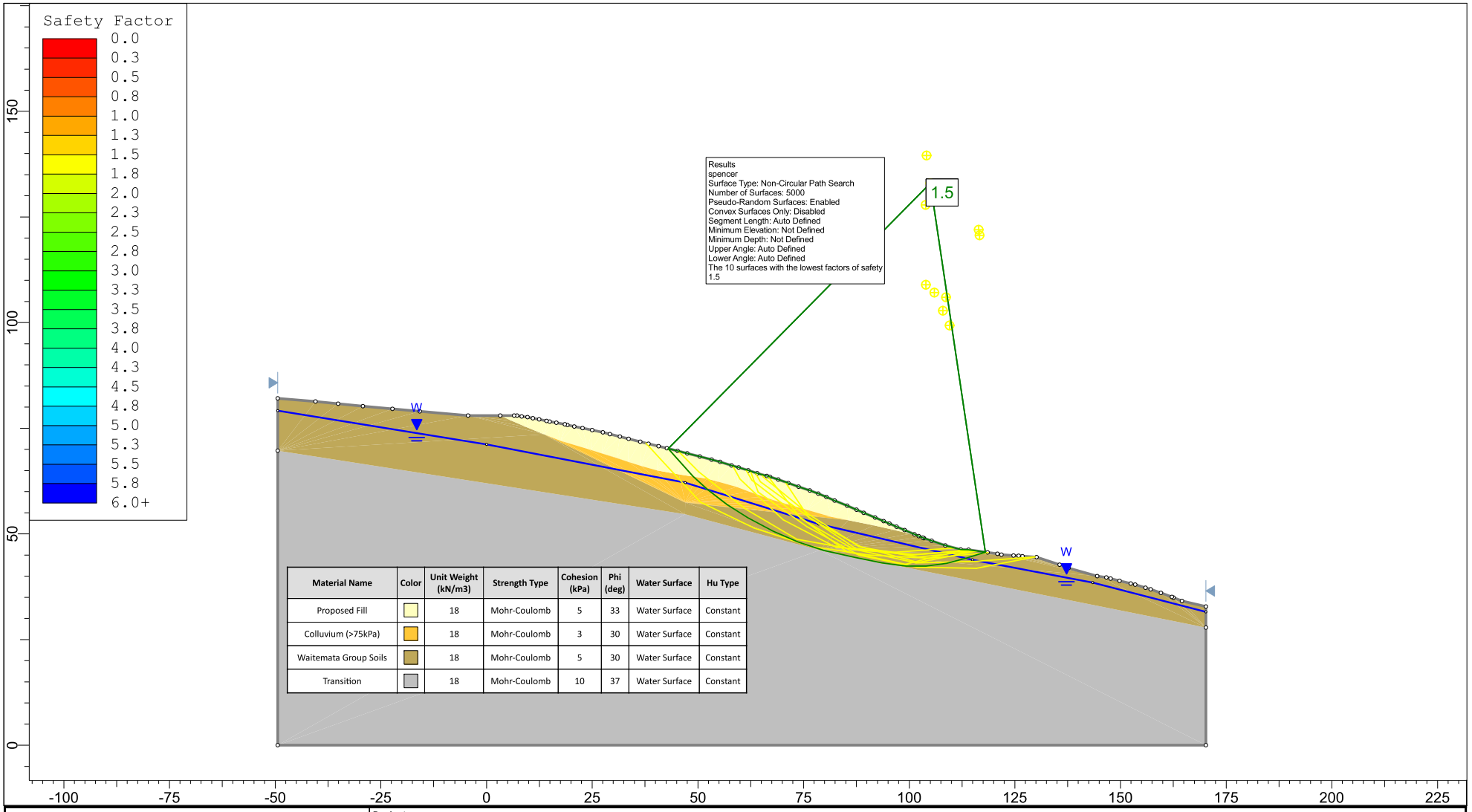


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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section AA - Run 7				
Drawn By	PH	Scale	1:1000	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S5AA - Run 7.slim



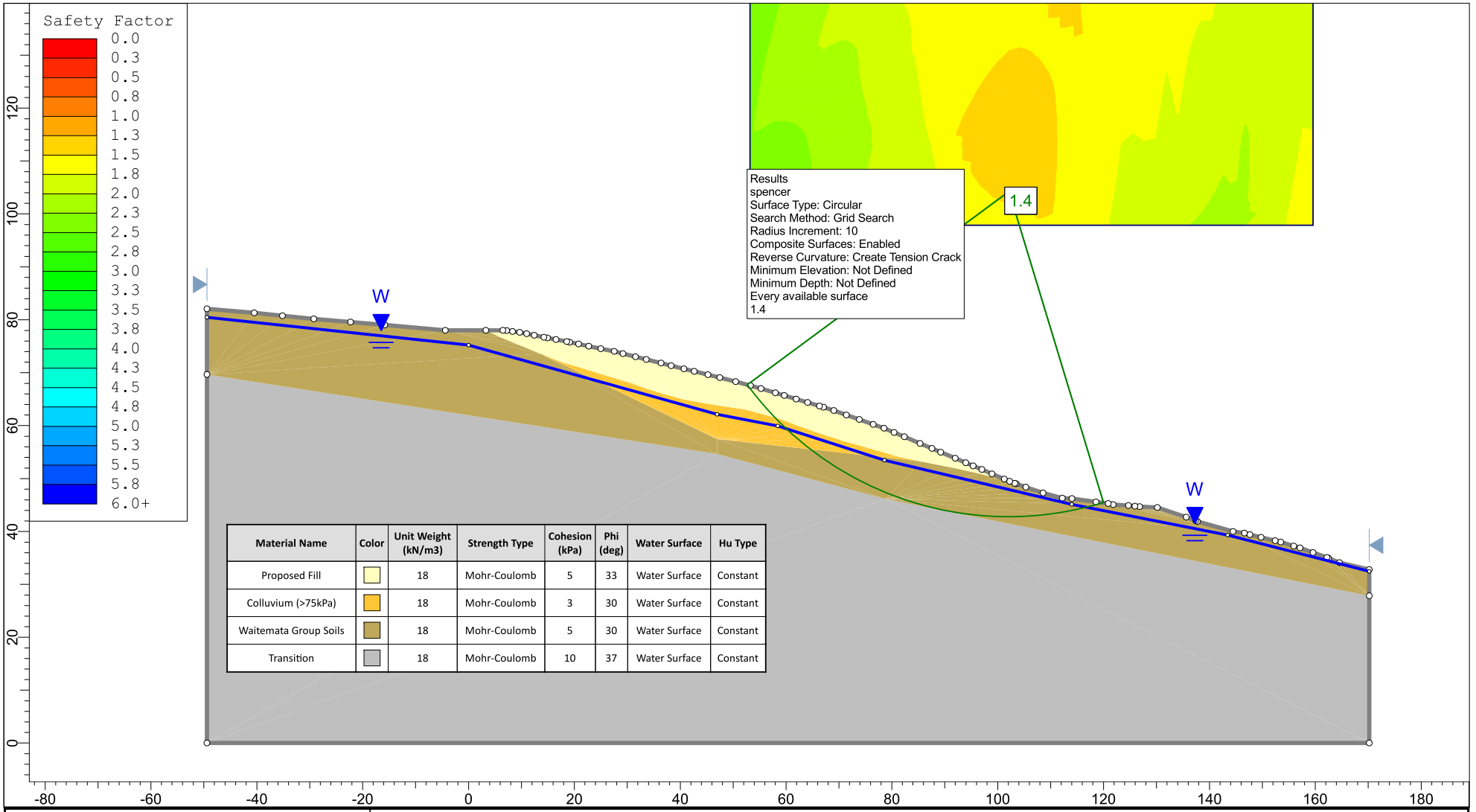
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section AA - Run 8				
Drawn By	PH	*Scale*	1:1250	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5AA - Run 8.slim



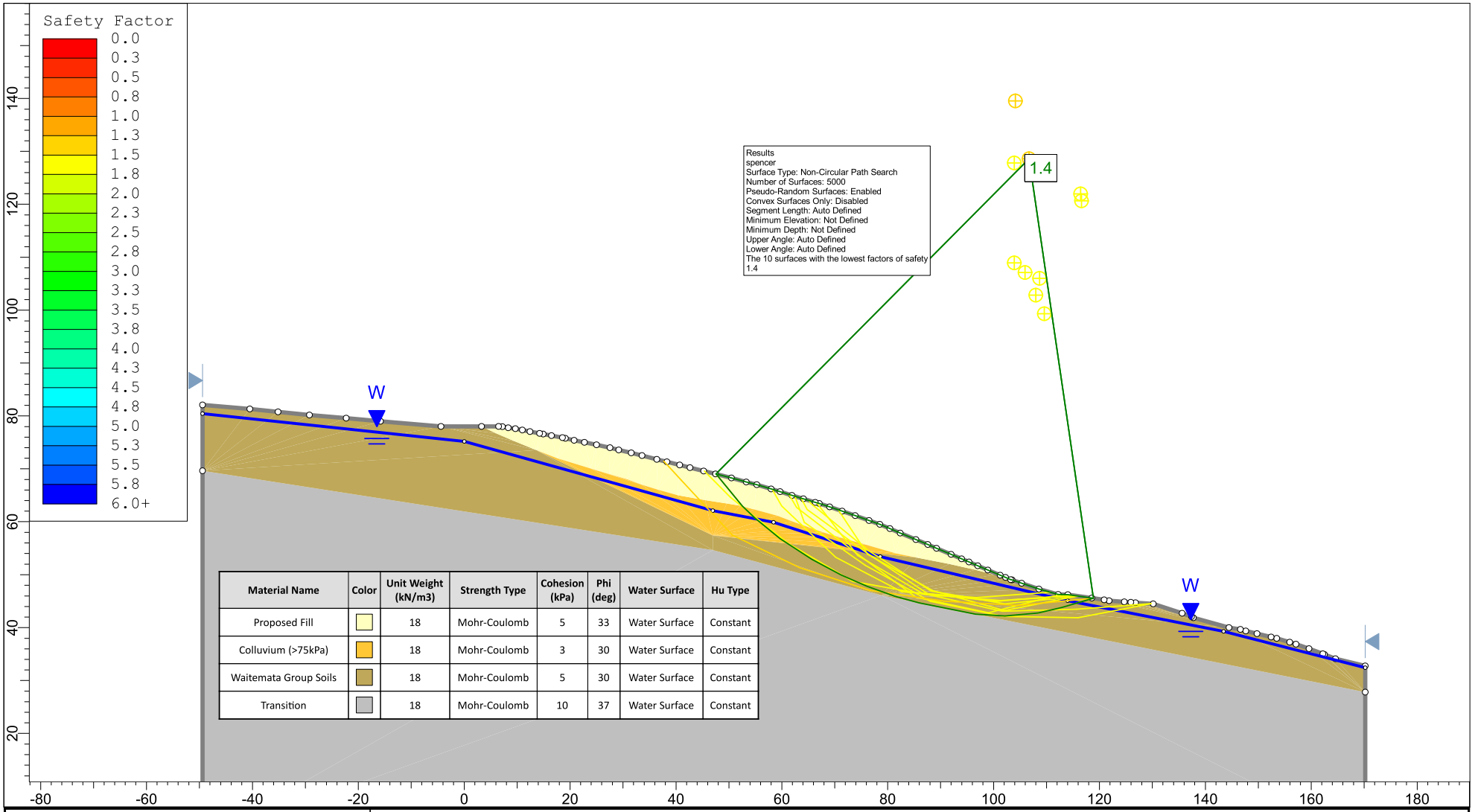
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section AA - Run 9				
Drawn By	PH	Scale	1:1000	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S5AA - Run 9.slim



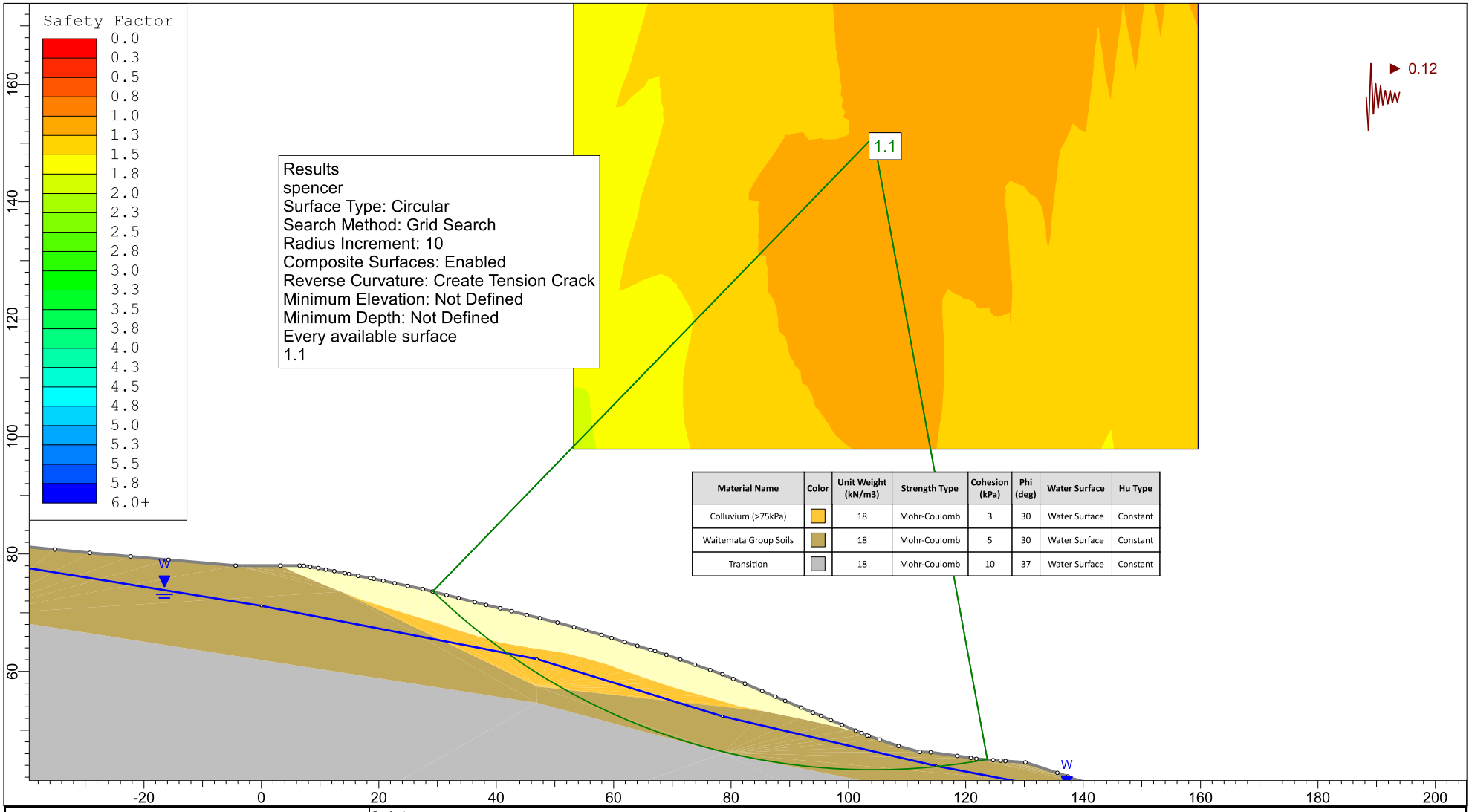
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 5, Section AA - Run 10		
Drawn By	PH	*Scale* 1:1000	*Company* KGA Geotechnical
Date	31/08/2015		*File Name* 7464 - S5AA - Run 10.slim



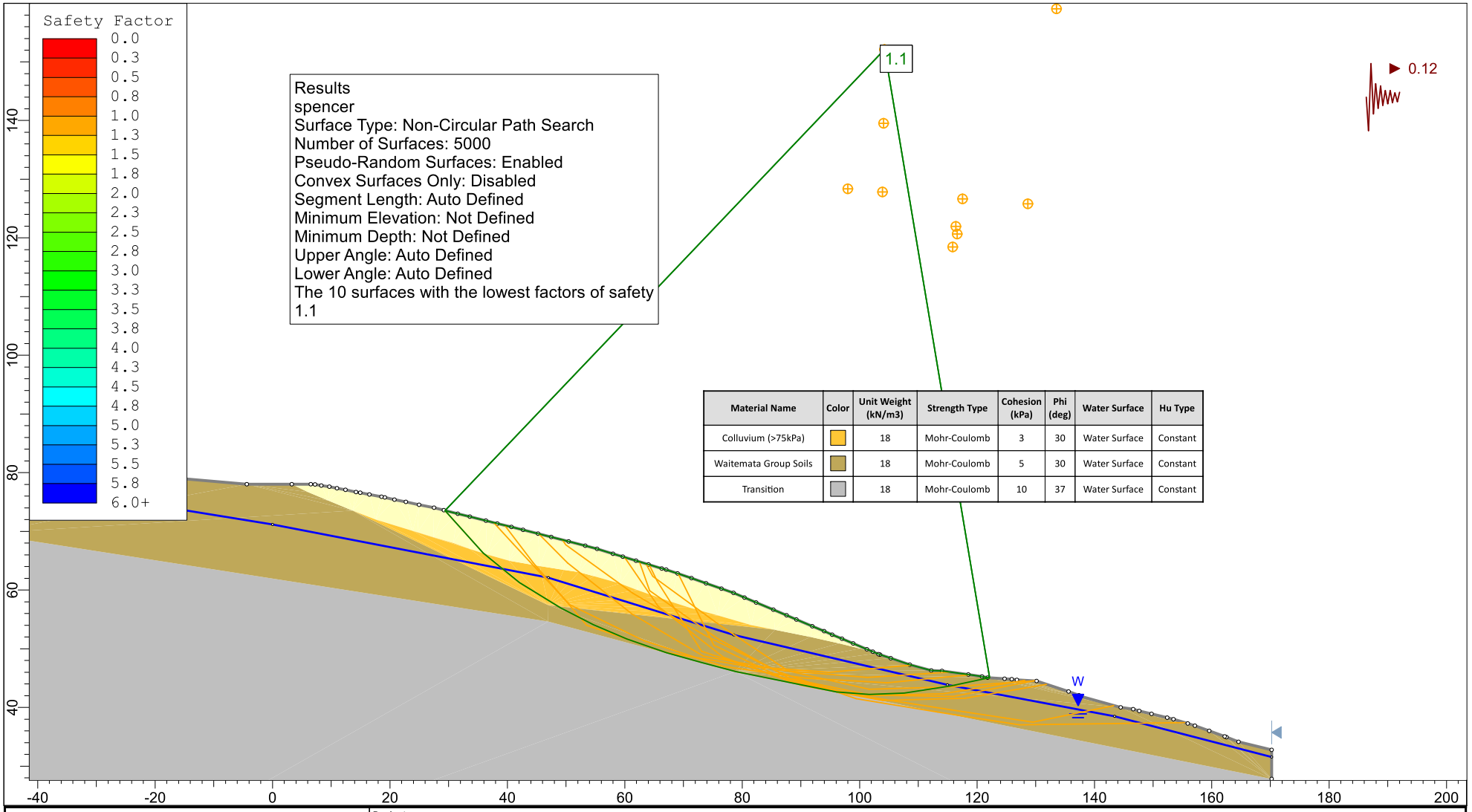
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section AA - Run 11				
Drawn By	PH	*Scale*	1:900	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5AA - Run 11.slim



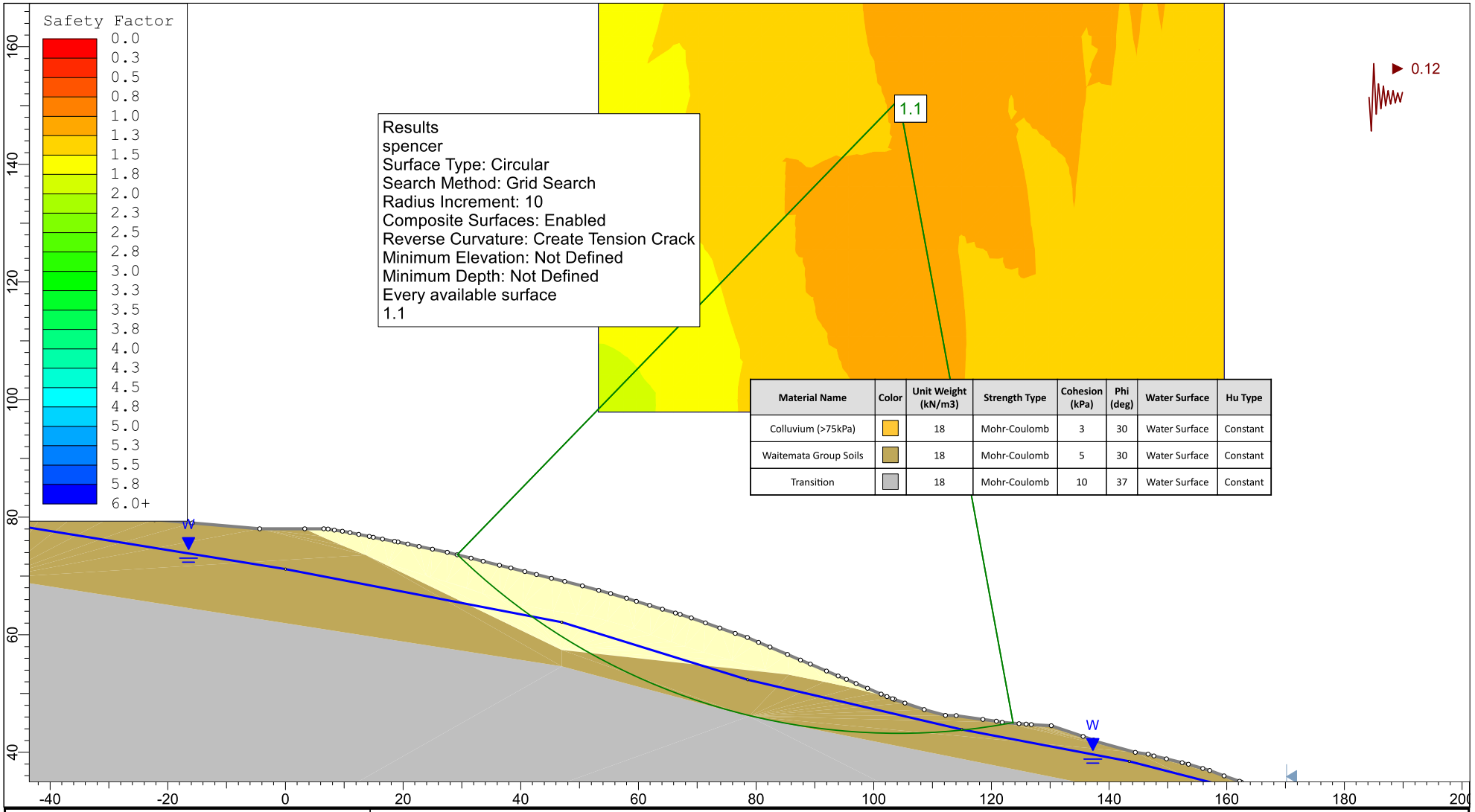
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section AA - Run 12				
Drawn By	PH	*Scale*	1:900	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5AA - Run 12.slim



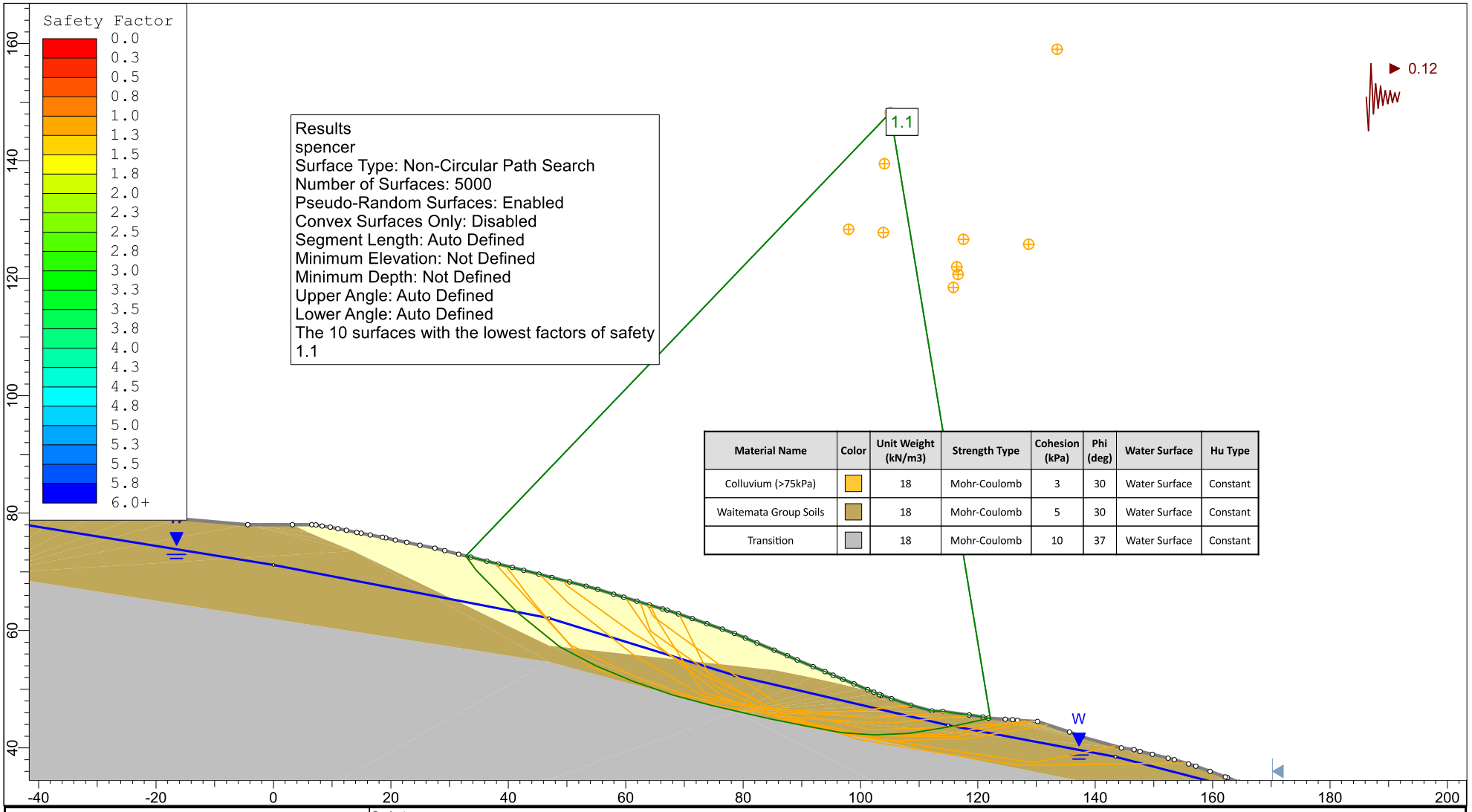
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section AA - Run 13				
Drawn By	PH	*Scale*	1:900	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5AA - Run 13.slim



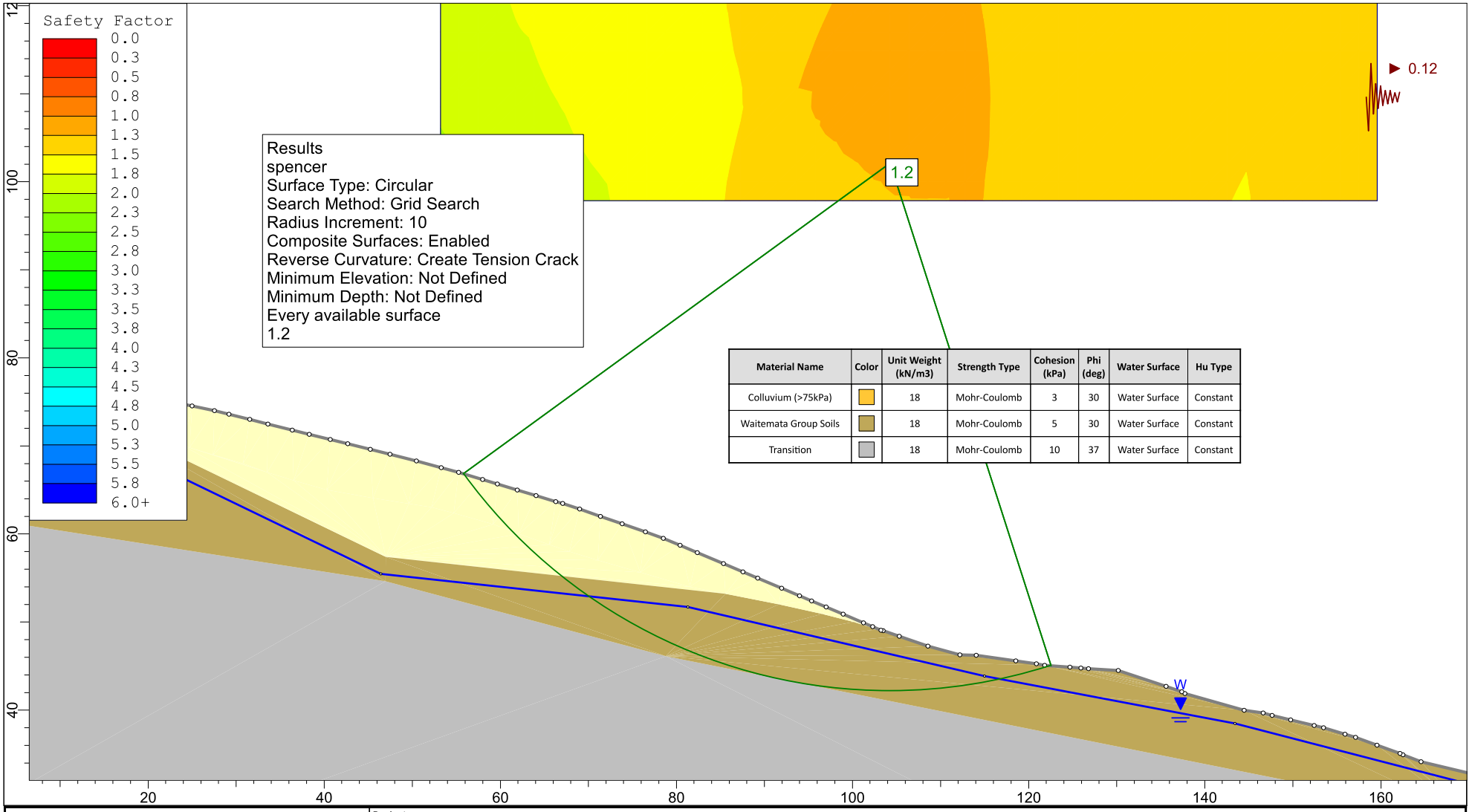
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section AA - Run 14				
Drawn By	PH	Scale	1:900	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S5AA - Run 14.slim



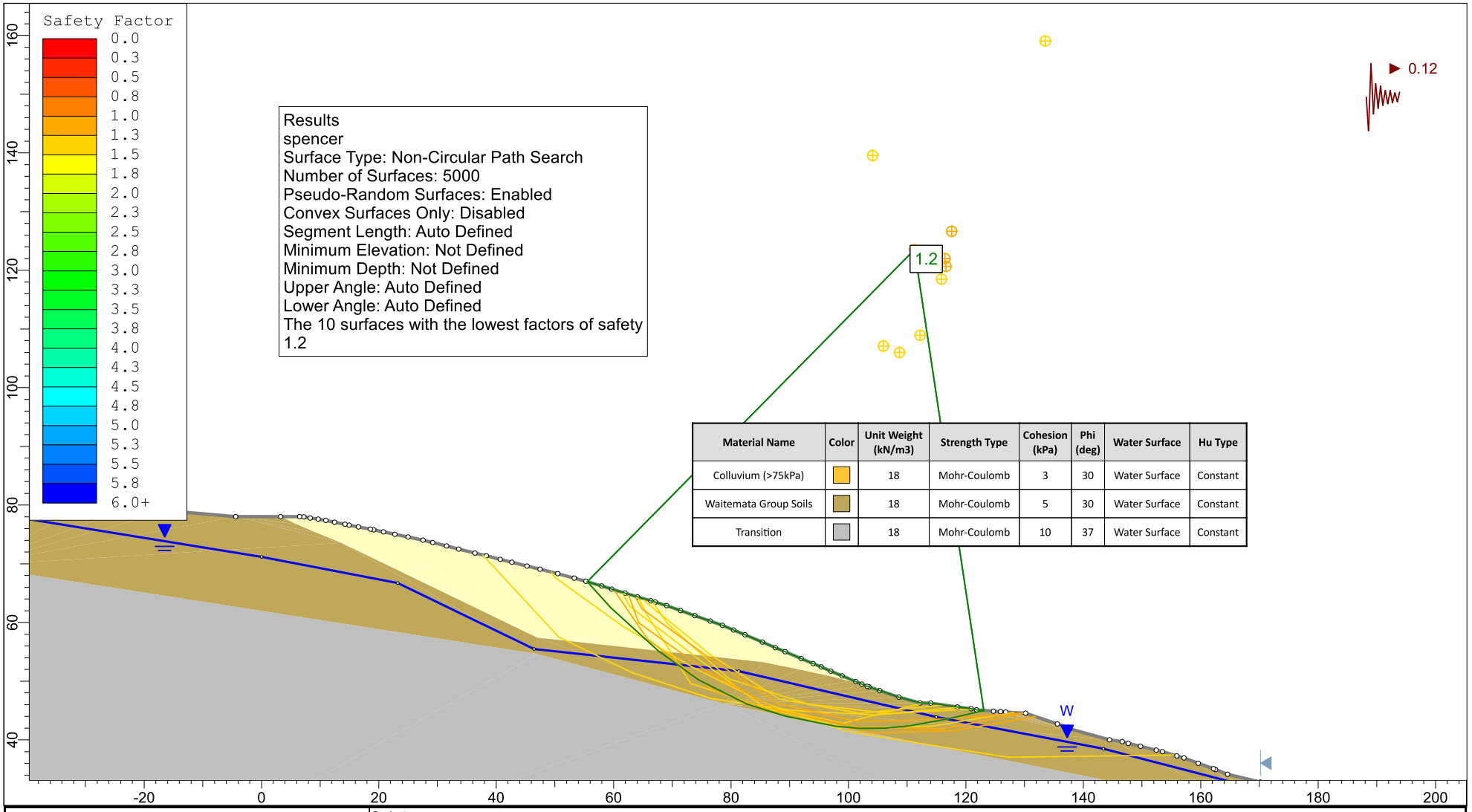
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section AA - Run 15				
Drawn By	PH	*Scale*	1:600	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5AA - Run 15.slim



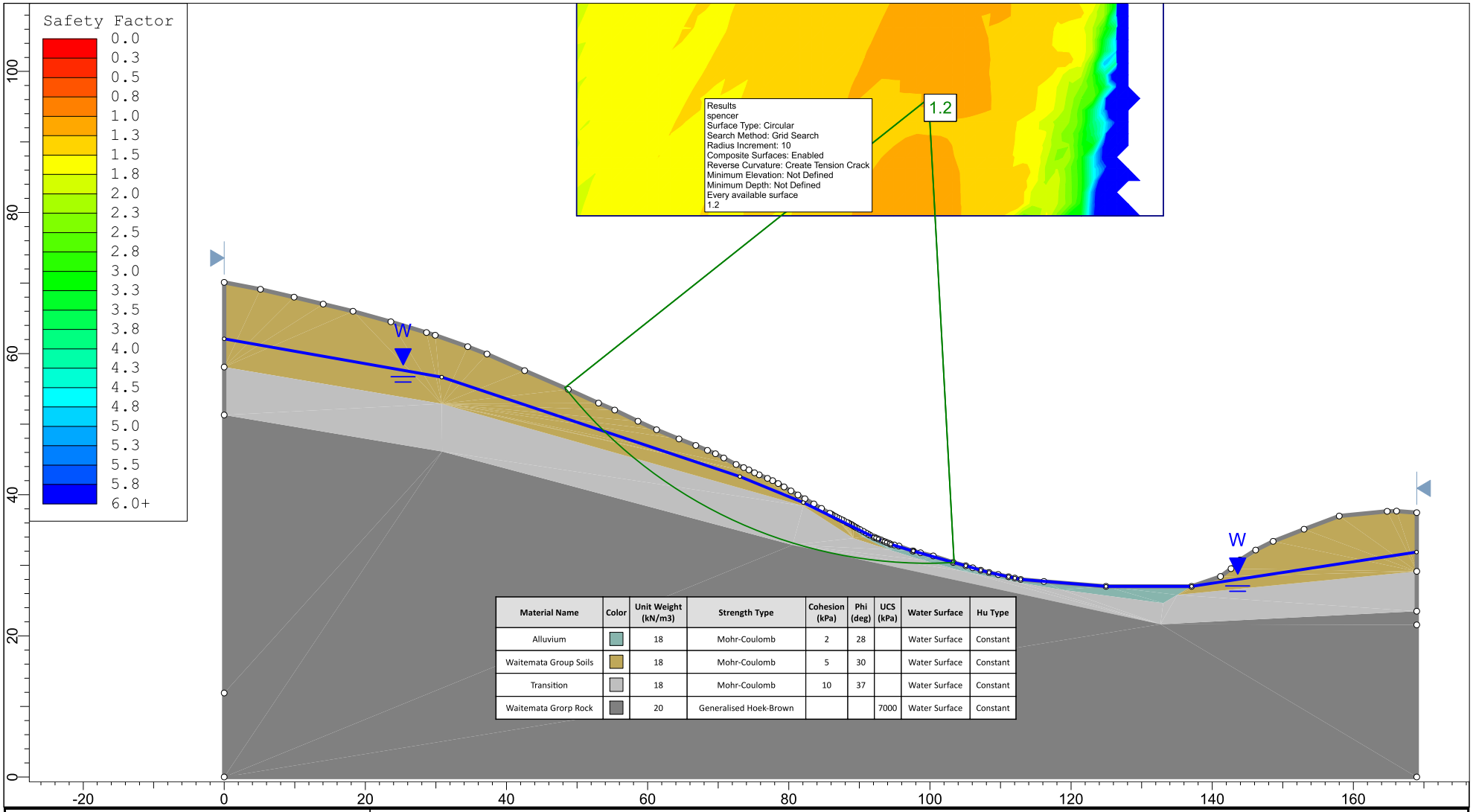
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section AA - Run 16				
Drawn By	PH	Scale	1:900	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S5AA - Run 16.slim



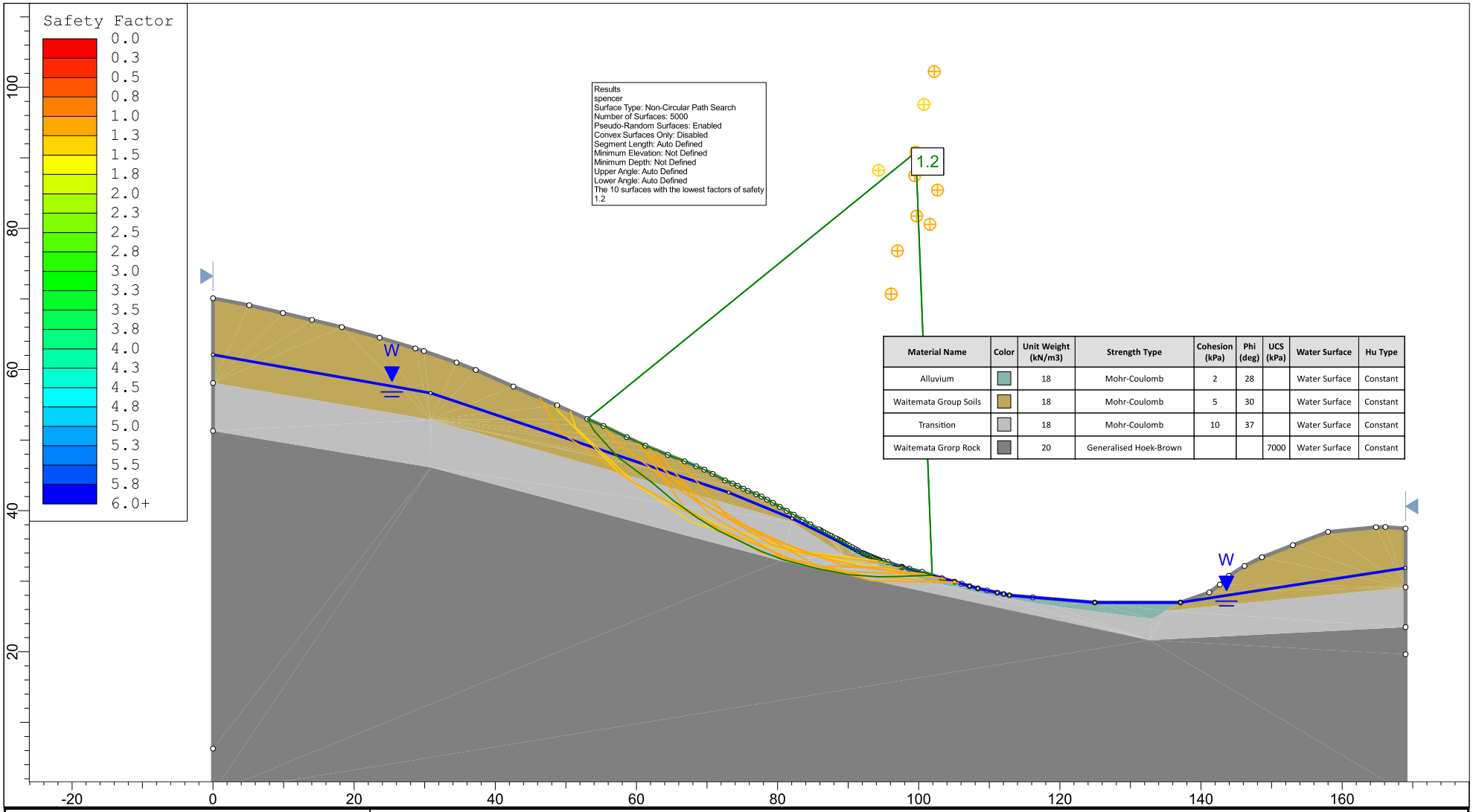
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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SLIDEINTERPRET 6.018

Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section BB - Run 1				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5BB - Run 1.slim

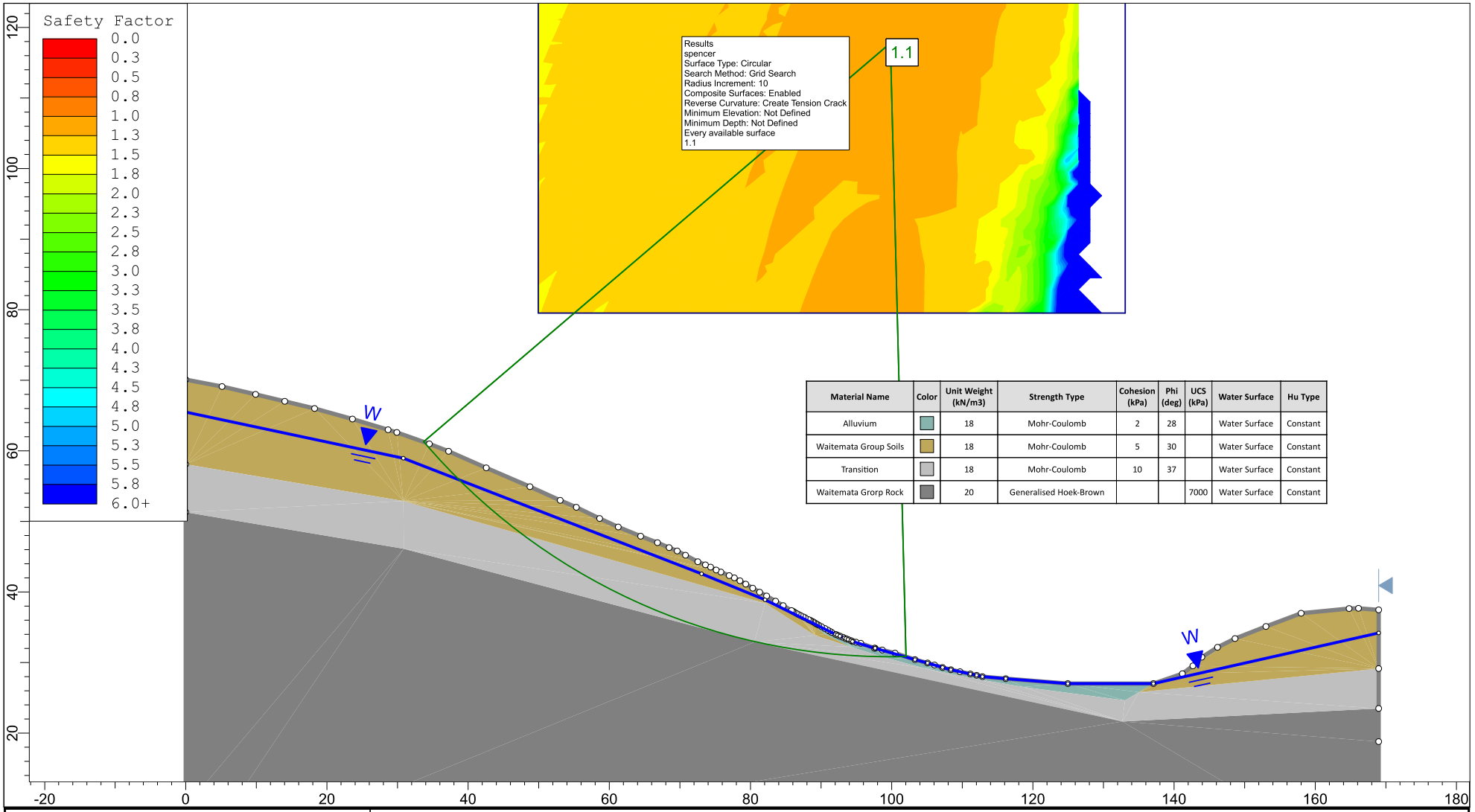


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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section BB - Run 2				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5BB - Run 2.slim



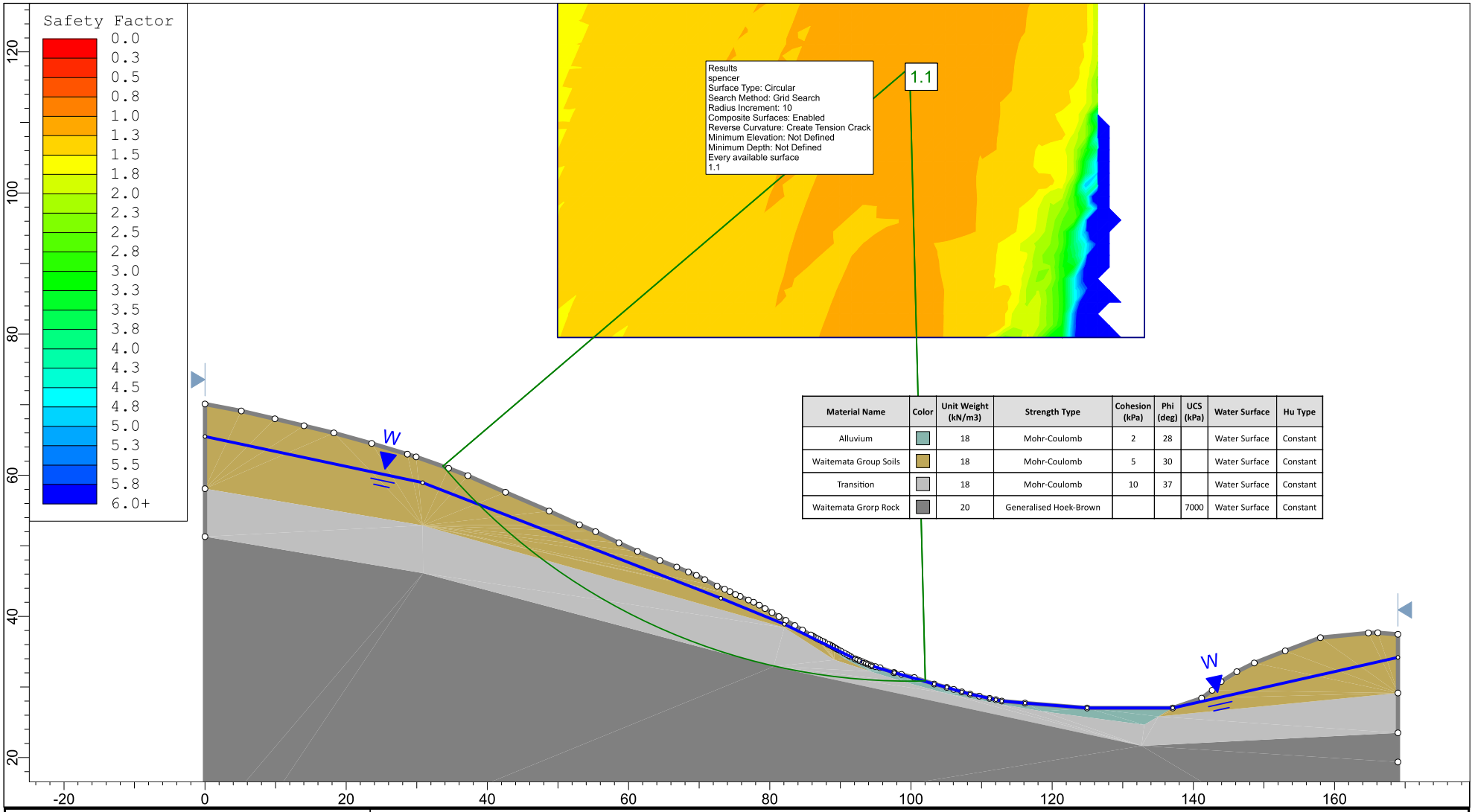
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section BB - Run 3				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5BB - Run 3.slim



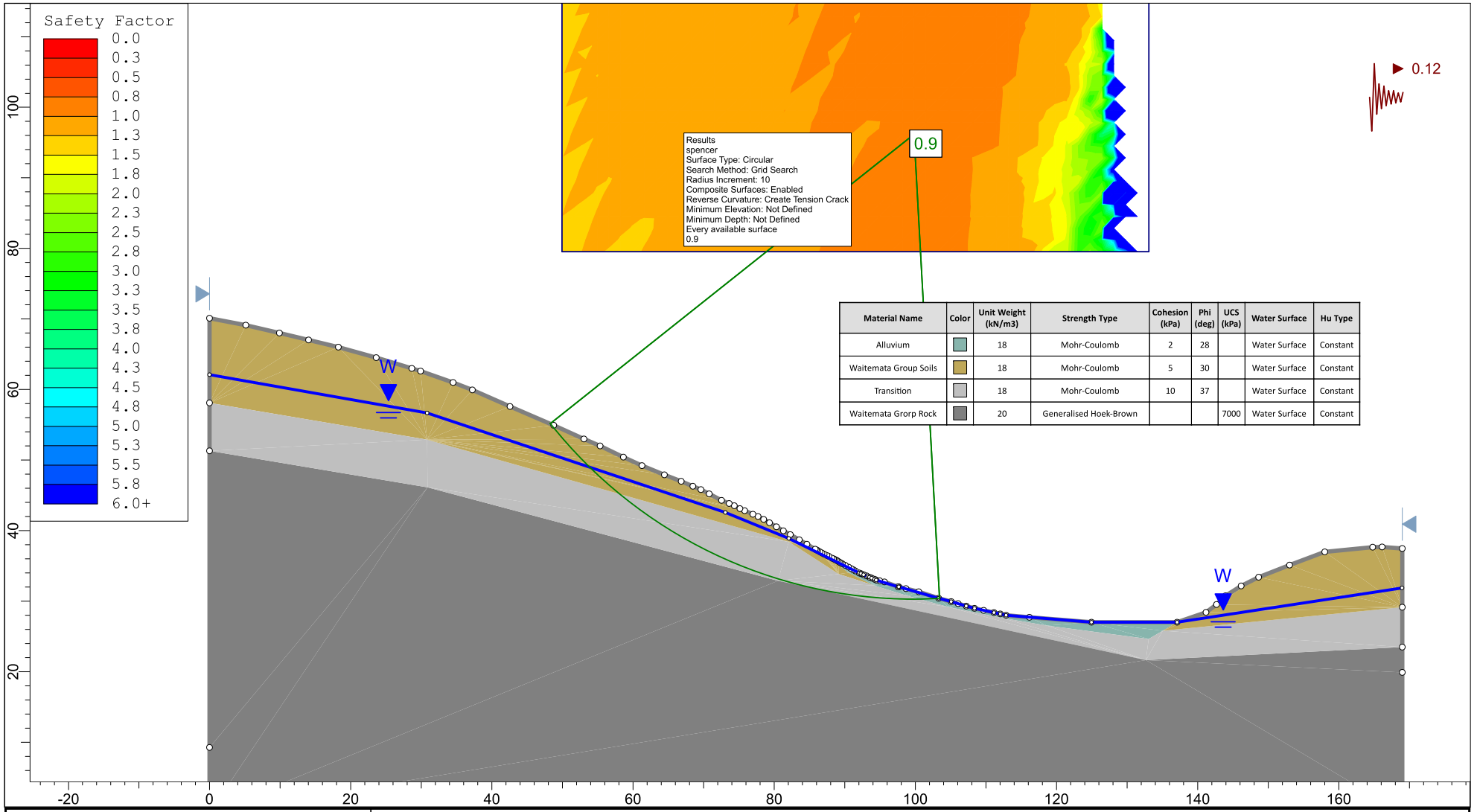
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section BB - Run 4				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5BB - Run 4.slim



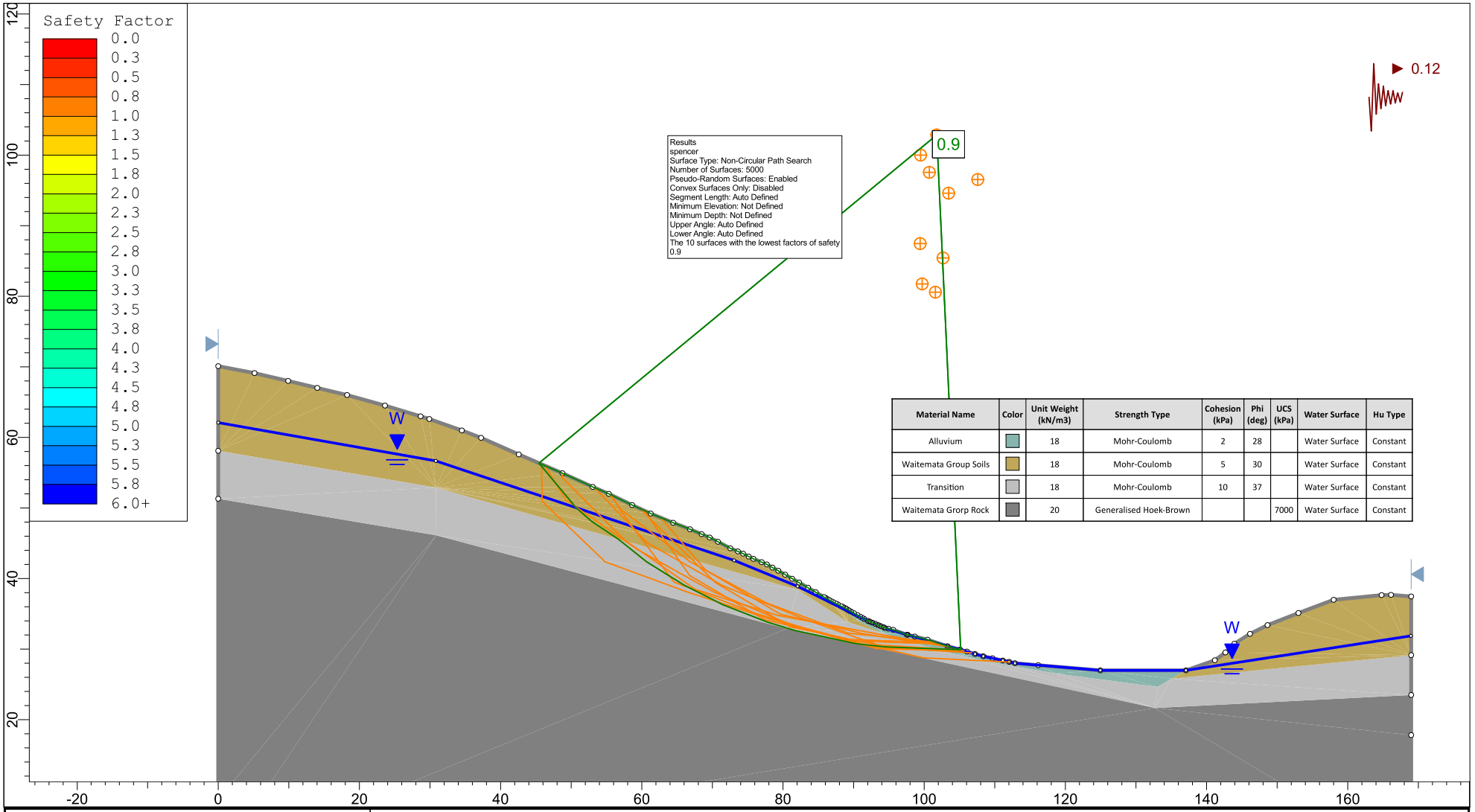
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section BB - Run 5				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5BB - Run 5.slim



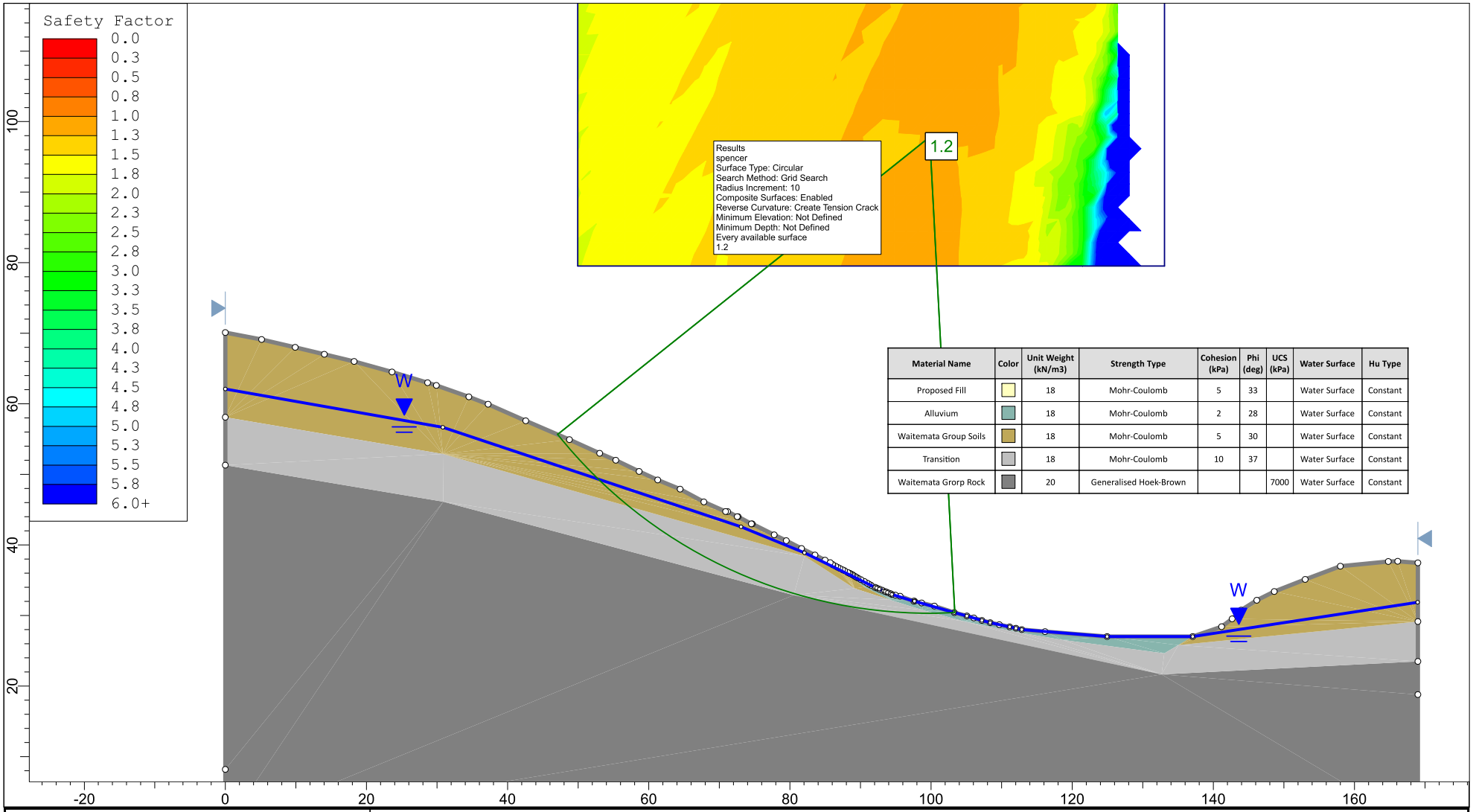
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section BB - Run 6				
Drawn By	PH	Scale	1:750	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S5BB - Run 6.slim



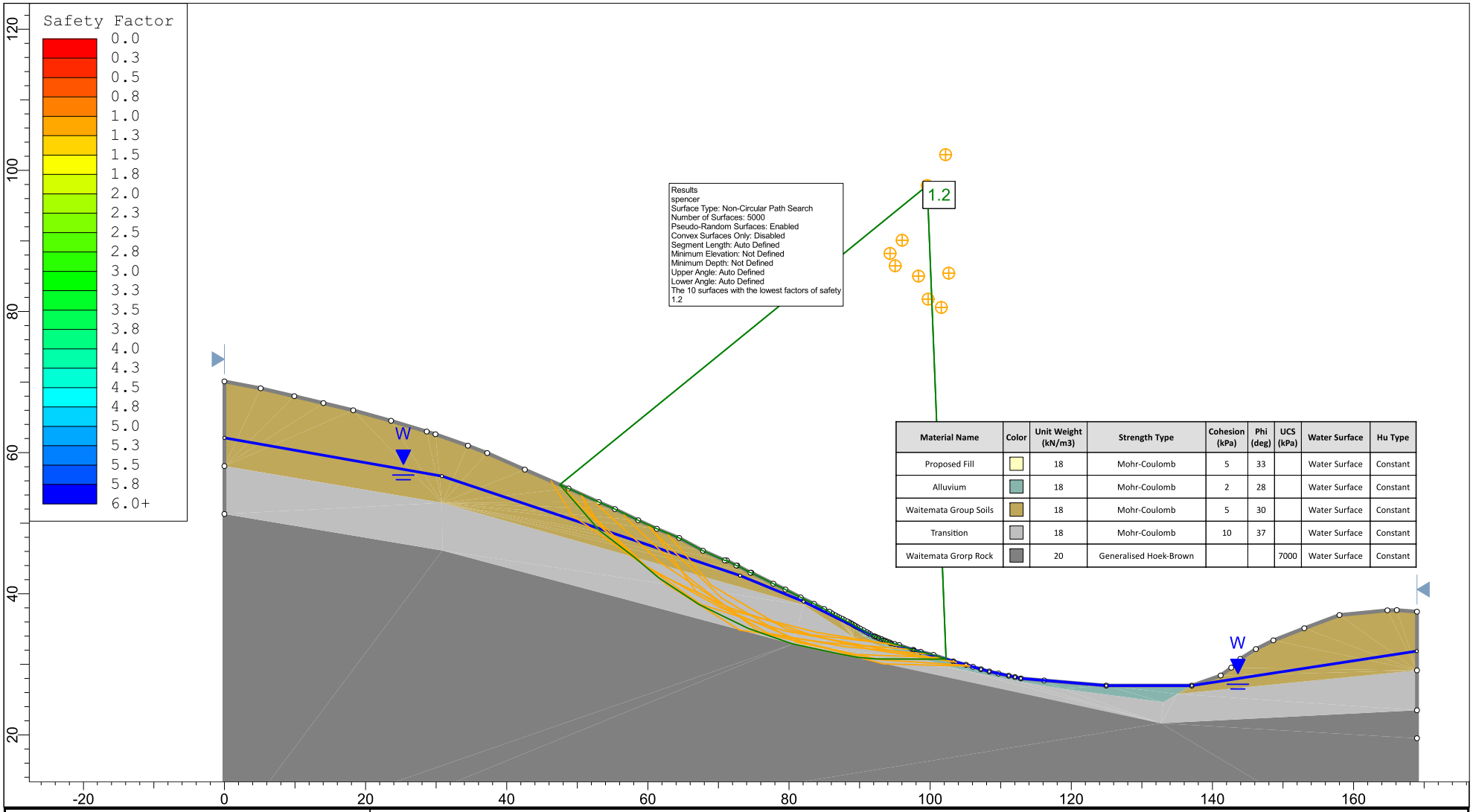
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section BB - Run 7				
Drawn By	PH	Scale	1:750	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S5BB - Run 7.slim



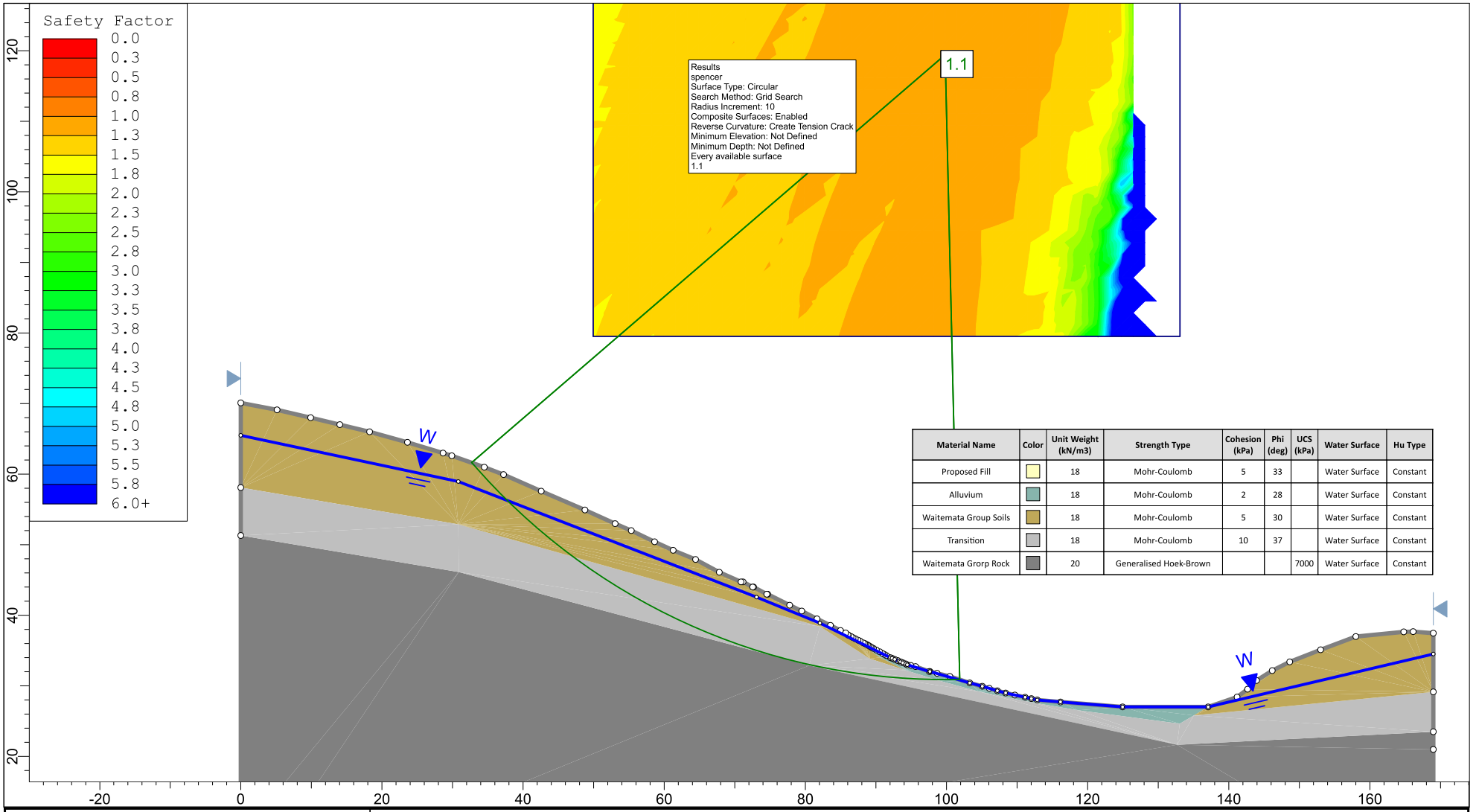
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section BB - Run 8				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5BB - Run 8.slim



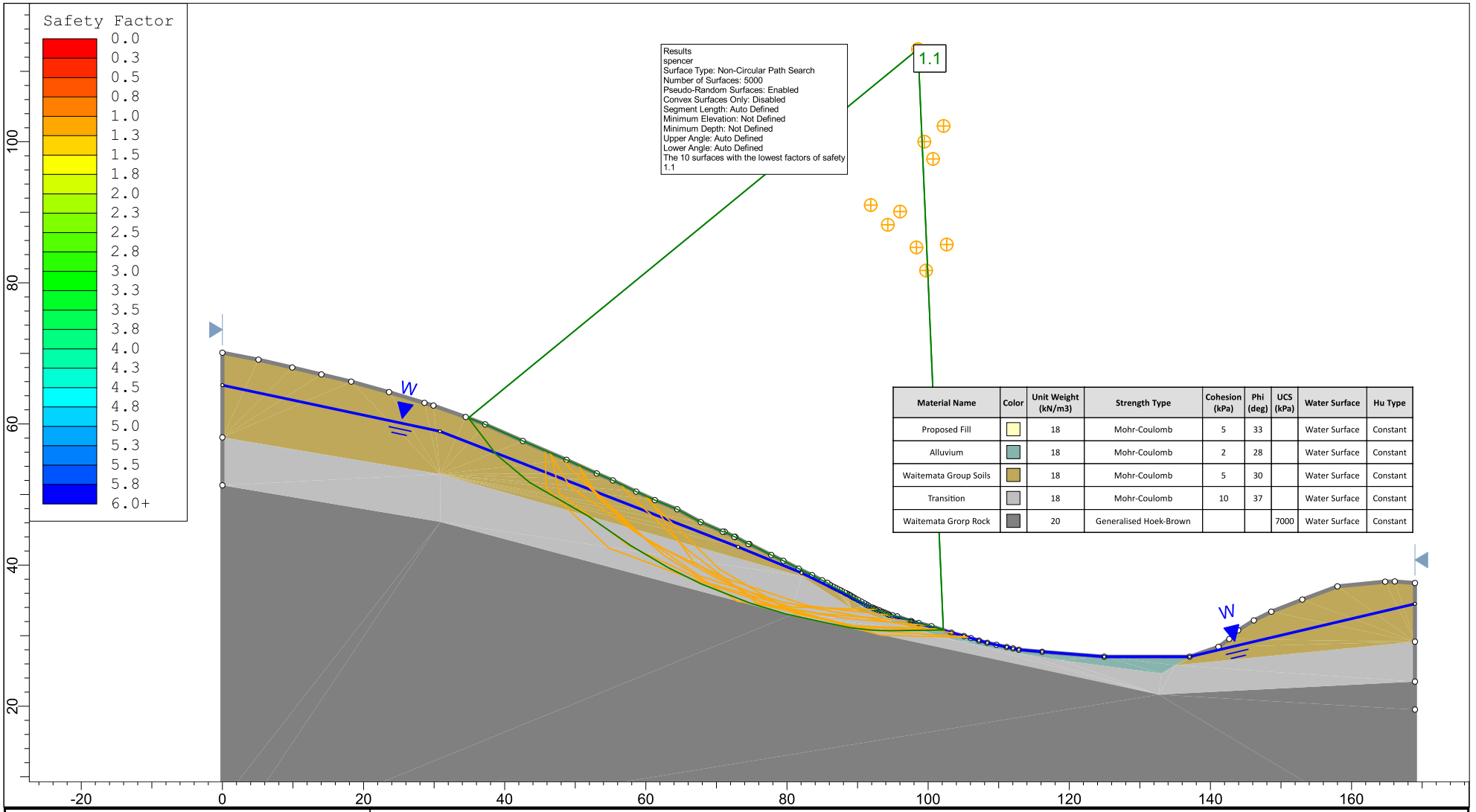
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section BB - Run 9				
Drawn By	PH	Scale	1:750	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S5BB - Run 9.slim



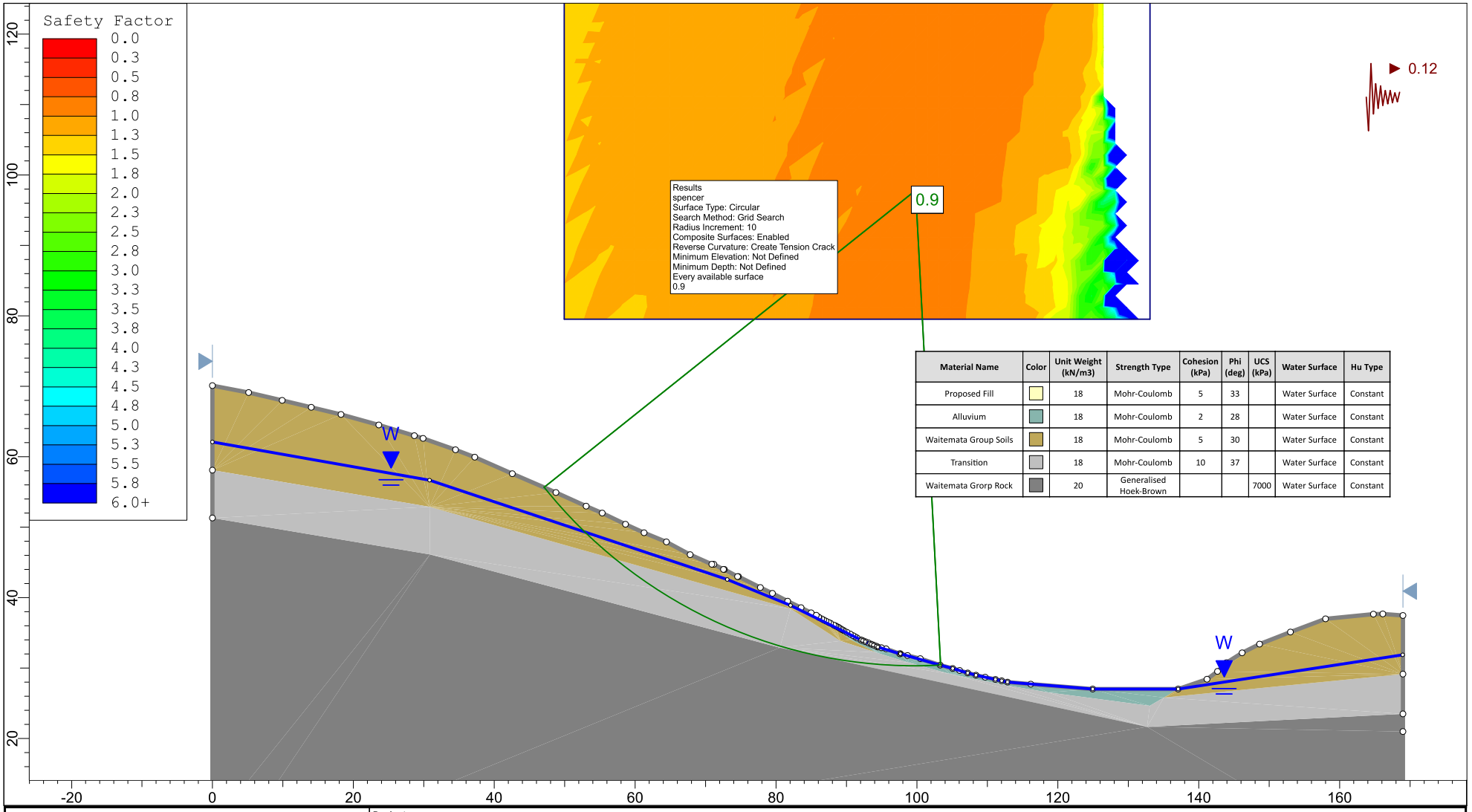
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section BB - Run 10				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5BB - Run 10.slim



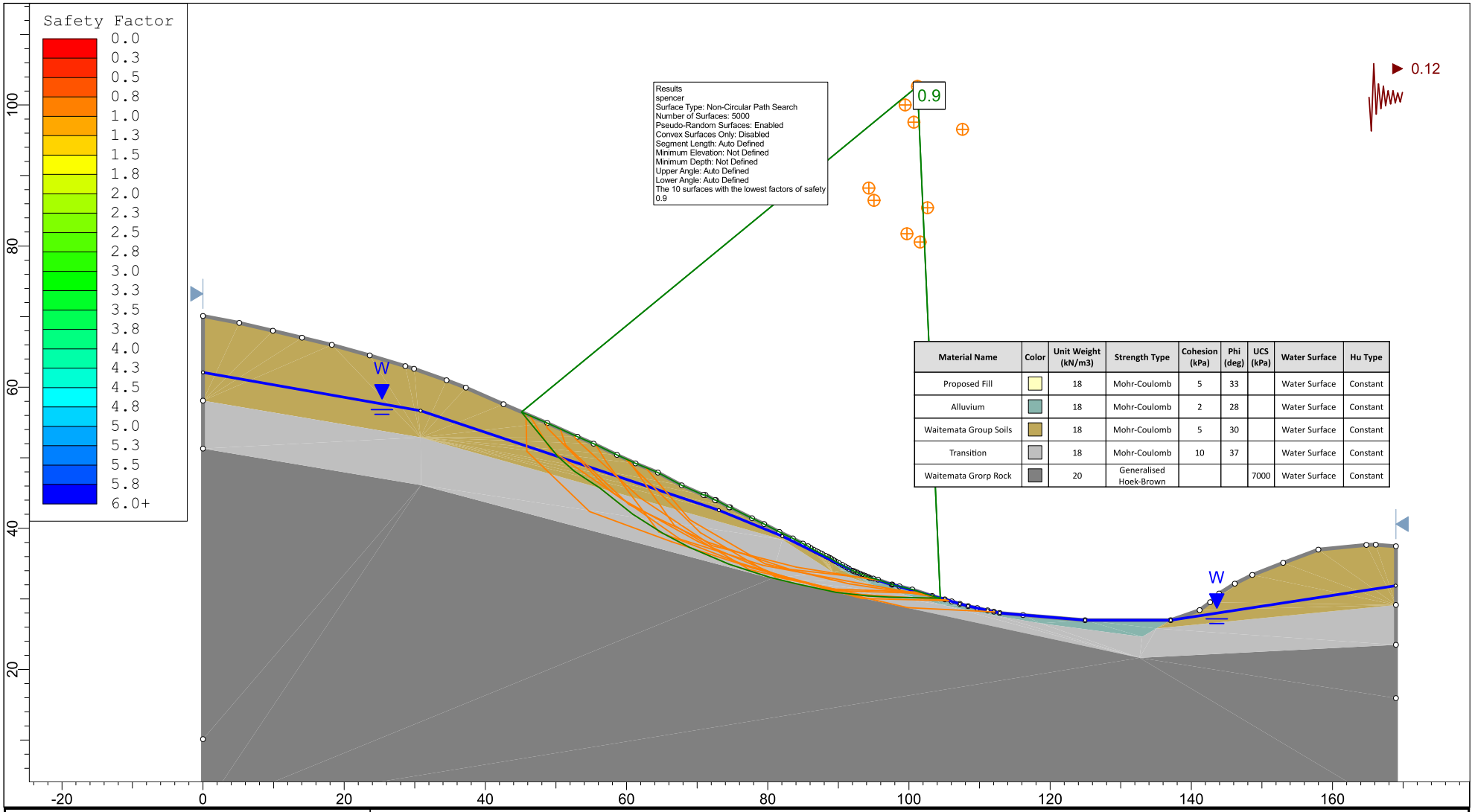
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section BB - Run 11				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5BB - Run 11.slim



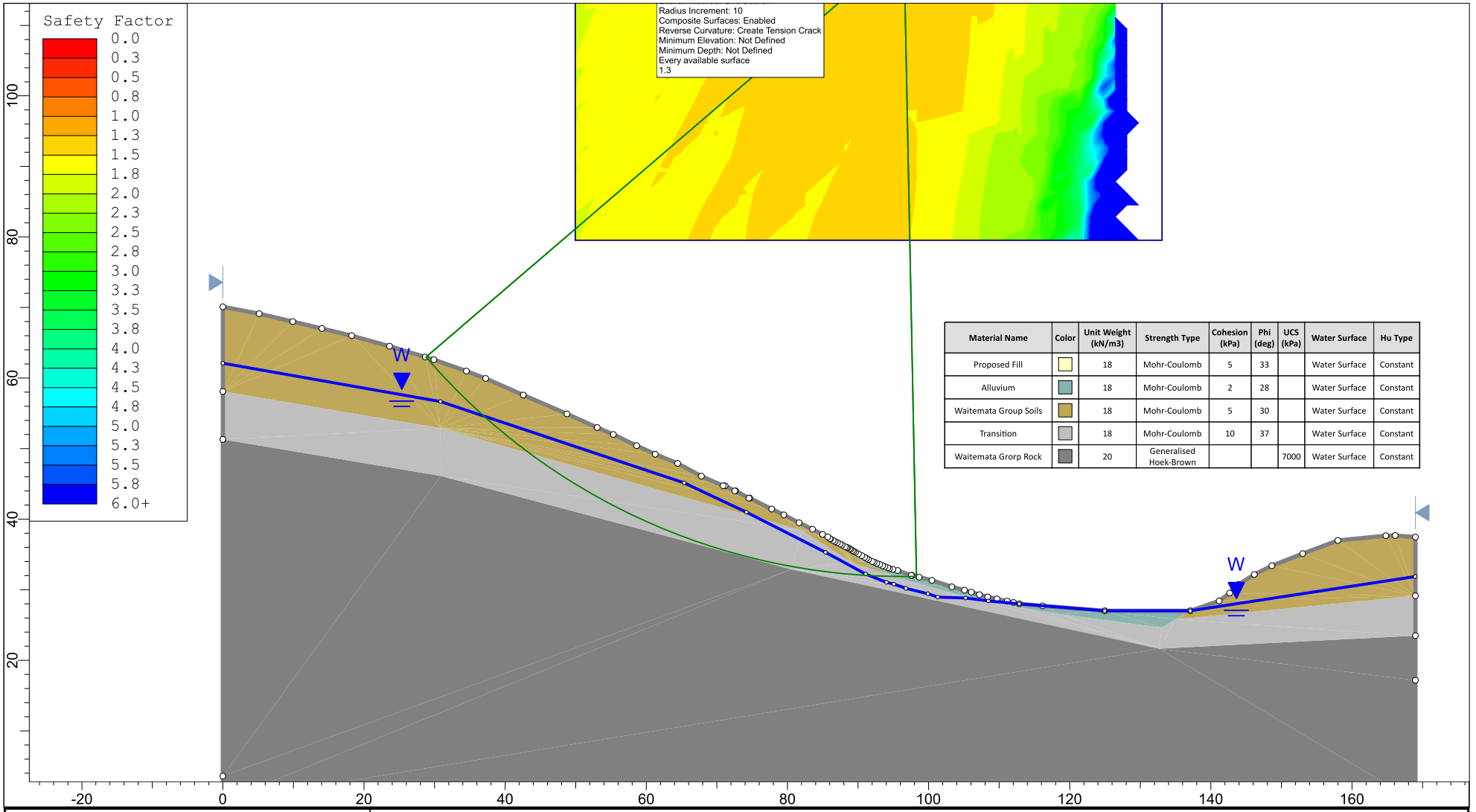
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section BB - Run 12				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5BB - Run 12.slim



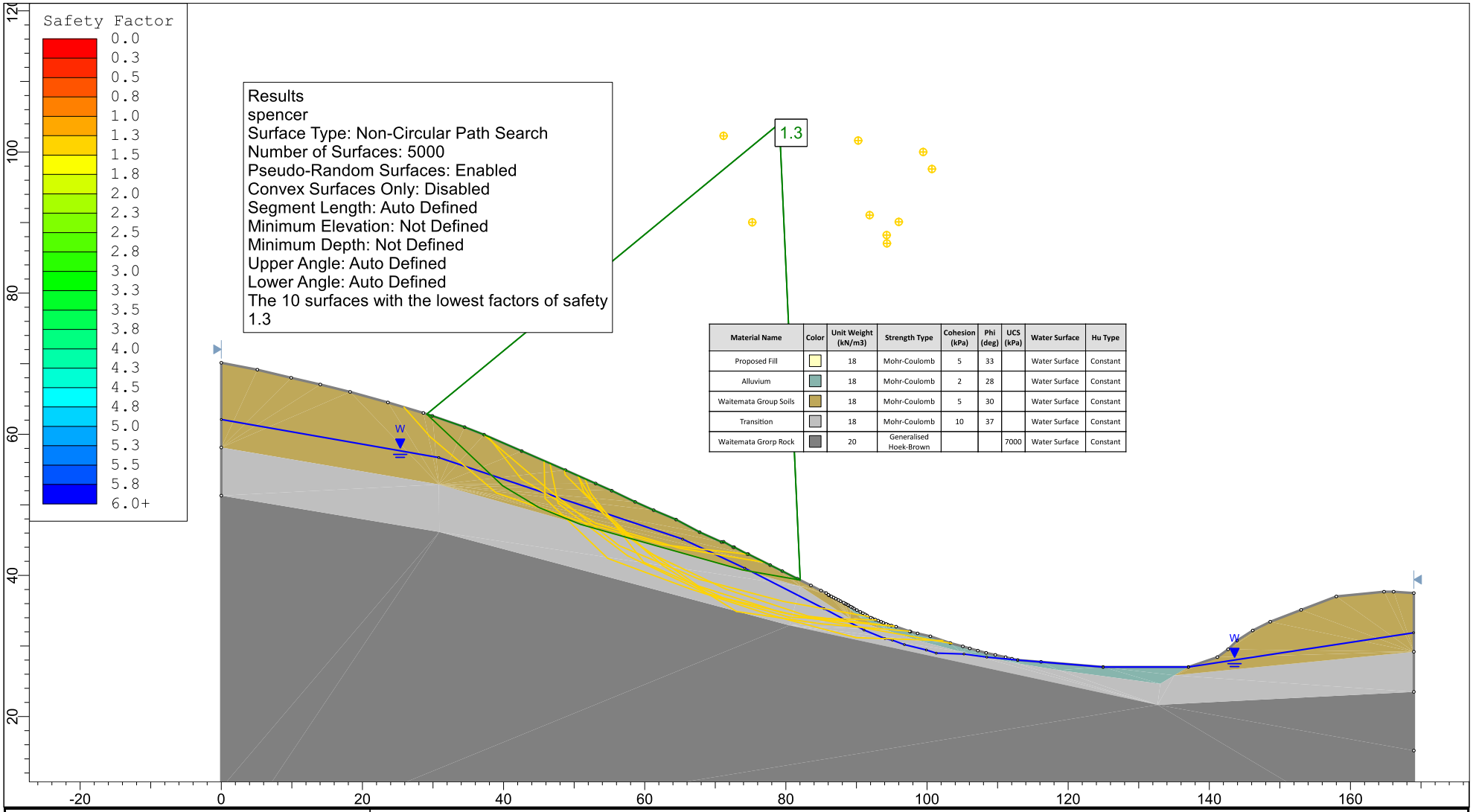
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section BB - Run 13				
Drawn By	PH	Scale	1:750	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S5BB - Run 13.slim



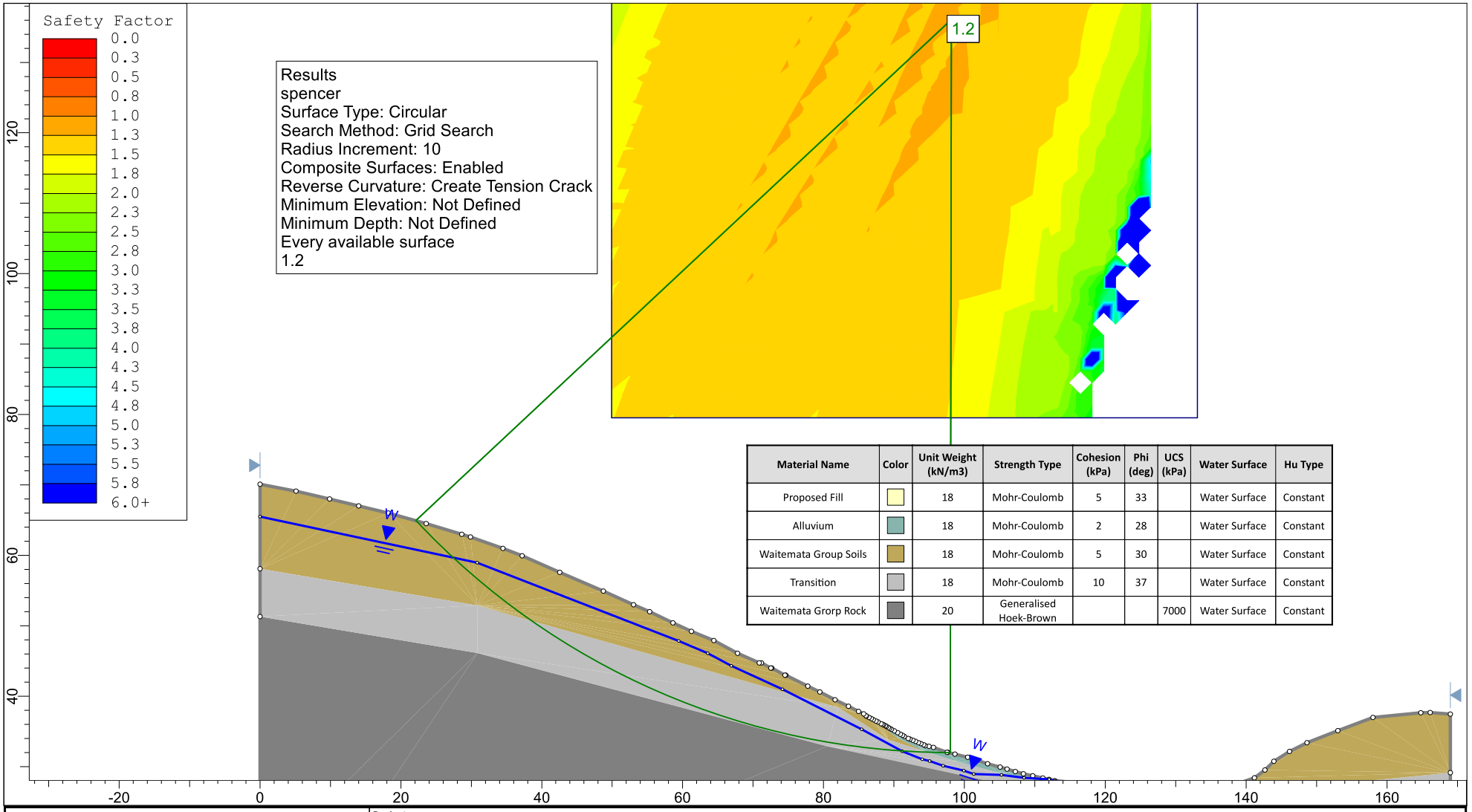
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section BB - Run 14				
Drawn By	PH	Scale	1:750	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S5BB - Run 14.slim



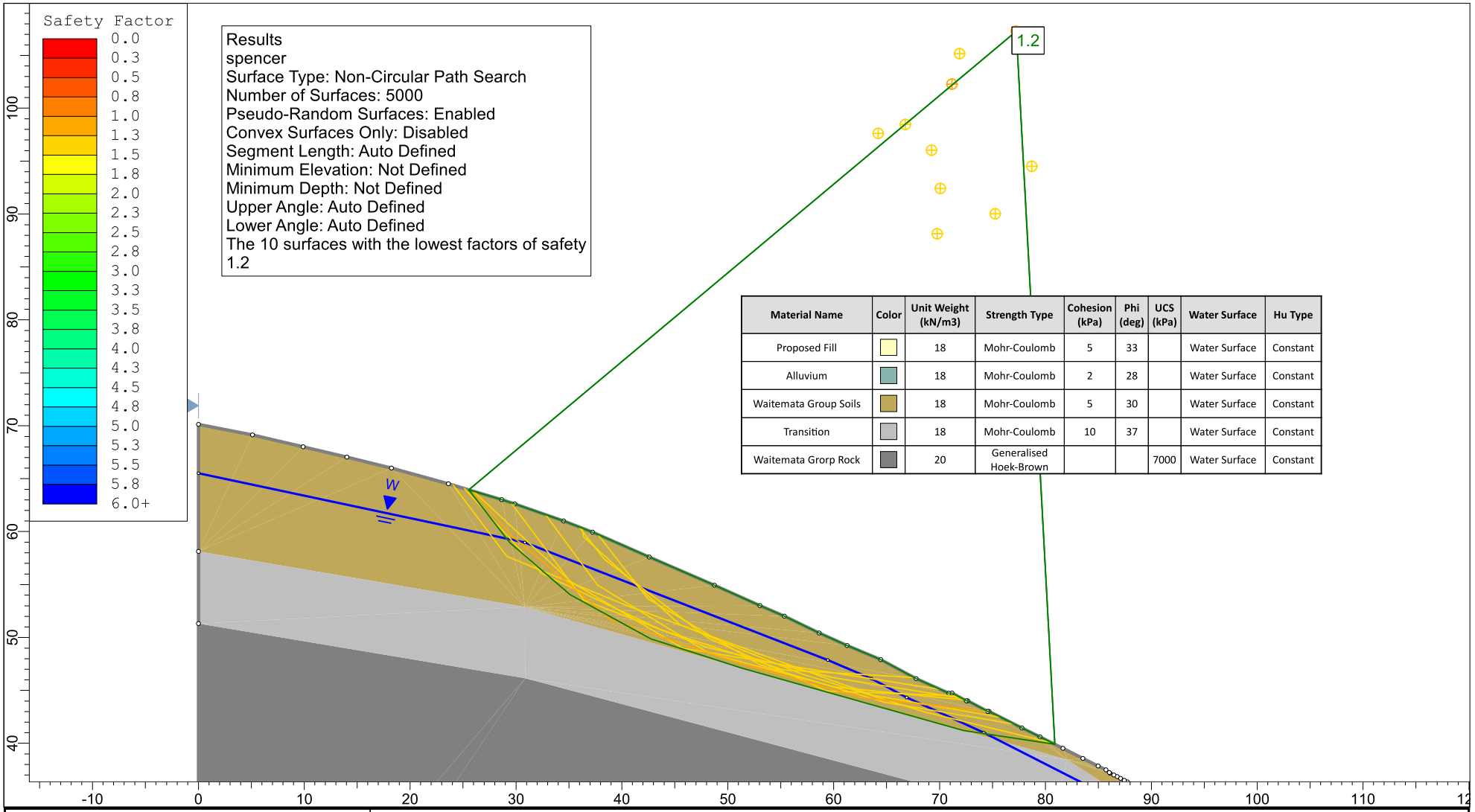
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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SLIDEINTERPRET 6.018

Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section BB - Run 15				
Drawn By	PH	Scale	1:750	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S5BB - Run 15.slim



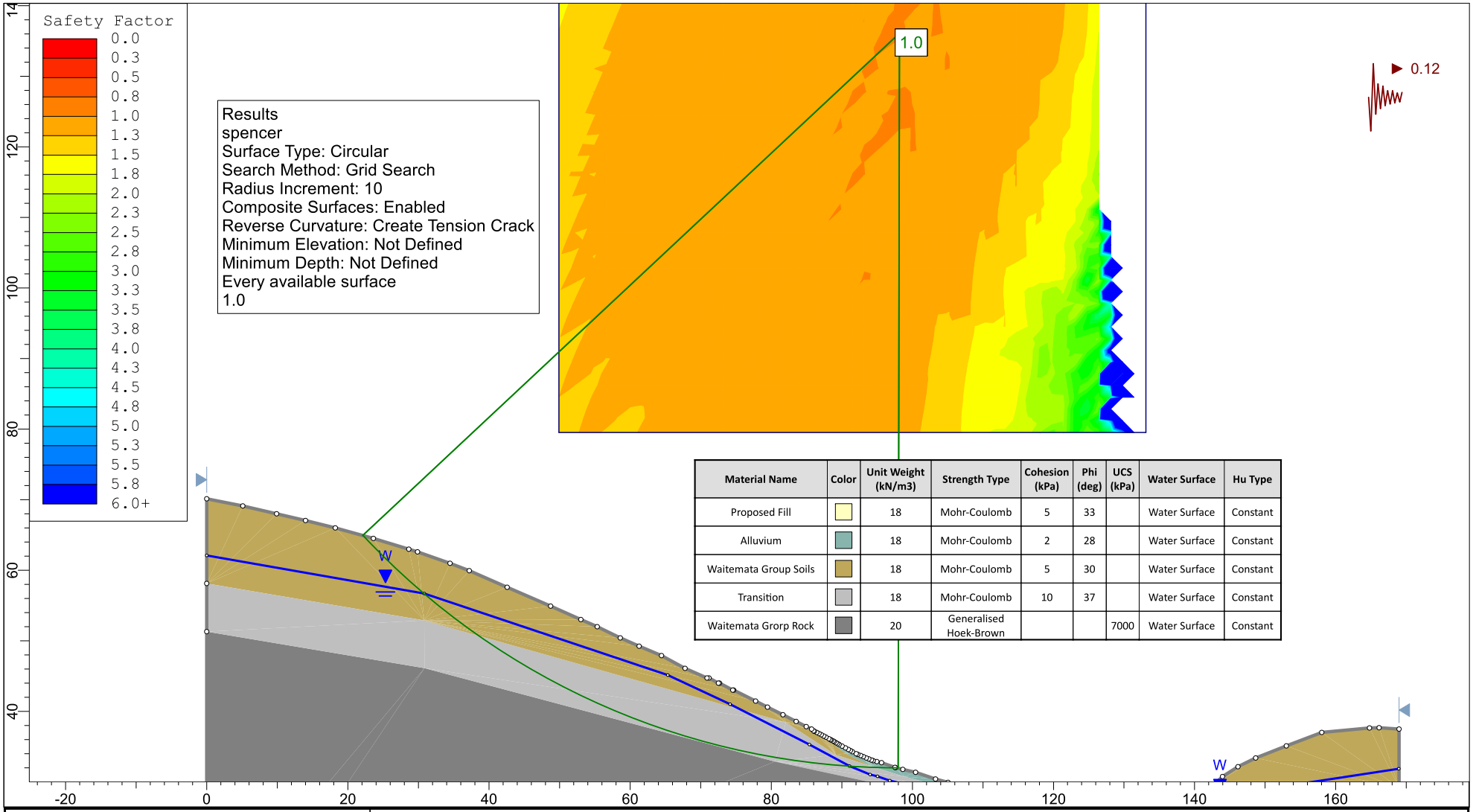
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section BB - Run 16				
Drawn By	PH	Scale	1:500	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S5BB - Run 16.slim



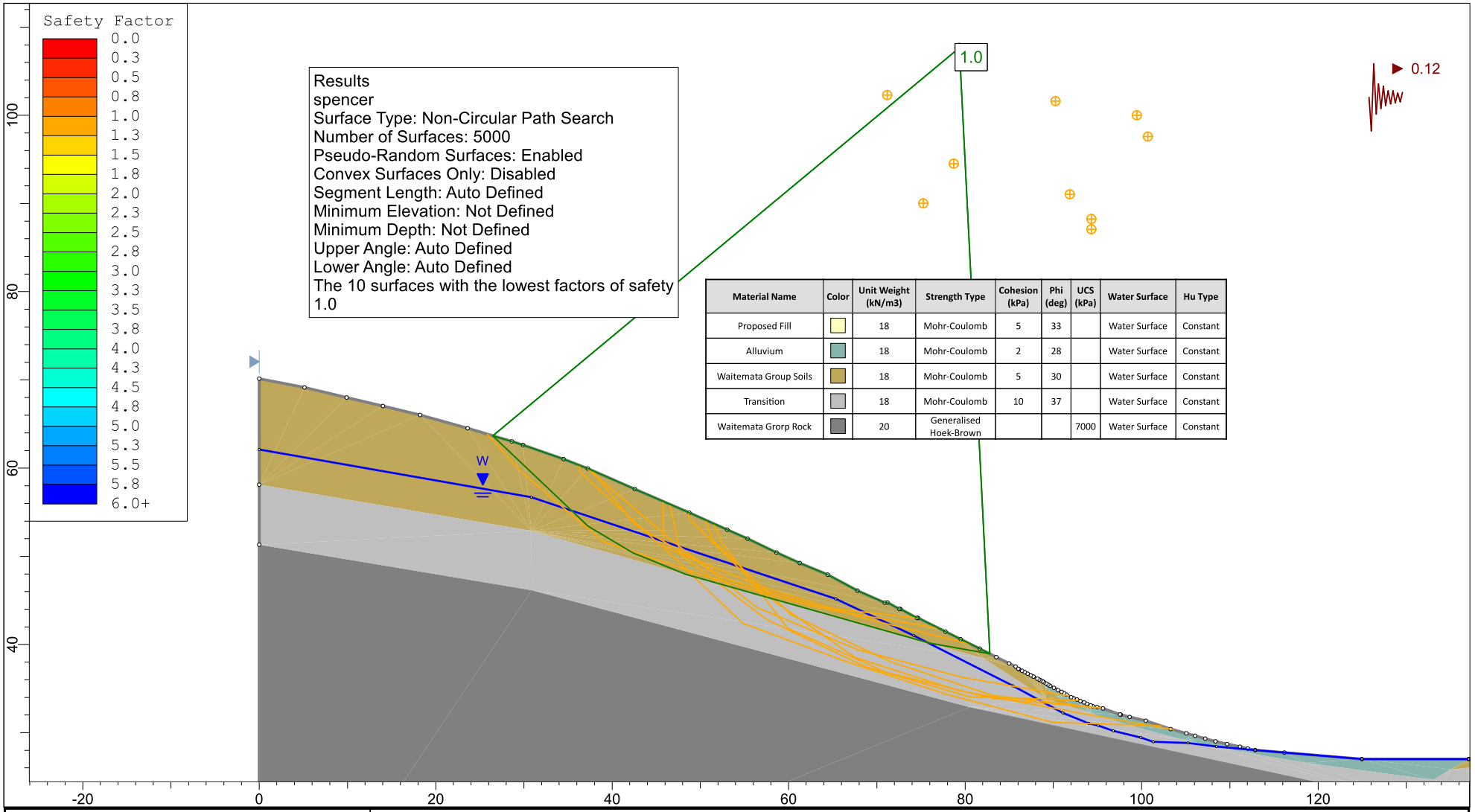
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa			
Analysis Description	Stage 5, Section BB - Run 17			
Drawn By	PH	Scale	1:750	Company: KGA Geotechnical
Date	31/08/2015			File Name: 7464 - S5BB - Run 17.slim



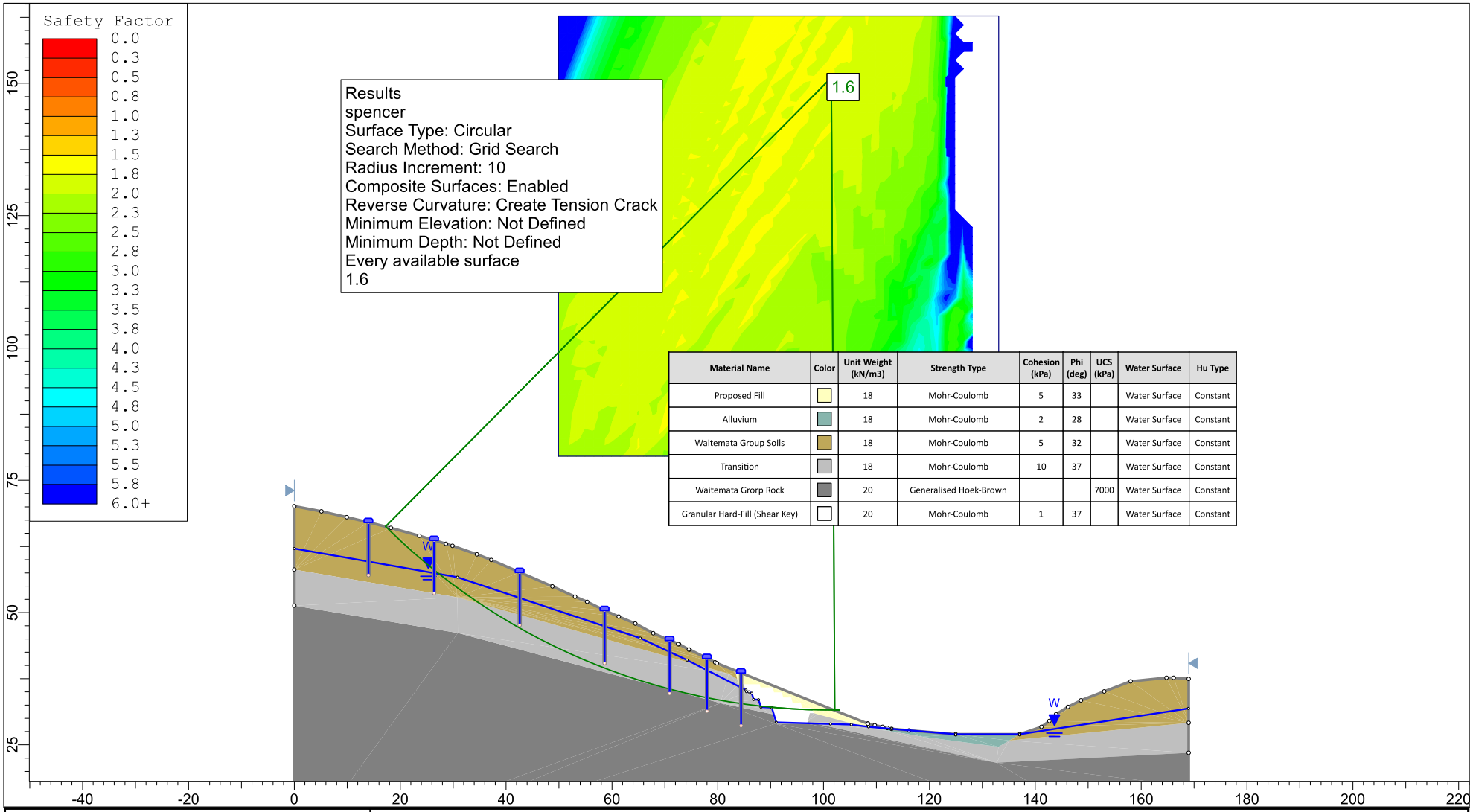
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section BB - Run 18				
Drawn By	PH	Scale	1:600	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S5BB - Run 18.slim



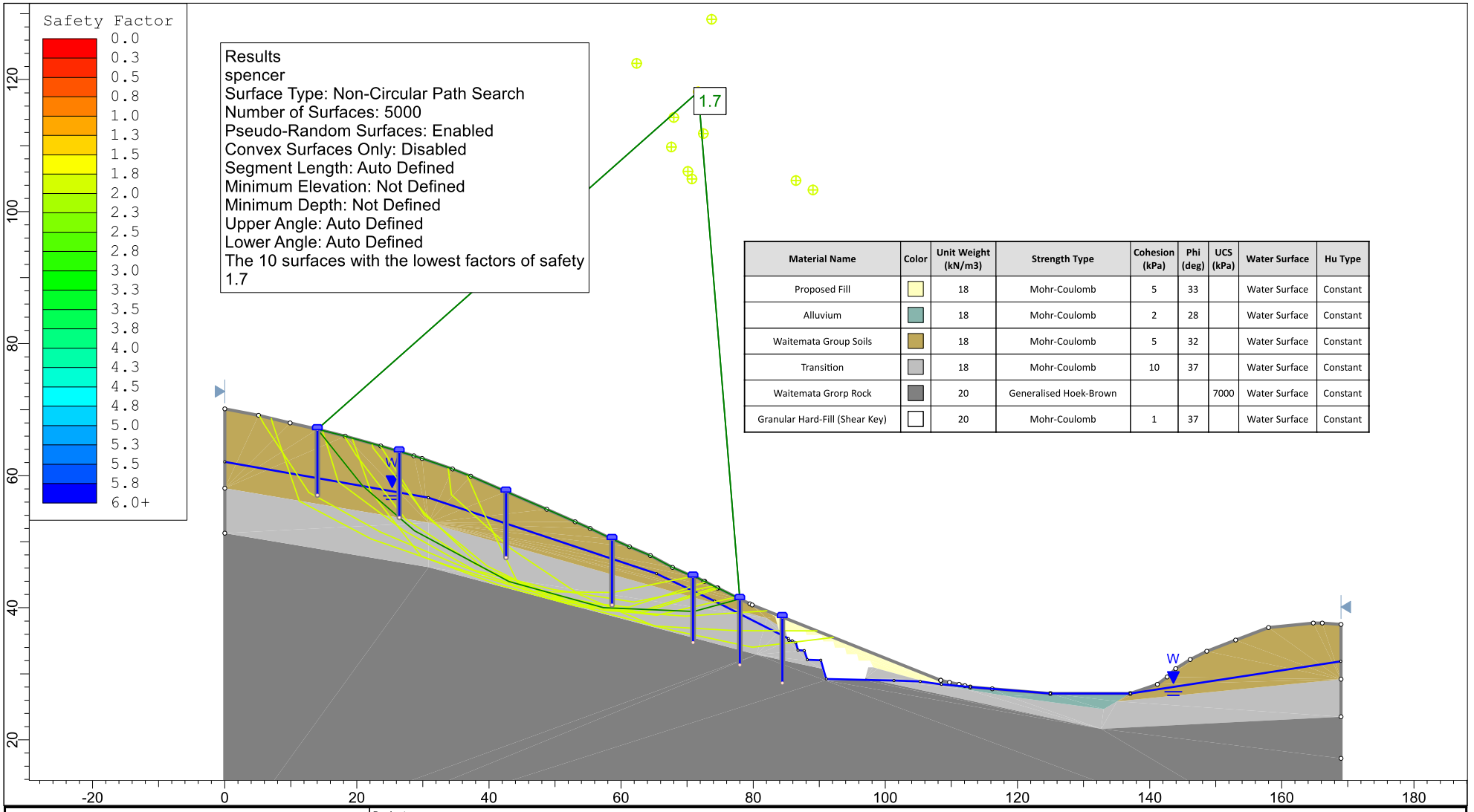
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	32		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Granular Hard-Fill (Shear Key)		20	Mohr-Coulomb	1	37		Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section BB - Run 19				
Drawn By	PH	*Scale*	1:1000	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5BB - Run 19.slim



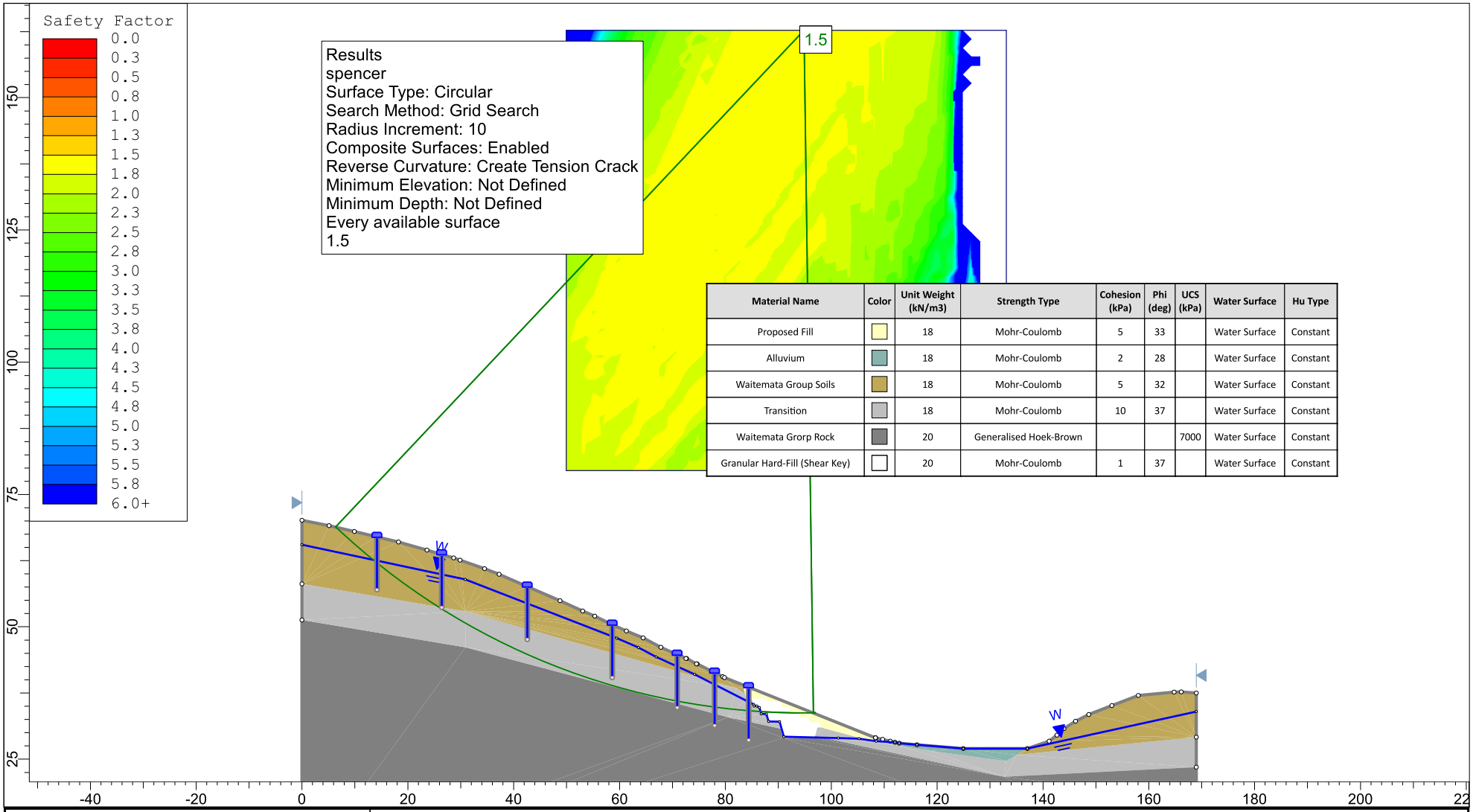
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	32		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Granular Hard-Fill (Shear Key)		20	Mohr-Coulomb	1	37		Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa			
Analysis Description	Stage 5, Section BB - Run 20			
Drawn By	PH	Scale	1:800	Company: KGA Geotechnical
Date	31/08/2015			File Name: 7464 - S5BB - Run 20.slim



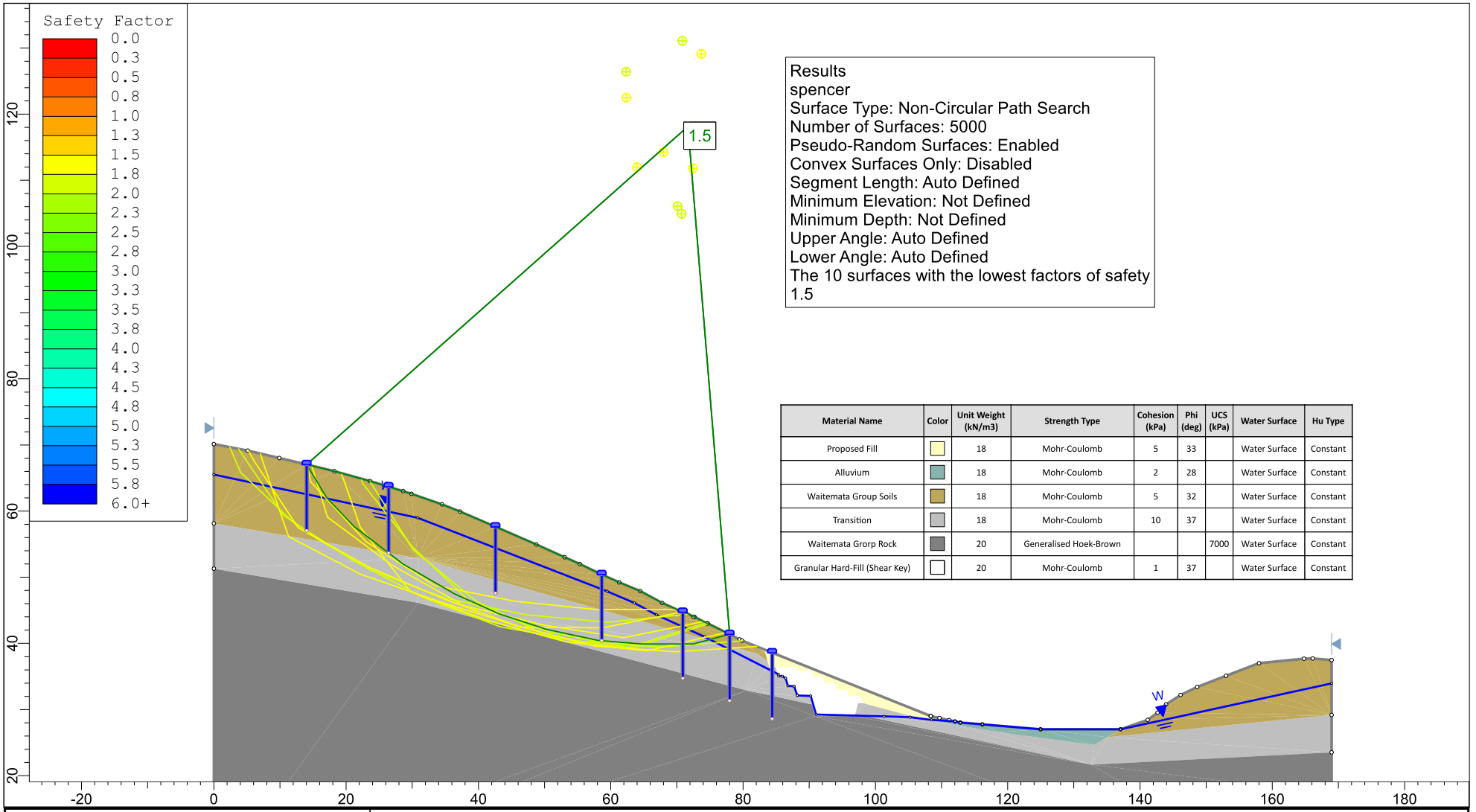
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	32		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Granular Hard-Fill (Shear Key)		20	Mohr-Coulomb	1	37		Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section BB - Run 21				
Drawn By	PH	*Scale*	1:1000	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5BB - Run 21.slim



Results
spencer
Surface Type: Non-Circular Path Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Segment Length: Auto Defined
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Upper Angle: Auto Defined
Lower Angle: Auto Defined
The 10 surfaces with the lowest factors of safety
1.5

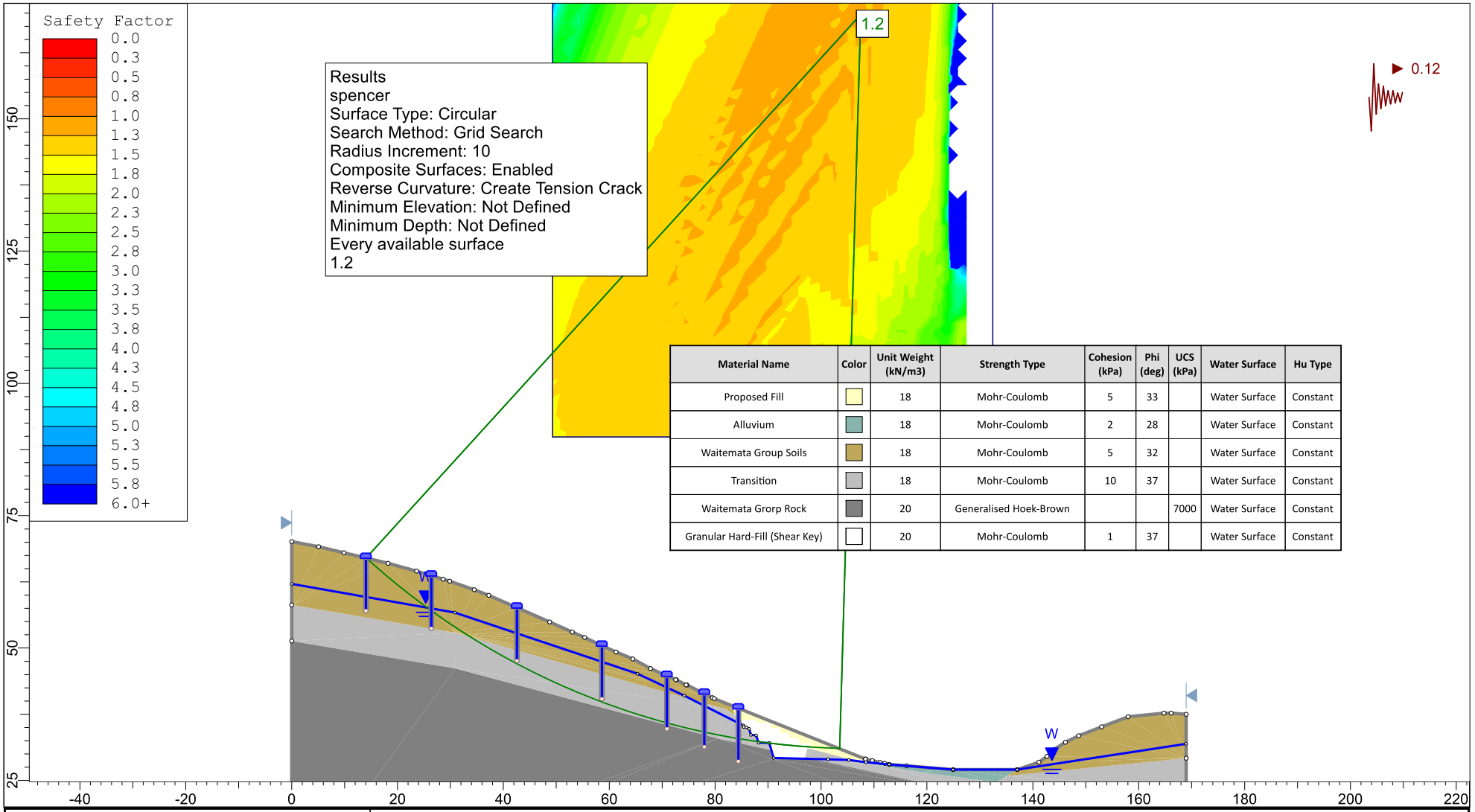
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	32		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Granular Hard-Fill (Shear Key)		20	Mohr-Coulomb	1	37		Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section BB - Run 22				
Drawn By	PH	Scale	1:800	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S5BB - Run 22.slim



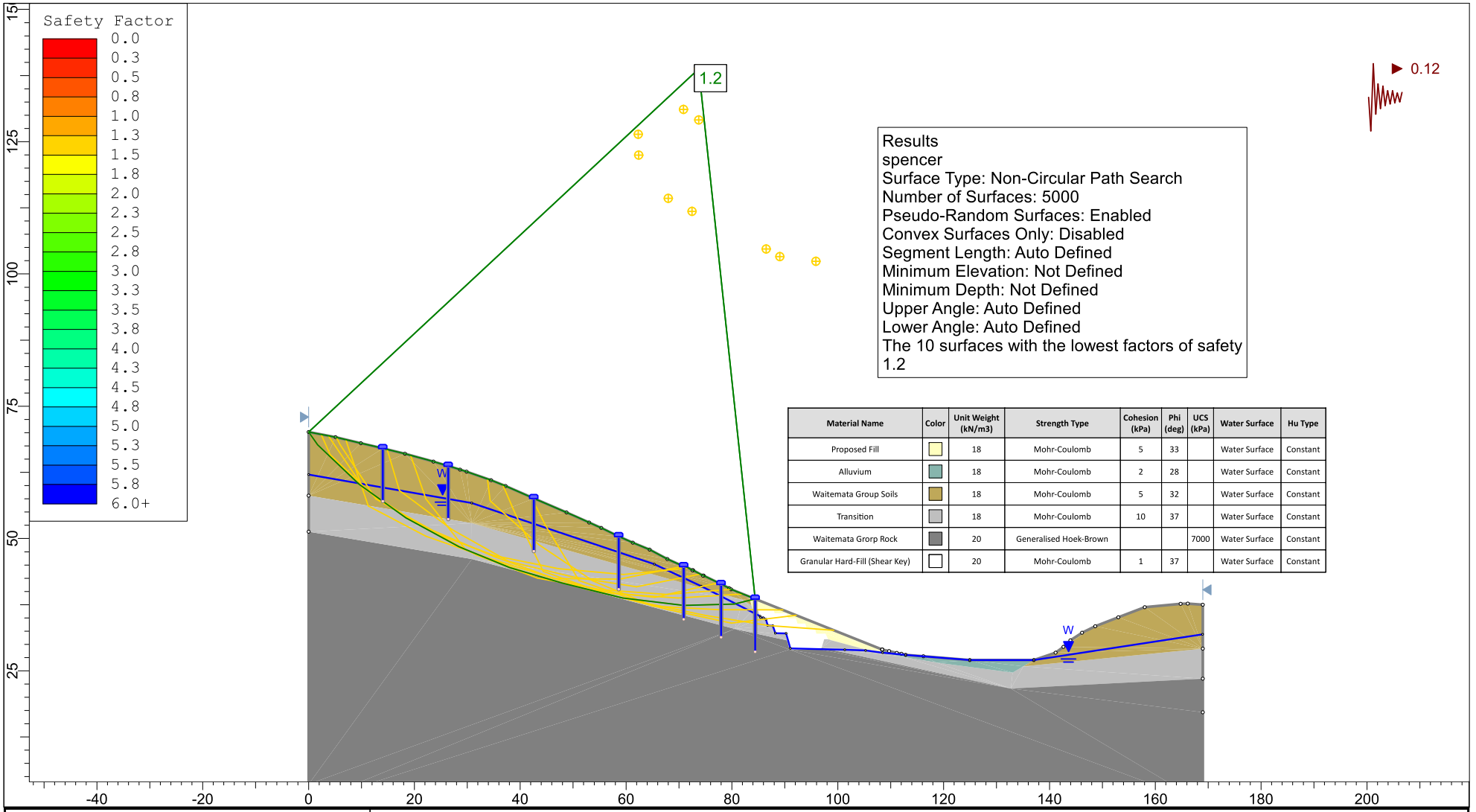
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	32		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Granular Hard-Fill (Shear Key)		20	Mohr-Coulomb	1	37		Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section BB - Run 23				
Drawn By	PH	Scale	1:1000	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S5BB - Run 23.slim



Results
spencer
Surface Type: Non-Circular Path Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Segment Length: Auto Defined
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Upper Angle: Auto Defined
Lower Angle: Auto Defined
The 10 surfaces with the lowest factors of safety
1.2

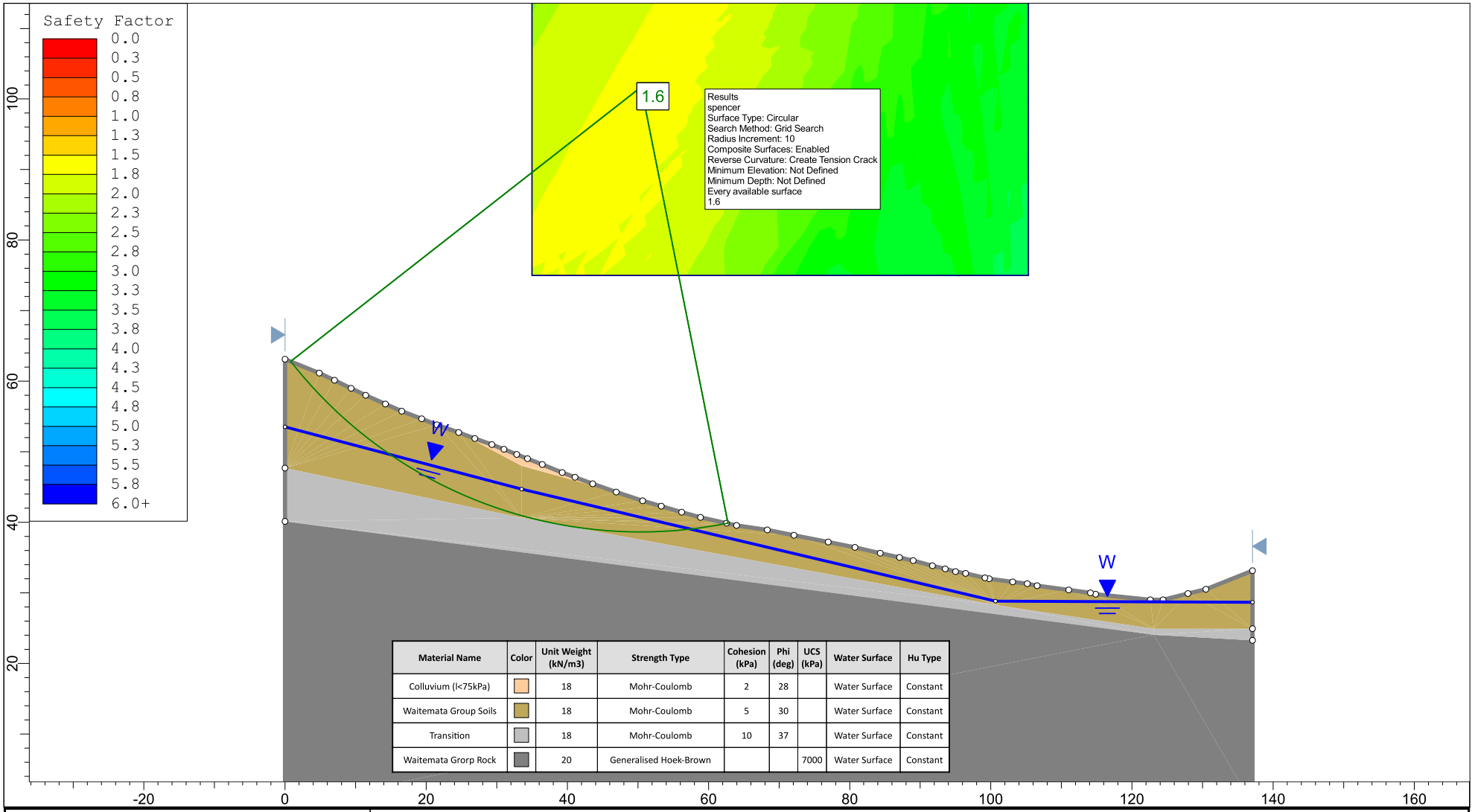
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	32		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Granular Hard-Fill (Shear Key)		20	Mohr-Coulomb	1	37		Water Surface	Constant

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SLIDEINTERPRET 6.018

Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section BB - Run 24				
Drawn By	PH	Scale	1:1000	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S5BB - Run 24.slim



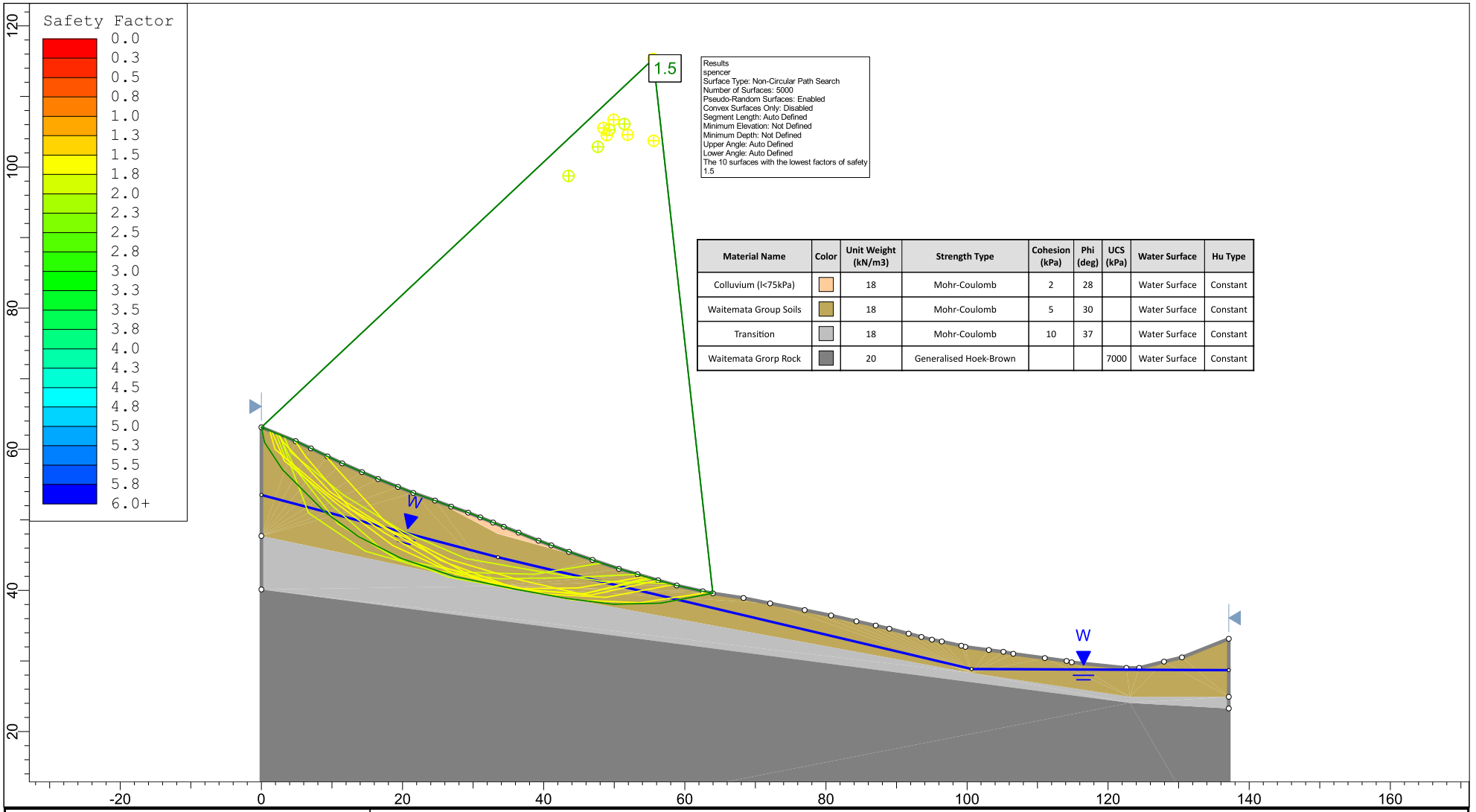
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 5, Section CC - Run 1		
Drawn By	PH	*Scale* 1:750	*Company* KGA Geotechnical
Date	31/08/2015		*File Name* 7464 - S5CC - Run 1.slim



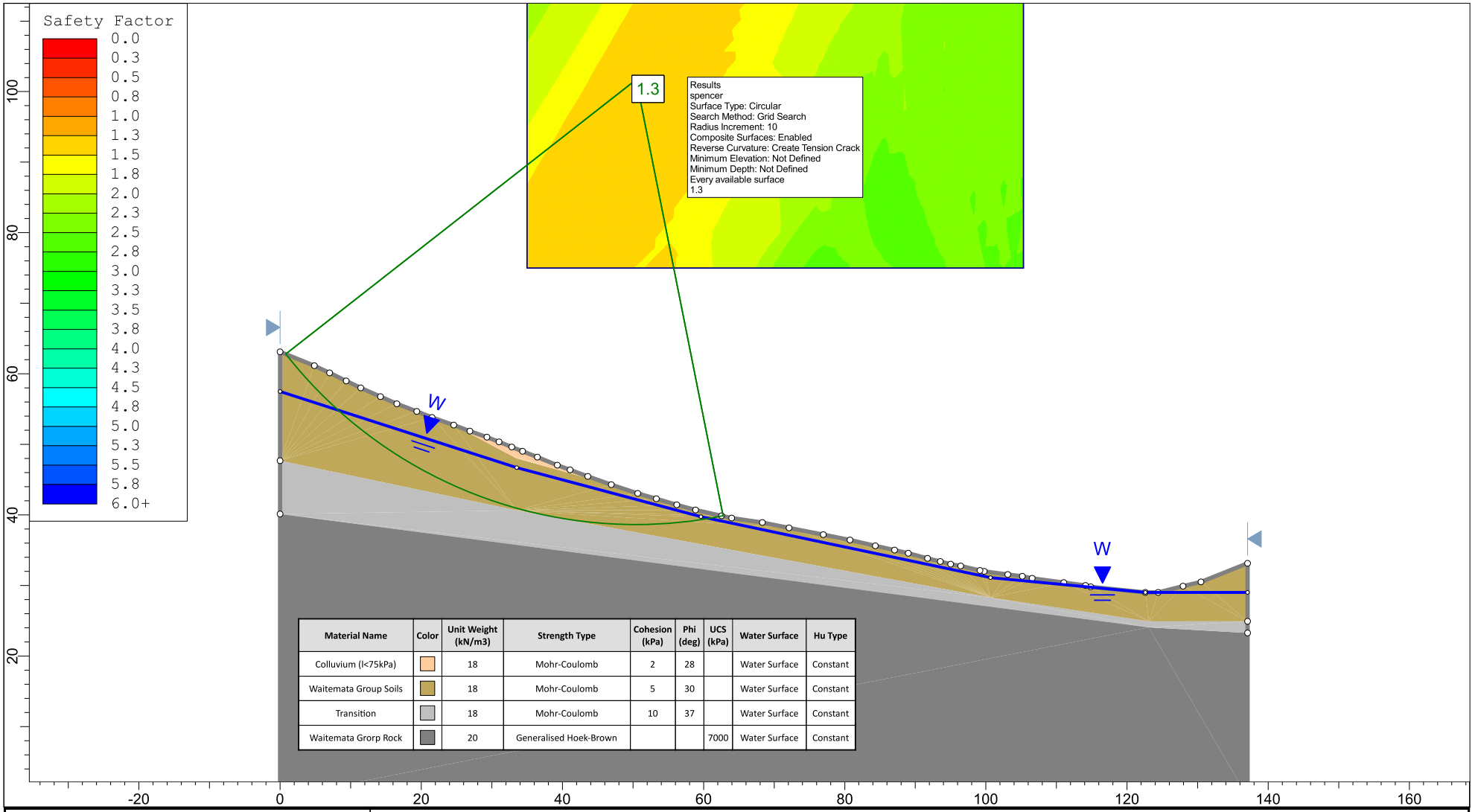
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section CC - Run 2				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5CC - Run 2.slim



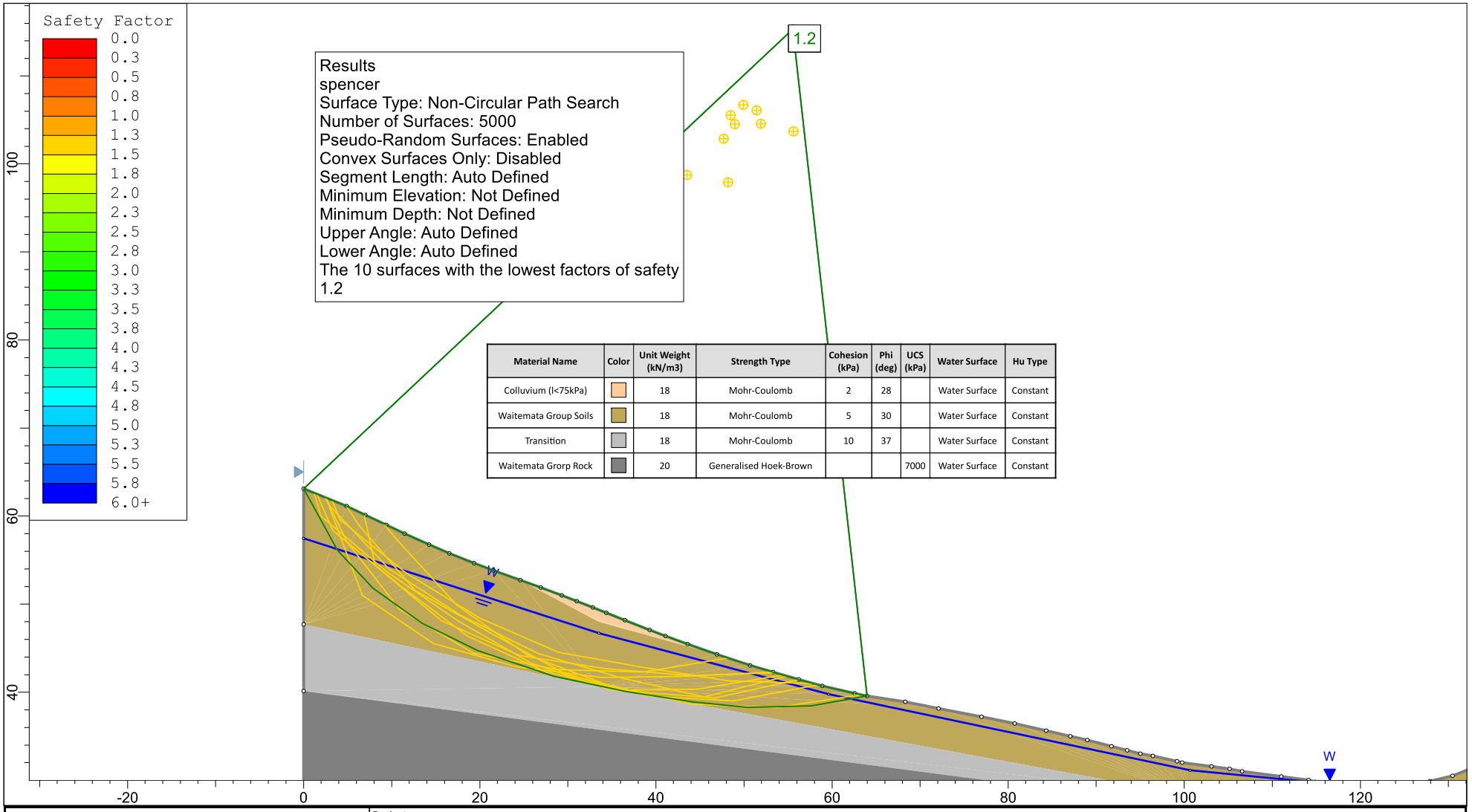
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 5, Section CC - Run 3		
Drawn By	PH	*Scale* 1:750	*Company* KGA Geotechnical
Date	31/08/2015		*File Name* 7464 - S5CC - Run 3.slim



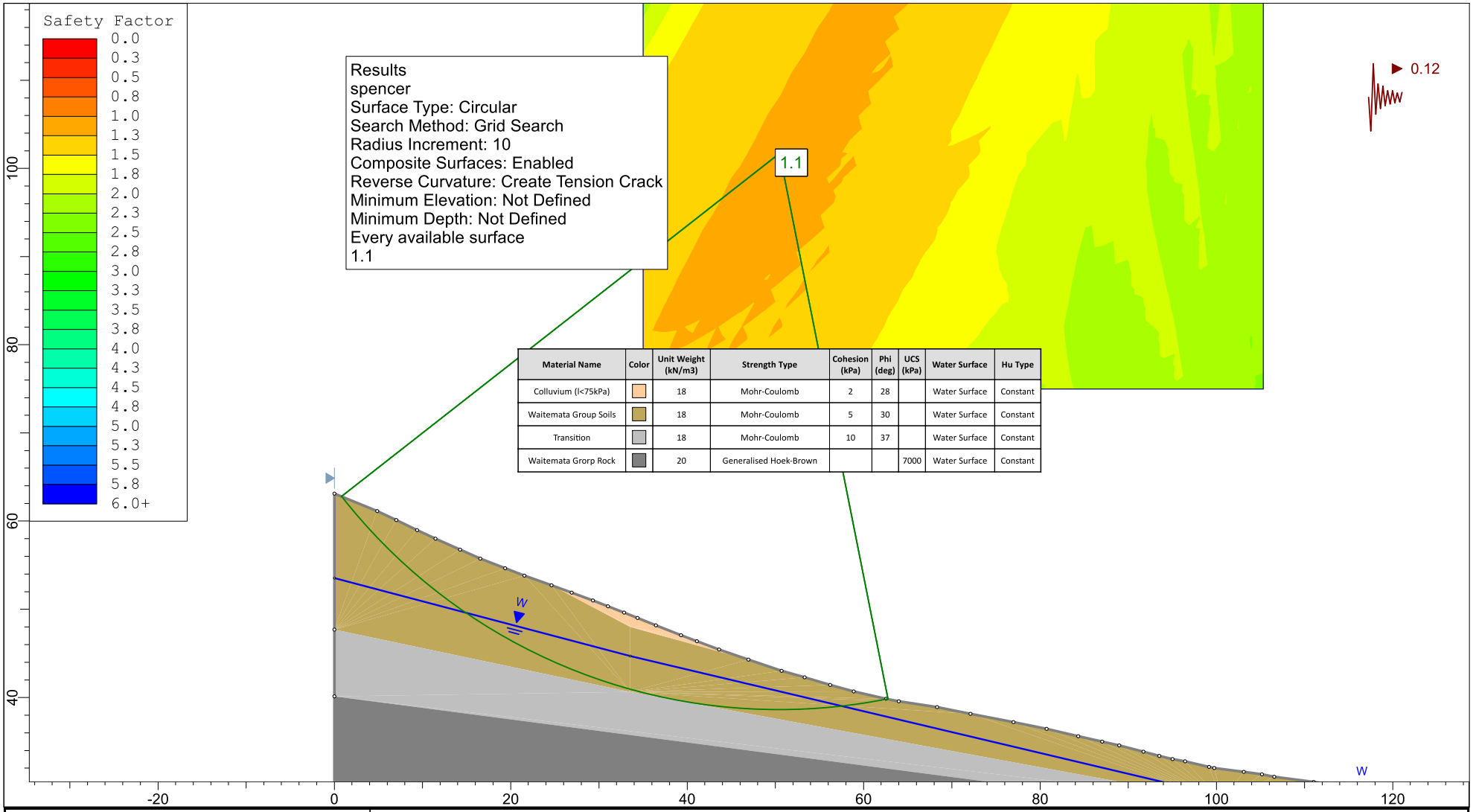
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section CC - Run 4				
Drawn By	PH	Scale	1:600	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S5CC - Run 4.slim



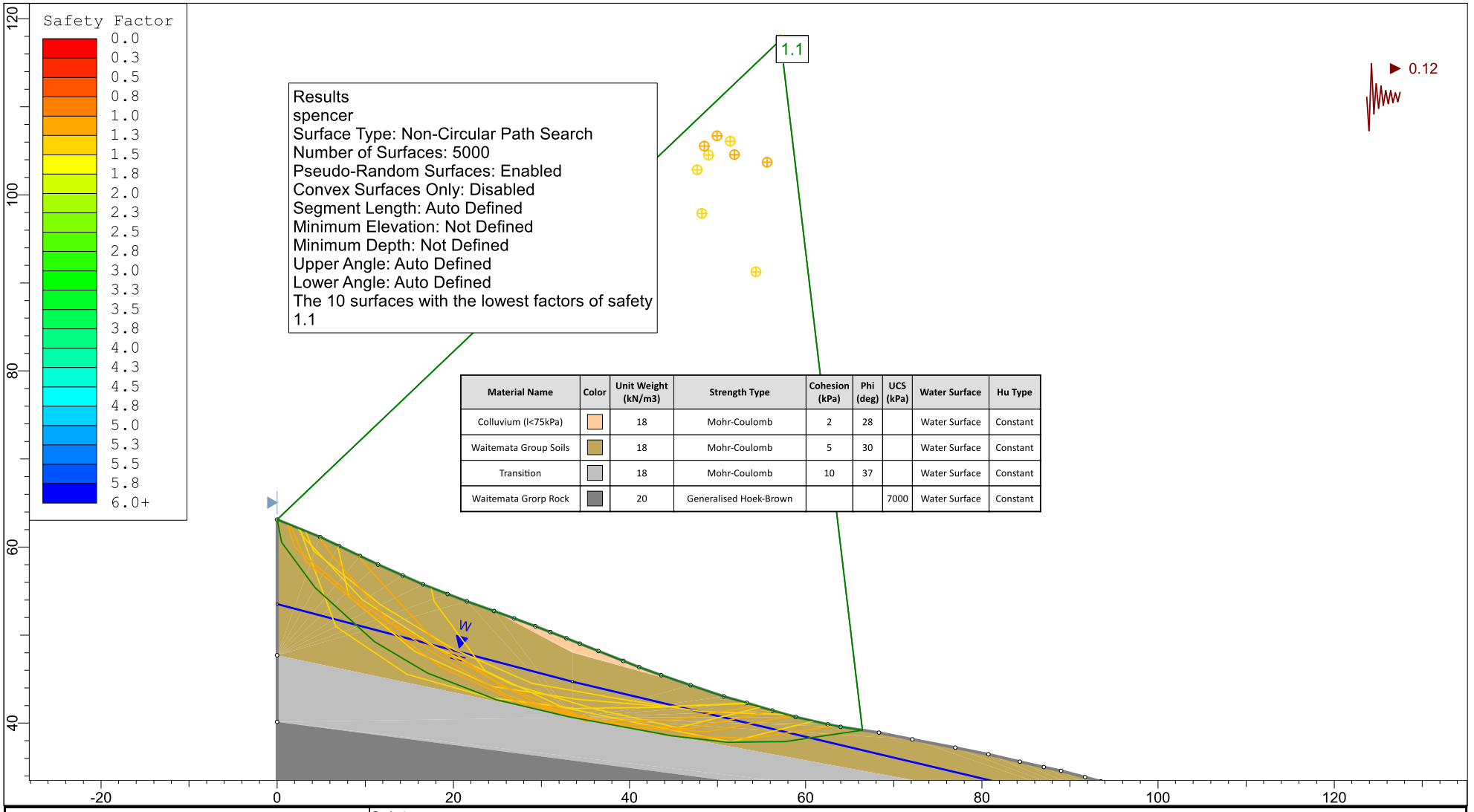
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section CC - Run 5				
Drawn By	PH	Scale	1:600	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S5CC - Run 5.slim



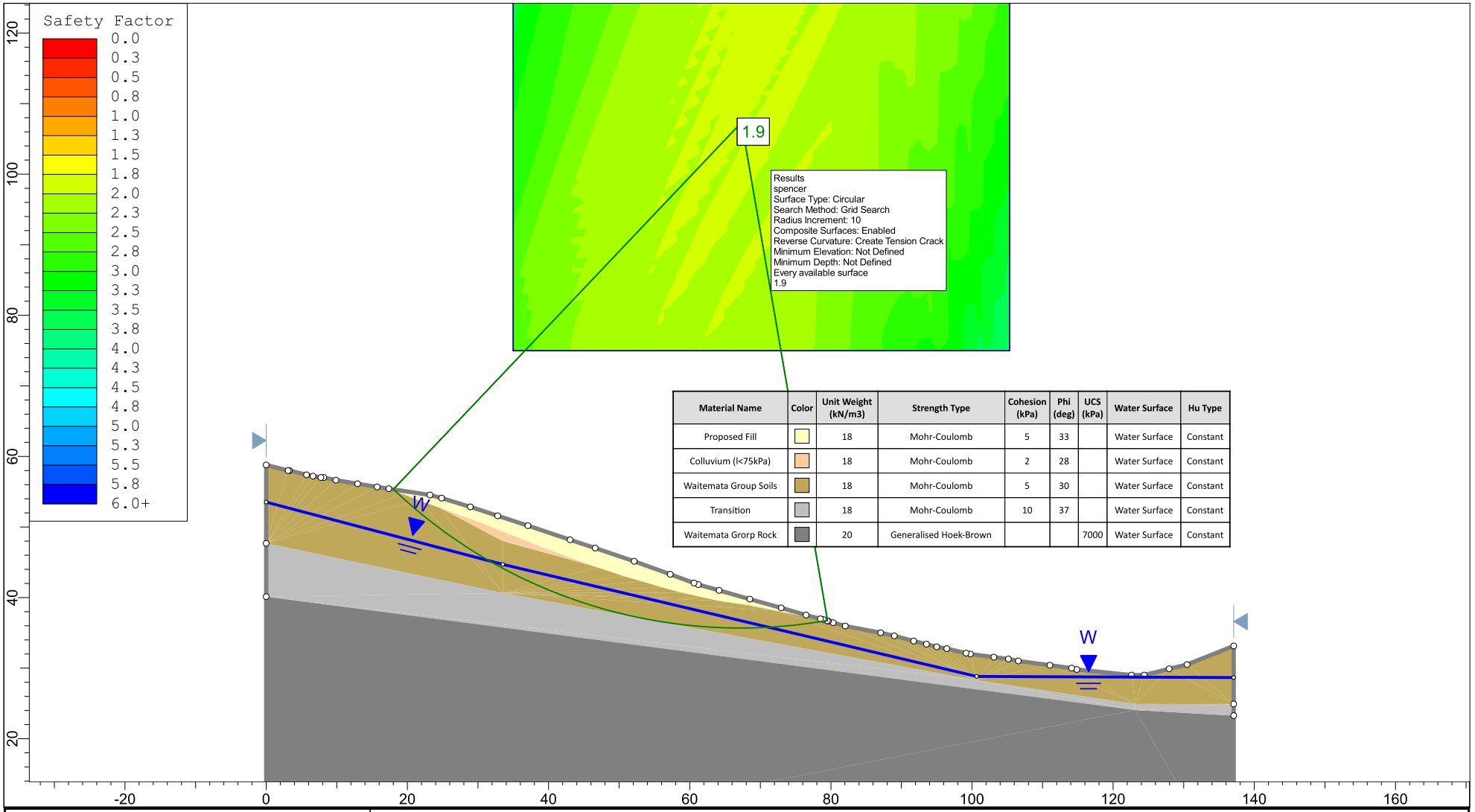
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section CC - Run 6				
Drawn By	PH	*Scale*	1:600	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5CC - Run 6.slim



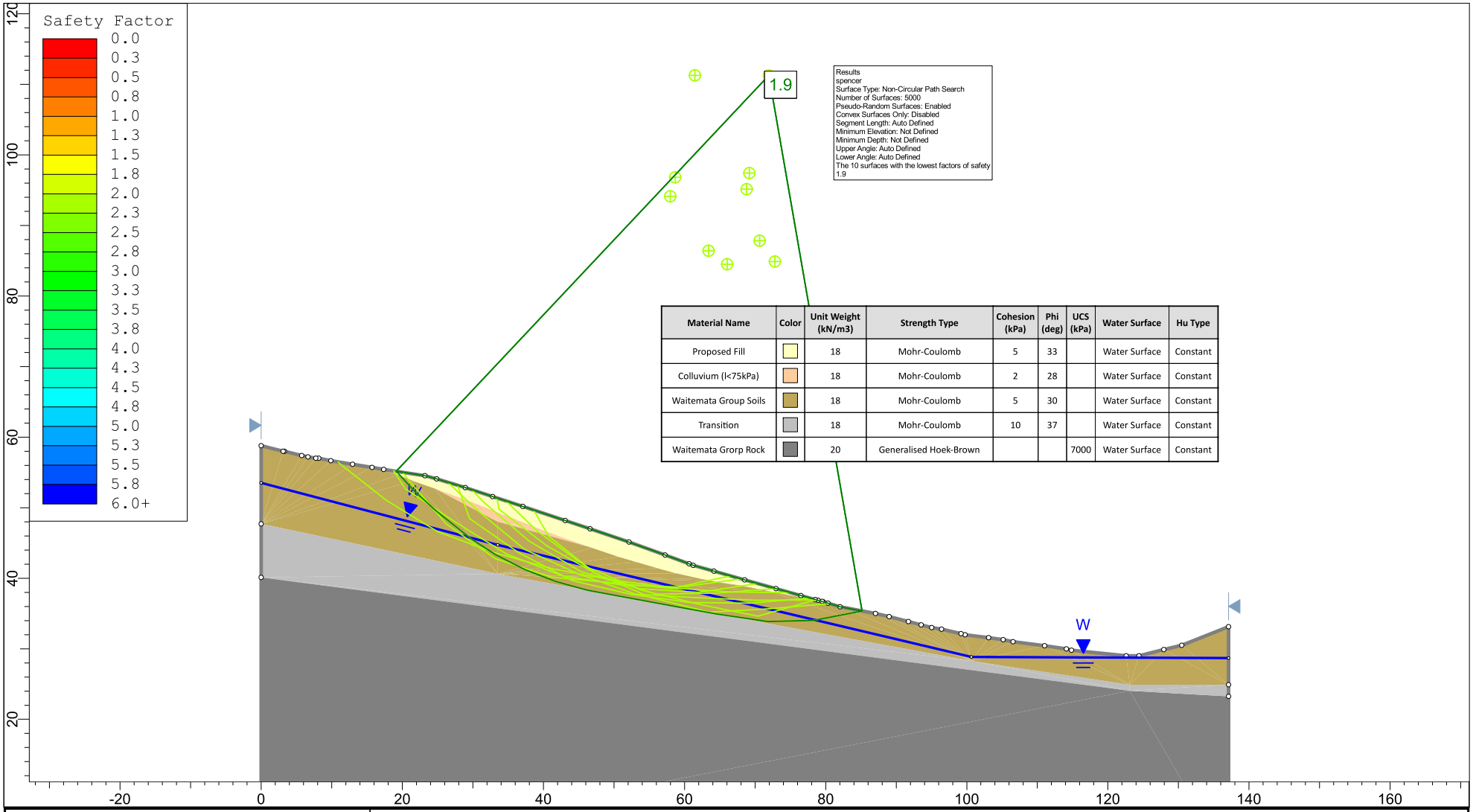
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section CC - Run 7				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5CC - Run 7.slim



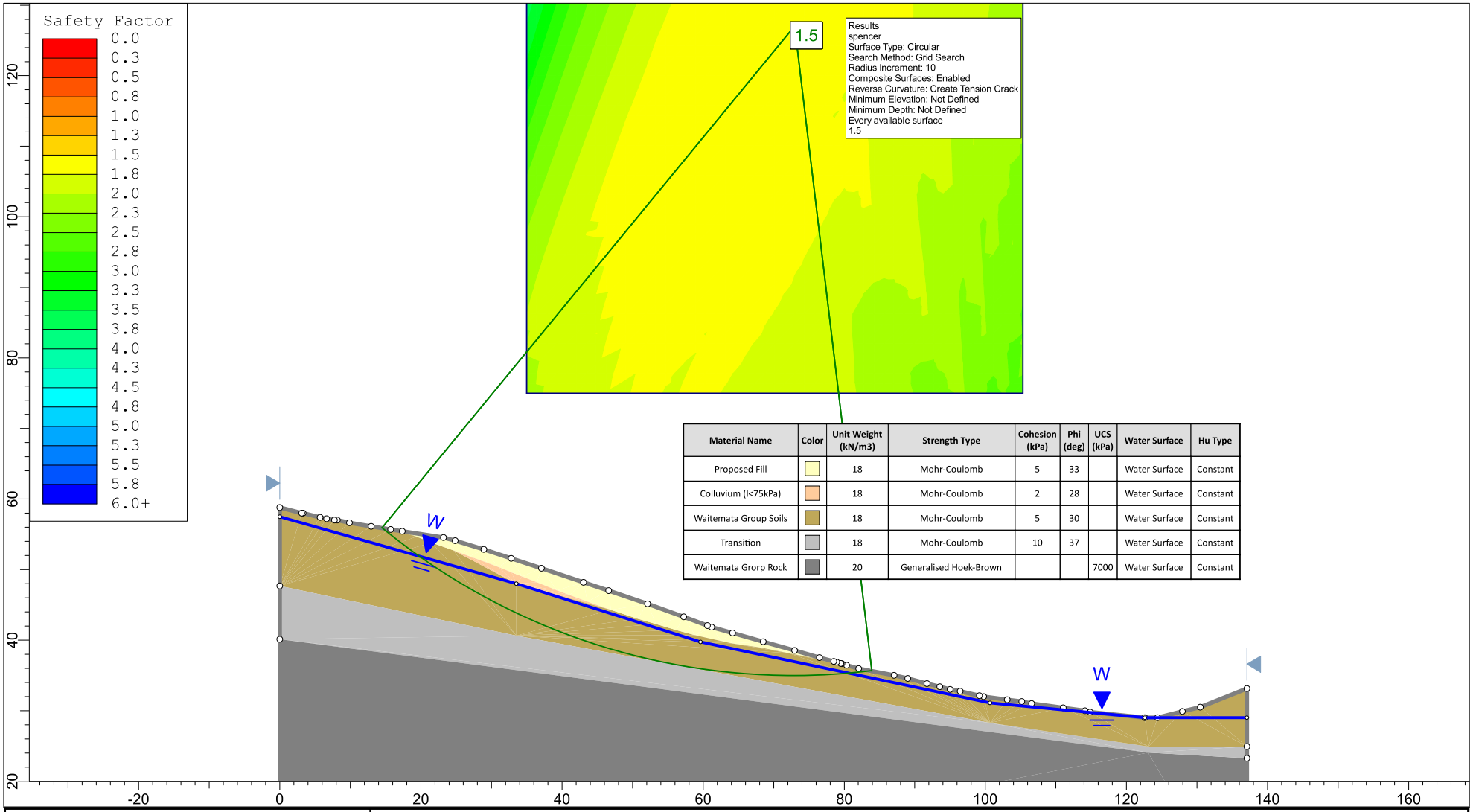
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section CC - Run 8				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5CC - Run 8.slim



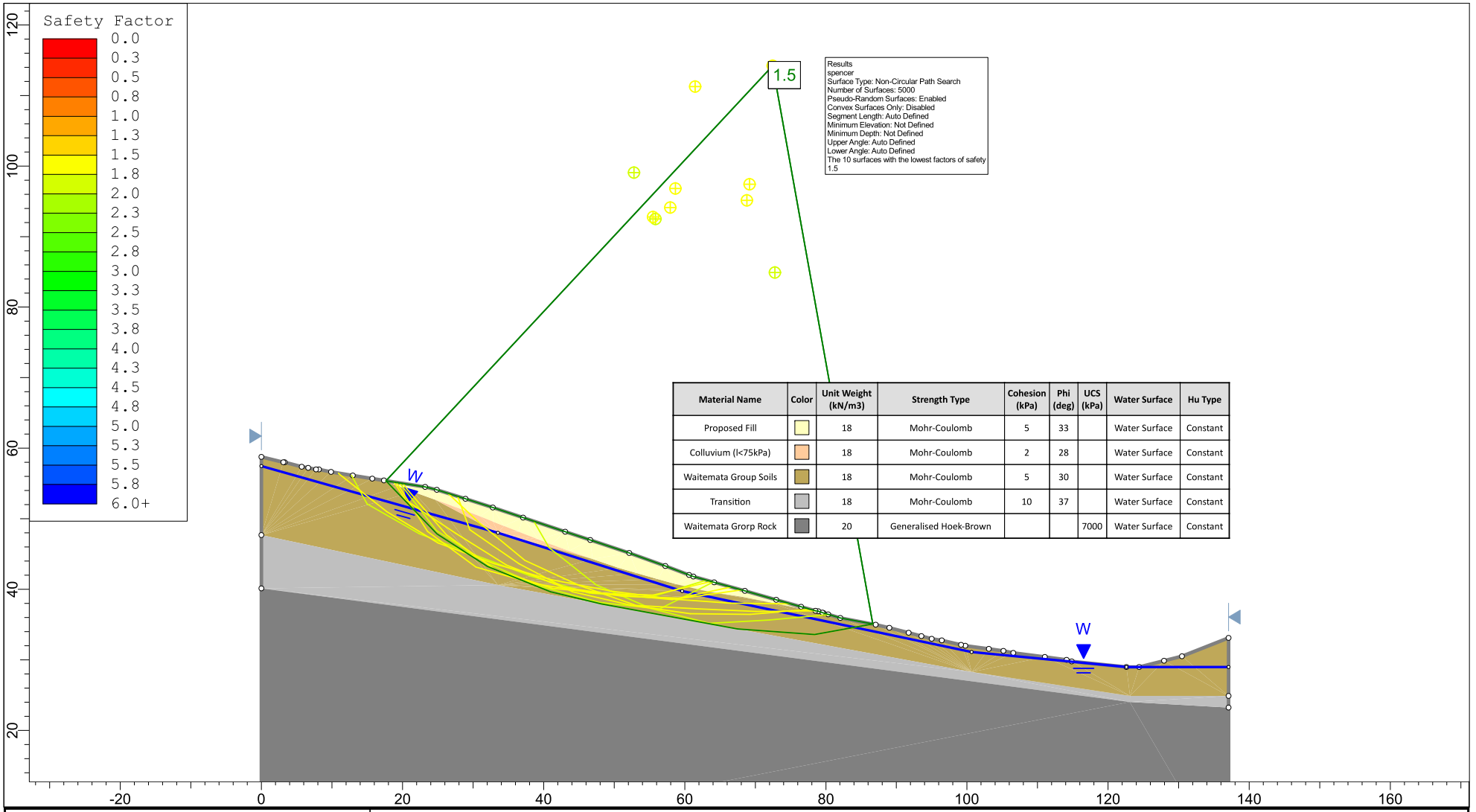
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Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section CC - Run 9				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5CC - Run 9.slim



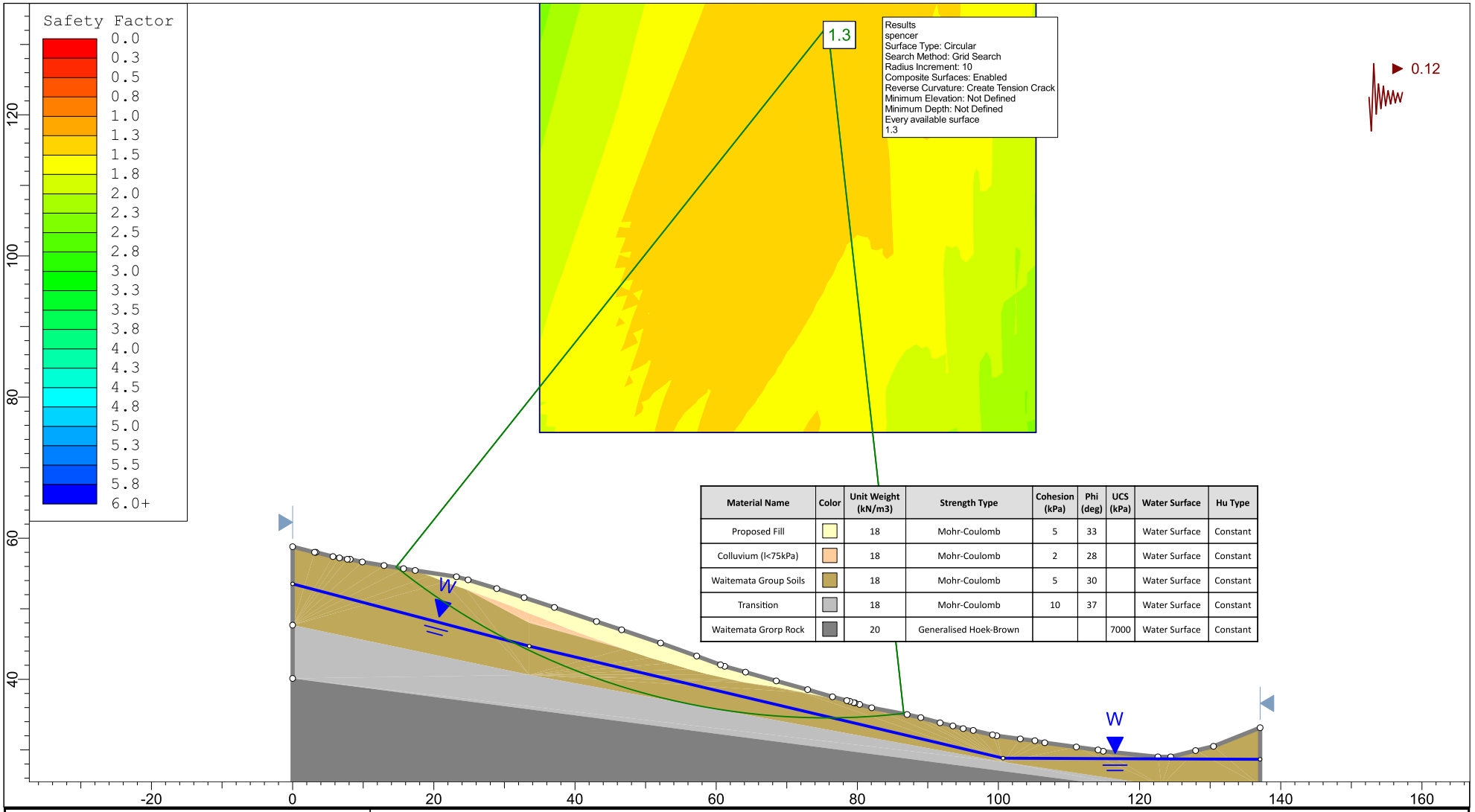
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section CC - Run 10				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5CC - Run 10.slim



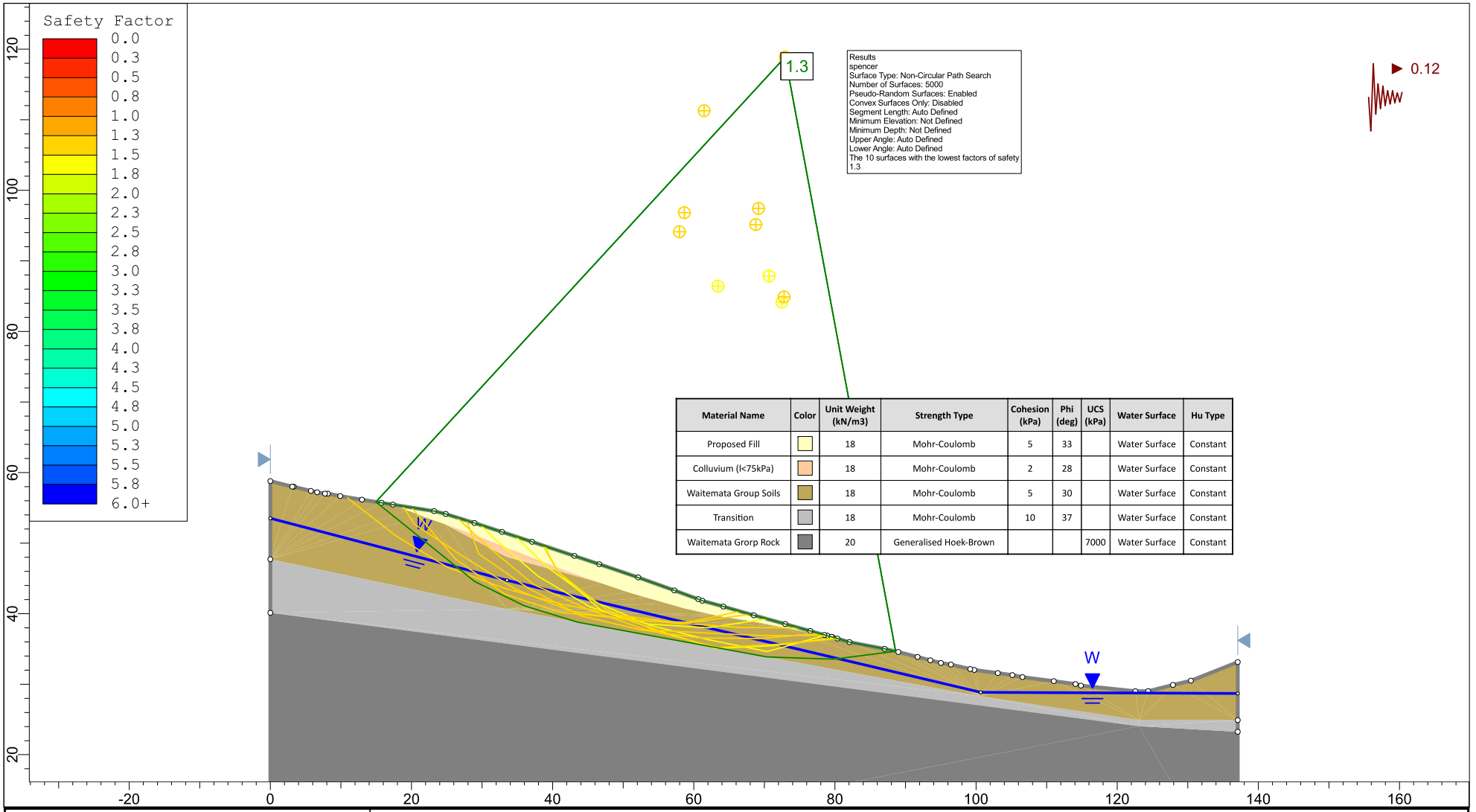
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section CC - Run 11				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5CC - Run 11.slim



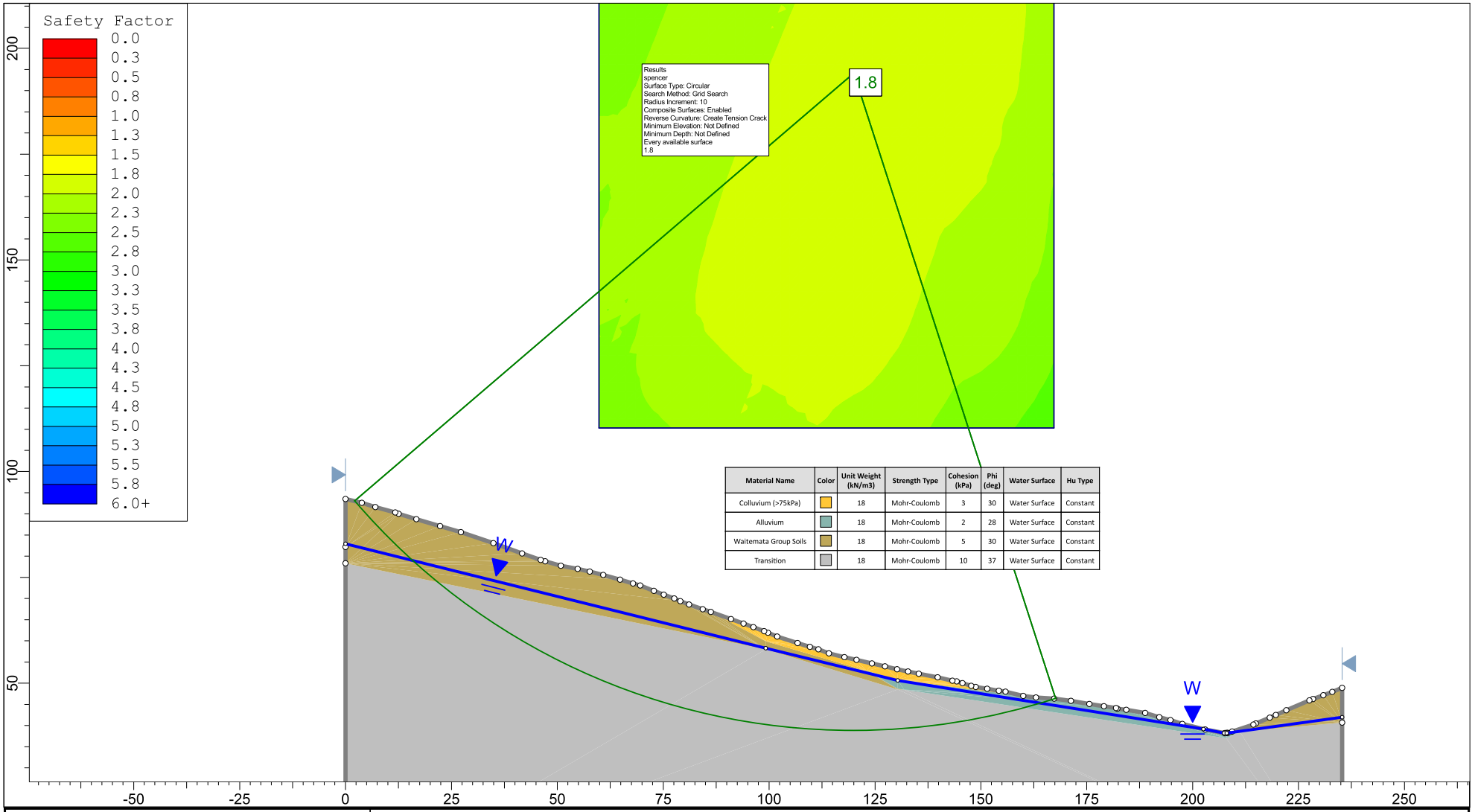
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section CC - Run 12				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5CC - Run 12.slim



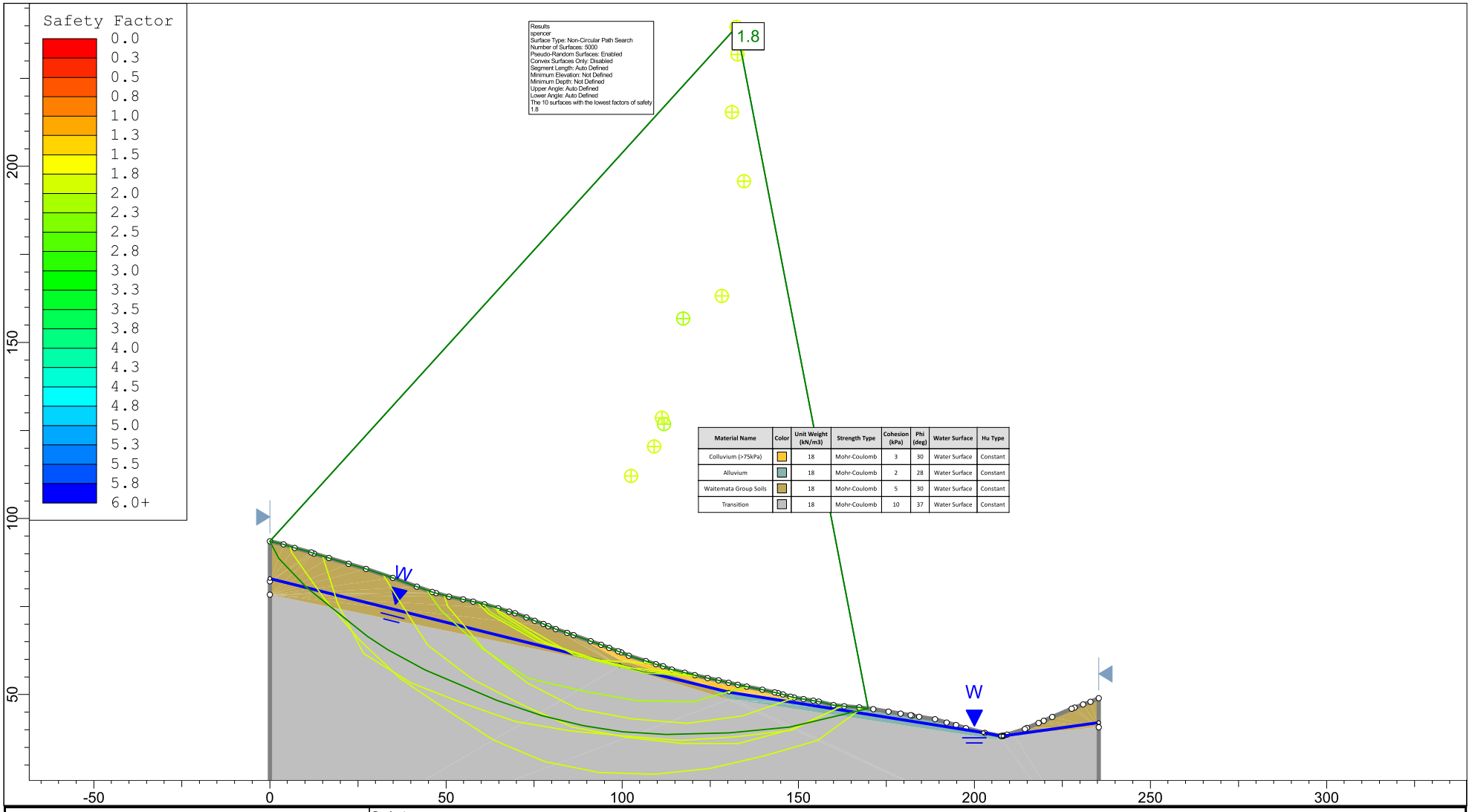
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Hall Farm West				
Analysis Description	Stage 5, Section DD - Run 1				
Drawn By	PH	*Scale*	1:1250	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5DD - Run 1.slim

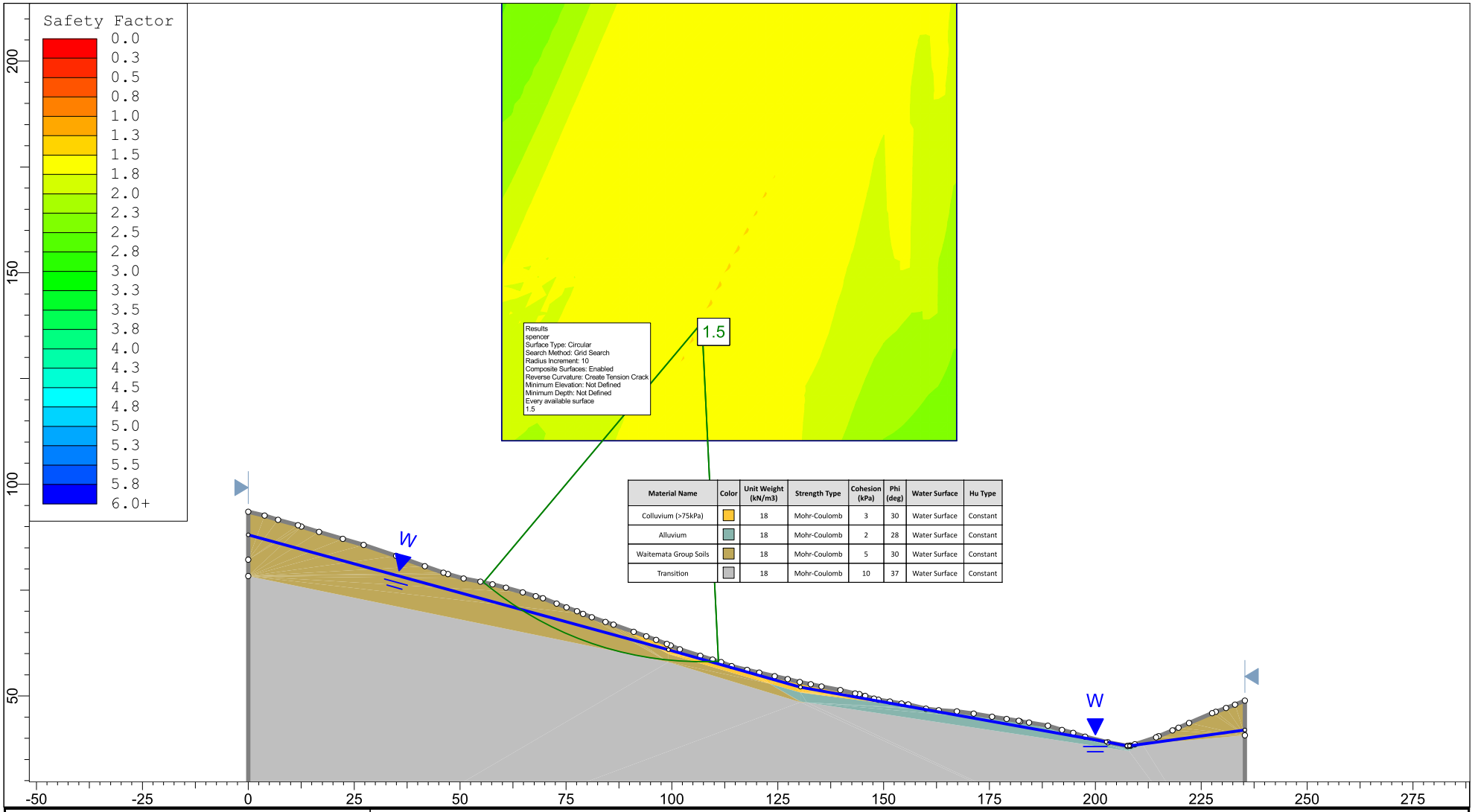


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Project	Proposed Subdivision - Hall Farm West				
Analysis Description	Stage 5, Section DD - Run 2				
Drawn By	PH	*Scale*	1:1500	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5DD - Run 2.slim



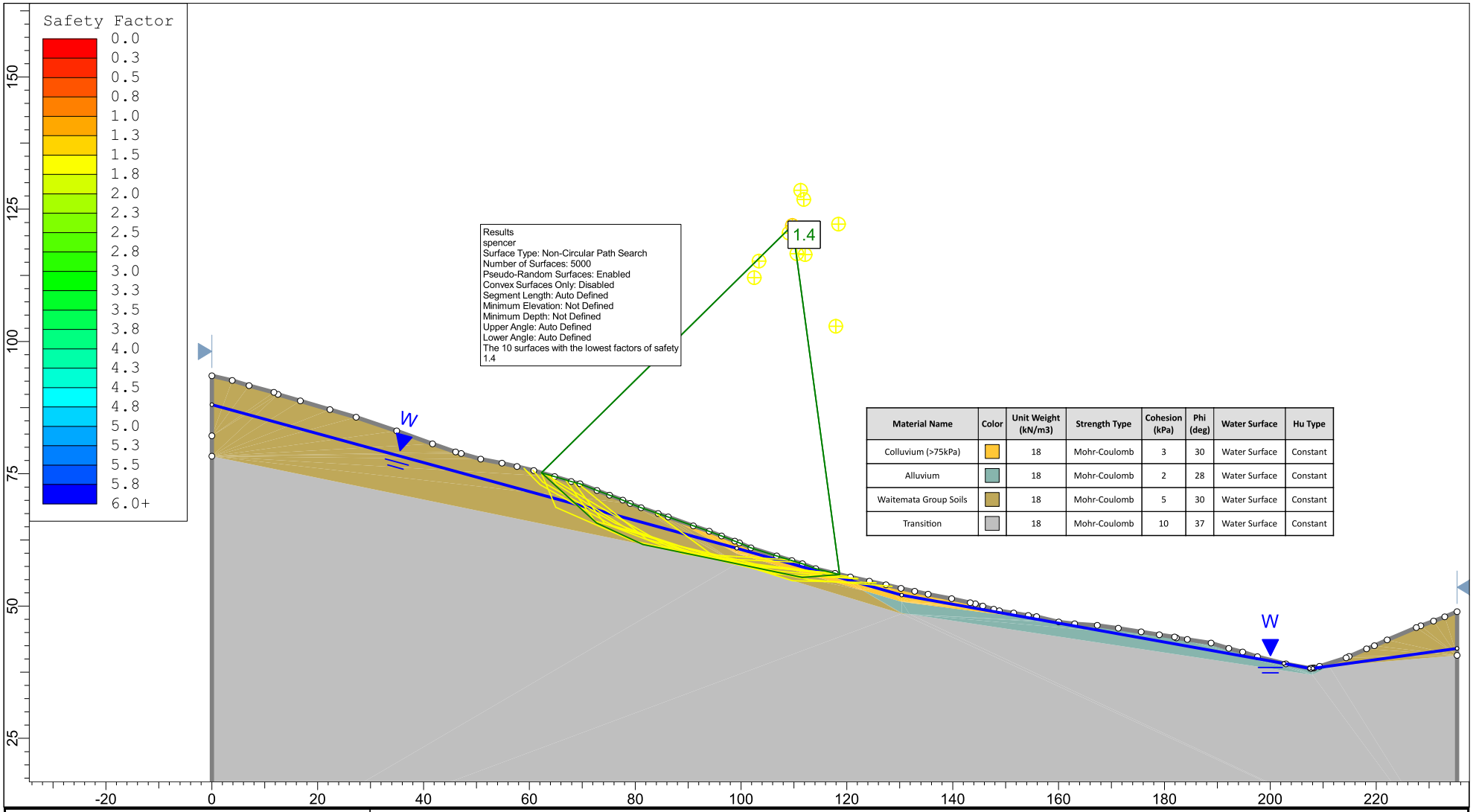
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Hall Farm West				
Analysis Description	Stage 5, Section DD - Run 3				
Drawn By	PH	*Scale*	1:1250	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5DD - Run 3.slim



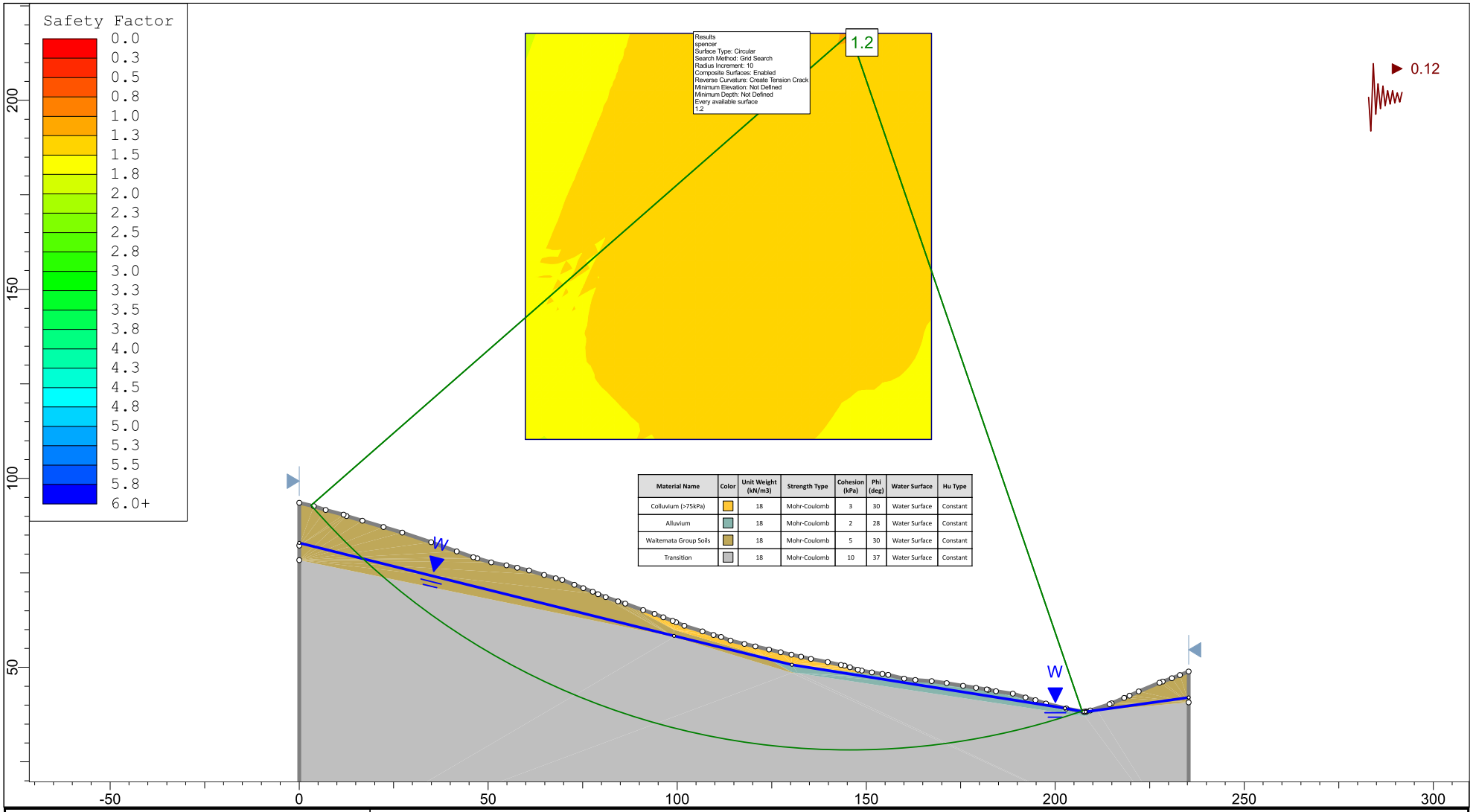
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Hall Farm West				
Analysis Description	Stage 5, Section DD - Run 4				
Drawn By	PH	*Scale*	1:1000	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5DD - Run 4.slim

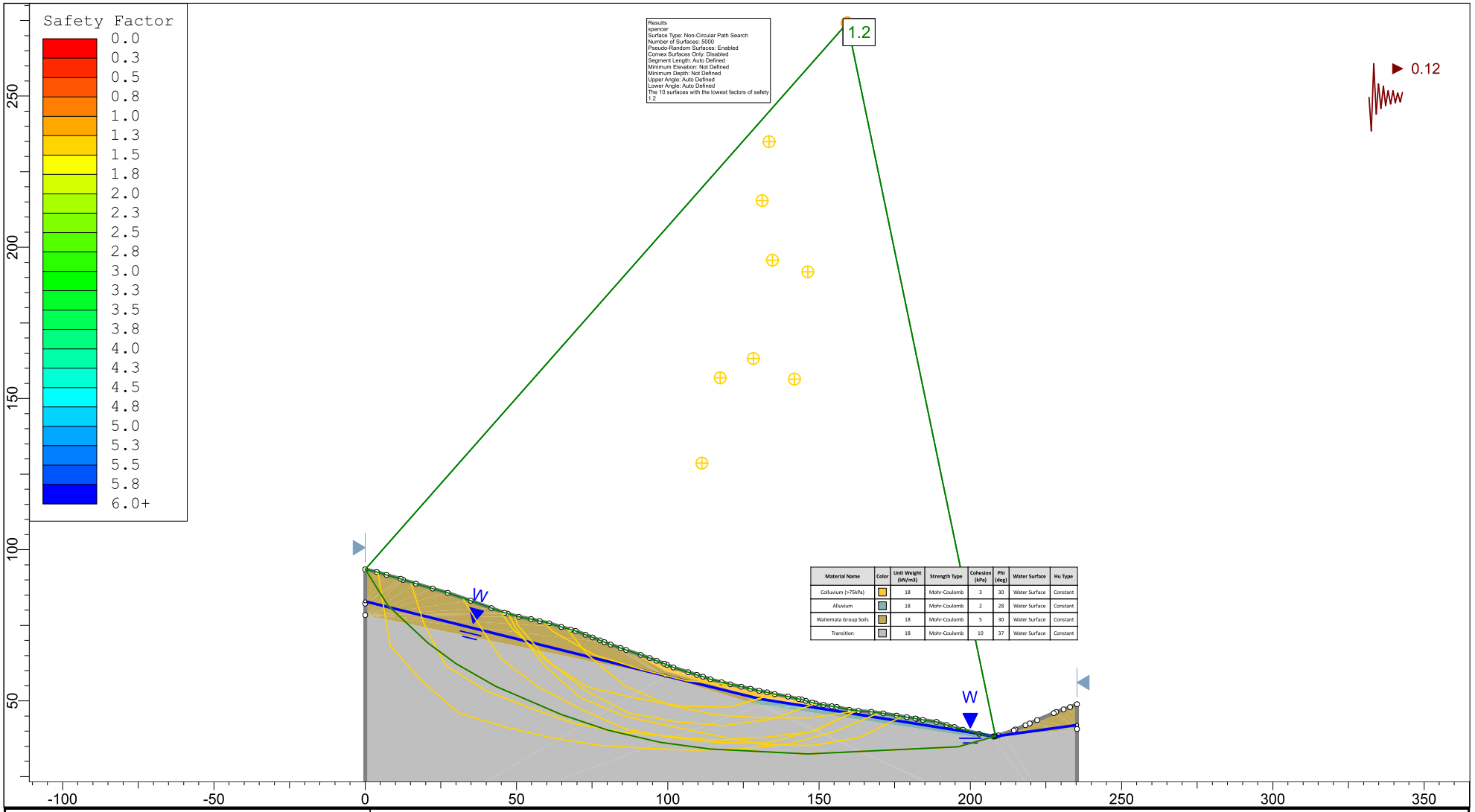


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Project	Proposed Subdivision - Hall Farm West				
Analysis Description	Stage 5, Section DD - Run 5				
Drawn By	PH	*Scale*	1:1400	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5DD - Run 5.slim

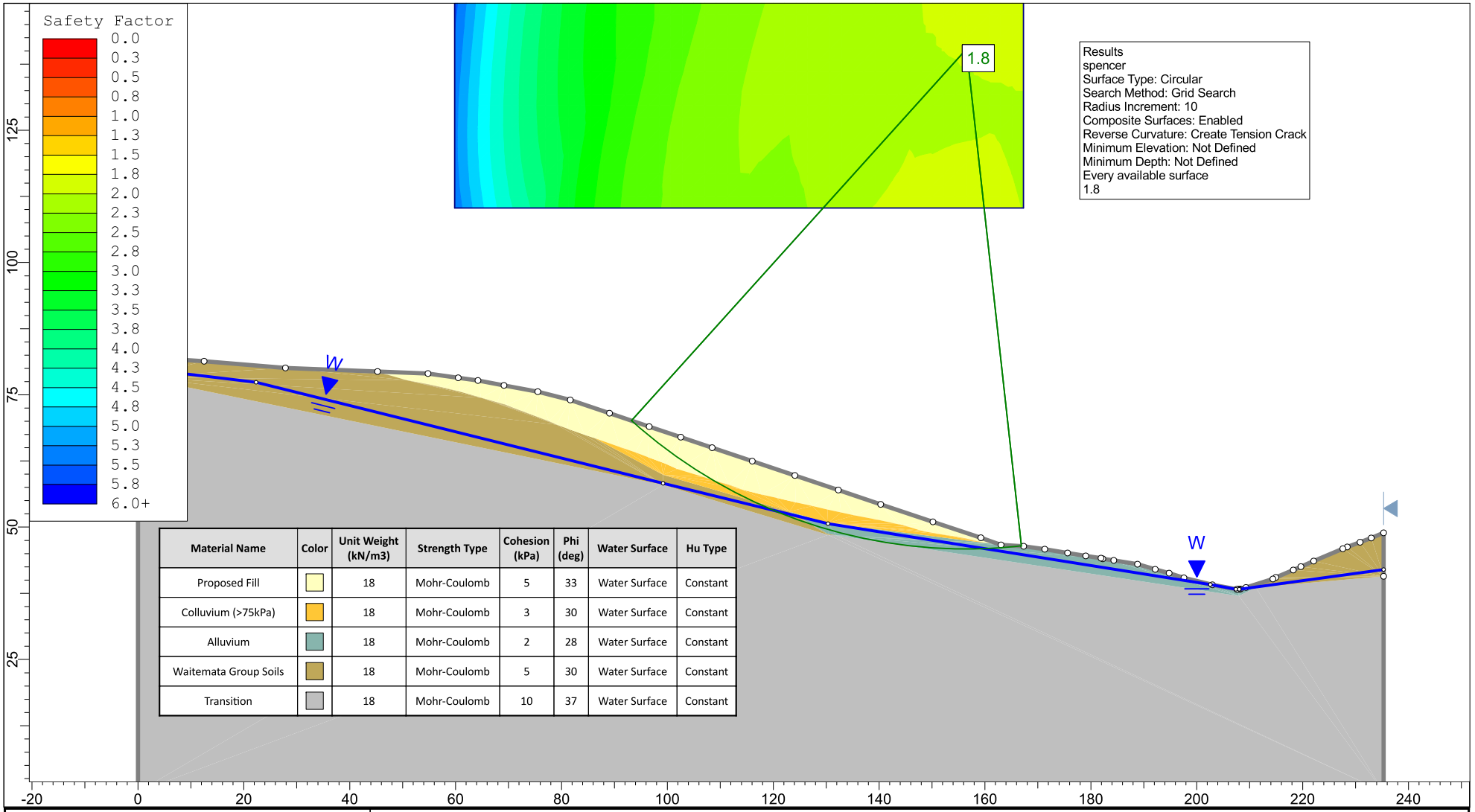


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Project	Proposed Subdivision - Hall Farm West				
Analysis Description	Stage 5, Section DD - Run 6				
Drawn By	PH	*Scale*	1:1750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5DD - Run 6.slim



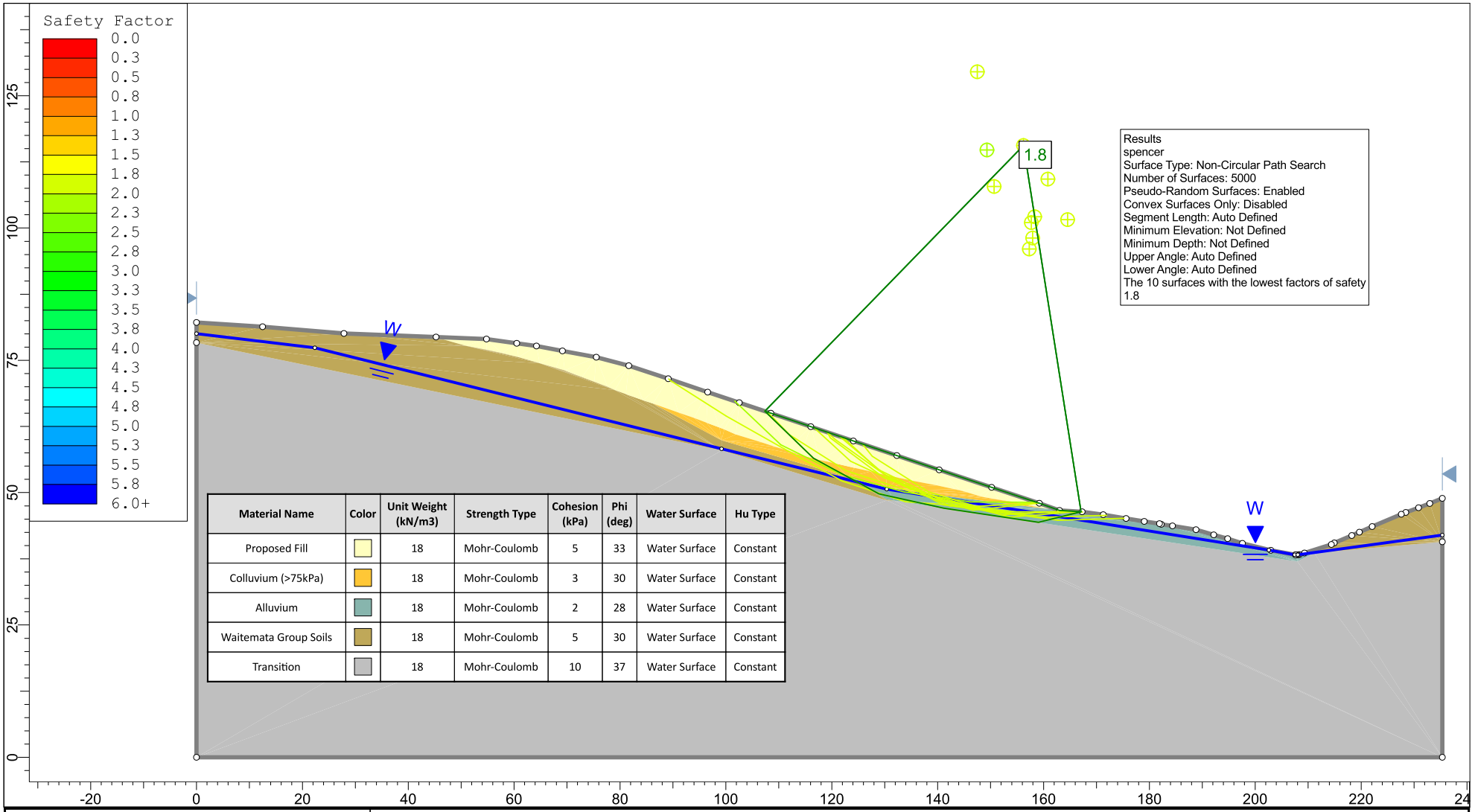
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Hall Farm West				
Analysis Description	Stage 5, Section DD - Run 7				
Drawn By	PH	Scale	1:1000	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S5DD - Run 7.slim



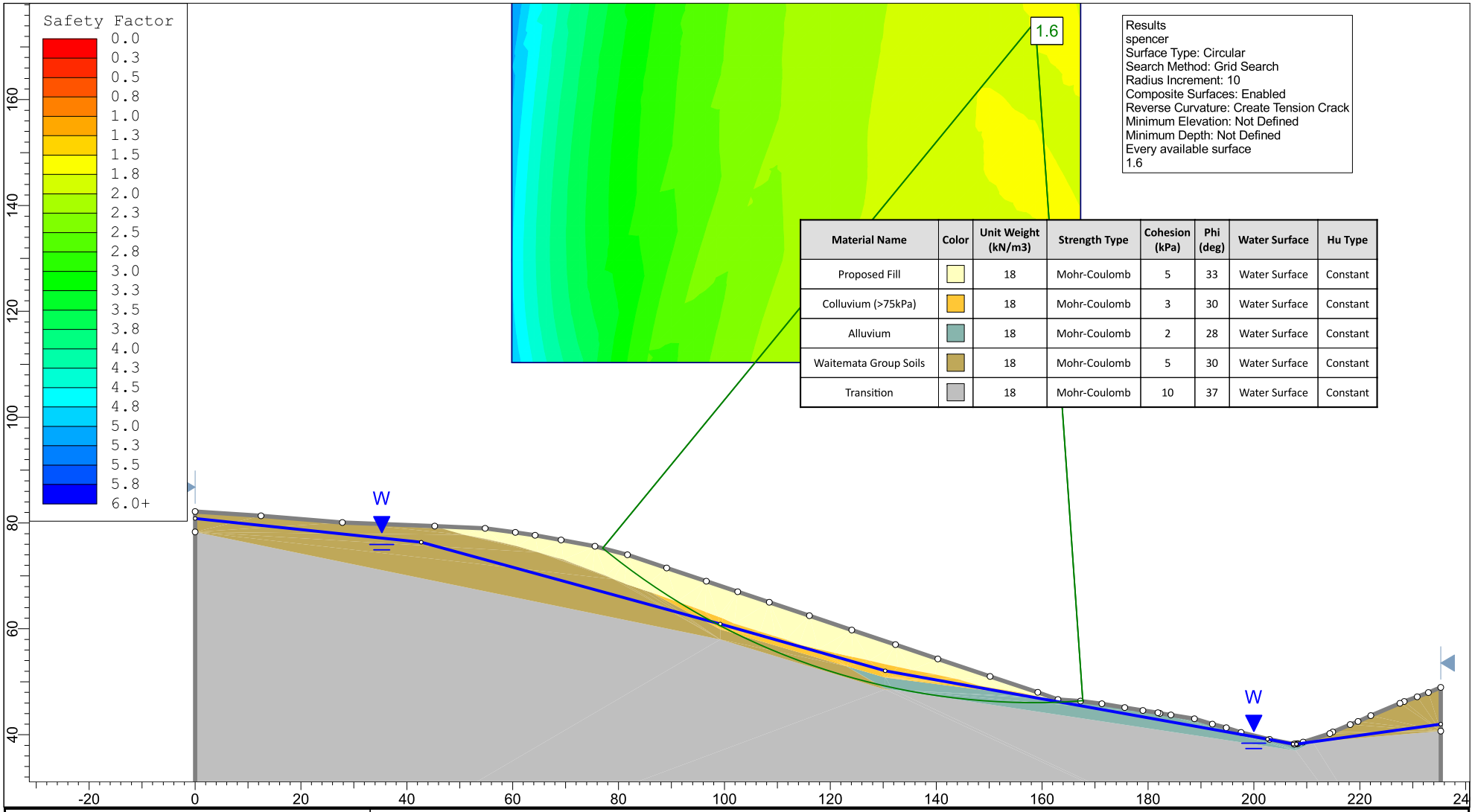
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Hall Farm West		
Analysis Description	Stage 5, Section DD - Run 8		
Drawn By	PH	*Scale* 1:1000	*Company* KGA Geotechnical
Date	31/08/2015		*File Name* 7464 - S5DD - Run 8.slim



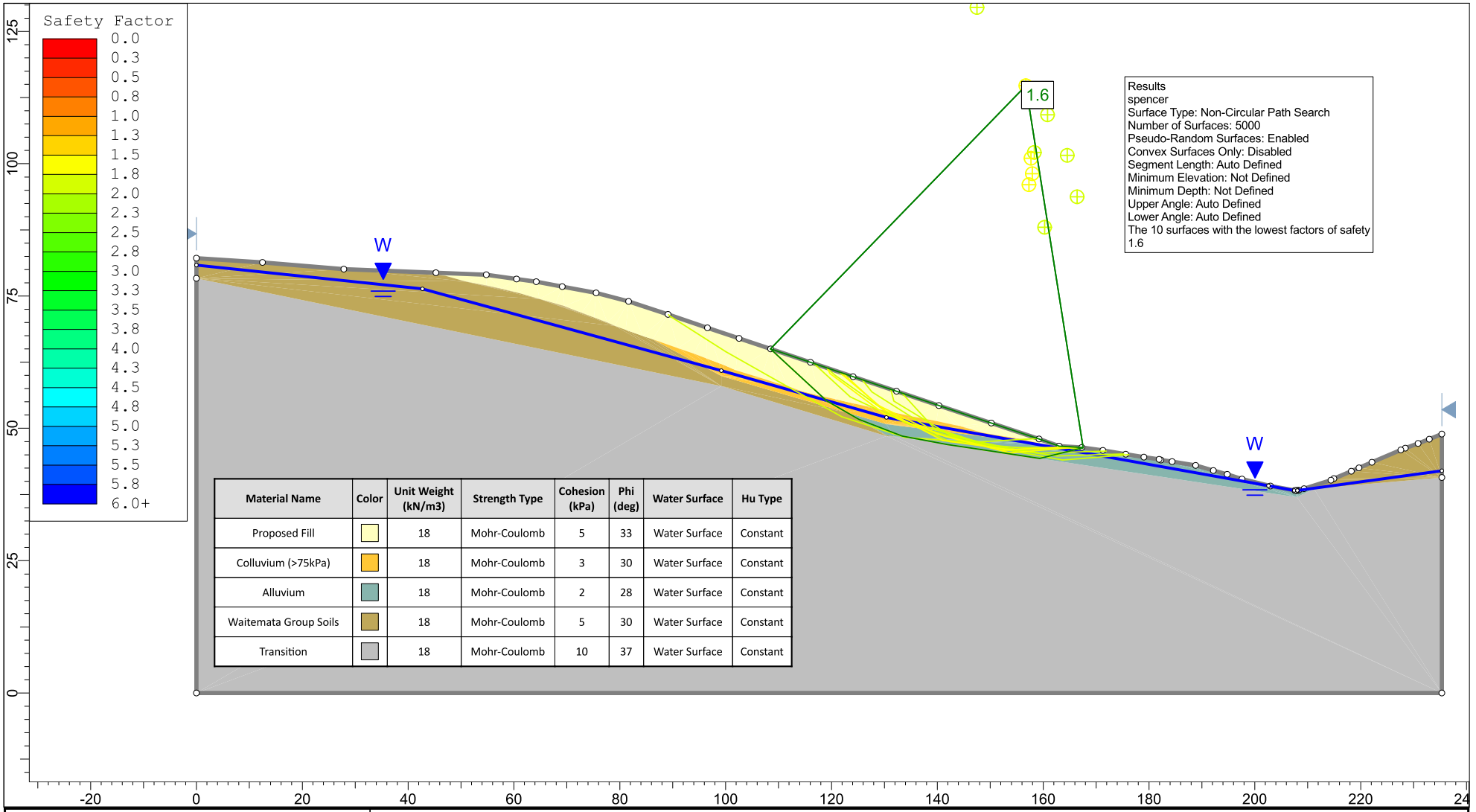
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Hall Farm West				
Analysis Description	Stage 5, Section DD - Run 9				
Drawn By	PH	*Scale*	1:1000	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5DD - Run 9.slim



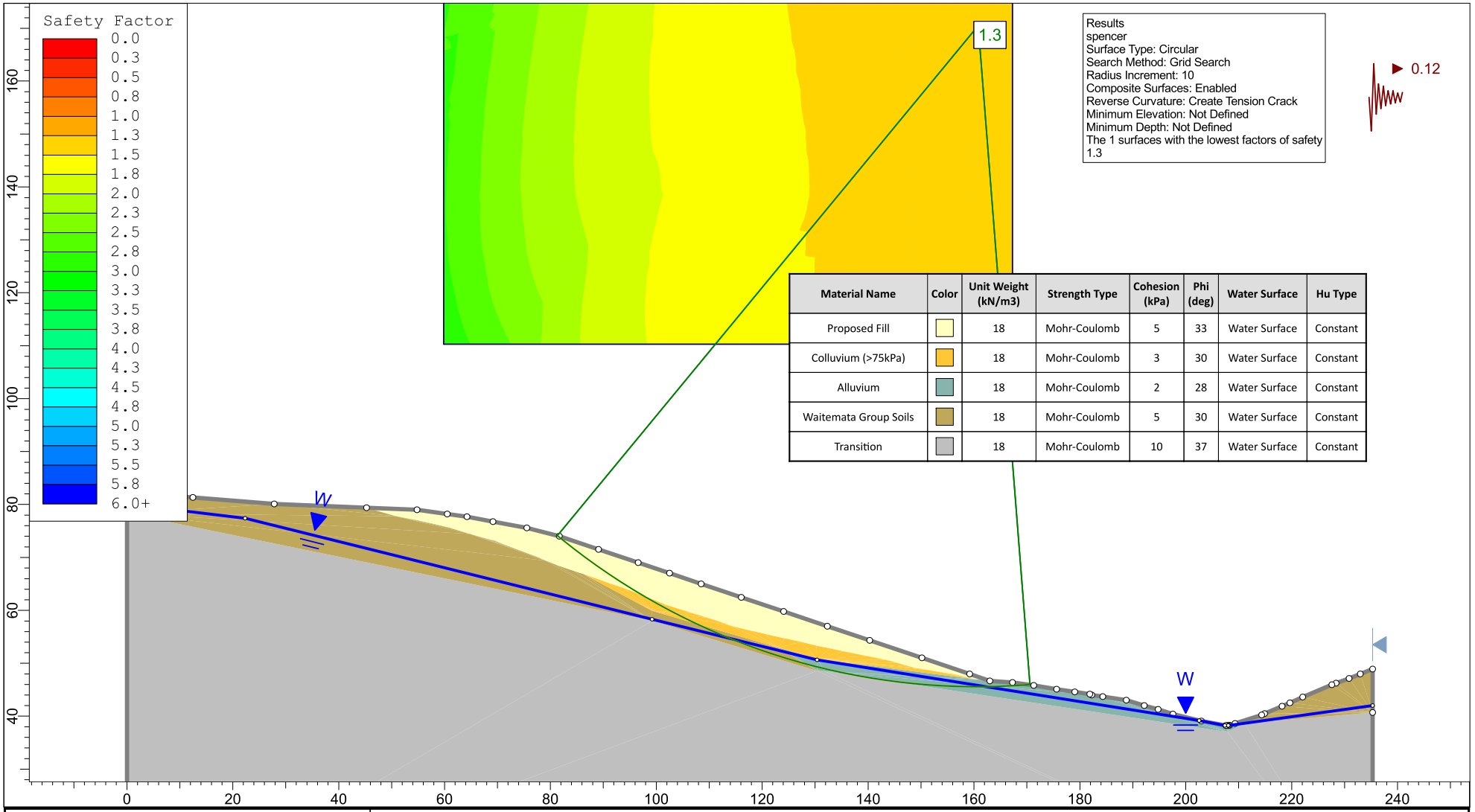
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Hall Farm West				
Analysis Description	Stage 5, Section DD - Run 10				
Drawn By	PH	*Scale*	1:1000	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5DD - Run 10.slim



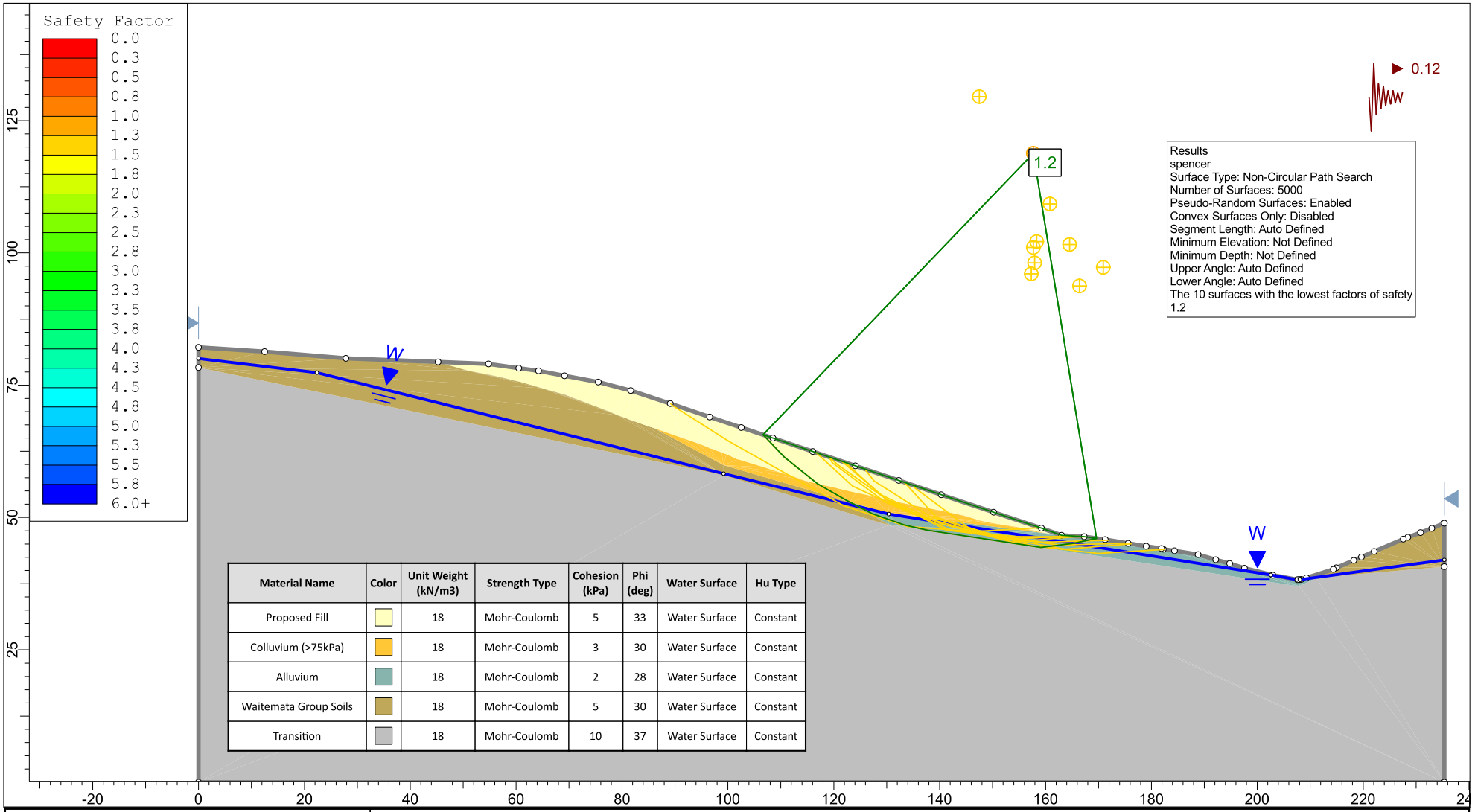
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Hall Farm West				
Analysis Description	Stage 5, Section DD - Run 11				
Drawn By	PH	Scale	1:1000	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S5DD - Run 11.slim



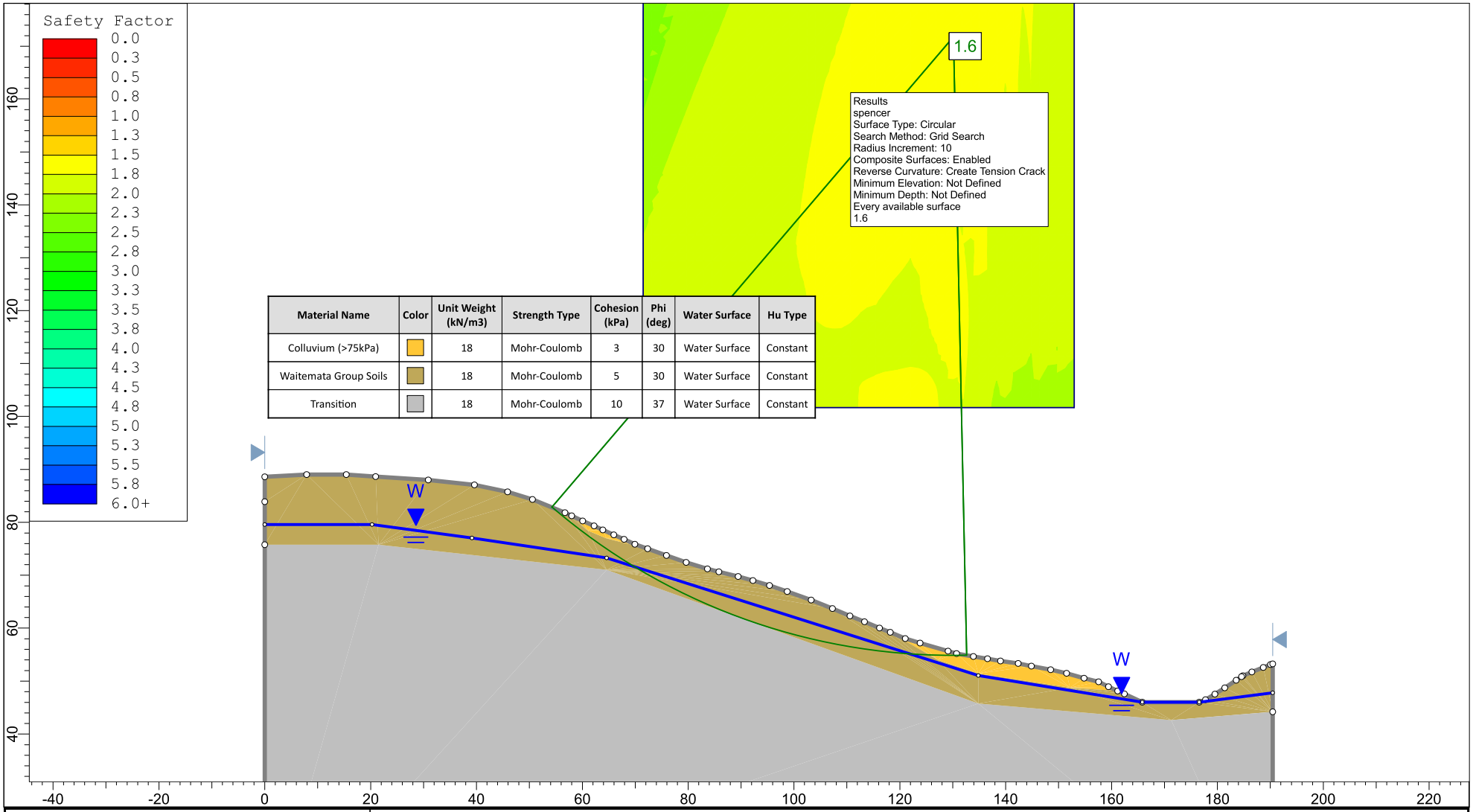
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Hall Farm West		
Analysis Description	Stage 5, Section DD - Run 12		
Drawn By	PH	*Scale* 1:1000	*Company* KGA Geotechnical
Date	31/08/2015		*File Name* 7464 - S5DD - Run 12.slim



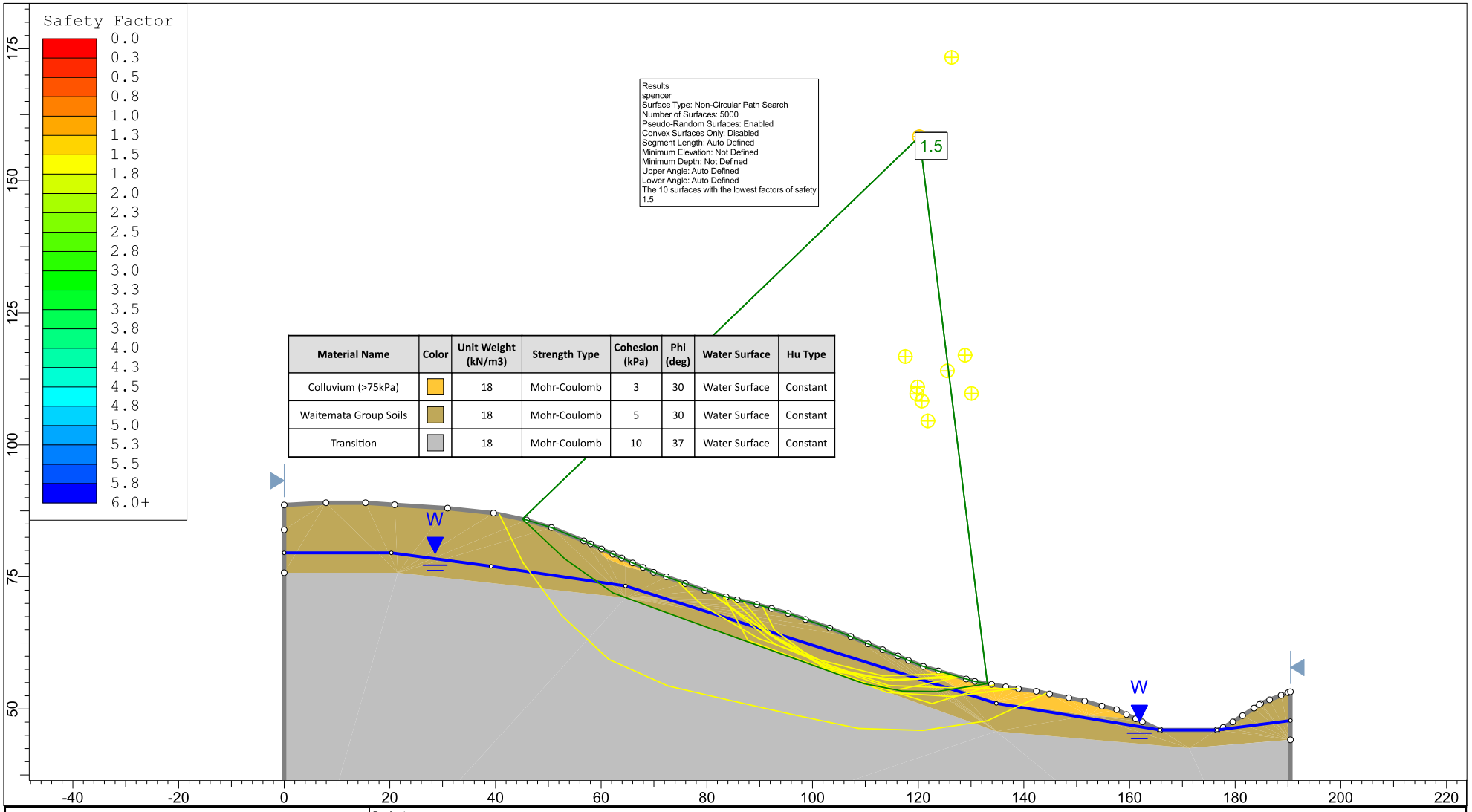
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section EE - Run 1				
Drawn By	PH	*Scale*	1:1000	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5EE - Run 1.slim



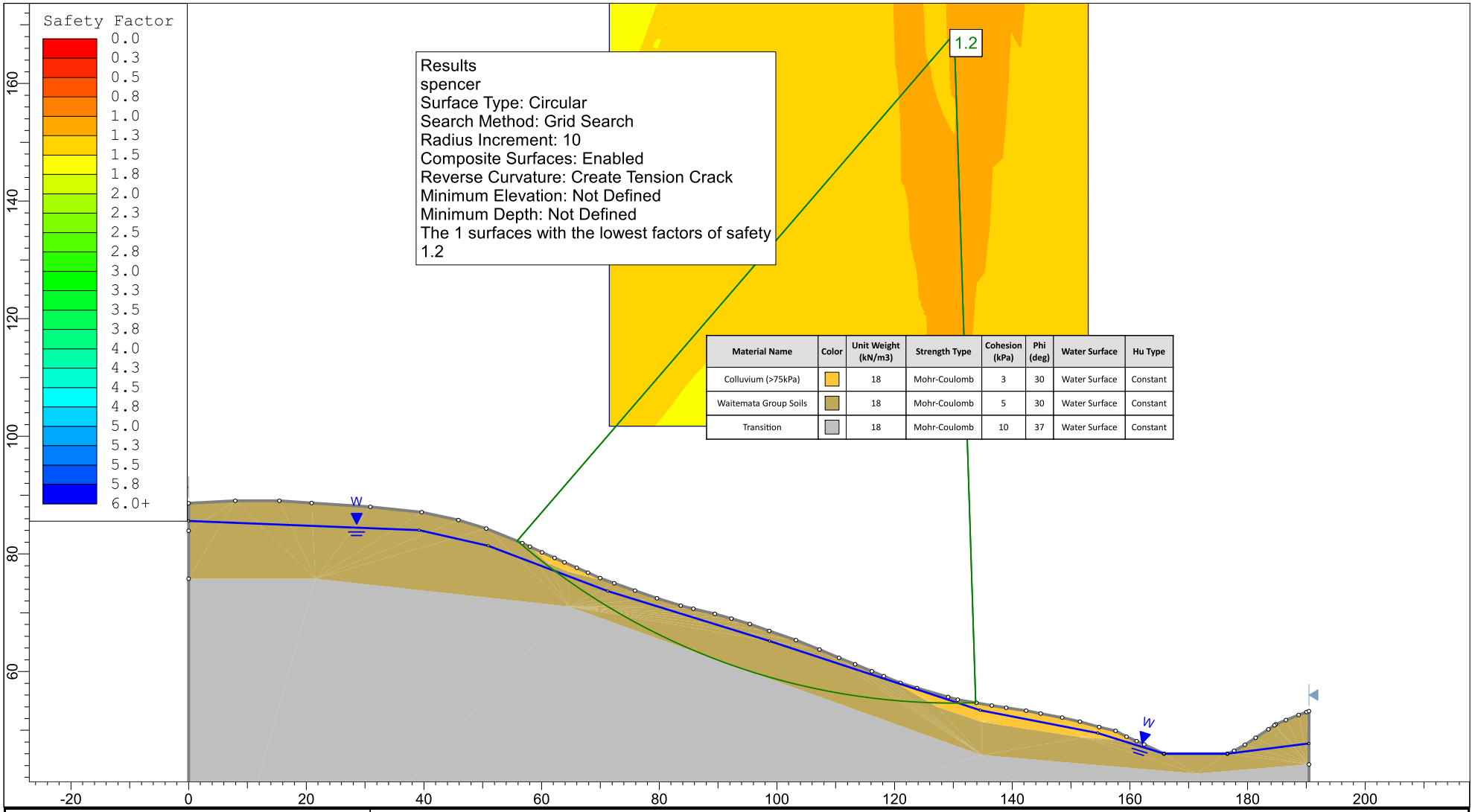
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section EE - Run 2				
Drawn By	PH	*Scale*	1:1000	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5EE - Run 2.slim

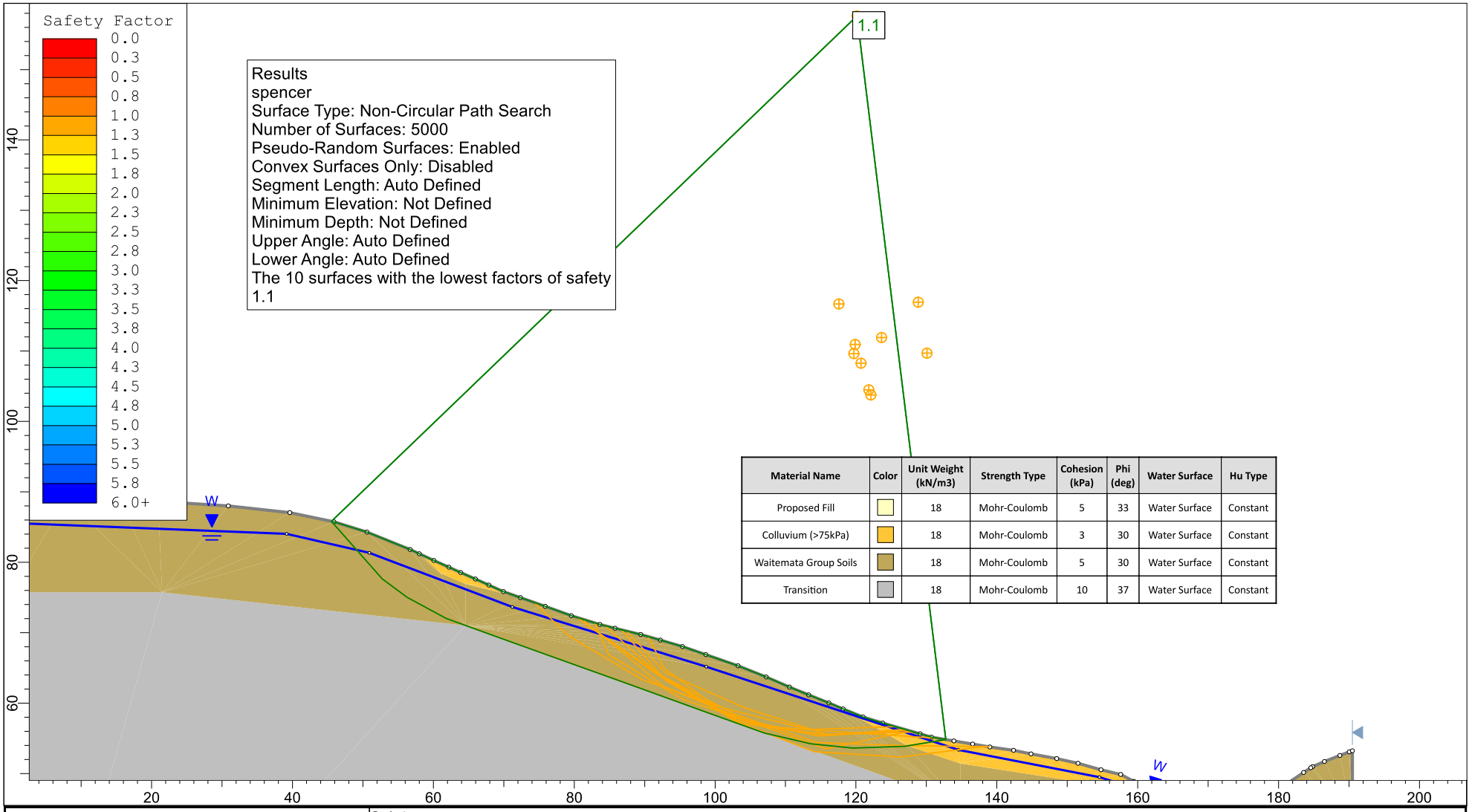


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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section EE - Run 3				
Drawn By	PH	*Scale*	1:900	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5EE - Run 3.slim



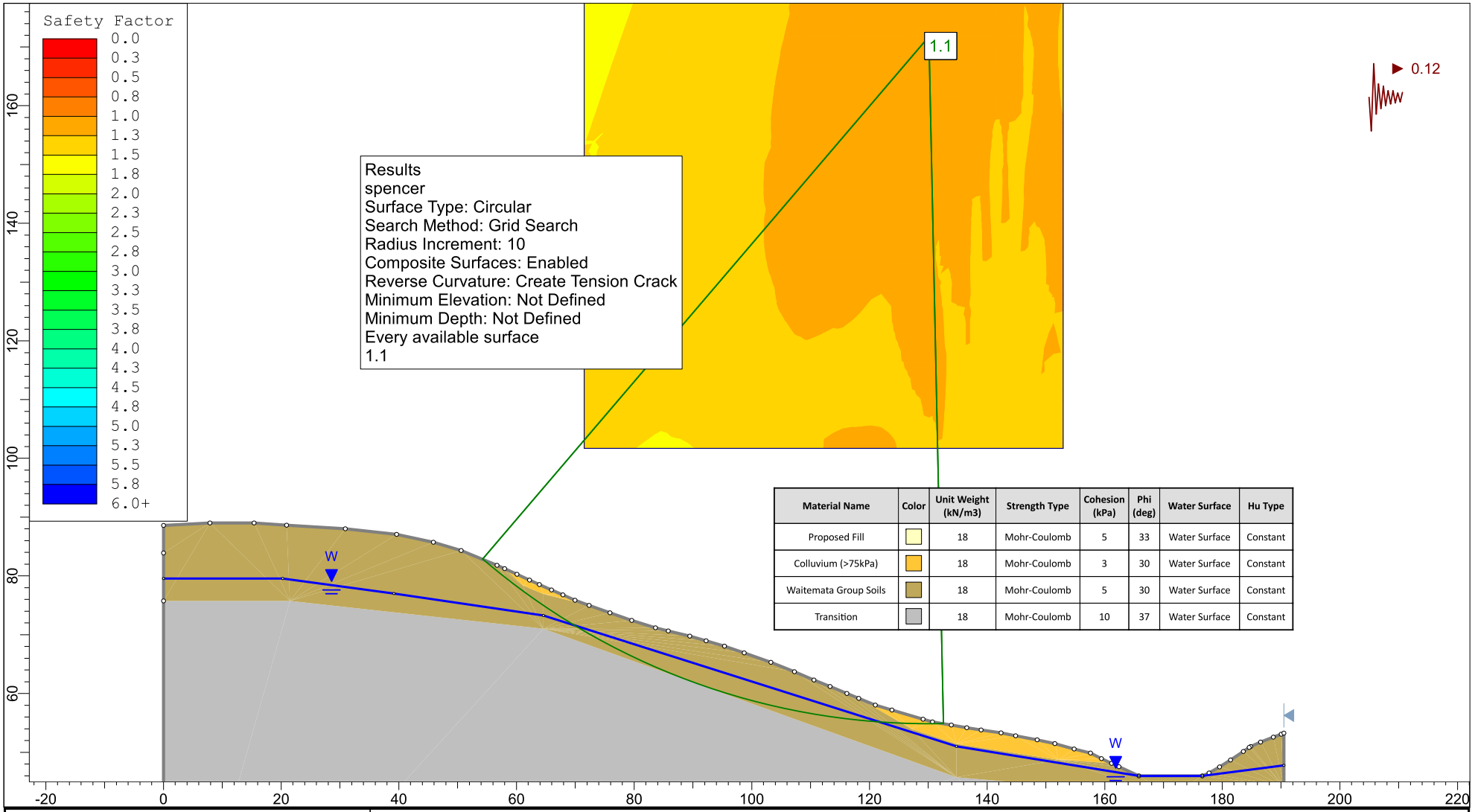
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section EE - Run 4				
Drawn By	PH	Scale	1:750	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S5EE - Run 4.slim



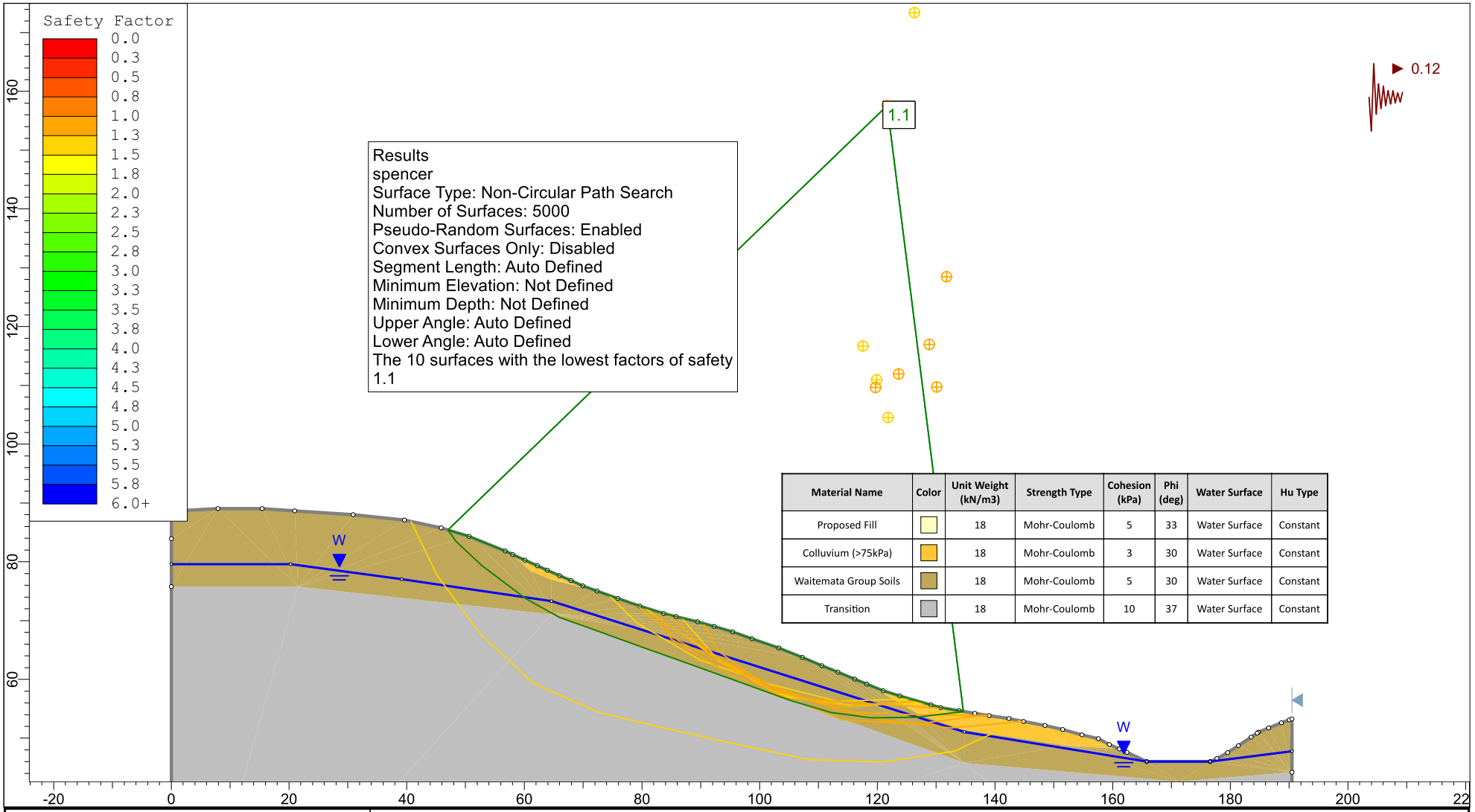
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section EE - Run 5				
Drawn By	PH	Scale	1:900	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S5EE - Run 5.slim



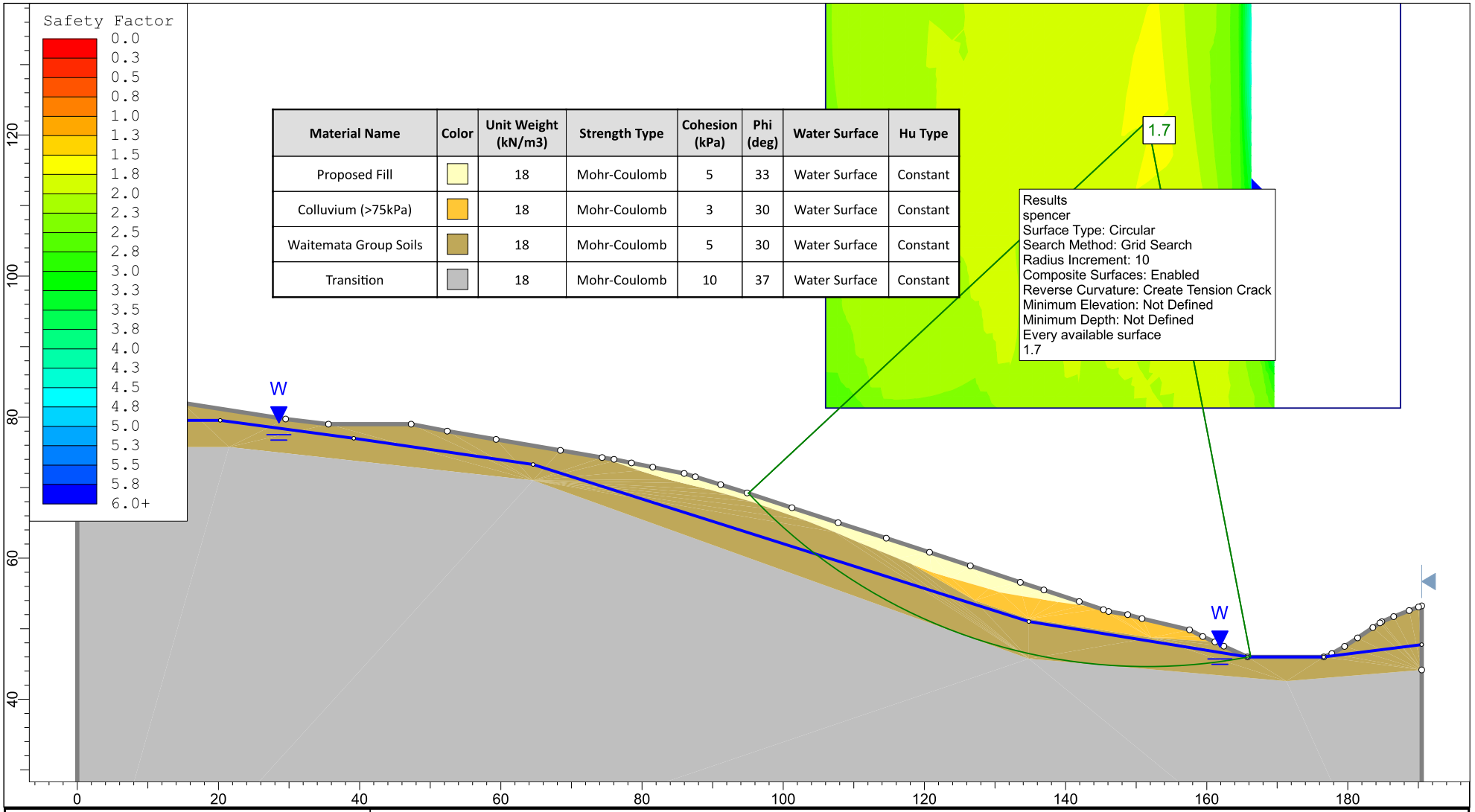
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section EE - Run 6				
Drawn By	PH	*Scale*	1:900	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5EE - Run 6.slim



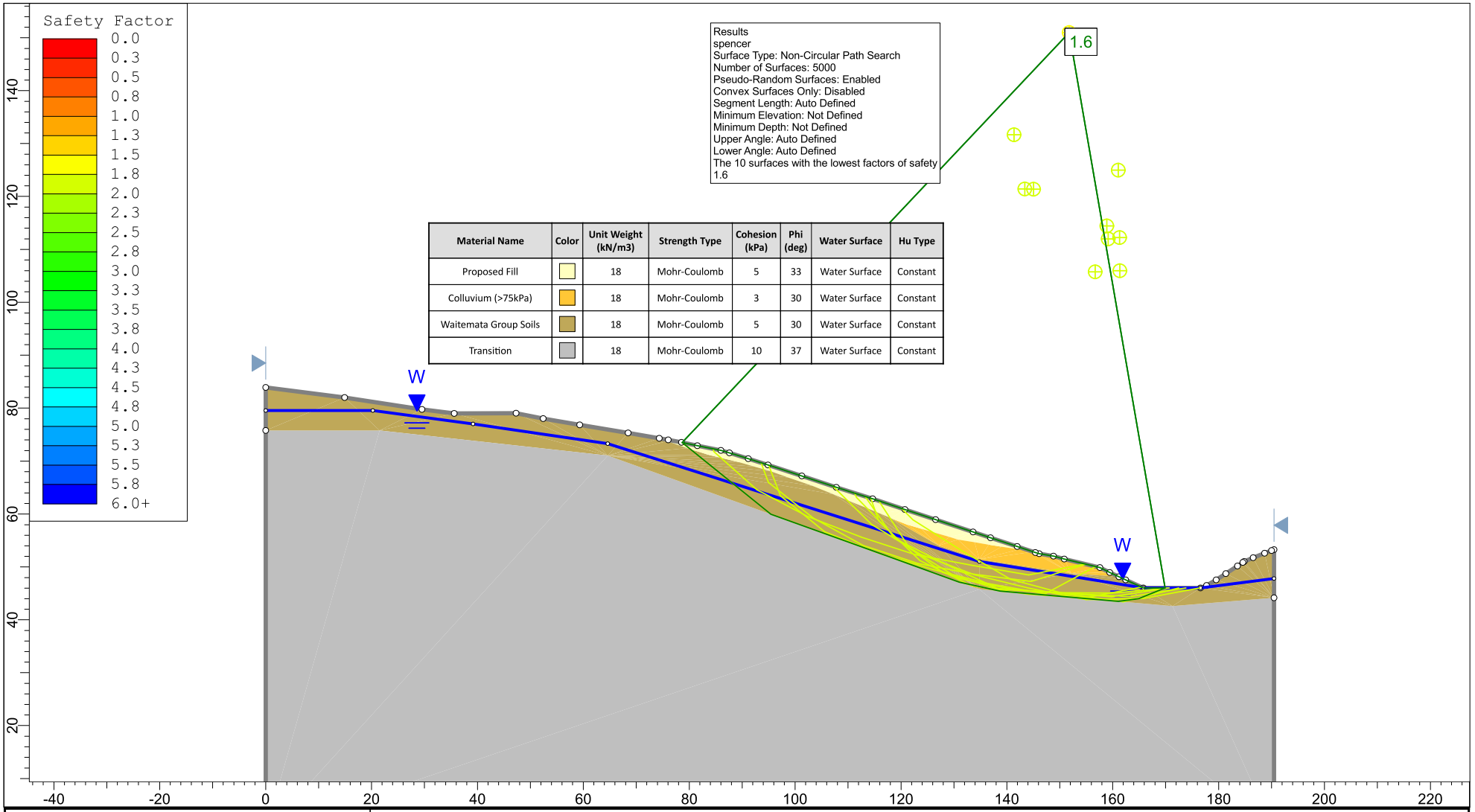
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section EE - Run 7				
Drawn By	PH	Scale	1:750	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S5EE - Run 7.slim



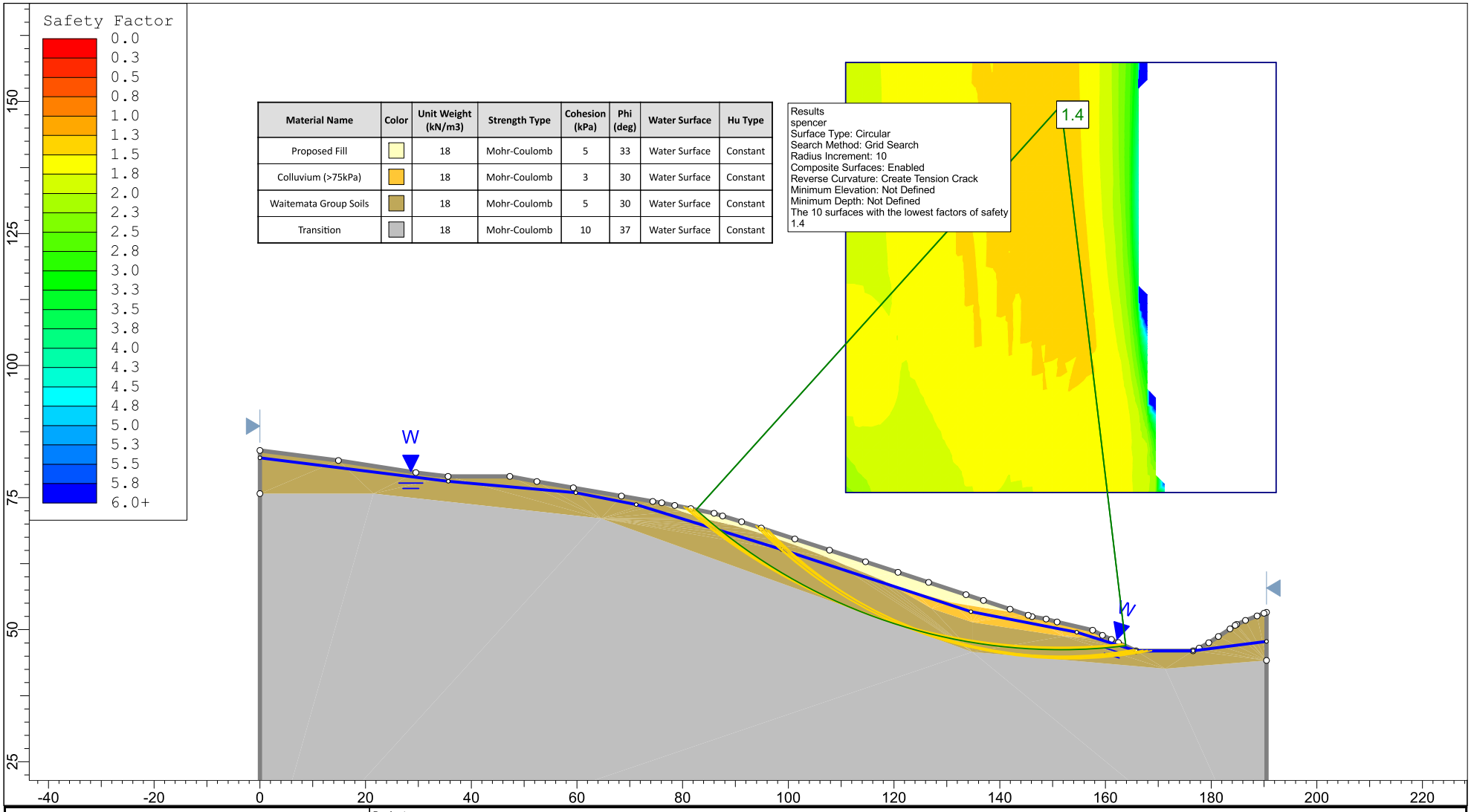
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section EE - Run 8				
Drawn By	PH	*Scale*	1:1000	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5EE - Run 8.slim

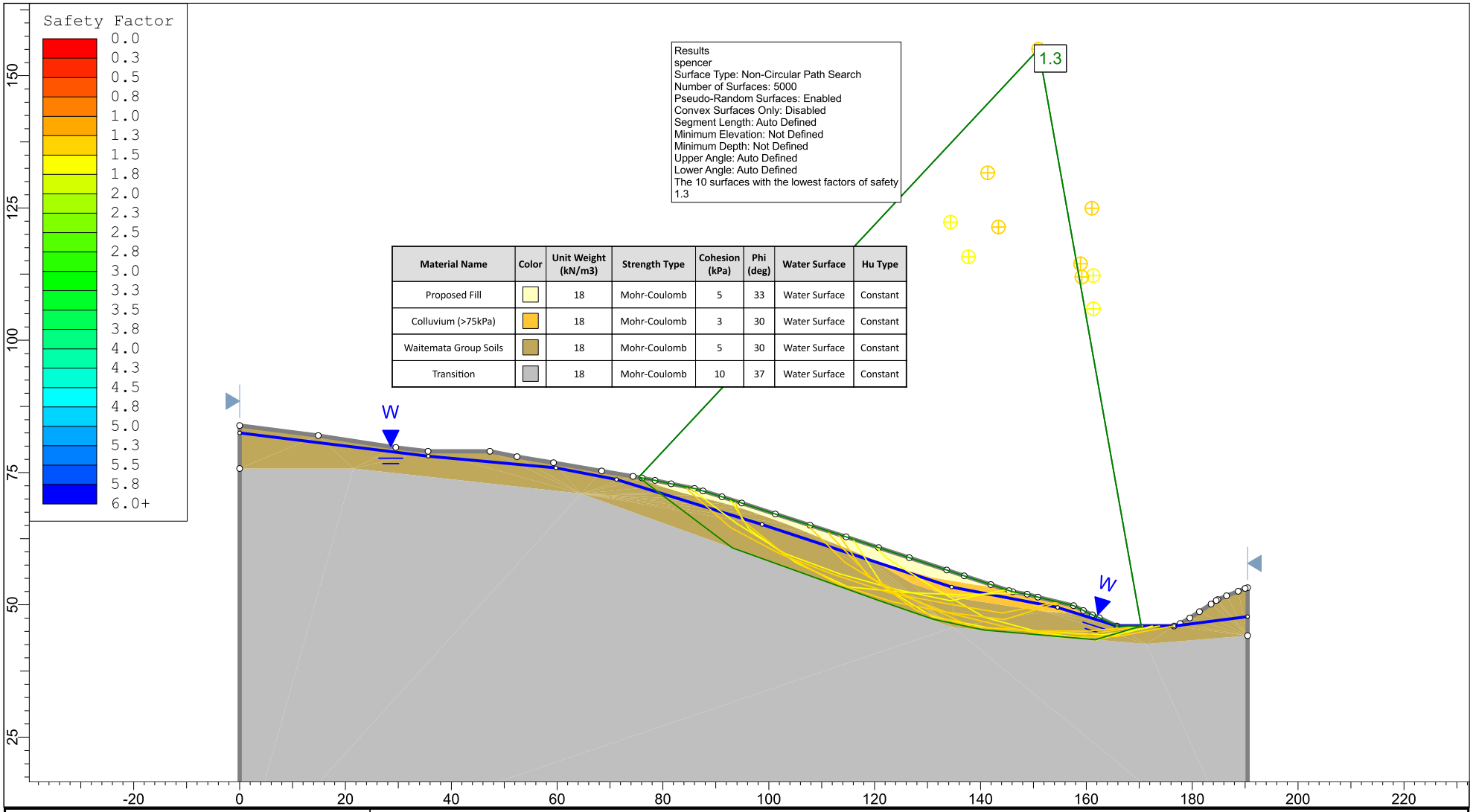


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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section EE - Run 9				
Drawn By	PH	Scale	1:1000	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S5EE - Run 9.slim



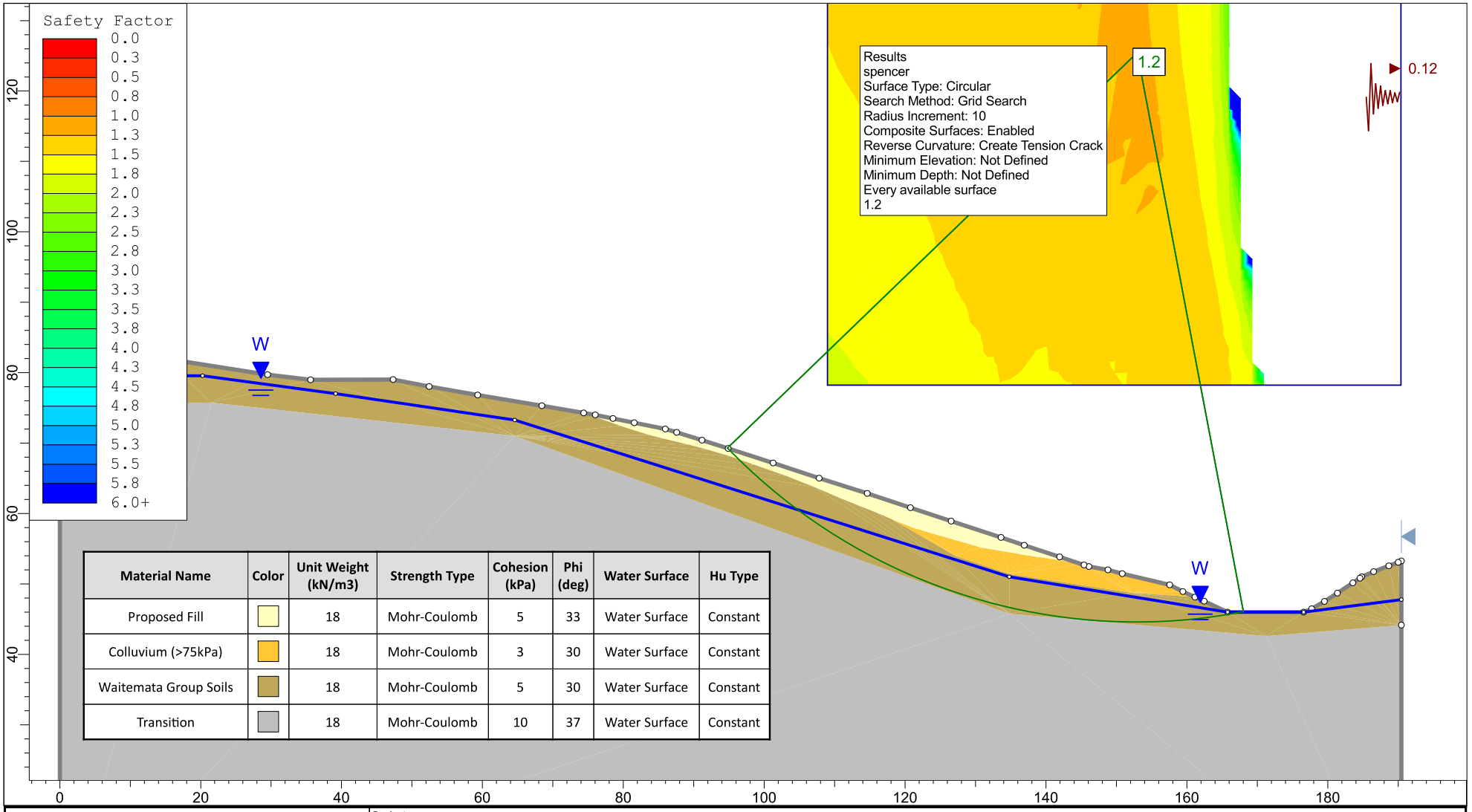
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section EE - Run 10				
Drawn By	PH	*Scale*	1:1000	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5EE - Run 10.slim



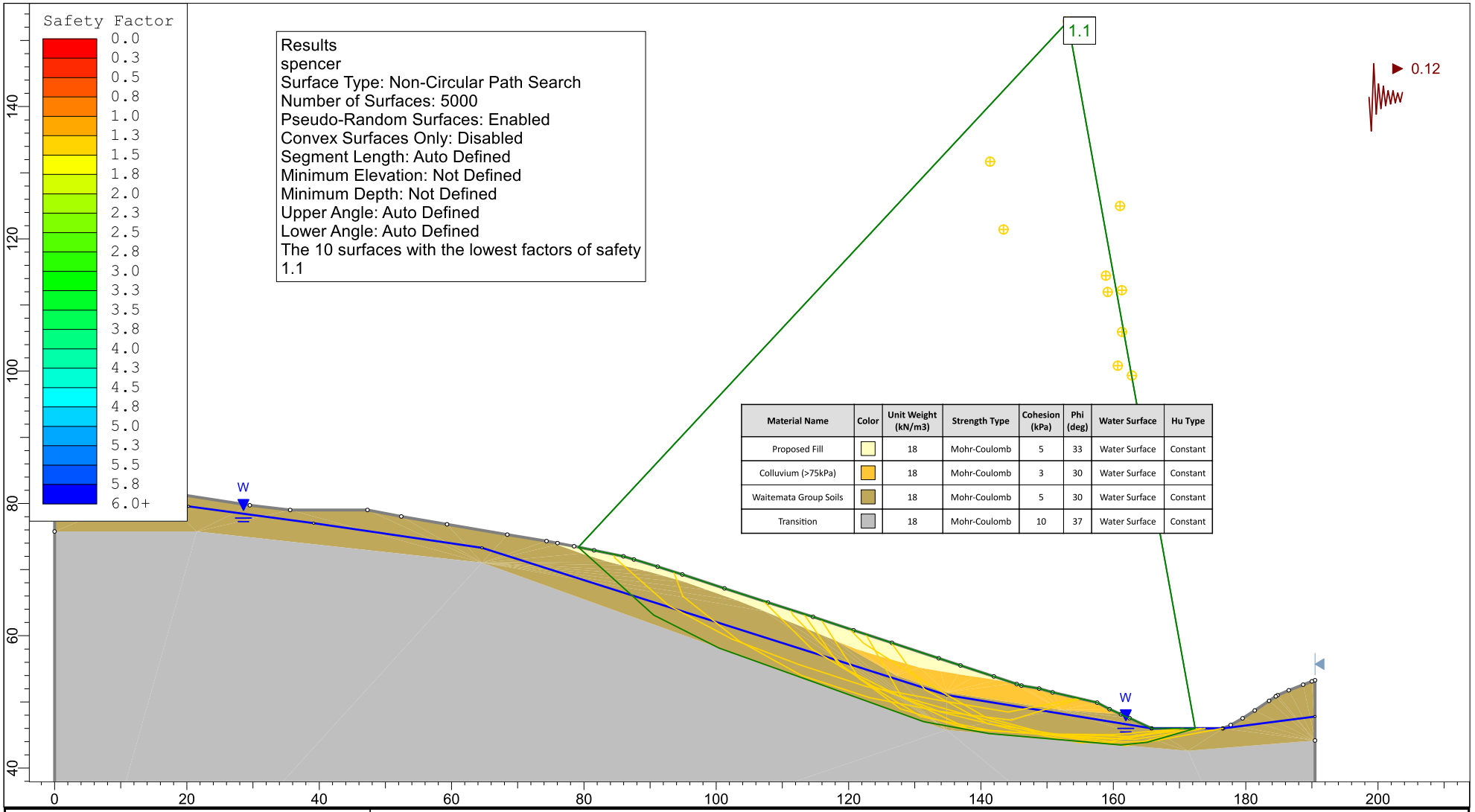
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section EE - Run 11				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5EE - Run 11.slim



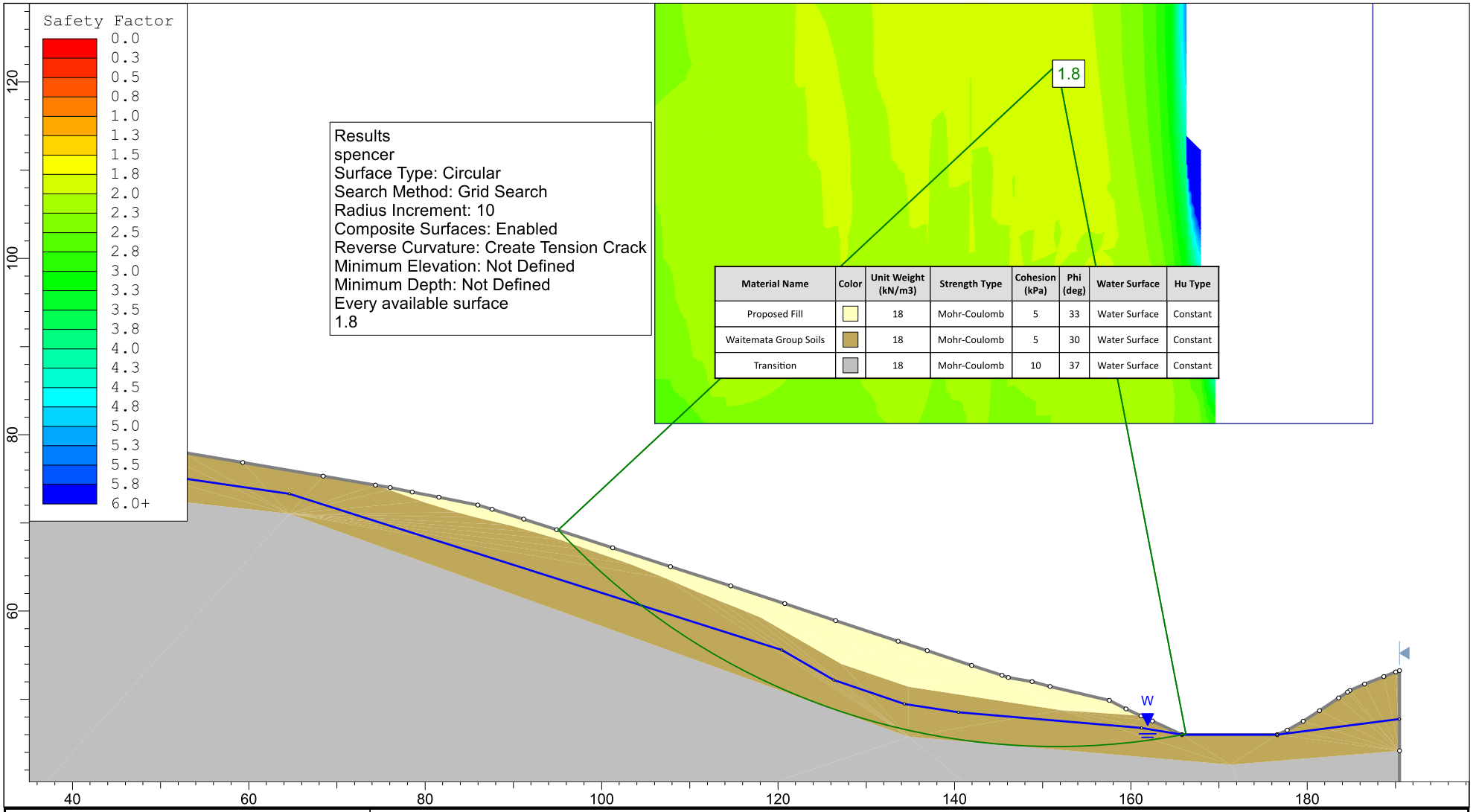
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section EE - Run 12				
Drawn By	PH	*Scale*	1:800	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5EE - Run 12.slim



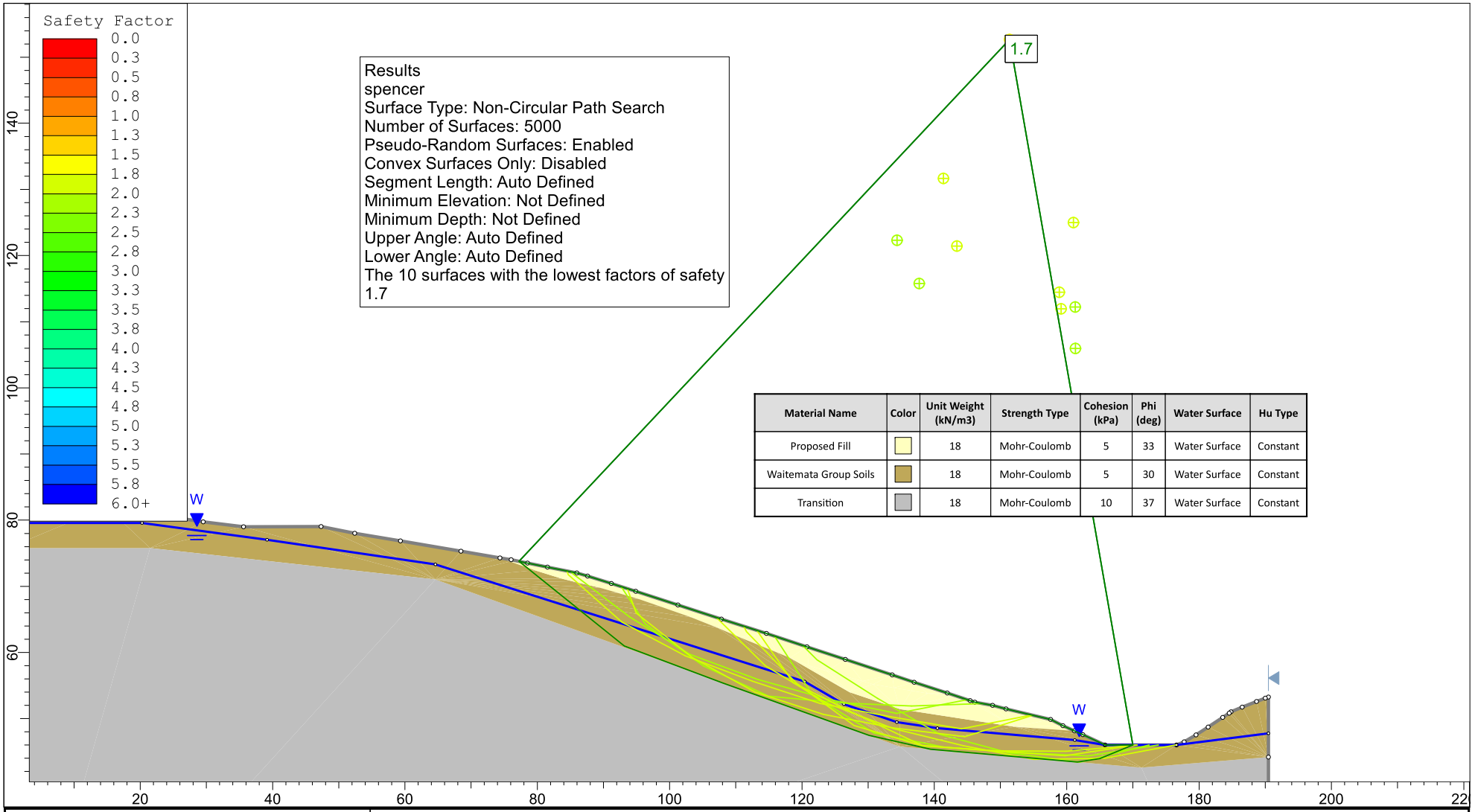
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section EE - Run 13				
Drawn By	PH	Scale	1:600	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S5EE - Run 13.slim



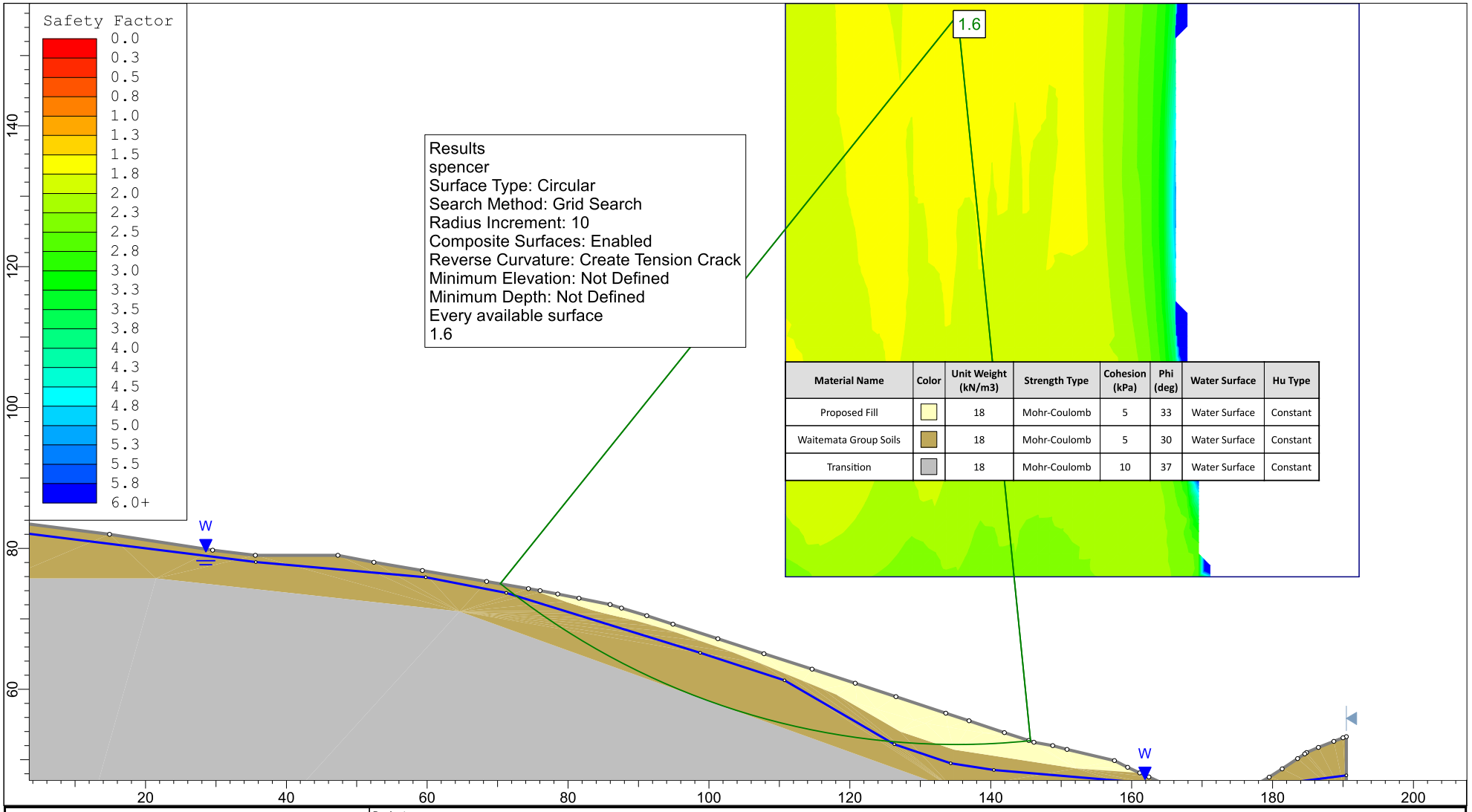
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section EE - Run 14				
Drawn By	PH	*Scale*	1:800	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5EE - Run 14.slim



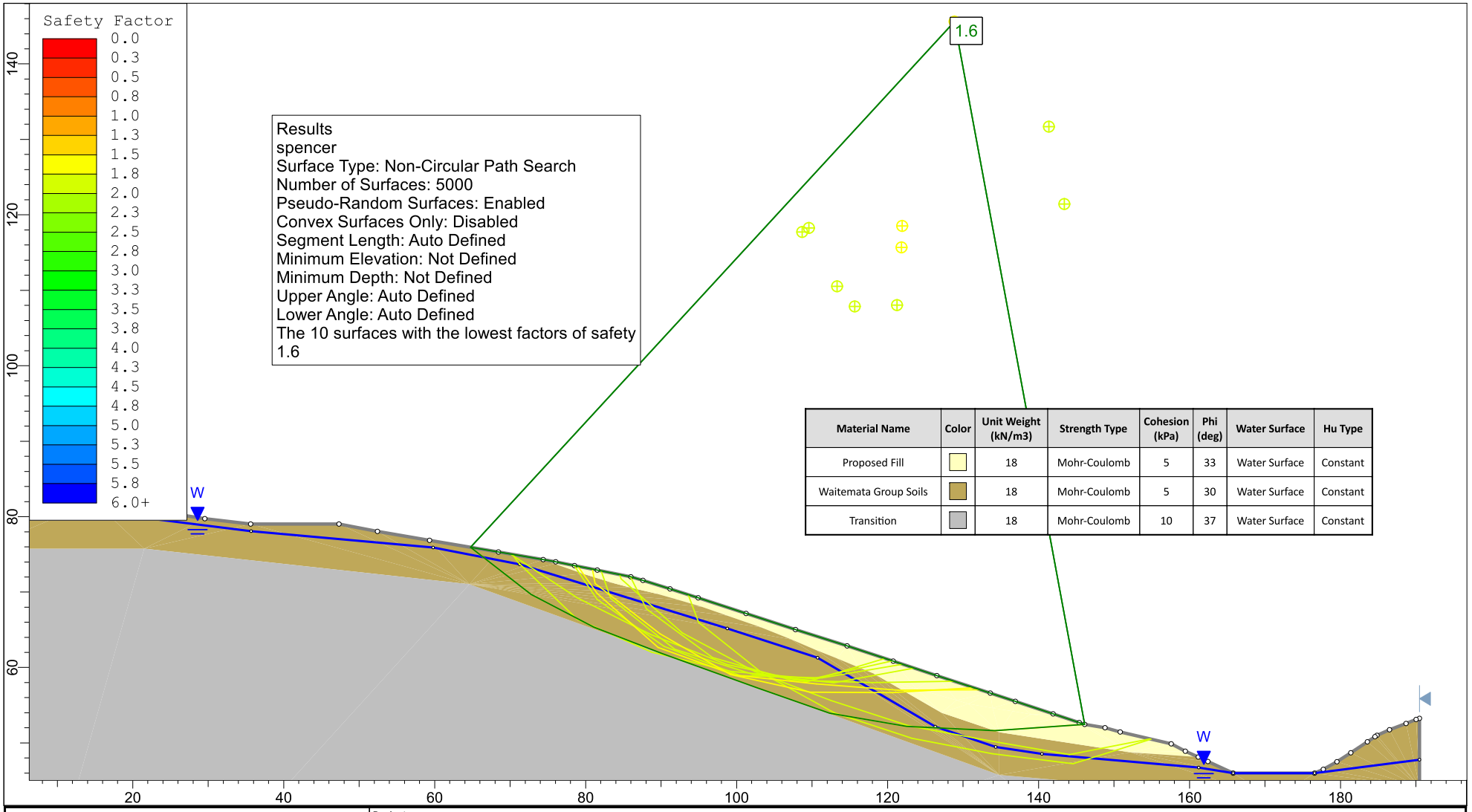
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section EE - Run 15				
Drawn By	PH	Scale	1:750	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S5EE - Run 15.slim



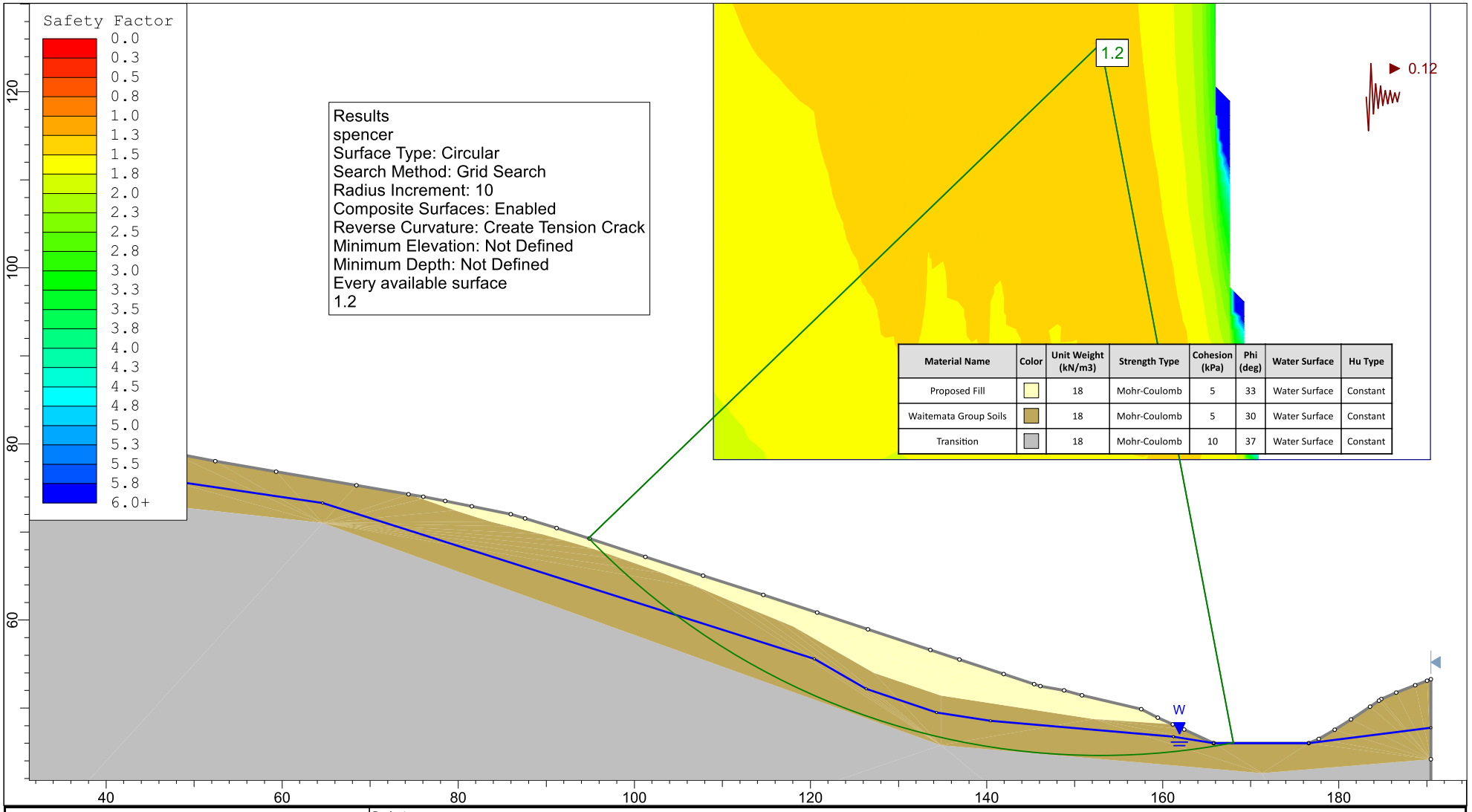
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section EE - Run 10				
Drawn By	PH	Scale	1:700	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S5EE - Run 16.slim



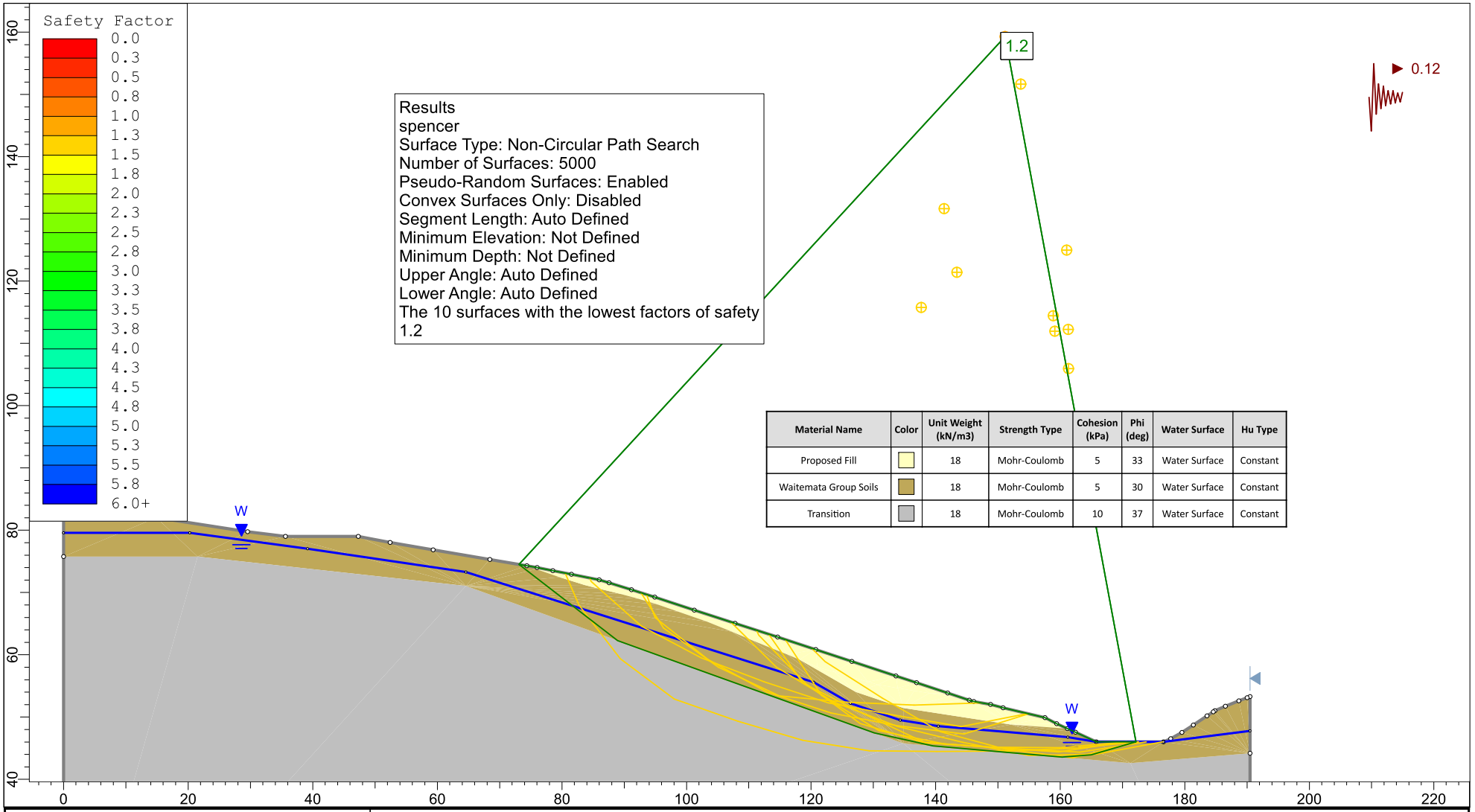
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section EE - Run 17				
Drawn By	PH	Scale	1:600	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S5EE - Run 17.slim



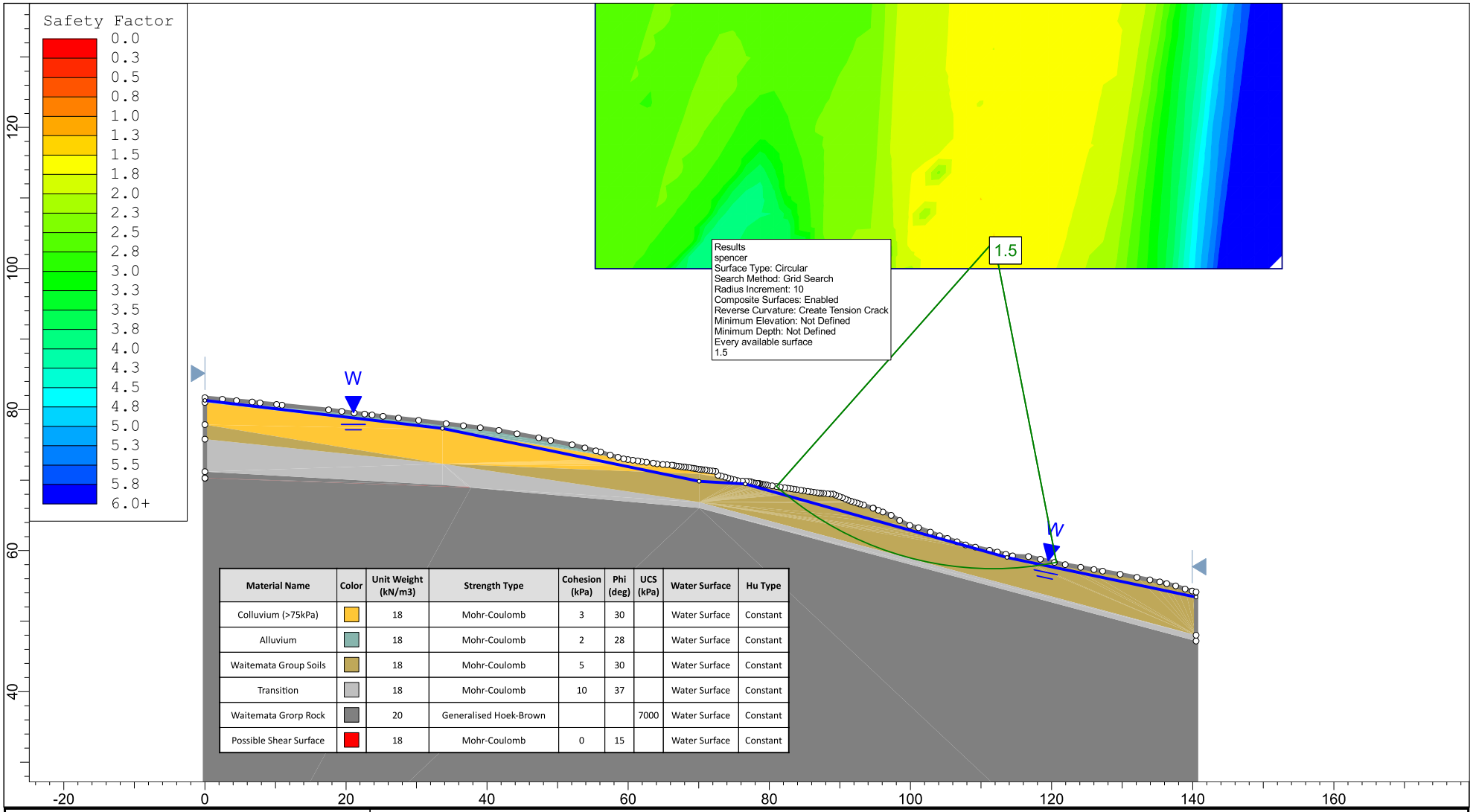
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33	Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30	Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section EE - Run 18				
Drawn By	PH	Scale	1:850	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S5EE - Run 18.slim



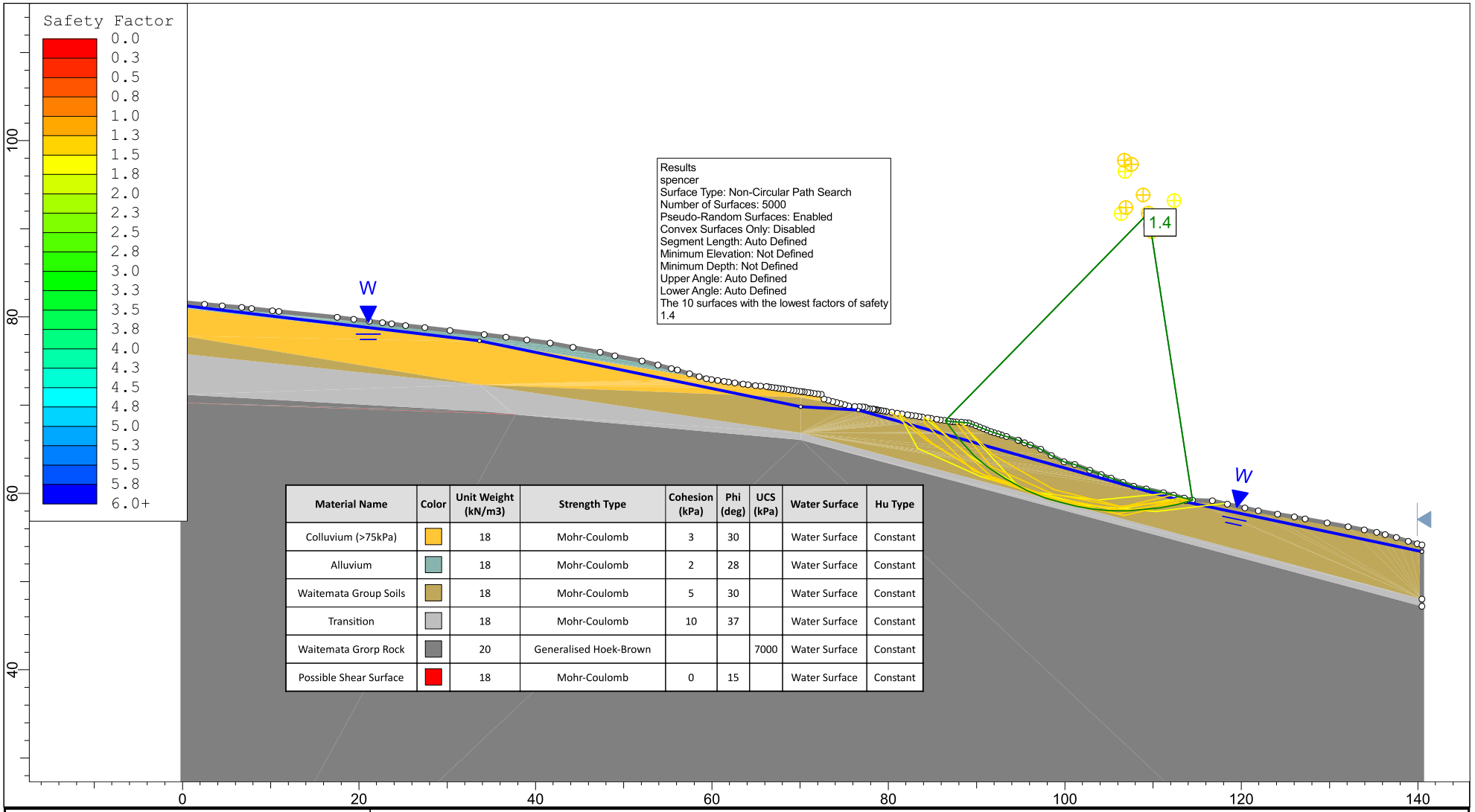
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 5, Section FF - Run 1		
Drawn By	PH	*Scale* 1:750	*Company* KGA Geotechnical
Date	31/08/2015		*File Name* 7464 - S5FF - Run 1.slim



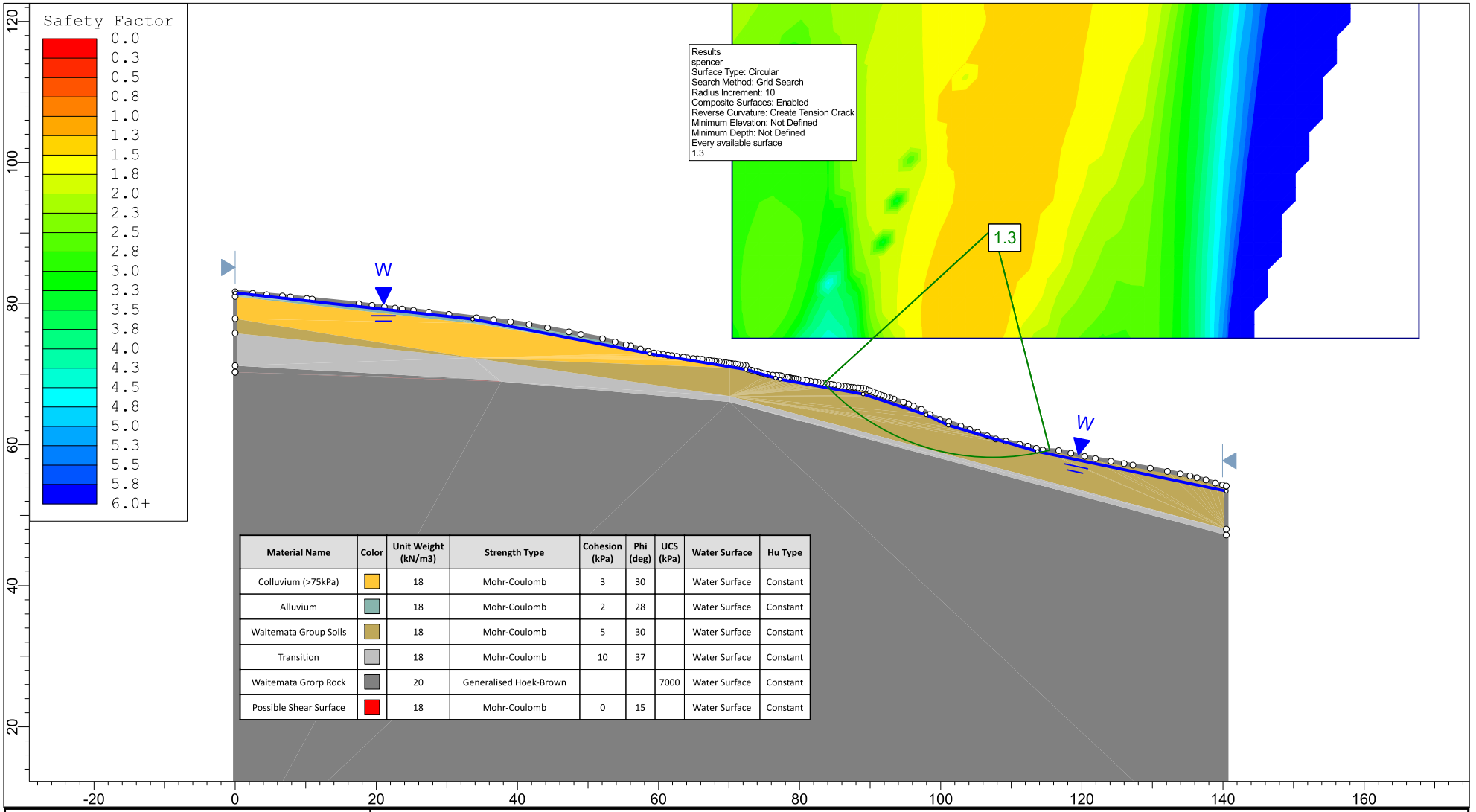
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 5, Section FF - Run 2		
Drawn By	PH	Scale	1:600
Company	KGA Geotechnical		
Date	31/08/2015	File Name	7464 - S5FF - Run 2.slim



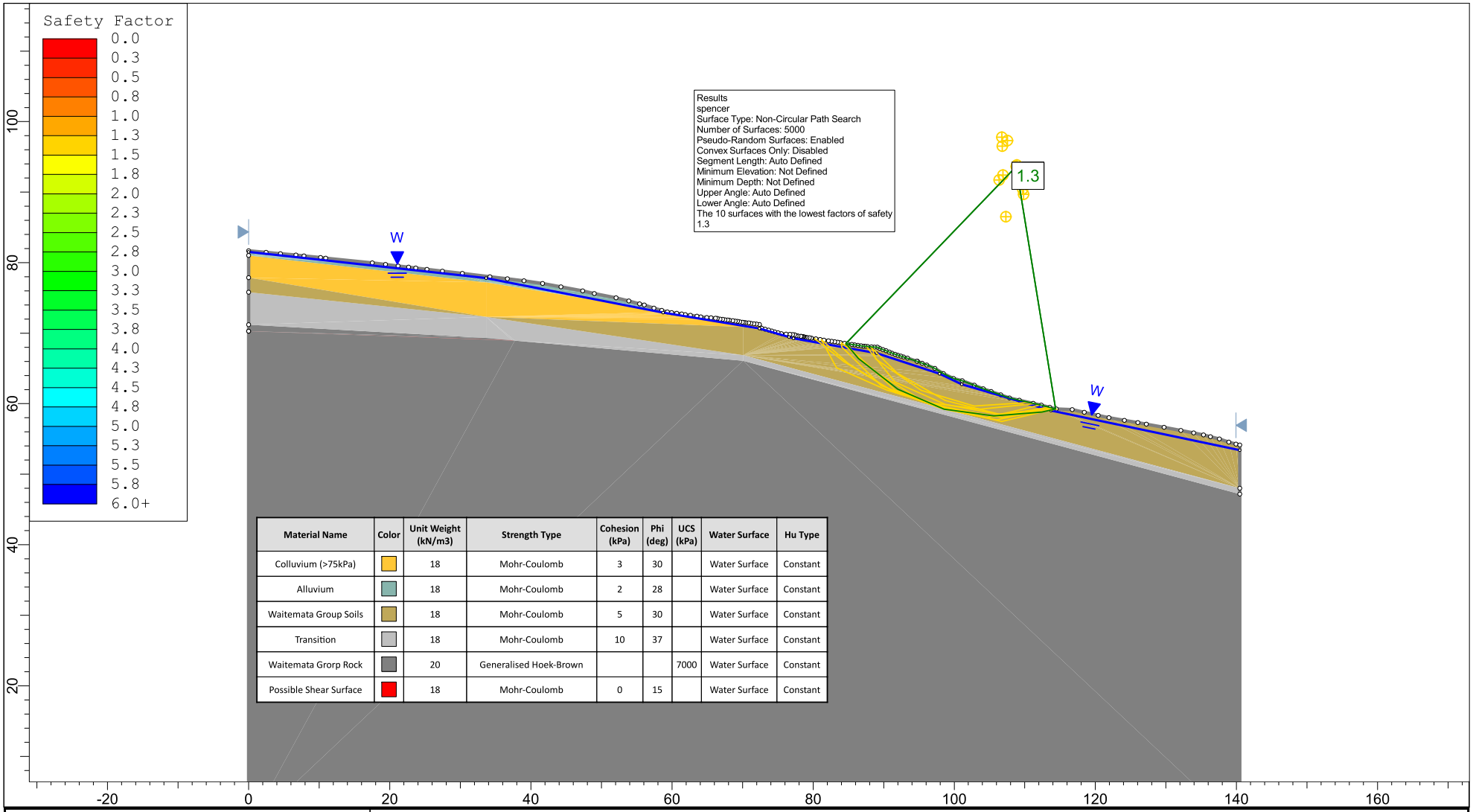
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 5, Section FF - Run 3		
Drawn By	PH	*Scale* 1:750	*Company* KGA Geotechnical
Date	31/08/2015		*File Name* 7464 - S5FF - Run 3.slim



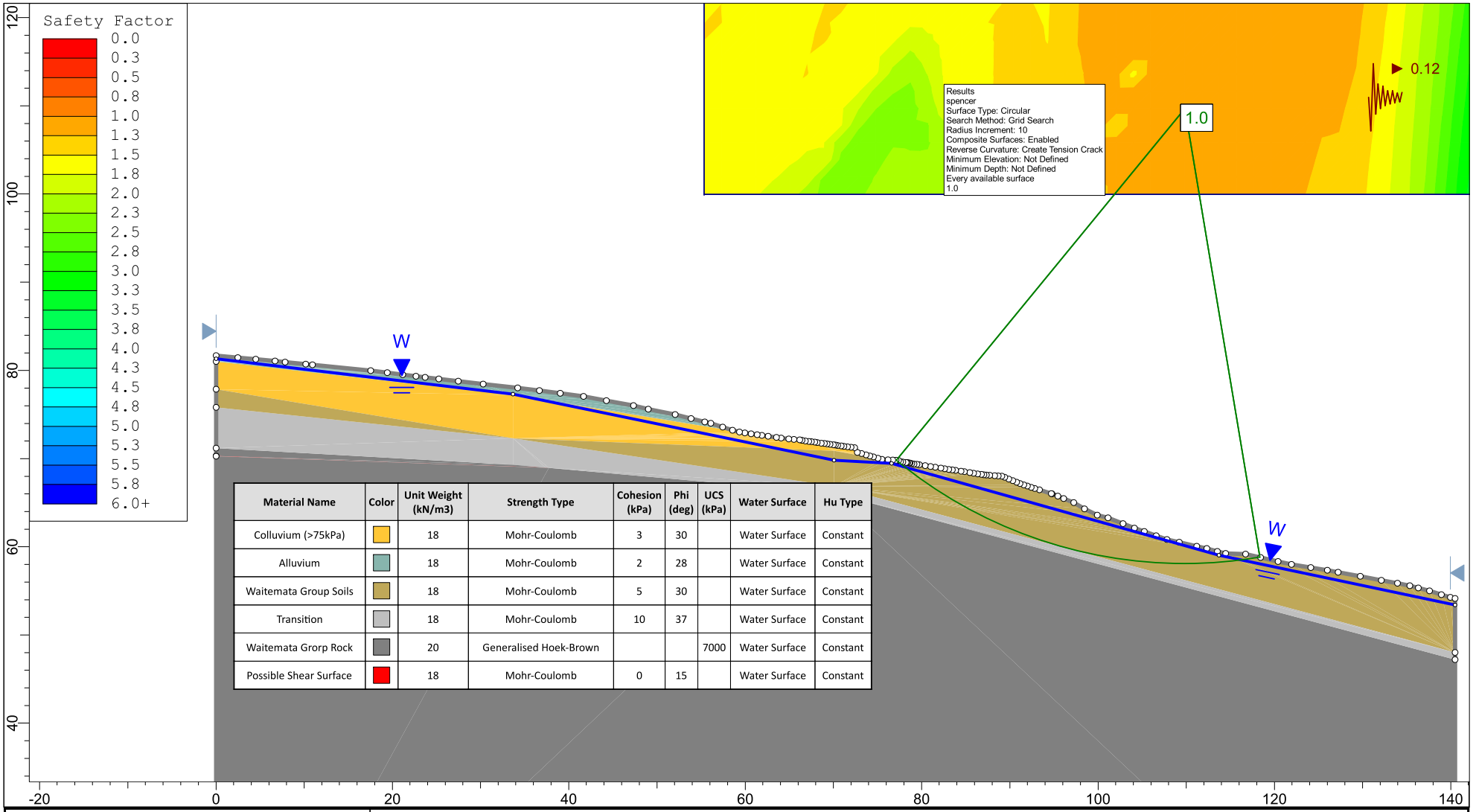
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa			
Analysis Description	Stage 5, Section FF - Run 4			
Drawn By	PH	*Scale*	1:750	*Company* KGA Geotechnical
Date	31/08/2015			*File Name* 7464 - S5FF - Run 4.slim



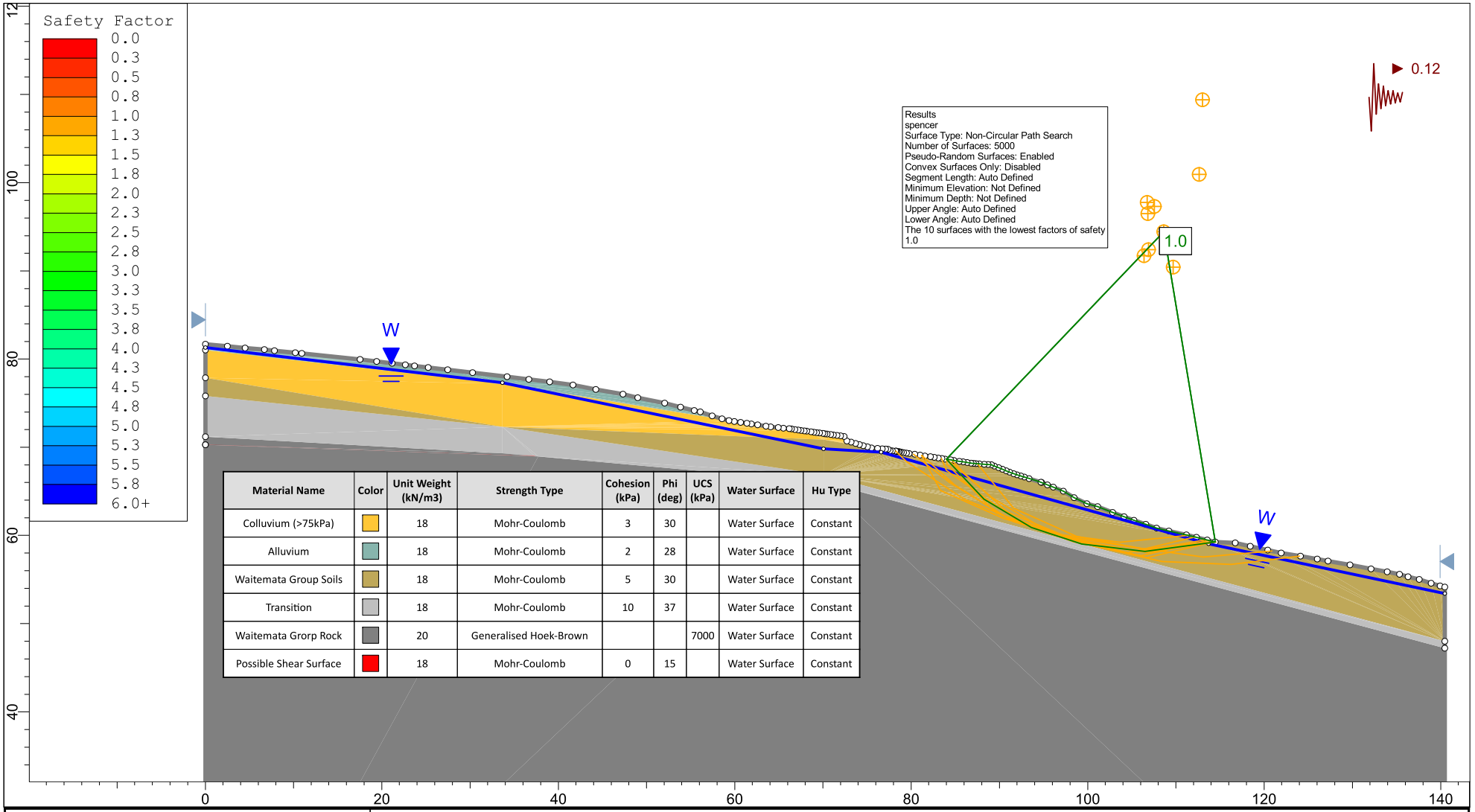
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 5, Section FF - Run 5		
Drawn By	PH	Scale 1:600	Company KGA Geotechnical
Date	31/08/2015		File Name 7464 - S5FF - Run 5.slim



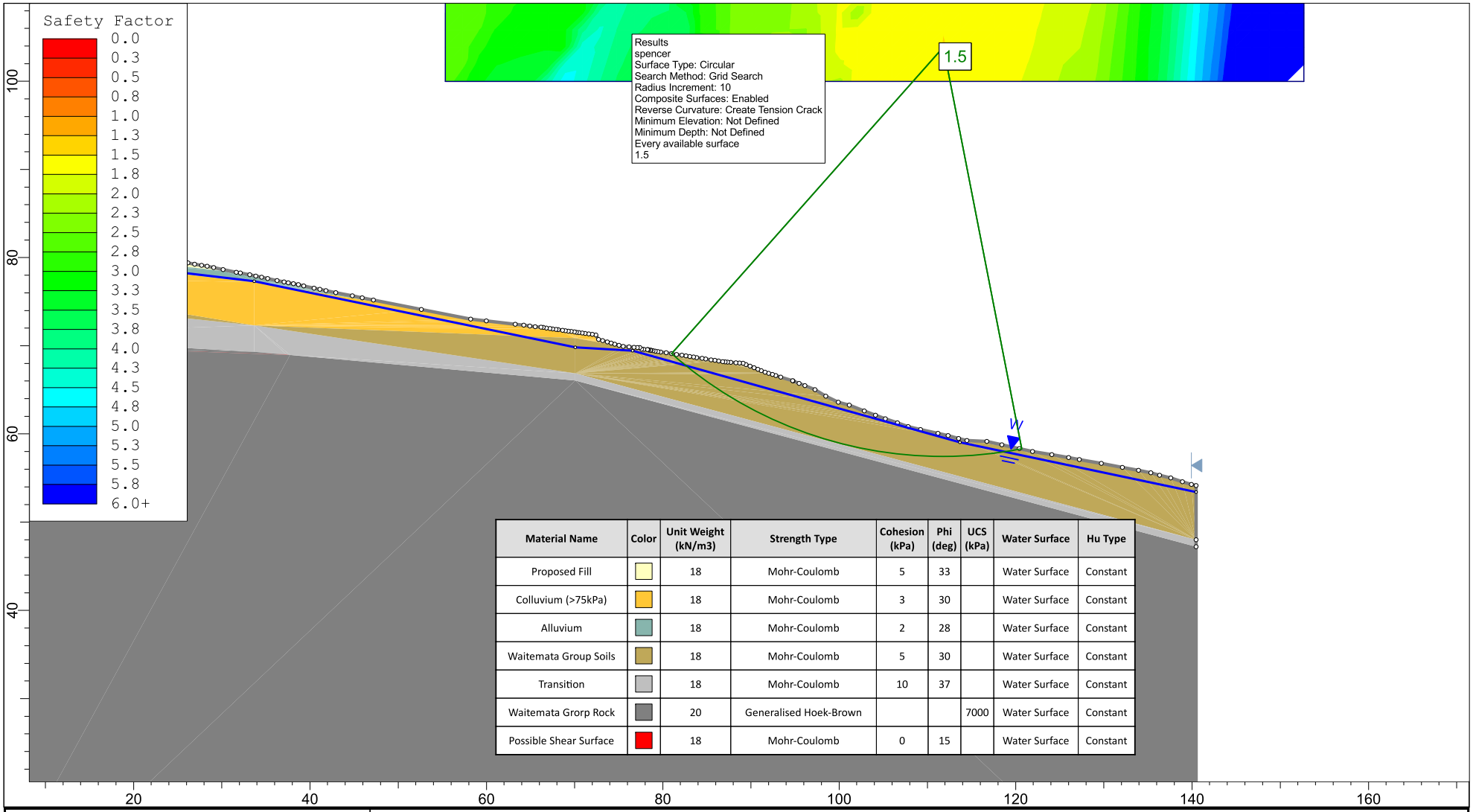
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 5, Section FF - Run 6		
Drawn By	PH	Scale	1:600
Company	KGA Geotechnical		
Date	31/08/2015	File Name	7464 - S5FF - Run 6.slim



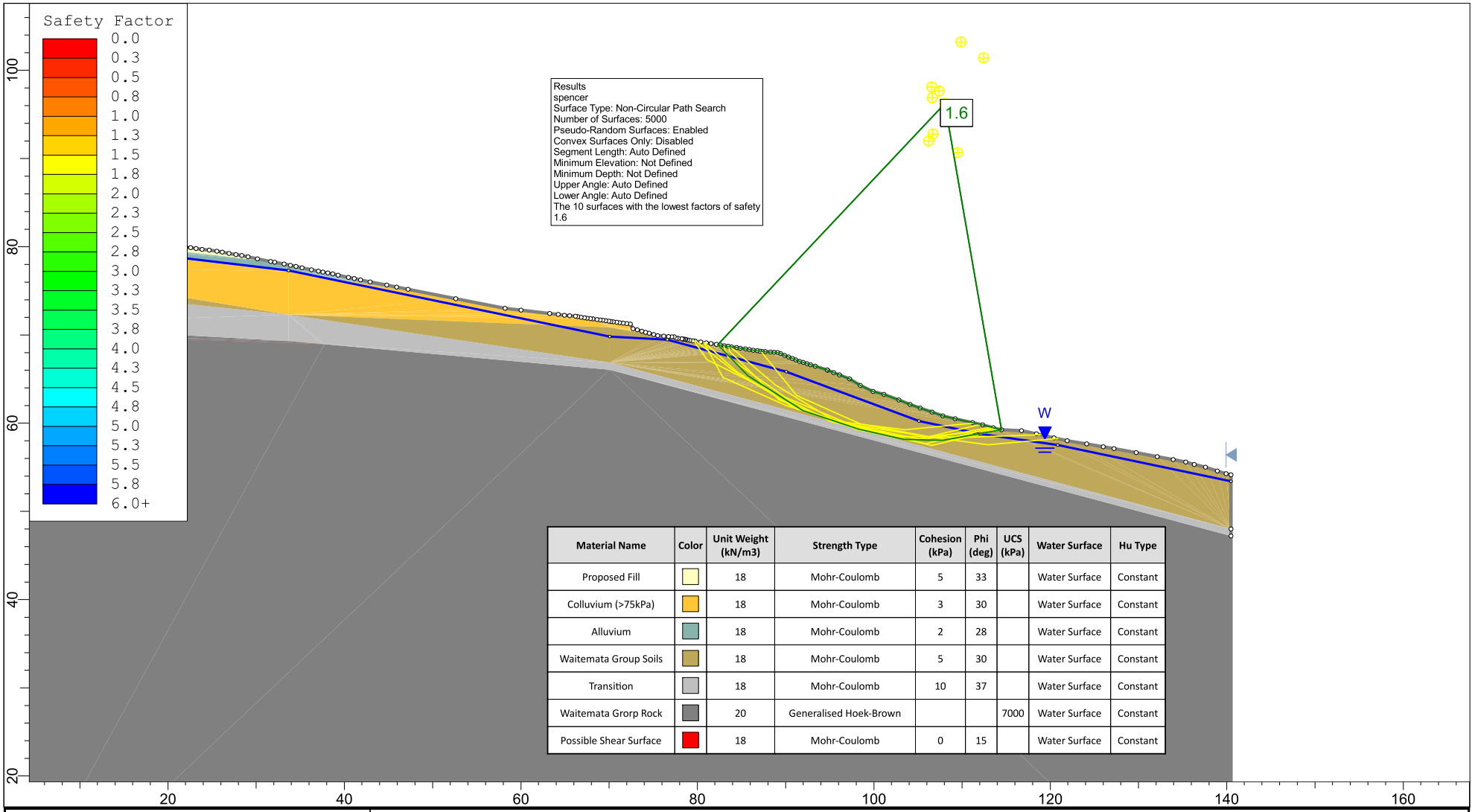
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section FF - Run 7				
Drawn By	PH	*Scale*	1:600	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5FF - Run 7.slim



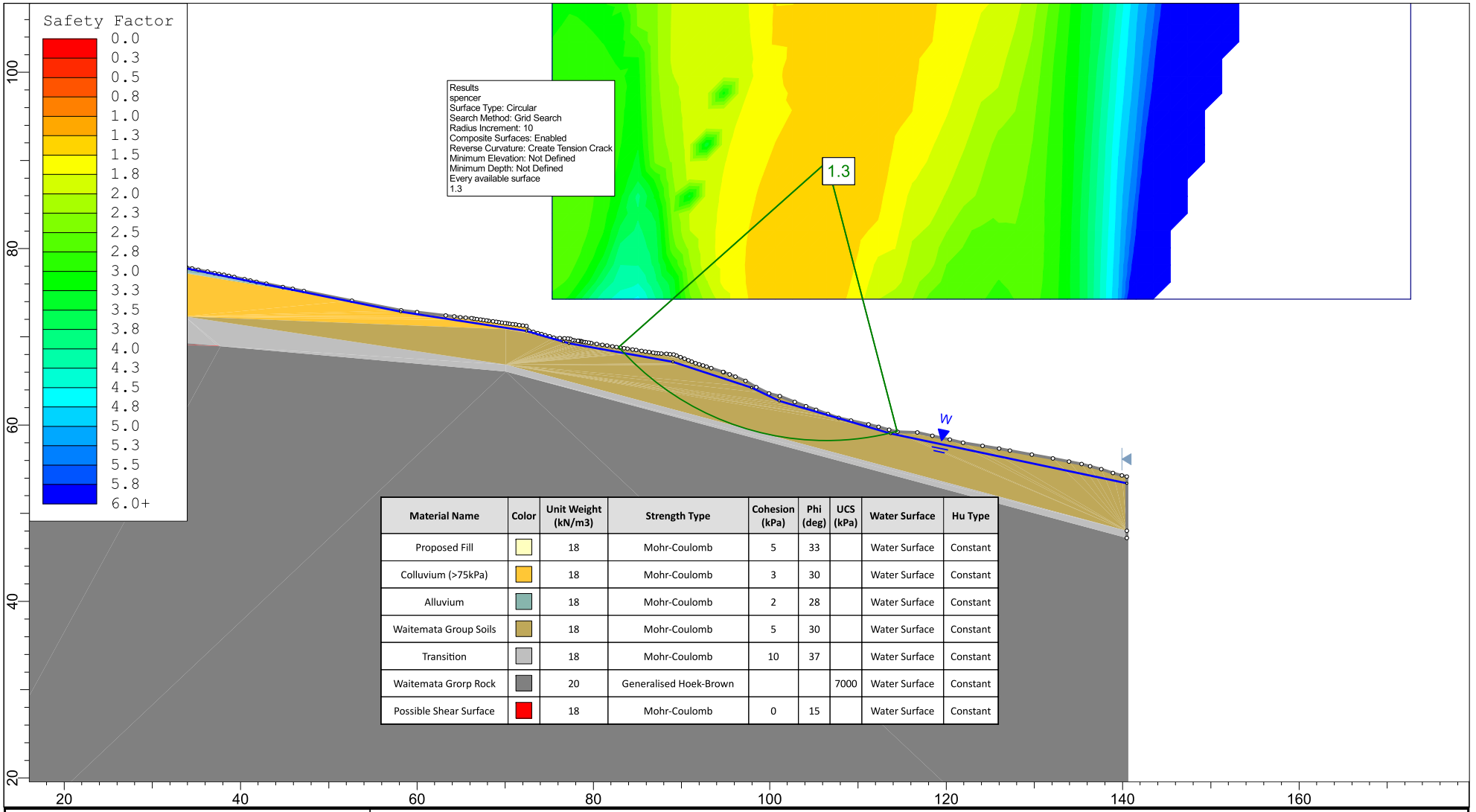
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section FF - Run 8				
Drawn By	PH	*Scale*	1:600	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5FF - Run 8.slim



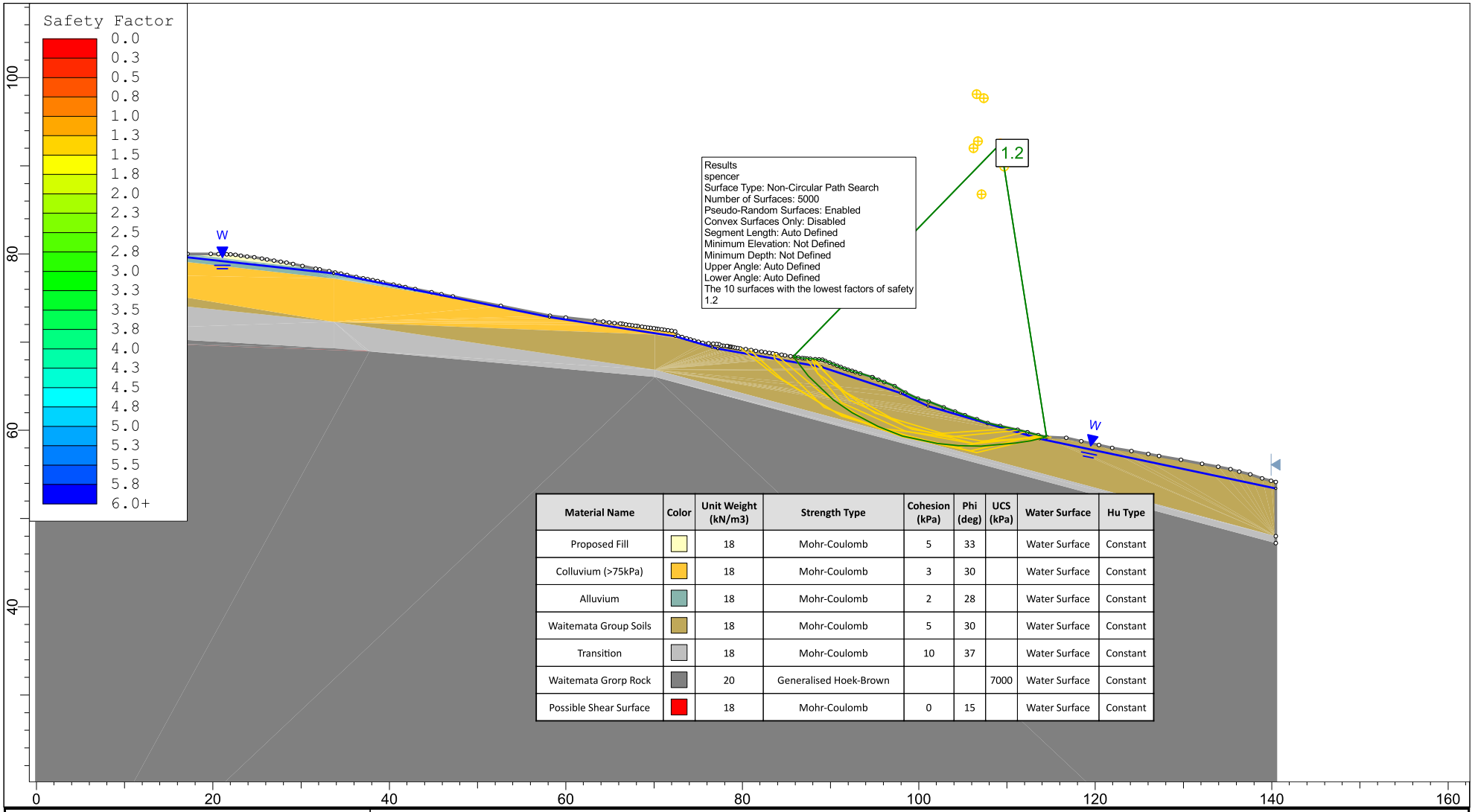
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section FF - Run 9				
Drawn By	PH	*Scale*	1:600	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5FF - Run 9.slim



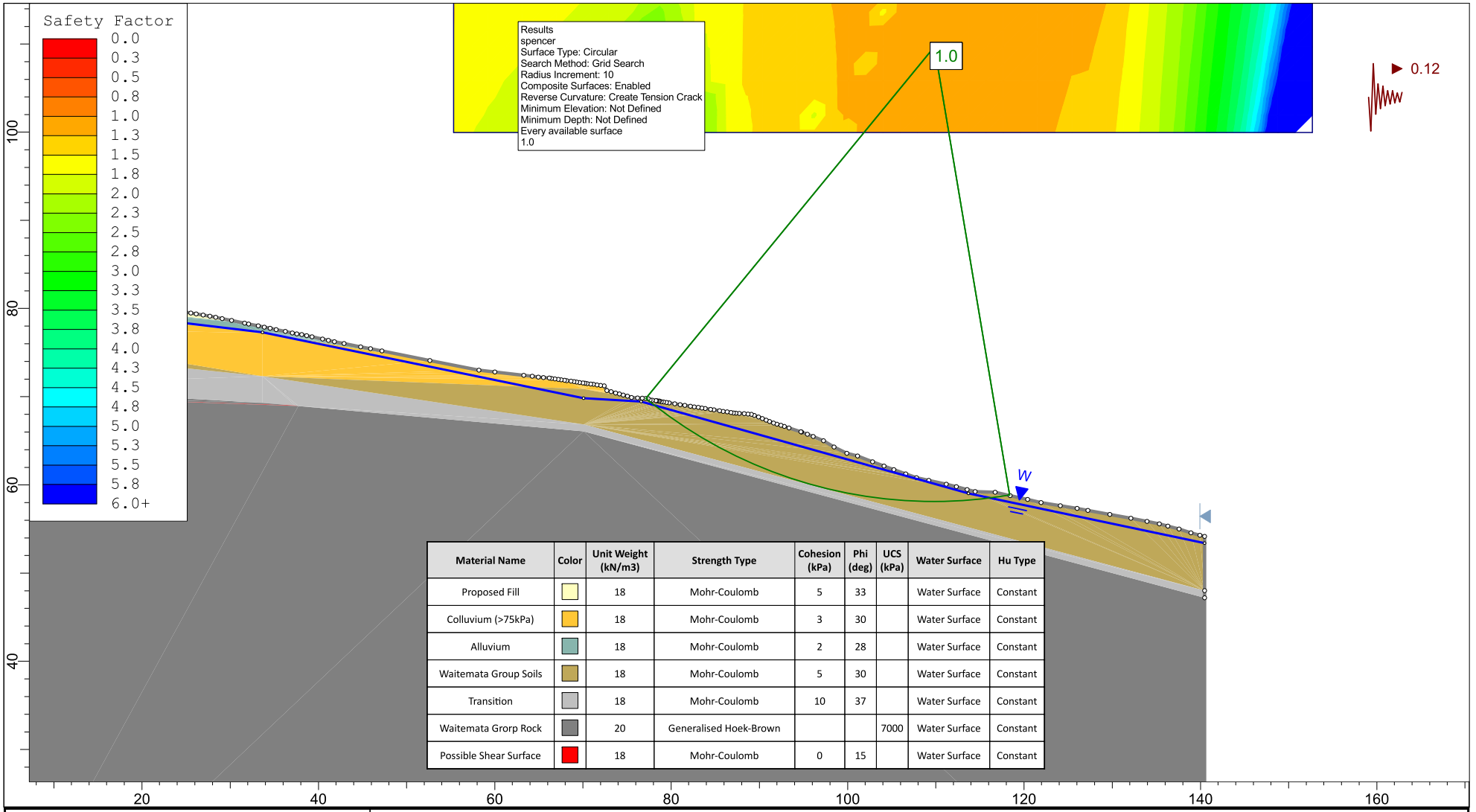
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section FF - Run 10				
Drawn By	PH	Scale	1:600	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S5FF - Run 10.slim



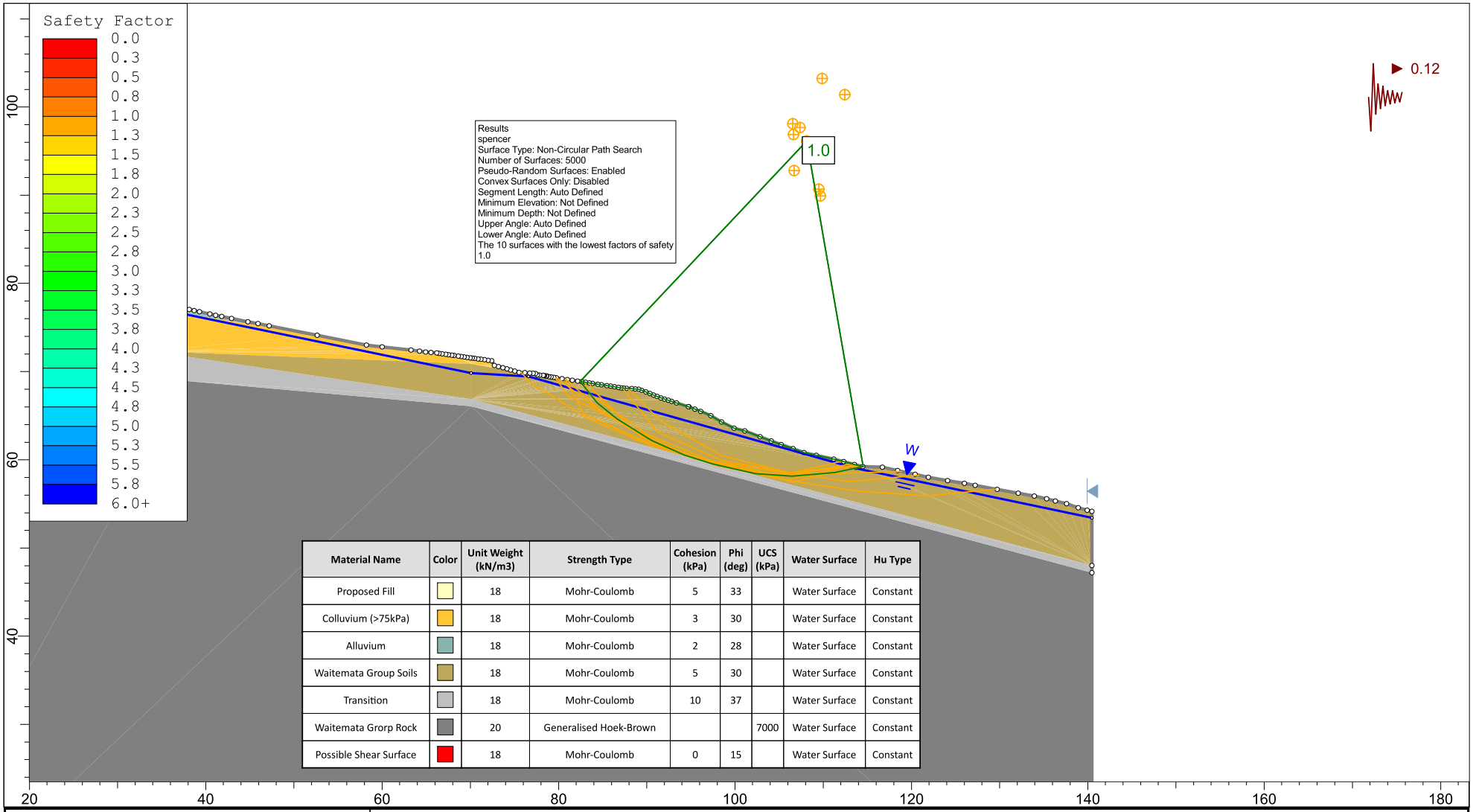
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section FF - Run 11				
Drawn By	PH	*Scale*	1:600	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5FF - Run 11.slim



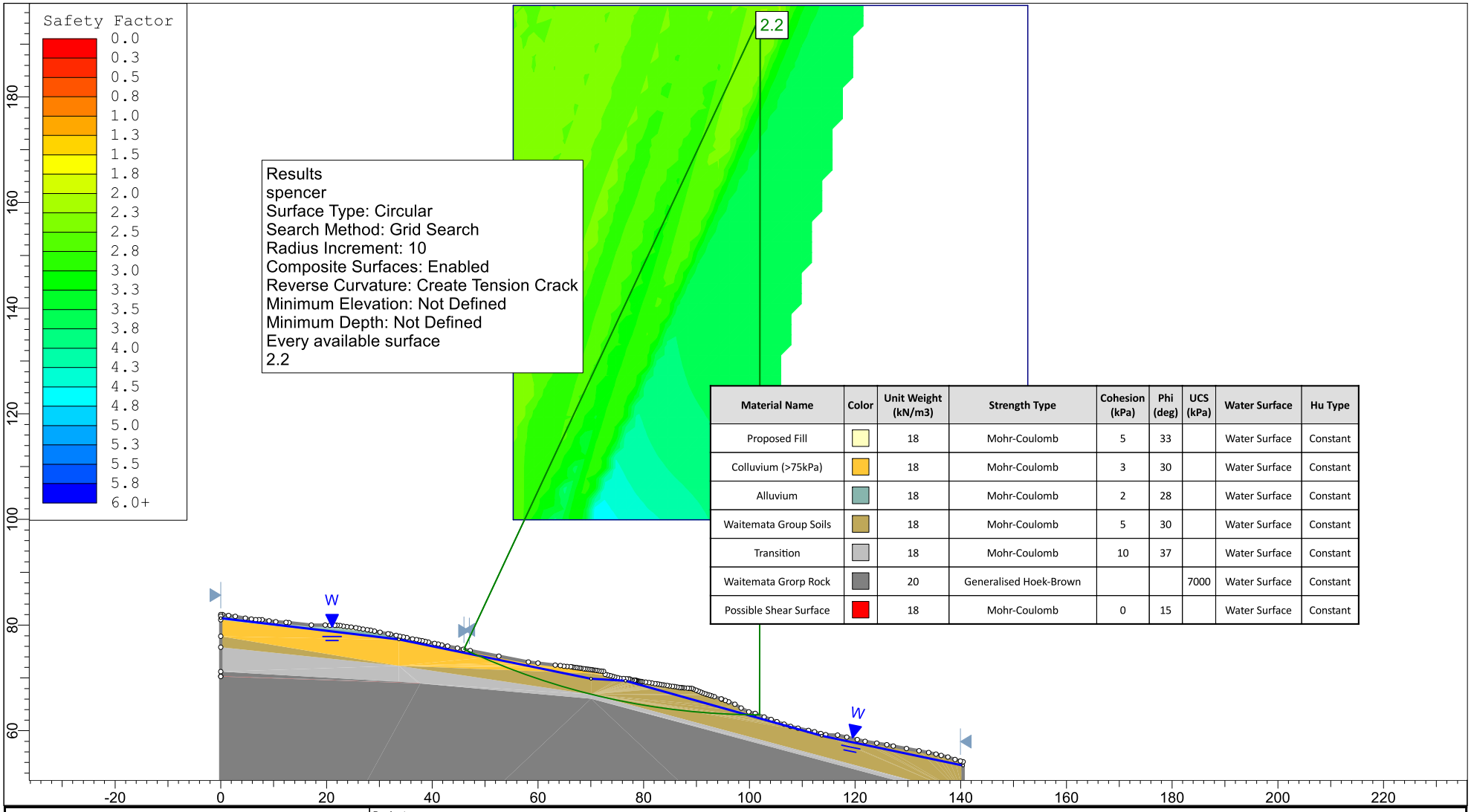
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 5, Section FF - Run 12		
Drawn By	PH	*Scale*	1:600
Company	KGA Geotechnical		
Date	31/08/2015	*File Name*	7464 - S5FF - Run 12.slim



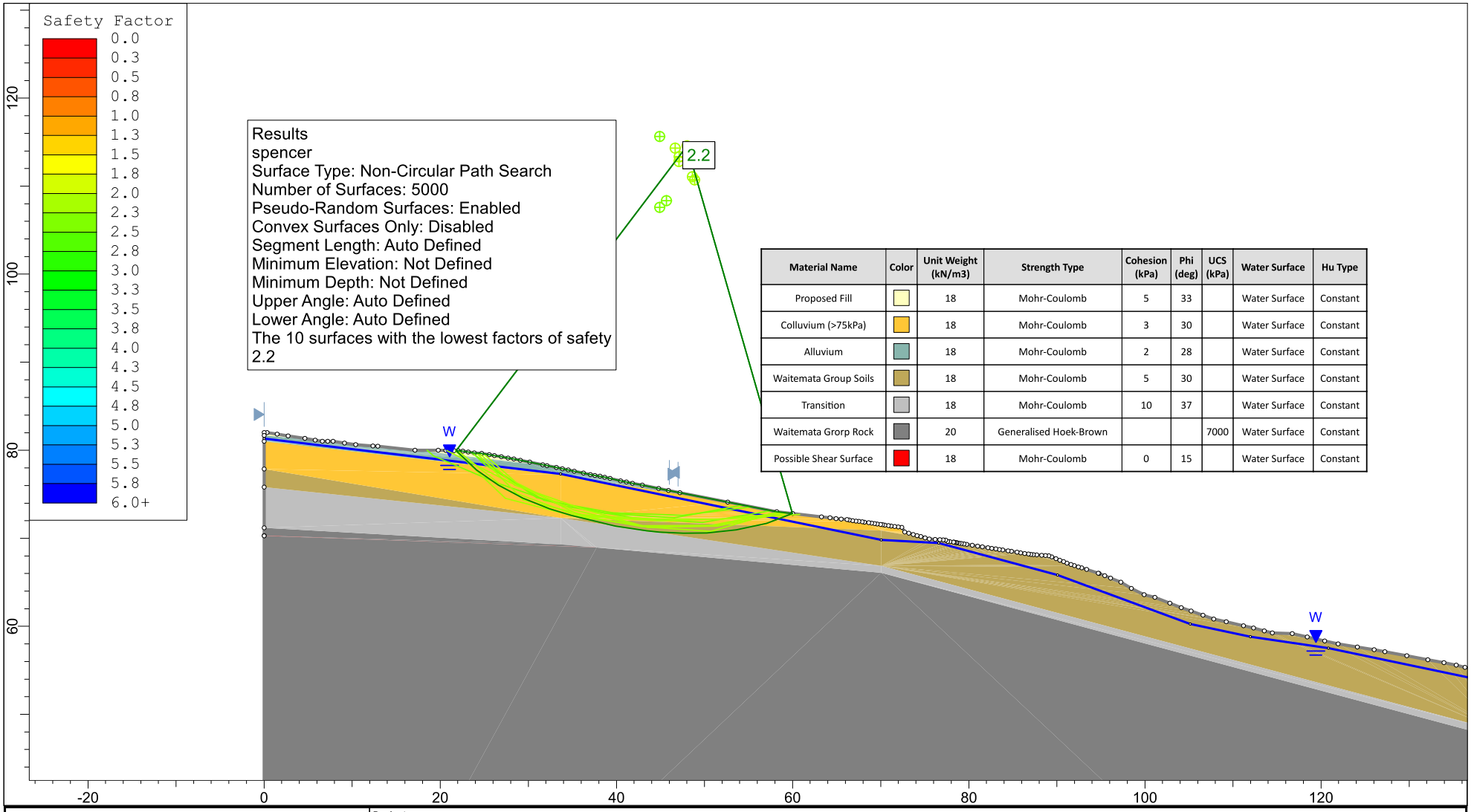
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section FF - Run 13				
Drawn By	PH	*Scale*	1:1000	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S5FF - Run 13.slim



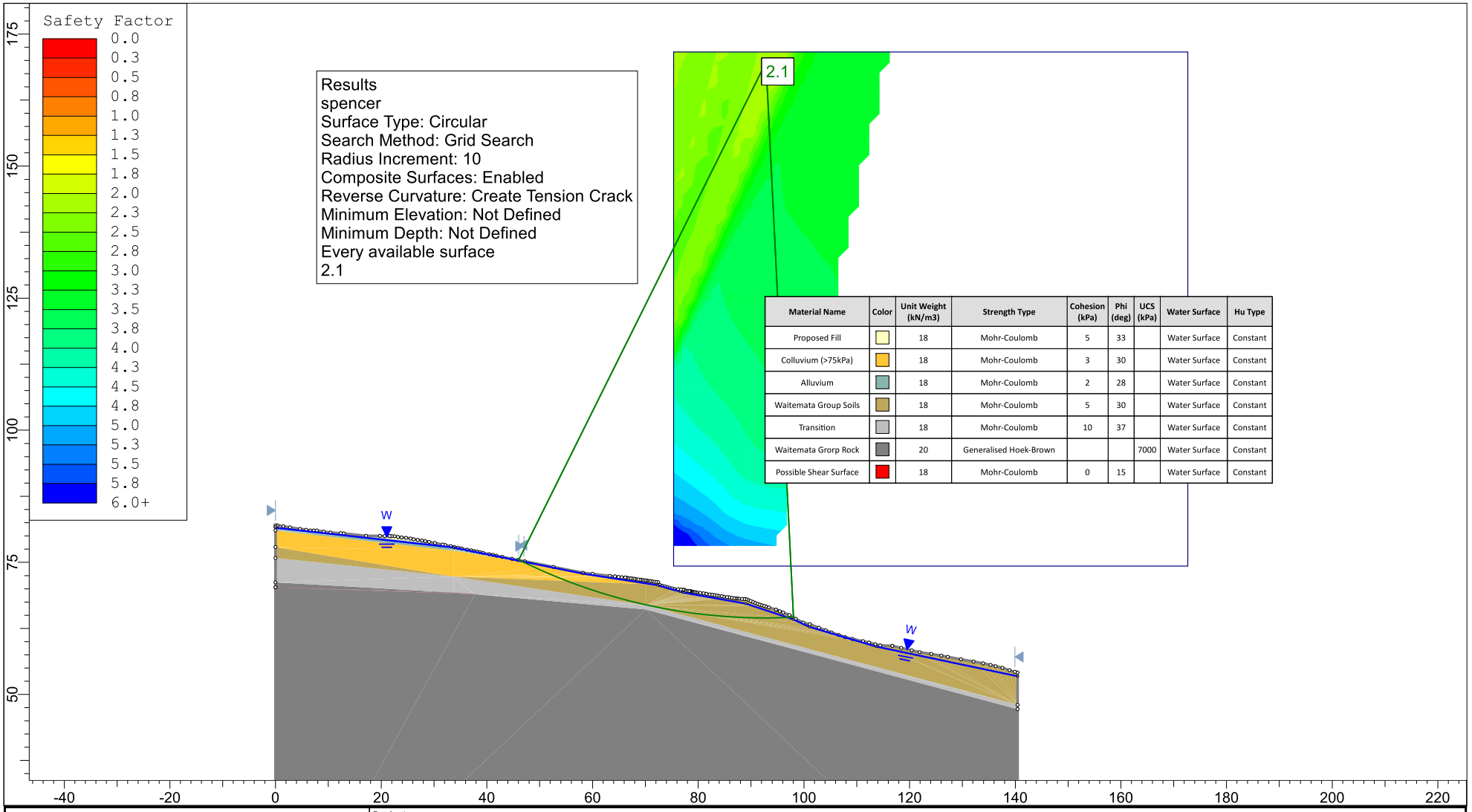
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section FF - Run 14				
Drawn By	PH	Scale	1:600	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S5FF - Run 14.slim



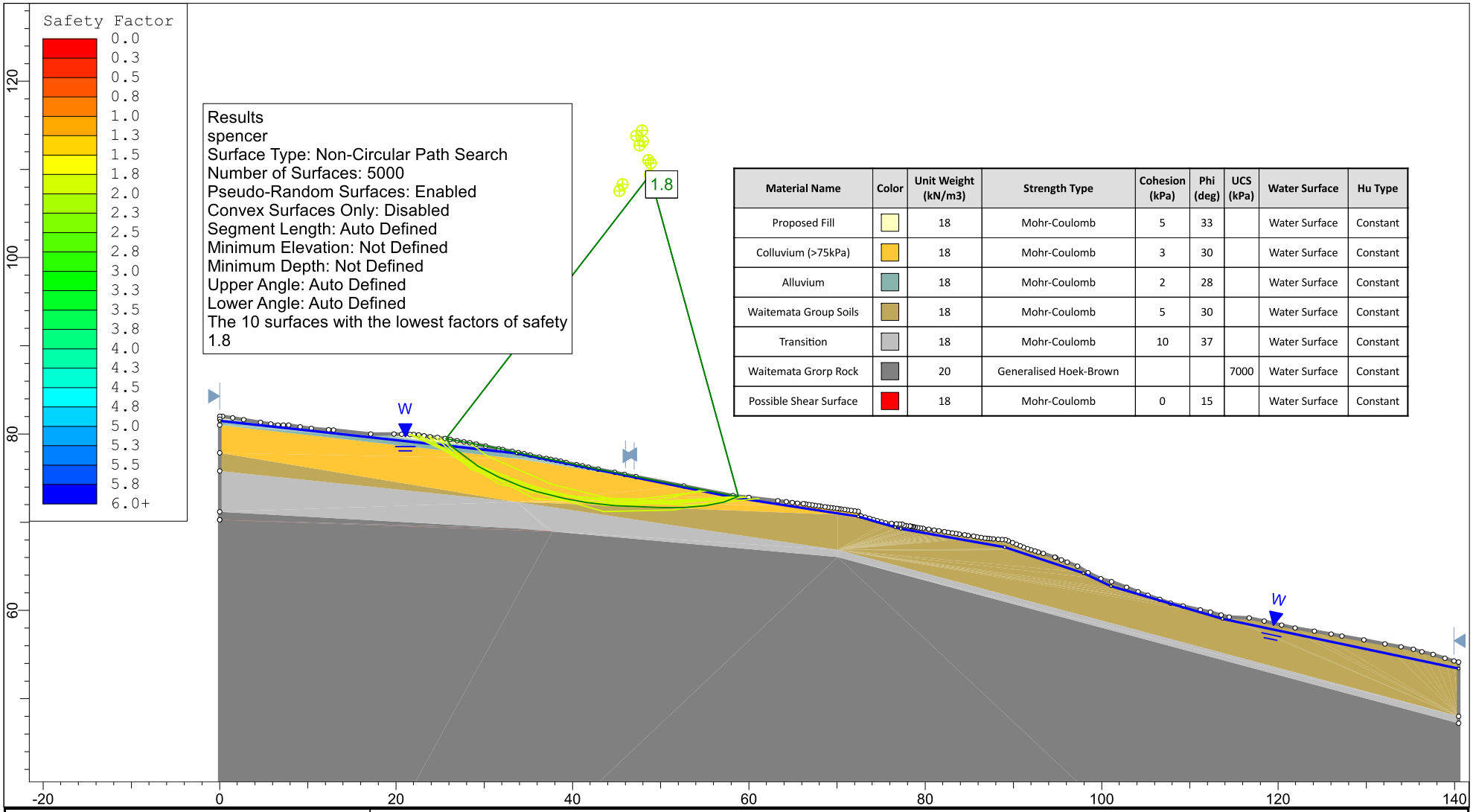
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa			
Analysis Description	Stage 5, Section FF - Run 15			
Drawn By	PH	Scale	1:1000	Company: KGA Geotechnical
Date	31/08/2015			File Name: 7464 - S5FF - Run 15.slim



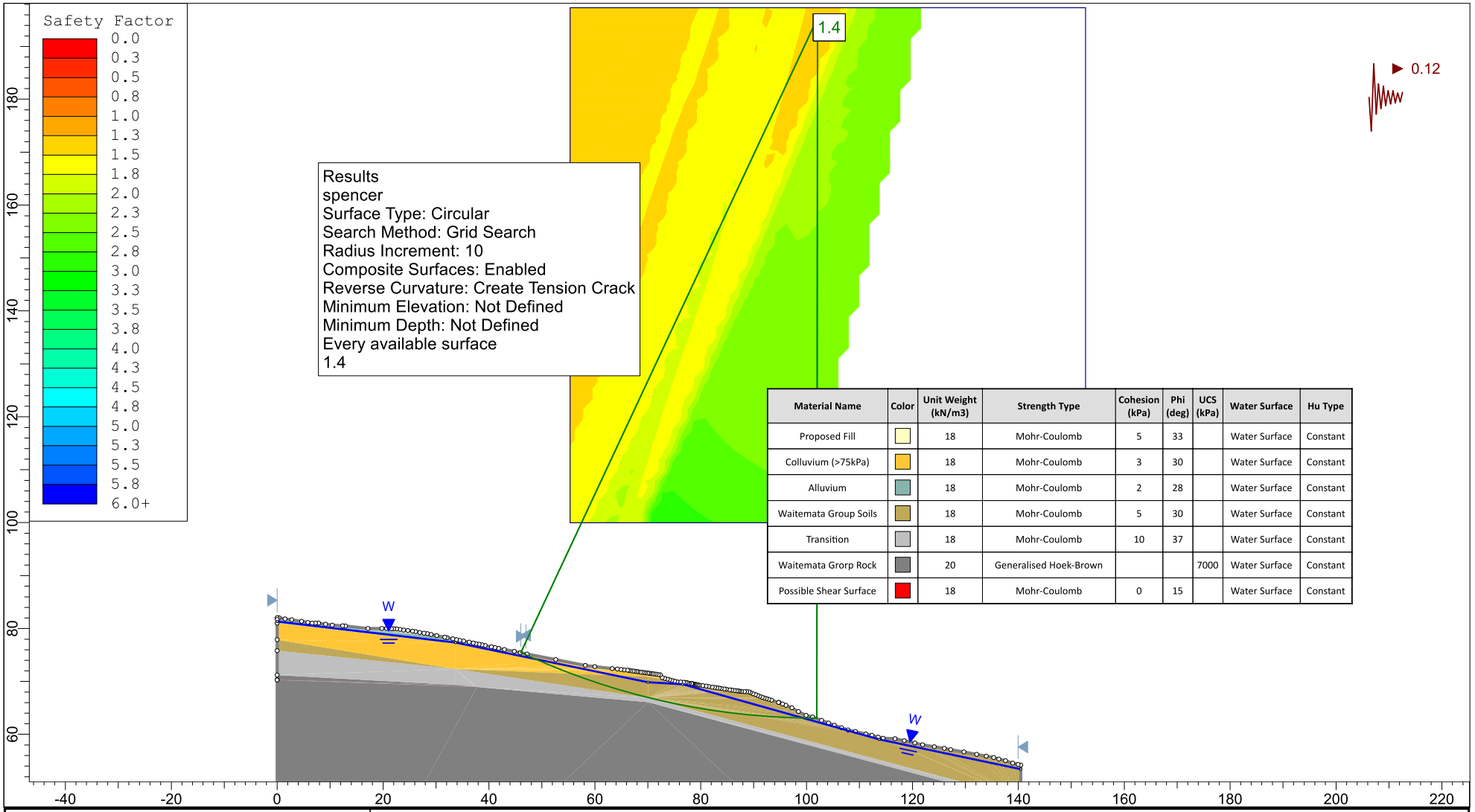
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section FF - Run 16				
Drawn By	PH	Scale	1:600	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S5FF - Run 16.slim



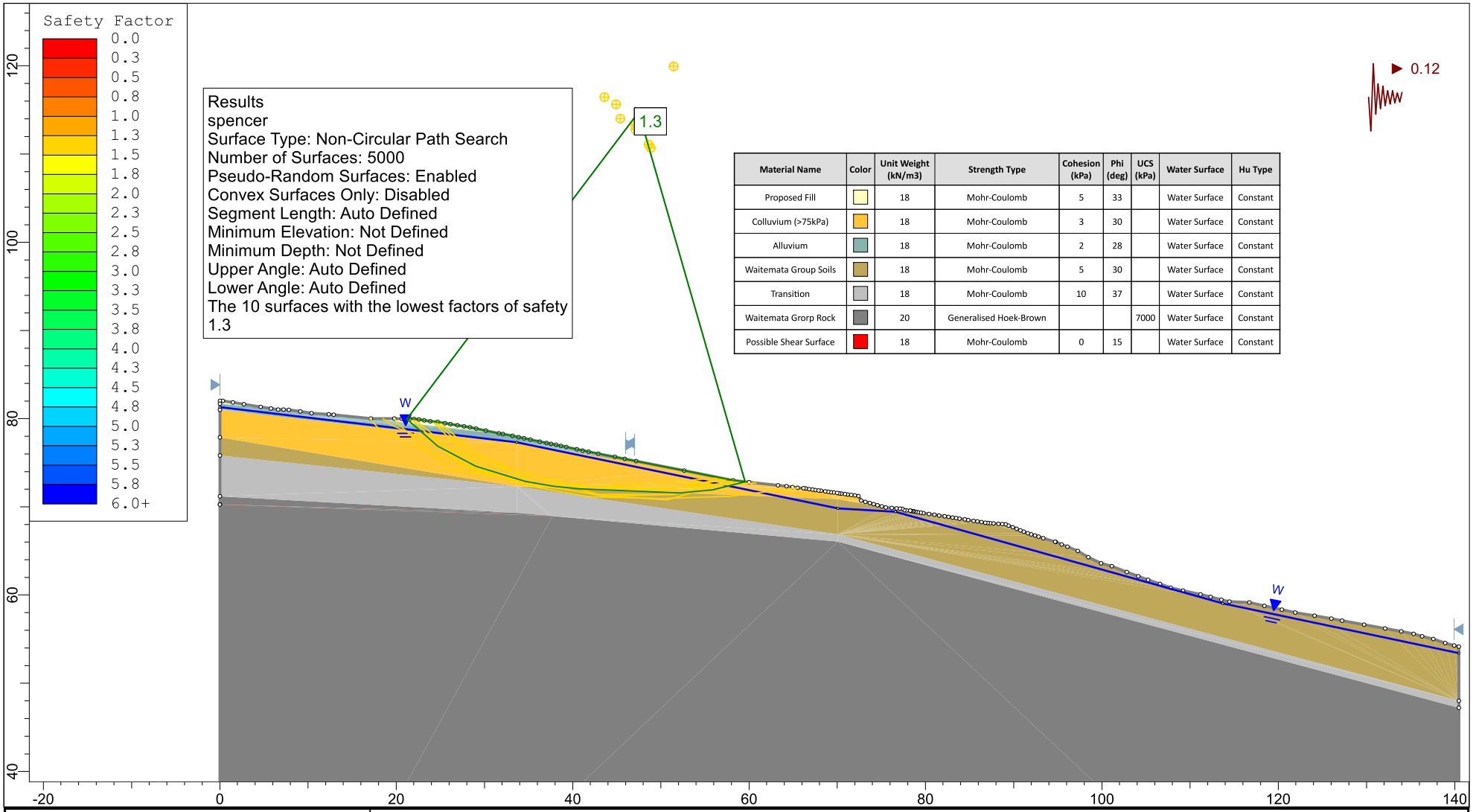
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 5, Section FF - Run 17				
Drawn By	PH	Scale	1:1000	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S5FF - Run 17.slim



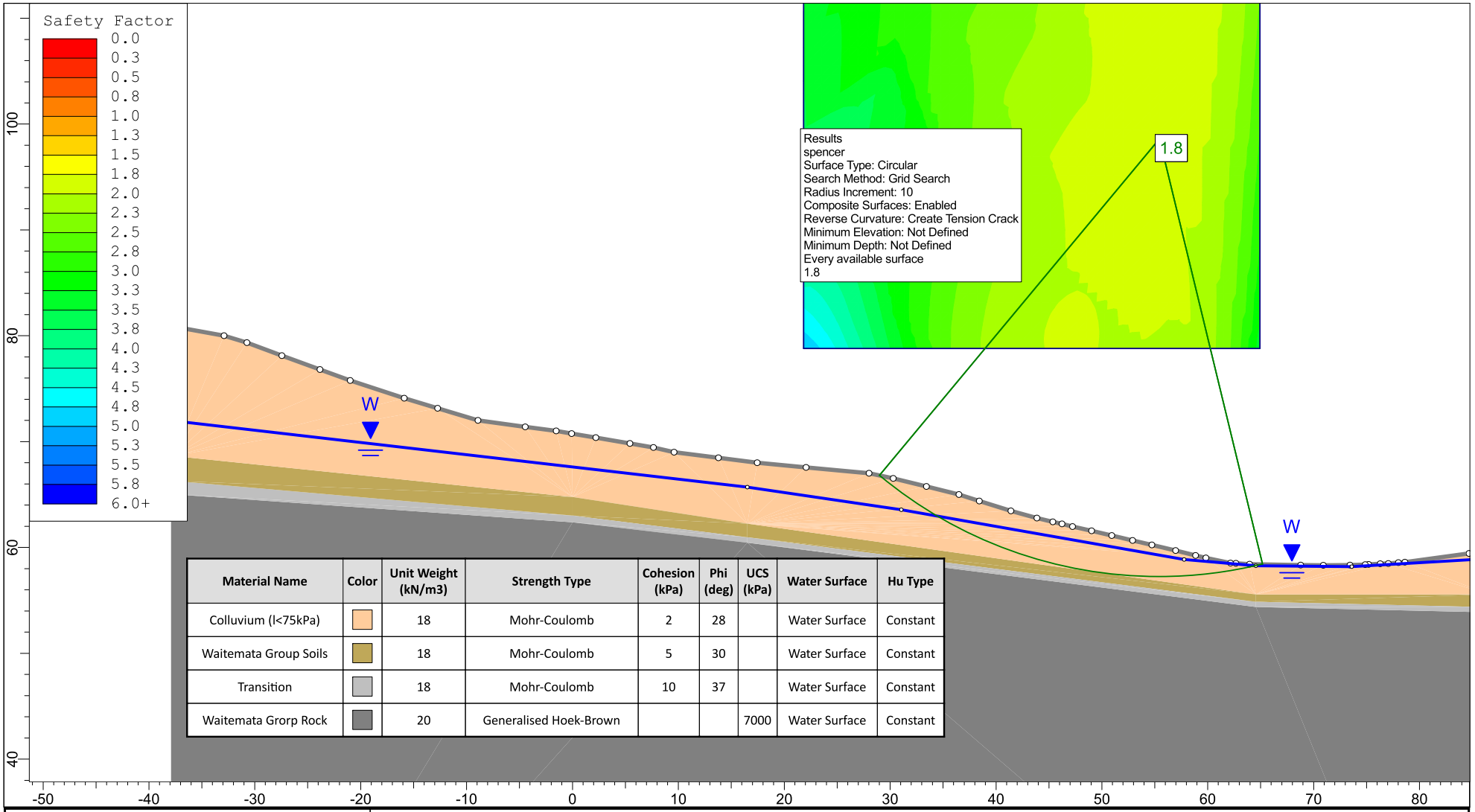
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant
Possible Shear Surface		18	Mohr-Coulomb	0	15		Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa			
Analysis Description	Stage 5, Section FF - Run 18			
Drawn By	PH	Scale	1:600	Company: KGA Geotechnical
Date	31/08/2015			File Name: 7464 - S5FF - Run 18.slim



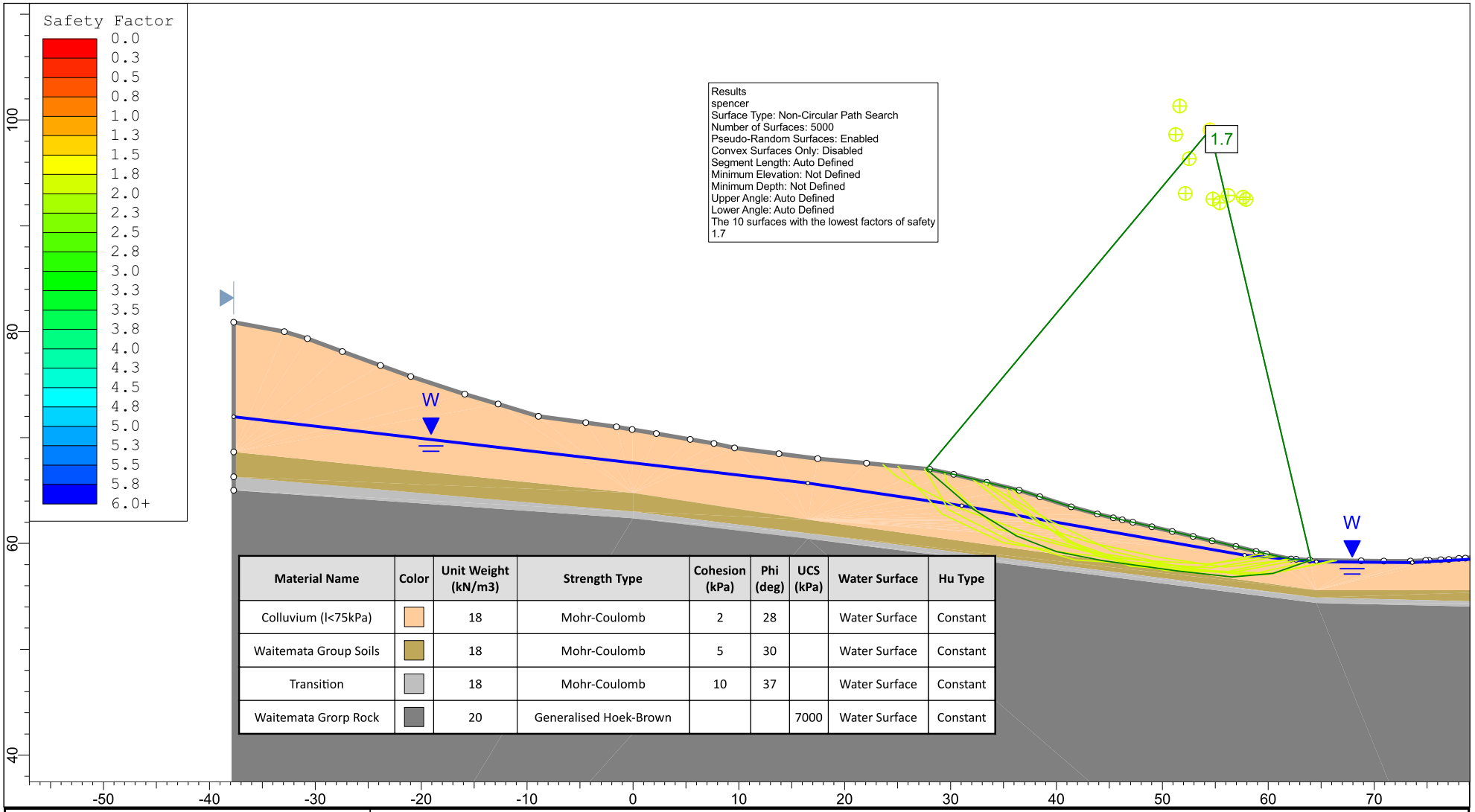
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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SLIDEINTERPRET 6.018

Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 6, Section AA - Run 1				
Drawn By	PH	Scale	1:500	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S6AA - Run 1.slim



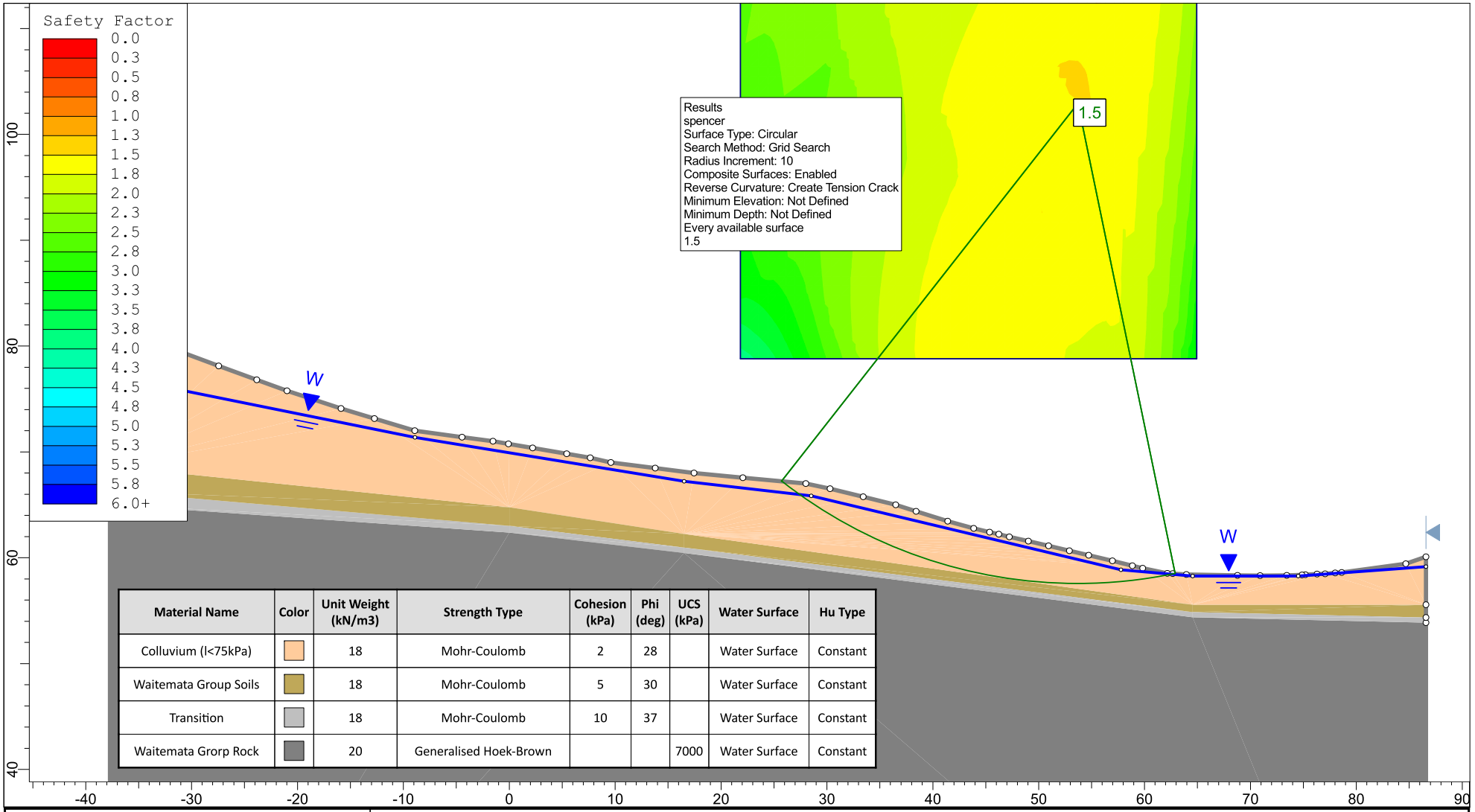
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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SLIDEINTERPRET 6.018

Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 6, Section AA - Run 2				
Drawn By	PH	Scale	1:500	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S6AA - Run 2.slim



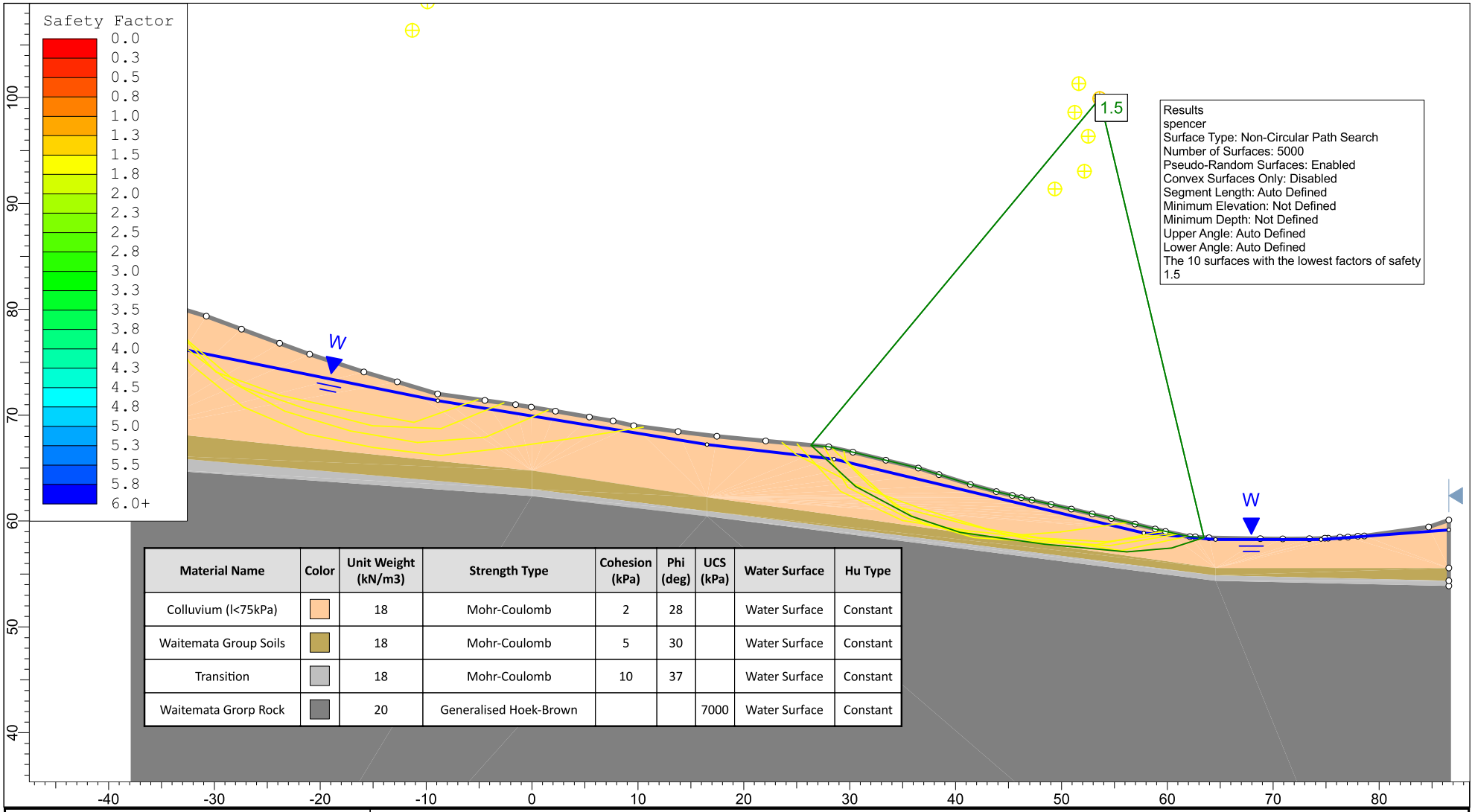
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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SLIDEINTERPRET 6.018

Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 6, Section AA - Run 3		
Drawn By	PH	Scale 1:500	Company KGA Geotechnical
Date	31/08/2015		File Name 7464 - S6AA - Run 3.slim



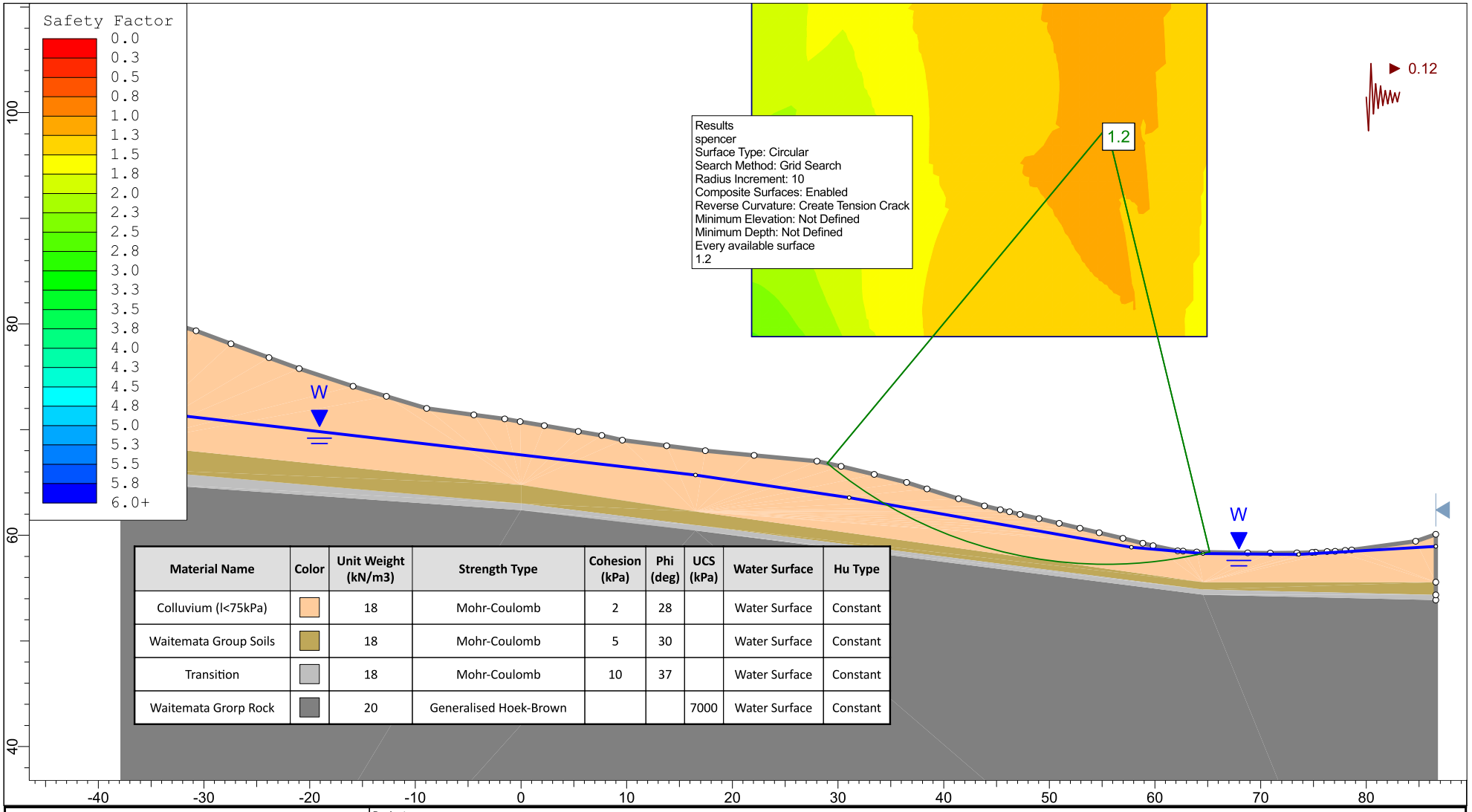
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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SLIDEINTERPRET 6.018

Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 6, Section AA - Run 4				
Drawn By	PH	Scale	1:500	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S6AA - Run 4.slim



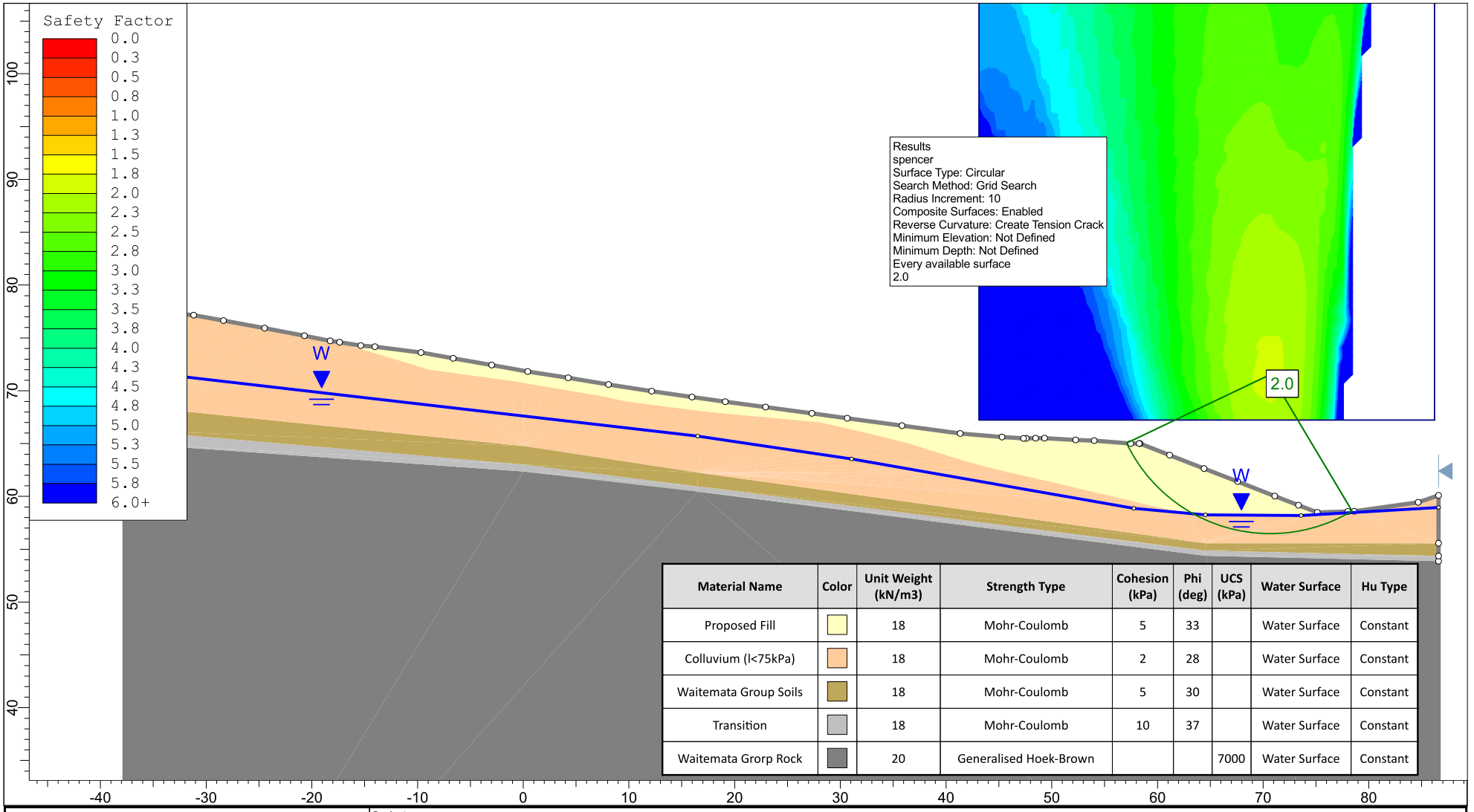
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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SLIDEINTERPRET 6.018

Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 6, Section AA - Run 5				
Drawn By	PH	Scale	1:500	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S6AA - Run 5.slim



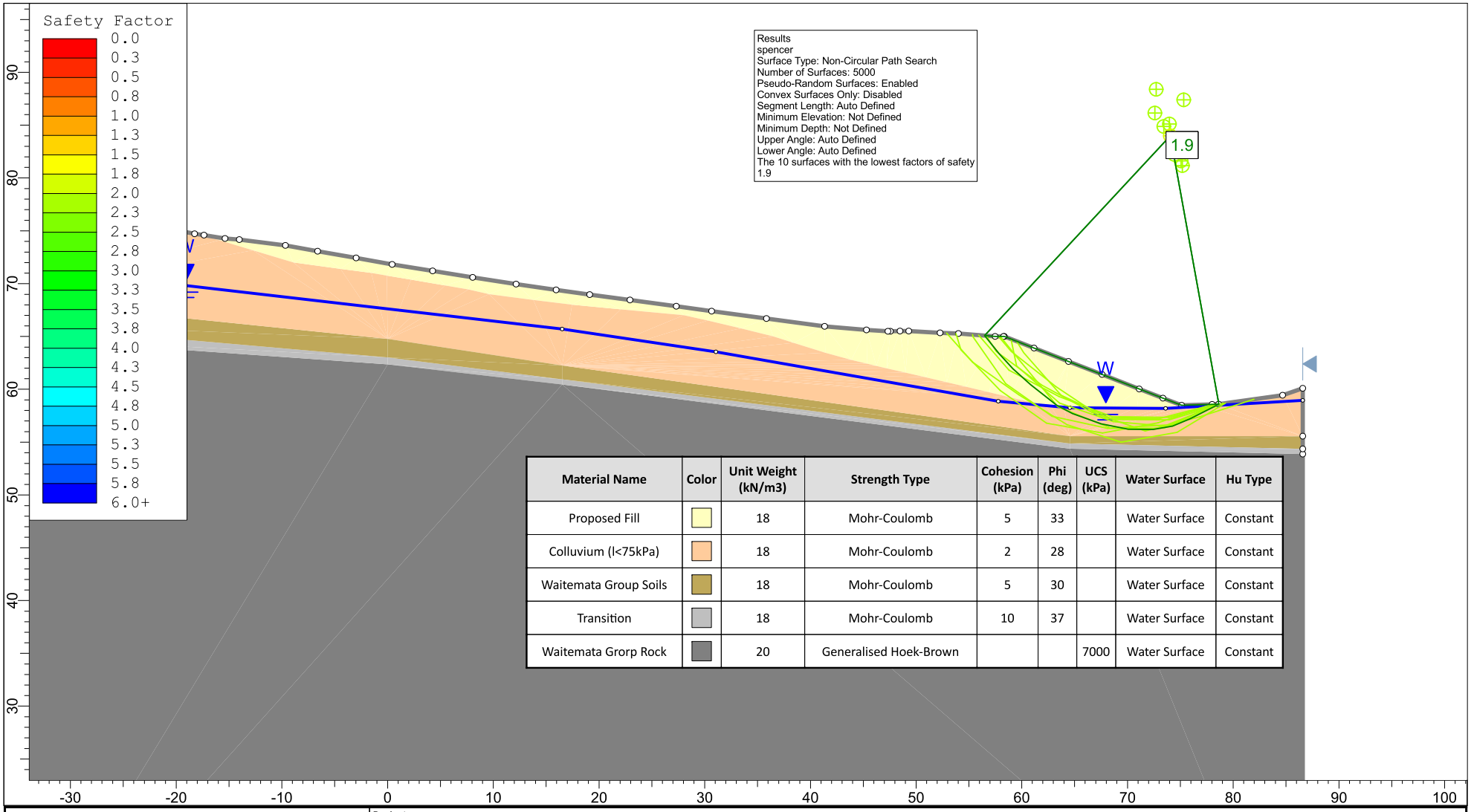
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 6, Section AA - Run 7				
Drawn By	PH	Scale	1:500	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S6AA - Run 7.slim



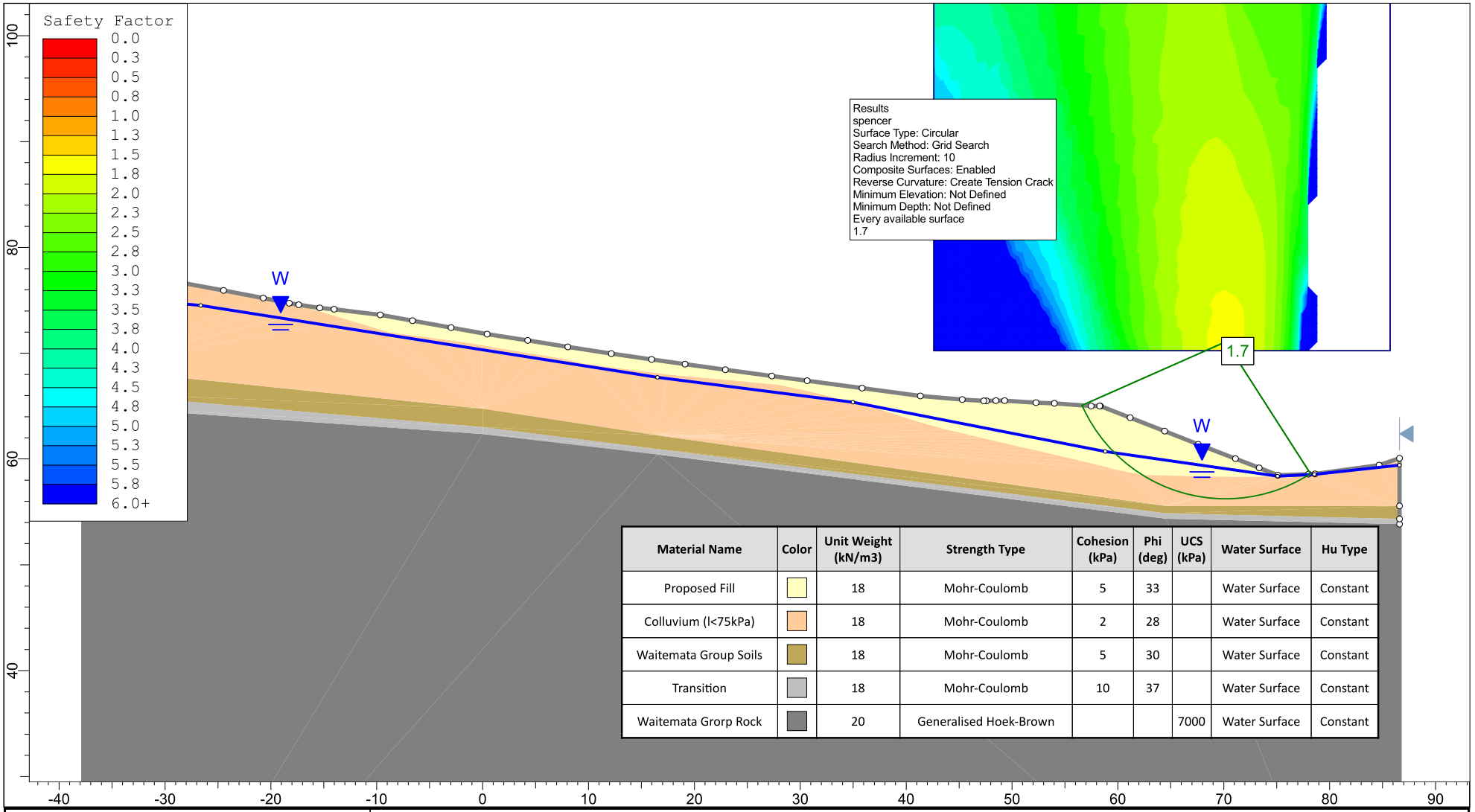
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 6, Section AA - Run 8				
Drawn By	PH	Scale	1:500	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S6AA - Run 8.slim



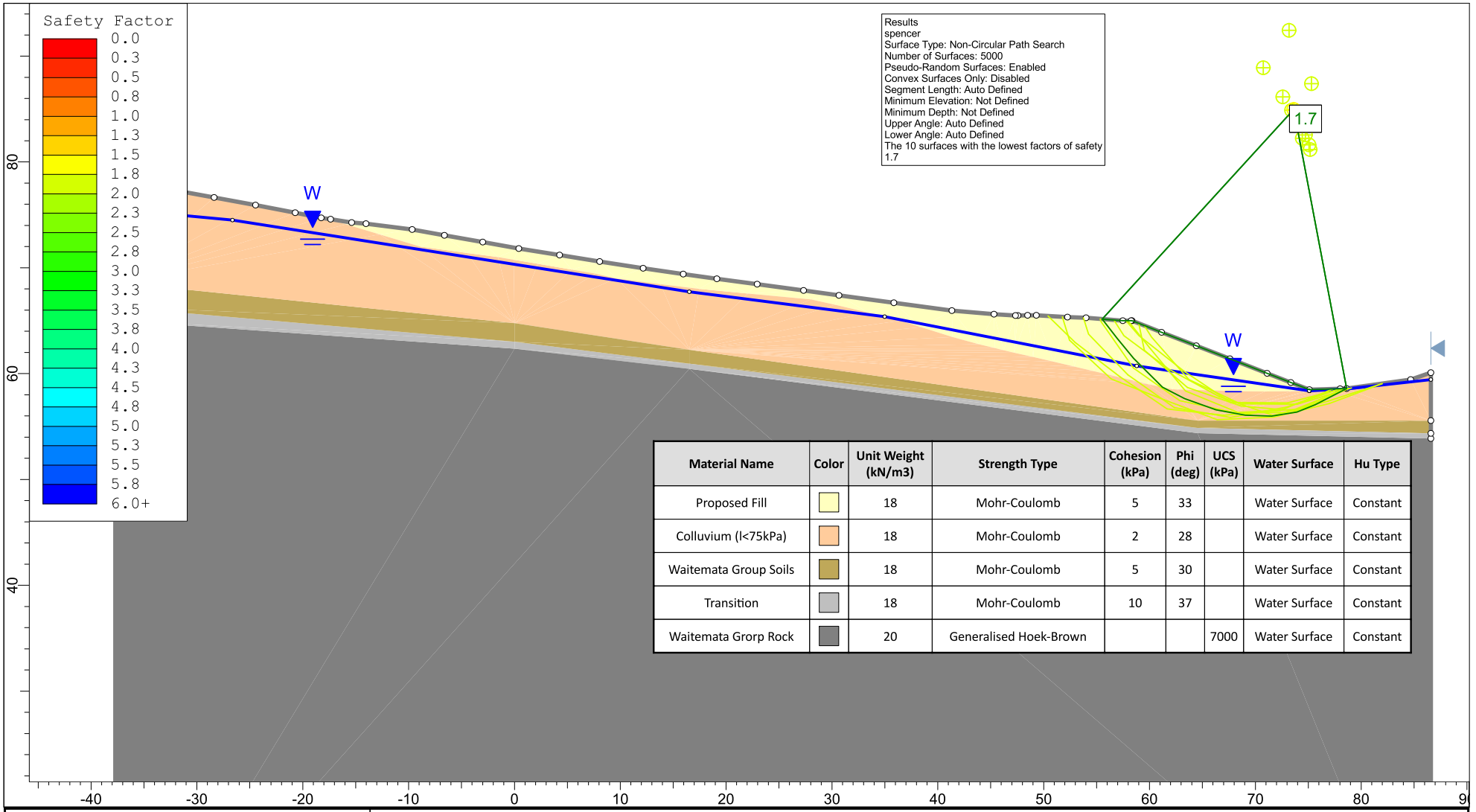
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 6, Section AA - Run 9				
Drawn By	PH	Scale	1:500	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S6AA - Run 9.slim



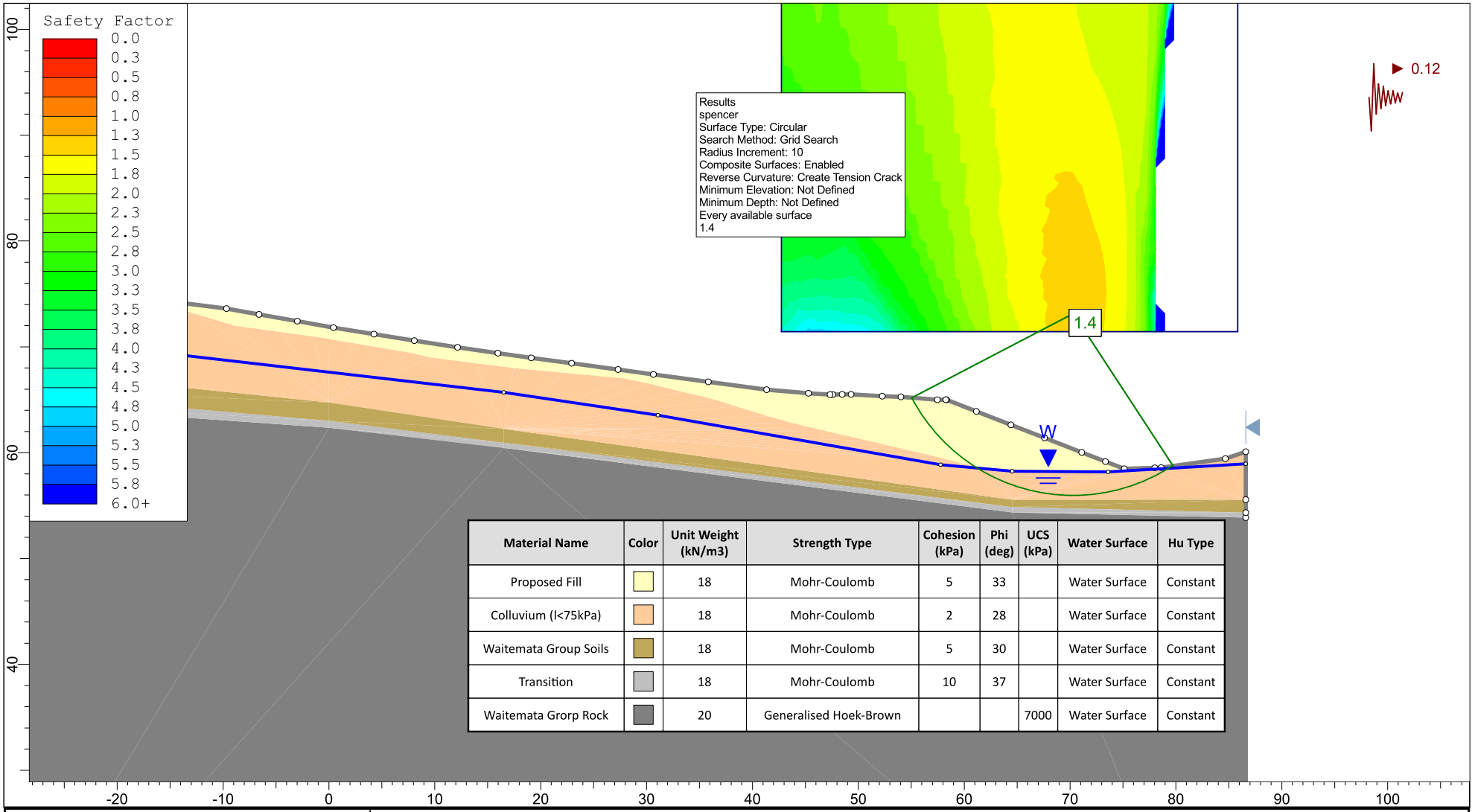
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 6, Section AA - Run 10				
Drawn By	PH	Scale	1:500	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S6AA - Run 10.slim

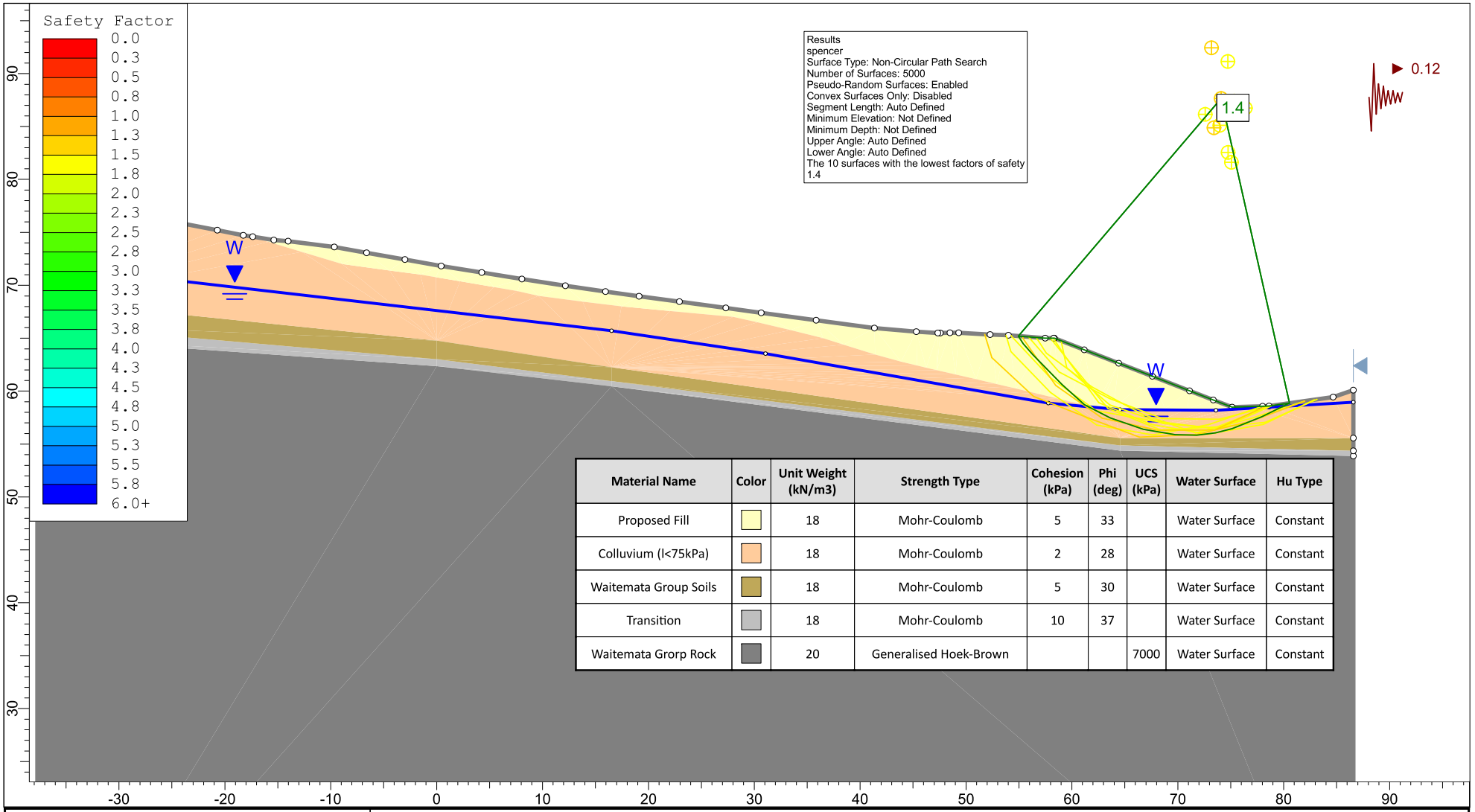


Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 6, Section AA - Run 11		
Drawn By	PH	Scale	1:500
Company	KGA Geotechnical		
Date	31/08/2015	File Name	7464 - S6AA - Run 11.slim



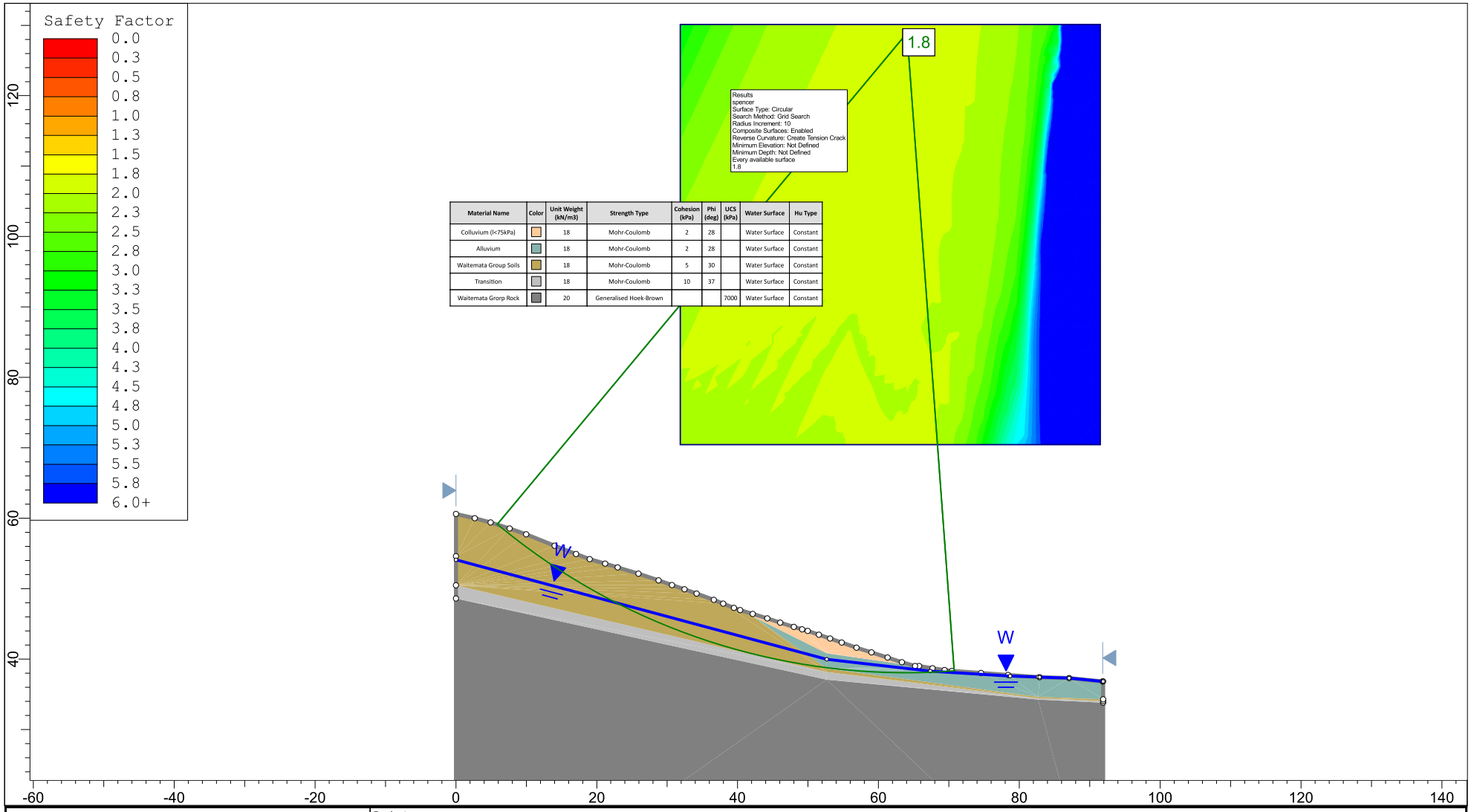
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 6, Section AA - Run 12				
Drawn By	PH	Scale	1:500	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S6AA - Run 12.slim

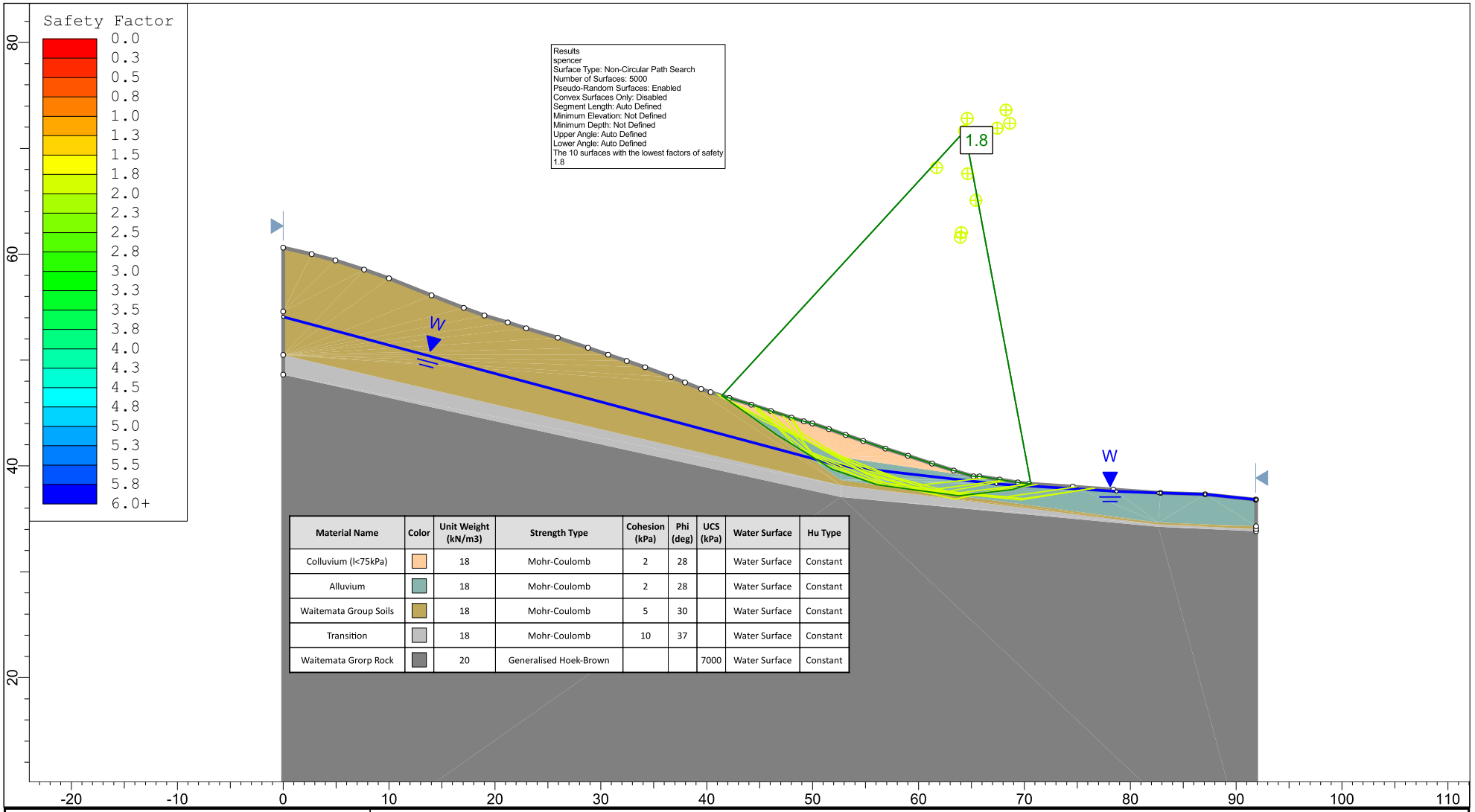


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SLIDEINTERPRET 6.018

Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 6, Section BB - Run 1				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S6BB - Run 1.slim



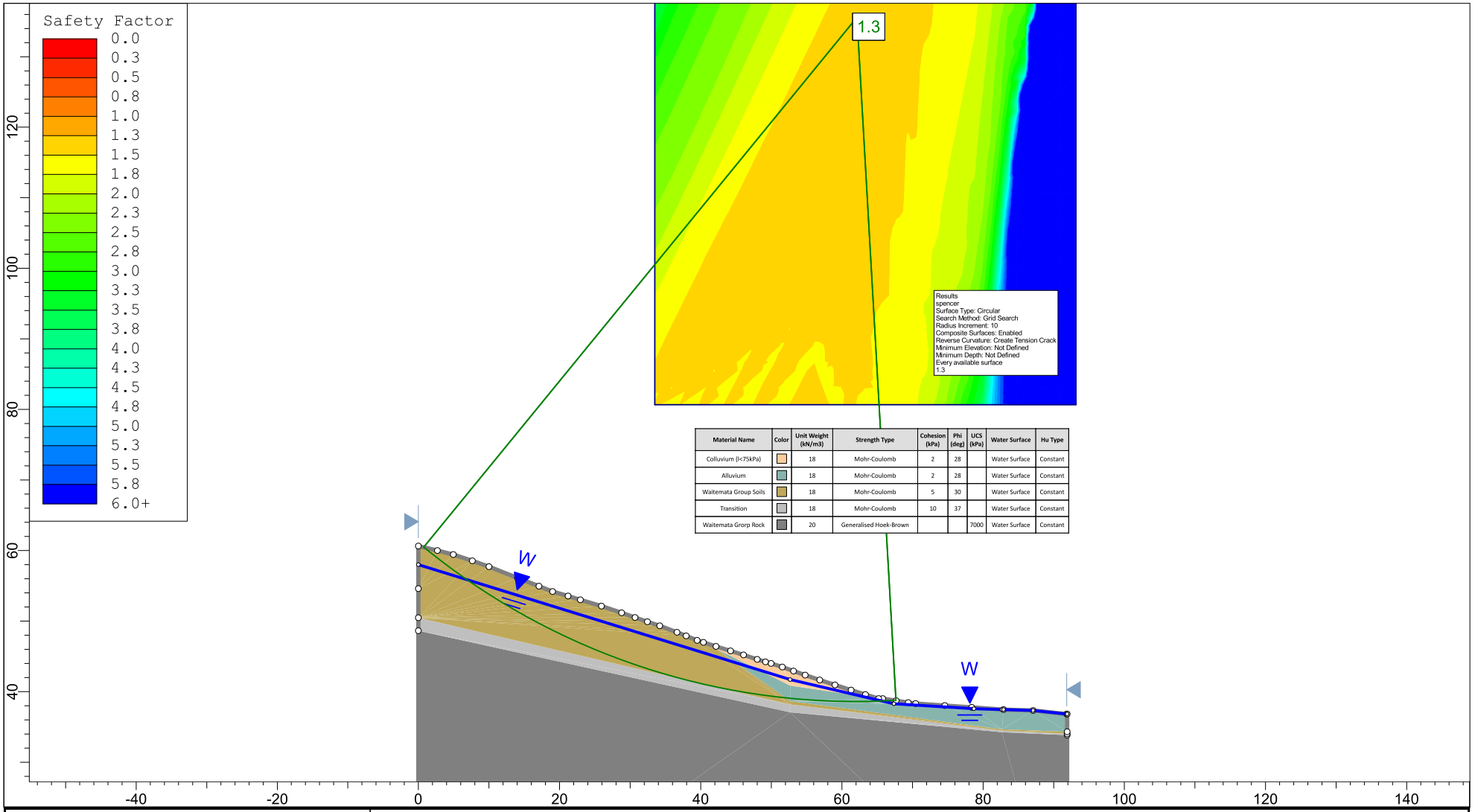
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa			
Analysis Description	Stage 6, Section BB - Run 2			
Drawn By	PH	*Scale*	1:500	*Company* KGA Geotechnical
Date	31/08/2015			*File Name* 7464 - S6BB - Run 2.slim



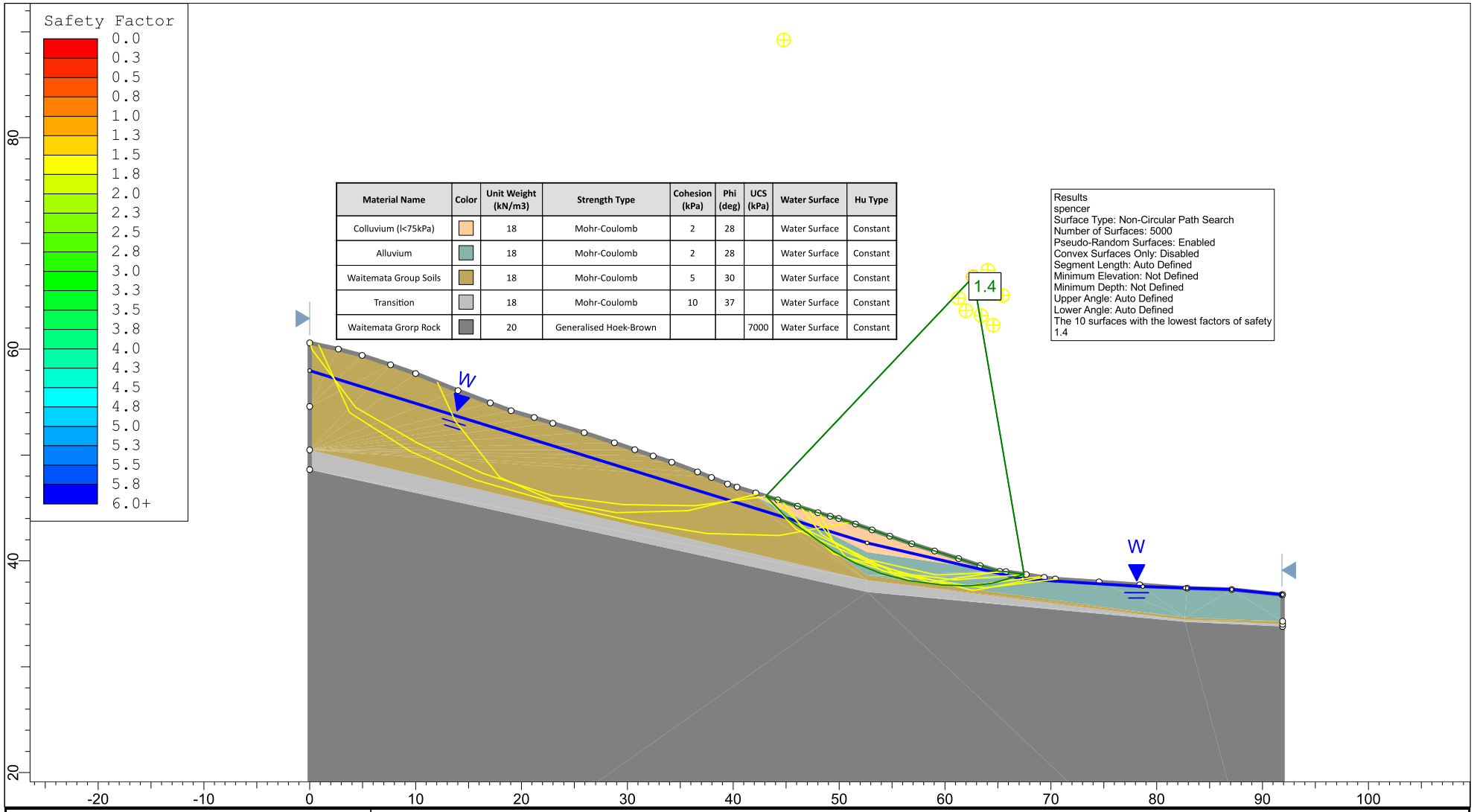
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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SLIDEINTERPRET 6.018

Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 6, Section BB - Run 3				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S6BB - Run 3.slim



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

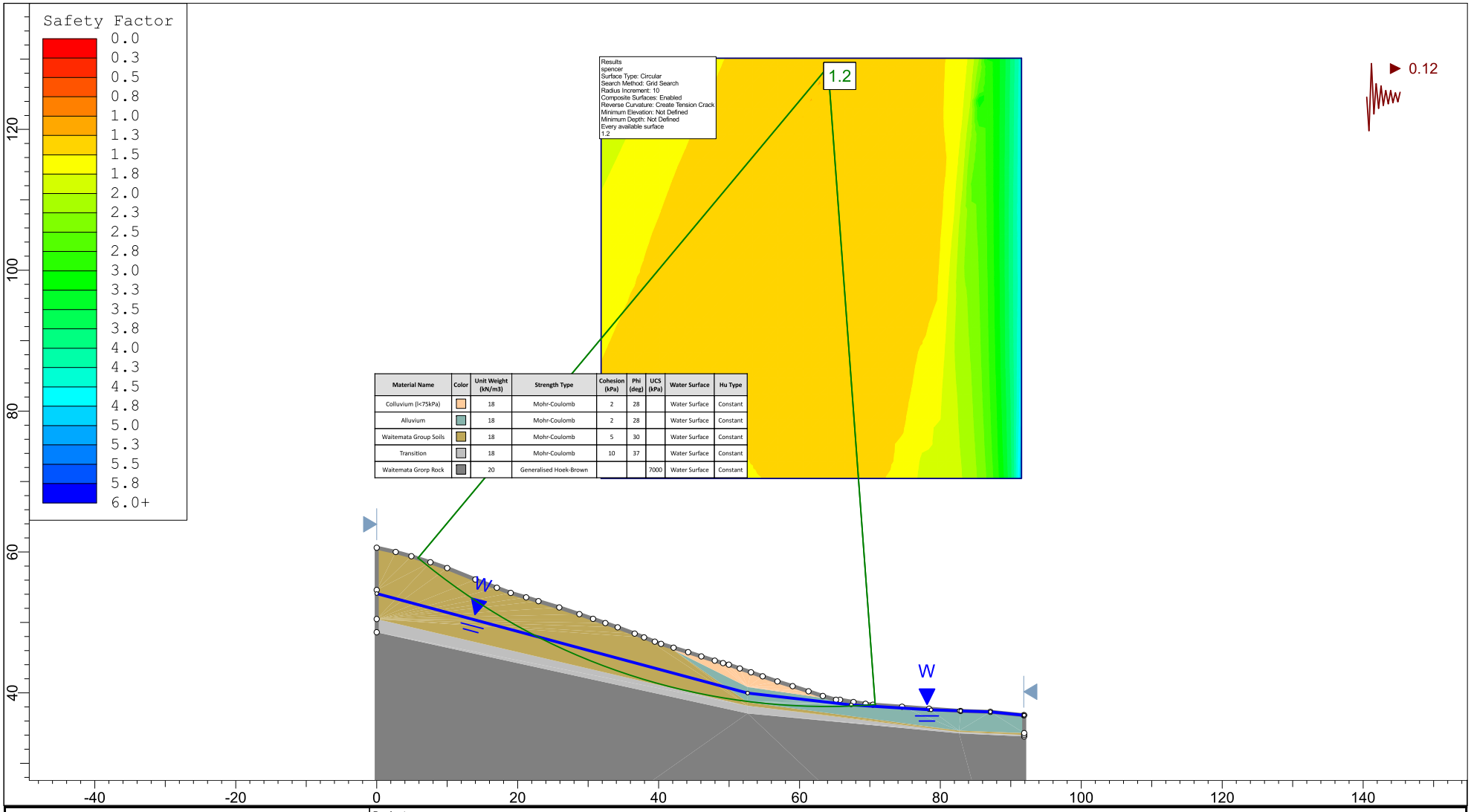
Results
spencer
Surface Type: Non-Circular Path Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Segment Length: Auto Defined
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Upper Angle: Auto Defined
Lower Angle: Auto Defined
The 10 surfaces with the lowest factors of safety
1.4

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SLIDEINTERPRET 6.018

Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 6, Section BB - Run 4				
Drawn By	PH	Scale	1:500	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S6BB - Run 4.slim



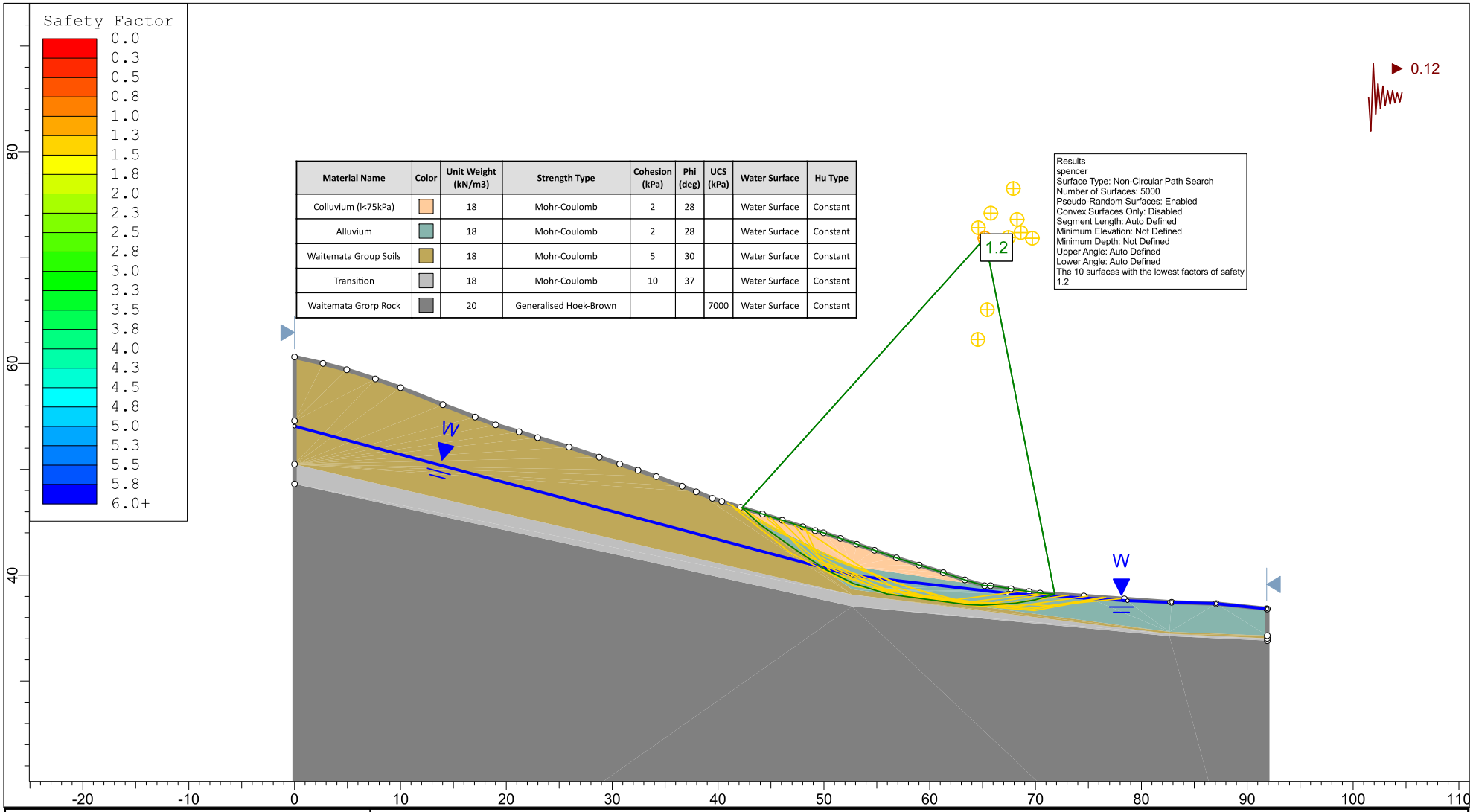
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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SLIDEINTERPRET 6.018

Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 6, Section BB - Run 5				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S6BB - Run 5.slim



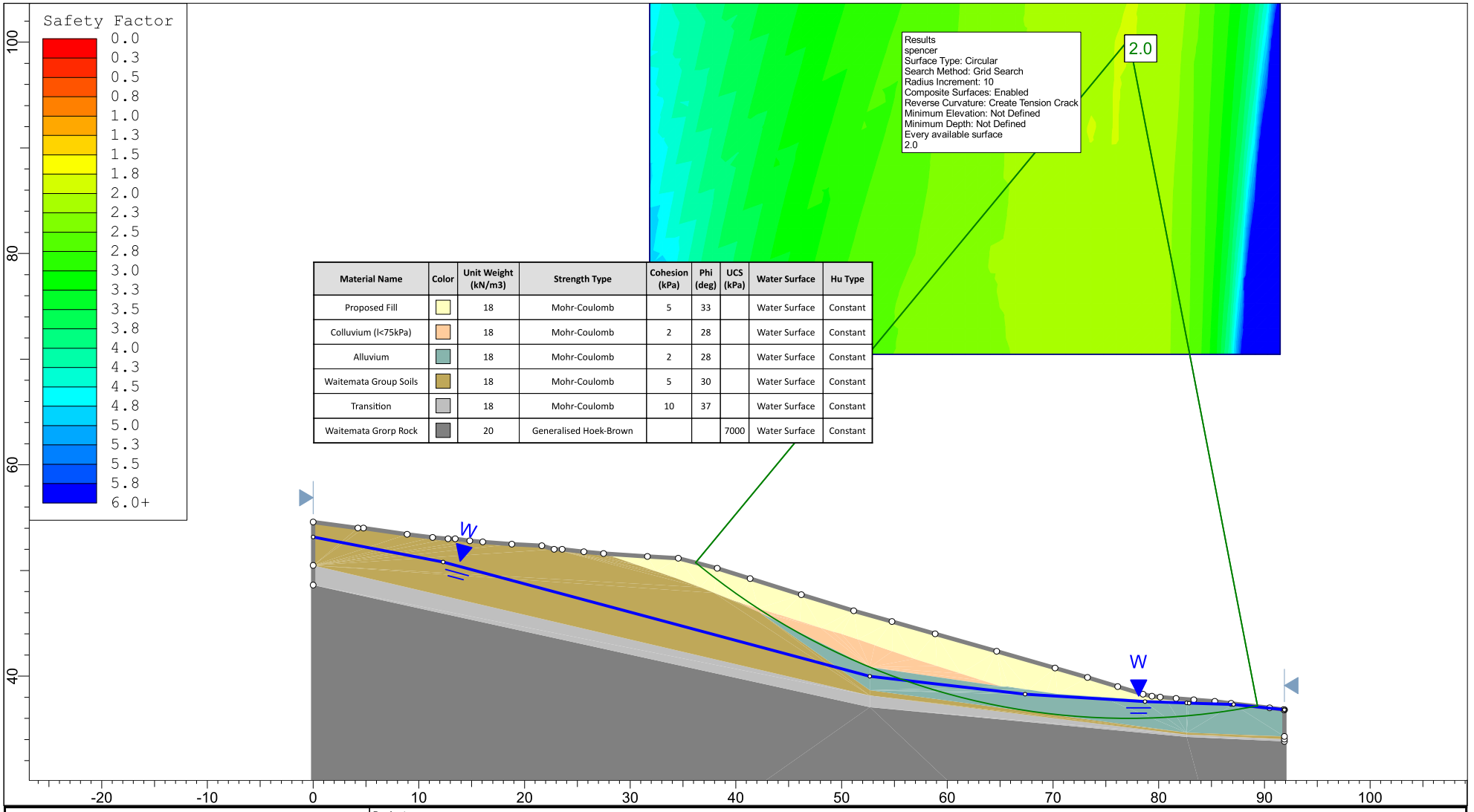
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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SLIDEINTERPRET 6.018

Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 6, Section BB - Run 6				
Drawn By	PH	Scale	1:500	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S6BB - Run 6.slim



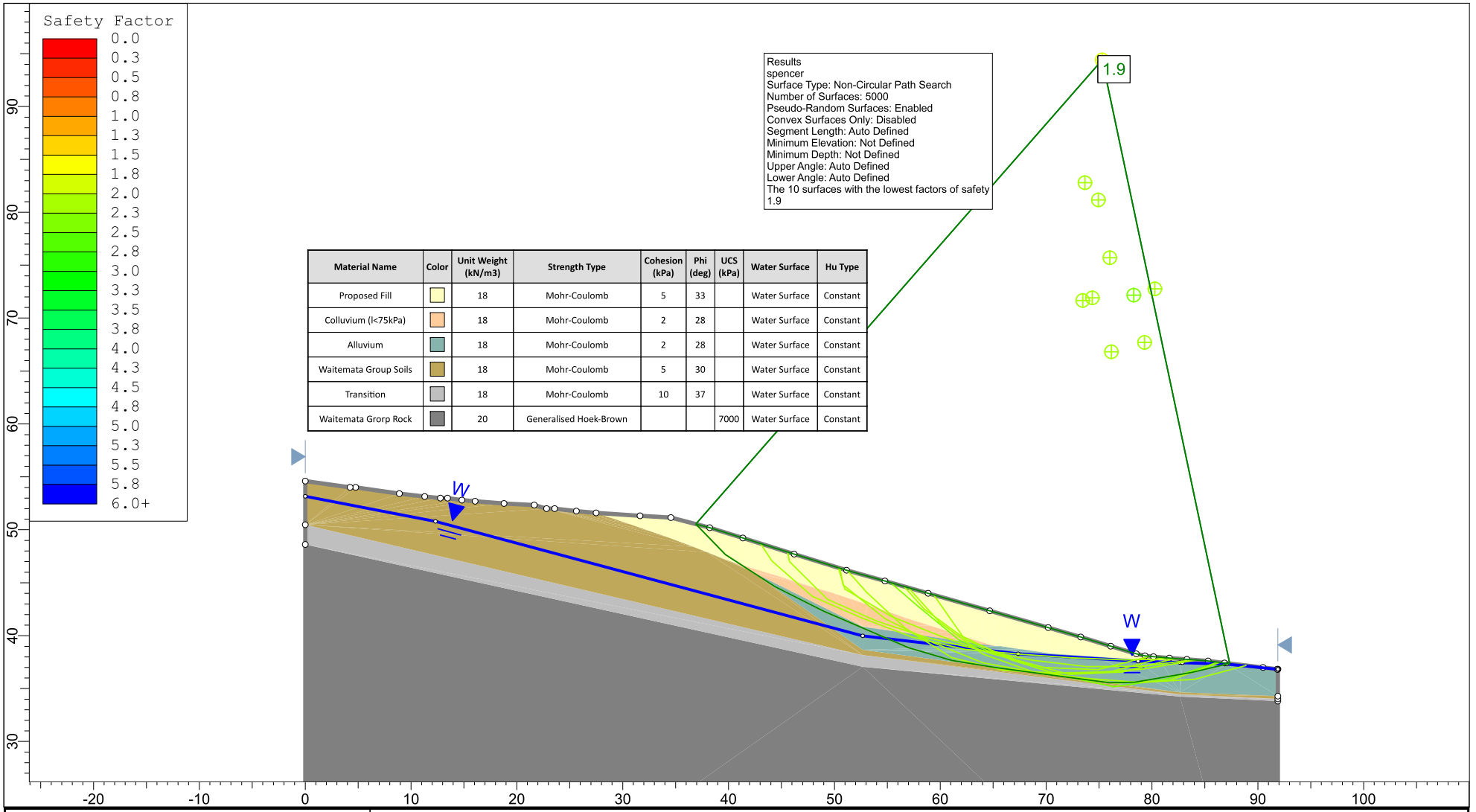
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 6, Section BB - Run 7				
Drawn By	PH	*Scale*	1:500	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S6BB - Run 7.slim



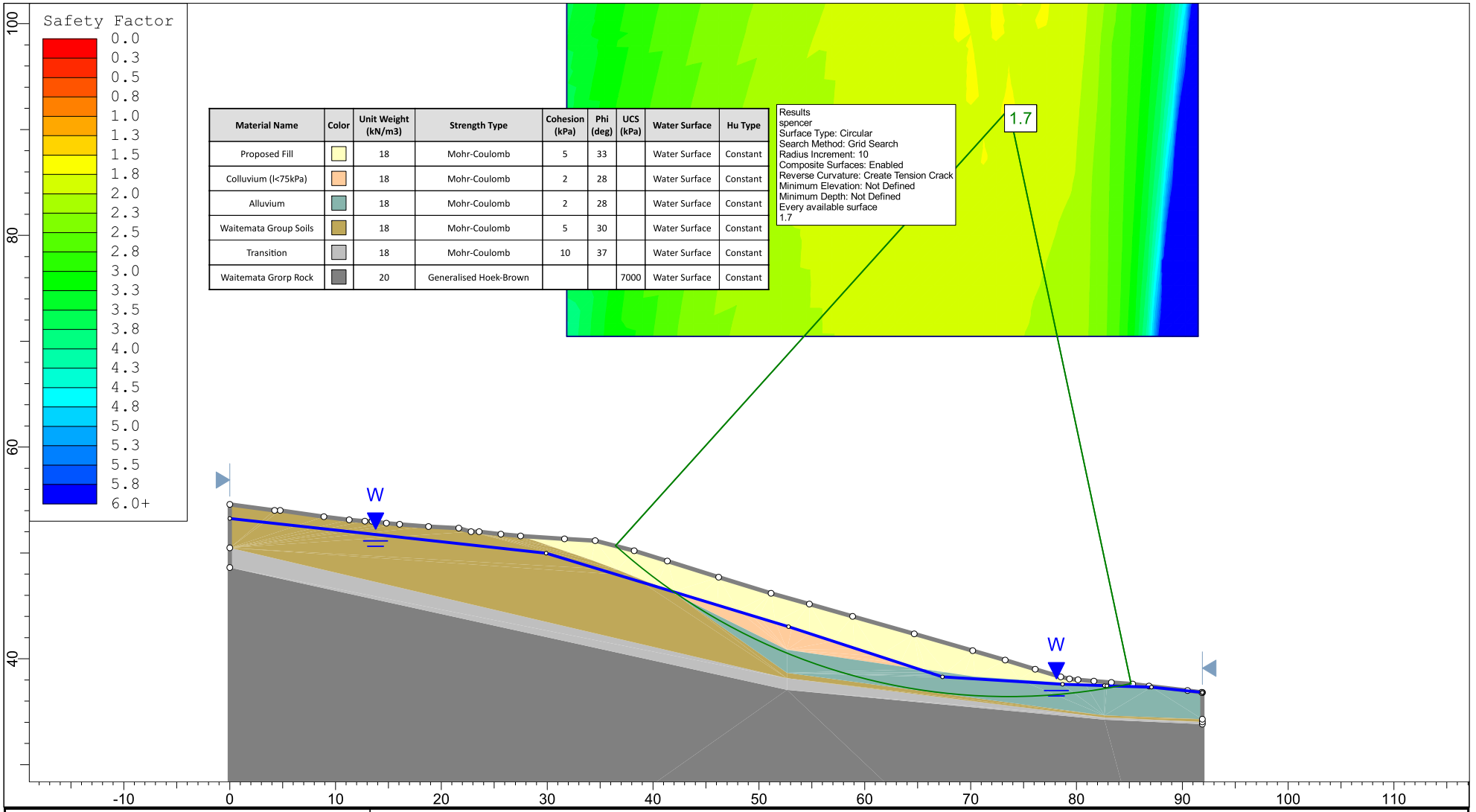
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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SLIDEINTERPRET 6.018

Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 6, Section BB - Run 8				
Drawn By	PH	*Scale*	1:500	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S6BB - Run 8.slim



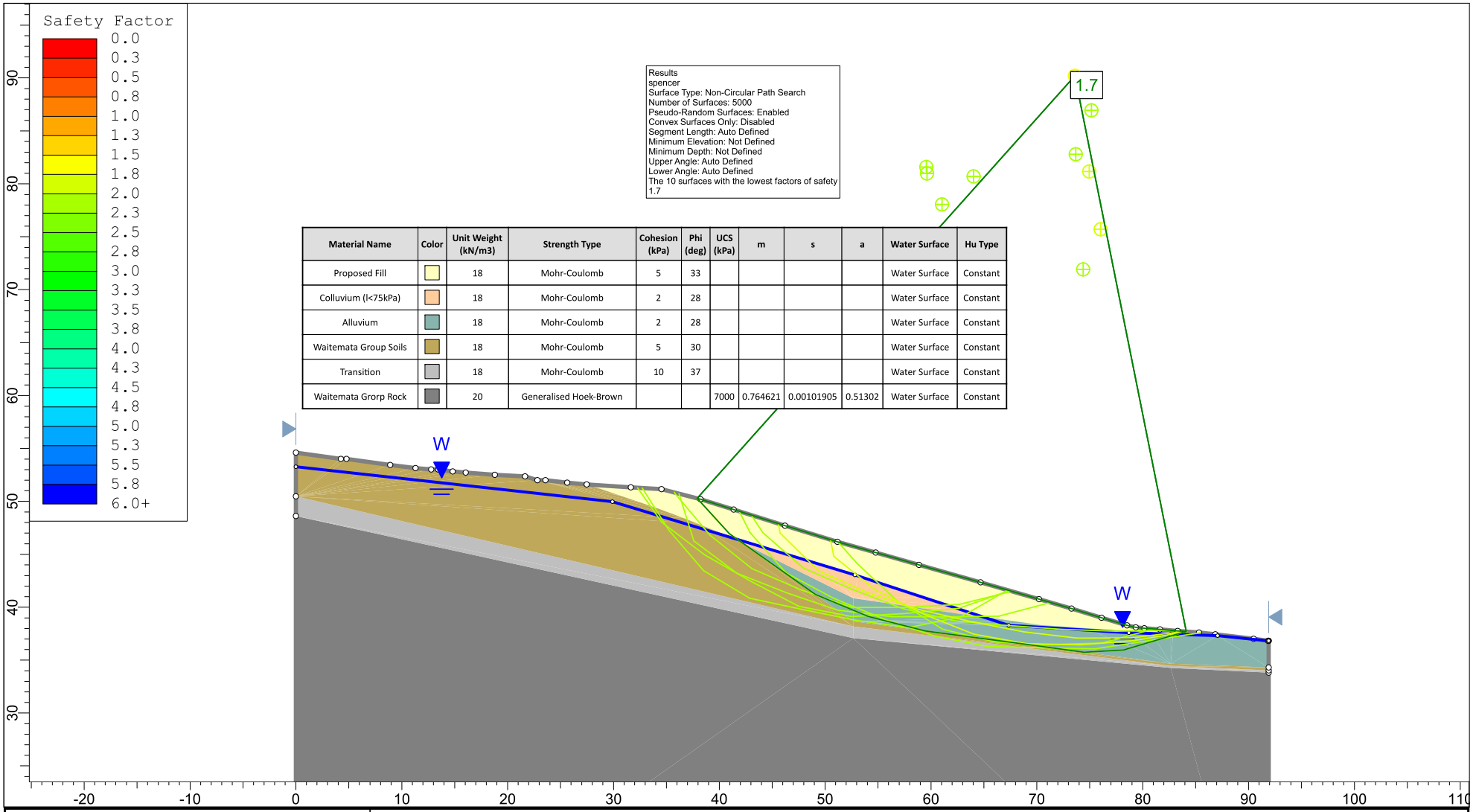
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa			
Analysis Description	Stage 6, Section BB - Run 9			
Drawn By	PH	*Scale*	1:500	*Company* KGA Geotechnical
Date	31/08/2015			*File Name* 7464 - S6BB - Run 9.slim



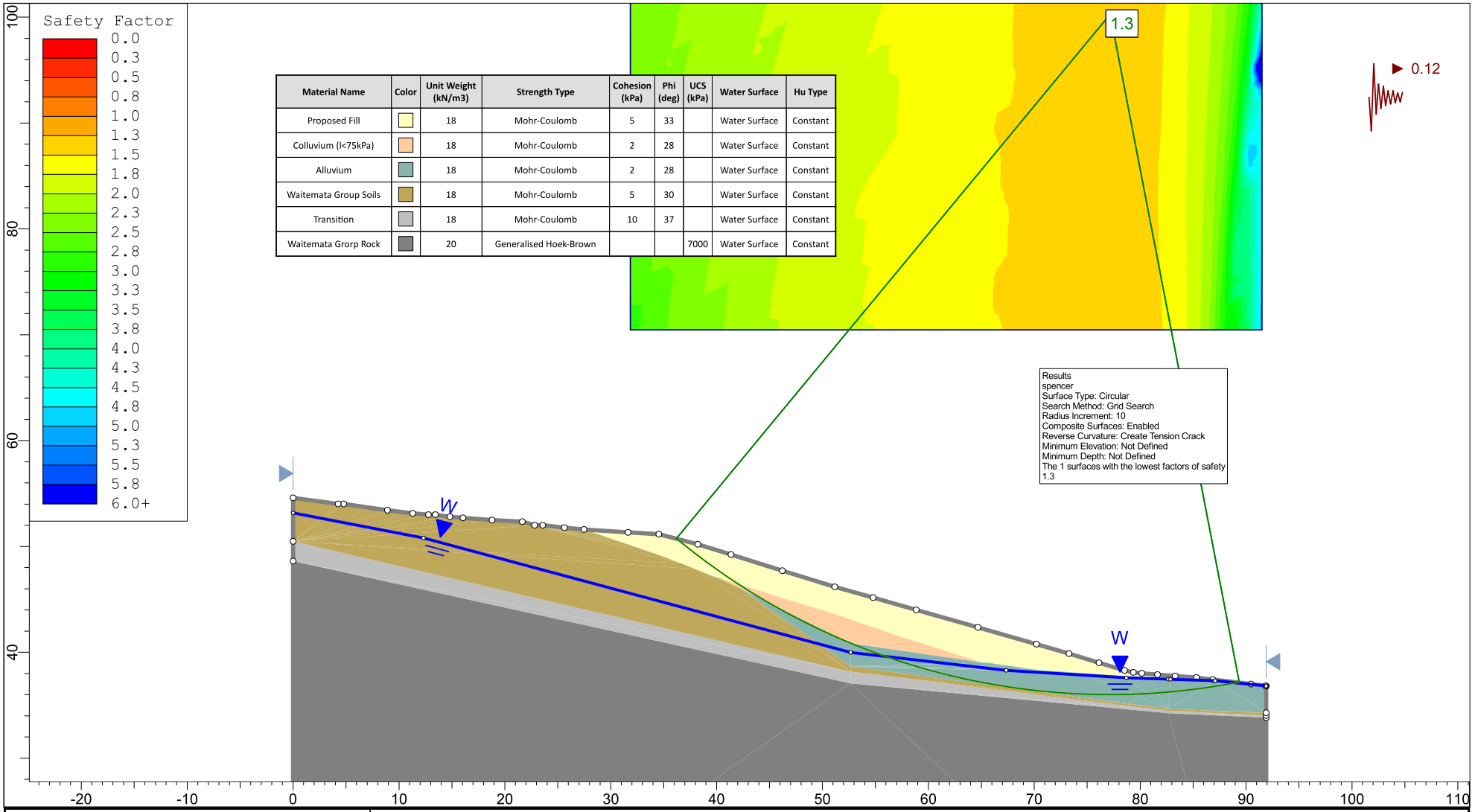
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	m	s	a	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33					Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28					Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28					Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30					Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37					Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	0.764621	0.00101905	0.51302	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 6, Section BB - Run 10				
Drawn By	PH	*Scale*	1:500	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S6BB - Run 10.slim



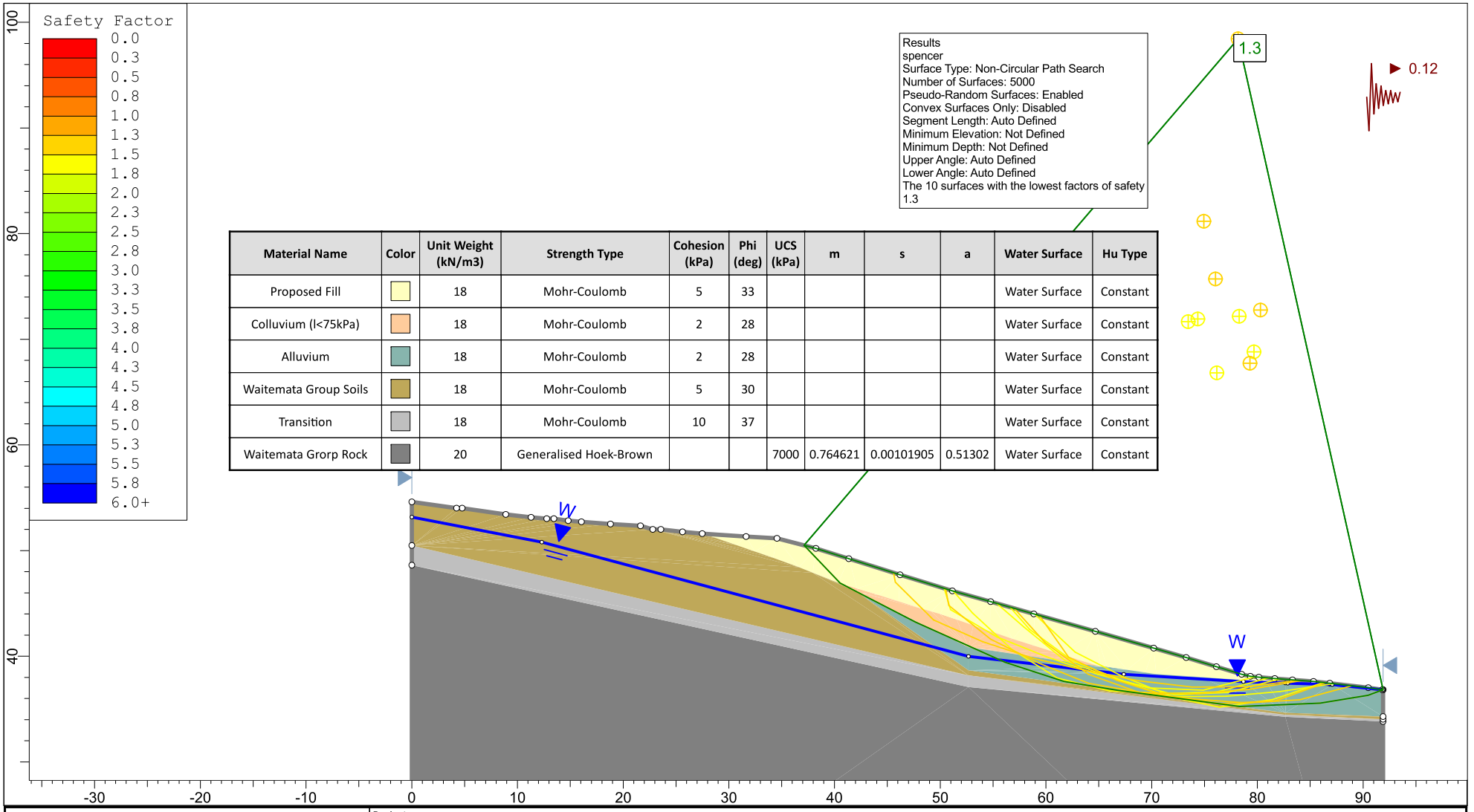
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 6, Section BB - Run 11				
Drawn By	PH	*Scale*	1:500	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S6BB - Run 11.slim



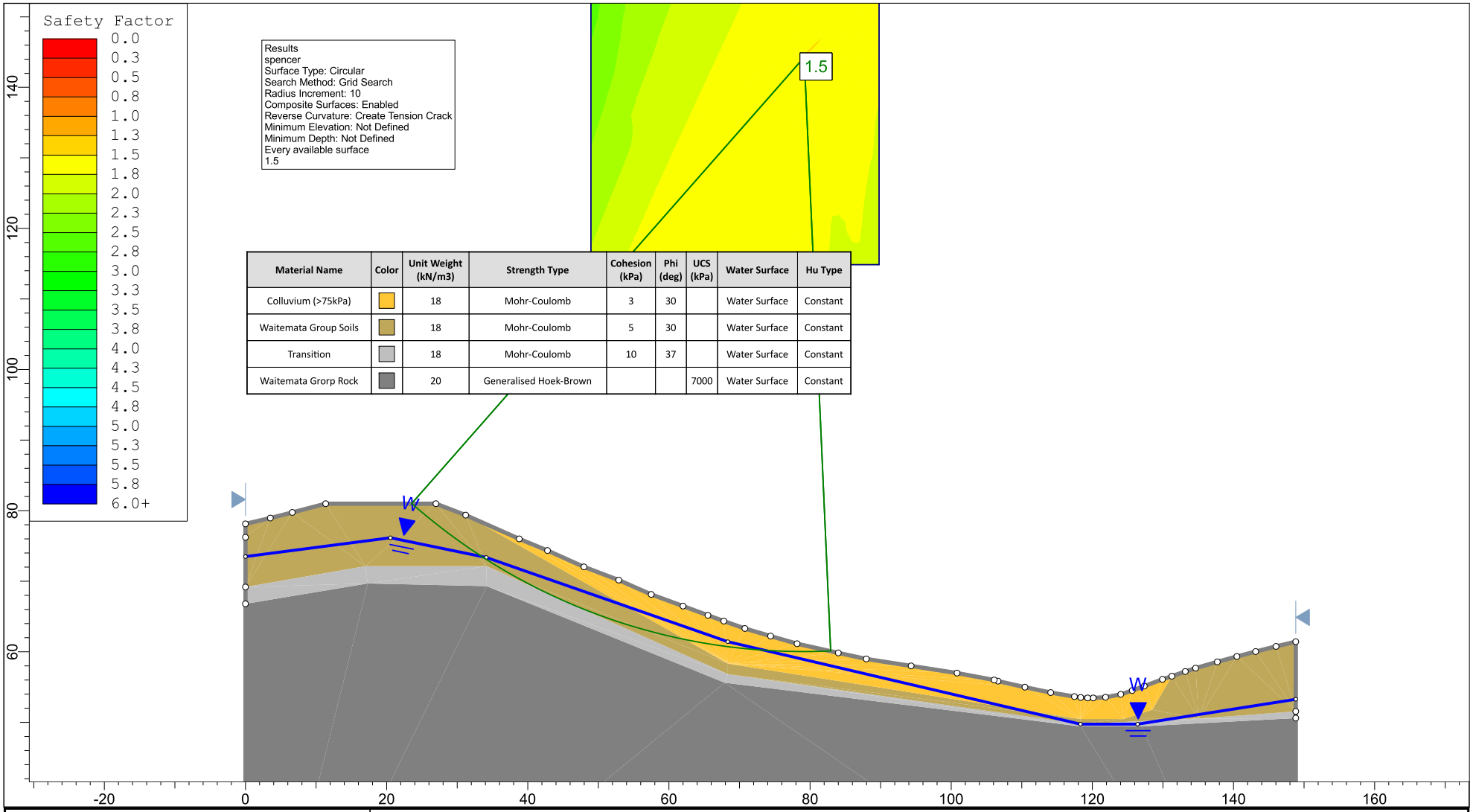
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	m	s	a	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33					Water Surface	Constant
Colluvium (I<75kPa)		18	Mohr-Coulomb	2	28					Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28					Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30					Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37					Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	0.764621	0.00101905	0.51302	Water Surface	Constant

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SLIDEINTERPRET 6.018

Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 6, Section BB - Run 12		
Drawn By	PH	Scale	1:500
Company	KGA Geotechnical		
Date	31/08/2015	File Name	7464 - S6BB - Run 12.slim



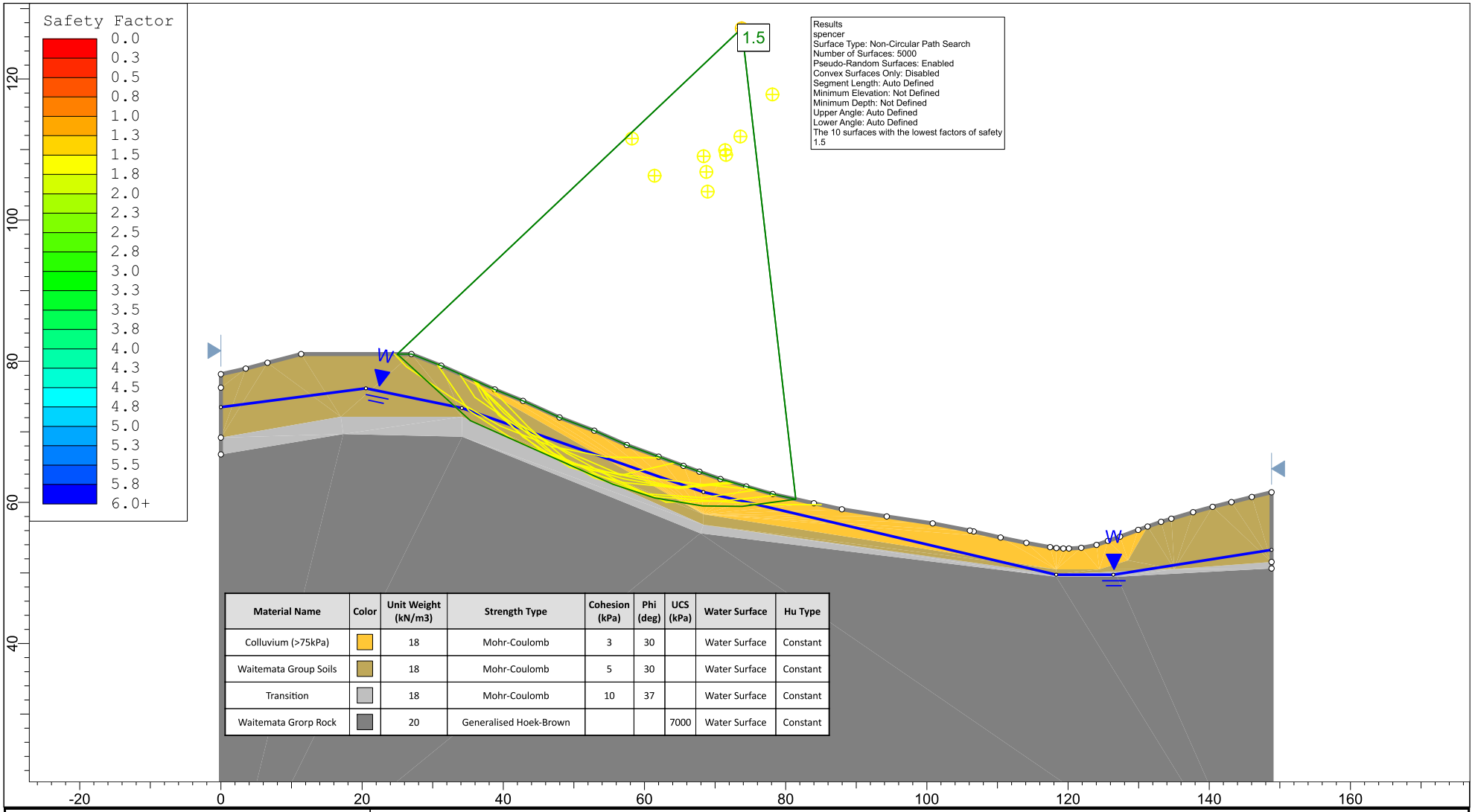
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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SLIDEINTERPRET 6.018

Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 7, Section AA - Run 1				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S7AA - Run 1.slim



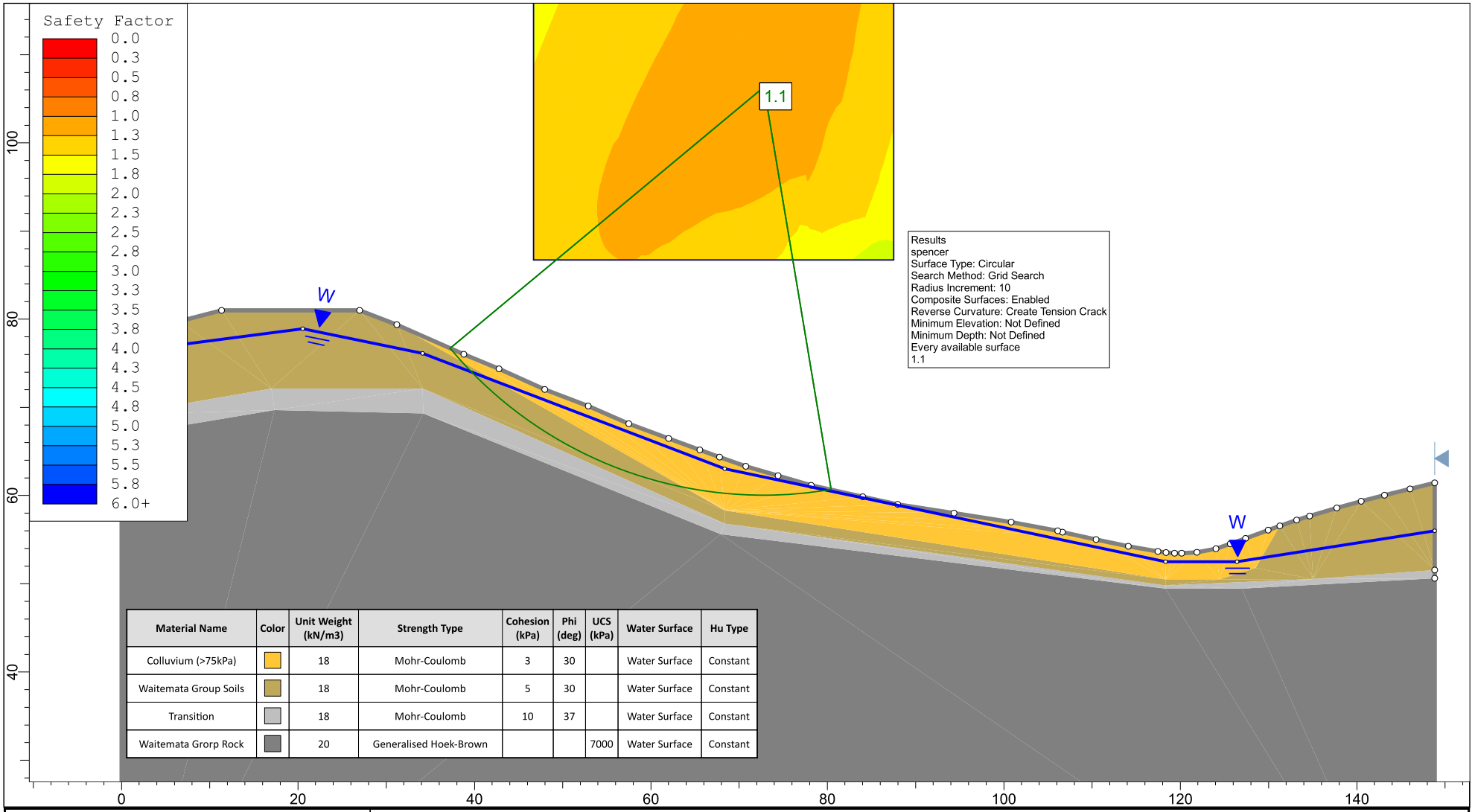
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 7, Section AA - Run 2		
Drawn By	PH	*Scale* 1:750	*Company* KGA Geotechnical
Date	31/08/2015		*File Name* 7464 - S7AA - Run 2.slim



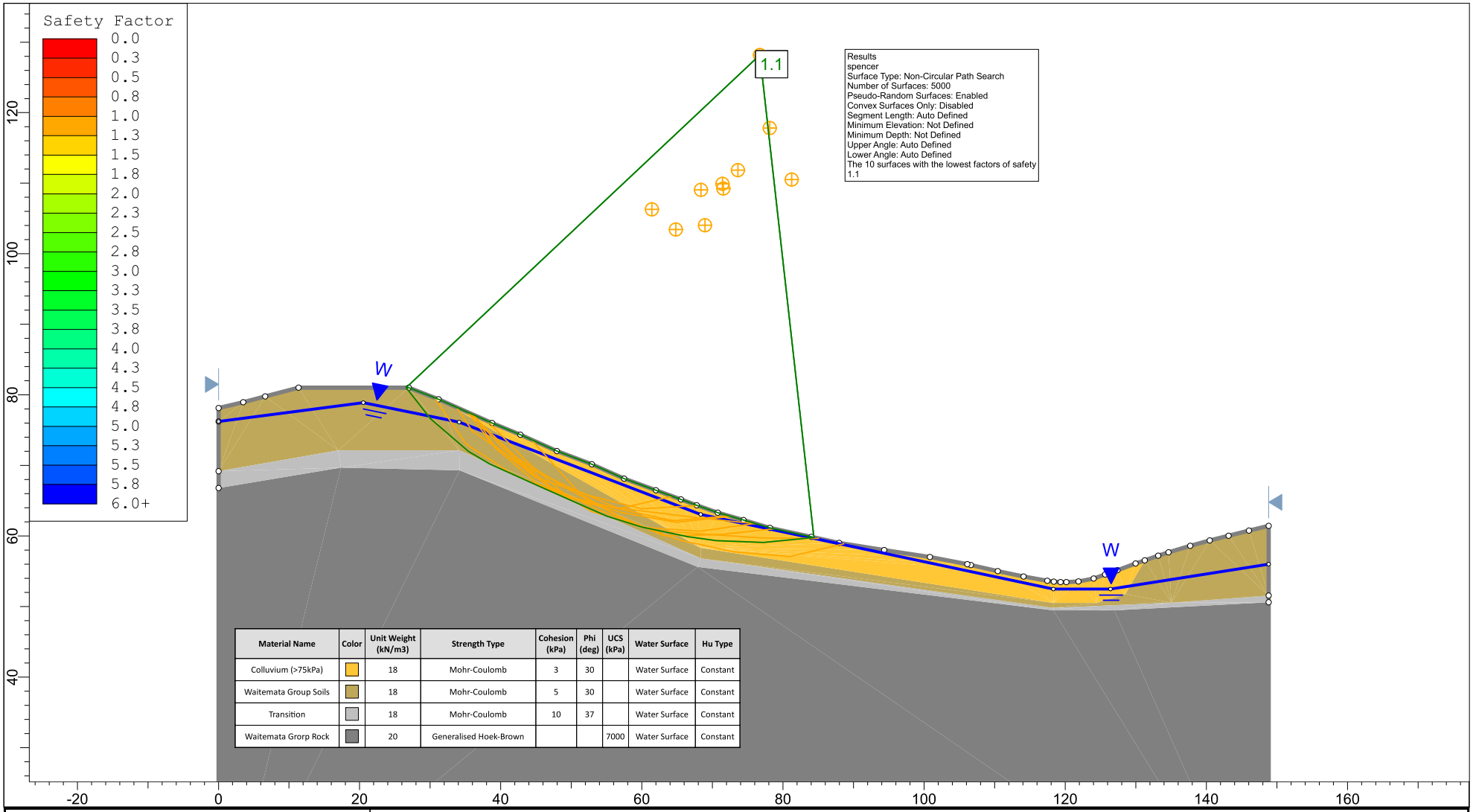
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 7, Section AA - Run 3		
Drawn By	PH	Scale 1:600	Company KGA Geotechnical
Date	31/08/2015		File Name 7464 - S7AA - Run 3.slim



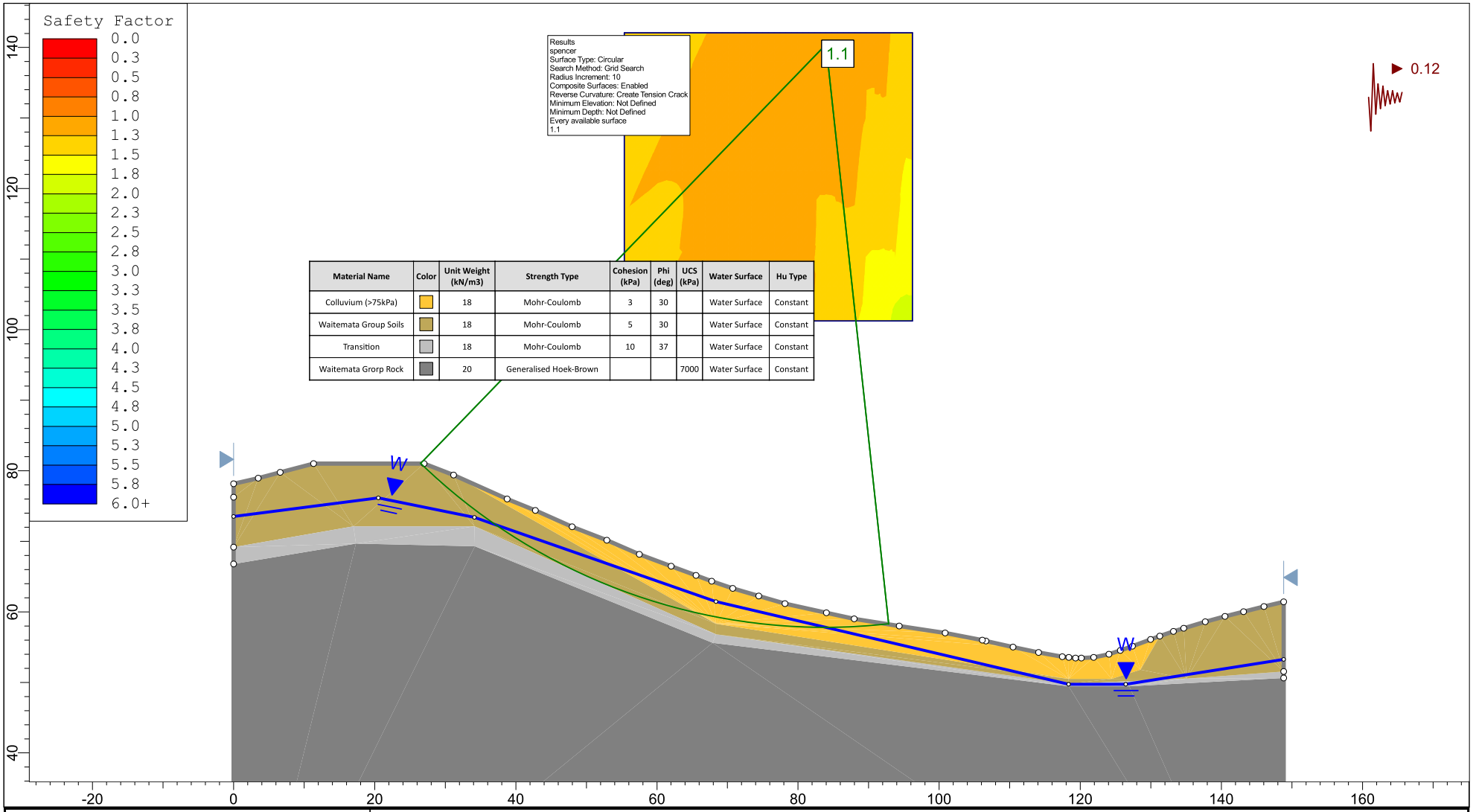
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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SLIDEINTERPRET 6.018

Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 7, Section AA - Run 4		
Drawn By	PH	*Scale* 1:750	*Company* KGA Geotechnical
Date	31/08/2015		*File Name* 7464 - S7AA - Run 4.slim

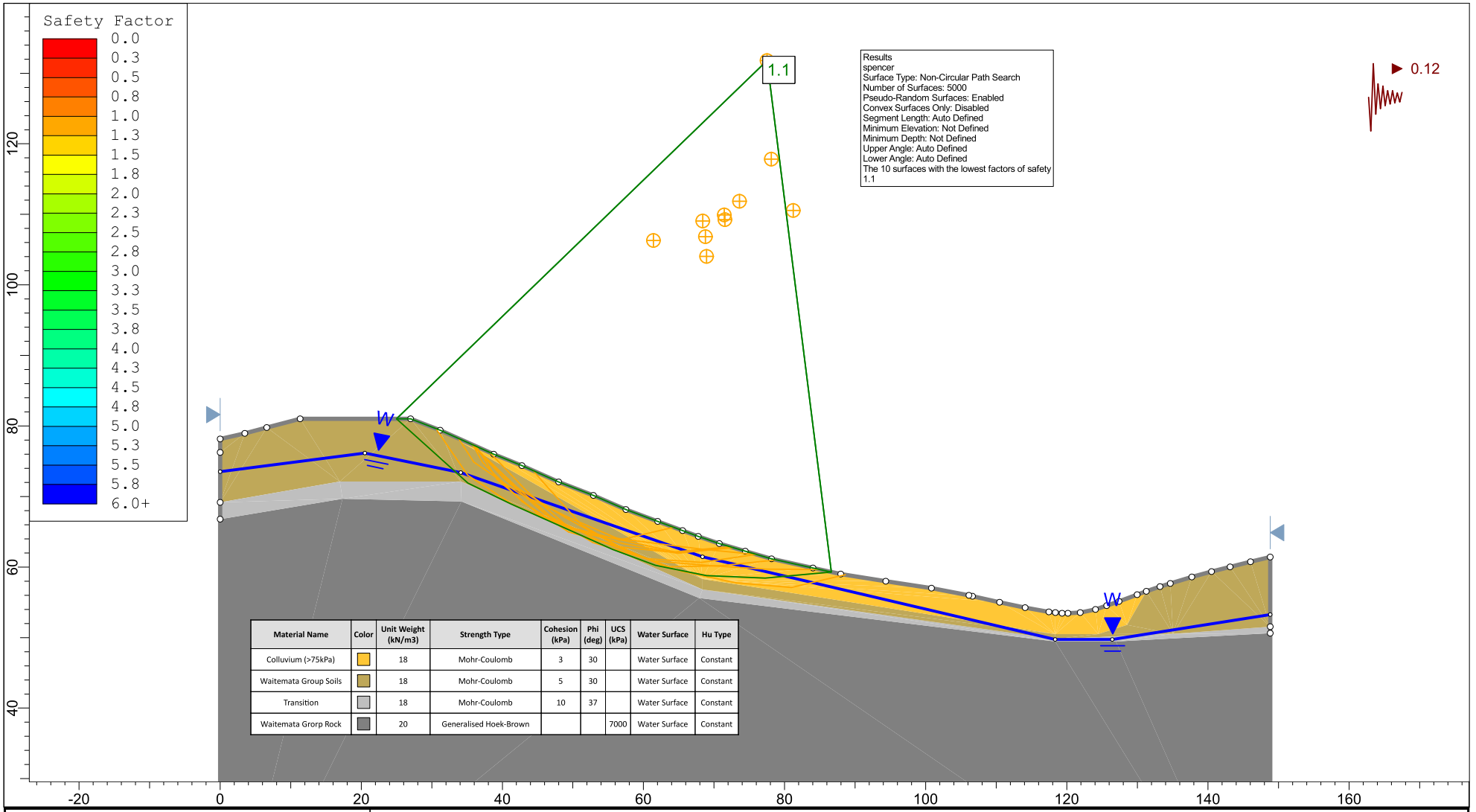


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SLIDEINTERPRET 6.018

Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 7, Section AA - Run 5				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S7AA - Run 5.slim



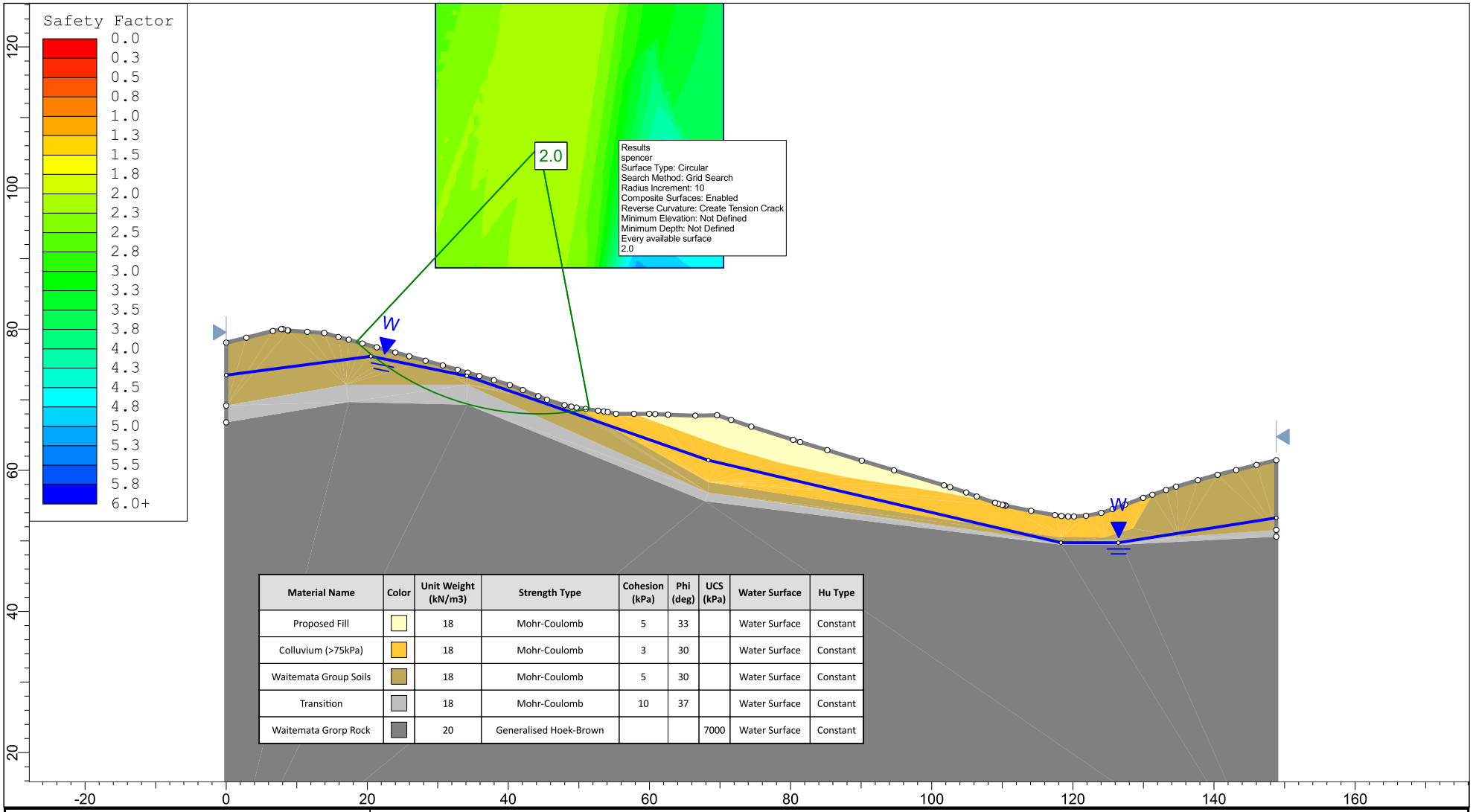
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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SLIDEINTERPRET 6.018

Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 7, Section AA - Run 6		
Drawn By	PH	*Scale* 1:750	*Company* KGA Geotechnical
Date	31/08/2015		*File Name* 7464 - S7AA - Run 6.slim



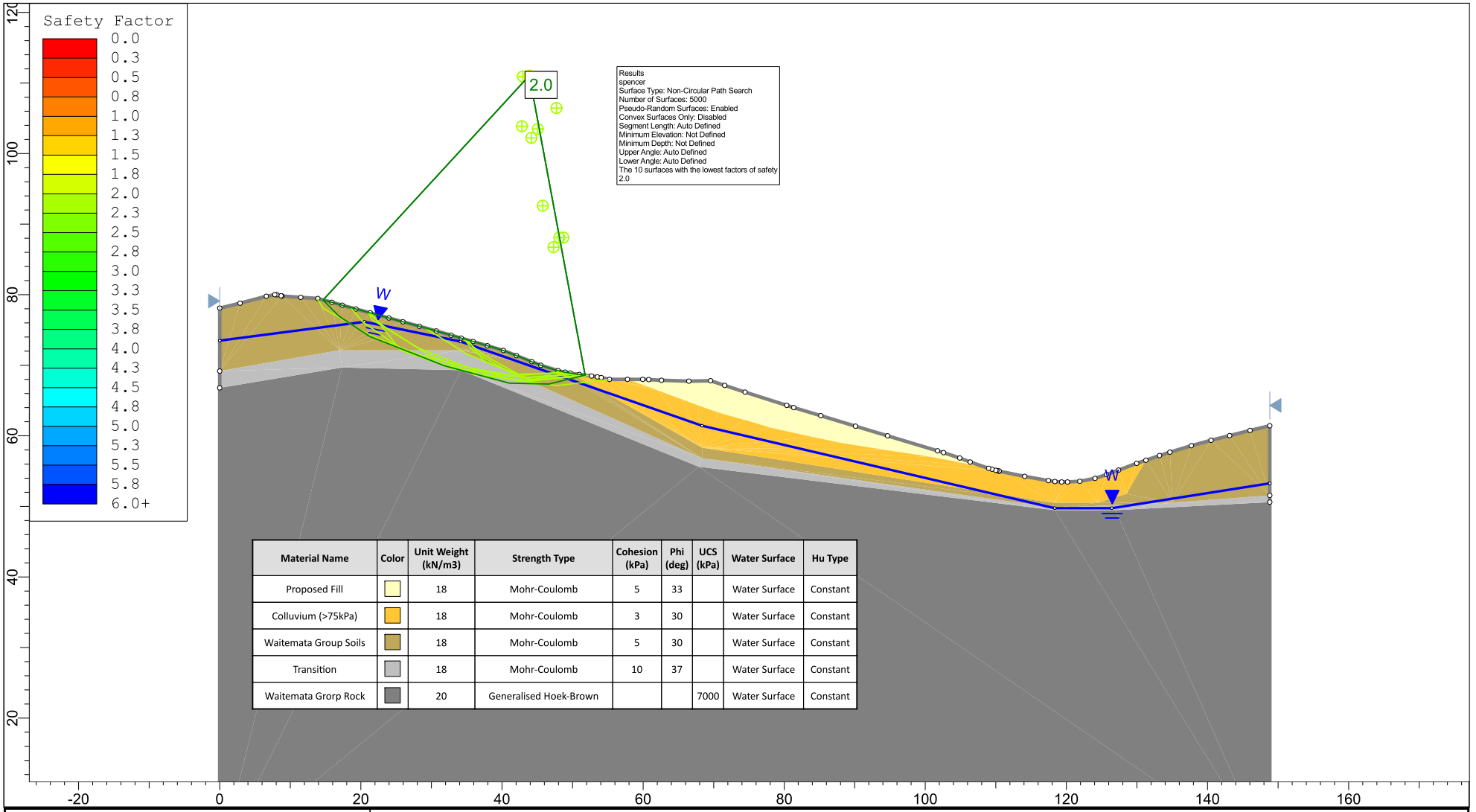
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 7, Section AA - Run 7				
Drawn By	PH	Scale	1:750	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S7AA - Run 7.slim



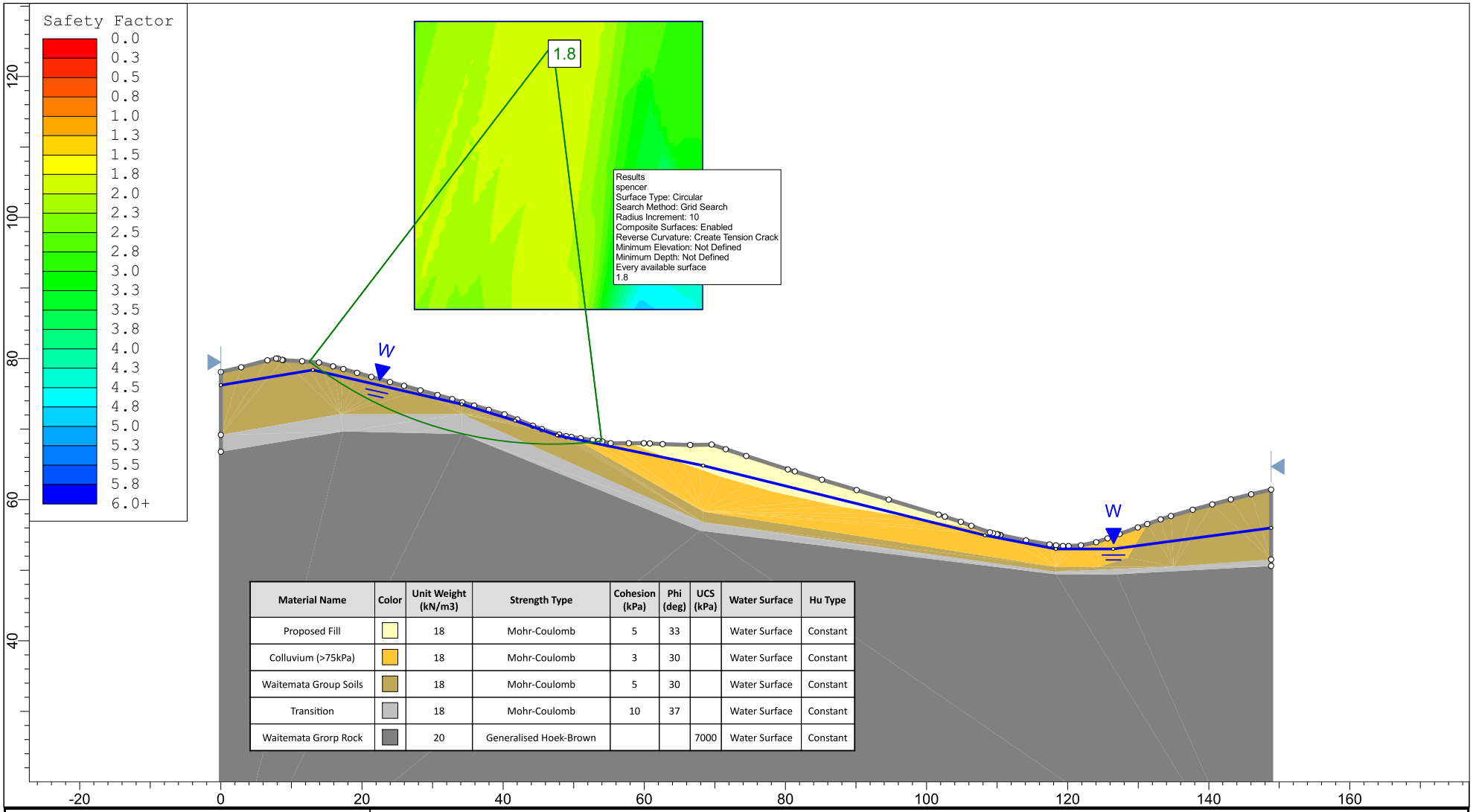
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 7, Section AA - Run 8				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S7AA - Run 8.slim



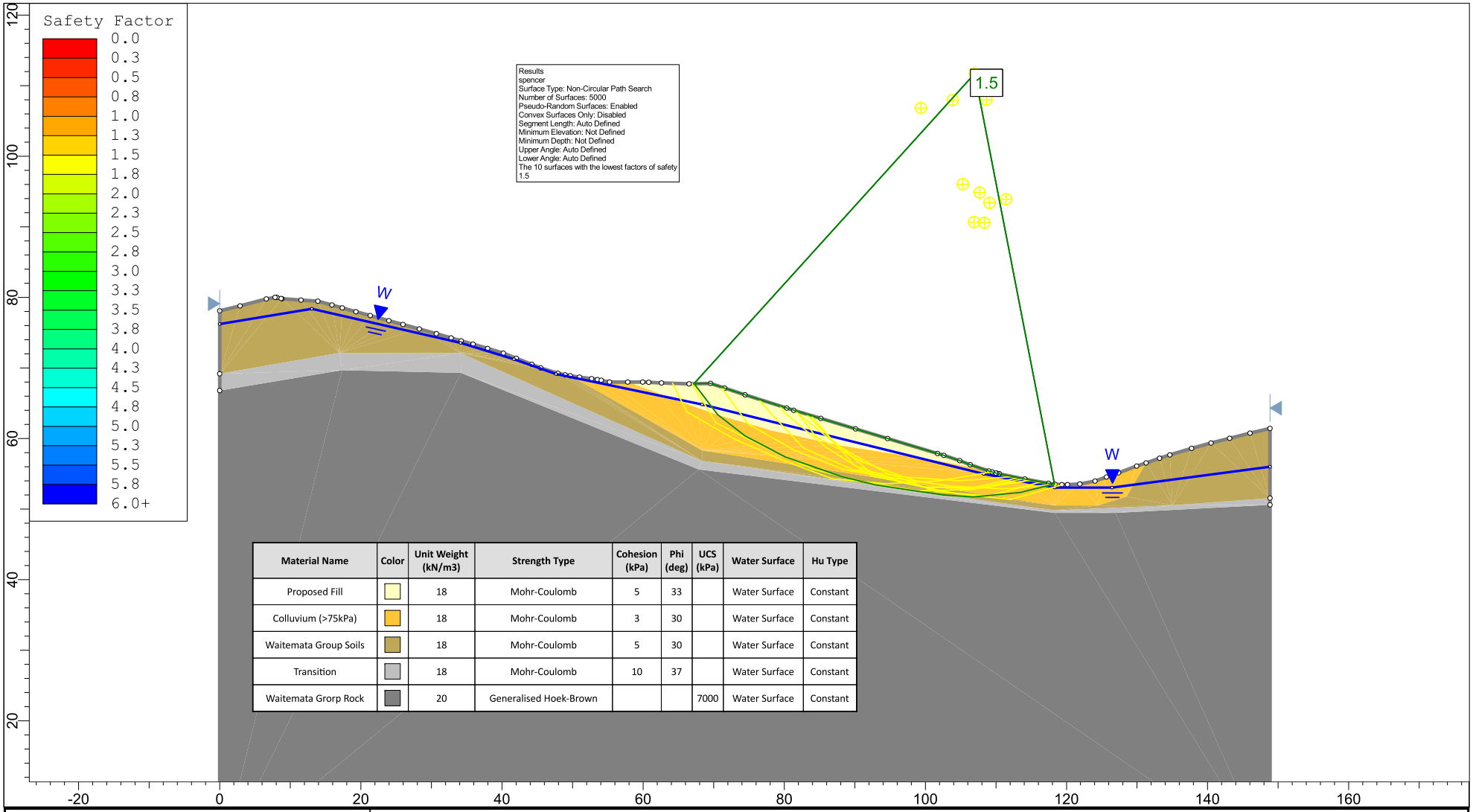
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa			
Analysis Description	Stage 7, Section AA - Run 9			
Drawn By	PH	*Scale*	1:750	*Company* KGA Geotechnical
Date	31/08/2015			*File Name* 7464 - S7AA - Run 9.slim



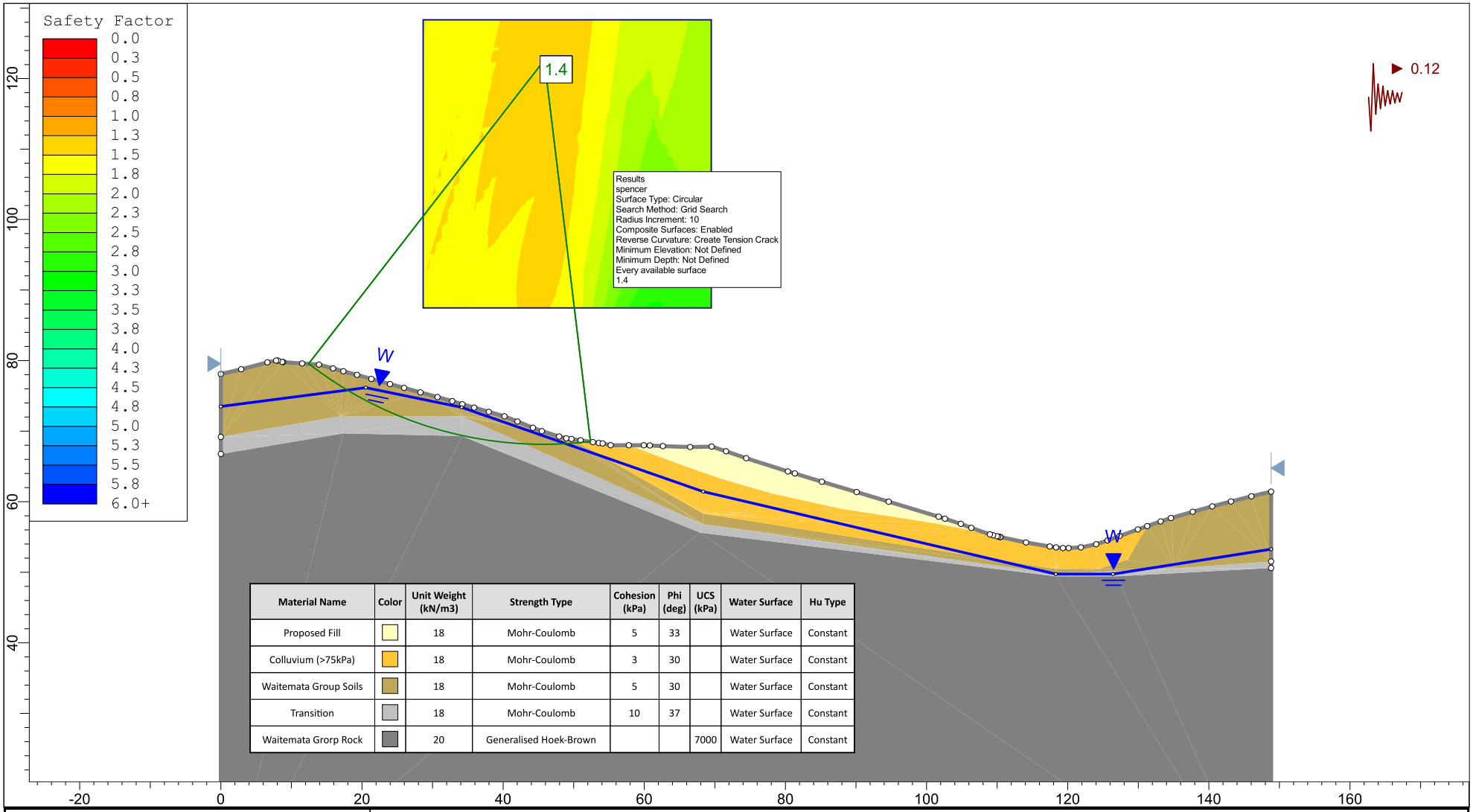
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 7, Section AA - Run 10				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S7AA - Run 10.slim



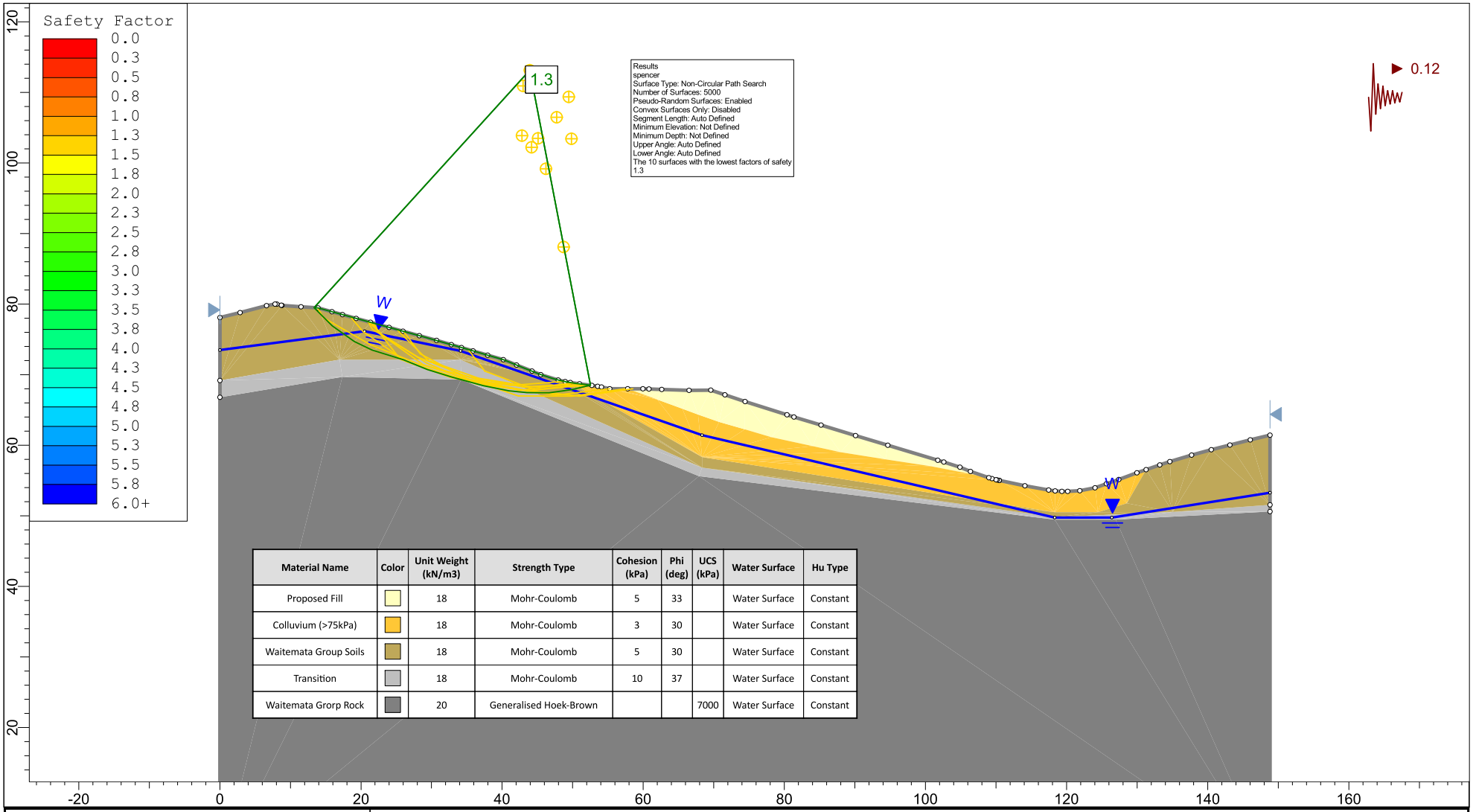
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 7, Section AA - Run 11				
Drawn By	PH	Scale	1:750	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S7AA - Run 11.slim



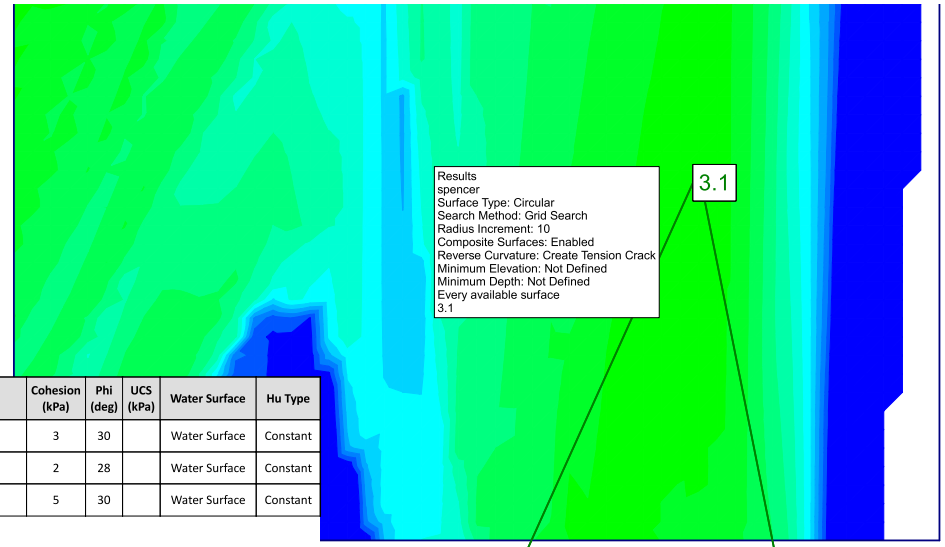
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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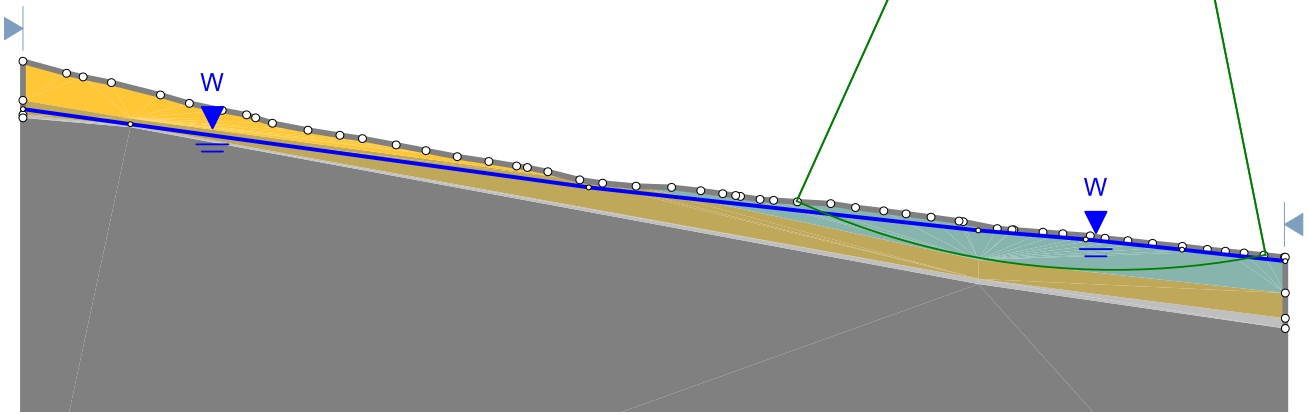
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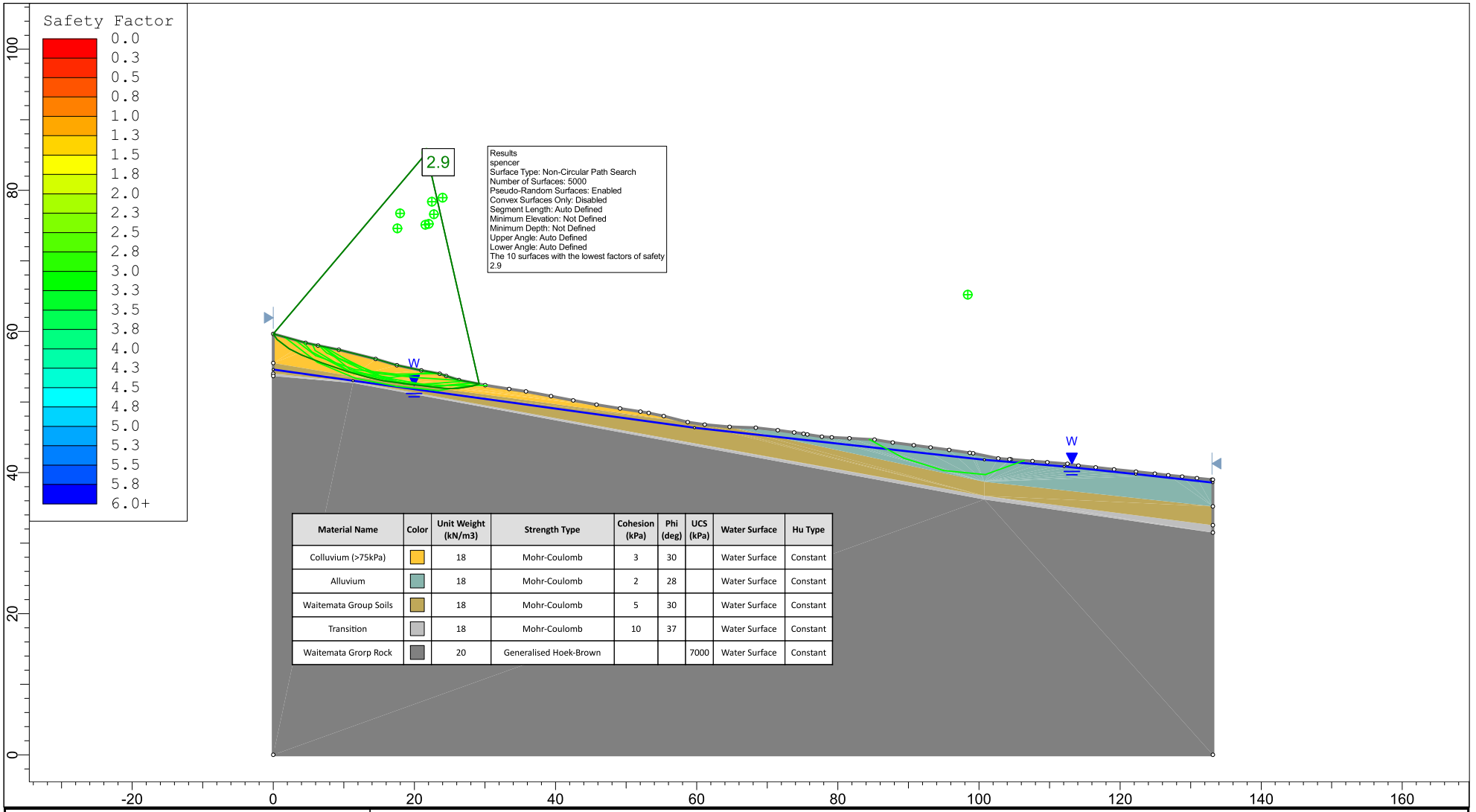
SLIDEINTERPRET 6.018

Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 7, Section AA - Run 12				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S7AA - Run 12.slim



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition								





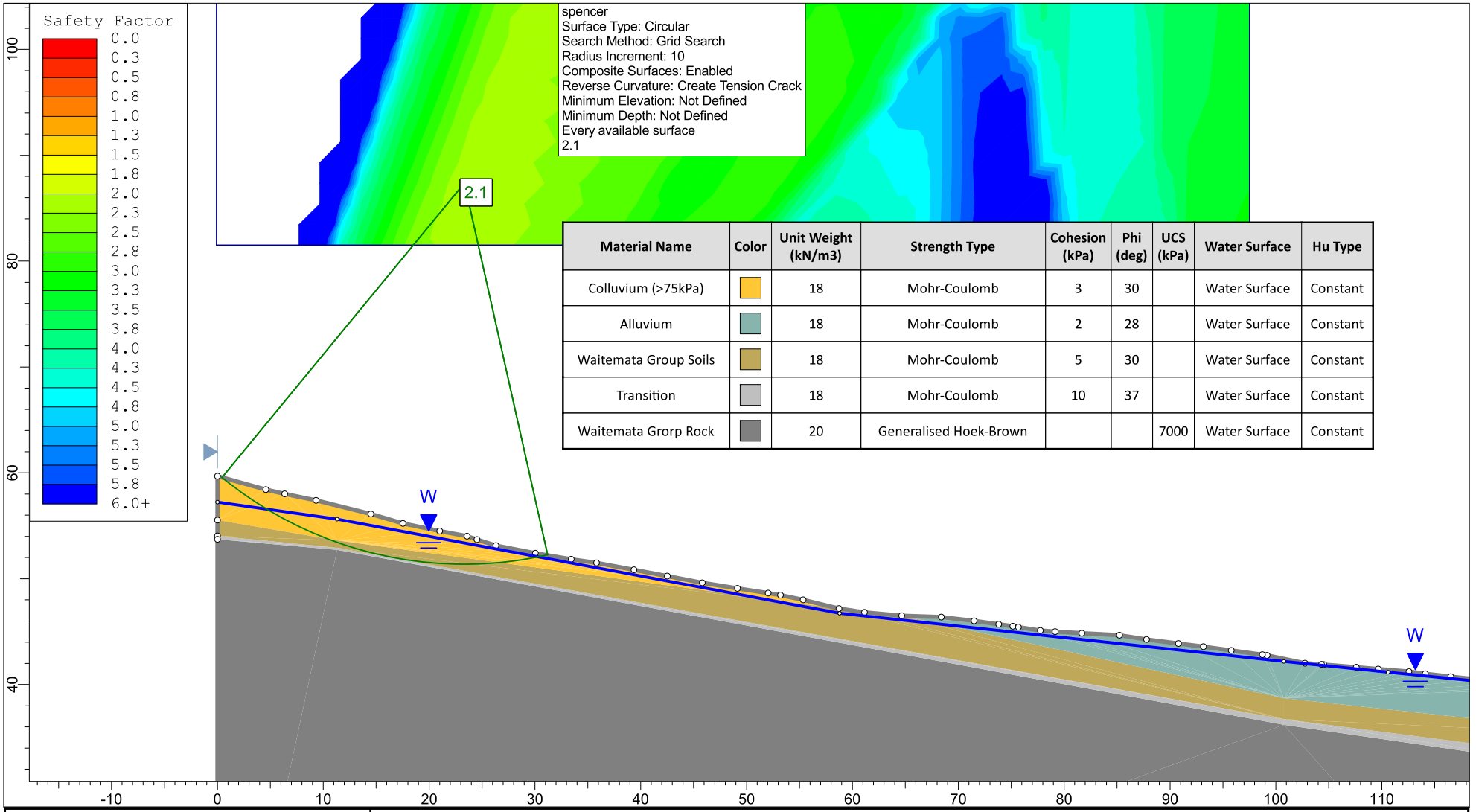
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 7, Section BB - Run 2				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S7BB - Run 2.slim



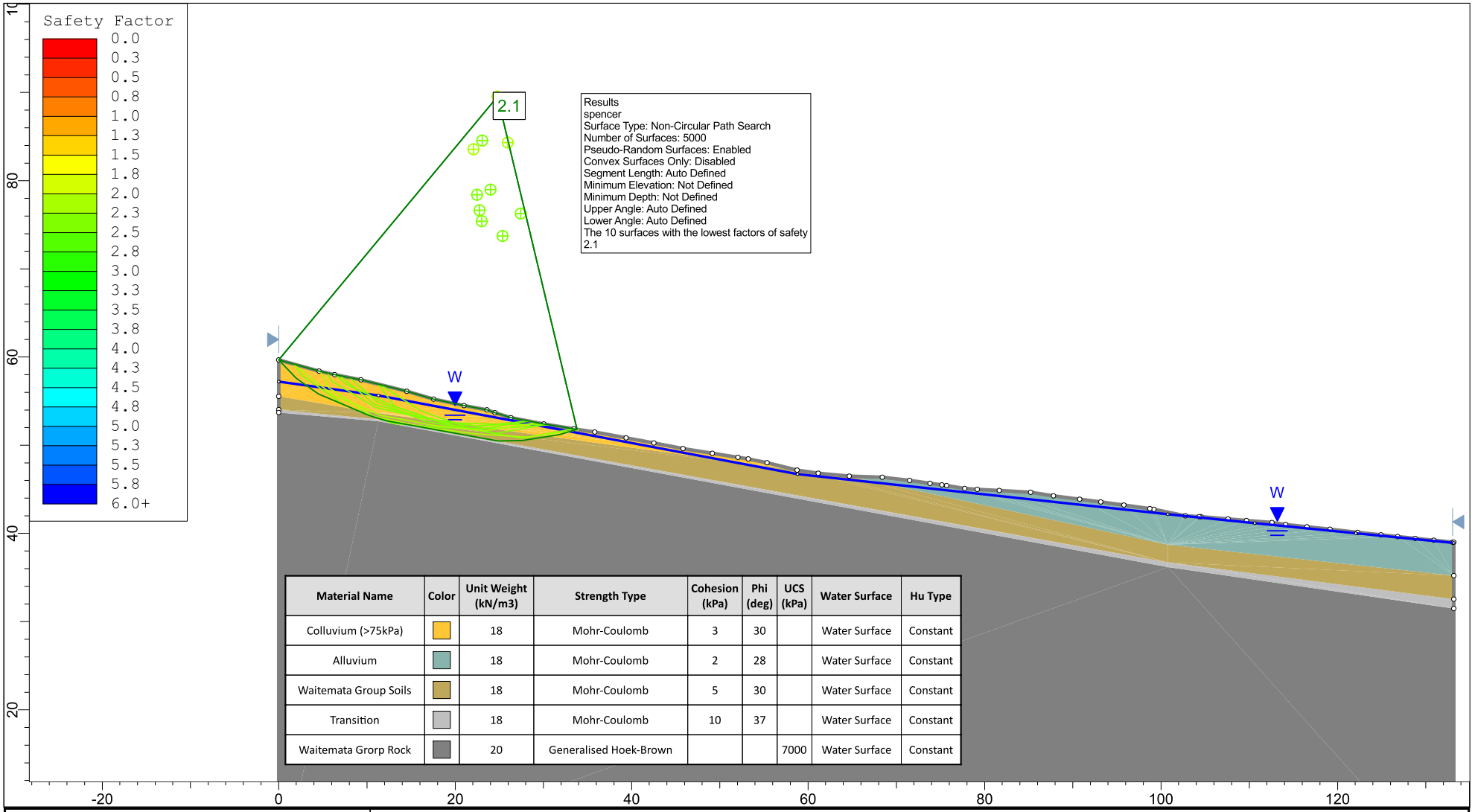
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 7, Section BB - Run 3				
Drawn By	PH	*Scale*	1:500	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S7BB - Run 3.slim



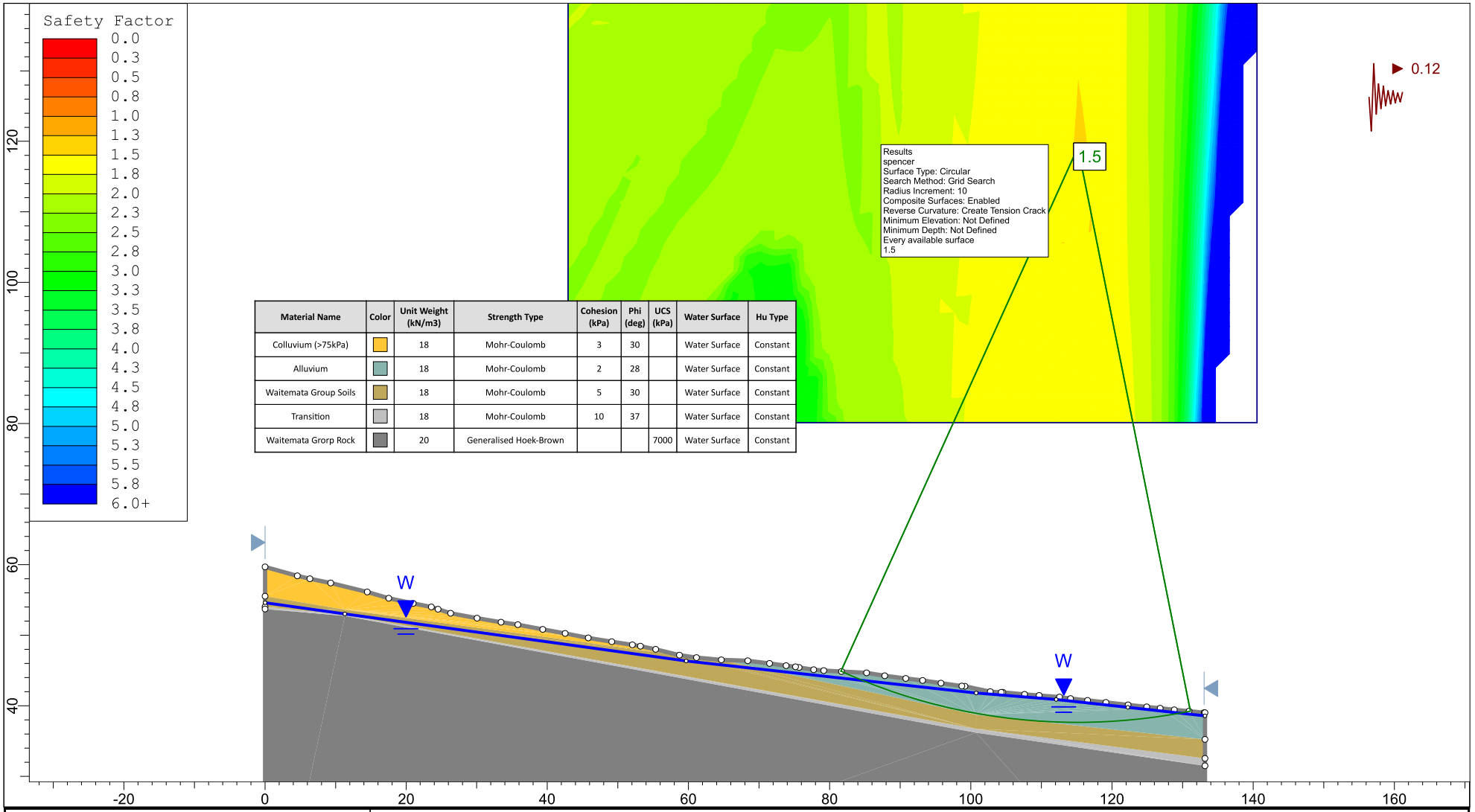
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 7, Section BB - Run 4				
Drawn By	PH	*Scale*	1:600	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S7BB - Run 4.slim



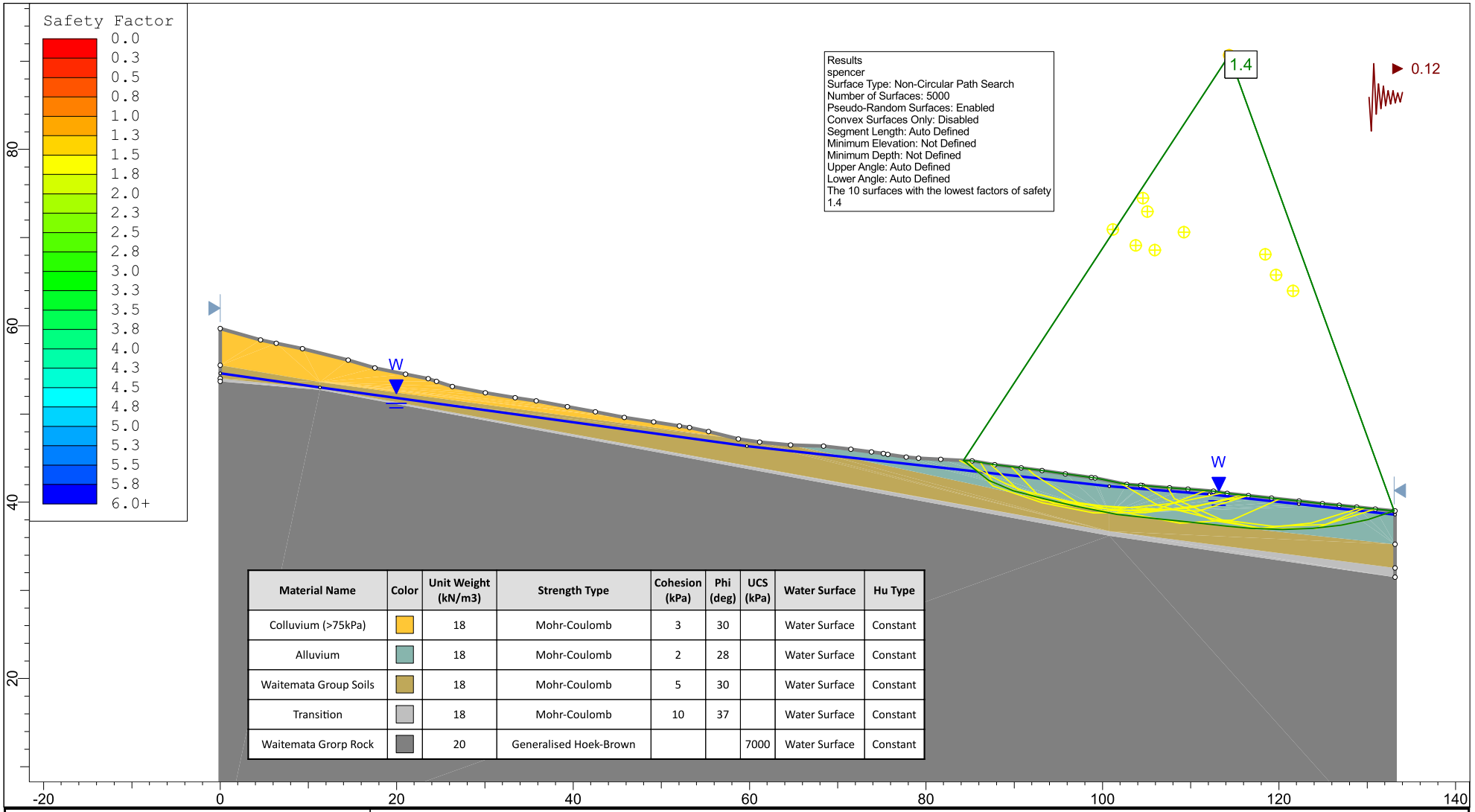
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 7, Section BB - Run 5				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S7BB - Run 5.slim



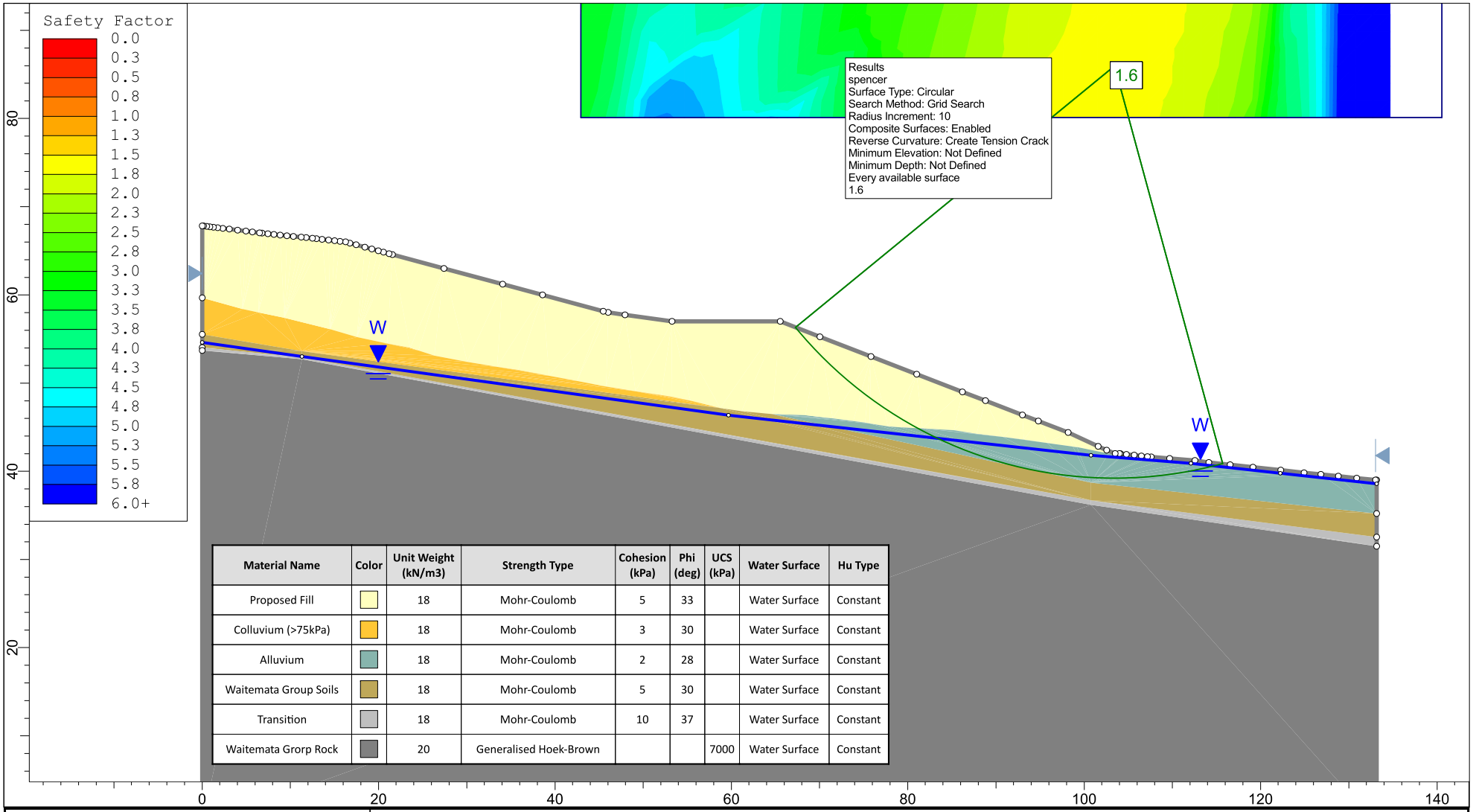
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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SLIDEINTERPRET 6.018

Project	Proposed Subdivision - Grand View Estate, Orewa			
Analysis Description	Stage 7, Section BB - Run 6			
Drawn By	PH	*Scale*	1:600	*Company* KGA Geotechnical
Date	31/08/2015			*File Name* 7464 - S7BB - Run 6.slim



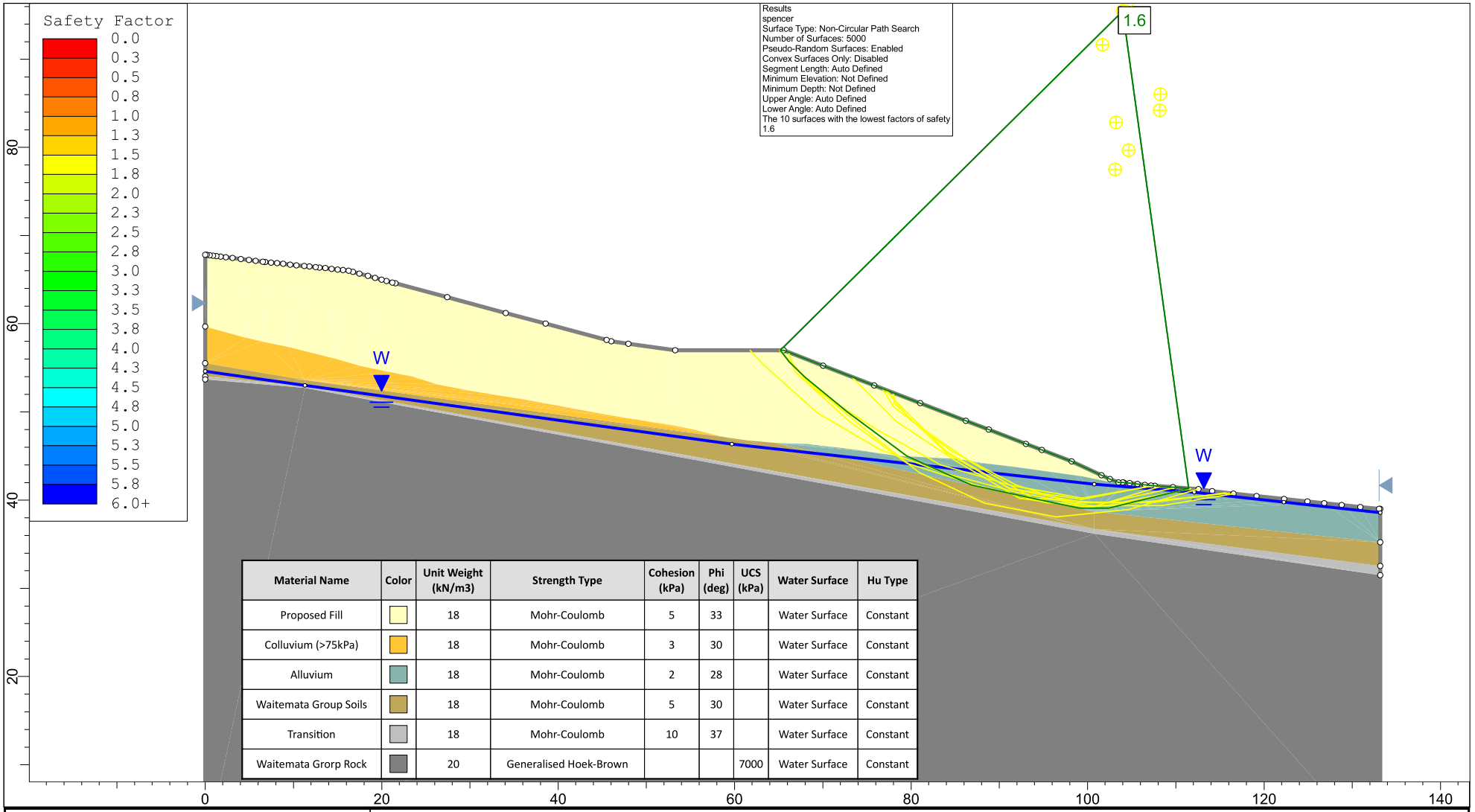
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa			
Analysis Description	Stage 7, Section BB - Run 7			
Drawn By	PH	*Scale*	1:600	*Company* KGA Geotechnical
Date	31/08/2015			*File Name* 7464 - S7BB - Run 7.slim



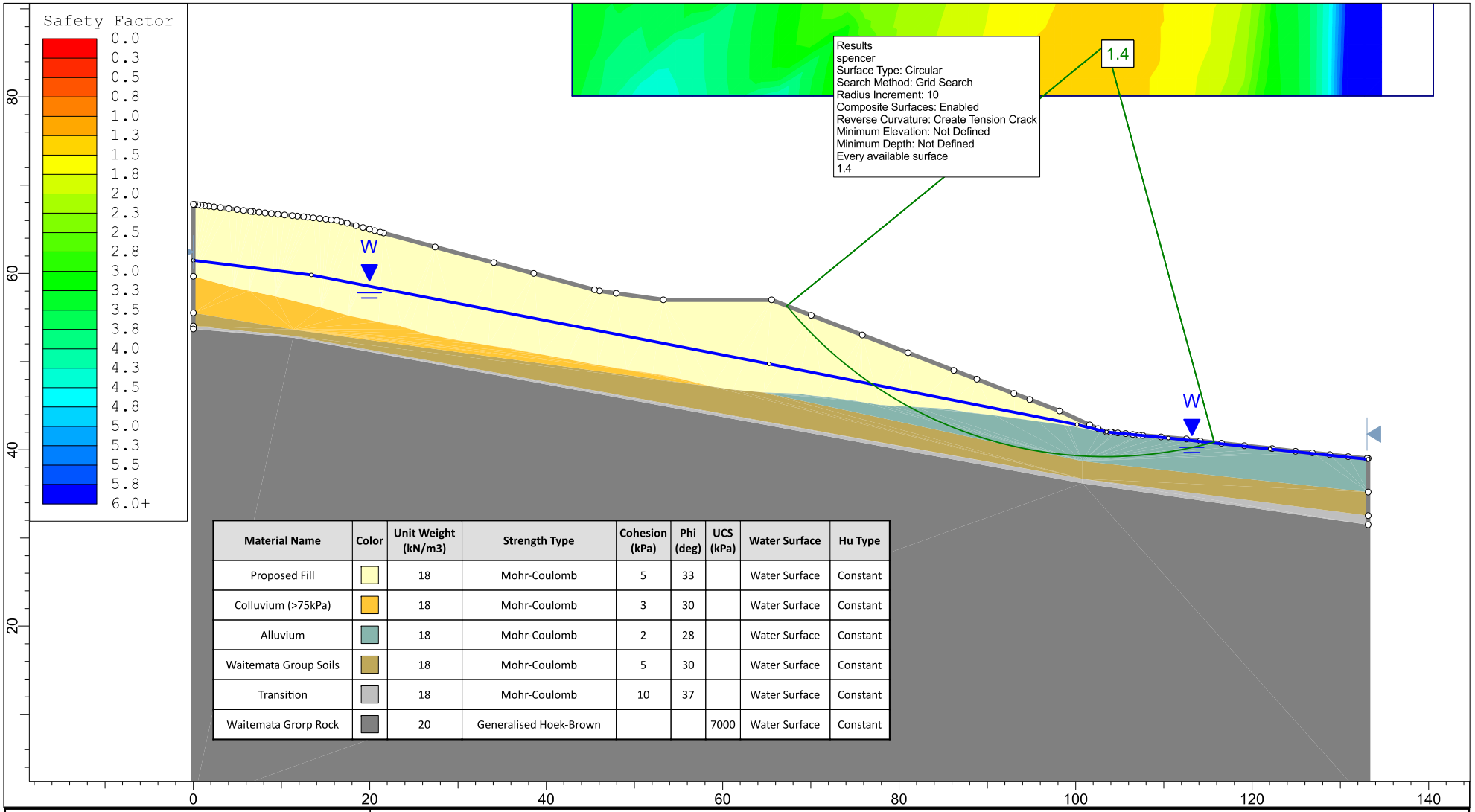
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 7, Section BB - Run 8		
Drawn By	PH	*Scale* 1:600	*Company* KGA Geotechnical
Date	31/08/2015		*File Name* 7464 - S7BB - Run 8.slim



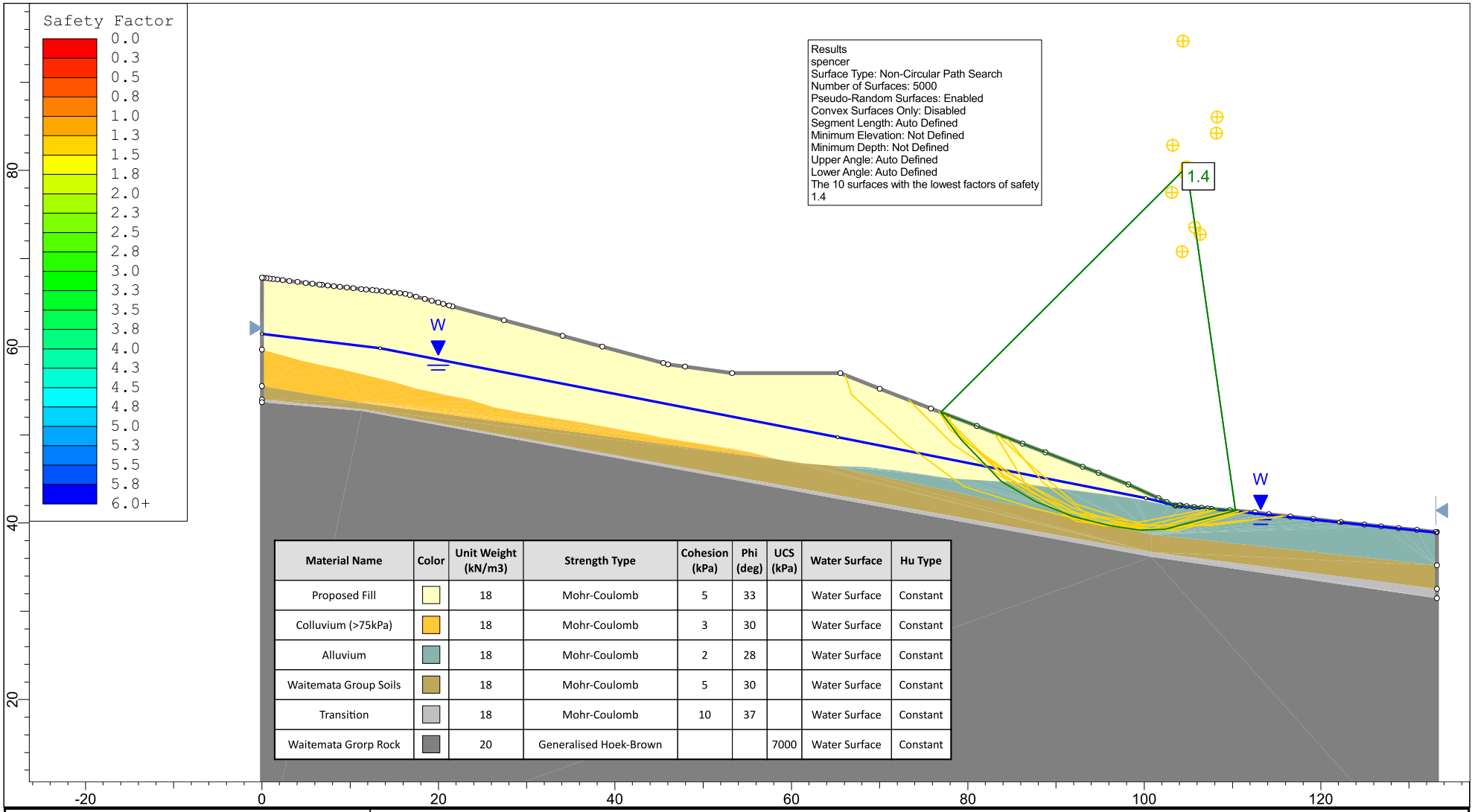
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 7, Section BB - Run 9		
Drawn By	PH	Scale 1:600	Company KGA Geotechnical
Date	31/08/2015		File Name 7464 - S7BB - Run 9.slim



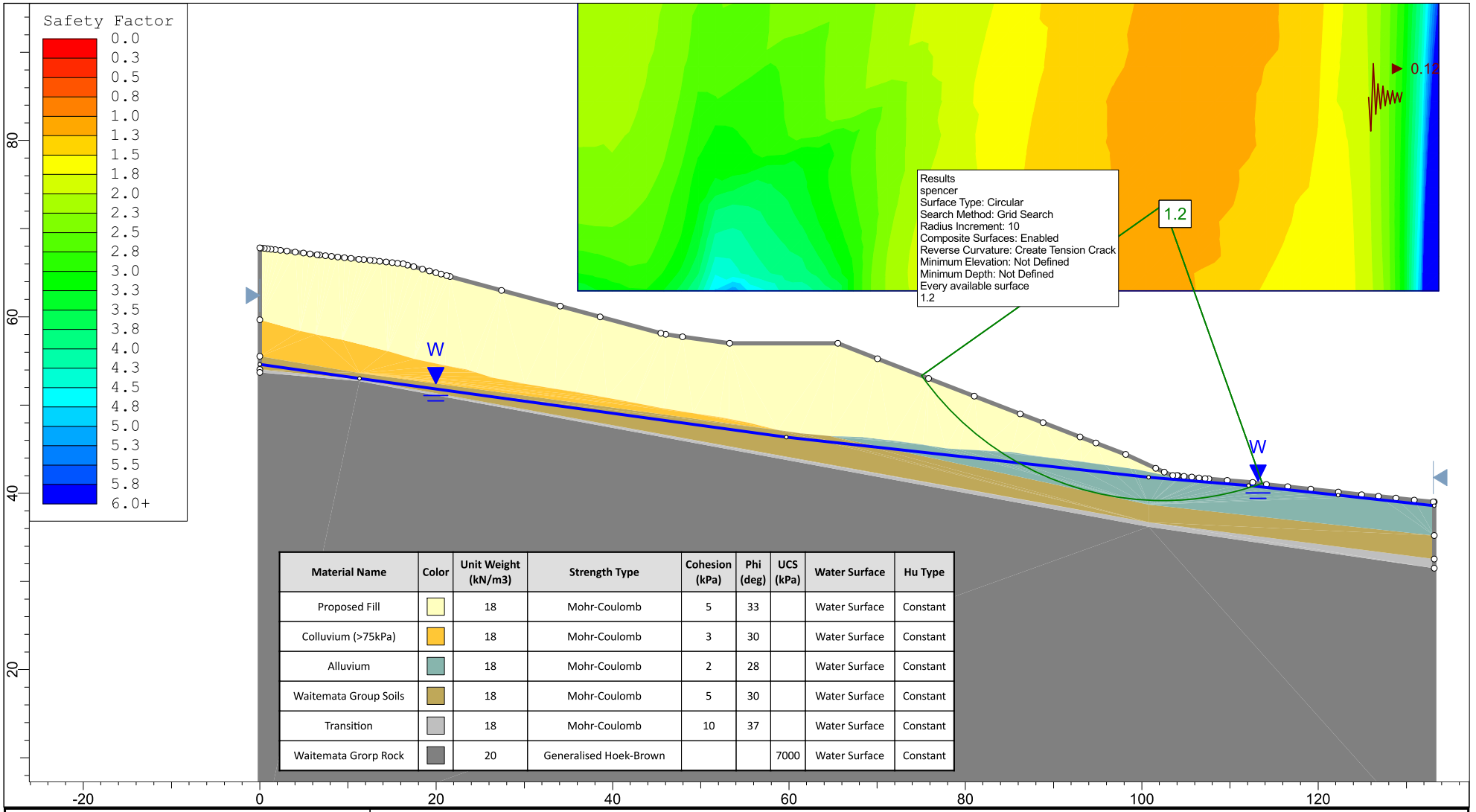
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 7, Section BB - Run 10				
Drawn By	PH	*Scale*	1:600	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S7BB - Run 10.slim



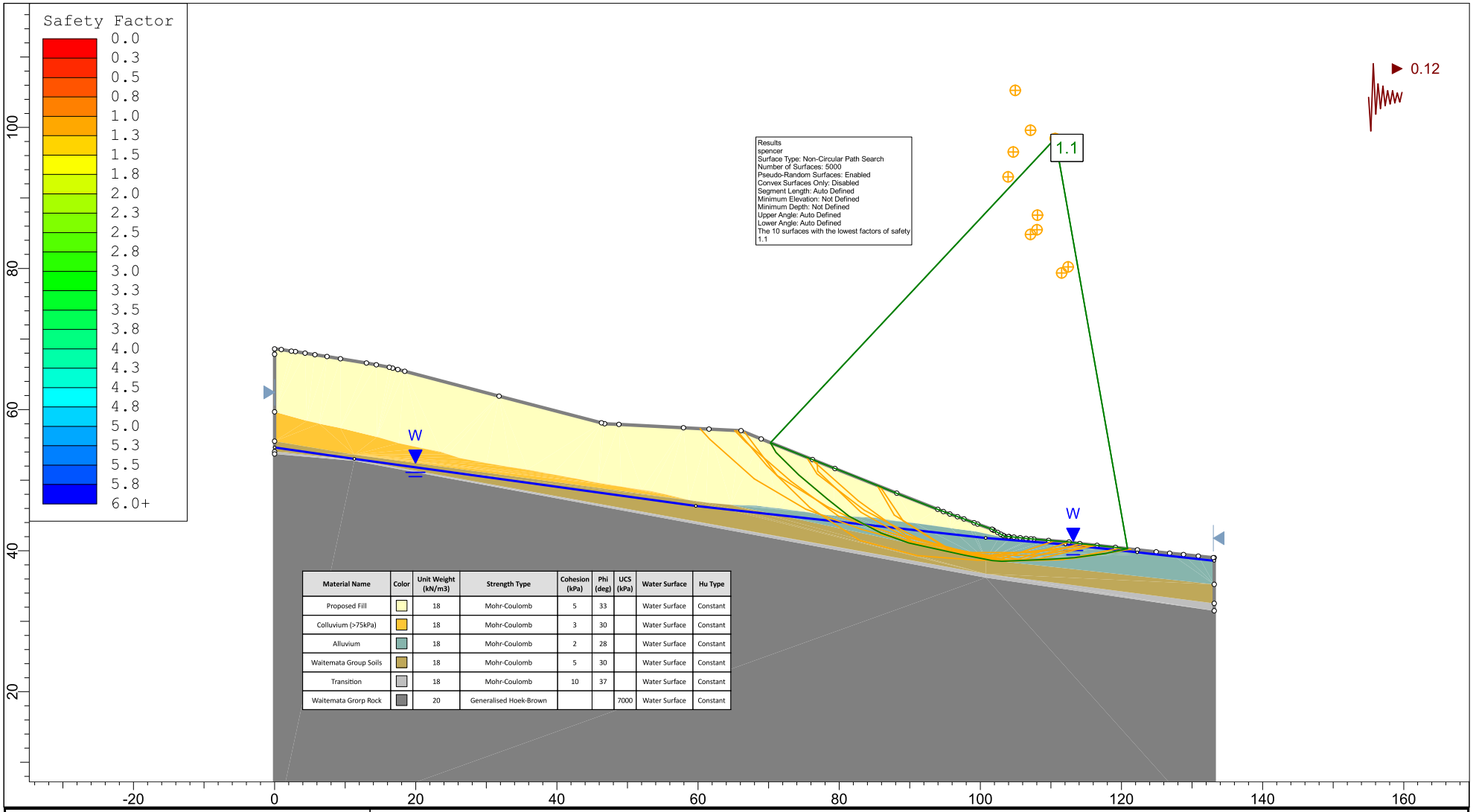
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Colluvium (>75kPa)		18	Mohr-Coulomb	3	30		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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SLIDEINTERPRET 6.018

Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 7, Section BB - Run 11				
Drawn By	PH	Scale	1:600	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S7BB - Run 11.slim

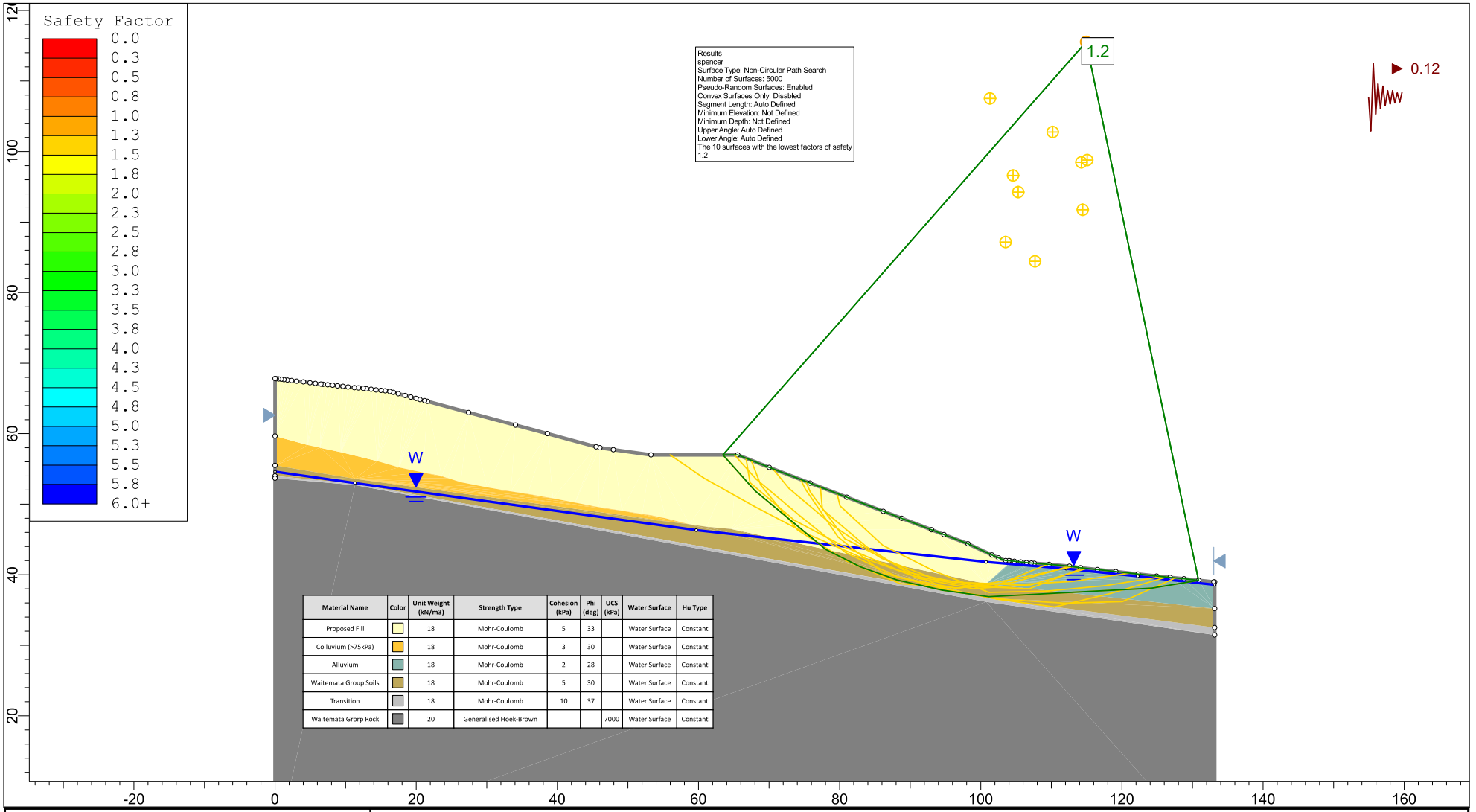


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SLIDEINTERPRET 6.018

Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 7, Section BB - Run 12		
Drawn By	PH	*Scale* 1:750	*Company* KGA Geotechnical
Date	31/08/2015		*File Name* 7464 - S7BB - Run 12.slim

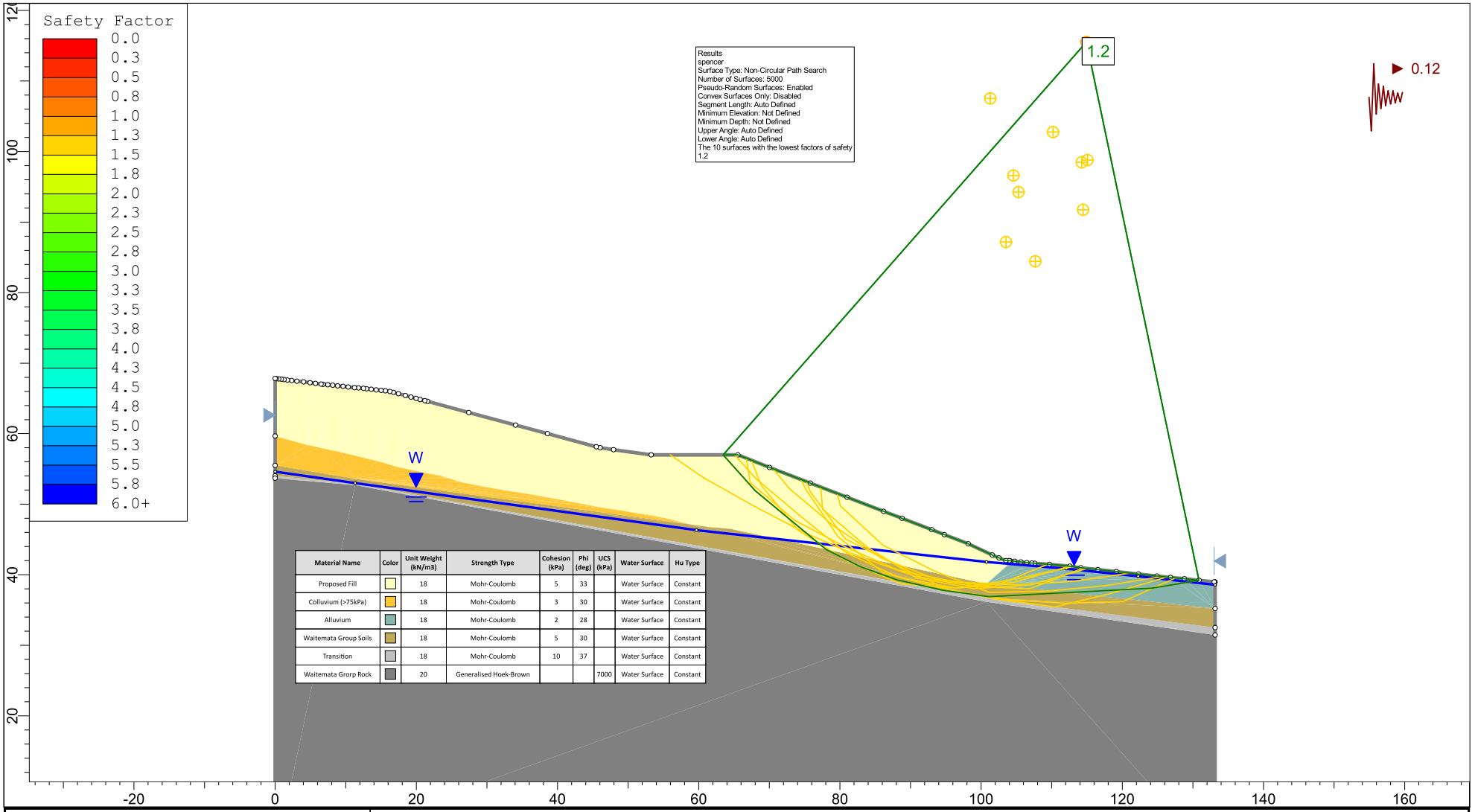


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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 7, Section BB - Run 13 (Run 12 with Excavated Alluvium)				
Drawn By	PH	*Scale*	1:750	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S7BB - Run 13.slim

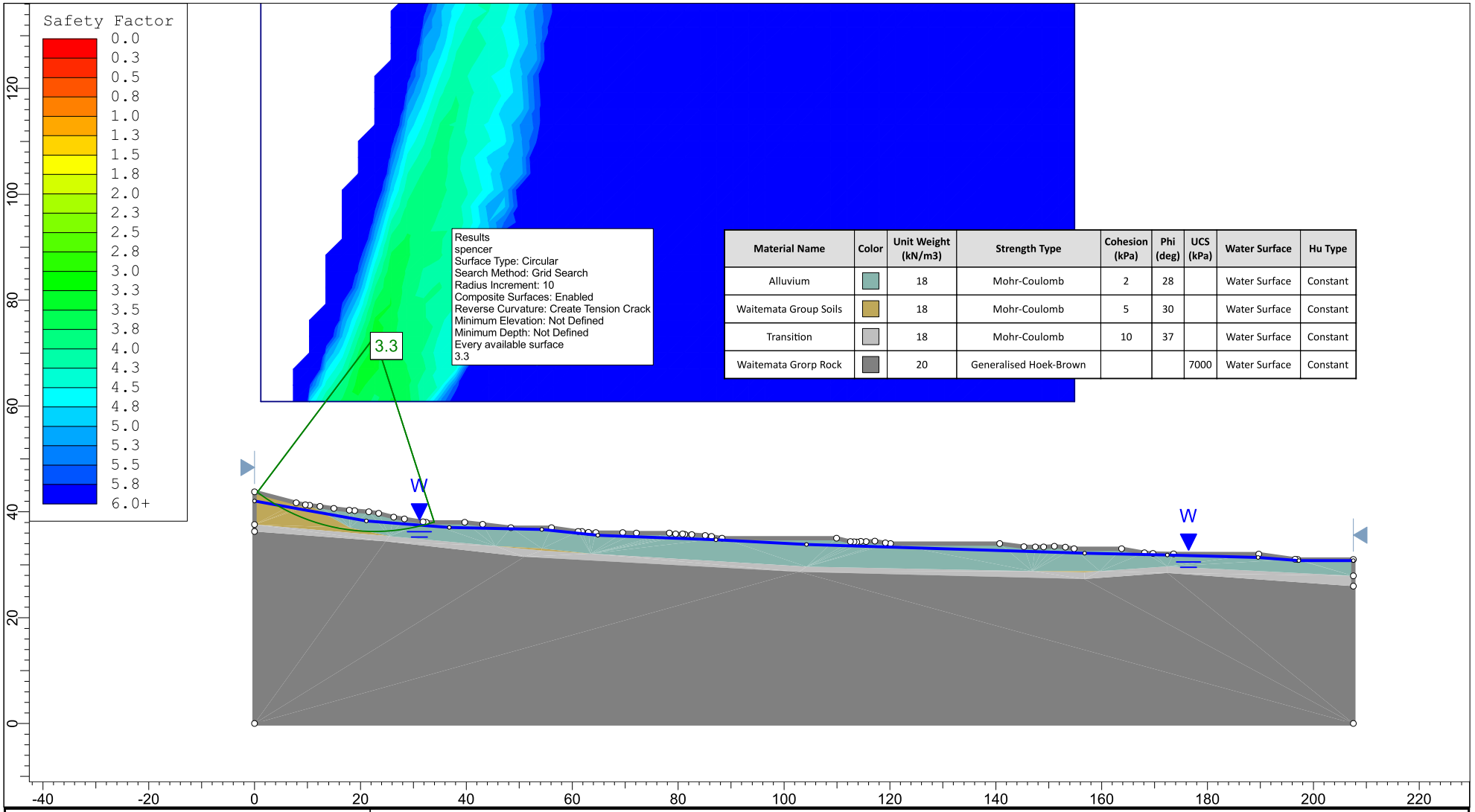


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Project	Proposed Subdivision - Grand View Estate, Orewa		
Analysis Description	Stage 7, Section BB - Run 18 (Excavated Alluvium)		
Drawn By	PH	*Scale* 1:750	*Company* KGA Geotechnical
Date	31/08/2015		*File Name* 7464 - S7BB - Run 18.slim



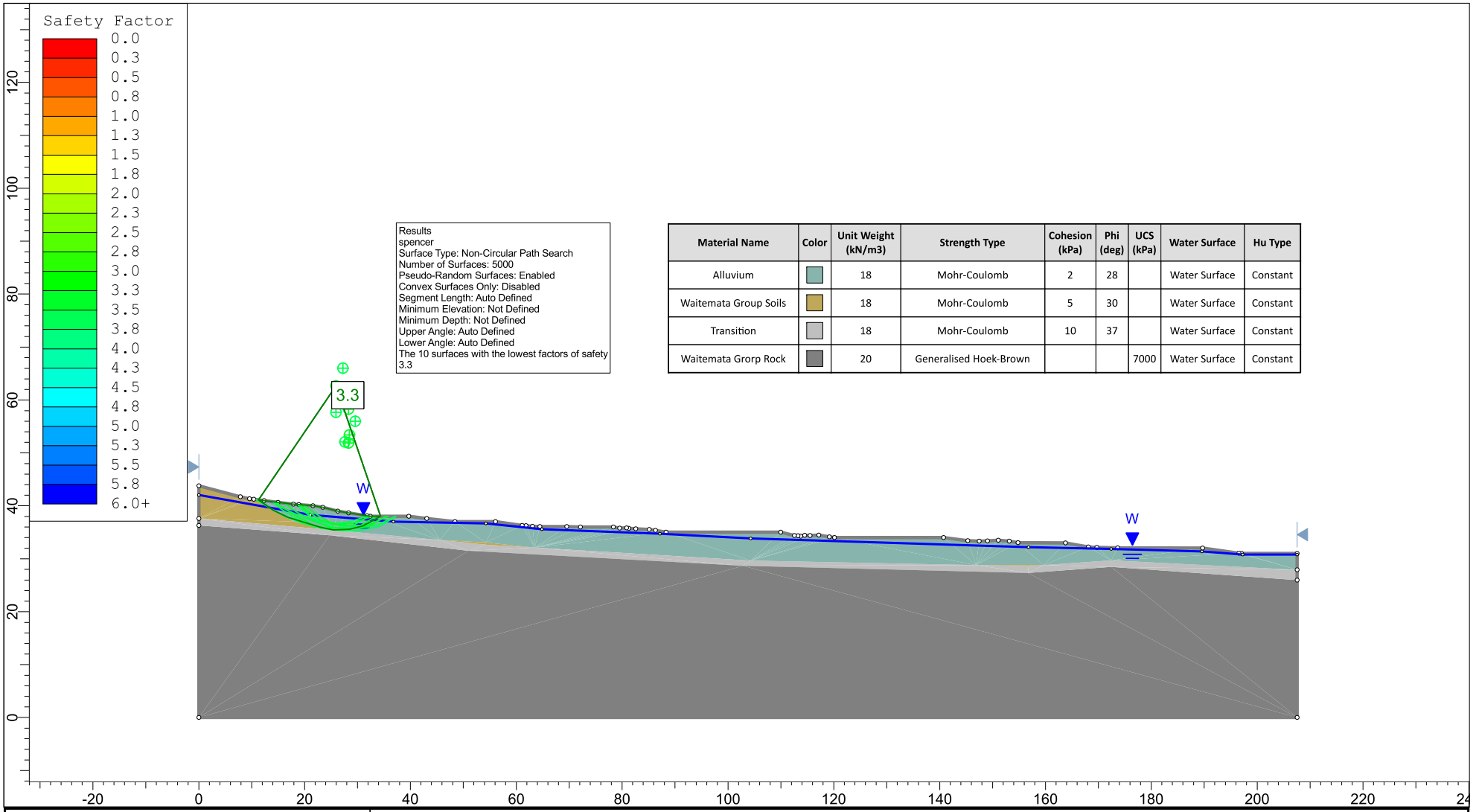
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 8, Section AA - Run 1				
Drawn By	PH	Scale	1:1000	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S8AA - Run 1.slim



Results
spencer
Surface Type: Non-Circular Path Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Segment Length: Auto Defined
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Upper Angle: Auto Defined
Lower Angle: Auto Defined
The 10 surfaces with the lowest factors of safety
3.3

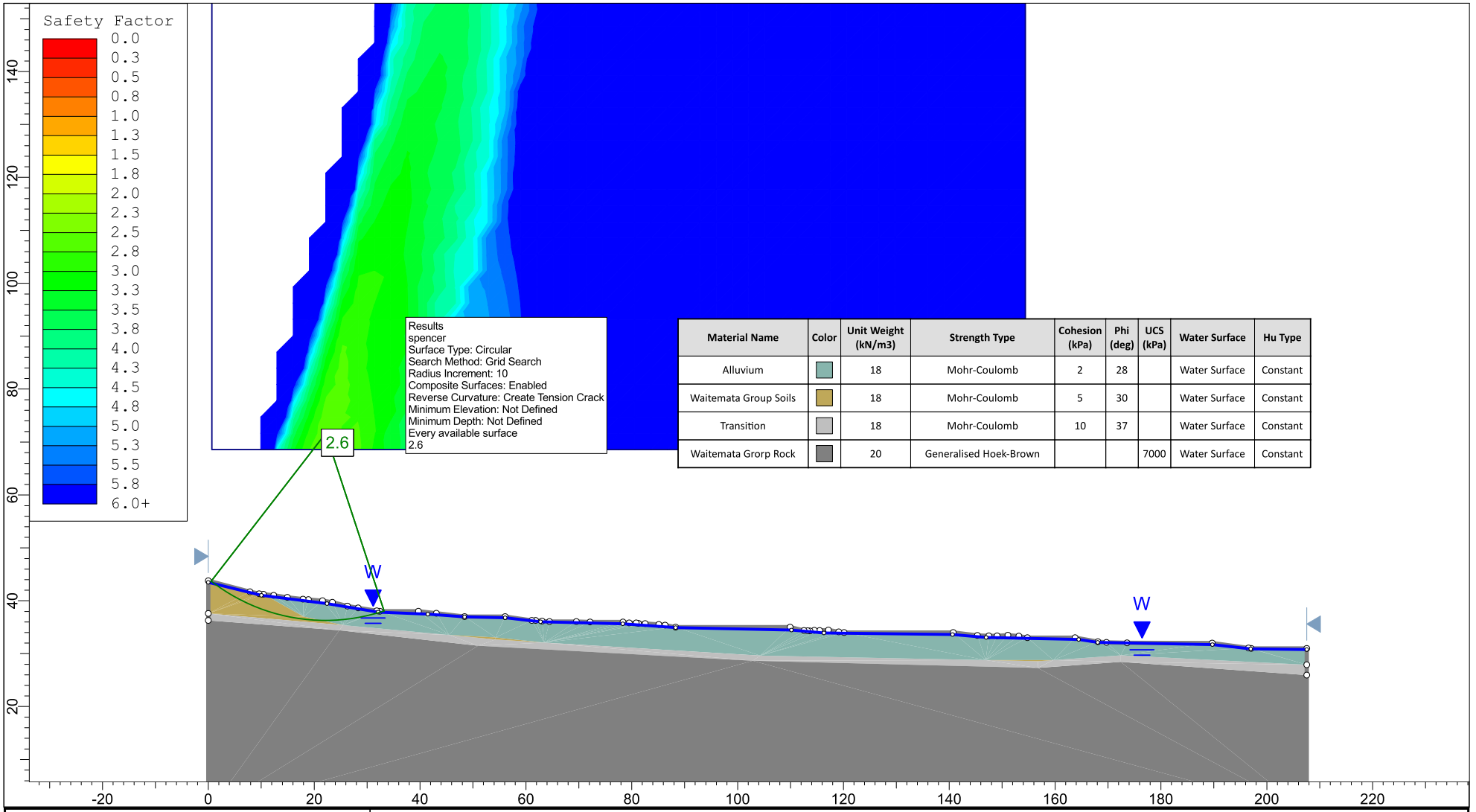
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 8, Section AA - Run 2				
Drawn By	PH	*Scale*	1:1000	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S8AA - Run 2.slim



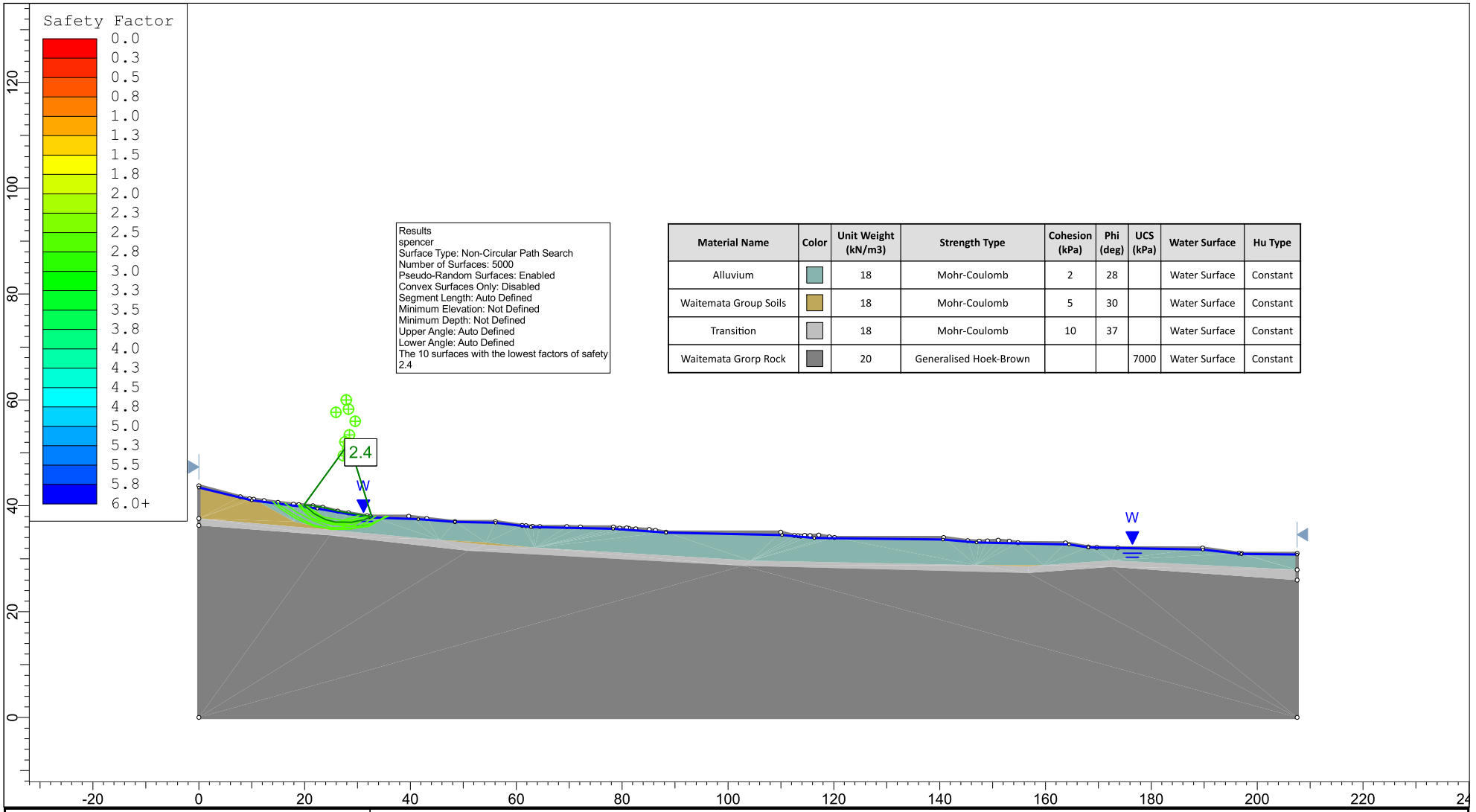
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 8, Section AA - Run 3				
Drawn By	PH	Scale	1:1000	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S8AA - Run 3.slim



Results
spencer
Surface Type: Non-Circular Path Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Segment Length: Auto Defined
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Upper Angle: Auto Defined
Lower Angle: Auto Defined
The 10 surfaces with the lowest factors of safety
2.4

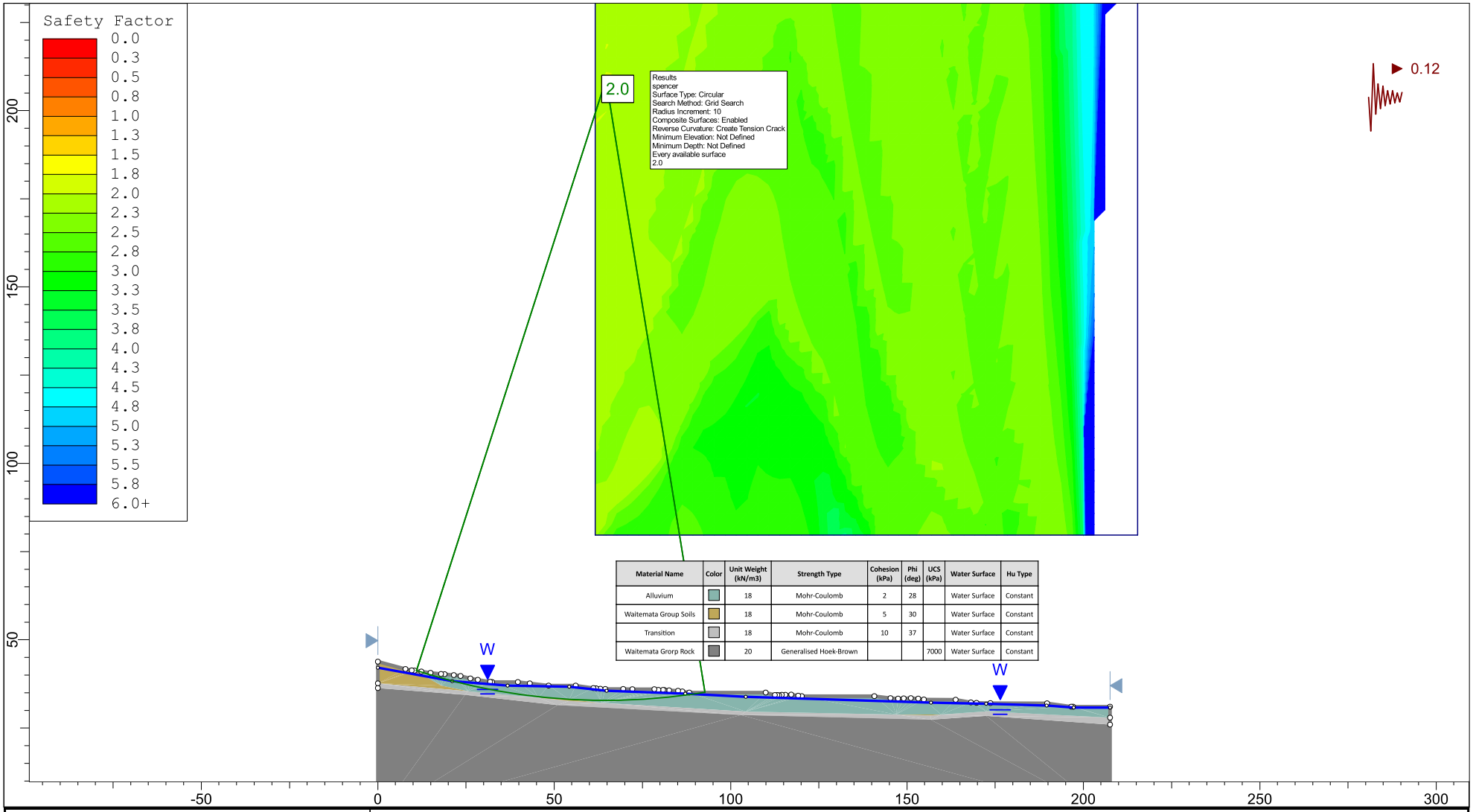
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 8, Section AA - Run 4				
Drawn By	PH	Scale	1:1000	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S8AA - Run 4.slim



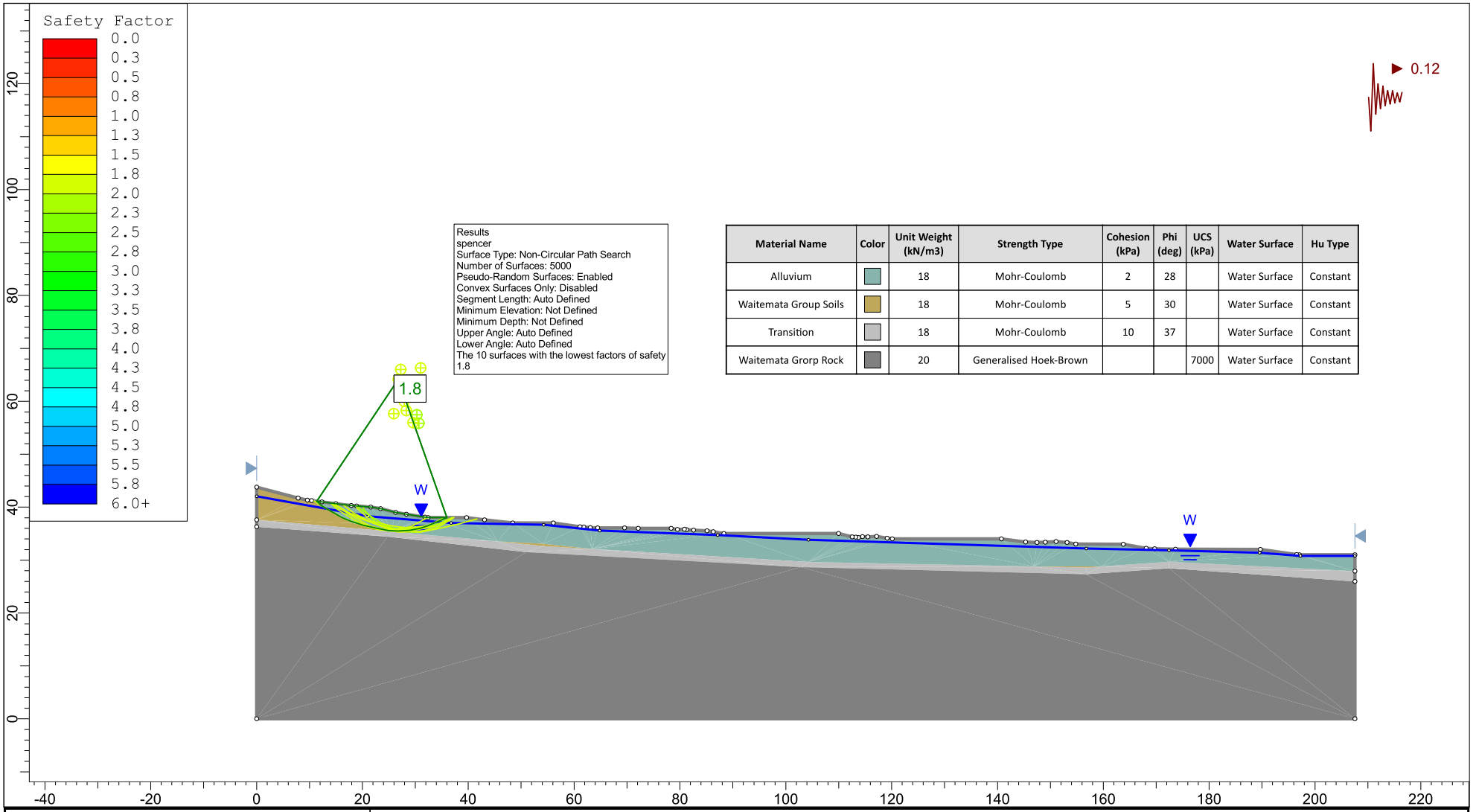
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 8, Section AA - Run 5				
Drawn By	PH	*Scale*	1:1500	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S8AA - Run 5.slim



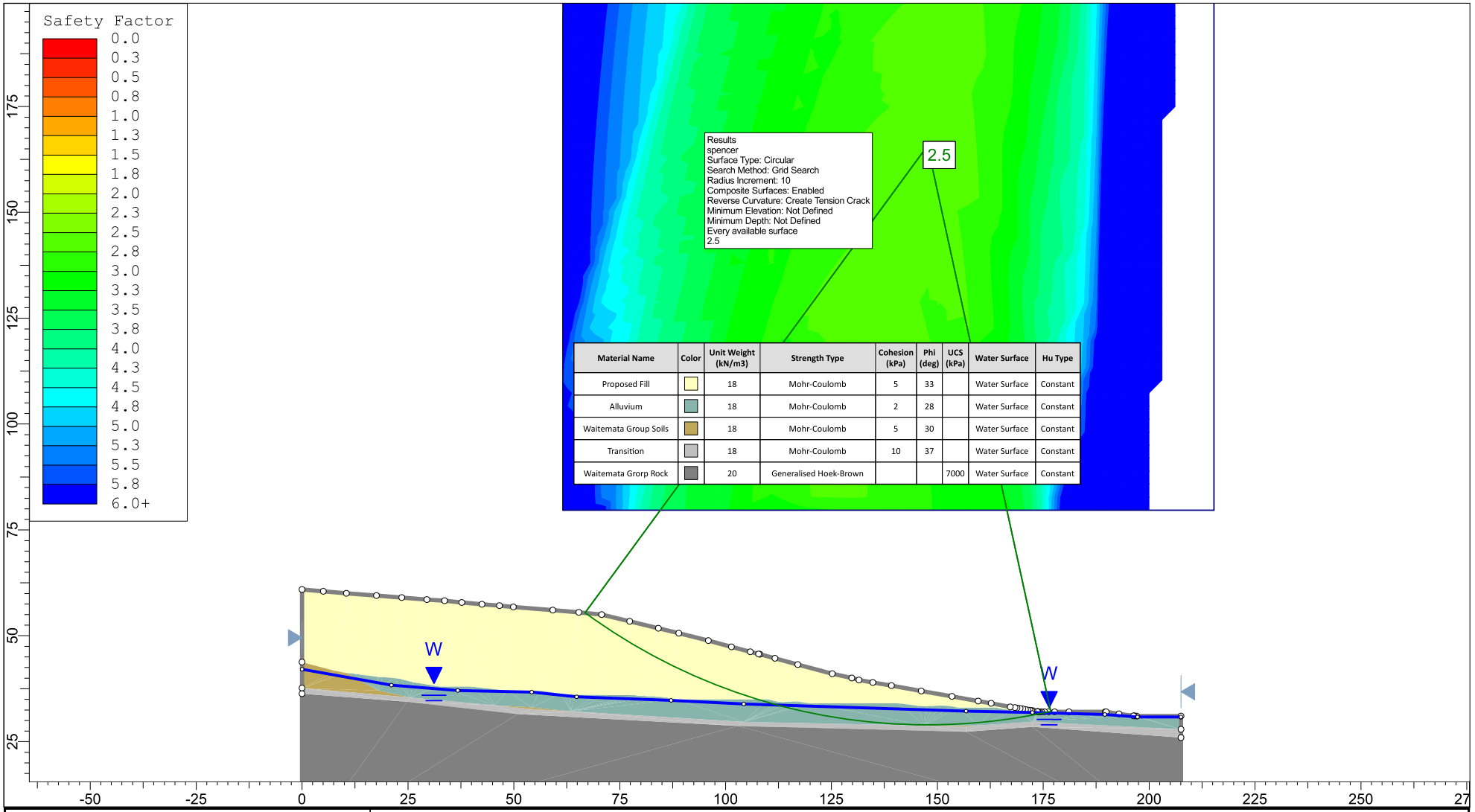
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 8, Section AA - Run 6				
Drawn By	PH	Scale	1:1000	Company	KGA Geotechnical
Date	31/08/2015			File Name	7464 - S8AA - Run 6.slim



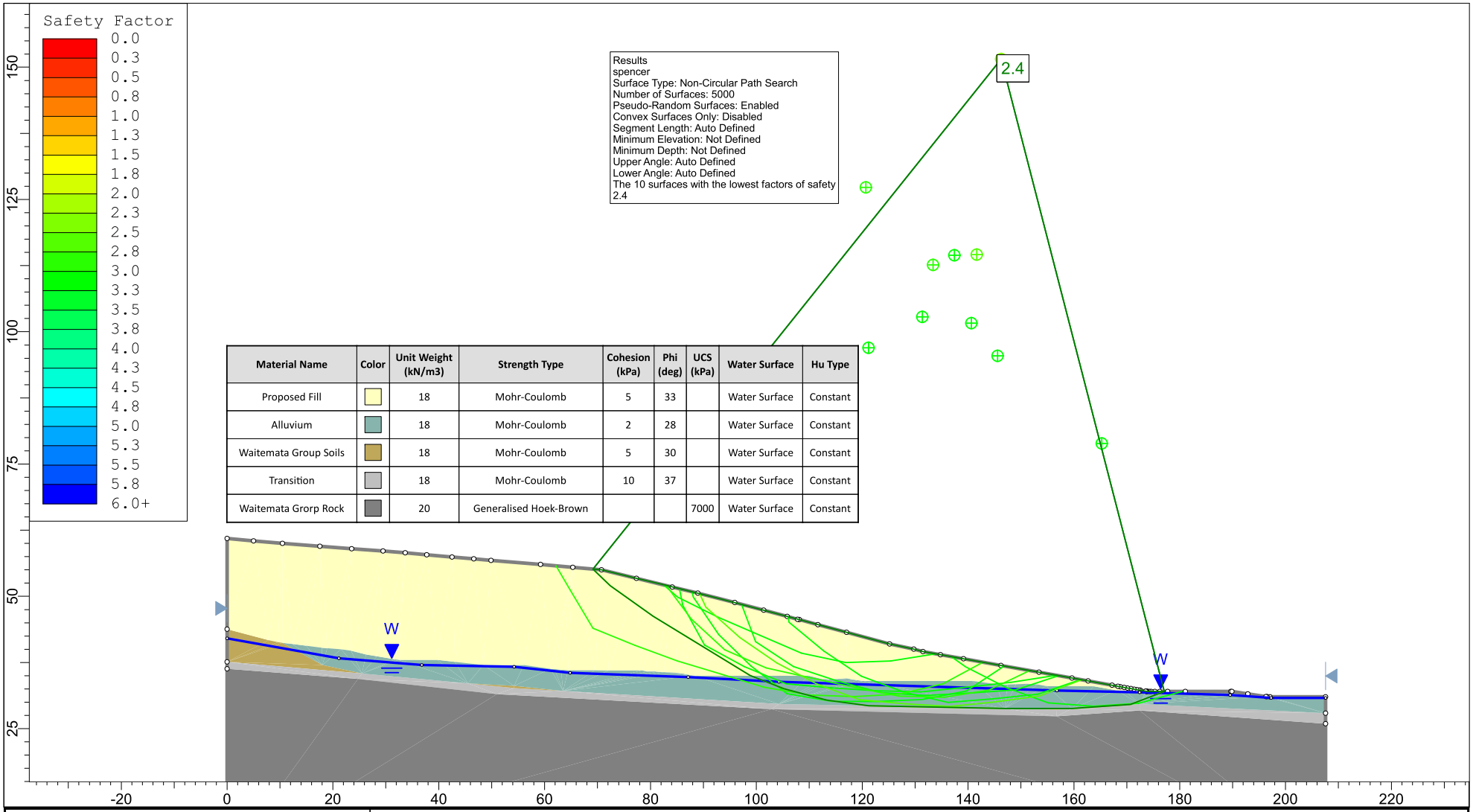
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 8, Section AA - Run 7				
Drawn By	PH	*Scale*	1:1250	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S8AA - Run 7.slim



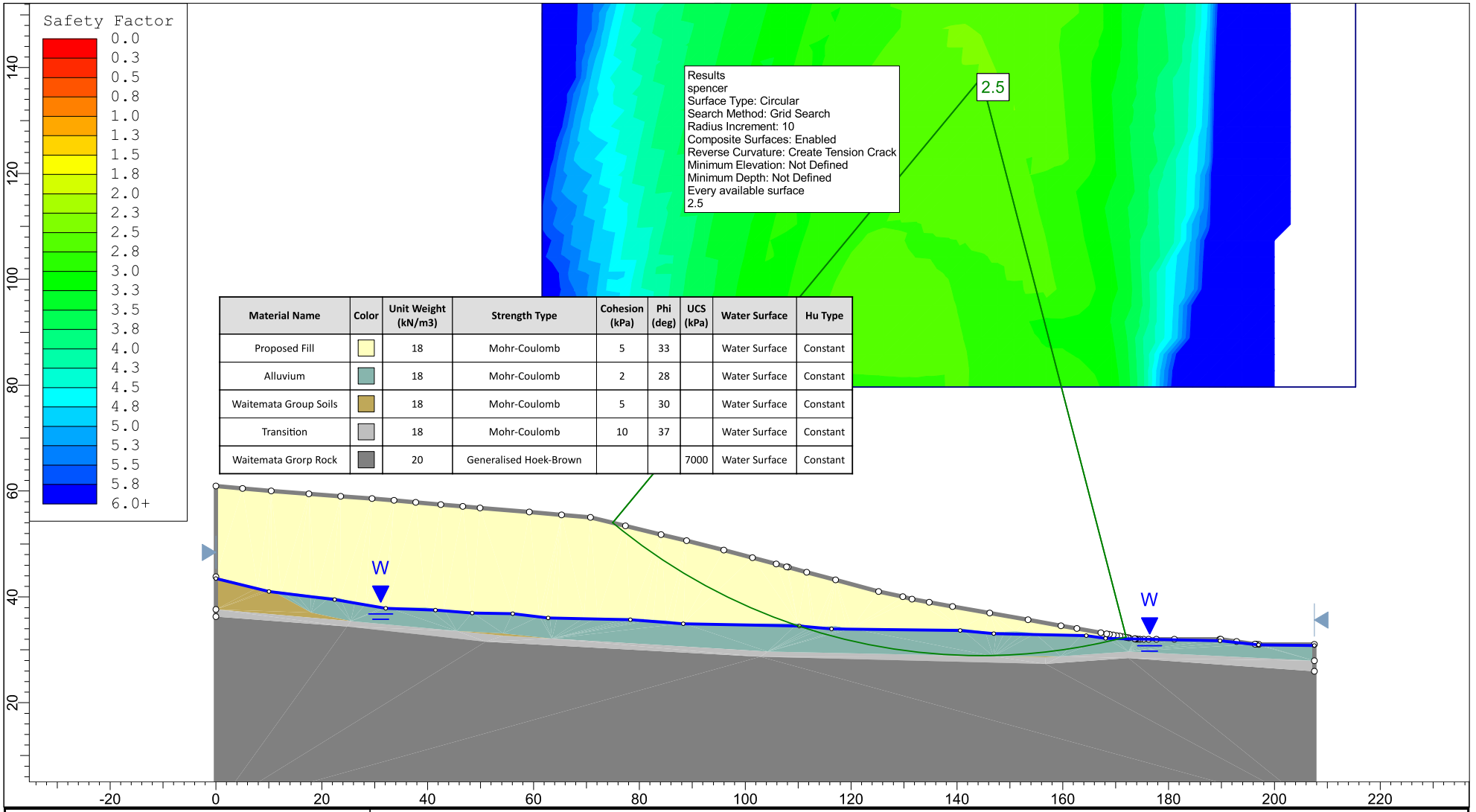
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 8, Section AA - Run 8				
Drawn By	PH	*Scale*	1:1000	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S8AA - Run 8.slim



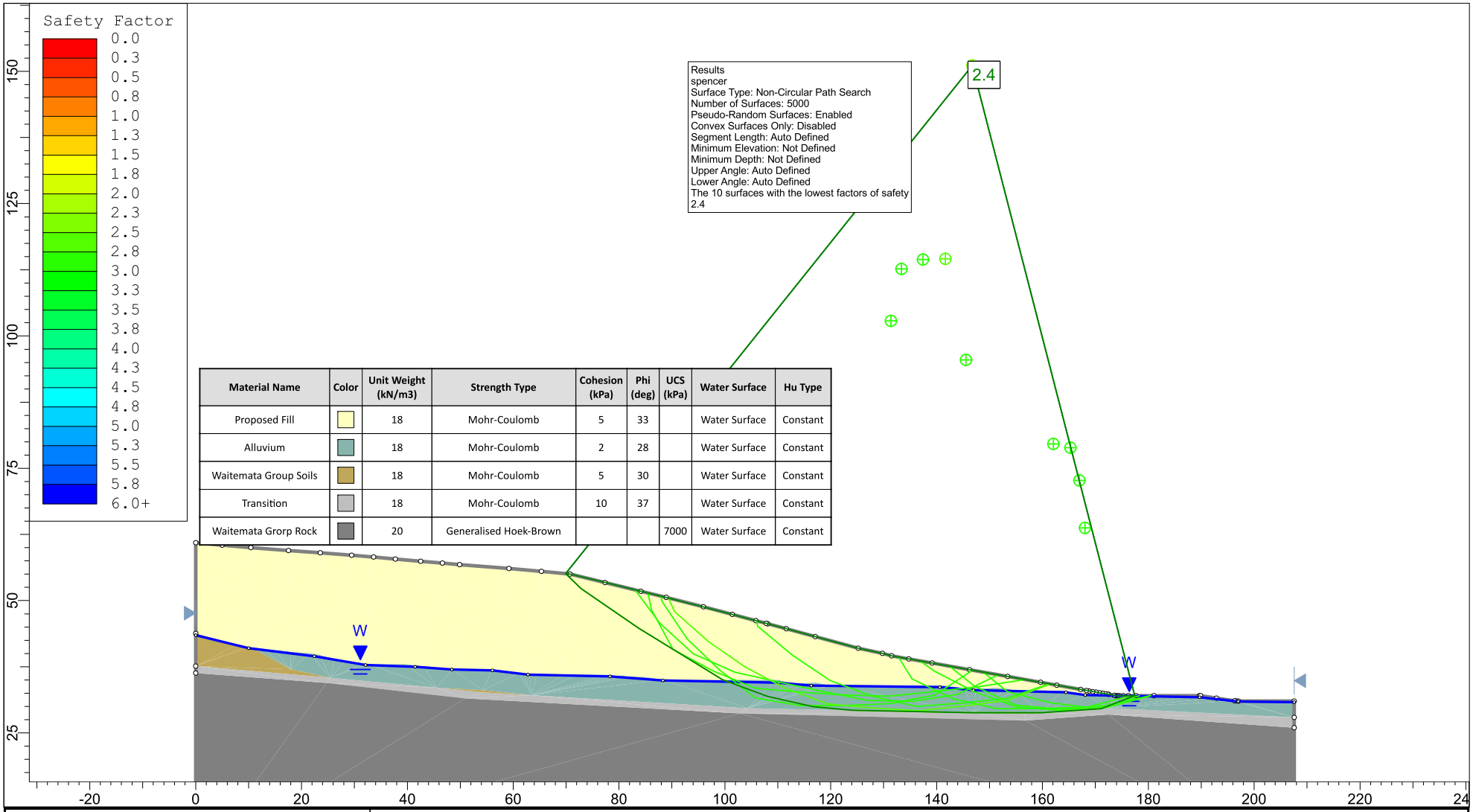
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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SLIDEINTERPRET 6.018

Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 8, Section AA - Run 9				
Drawn By	PH	*Scale*	1:1000	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S8AA - Run 9.slim



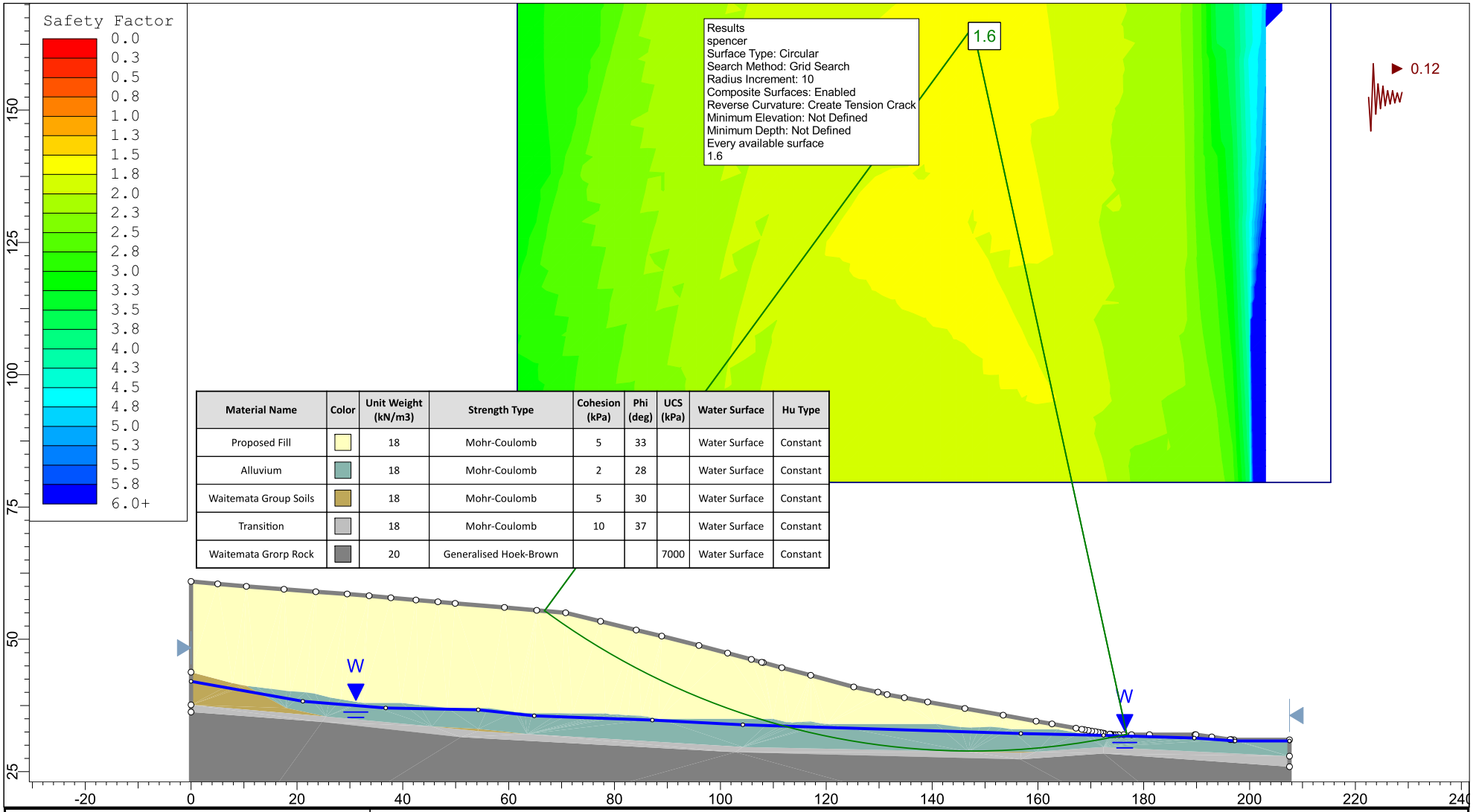
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 8, Section AA - Run 10				
Drawn By	PH	*Scale*	1:1000	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S8AA - Run 10.slim



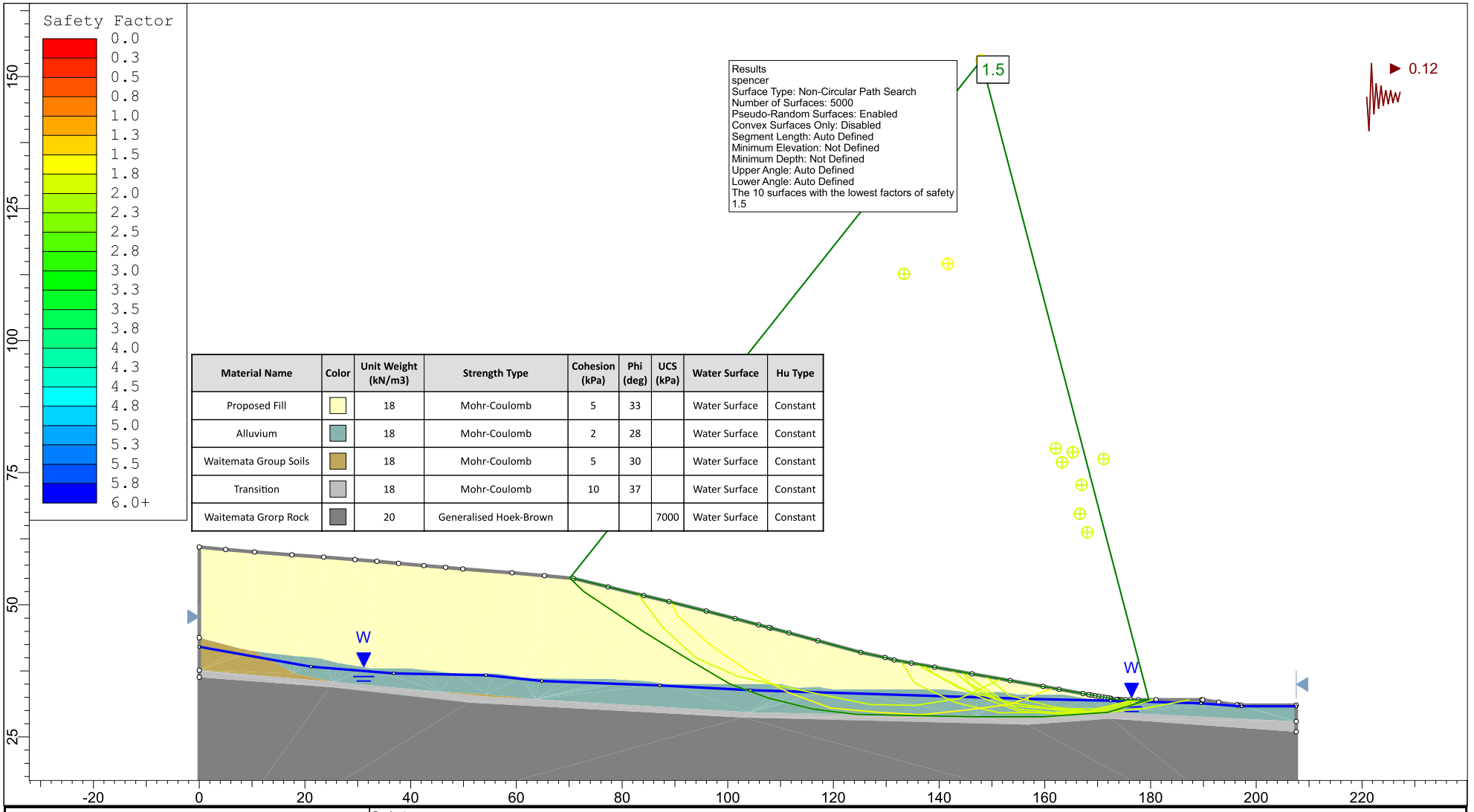
Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 8, Section AA - Run 11				
Drawn By	PH	*Scale*	1:1000	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S8AA - Run 11.slim



Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)	UCS (kPa)	Water Surface	Hu Type
Proposed Fill		18	Mohr-Coulomb	5	33		Water Surface	Constant
Alluvium		18	Mohr-Coulomb	2	28		Water Surface	Constant
Waitemata Group Soils		18	Mohr-Coulomb	5	30		Water Surface	Constant
Transition		18	Mohr-Coulomb	10	37		Water Surface	Constant
Waitemata Grorp Rock		20	Generalised Hoek-Brown			7000	Water Surface	Constant

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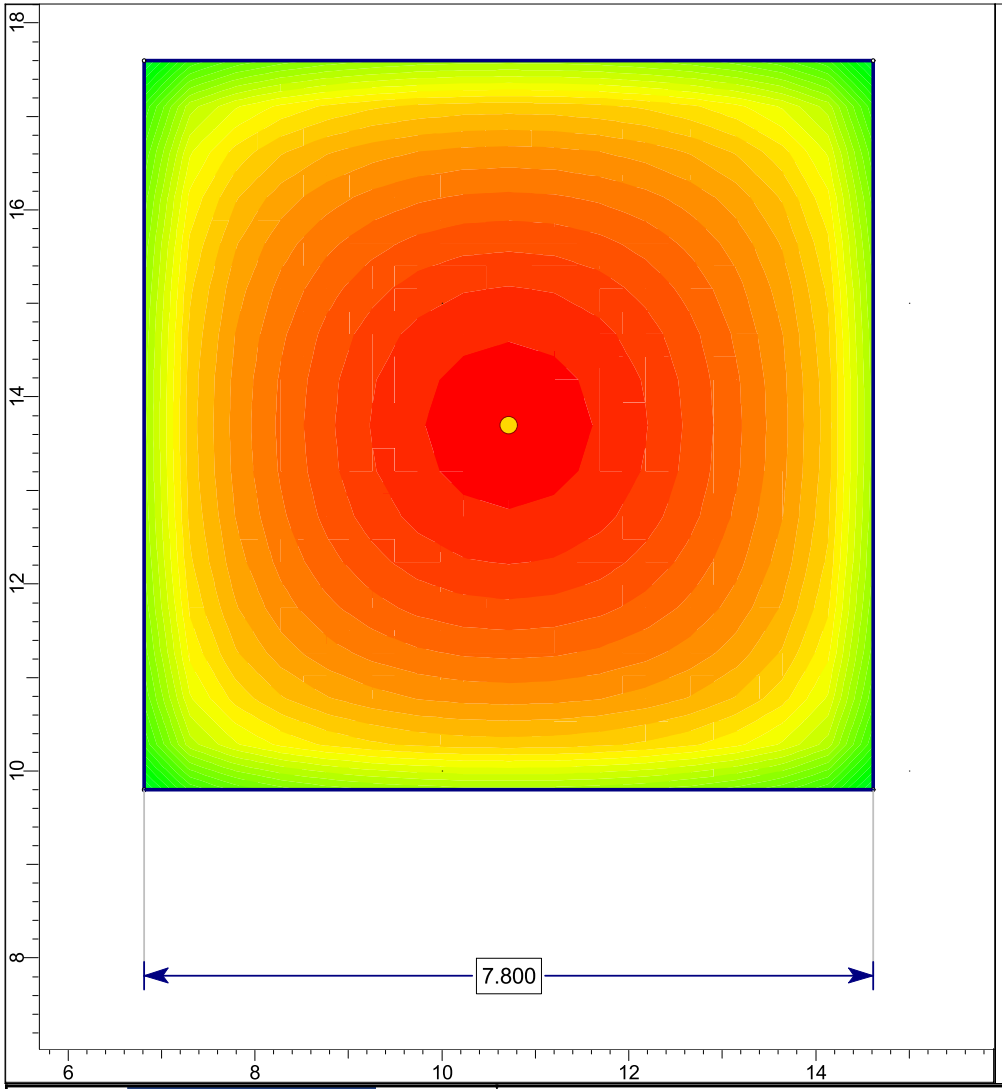
KGA GEOTECHNICAL

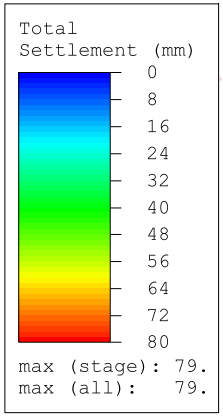
SLIDEINTERPRET 6.018

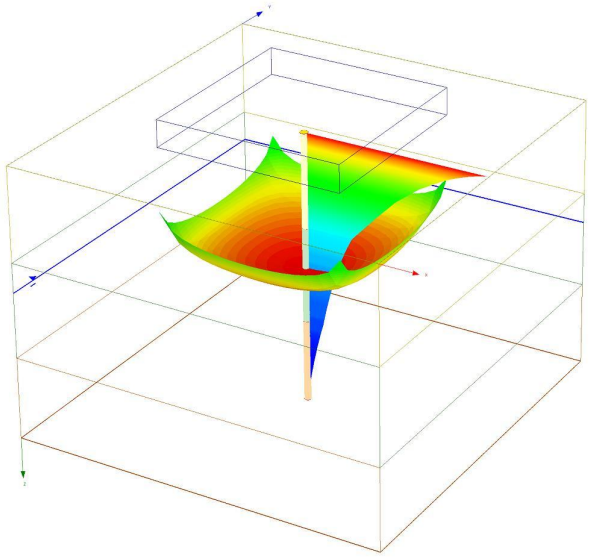
Project	Proposed Subdivision - Grand View Estate, Orewa				
Analysis Description	Stage 8, Section AA - Run 12				
Drawn By	PH	*Scale*	1:1000	*Company*	KGA Geotechnical
Date	31/08/2015			*File Name*	7464 - S8AA - Run 12.slim

APPENDIX 5

Consolidation Settlement Analysis Results



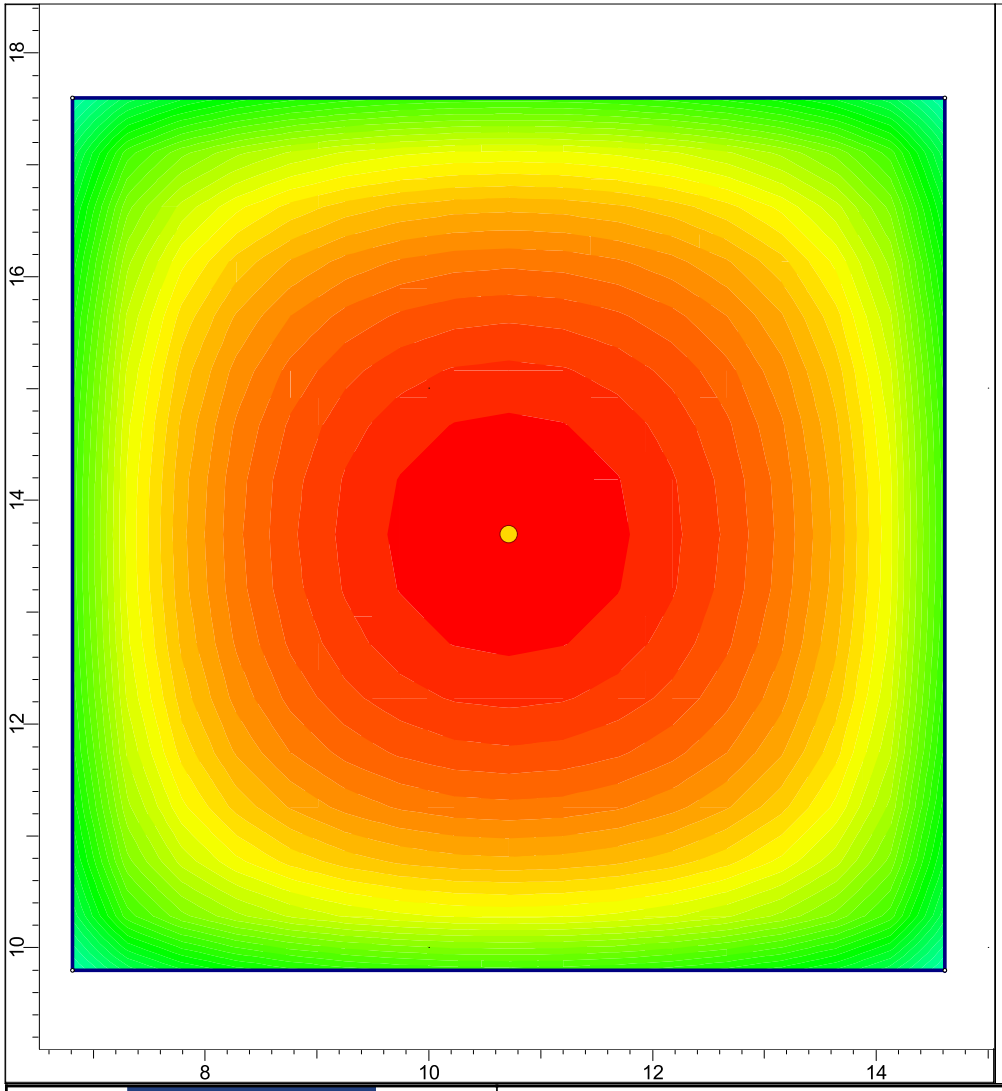


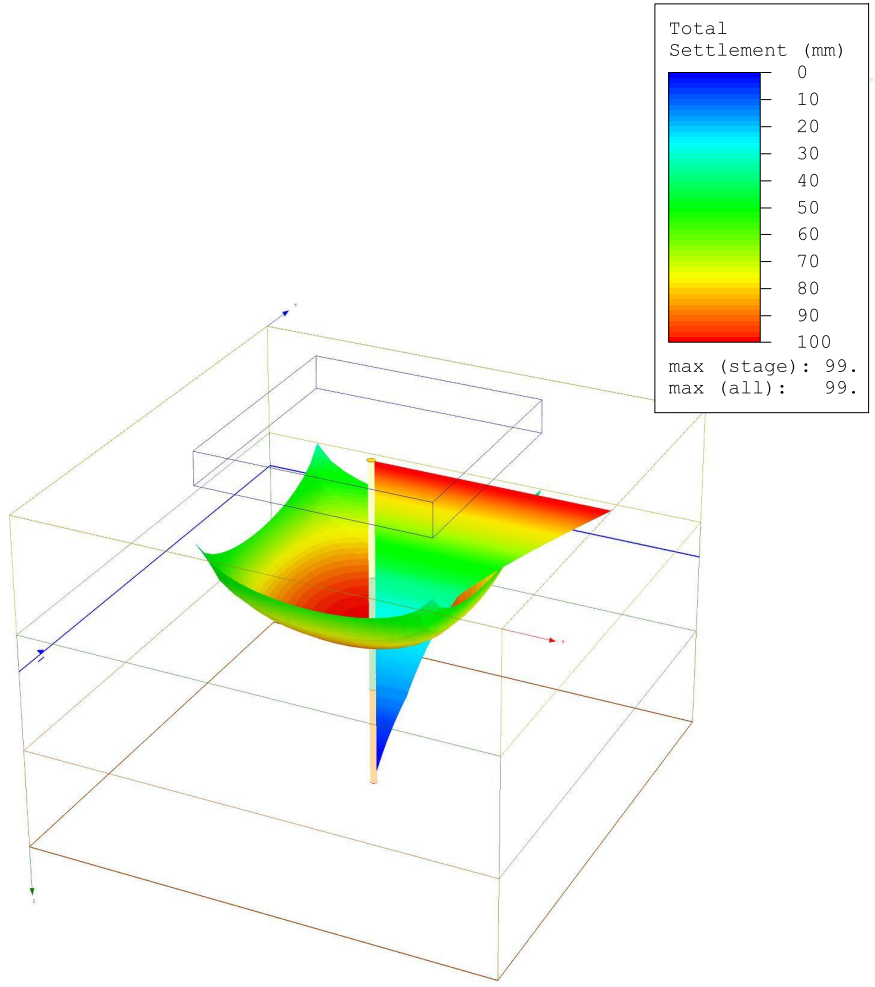


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SETTLE3D 3.015

Project	Grand View Estate, Orewa		
Analysis Description	Settlement Analysis - 4m fill only		
Drawn By	Jennifer Lo	*Stage Name*	Place 4m engr fill
Date	3/09/2015, 12:48:21 p.m.	*File Name*	4m fill only.s3z

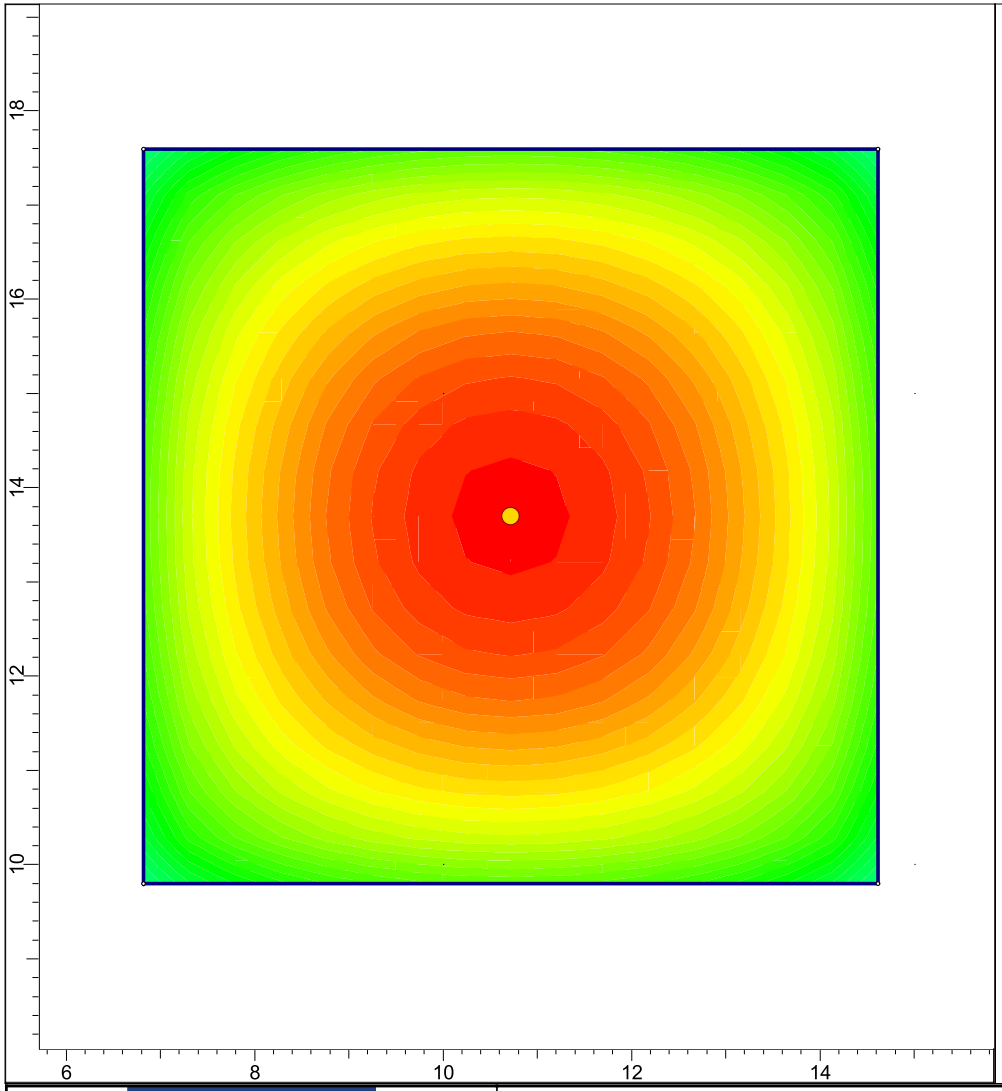


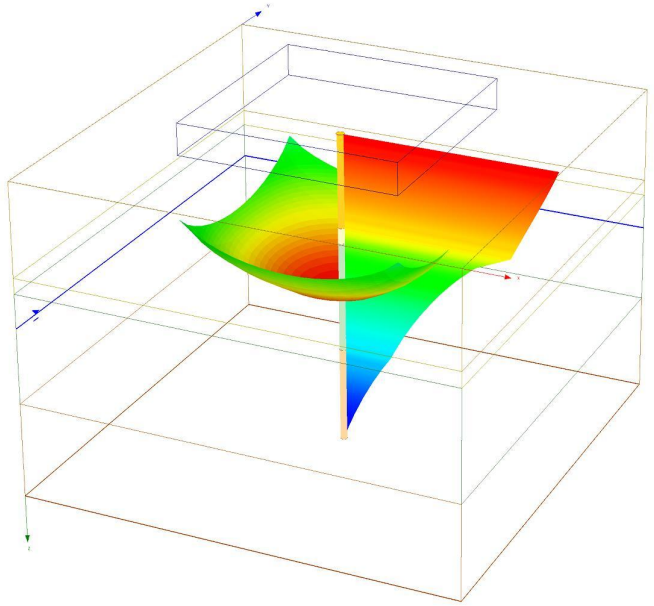


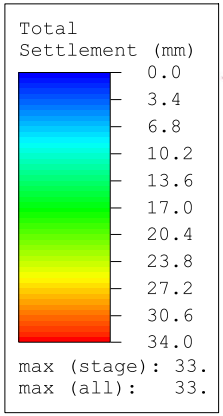
KGA GEOTECHNICAL

SETTLE3D 3.015

Project	Grand View Estate, Orewa		
Analysis Description	Settlement Analysis - 4m fill only		
Drawn By	Jennifer Lo	*Stage Name*	Place 4m engr fill
Date	3/09/2015, 12:48:21 p.m.	*File Name*	4m fill only (mv).s3z





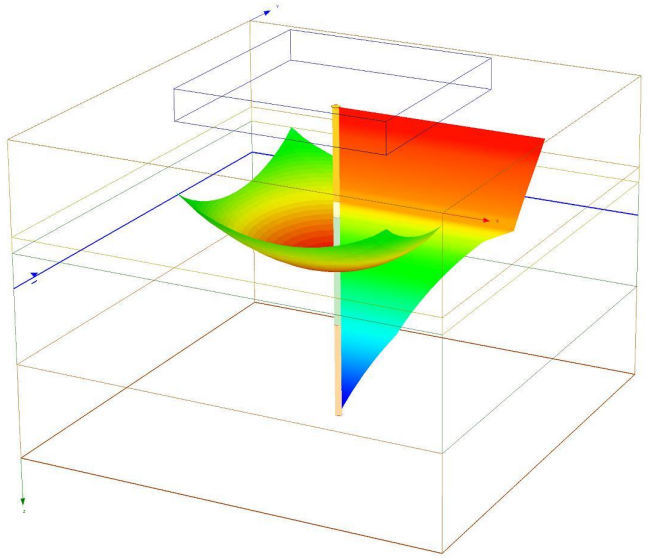


SETTLE3D 3.015

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Project	Grand View Estate, Orewa		
Analysis Description	Settlement Analysis - 4m fill with top 3m replacement		
Drawn By	Jennifer Lo	*Stage Name*	Place 4m engr fill
Date	3/09/2015, 12:48:21 p.m.	*File Name*	Replace 3m+4m fill only.s3z



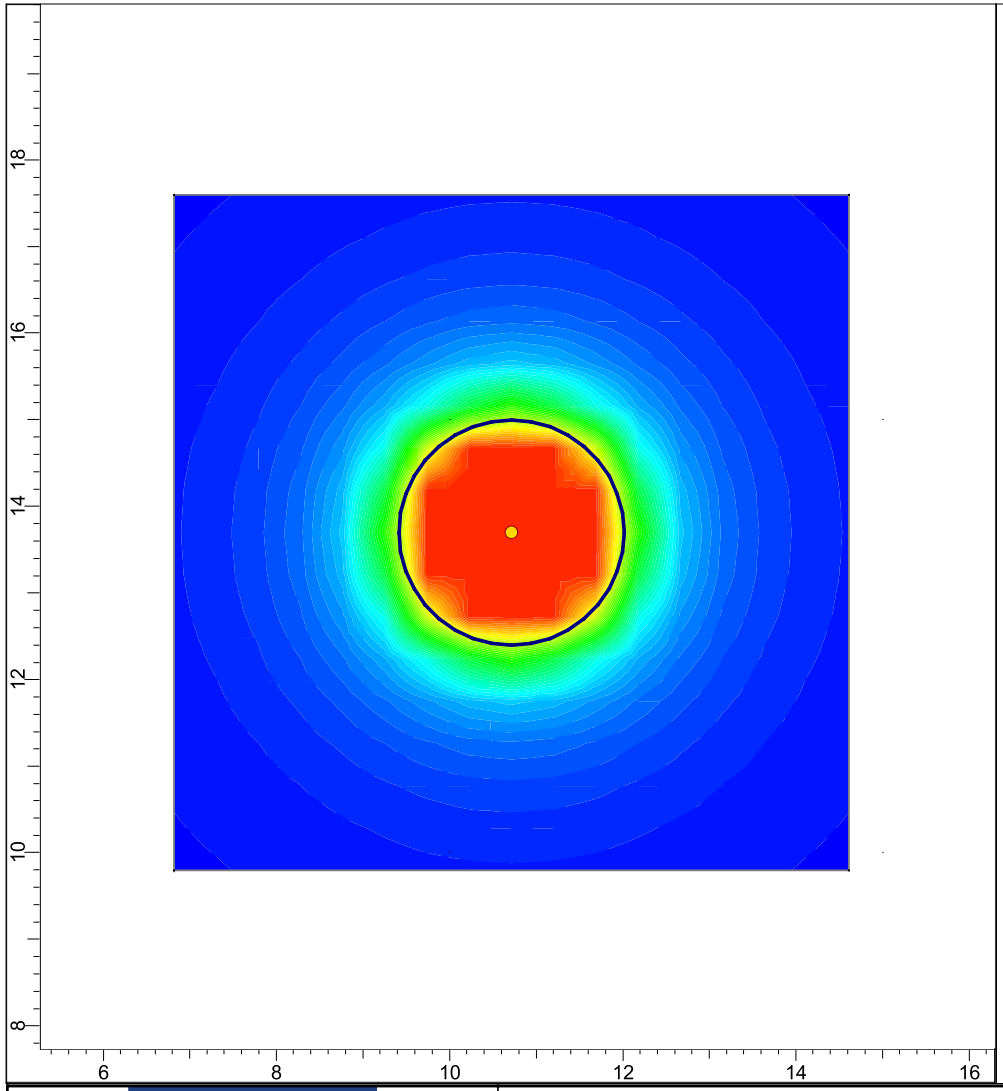


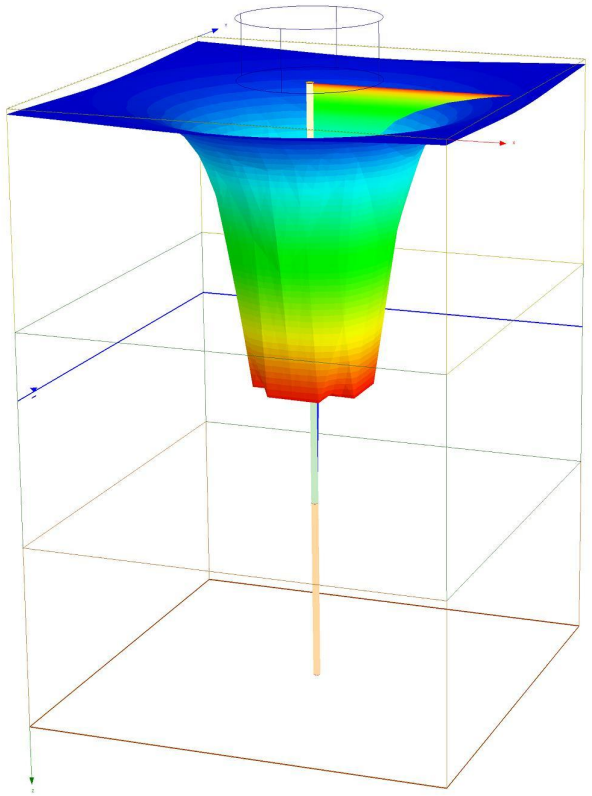
Total
Settlement (mm)
0.0
4.7
9.4
14.1
18.8
23.5
28.2
32.9
37.6
42.3
47.0
max (stage): 46.
max (all): 46.

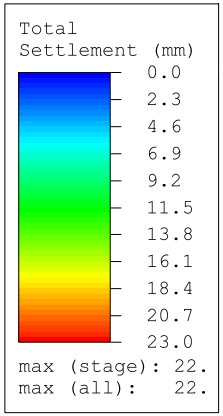
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SETTLE3D 3.015

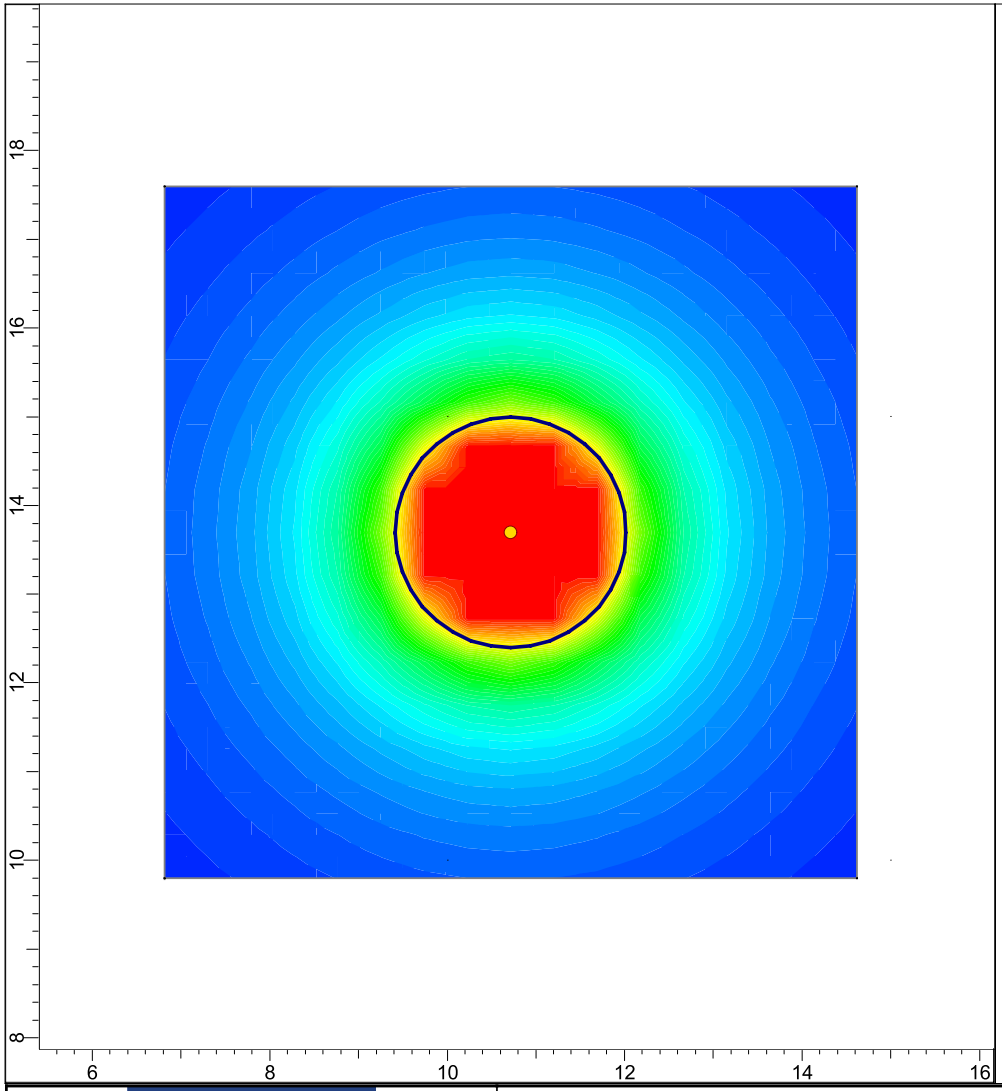
Project	Grand View Estate, Orewa		
Analysis Description	Settlement Analysis - 4m fill with top 3m replacement		
Drawn By	Jennifer Lo	*Stage Name*	Place 4m engr fill
Date	3/09/2015, 12:48:21 p.m.	*File Name*	Replace 3m+4m fill only (mv).s3z

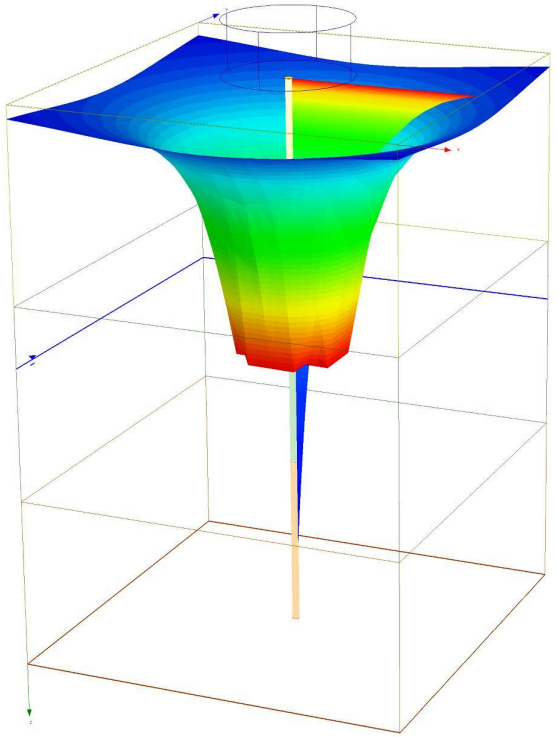


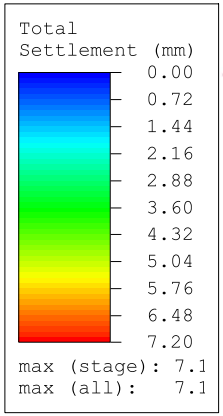




SETTLE3D 3.015	*Project*	Grand View Estate, Orewa	
	Analysis Description	Settlement Analysis - No fill/cut, water tank only	
	Drawn By	Jennifer Lo	*Stage Name* Water Tank Added
	Date	3/09/2015, 12:48:21 p.m.	*File Name* No fill-cut Water tank.s3z



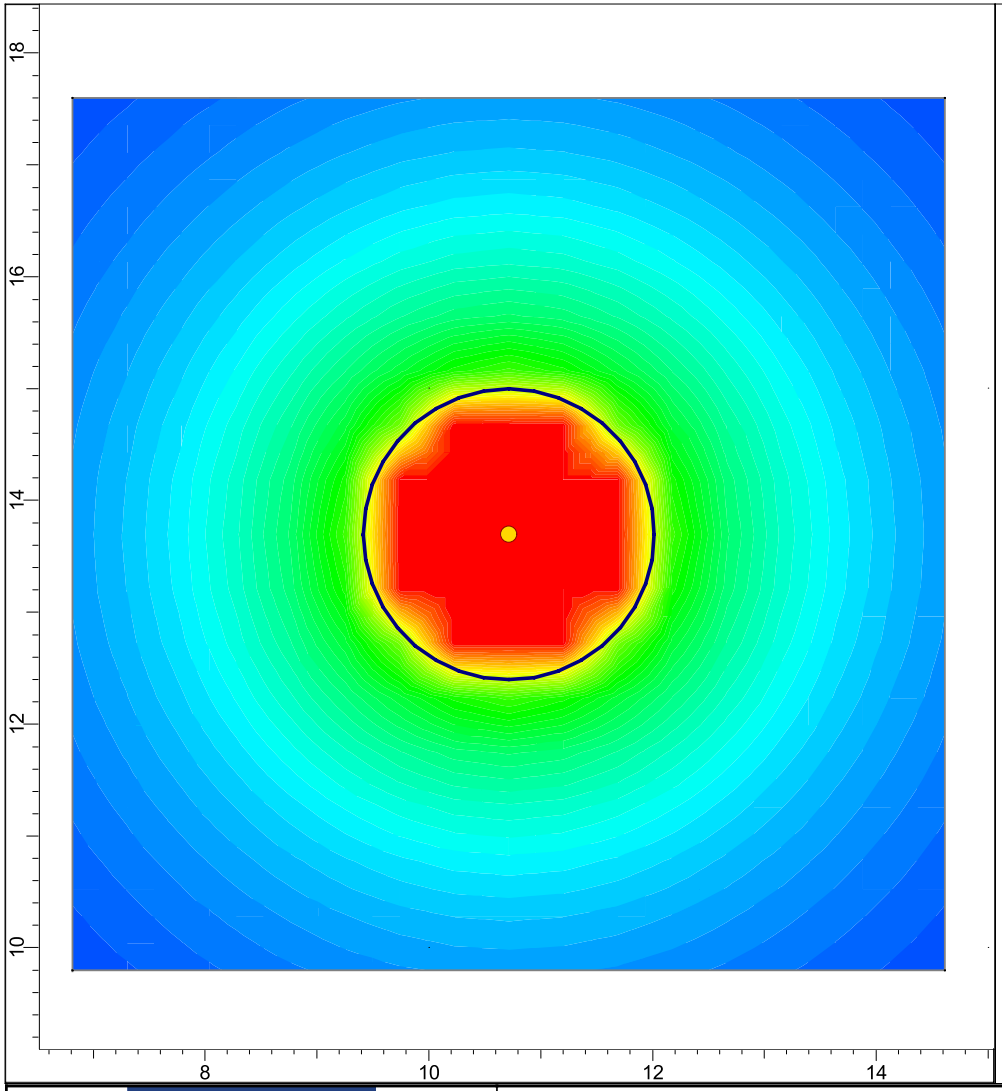


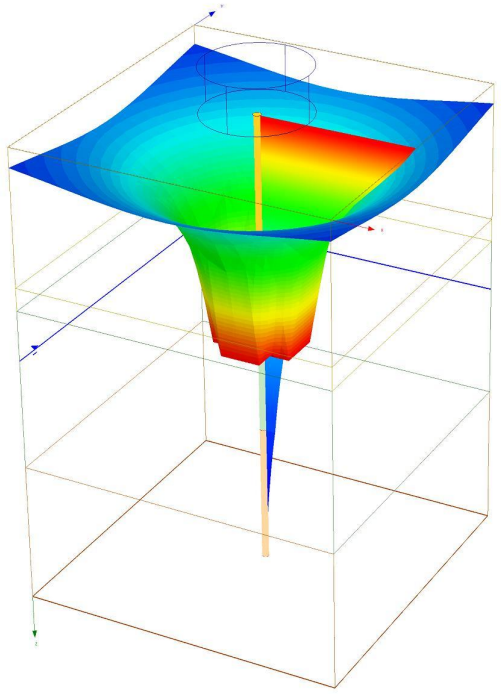


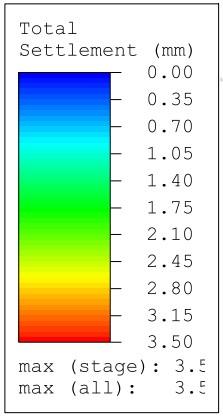
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SETTLE3D 3.015

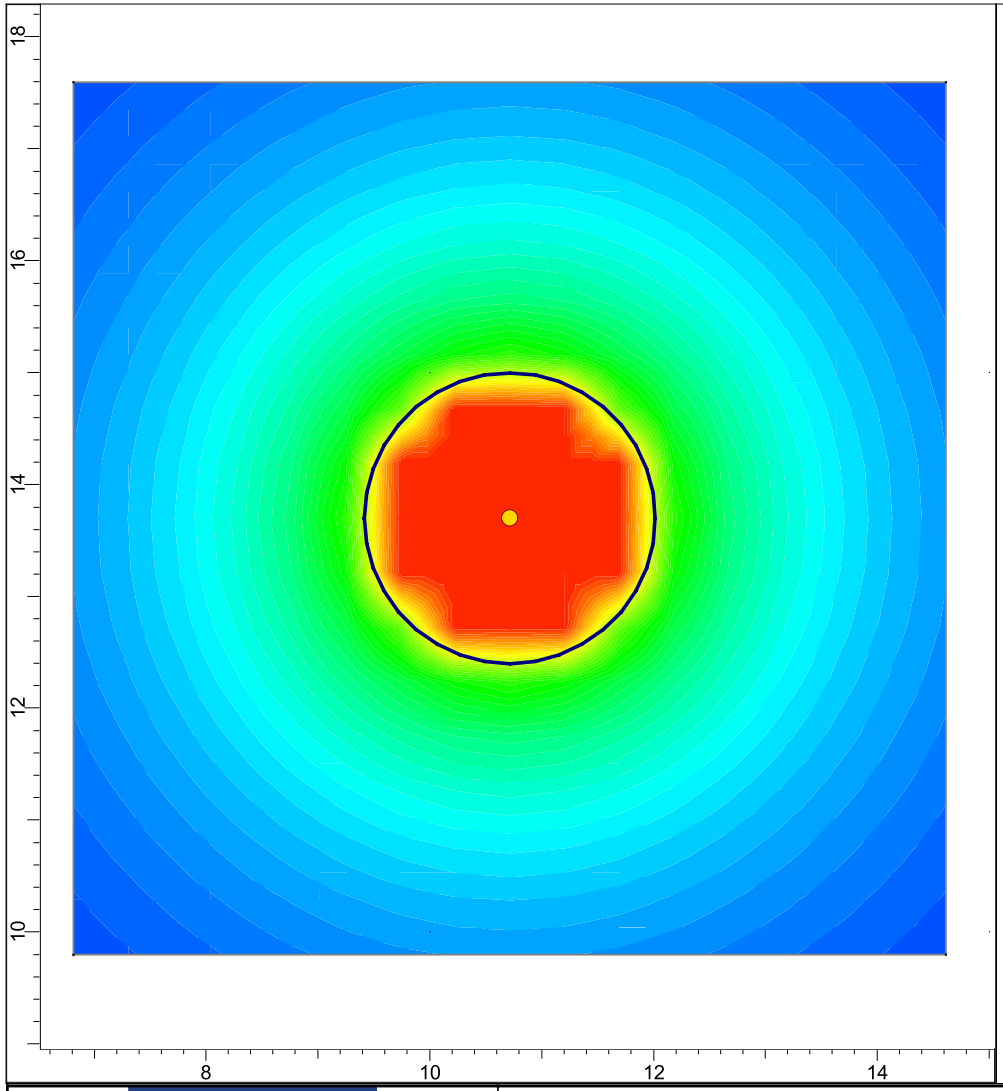
Project	Grand View Estate, Orewa		
Analysis Description	Settlement Analysis - No fill/cut, water tank only		
Drawn By	Jennifer Lo	*Stage Name*	Water Tank Added
Date	3/09/2015, 12:48:21 p.m.	*File Name*	No fill-cut Water tank (mv).s3z

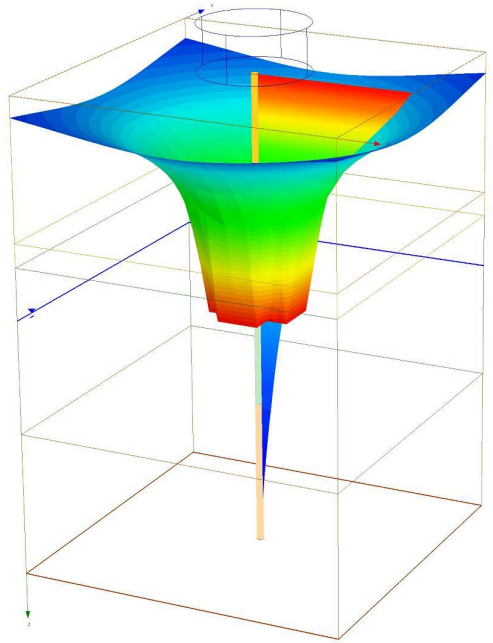


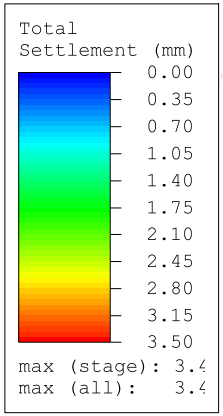




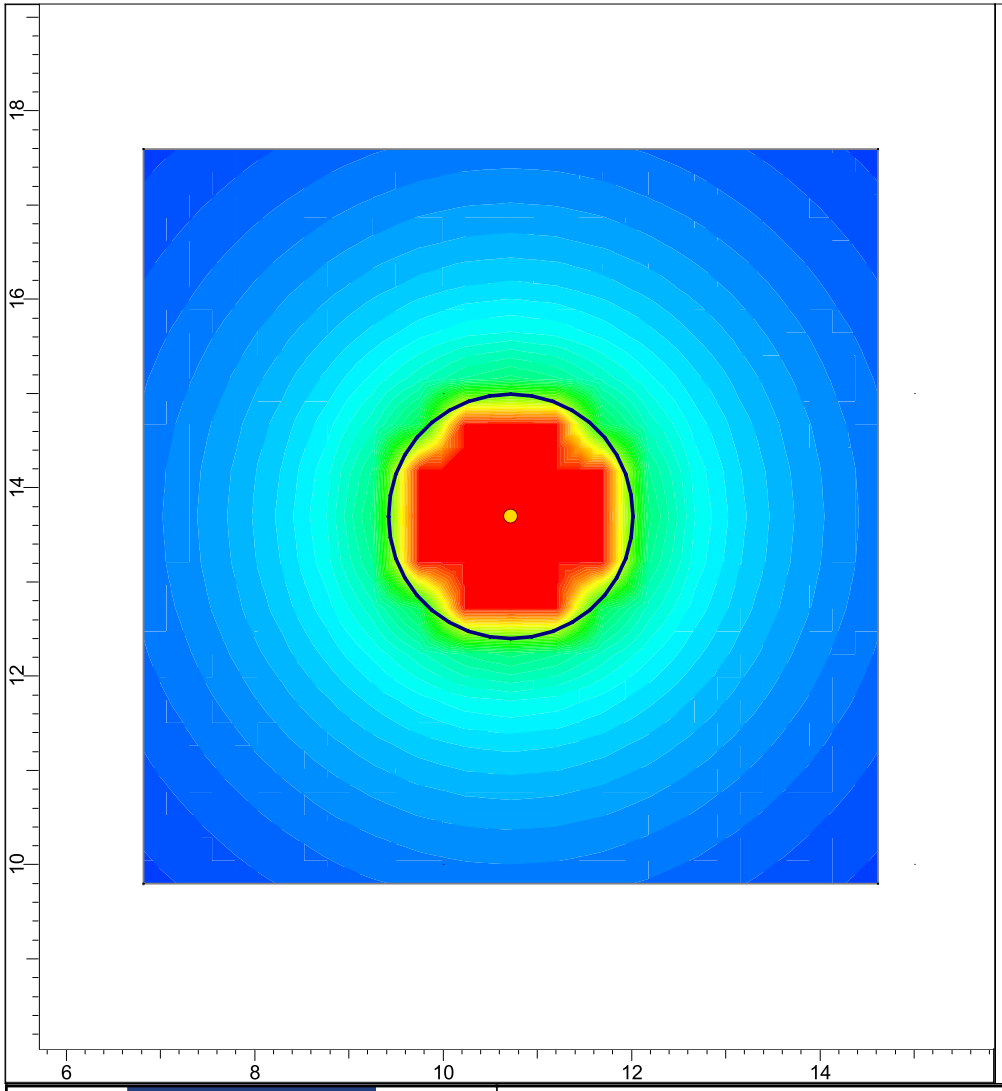
SETTLE3D 3.015	*Project*	Grand View Estate, Orewa	
	Analysis Description	Settlement Analysis - Water tank with Fill Replacement at top 3m	
	Drawn By	Jennifer Lo	*Stage Name* Water Tank Added
	Date	3/09/2015, 12:48:21 p.m.	*File Name* Replace 3m of fill Water tank.s3z

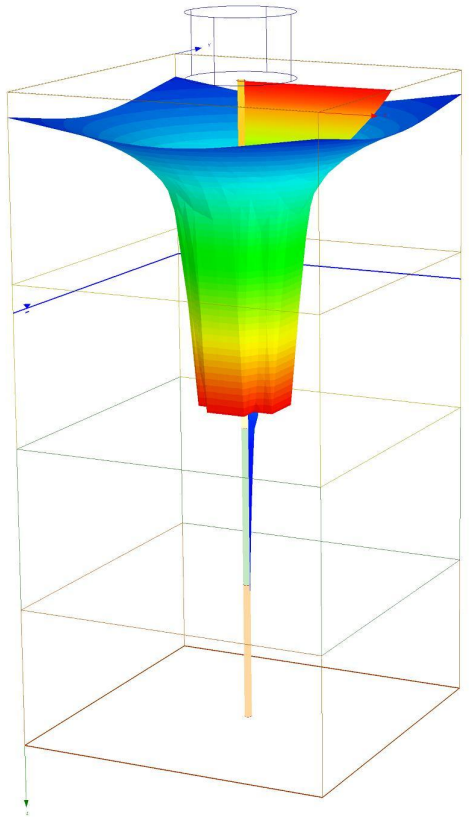


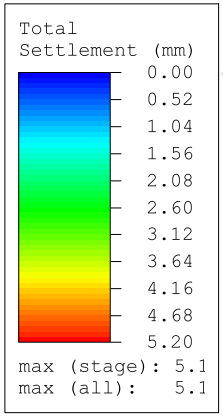




SETTLE3D 3.015	*Project*	Grand View Estate, Orewa	
	Analysis Description	Settlement Analysis - Water tank with Fill Replacement at top 3m	
	Drawn By	Jennifer Lo	*Stage Name* Water Tank Added
	Date	3/09/2015, 12:48:21 p.m.	*File Name* Replace 3m of fill Water tank (mv).s3z



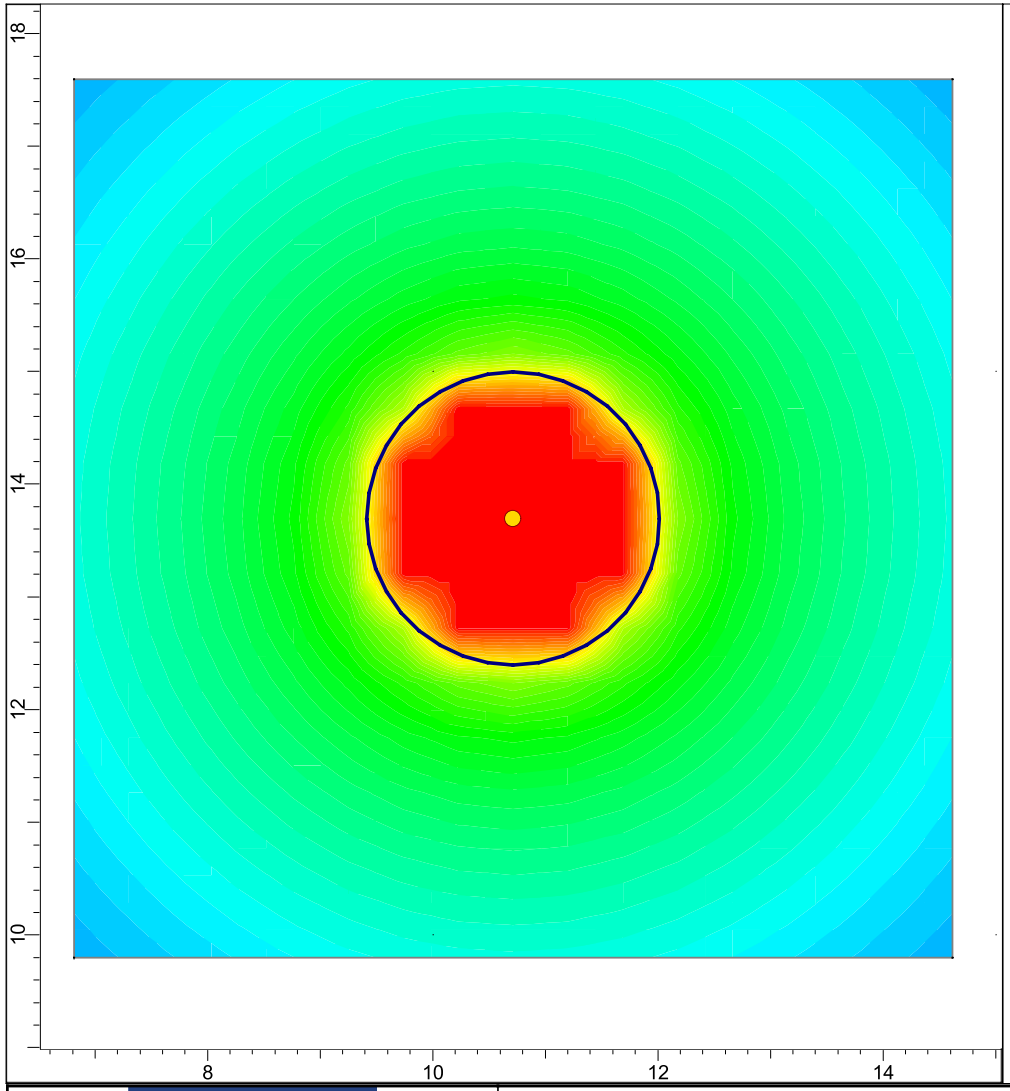


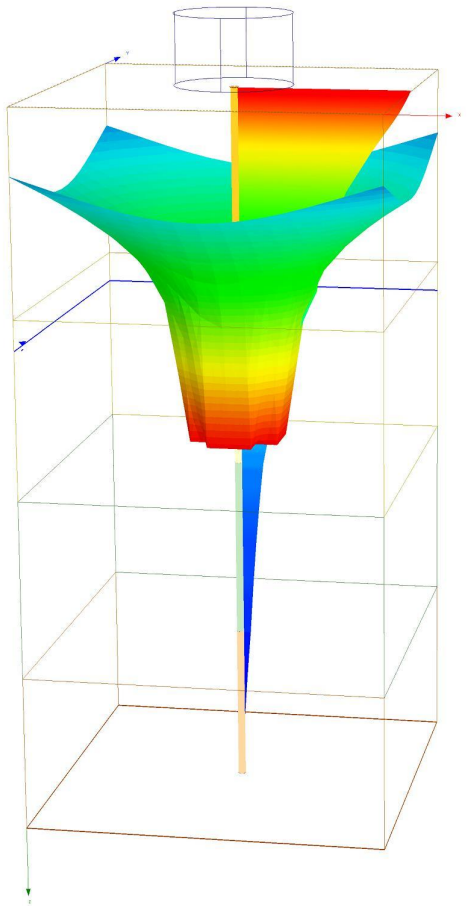


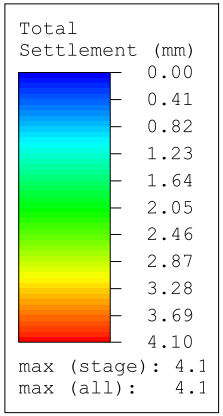
SETTLE3D 3.015

KGA GEOTECHNICAL

Project	Grand View Estate, Orewa		
Analysis Description	Settlement Analysis - 4m fill and water tank		
Drawn By	Jennifer Lo	*Stage Name*	Water Tank Added
Date	3/09/2015, 12:48:21 p.m.	*File Name*	4m fill Water tank.s3z



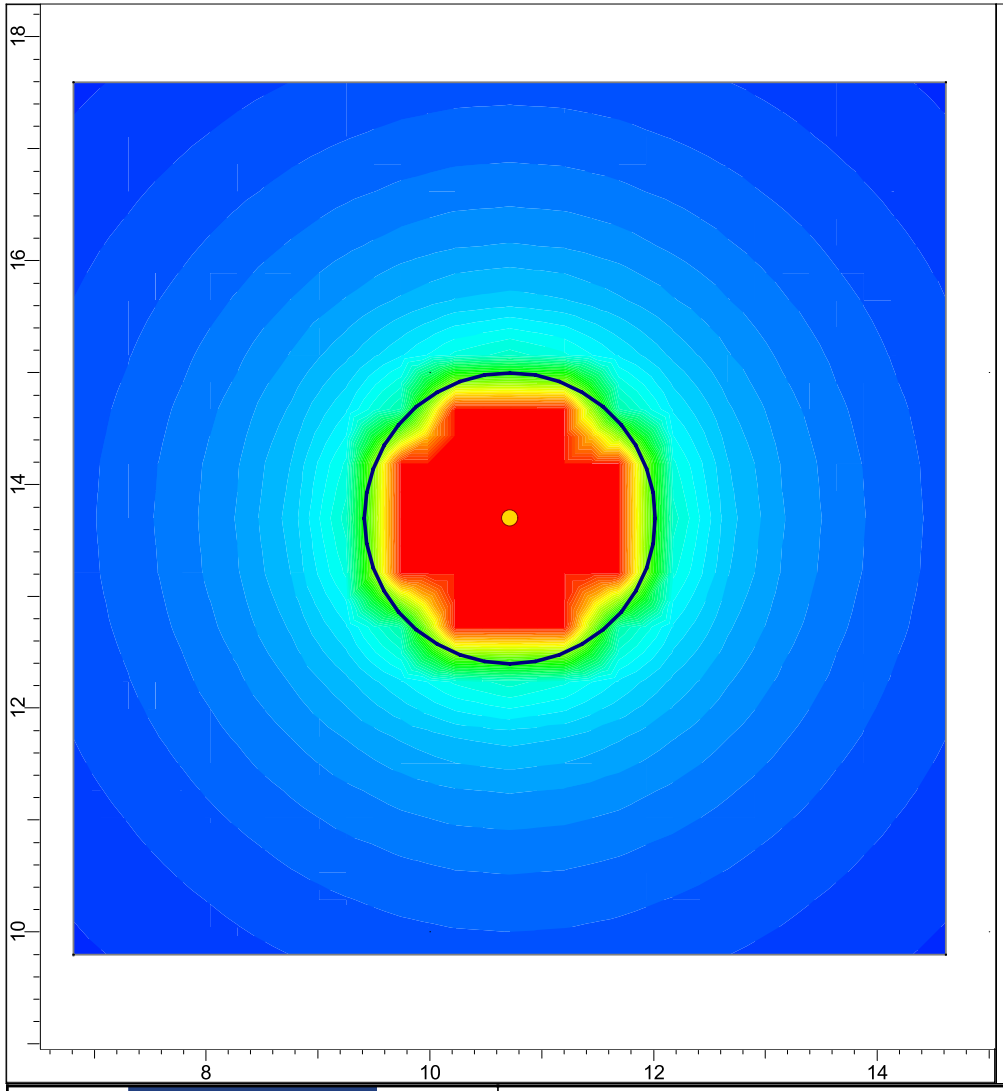


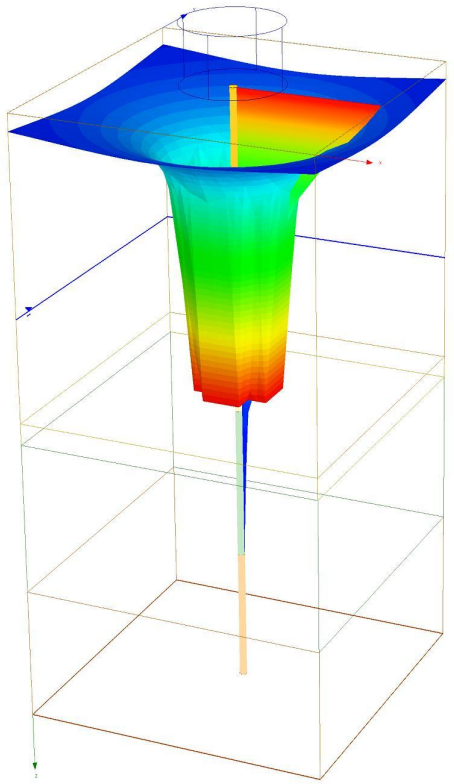


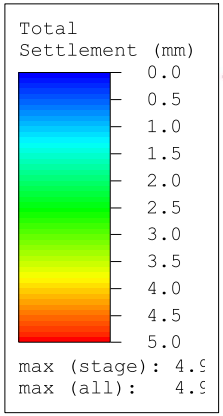
KGA GEOTECHNICAL

SETTLE3D 3.015

Project	Grand View Estate, Orewa		
Analysis Description	Settlement Analysis - 4m fill and water tank		
Drawn By	Jennifer Lo	*Stage Name*	Water Tank Added
Date	3/09/2015, 12:48:21 p.m.	*File Name*	4m fill Water tank (mv).s3z



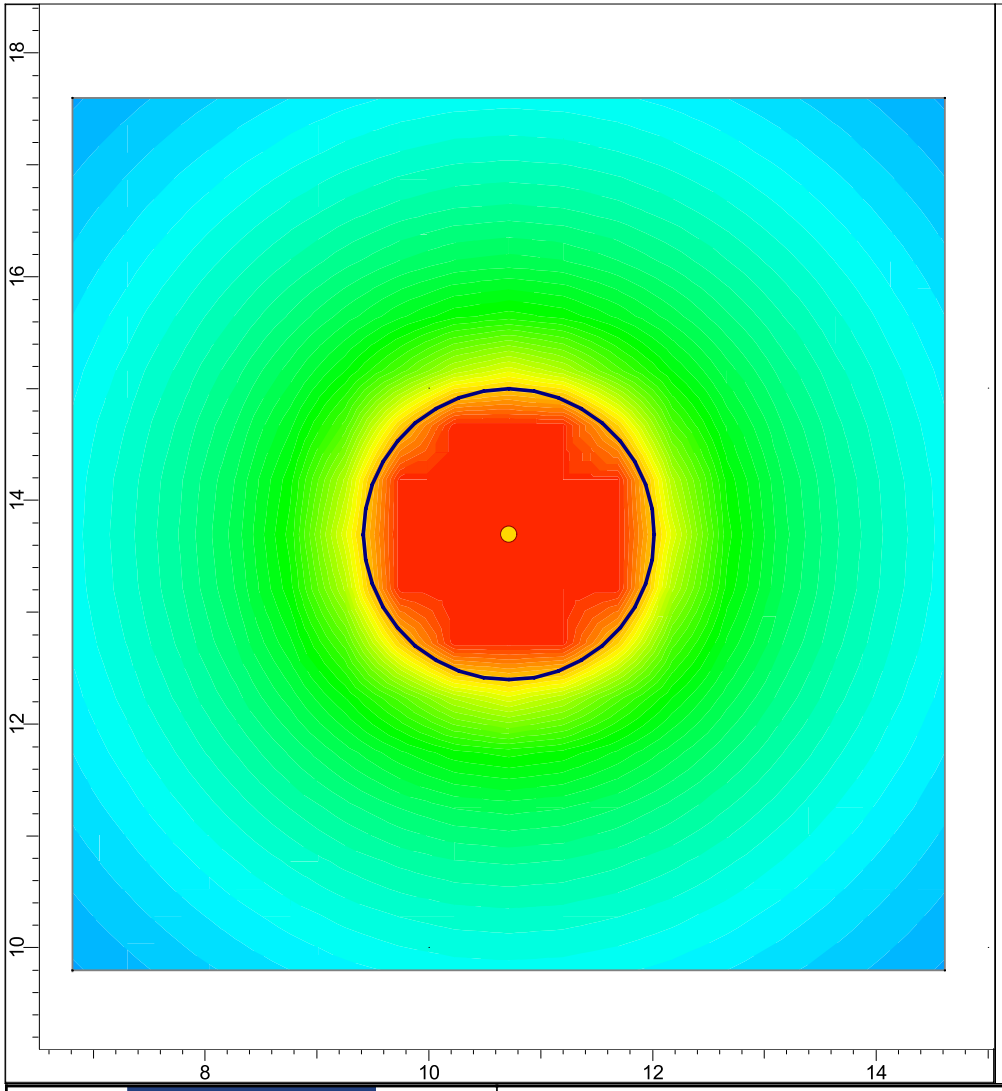


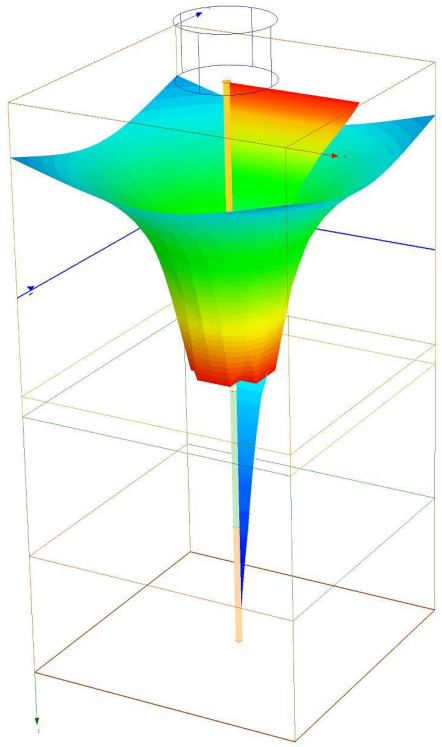


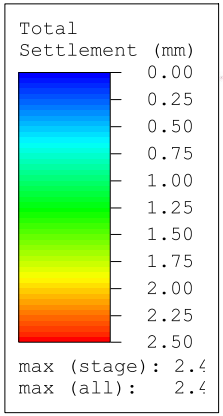
SETTLE3D 3.015

KGA GEOTECHNICAL

Project	Grand View Estate, Orewa		
Analysis Description	Settlement Analysis - 4m fill with top 3m replacement and water tank		
Drawn By	Jennifer Lo	*Stage Name*	Water Tank Added
Date	3/09/2015, 12:48:21 p.m.	*File Name*	Replace 3m+4m fill Water tank.s3z







SETTLE3D 3.015

KGA GEOTECHNICAL

Project	Grand View Estate, Orewa		
Analysis Description	Settlement Analysis - 4m fill with top 3m replacement and water tank		
Drawn By	Jennifer Lo	*Stage Name*	Water Tank Added
Date	3/09/2015, 12:48:21 p.m.	*File Name*	Replace 3m+4m fill Water tank (mv).s3z