GEOTECHNICAL INVESTIGATION REPORT

PROPOSED SUBDIVISION

606 RIDGE ROAD
MOTUKARARA
SELWYN

LOCHLEA FARMING CO LTD

Reference: C0124

Prepared: 26-08-2022

Geoconsult, PO Box 10043, Phillipstown, Christchurch 8145

P: (03)281 7737, F: (03)281 7738, E: office@geoconsult.co.nz, W: www.geoconsult.co.nz

Contents

1. INTRODUCTION

This report has been prepared for Lochlea Farming Co Ltd in accordance with our proposal letter dated 18 May 2022. It presents the findings of a geotechnical investigation carried out for the proposed subdivision of 606 Ridge Road, Motukarara (Section 3 Block IV RES 959).

The purpose of our investigation was to ascertain subsoil conditions, assess liquefaction potential and provide comment on the suitability of the site for subdivision.

2. SITE DESCRIPTION

The subject property (legally described as Section 3 Block IV RES 959) is located to the west of the intersection between Gammacks Road, and Ridge Road. It comprises a near level to gently sloping rectangular shaped section with an approximate area of 42.42Ha.

The property comprises a number of grassed paddocks with several trees dotted along the site boundaries and paddock fence lines.

An existing farmhouse is located within the eastern most corner of the property. This dwelling falls outside the scope of this investigation.

A regionally continuous area of raised land that runs the length of Ridge Road (hence its name) passes though the eastern edge of the property. This raised area of land appears to represent a relic dune or beach deposit.

The Halswell Canal is located to the east of the property. The Canal is positioned ~52m from the eastern corner of the property, and ~444m from the northern corner of the property. The canal is roughly straight, and its base is approximate 1 to 2m below the level of the site.

Canterbury Maps image showing the extent of the property (blue).

3. SITE PHOTOGRAPHS

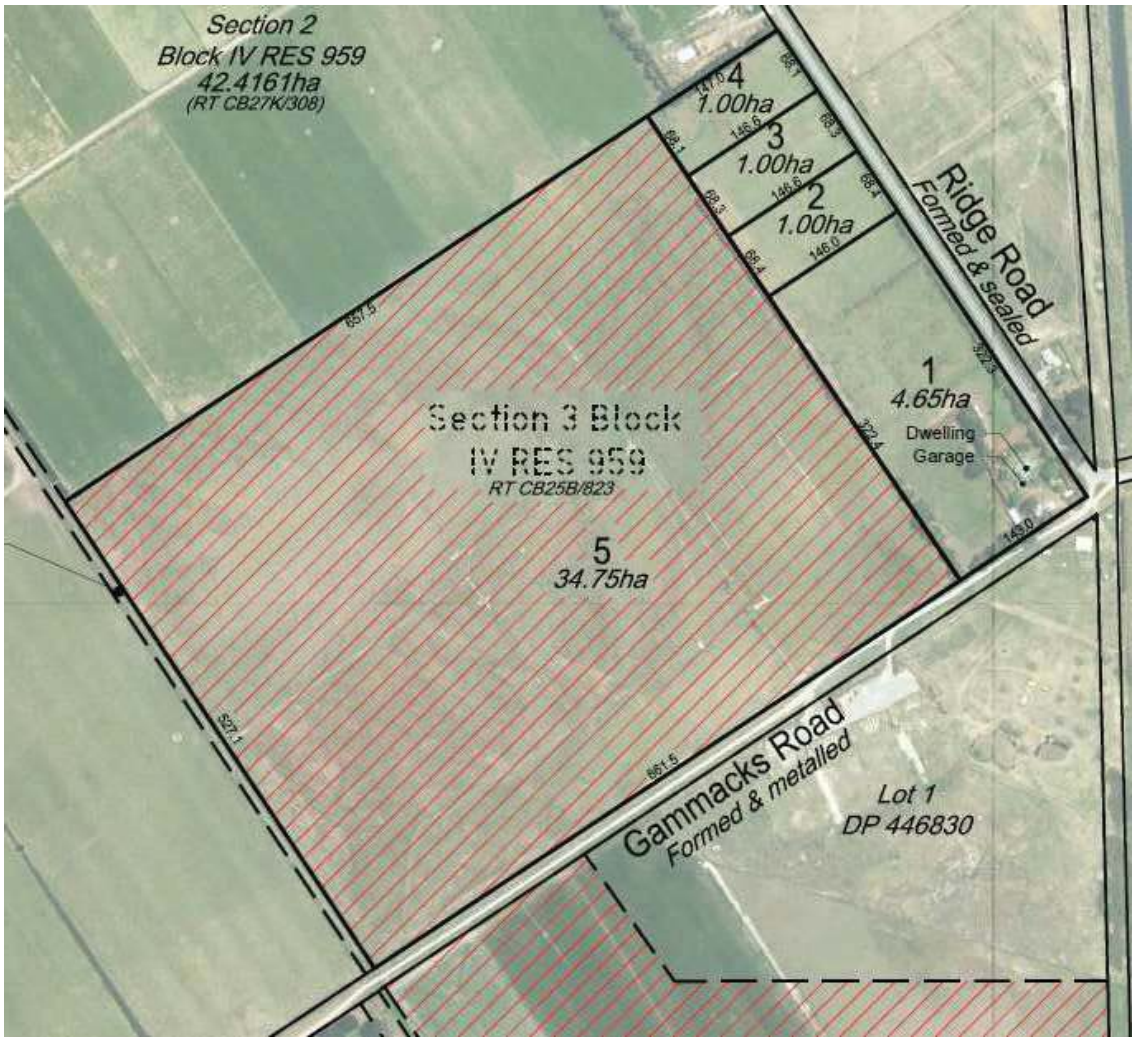
Photo	Description
	**Photo 1** – Looking north across the subject site. Note the near level to gently sloping nature of the site.
	**Photo 2** – Looking northwards along the Haswell Canal.

4. PROPOSED DEVELOPMENT

We have been supplied with a 'Graham Fowler Consulting' drawing, numbered: GF-066 - V60 - A, reference: 606 Ridge Road - Subdivision, Lots 1-5 being a subdivision of Section 3 Block IV Reserve 959 dated: 17-05-2022. Based on this information and correspondence with Graham Fowler we understand that the proposed development will comprise:

- The subdivision of the existing property to create 5 new lots.
- Lot 1 will contain the existing dwelling
- Lots 2, Lot 3 and Lot 4 are earmarked for future residential development
- Lot 5 will contain the balance of the property and will have a No Build Covenant placed upon it.

Based upon the above, Geoconsult is of the understanding that 3 safe stable building platforms need to be identified within the proposed Lot 2, Lot 3 and Lot 4. These lots will form the basis of the 'subject site' for the remainder of this report. Lot 1 and Lot 5 fall outside the scope of this investigation.



Extract of the Graham Fowler Consulting' drawing showing the proposed layout of the subdivision.

5. EXISTING GEOTECHNICAL INFORMATION

5.1 MBIE Site Classification

The site has been classified by the Ministry of Building Innovation and Employment (MBIE) as a Technical Category 2 (TC2) site, indicating that minor to moderate land damage from liquefaction is possible in future large earthquakes. Lightweight construction or enhanced foundations are likely to be required such as enhanced concrete raft foundations (ie, stiffer floor slabs that tie the structure together).

5.2 Vertical Ground Movements

Comparison of Lidar digital elevation models of the Christchurch urban area made between 4 September 2010 and 22 February 2011 indicate vertical elevation change in the order of 100mm has occurred on site in response to settlement caused by the earthquakes. Note: the settlements indicated falls within the error range of the data set (+/-100mm).

5.3 Aerial Photographs

The earliest available aerial image of the subject site is titled 'imagery 1940-1944'. This image indicates at the time it was taken; the site largely resembled its current arrangement. The dwelling within the western corner of the property had already been constructed and the paddocks has a similar arrangement to the current layout.

Subsequent images indicate no significant changes occurred at the subject site. Images taken following significant earthquake events associated with the Canterbury earthquake sequence were not available.

5.4 Observed Liquefaction in Rural Areas

GNS Science has examined post-earthquake satellite and aerial photographs to map liquefaction that occurred in rural areas. A digitised copy of the mapped liquefaction is available in the 'observed liquefaction in rural areas' map within Christchurch City Councils 'Christchurch Liquefaction Information' viewer.

Mapping indicates that following the September 2010 a 'certain – unknown' feature was identified on the subject site and flooding was indicated north of the site within the area between Ridge Road and the canal.

Mapping indicates that following the February 2011 earthquake expressions of liquefaction were not evident on the subject site.

5.5 Flood Levels and Minimum Floor Levels

Based on council records at the time of reporting we understand that the property within which the subject site is located would be affected by flooding within a future 1:200-year event. Mapping indicates flood depths would vary between 0.1m and 0.6m deep across the site.

However, as discussed above, a regionally continuous area of raised land passes though the eastern edge of the property. This raised area of land appears to elevated above the 1 in 200-year flood levels.

However, we recommend confirmation is obtained from Selwyn District Council/a registered surveyor prior to subdivision.

6. GEOLOGY AND GEOMORPHOLOGY

The Geological Map of the Christchurch Area (Forsyth, P.J.; Barnell, D.J.A; Jongens, R. (compilers) 2008. Geology of the Christchurch area, Institute of Geological & Nuclear Sciences 1:250000 geological map 16. 1 sheet + 67p, Lower Hutt, New Zealand, GNS Science) shows the site to be located at the interface between 2 geological units. These are:

- **Young beach deposit**, described as Quaternary aged, unweathered gravel and sand of former beaches and storm beach ridges deposited at edges of sea or lake.

And

- **Young lake deposit**, described as Quaternary aged, Lacustrine silt, mud, sand & some peat around present and former lake shore (Lake Ellesmere)

The young beach deposits appear to have been deposited atop the young lake deposits and represent the area of high ground identified passing though the eastern edge of the subject site. The young lake deposits appear to be regionally continuous in this area.

7. SITE INVESTIGATION

The approximate locations of the CPT Tests and boreholes are shown on the aerial photograph below. All test results are also attached.

Canterbury Maps image showing approximate proposed Lots 2,3 and 4 (subject site), investigated safe stable building platforms (orange) and test locations.

Our site investigation work comprised the following:

Test	Depth Achieved	Comments
Cone Penetrometer Tests (CPT)	10.1m to 15.2m	Target depth achieved
9 x Hand Auger Boreholes (HA)	1.0m to 3.0m	Target depth achieved or repeated hole collapse in saturated sandy material
8 x Scala Penetrometer Tests (SP)	2.9m	Target depth achieved

8. GROUND MODEL

8.1 Subsoil Conditions

Normalised soil behaviour types based on the 1990 Robertson correlations encountered in the CPT tests are given on the attached CPT test outputs. Detailed descriptions of the subsoils encountered in the hand auger boreholes are shown in the attached hand auger logs. The subsoils were generally found to comprise:

Depth to Upper Surface of Layer	General Soil Description
0m	**Sandy Topsoil –** dark brown, moist
0.1m to 0.3m	**Young beach deposits** – Comprising loose to medium dense, orange mottled grey, SAND to silty SAND. Occasional clayey silt lenses identified within this unit.
~3.5m	***Inferred young lake deposits** – loose to medium dense/soft to stiff interbedded SANDS, SILTS, CLAYS and PEAT
8.5m to 9.75m	***** **Inferred marine/beach deposits** – medium dense SAND to silty SAND
~12m	***Inferred swamp/lake deposits** – soft to firm CLAY and PEAT
14.5m +	***** **Inferred marine/beach deposits** – medium dense to dense SAND to silty SAND

**Inferred from CPT*

8.2 Groundwater Conditions

The CPT tests and hand auger boreholes encountered groundwater between 1.4m to 1.9m below ground level; however, higher levels may be possible following periods of extended or heavy periods of rainfall or snow melt. We have assumed a groundwater table of 1.0m for liquefaction assessment purposes.

9. LIQUEFACTION ASSESSMENT

9.1 Introduction

Liquefaction is the process where saturated sand and silt grains temporarily lose strength and act as a fluid. This effect can be caused by a build-up of excess pore water pressure due to earthquake shaking and can result in significant damage to buildings and infrastructure.

For liquefaction and/or lateral spreading to occur, the subsoils must have the following properties:

- loose (compacted soils tend not to liquefy)
- sandy or silty (clays and gravels tend not to liquefy)
- saturated (only soils below the ground water table are susceptible to liquefaction)

The relatively young deposits beneath the subject site include loose, saturated non-cohesive soils which are considered susceptible to liquefaction which may be triggered during a sufficiently large seismic event. We have subsequently undertaken a liquefaction assessment as follows.

9.2 Assessment

We have undertaken a liquefaction assessment using the computer programme CLiq version 3 by Geologismiki using the CPT tests results. The following assessment methodologies have been applied:

- Analysis Method - Idriss and Boulanger (2014)
- Fines correction method - Robertson and Wride (1998)
- Settlement estimates - Zhang et al (2002).

The following design cases have been considered for the liquefaction assessment:

- Serviceable Limit State (SLS) – loads a building or structure is likely to be subjected to more frequently during its design life. A building should be readily repairable when subjected to SLS loads. SLS loads are based on a one in 25-year earthquake.
- Ultimate Limit State (ULS) - loads a building or structure may be subjected to during a large (severe), relatively rare event. A building should be designed to lower the risk of collapse, and therefore minimise the risk or protect life safety to human life when subjected to ULS loads. ULS loads are based on a one in 500-year earthquake.

In order to determine an appropriate CRR-PL values and C(FC) values for the assessment a back analysis of the earthquakes experienced to date has been undertaken. The past performance of the site was then compared to the outputs of the assessment and adjusted as necessary. Having completed this assessment, we have adopted a CRR-PL of 15% and a C(CF) of 0.

Based on a review of available geological information, a site subsoil classification - Class D (Deep Soils) in accordance with NZ1170.5 has been applied. The following seismic design parameters have been used in our liquefaction assessment. These are as recommended in the Department of Building and Housing Guidelines (December 2012).

Design Condition	Annual Probability of Exceedance	Magnitude (M)	Peak Ground Acceleration
SLS1	1/25	7.5	0.13g
SLS2	1/25	6.0	0.19g
ULS	1/500	7.5	0.35g

10. RESULTS

10.1 Liquefaction Induced Settlements

Printouts of the liquefaction assessment are attached. The results are summarised as follows:

Settlement due to liquefaction over the upper 10m of the soil profile						
Test	**SLS1 Design Condition**		**SLS2 Design Condition**		**ULS Design Condition**	
	Vertical Settlement (mm)	**LSN**	**Vertical Settlement (mm)**	**LSN**	**Vertical Settlement (mm)**	**LSN**
CPT1	71	Minor expression of liquefaction	94	Moderate expression of liquefaction	119	Moderate to severe expression of liquefaction
CPT2	72	Minor expression of liquefaction	93	Moderate expression of liquefaction	117	Moderate to severe expression of liquefaction
CPT3	67	Minor expression of liquefaction	96	Moderate expression of liquefaction	123	Moderate to severe expression of liquefaction
CPT4	63	Minor expression of liquefaction	87	Moderate expression of liquefaction	111	Moderate to severe expression of liquefaction
CPT5	67	Minor expression of liquefaction	94	Moderate expression of liquefaction	120	Moderate to severe expression of liquefaction
CPT6	40	Little to no expression of liquefaction	66	Minor expression of liquefaction	96	Moderate to severe expression of liquefaction

10.2 Liquefaction Assessment Conclusion

The results of the assessment indicate that under an SLS earthquake event, green field settlement in the order of 96mm is estimated in response to liquefaction over the upper 10m of the soil profile. However, given the accuracy of the liquefaction assessment, it is important to note that settlements are almost as likely to be greater than 100mm than less in this case.

The liquefaction severity number (LSN) indicates that a moderate expression of liquefaction is expected at the ground surface during an SLS event. The analysis indicates that liquefaction of subsoils occurs predominantly below 1.5m throughout the tested depth.

During a ULS earthquake event, green field settlements in the order of 123mm are estimated in response to liquefaction over the upper 10m of the soil profile.

The LSN indicates that a moderate to severe expressions of liquefaction is expected at the ground surface in a future ULS event. The analysis indicates that liquefaction of subsoils occurs throughout the tested depth.

Differential settlements in the order of one half to two thirds of the estimated values may be expected under all design conditions.

Settlements to structures founded at the ground surface may be greater than those indicated above. Factors such as soil evacuation (sand boils) and building loads can have a significant impact on settlement. Unfortunately, there are no reliable empirical methods available by which to calculate the effects these factors will have on the settlements calculated.

The assessment indicates the site fits the definition of an upper bound TC3 site under both SLS and ULS design conditions.

11. DISCUSSION

Suitability of Site for Subdivision

Section 106 of the Resource Management Act 1991 (RMA), states the following:

(1) A consent authority may refuse to grant a subdivision consent, or may grant a subdivision consent subject to conditions, if it considers that—

(a) there is a significant risk from natural hazards; or

(b) *[Repealed]*

(c) sufficient provision has not been made for legal and physical access to each allotment to be created by the subdivision.

(1A) For the purpose of subsection (1)(a), an assessment of the risk from natural hazards requires a combined assessment of—

(a) the likelihood of natural hazards occurring (whether individually or in combination); and

(b) the material damage to land in respect of which the consent is sought, other land, or structures that would result from natural hazards; and

(c) any likely subsequent use of the land in respect of which the consent is sought that would accelerate, worsen, or result in material damage of the kind referred to in paragraph (b).

(2) Conditions under subsection (1) must be—

(a) for the purposes of avoiding, remedying, or mitigating the effects referred to in subsection (1); and

(b) of a type that could be imposed under section 108.

Our assessment of the site with respect to Section 106 of the RMA is outlined below.

Erosion

There is currently no evidence on site to suggest active erosion is currently occurring within influence of the identified building platform. Provided our recommendations with respect to storm water (below) are followed, we consider it unlikely that the proposed development will have a negative impact on site erosion.

Falling Debris

The site is flat and located away from higher topography. Subsequently, there is no risk of falling debris.

Slippage/Lateral Movement

The identified building platform is situated in excess of 200m from the nearest water course. Subsequently in accordance with MBIE Guidance 'Repairing and Rebuilding Houses affected by the Canterbury Earthquakes' December 2012, we assess the site to have a 'minor to moderate' 'global lateral movement' risk and a 'minor' 'lateral stretch' risk.

Subsidence

The results of the liquefaction assessment indicate the subject site fits the definition of an upper bound TC3 property, indicating that moderate to significant land damage from liquefaction is possible in future large earthquakes. Given the accuracy of the assessment, settlements under SLS may be greater than 100mm, the below recommendations have taken this possibility into consideration.

Geoconsult consider there to be 2 main approaches by which to accommodate the liquefaction risk. This would comprise either:

- **Deep ground improvement –** Type G4 deep stone columns in conjunction with TC2 enhanced slab (option 1)

- **TC3 relevellable foundation –** comprising either:
  - A type 2b surface structure (option 2) OR
  - A 1.2m thick, Type G1d crushed reinforced gravel raft with a relevellable concrete surface structure (option 3).

The remedial solution selected will partially be reliant upon the performance requirements of the resource consent. Where TC2 ground performance is required in order to satisfy the resource consent, only the option 1 would be appropriate.

Where TC3 deformations are considered acceptable options 1, 2 and 3 are all considered appropriate.

Detailed recommendations are outlined below

Inundation

As discussed above, with reference to the Selwyn District Council records, we understand the identified safe stable building platforms are situated outside the defined flood zones for a 1 in 200-year event and therefore, flooding of the identified building platforms is considered unlikely.

Conclusion

Based on the above, provided our recommendations are followed, and provided the TC3 ground performance is taken into consideration, Geoconsult does not consider there to be a geotechnical reason under Section 106 of the Resource Management Act to prevent the proposed subdivision from occurring. A statement of professional opinion as to the suitability of the suite for subdivision is attached.

12. RECOMMENDATIONS

12.1.1 Introduction

Where developments are proposed outside the identified building platform, further shallow testing and CPT testing may be required in order to confirm available bearing and in order to confirm the liquefaction risk. This investigation should be specified by a suitably qualified geotechnical engineer once development plans become available.

Geoconsult considered there to be 3 possible founding options for proposed new dwellings within the identified safe stable building platforms. These 3 options are as follows:

- Option 1 – Type G4 deep stone columns in conjunction TC2 enhanced foundation system
- Option 2 – Type 2B surface structure
- Option 3 – Type G1d crushed reinforced gravel raft with a relevelable concrete surface structure

Option 1 will not eliminate the liquefaction risk but will reduce deformations at the subject site to that of a TC2 site.

Option 2 and 3 will not change the liquefaction risk at the subject site, but allows for relevel.

Detailed recommendations outlined as follows:

12.1.2 **Option 1**

A specifically designed deep foundation treatment in general accordance with type G4 'Deep Stone Columns' from the MBIE's 'Repairing and Rebuilding Houses affected by the Canterbury Earthquakes' December 2012 is considered a suitable ground improvement method for this site.

The treatment should extend a minimum of 8.0m below ground level and 1.5m outside the building footprint. This should be designed and constructed by a specialist contractor experienced in the design and construction of the ground improvement.

Following completion of the above ground improvement, an option 2 or 4 TC2 enhanced slab foundation in general accordance with section 5.3 of the MBIE's 'Repairing and Rebuilding Houses affected by the Canterbury Earthquakes' December 2012 be provided for the subject site.

The intention of this foundation is not to eliminate the liquefaction risk but to accommodate it within the design of the structure. Should settlement occur in a future seismic event, the intention of this foundation is to help reduce the differential component of this settlements to acceptable levels. Where excessive settlements occur, releveling may be required.

Conformation of available bearing will need to be determined by the ground improvement designer. Note where less than 300kPa the TC2 enhanced timber floor will require specific design to accommodate the reduced bearing capacity.

12.1.3 **Option 2**

Geoconsult recommend a foundation in general accordance with a Type 2B surface structure from the MBIE's 'Repairing and Rebuilding Houses affected by the Canterbury Earthquakes' December 2012 be provided.

These foundations comprise a suspended timber floor which is constructed over a concrete 'underslab' founded atop a 600mm thick gravel raft.

This gravel raft should be a minimum of 600mm thick, with the base overlying soils with adequate bearing. Any remaining vegetation, topsoil, fill and any soft or otherwise unsuitable material should be removed from the building platform or earthworks area ensuring the base of the excavation remains level. The gravel should comprise well sorted, well graded AP40 hard fill. Two layers of Triax TX160 (or equivalent) geogrid should be incorporated into the gravel raft structure. The first layer should be placed at 100mm from the base of the gravel raft, with second layer placed 200mm from the base of the raft 100mm above the first geogrid layer. The gravel raft should extend a minimum of 0.5m outside the footprint of the 'underslab'.

The intention of this foundation is not to eliminate the liquefaction risk but to accommodate it within the design of the structure. When settlement in future seismic events occurs the surface structure allows for re-levelling.

A geotechnical ultimate bearing capacity of 200kPa can be assumed for design purposes atop the gravel raft.

12.1.4 **Option 3**

We recommend the subsoils over the upper 1.2m of the soil profile and any remaining vegetation, topsoil, fill and any soft or otherwise unsuitable materials be removed from the earthworks area.

Following their removal, we recommend a shallow foundation treatment in accordance with a type G1d 'Reinforced Crushed gravel raft', Section 15.3 from the MBIE's 'Repairing and Rebuilding Houses affected by the Canterbury Earthquakes' December 2012 be provided.

This method of ground improvement involves the formation of a 1.2m thick Geogrid reinforced densified block of engineer AP40 hard fill, the gravel raft should extend a minimum of 2m outside the footprint of the proposed development.

We recommend a bidim cloth be placed at the base of the excavation and up the sides.

2 layers of Triax TX160 (or equivalent) should be placed at 0.2m and 0.4m from the base of the excavation.

In all cases, the gravel raft should extend a minimum of 1.2m below any proposed foundation elements. Where foundation elements required embedment into the gravel raft, the raft should be thickened proportionately.

Temporary drawdown of the water table or other means of dewatering may be required if the area of ground needing improvement is below the water table.

Following completion of the above gravel raft we recommend a specifically designed relevellable concrete surface structure in general accordance with the MBIE's 'Repairing and Rebuilding Houses affected by the Canterbury Earthquakes', December 2012 is considered a suitable founding option for this site.

This foundation should be designed to withstand both the vertical and lateral settlements estimated in the liquefaction assessment.

The intention of this foundation is not to eliminate the liquefaction risk but to accommodate it within the design of the structure. When settlement in future seismic events occurs the surface structure allows for relevelling.

A geotechnical ultimate bearing capacity of 200kPa can be assumed for design purposes atop the gravel raft.

12.1.5 **Alternative foundations options**

Geoconsult is happy to consider alternative foundation options for the subject site. Where an alternative is proposed, the matter should be referred to Geoconsult for comment.

13. FLOOD RISK

In all cases, consideration should be given when designing the foundations to ensure the building is founded at least 400mm above the minimum flood level for the area. Minimum flood level requirements should be confirmed with council prior to designing of the foundations.

If the site is found to be below the required levels, then the ground may need to be raised to ensure the building platform meets council requirements. If earthworks are required to achieve this, the matter should be referred back to Geoconsult for further assessment.

14. STORMWATER CONTROL

When no public stormwater system is available, stormwater from paved areas, roofs, tank overflows and all other sources should be collected in sealed pipes and discharged to a safe disposal point away from the development area with an energy dissipater fitted at its outlet. Concentrated stormwater flows should not be allowed to discharge onto or into the ground close to the buildings or on sloping ground as this would be detrimental to foundation conditions and site stability.

15. PLAN REVIEW

It is recommended that Geoconsult be engaged to review detailed development plans when they are available. This is to ensure that the information used as the basis of this report is consistent with final development proposals and that the recommendations outlined in this report have been interpreted correctly.

16. SITE INSPECTIONS DURING CONSTRUCTION

It is recommended that Geoconsult be engaged to inspect all earthworks and foundation excavations during construction. This is to confirm expected ground conditions and to ensure compliance with the recommendations contained in this report.

Council is likely to make geotechnical inspections during construction, and receipt of a Producer Statement - Geotechnical Review (PS4), a requirement of Building Consent.

It is the Client's responsibility to ensure that we are notified of any required inspections and that we are given adequate notice to carry out the inspections (at least 24 hours).

We will issue a Producer Statement - Geotechnical Review (PS4) upon successful completion of the inspected works. The inspections and preparation of the Producer Statement will be at additional cost to that of preparing this report.

17. LIMITATIONS

The recommendations and opinions contained in this report are based on the subsoils encountered at discrete test locations. We have made assumptions about the nature of the ground conditions across the site based on this limited subsoil information and actual ground conditions may vary from those assumed in this report. If any variations from the assumed ground conditions are found to exist during construction the matter should be referred back to Geoconsult.

This report has been prepared solely for the benefit of Lochlea Farming Co Ltd as our client and their nominated agents for the purposes of the specific brief as stated in this report. Geoconsult accepts no liability in respect to any matters arising from the use of the information given in this report by any other person or organisation or for any other purpose except that it may be relied upon by council in processing a building consent application for the proposed development as described herein.

Section 5 of this report used information from maps and/or data extracted from the Canterbury Geotechnical Database (https://canterburygeotechnicaldatabase.projectorbit.com), which were prepared and/or compiled for the Earthquake Commission (EQC) to assist in assessing insurance claims made under the Earthquake Commission Act 1993. The source maps and data were not intended for any other purpose. EQC and its engineers, Tonkin & Taylor, have no liability for any use of the maps and data or for the consequences of any person relying on them in any way. This "Important notice" must be reproduced wherever those figures or any derivatives are reproduced.

GEOCONSULT

Author:	**Warren Sillitoe** **Engineering Geologist**	**Signed:** 
Reviewed by:	**Hayden Gibson** **Engineering Geologist**	**Signed:** 
Approved by:	**Phil Williams** **Geotechnical Team Leader**	**Signed:** 

HAND AUGER & SCALA LOG

Geoconsult GEOTECHNICAL CONSULTANTS

No.: HA-01			
Job No.: CO124			
Client: Lochlea Farming Co Ltd	**Project:** 606 Ridge Road		**Date:** 17/08/2022
Location: Motukarara	**Coordinates:** E 1,565,186.97 , N 5,157,950.78	**Ground Level:**	**Sheet:** 1 of 1

Soil Description	Samples	Depth (m)	Legend
Medium SAND; dark brown. Moist. (TOPSOIL)		0.0	
Medium SAND with minor organic silt; light brown. Moist. (TOPSOIL)		0.2	
Medium SAND with minor silt; brownish. Moist. (YOUNG BEACH DEPOSITS)		0.4	
		0.6	
		0.8	
		1.0	
Silty medium SAND; greyish mottled orange. Wet.		1.2	
		1.4	
		1.6	
		1.8	
EOH:2.00 m		2.0	
		2.2	
		2.4	
		2.6	
		2.8	

Scala Penetrometer (Blows / 50mm): 2, 4, 6, 8, 10, 12, 14, 16, 18

Water: SWL 1.80 m, 17/08/2022 10:57:06 AM

Hand Auger Remarks:

Scala Remarks:

Logged By:	Checked By:	Hole Depth:	Legend:
NM	WJS	2.90 m	In flow; Out flow; Standing Water Level

Produced with Core-GS

Printed: 26/08/2022 1:45:51 PM

HAND AUGER & SCALA LOG

Geoconsult GEOTECHNICAL CONSULTANTS

No.: HA-02

Job No.: CO124

Client:	Project:		Date:
Lochlea Farming Co Ltd	606 Ridge Road		17/08/2022
Location: Motukarara	**Coordinates:** E 1,565,184.71 , N 5,157,967.21	**Ground Level:**	**Sheet:** 1 of 1

Soil Description	Samples	Depth (m)	Legend	Scala Penetrometer (Blows / 50mm)	Water
TOPSOIL; dark brown. Moist. (TOPSOIL)		0.0	TS	2 4 6 8 10 12 14 16 18	
Fine to medium SAND with some silt minor organic silt; brown. Moist. (TOPSOIL)					
Silty fine to medium SAND; orange mottled grey. Moist. (YOUNG BEACH DEPOSITS)		0.2			
0.5m: Becomes SAND with 100mm thick bands of silty SAND		0.4			
		0.6			
		0.8			
		1.0			
		1.2			
1.4m: Becomes silty SAND		1.4			
1.6m: Without silt, becomes blueish grey mottled orange		1.6			
1.8m: Saturated		1.8			SWL 1.80 m 17/08/2022 10:12:47 AM
2.0m: Becomes silty SAND		2.0			
		2.2			
		2.4			
		2.6			
EOH:3.00 m		2.8			

Hand Auger Remarks:

Scala Remarks:

Logged By:	Checked By:	Hole Depth:	Legend:
HG	WJS	3.00 m	Out flow ◁ In flow ▷ Standing Water Level ▼

Produced with Core-GS

Printed: 26/08/2022 1:45:52 PM

HAND AUGER & SCALA LOG

Geoconsult GEOTECHNICAL CONSULTANTS

No.:	Job No.:
HA-03	CO124

Client:	Project:	Date:
Lochlea Farming Co Ltd	606 Ridge Road	17/08/2022

Location:	Coordinates:	Ground Level:	Sheet:
Motukarara	E 1,565,187.18 , N 5,157,925.79		1 of 1

Soil Description	Samples	Depth (m)	Legend
Sandy TOPSOIL. Moist; sand, fine to medium. (TOPSOIL)		0	TS
Medium SAND with minor organic silt; brown. Moist. (TOPSOIL)		0.2	
Fine to medium SAND; light orange brown streaked orange. Moist. (YOUNG BEACH DEPOSITS)		0.4	
0.8m: Wet and mottled orange		0.6	
		0.8	
1.0m: Silty sand		1.0	
		1.2	
Clayey SILT with some sand; blueish grey. Firm to stiff; wet; medium to high plasticity and highly dialatent. (YOUNG BEACH DEPOSITS)		1.4	
Medium SAND; blueish grey. Wet. (YOUNG BEACH DEPOSITS)		1.6	
1.6m: Saturated		1.8	
EOH:2.00 m		2.0	
		2.2	
		2.4	
		2.6	
		2.8	

Scala Penetrometer (Blows / 50mm): 2, 4, 6, 8, 10, 12, 14, 16, 18

Water: SWL 1.60 m, 17/08/2022 10:46:42 AM

Hand Auger Remarks:

Scala Remarks:

Logged By:	Checked By:	Hole Depth:	Legend:
HG	WJS	2.90 m	In flow; Out flow; Standing Water Level

Produced with Core-GS

Printed: 26/08/2022 1:45:52 PM

HAND AUGER & SCALA LOG

Geoconsult GEOTECHNICAL CONSULTANTS

No.:	Job No.:
HA-04	CO124

Client:	Project:	Date:
Lochlea Farming Co Ltd	606 Ridge Road	17/08/2022

Location:	Coordinates:	Ground Level:	Sheet:
Motukarara	E 1,565,112.20 , N 5,158,079.78		1 of 1

Soil Description	Depth (m)
Sandy TOPSOIL; dark brown. Moist; sand, fine to medium. (TOPSOIL)	
Fine to medium SAND with minor organic silt; brown. Moist. (TOPSOIL)	
Fine to medium SAND; light orangish brown streaked light grey. Moist. (YOUNG BEACH DEPOSITS)	
0.5m: Becomes silty SAND	0.5
0.8m: Becomes blueish grey mottled orange	0.8
1.0m: Without silt	1.0
1.5m: 50mm band of highly dialatent SILT with minor sand	1.5
1.8m: Saturated	1.8
EOH:2.30 m	2.3

Samples | Legend: TS | Scala Penetrometer (Blows / 50mm): 2 4 6 8 10 12 14 16 18 | Water: SWL 1.80 m, 17/08/2022 11:23:18 AM

Hand Auger Remarks:
2.3m end repeated hole collapse

Scala Remarks:

Logged By:	Checked By:	Hole Depth:	Legend:
HG	WJS	2.90 m	In flow; Out flow; Standing Water Level

Produced with Core-GS

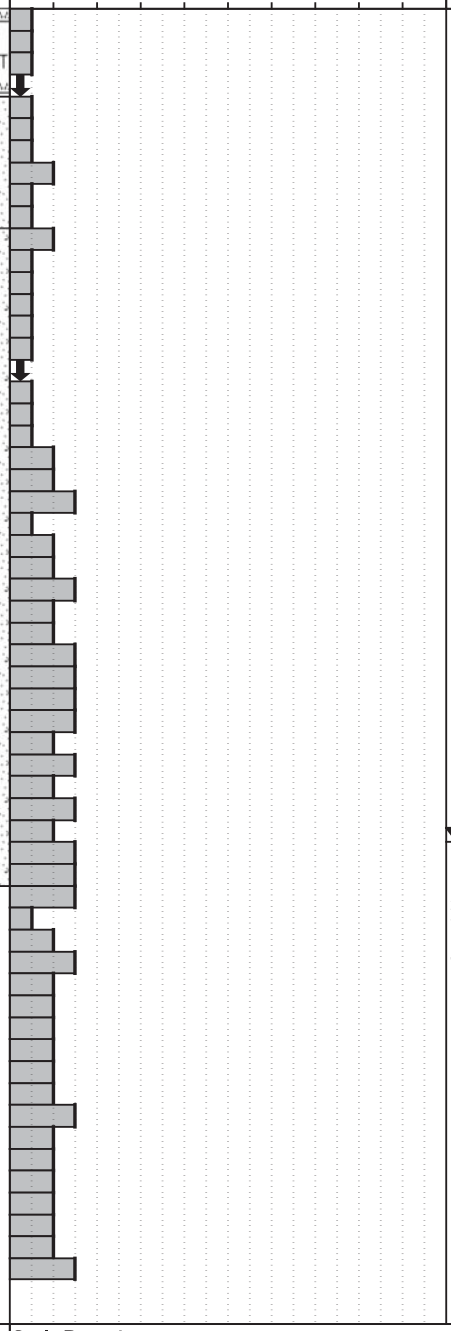
Printed: 26/08/2022 1:45:53 PM

HAND AUGER & SCALA LOG

Geoconsult GEOTECHNICAL CONSULTANTS

No.: HA-05			
Job No.: CO124			
Client: Lochlea Farming Co Ltd	**Project:** 606 Ridge Road		**Date:** 17/08/2022
Location: Motukarara	**Coordinates:** E 1,565,022.51 , N 5,158,257.91	**Ground Level:**	**Sheet:** 1 of 1

Soil Description	Samples	Depth (m)	Legend
TOPSOIL with some sand; dark brown. Moist; sand, medium. (TOPSOIL)		0.0	TS
Medium SAND with minor silt; brown. Moist. (YOUNG BEACH DEPOSITS)		0.4	
Silty medium SAND; brownish grey streaked orange. Wet. (YOUNG BEACH DEPOSITS)		0.6	
1.5m: Silty, blueish grey		1.4	
1.9m: Saturated		1.8	
EOH:2.00 m		2.0	



Water

SWL 1.90 m
17/08/2022 11:23:02 AM

Hand Auger Remarks:

Scala Remarks:

Logged By:	Checked By:	Hole Depth:	Legend:
NM	WJS	2.90 m	In flow / Out flow / Standing Water Level

Produced with Core-GS

Printed: 26/08/2022 1:45:54 PM

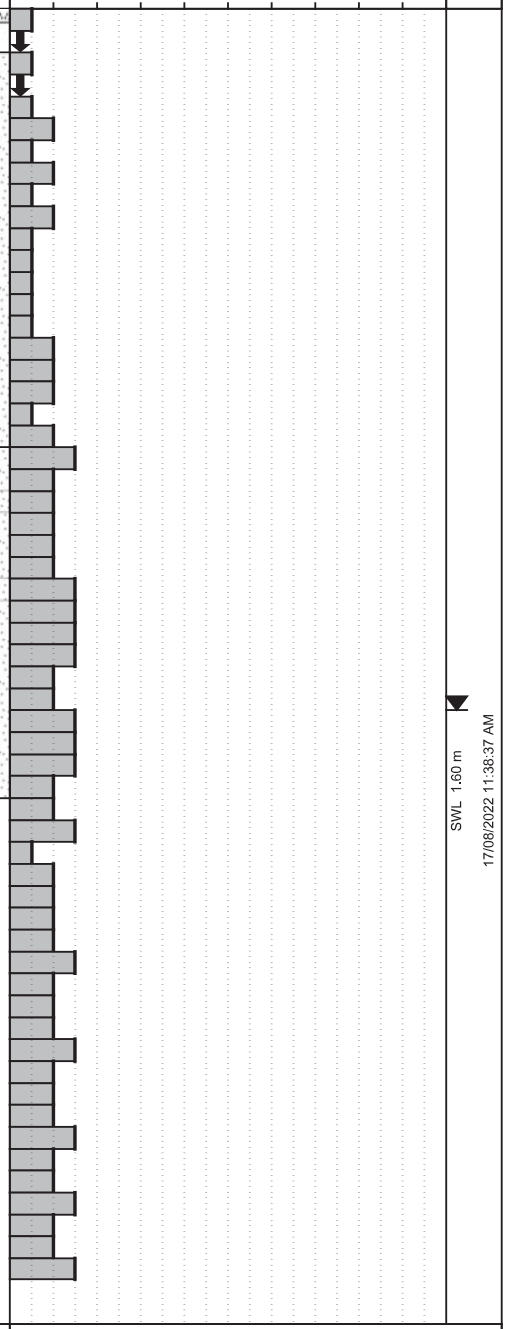
HAND AUGER & SCALA LOG

Geoconsult GEOTECHNICAL CONSULTANTS

No.:	Job No.:
HA-06	CO124

Client:	Project:		Date:
Lochlea Farming Co Ltd	606 Ridge Road		17/08/2022
Location:	**Coordinates:**	**Ground Level:**	**Sheet:**
Motukarara	E 1,565,085.13 , N 5,158,066.09		1 of 1

Soil Description	Samples	Depth (m)	Legend
Sandy TOPSOIL; dark brown. Moist; sand, medium. (TOPSOIL)		0.0	TS
Medium SAND; brownish orange streaked grey. Moist. (YOUNG BEACH DEPOSITS)		0.2, 0.4, 0.6, 0.8	
Fine to medium SAND; blueish grey. Wet. (YOUNG BEACH DEPOSITS)		1.0	
1.1m - 1.2m: Highly dialatent SILT		1.2	
1.3m - 1.4m: Highly dialatent SILT		1.4	
1.6m: Saturated		1.6	
EOH:1.80 m		1.8, 2.0, 2.2, 2.4, 2.6, 2.8	



Hand Auger Remarks:

Scala Remarks:

Logged By:	Checked By:	Hole Depth:	Legend:
HG	WJS	2.90 m	In flow ▷ / Out flow ◁ / Standing Water Level ▼

Produced with Core-GS

Printed: 26/08/2022 1:45:55 PM

HAND AUGER & SCALA LOG

Geoconsult GEOTECHNICAL CONSULTANTS

No.: HA-07			
Job No.: CO124			
Client: Lochlea Farming Co Ltd	**Project:** 606 Ridge Road		**Date:** 17/08/2022
Location: Motukarara	**Coordinates:** E 1,565,176.90 , N 5,158,013.04	**Ground Level:**	**Sheet:** 1 of 1

Soil Description	Samples	Depth (m)	Legend
Sandy TOPSOIL; dark brown. Moist; sand, fine to medium. (TOPSOIL)		0.0	TS
Fine to medium SAND with minor organic silt; brown. Moist. (TOPSOIL)		0.2	
Fine to medium SAND; orangish brown streaked grey. Moist. (YOUNG BEACH DEPOSITS)		0.4	
0.7m: 50mm thick band of SILT with minor sand		0.6	
		0.8	
0.9m: Becomes grey mottled orange and wet		1.0	
1.1m: 50mm thick band of SILT		1.2	
		1.4	
1.4m: Becomes blueish grey mottled orange		1.6	
1.5m: 100mm band of highly dialatent SILT		1.8	
1.9m: Saturated		2.0	
EOH:2.00 m		2.2	
		2.4	
		2.6	
		2.8	

Scala Penetrometer (Blows / 50mm)

2 4 6 8 10 12 14 16 18

Water

SWL 1.90 m
17/08/2022 12:28:21 PM

Hand Auger Remarks:
2m

Scala Remarks:

Logged By:	Checked By:	Hole Depth:	Legend:
HG	WJS	2.90 m	In flow, Out flow, Standing Water Level

Produced with Core-GS

Printed: 26/08/2022 1:45:55 PM

HAND AUGER & SCALA LOG

Geoconsult GEOTECHNICAL CONSULTANTS

No.: HA-08

Job No.: CO124

Client:	Project:		Date:
Lochlea Farming Co Ltd	606 Ridge Road		17/08/2022
Location: Motukarara	**Coordinates:** E 1,565,127.03 , N 5,158,016.78	**Ground Level:**	**Sheet:** 1 of 1

Soil Description	Samples	Depth (m)	Legend	Scala Penetrometer (Blows / 50mm)	Water
Sandy TOPSOIL; dark brown. Moist; sand, fine to medium. (TOPSOIL)		0	TS	2 4 6 8 10 12 14 16 18	
Fine to medium SAND with minor organic silt; brown. Moist. (TOPSOIL)		0.2			
Fine to medium SAND; orangish brown mottled grey. Moist. (YOUNG BEACH DEPOSITS)		0.4			
0.5m - 0.8m: Becomes silty SAND		0.6			
		0.8			
0.9m: Becomes grey mottled orange and wet		1.0			
1.1m: 50mm band of highly dialatent SILT with minor sand		1.2			
1.2m: Becomes blueish grey mottled orange		1.4			
1.4m: 100mm band of highly dialatent SILT with minor sand		1.6			
		1.8			SWL 1.80 m 17/08/2022 1:03:25 PM
EOH:2.00 m		2.0			
		2.2			
		2.4			
		2.6			
		2.8			

Hand Auger Remarks:
2m end due to proximity to CPT

Scala Remarks:

Logged By:	Checked By:	Hole Depth:	Legend:
HG	WJS	2.90 m	Out flow ◁ In flow ▷ Standing Water Level ▼

Produced with Core-GS

Printed: 26/08/2022 1:45:56 PM

HAND AUGER & SCALA LOG

Geoconsult GEOTECHNICAL CONSULTANTS

No.:	Job No.:
HA-09	CO124

Client:	Project:	Date:
Lochlea Farming Co Ltd	606 Ridge Road	17/08/2022

Location:	Coordinates:	Ground Level:	Sheet:
Motukarara	E 1,565,155.76 , N 5,158,020.92		1 of 1

Soil Description	Samples	Depth (m)	Legend	Scala Penetrometer (Blows / 50mm)	Water
Sandy TOPSOIL; dark brown. Moist; sand, fine to medium. (TOPSOIL)		0.0		2 4 6 8 10 12 14 16 18	Groundwater Not Encountered
Fine to medium SAND with minor organic silt; brown. Moist. (TOPSOIL)		0.2			
Fine to medium SAND; orangish brown streaked grey. Moist. (YOUNG BEACH DEPOSITS)		0.4			
0.5m: Becomes silty SAND		0.6			
0.7m: Becomes grey mottled orange and wet		0.8			
0.8m: Without silt		1.0			
EOH:1.00 m		1.2			
		1.4			
		1.6			
		1.8			
		2.0			
		2.2			
		2.4			
		2.6			
		2.8			

Hand Auger Remarks:
1m fill checker

Scala Remarks:

Logged By:	Checked By:	Hole Depth:	Legend:
HG	WJS	1.00 m	Out flow ◁ In flow ▷ Standing Water Level ▼

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12 Marylands Place, Middleton, Christchurch 8024
PO Box 10043 Phillipstown, Christchurch 8145
office@geoconsult.co.nz
https://www.geoconsult.co.nz/

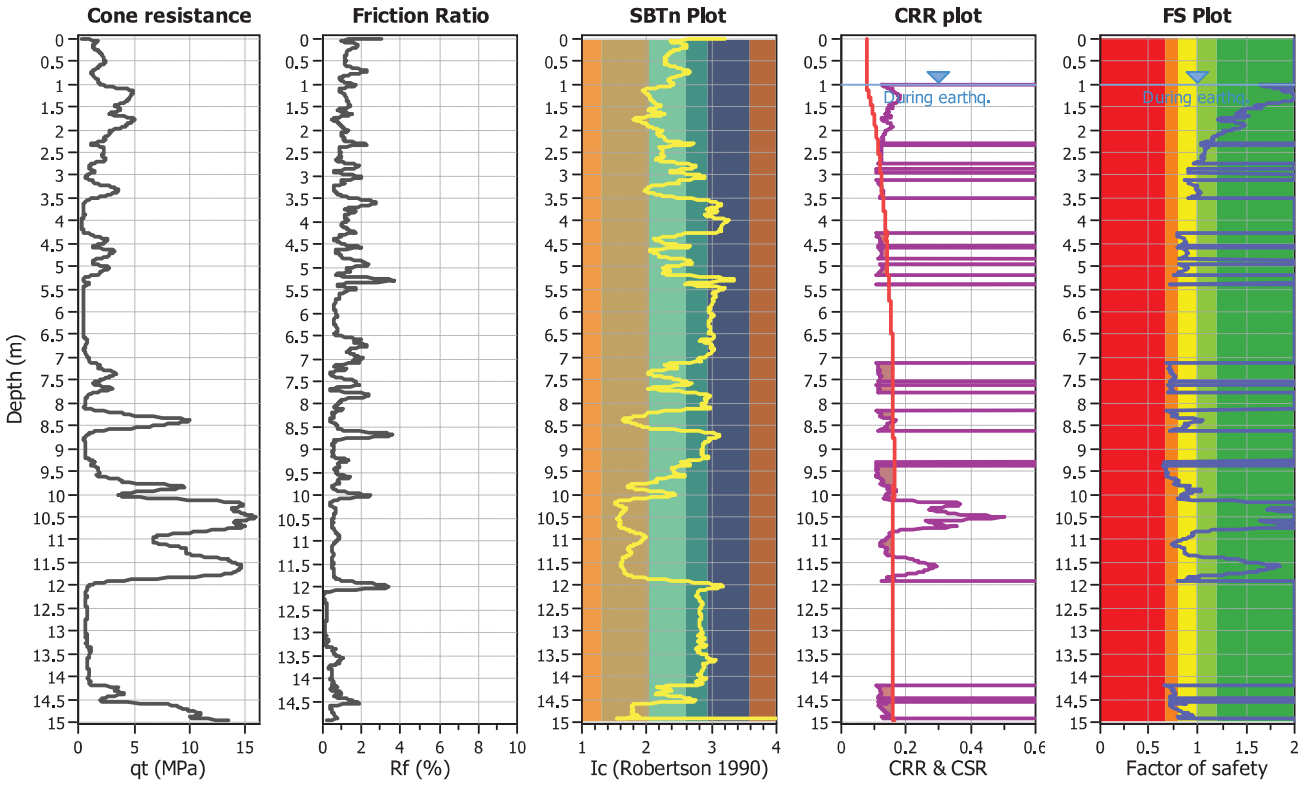
LIQUEFACTION ANALYSIS REPORT

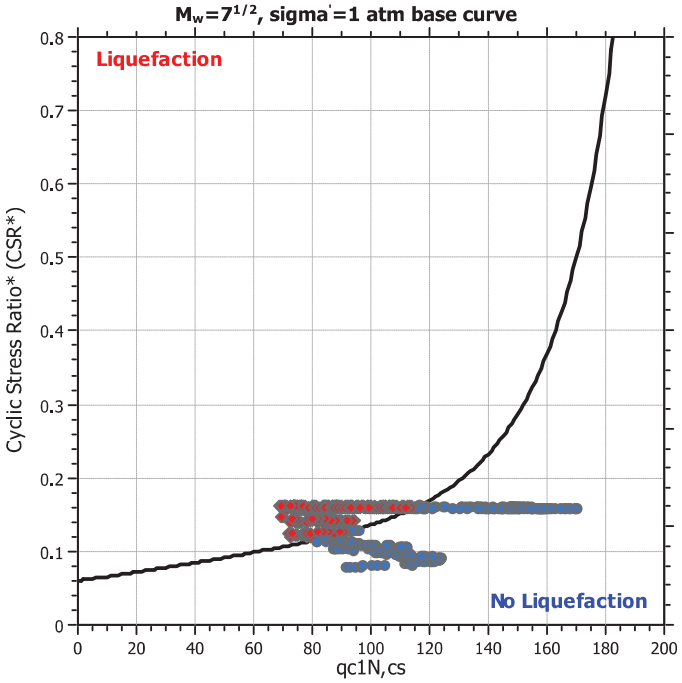
Project title : CO124 **Location : 606 Ridge Road, Motukarara**

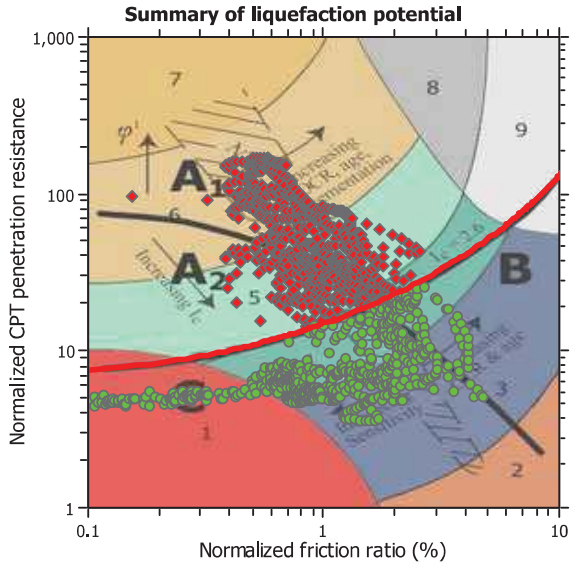
CPT file : CPT 1 - SLS1

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A		
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth applied:	No
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	Limit depth:	N/A
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes	MSF method:	Method

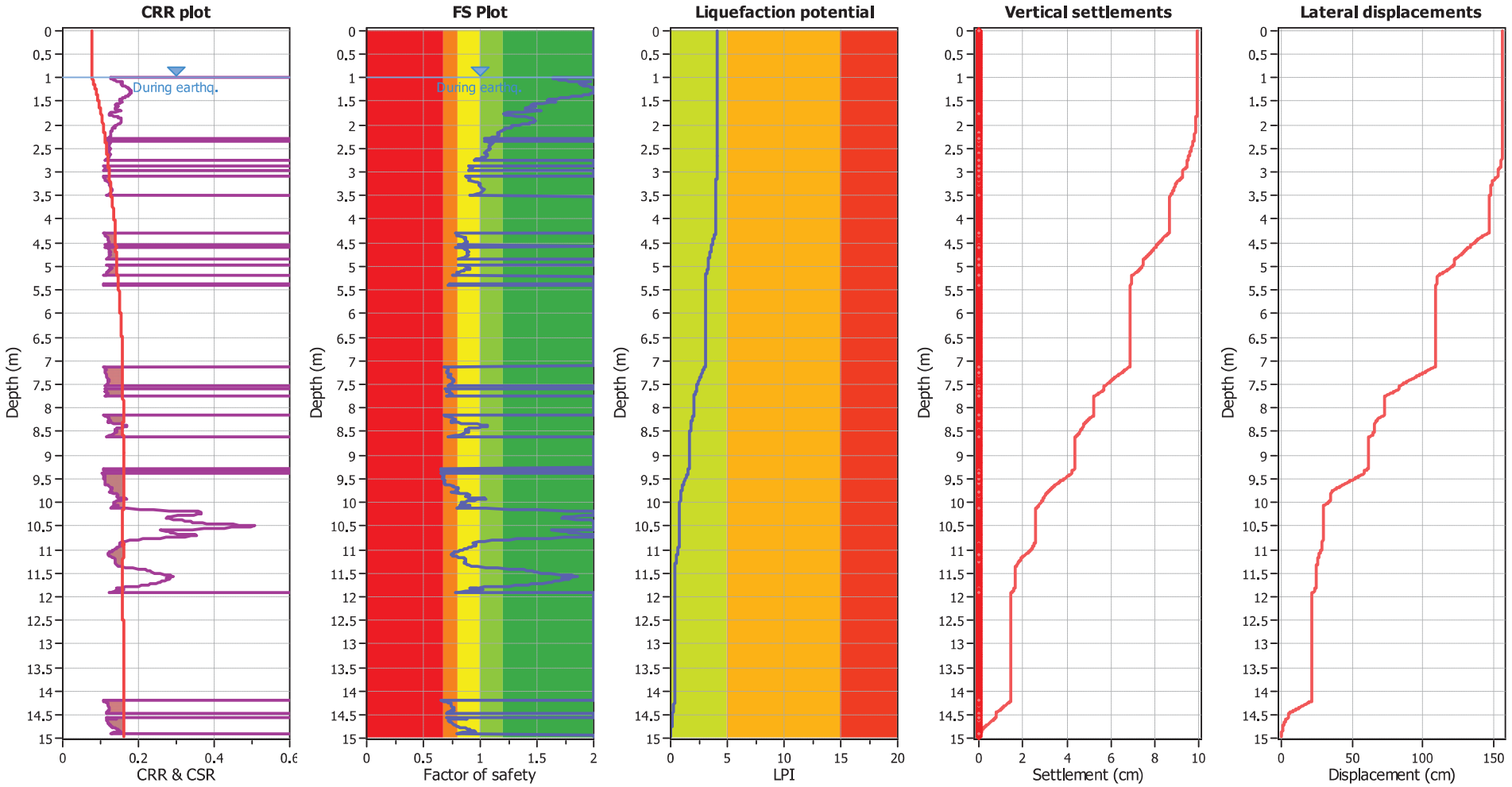






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

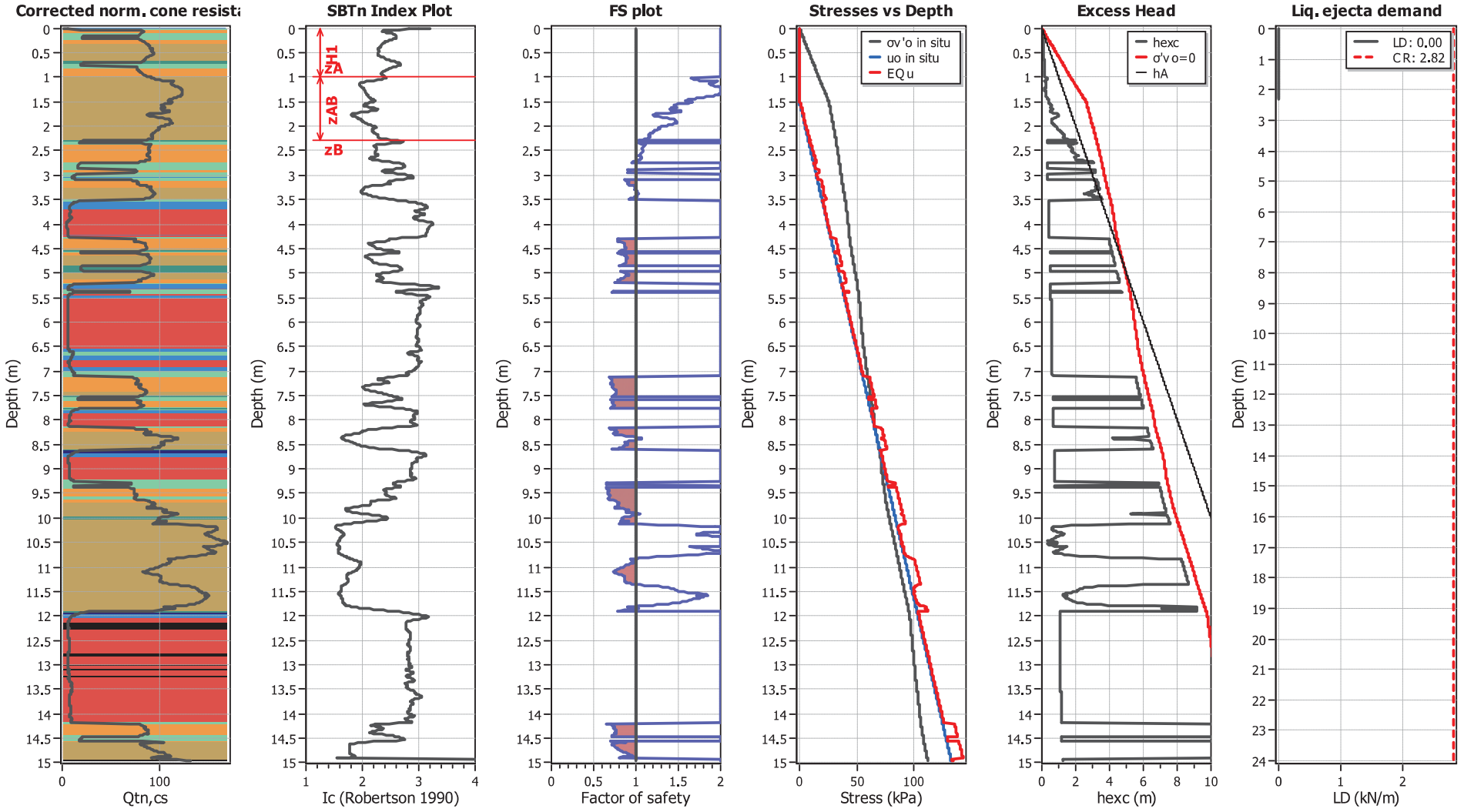
F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Ejecta Severity Estimation



12 Marylands Place, Middleton, Christchurch 8024
PO Box 10043 Phillipstown, Christchurch 8145
office@geoconsult.co.nz
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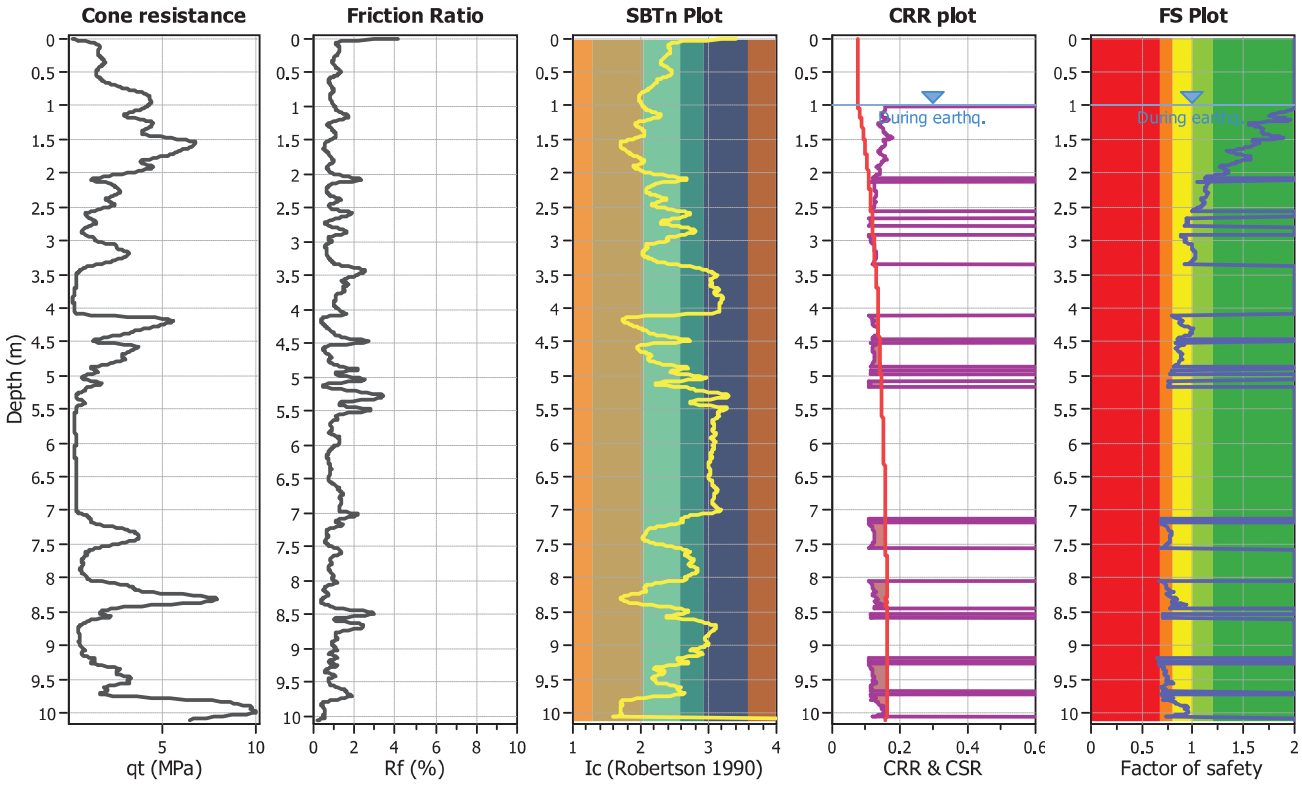
LIQUEFACTION ANALYSIS REPORT

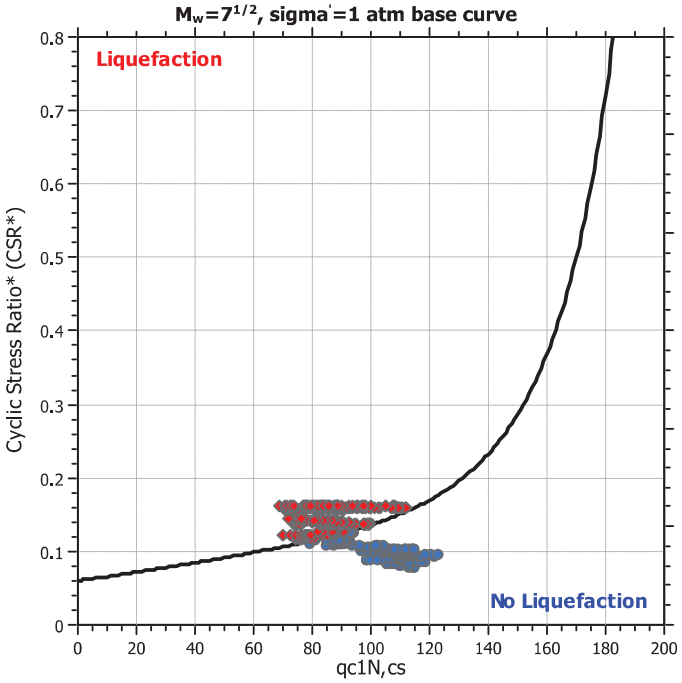
Project title : CO124 **Location : 606 Ridge Road, Motukarara**

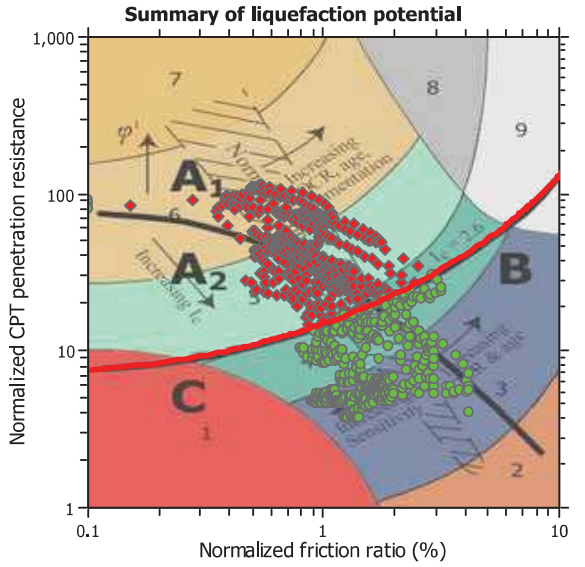
CPT file : CPT 2 - SLS1

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

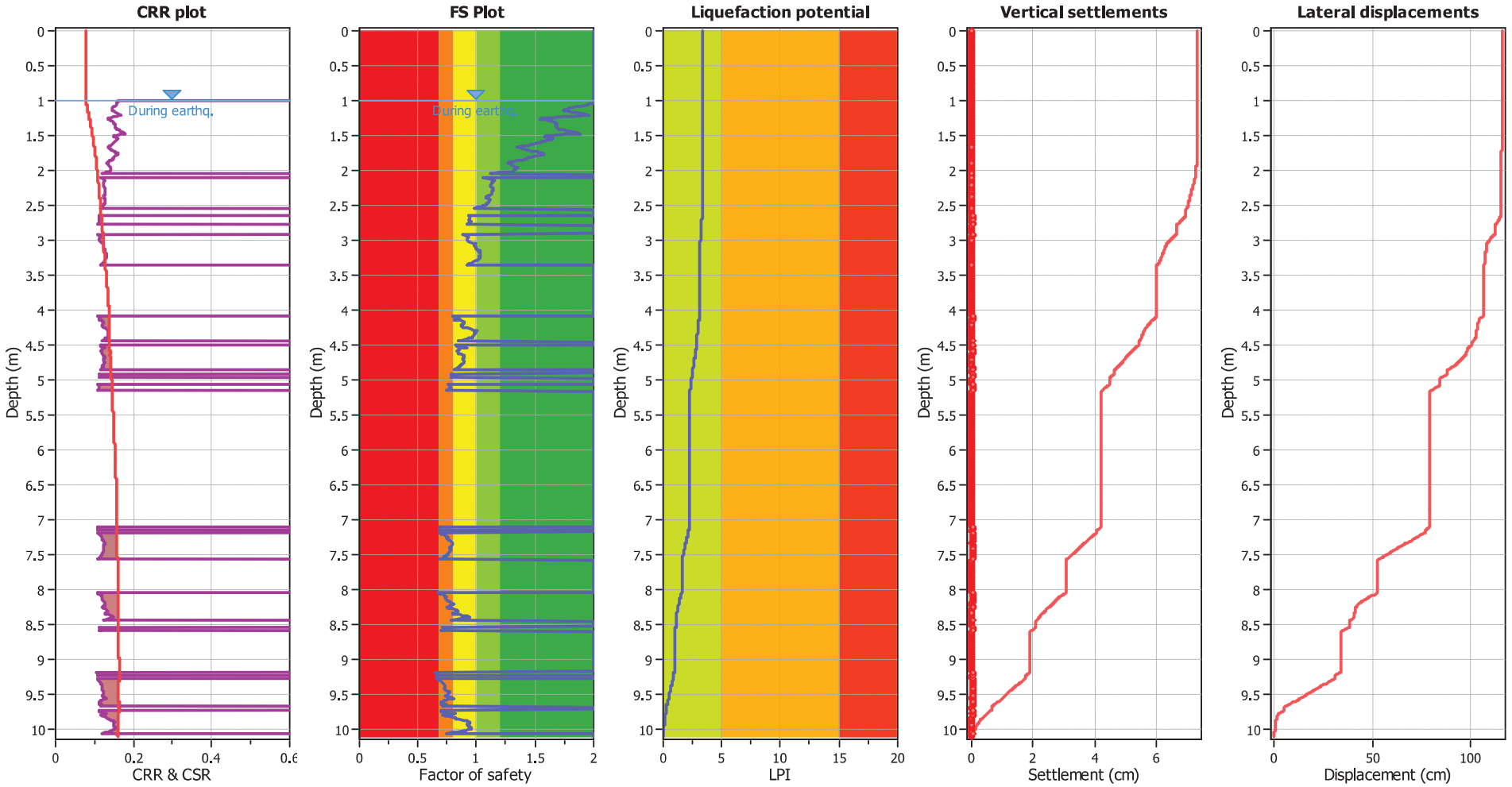






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

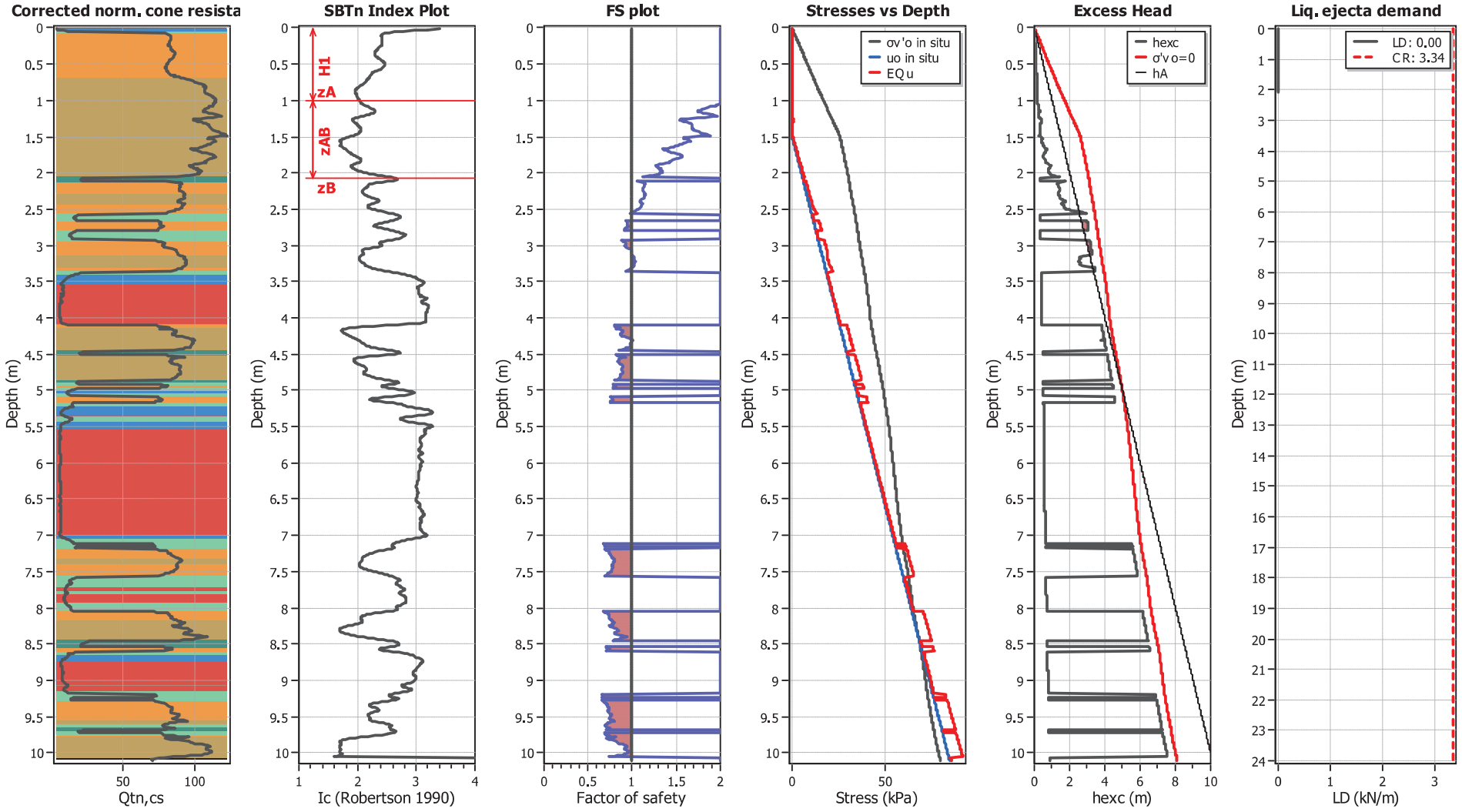
F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Ejecta Severity Estimation



12 Marylands Place, Middleton, Christchurch 8024
PO Box 10043 Phillipstown, Christchurch 8145
office@geoconsult.co.nz
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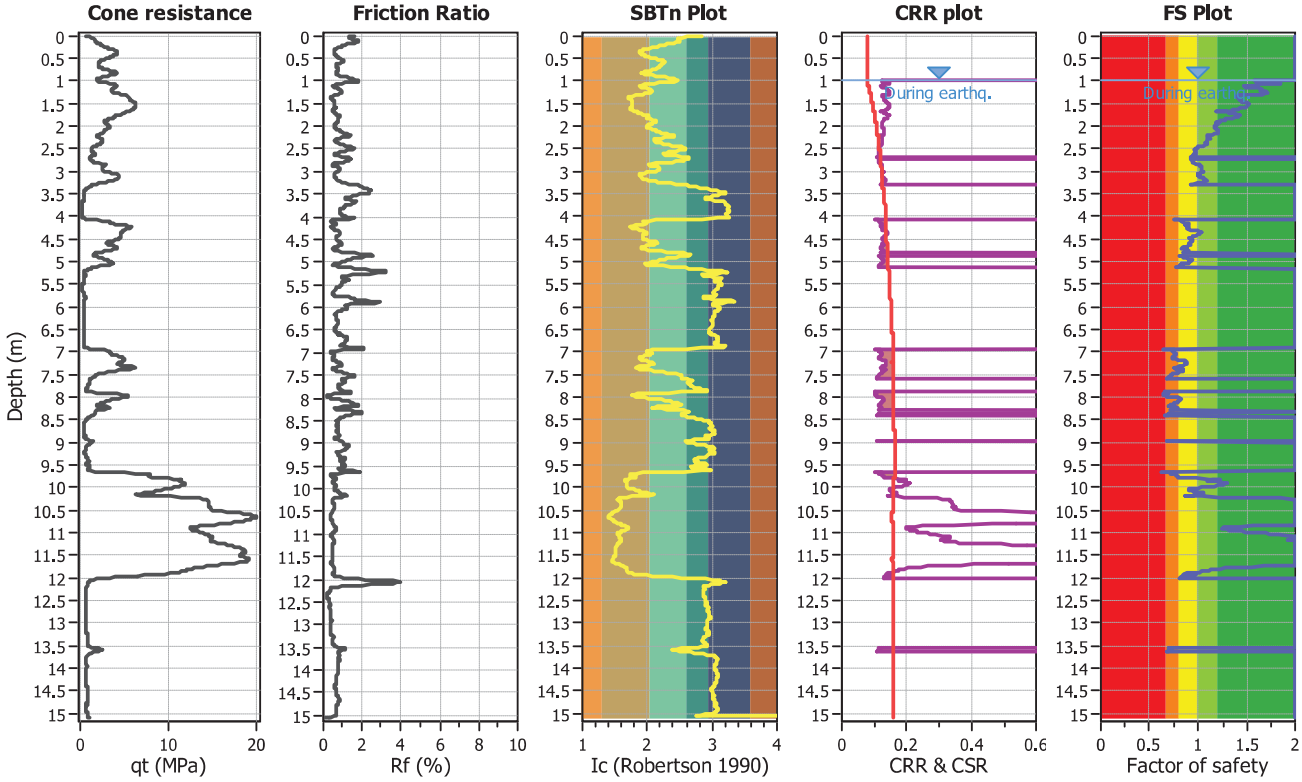
LIQUEFACTION ANALYSIS REPORT

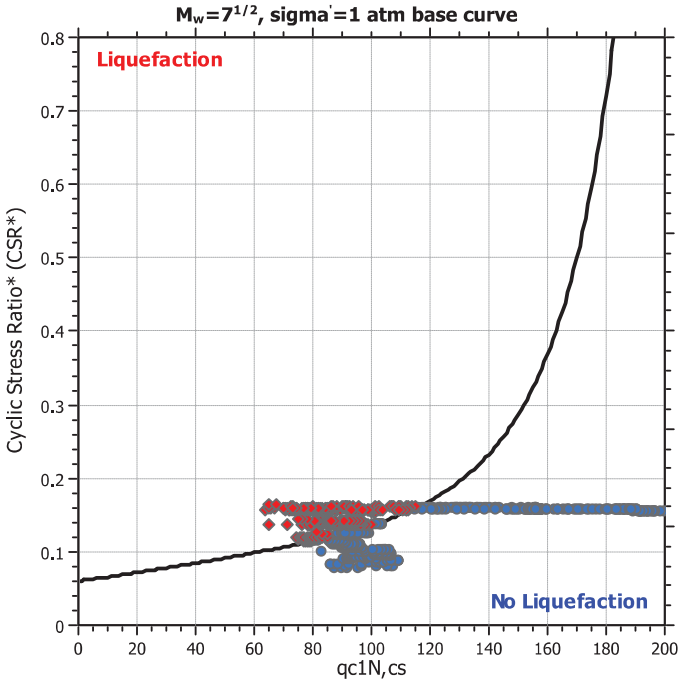
Project title : CO124 **Location : 606 Ridge Road, Motukarara**

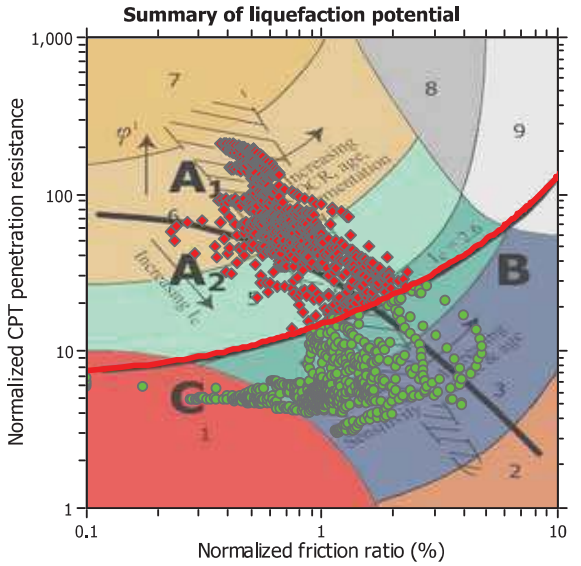
CPT file : CPT 3 - SLS1

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

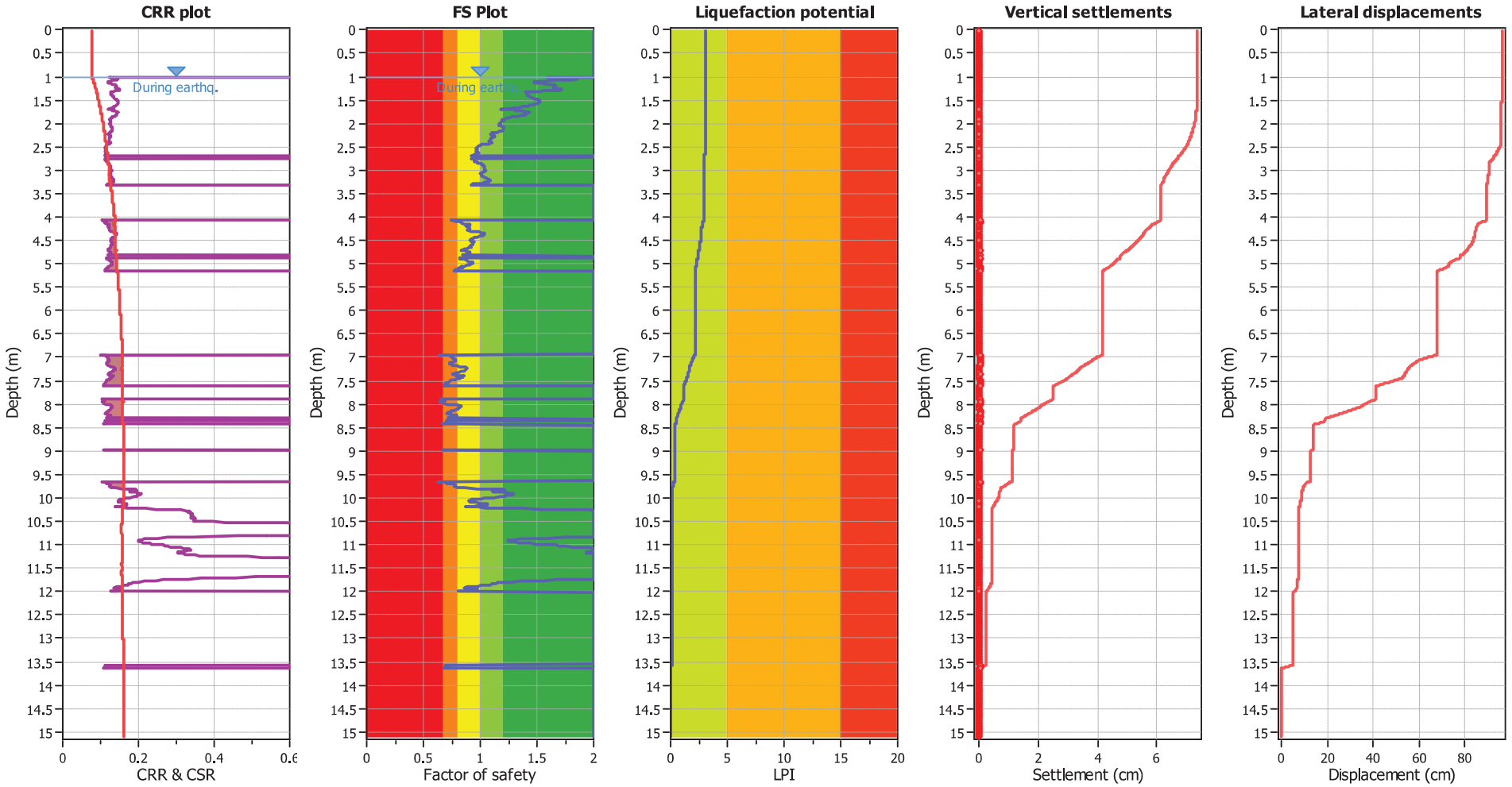






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

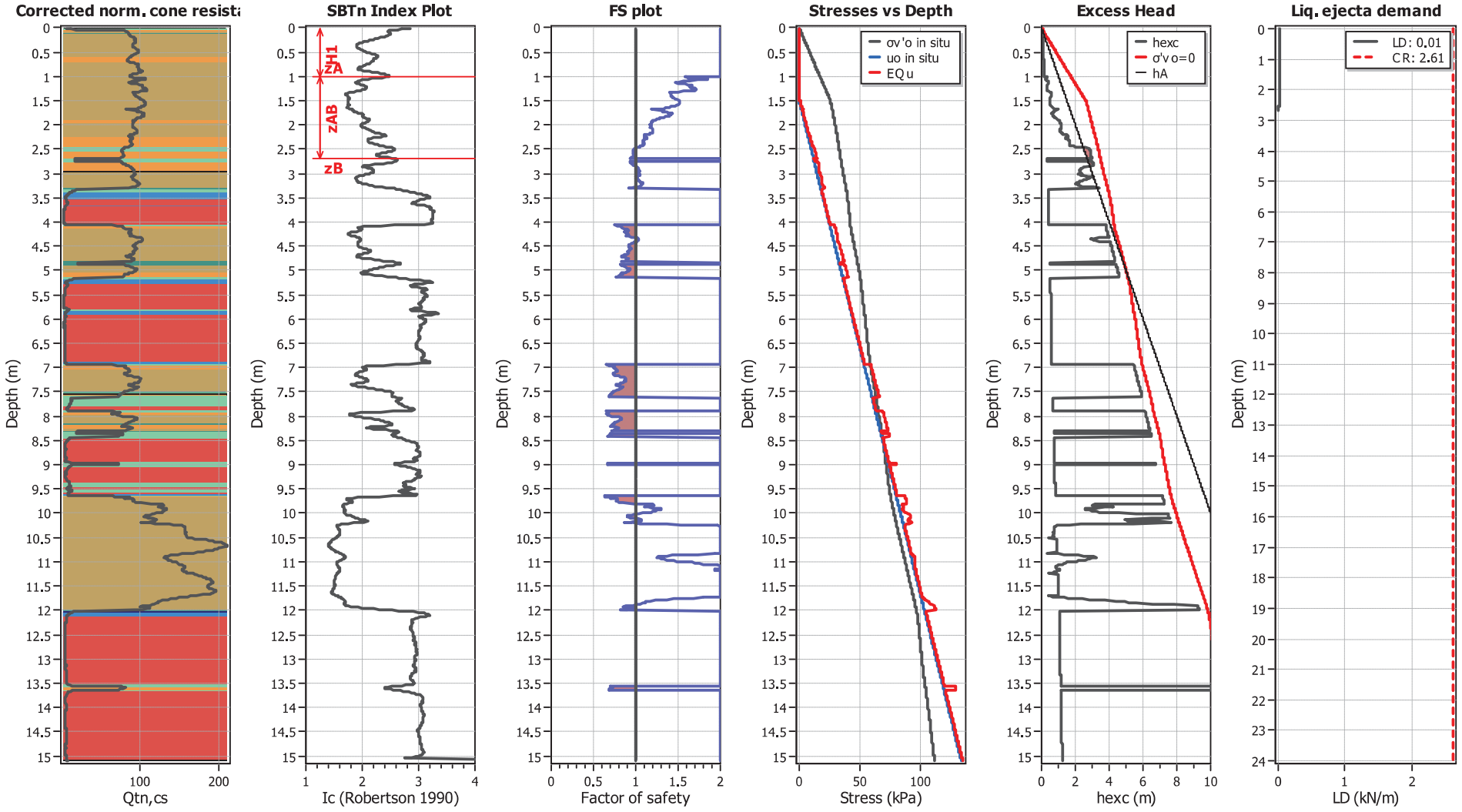
F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Ejecta Severity Estimation



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PO Box 10043 Phillipstown, Christchurch 8145
office@geoconsult.co.nz
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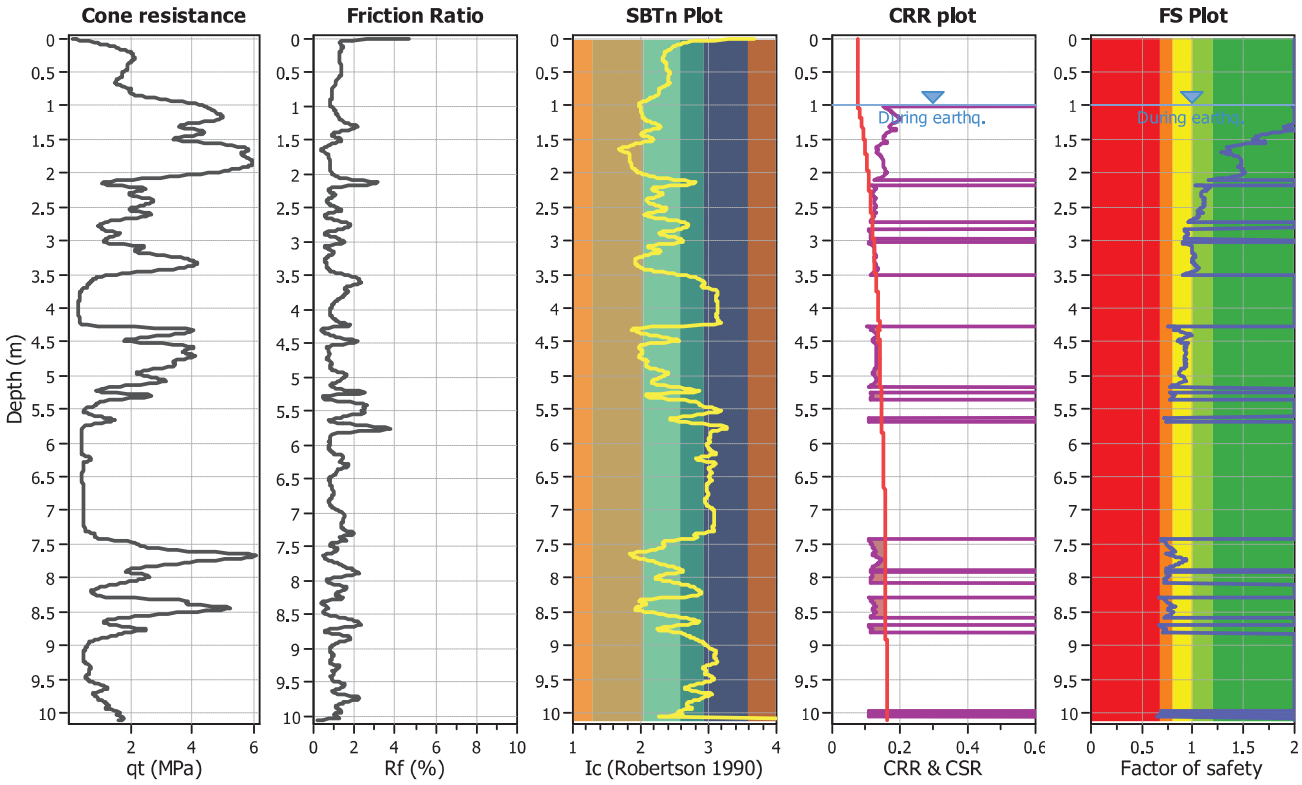
LIQUEFACTION ANALYSIS REPORT

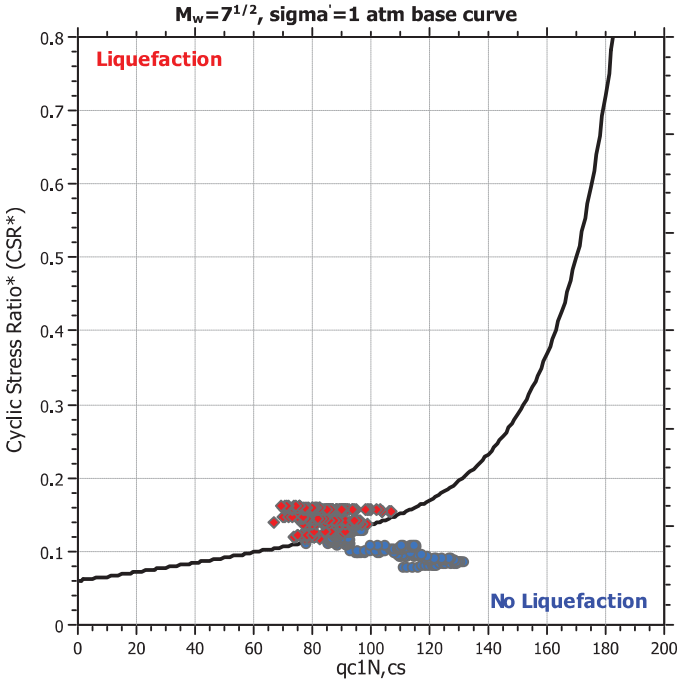
Project title : CO124 **Location : 606 Ridge Road, Motukarara**

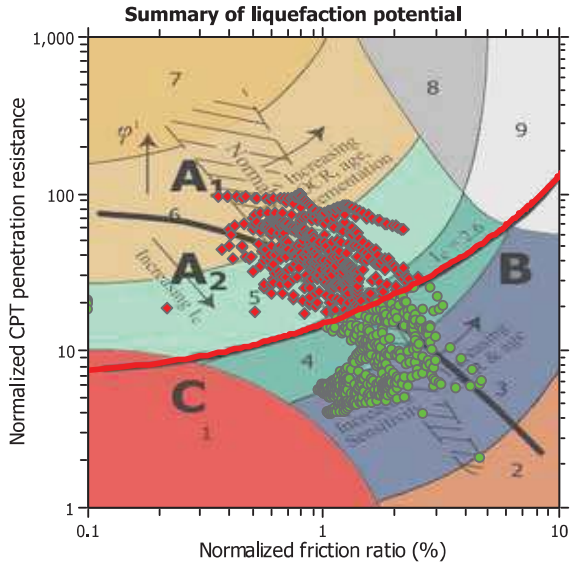
CPT file : CPT 4 - SLS1

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

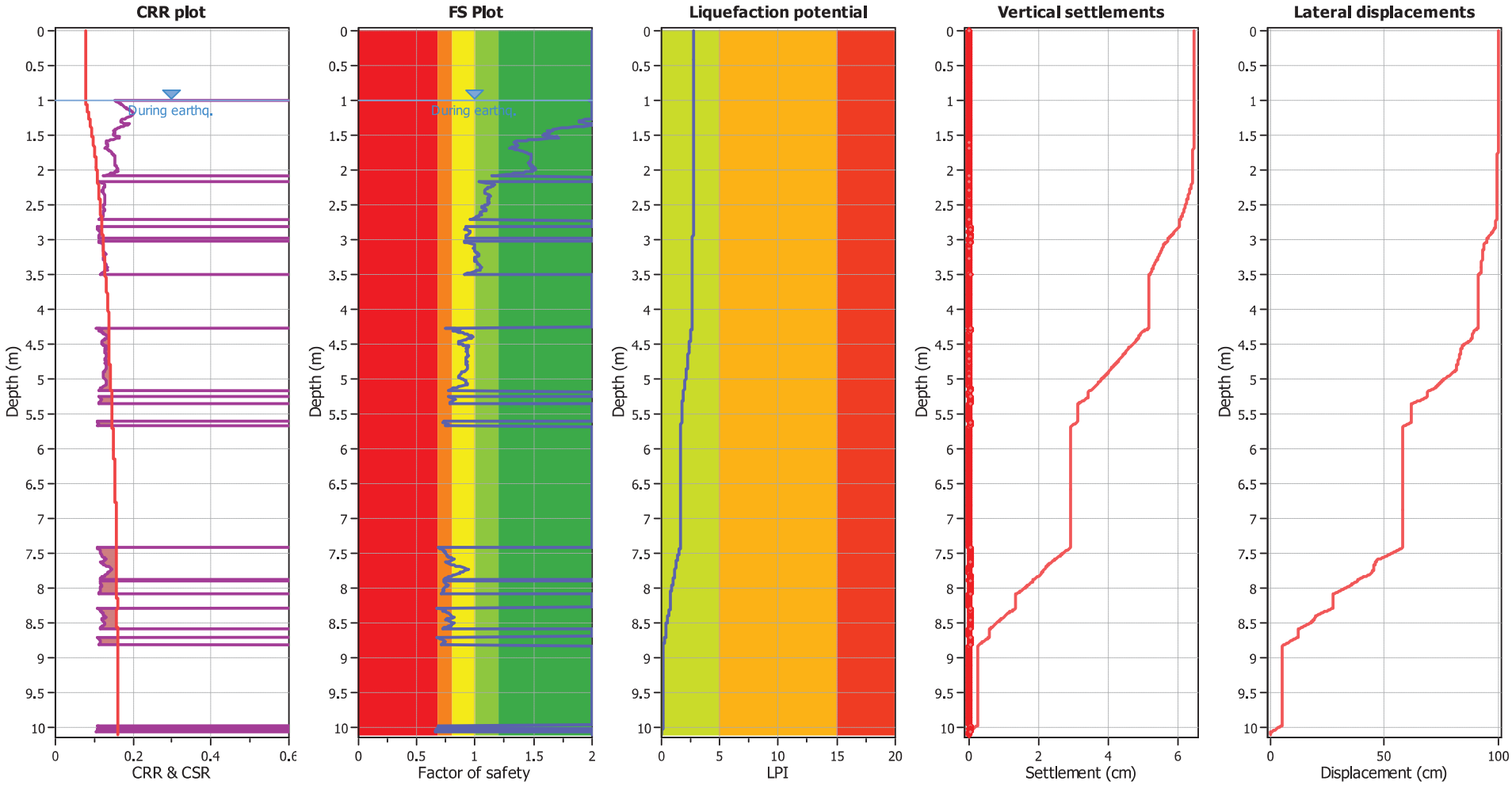






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

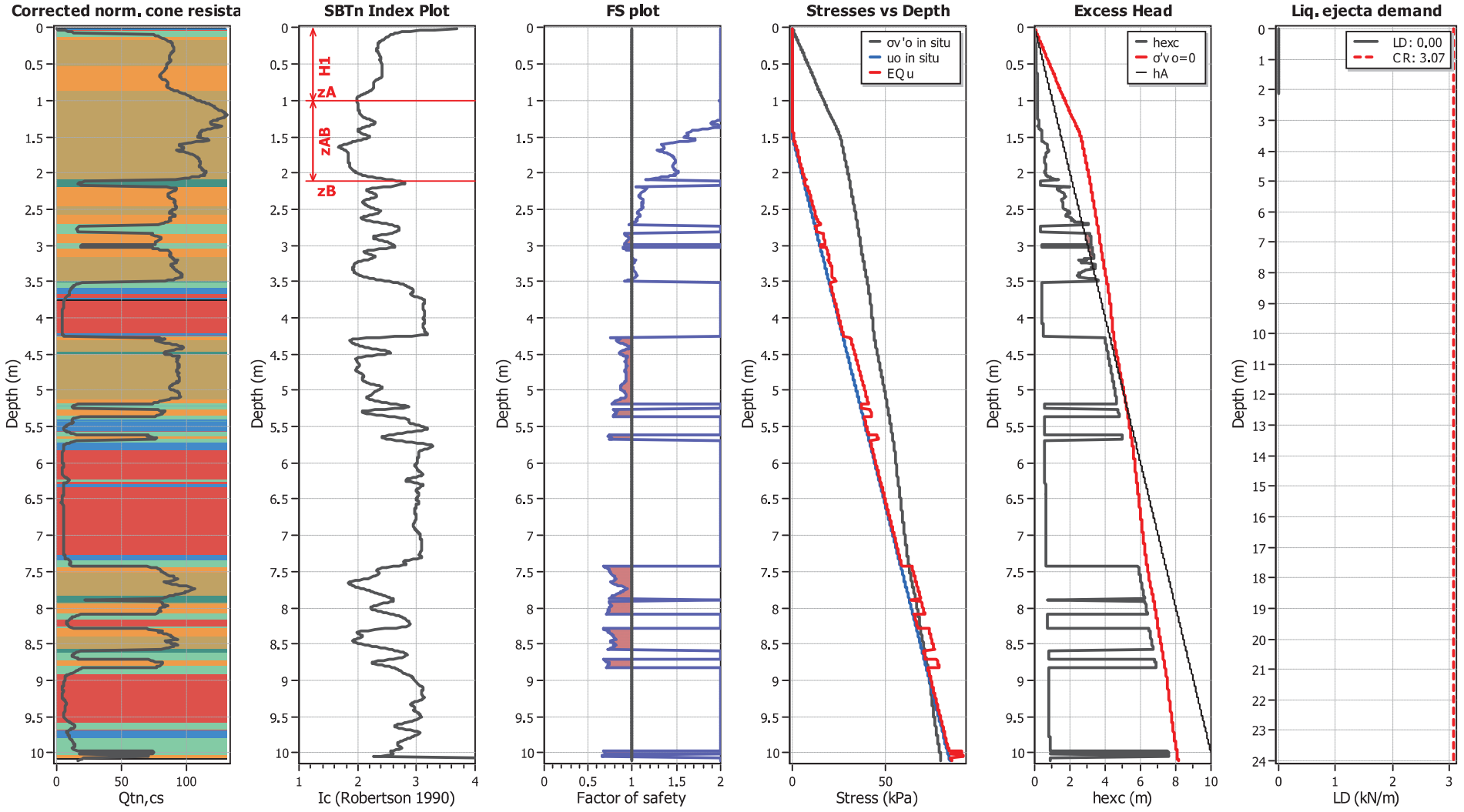
F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Ejecta Severity Estimation



12 Marylands Place, Middleton, Christchurch 8024
PO Box 10043 Phillipstown, Christchurch 8145
office@geoconsult.co.nz
https://www.geoconsult.co.nz/

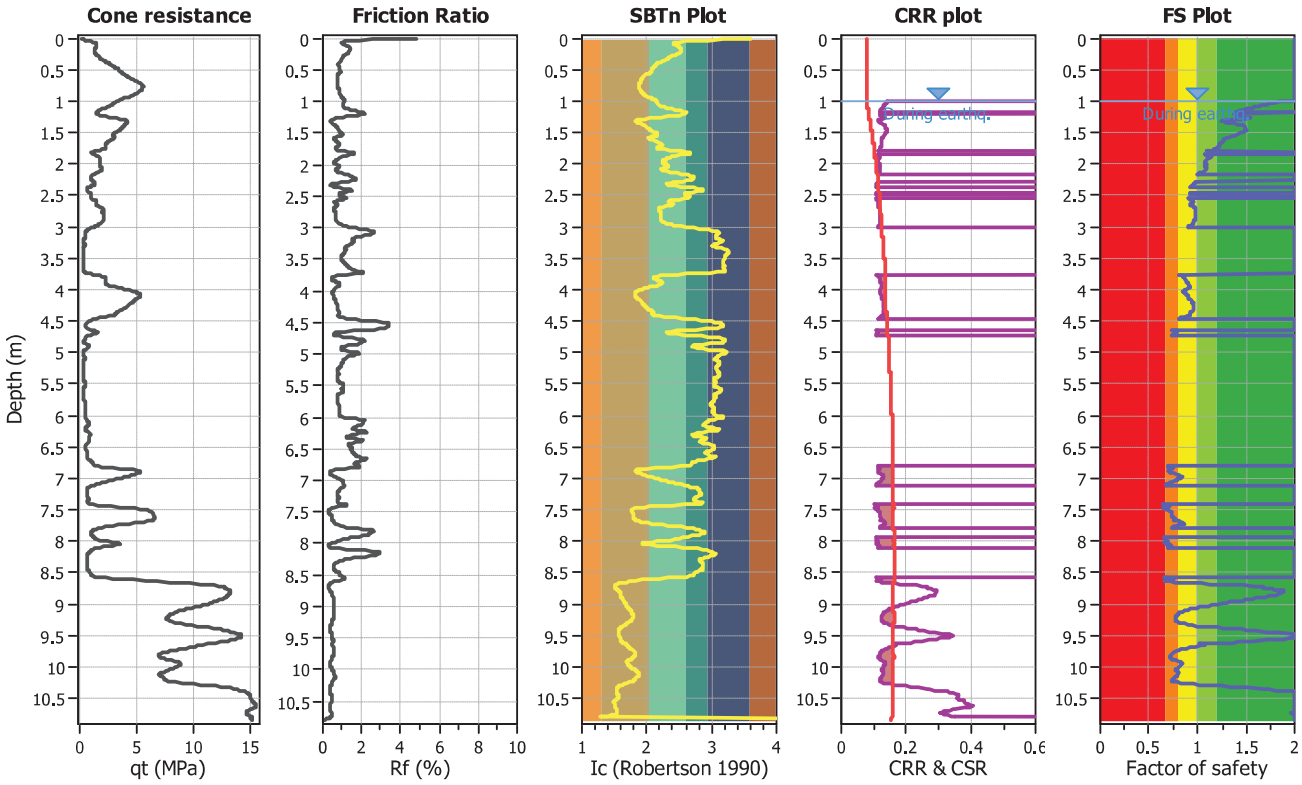
LIQUEFACTION ANALYSIS REPORT

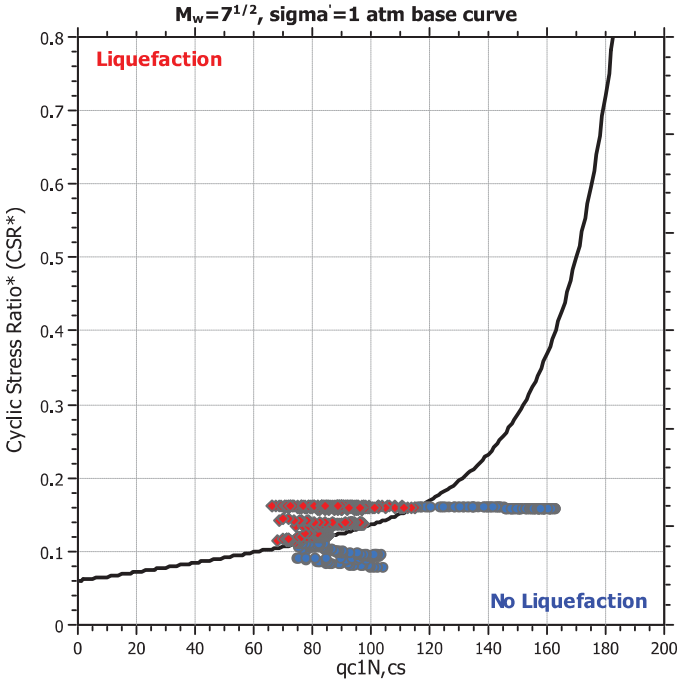
Project title : CO124 **Location : 606 Ridge Road, Motukarara**

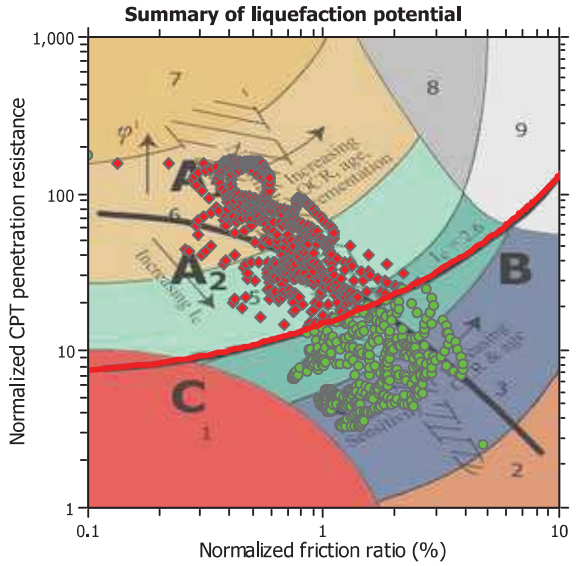
CPT file : CPT 5 - SLS1

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

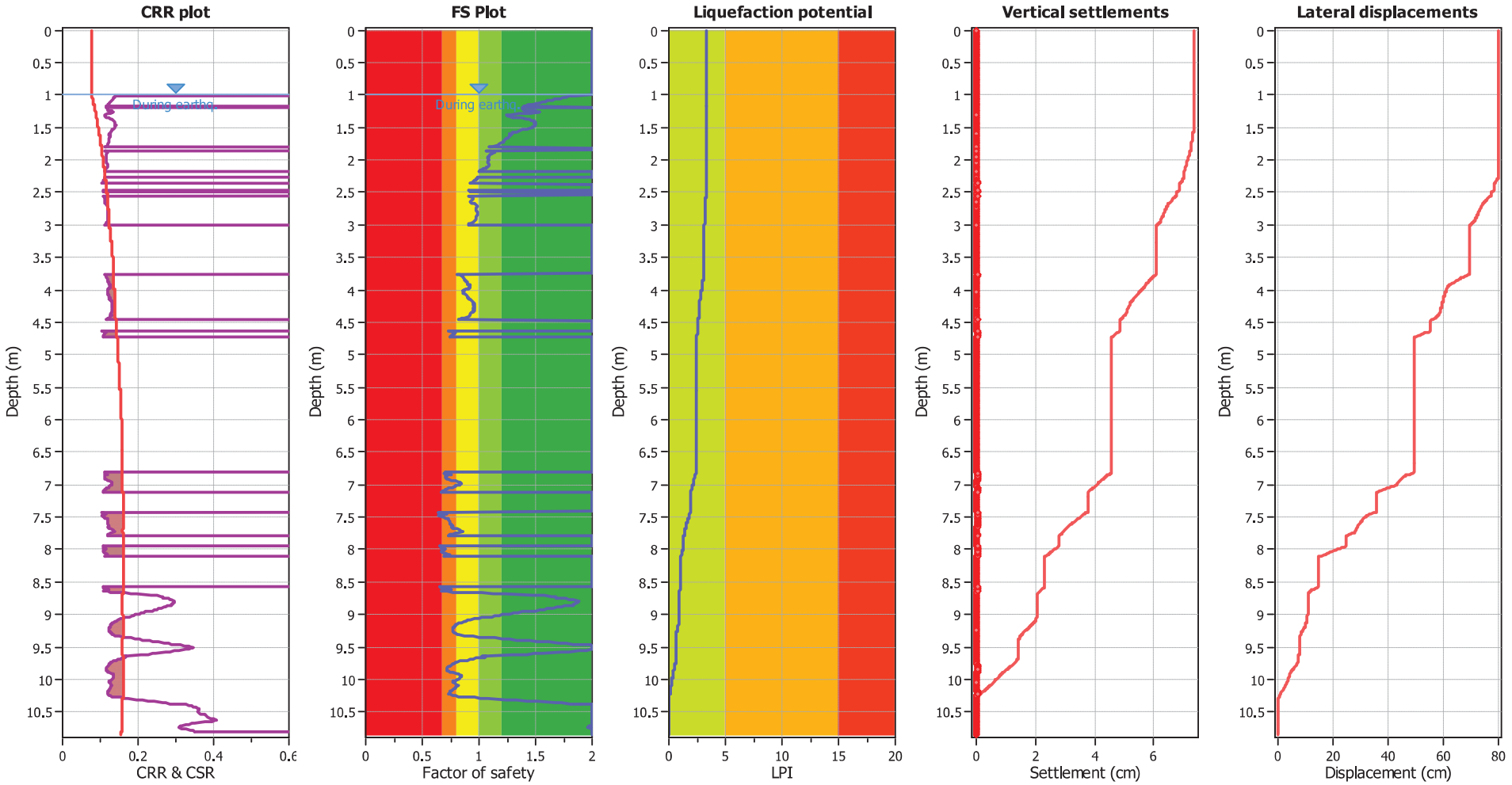






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

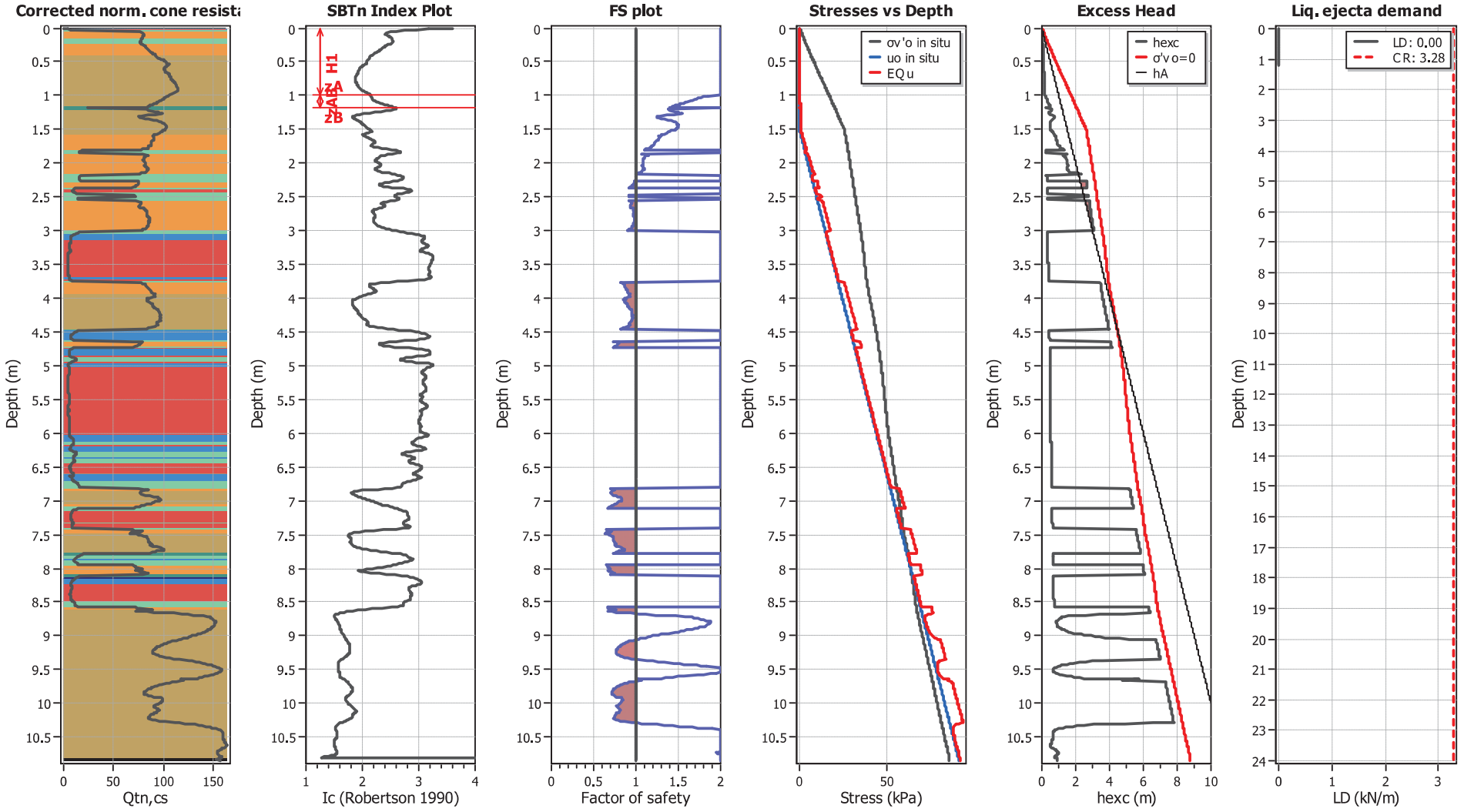
F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Ejecta Severity Estimation



12 Marylands Place, Middleton, Christchurch 8024
PO Box 10043 Phillipstown, Christchurch 8145
office@geoconsult.co.nz
https://www.geoconsult.co.nz/

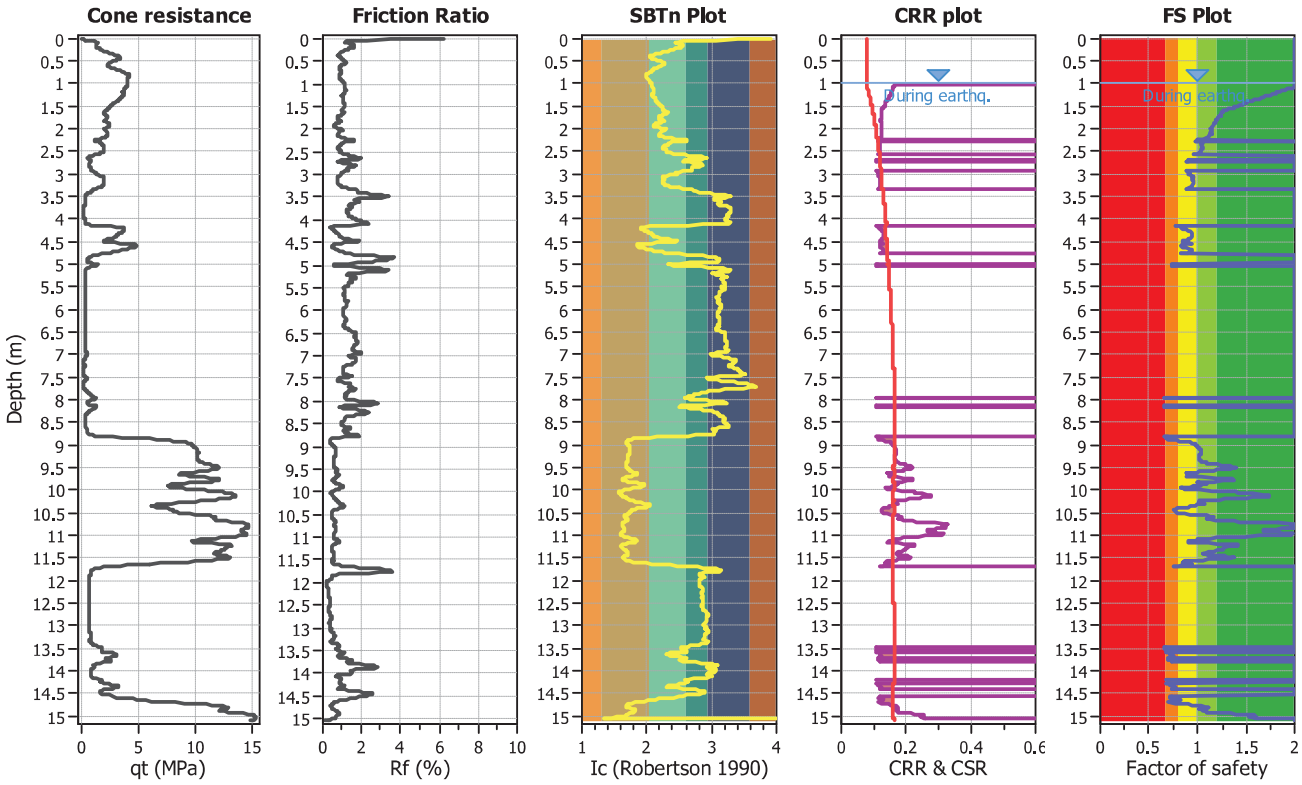
LIQUEFACTION ANALYSIS REPORT

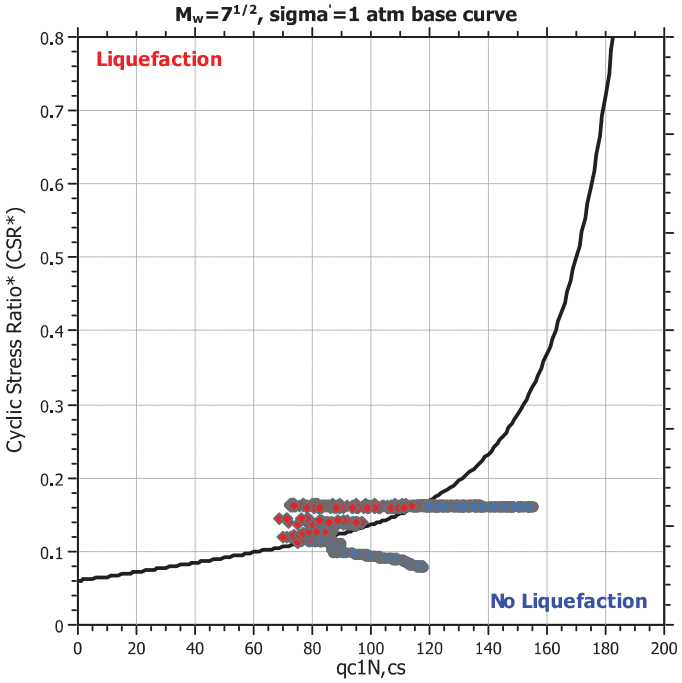
Project title : CO124 **Location : 606 Ridge Road, Motukarara**

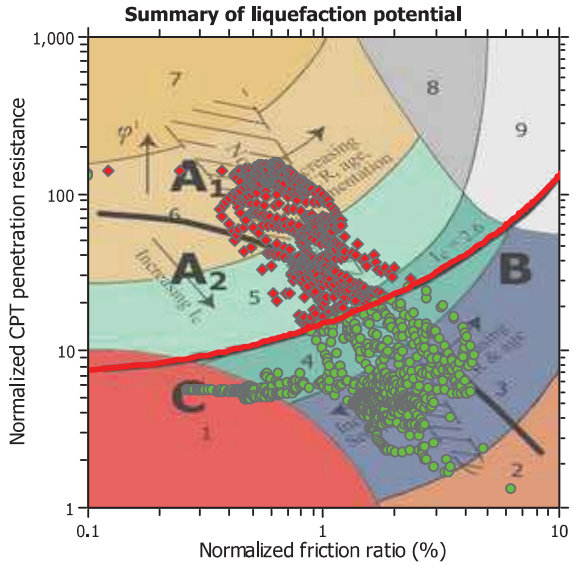
CPT file : CPT 6 - SLS1

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.13	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

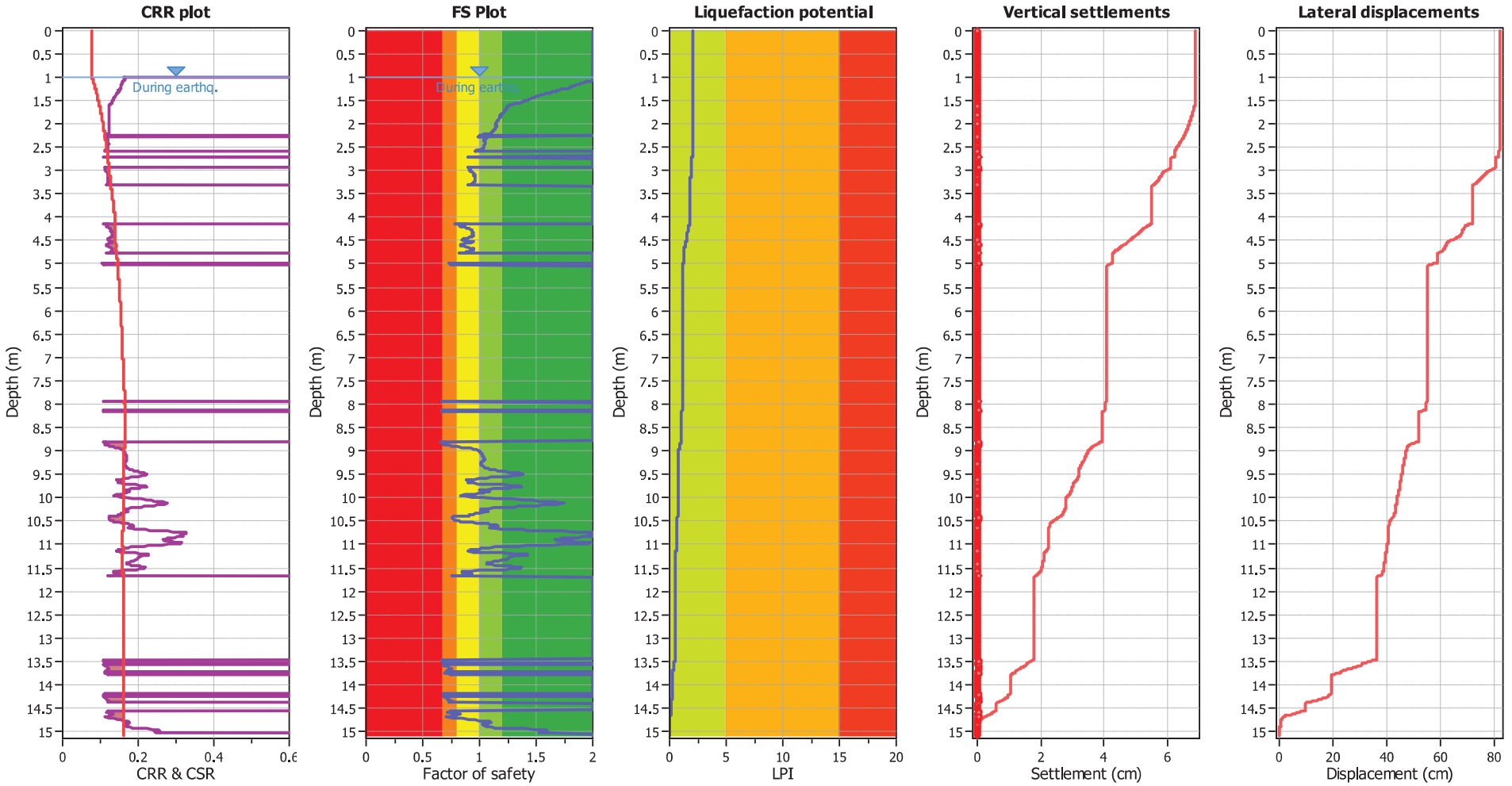






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

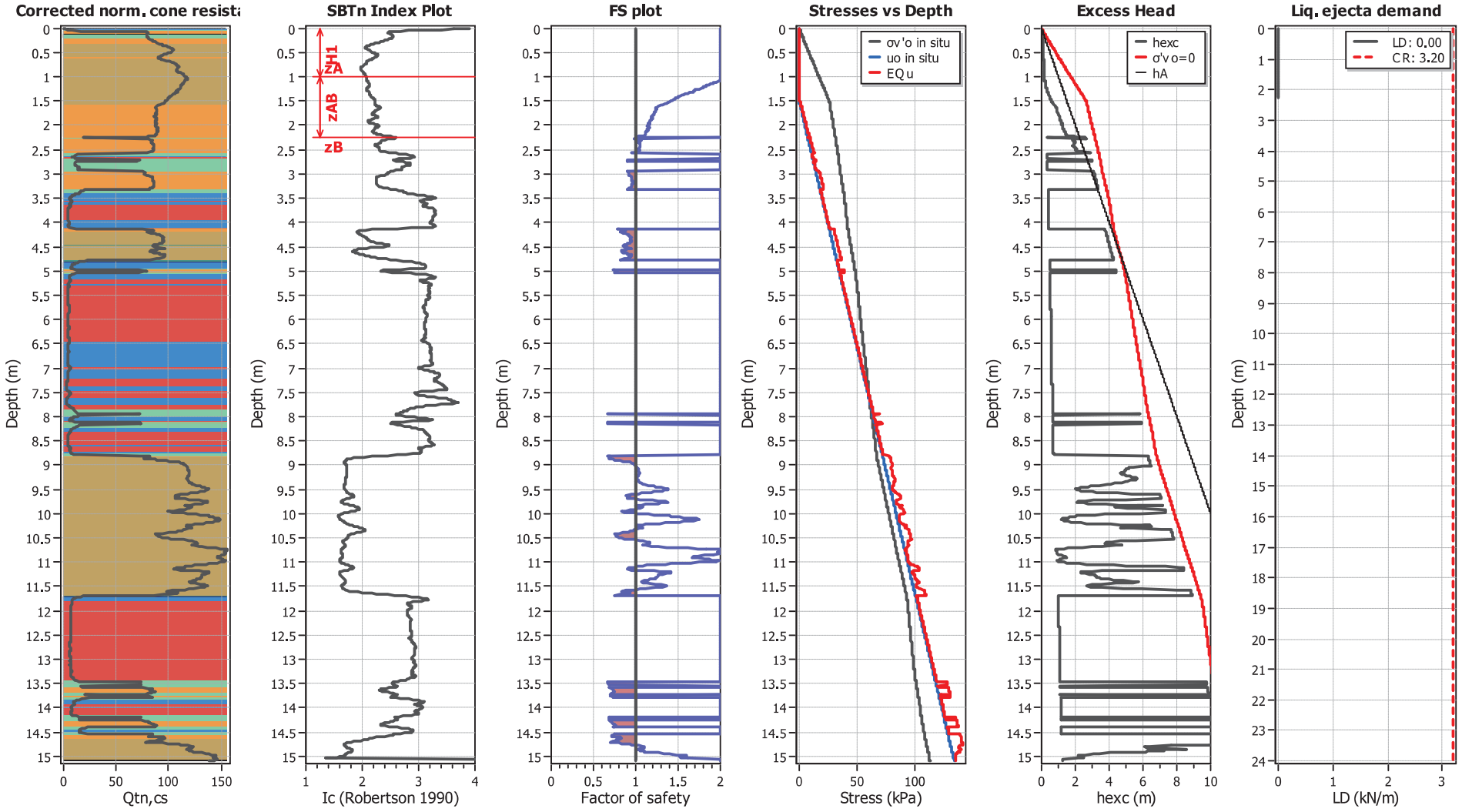
F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Ejecta Severity Estimation



12 Marylands Place, Middleton, Christchurch 8024
PO Box 10043 Phillipstown, Christchurch 8145
office@geoconsult.co.nz
https://www.geoconsult.co.nz/

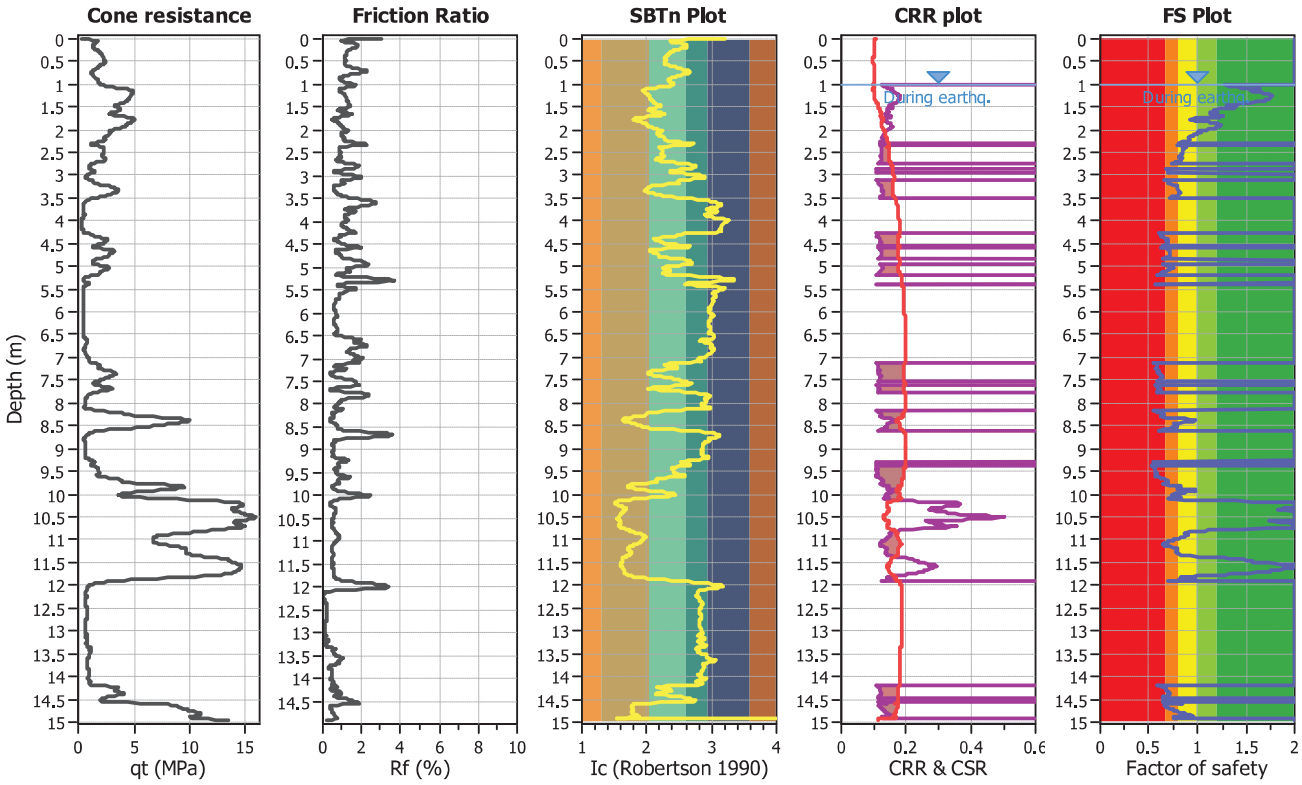
LIQUEFACTION ANALYSIS REPORT

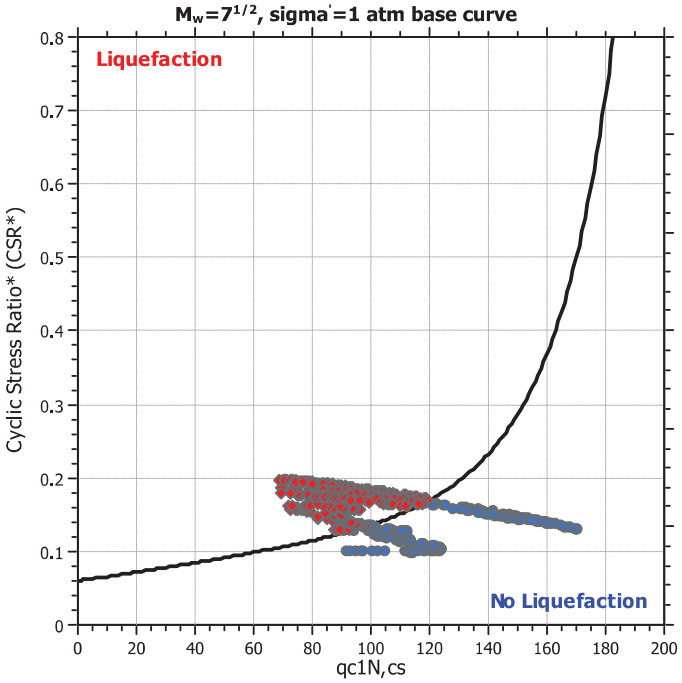
Project title : CO124 **Location : 606 Ridge Road, Motukarara**

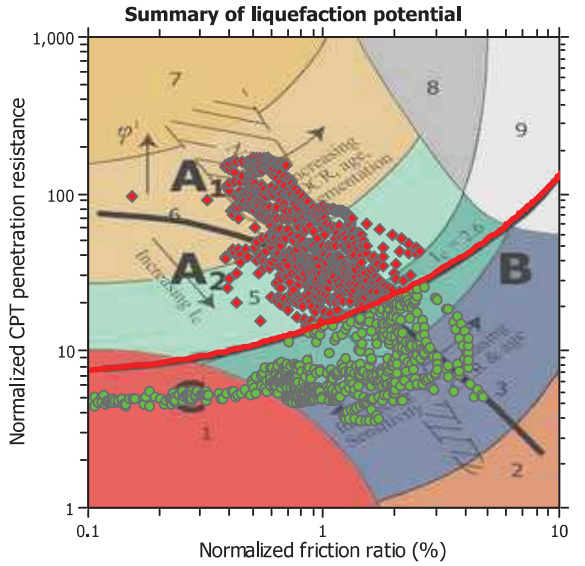
CPT file : CPT 1 - SLS2

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

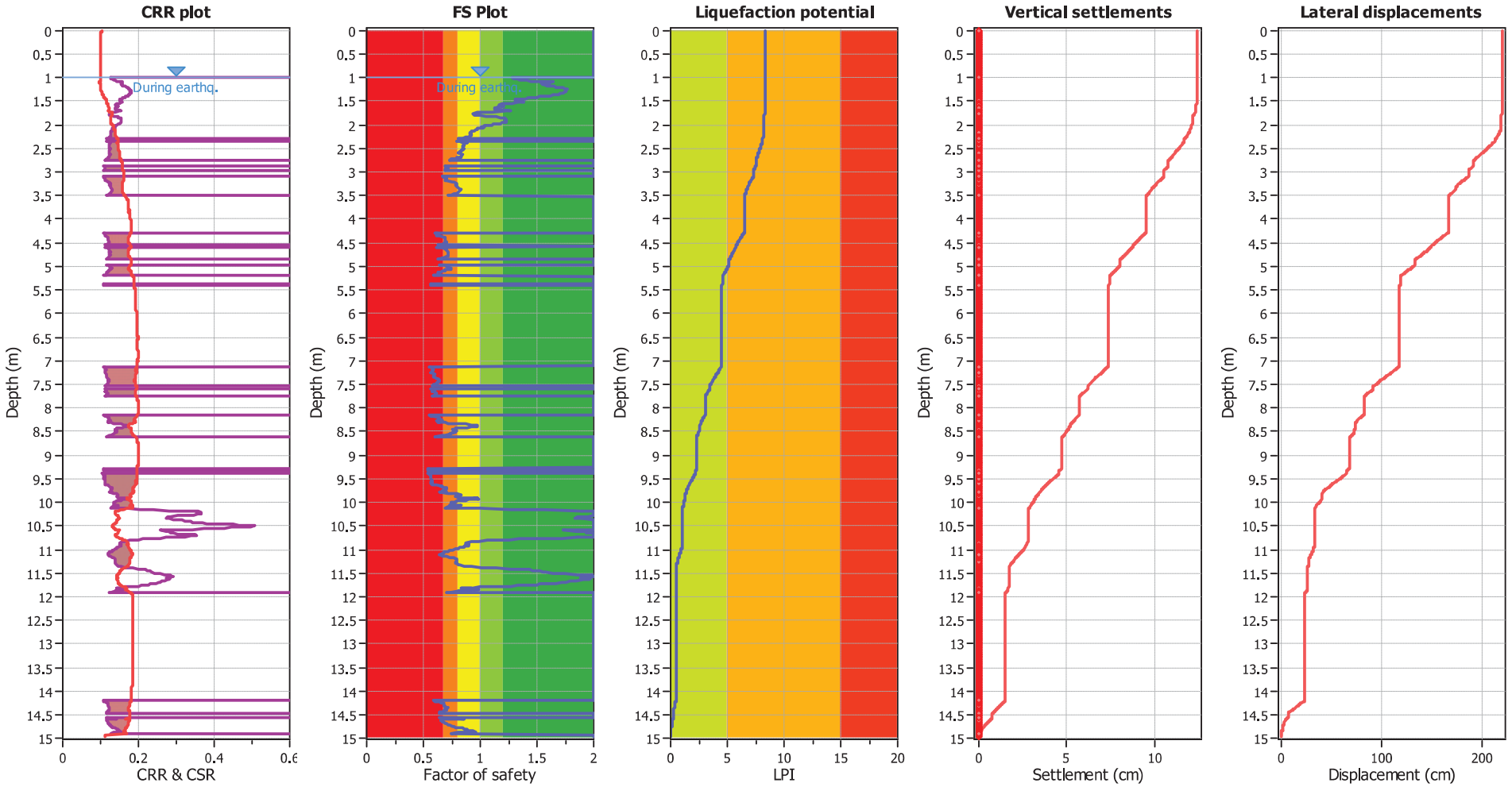






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

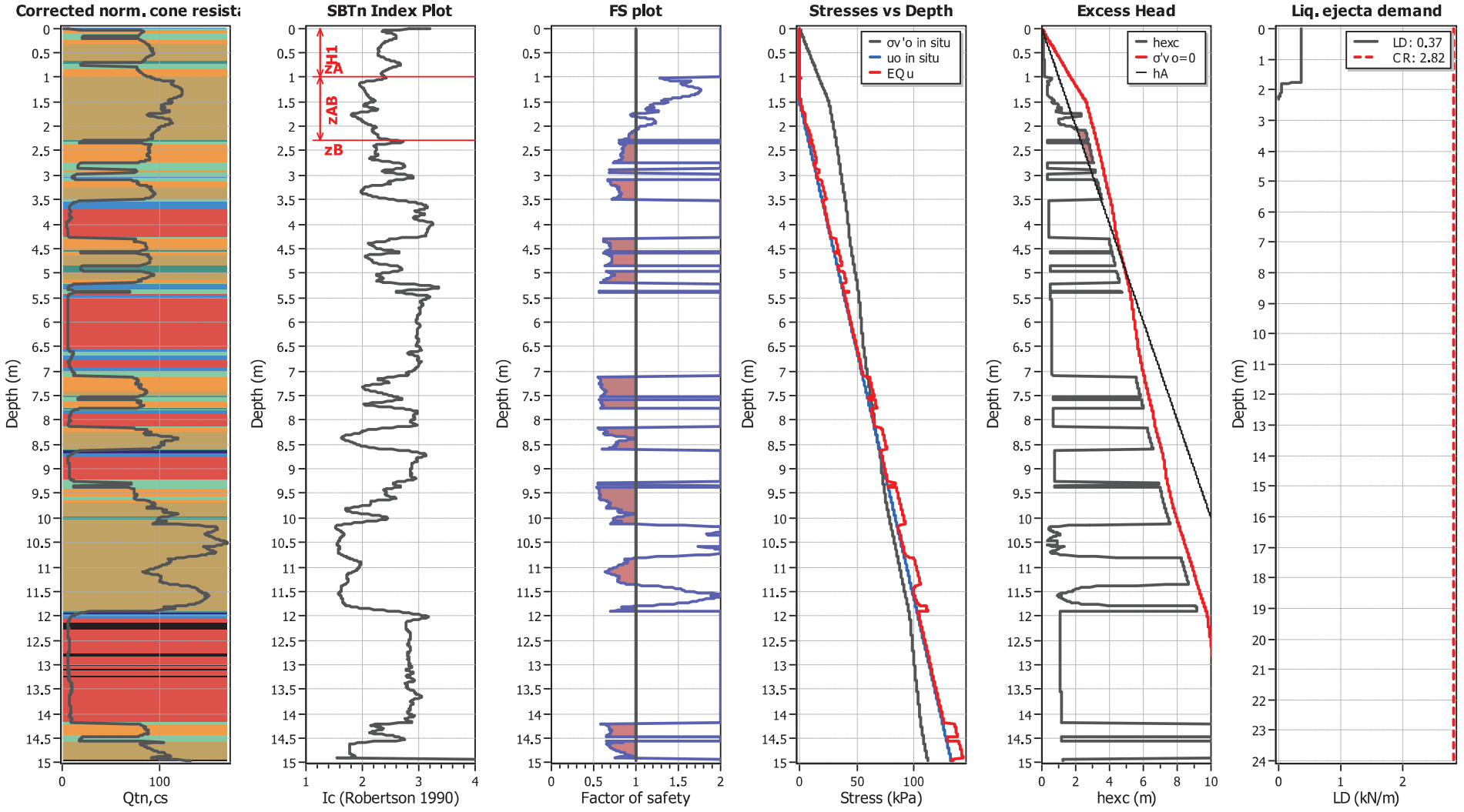
F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Ejecta Severity Estimation



12 Marylands Place, Middleton, Christchurch 8024
PO Box 10043 Phillipstown, Christchurch 8145
office@geoconsult.co.nz
https://www.geoconsult.co.nz/

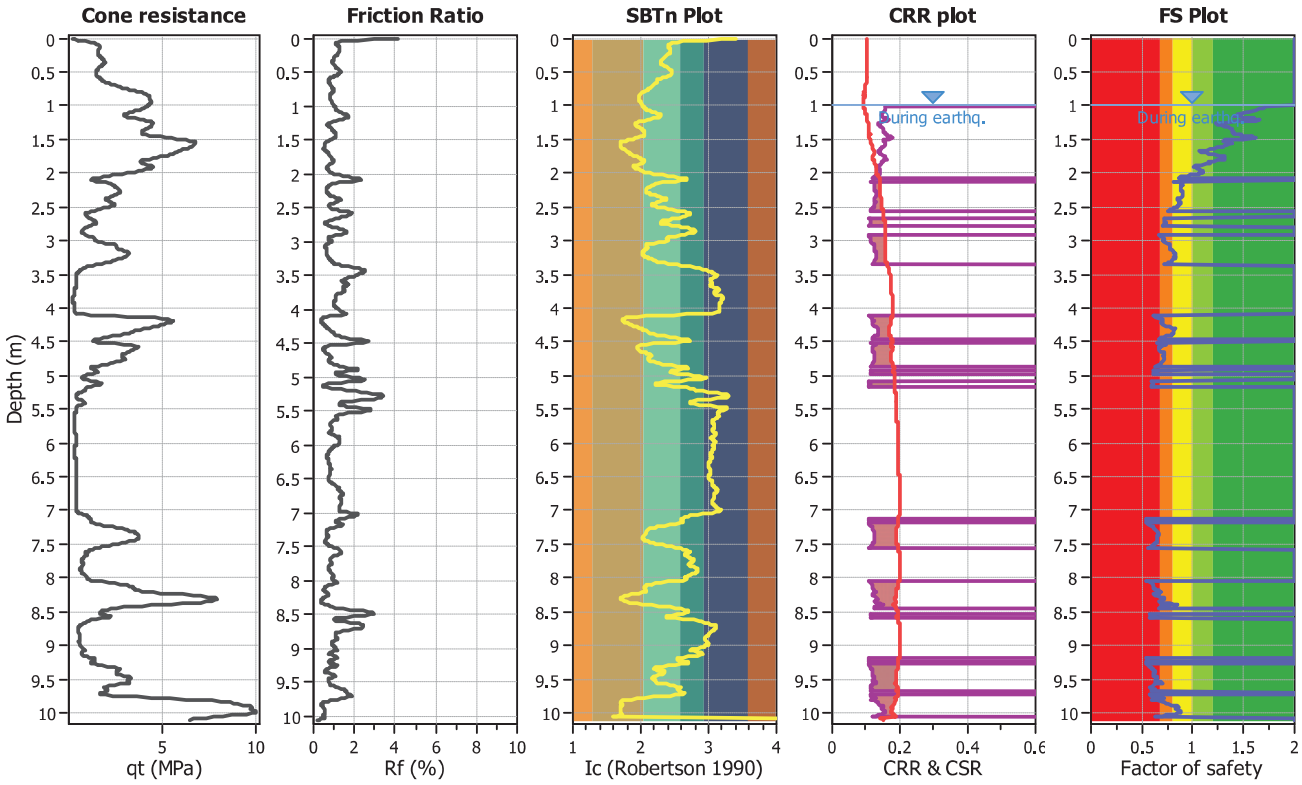
LIQUEFACTION ANALYSIS REPORT

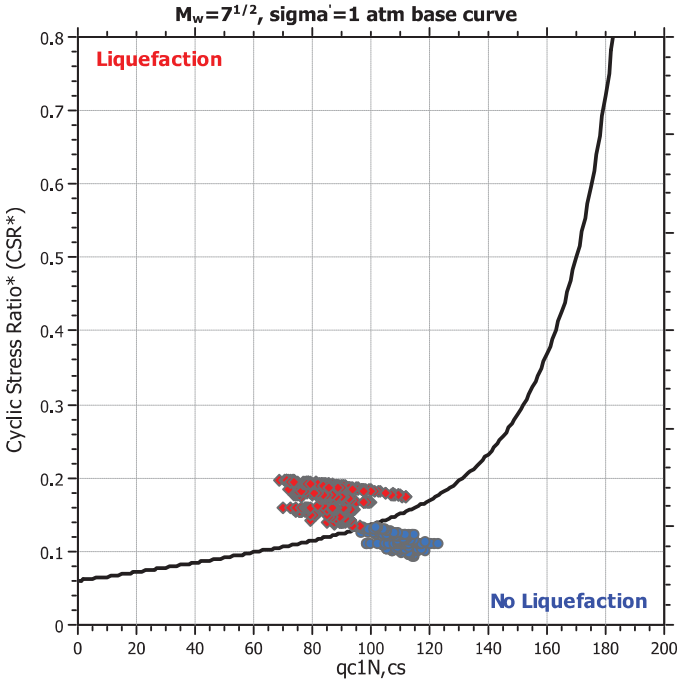
Project title : CO124 **Location : 606 Ridge Road, Motukarara**

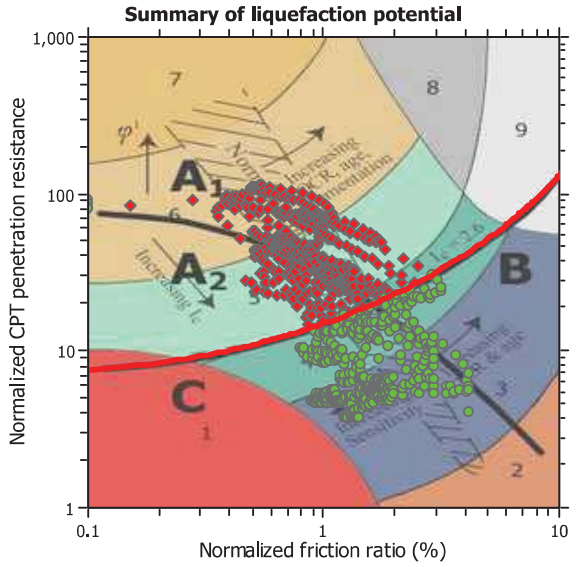
CPT file : CPT 2 - SLS2

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

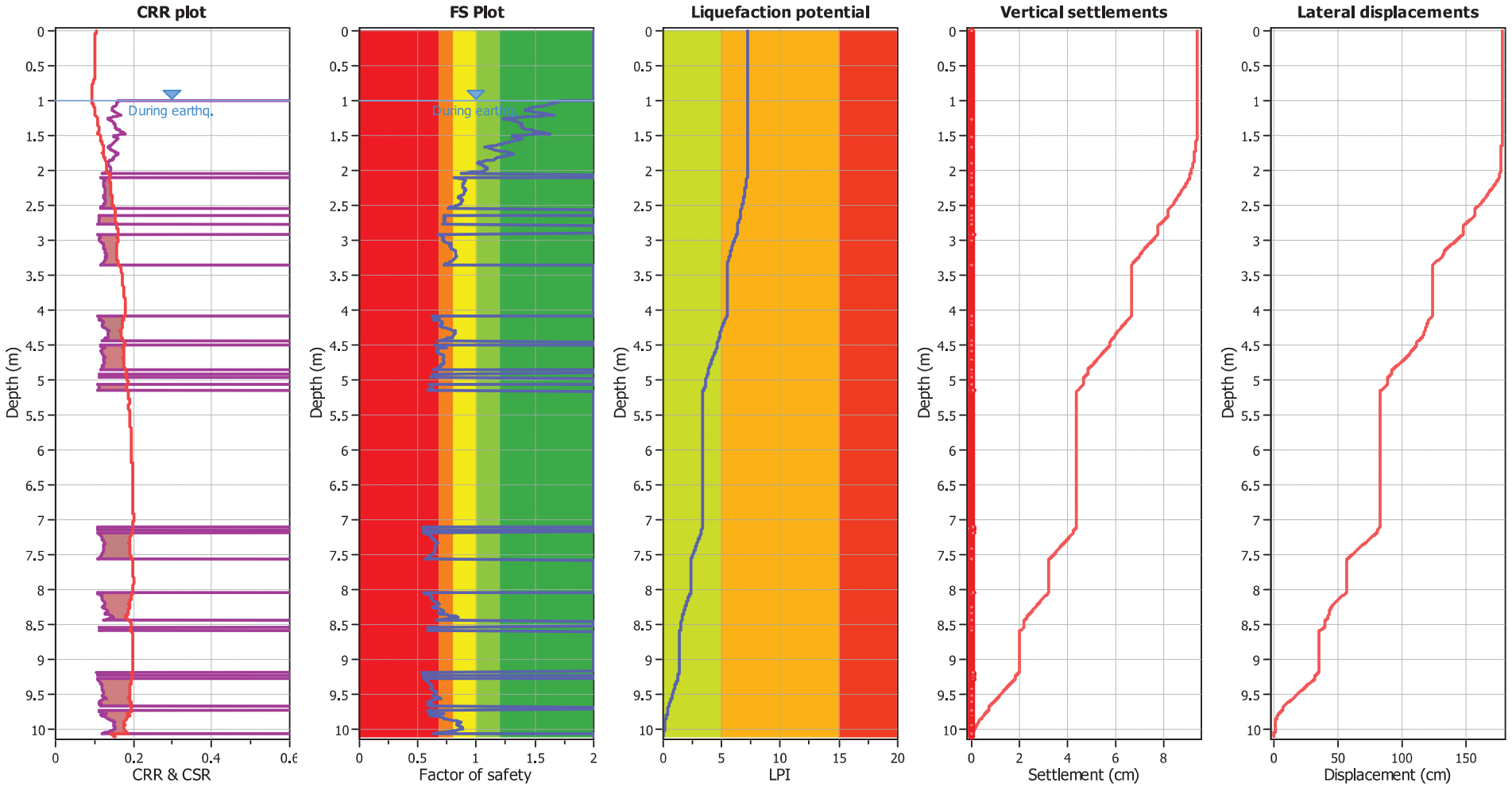






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

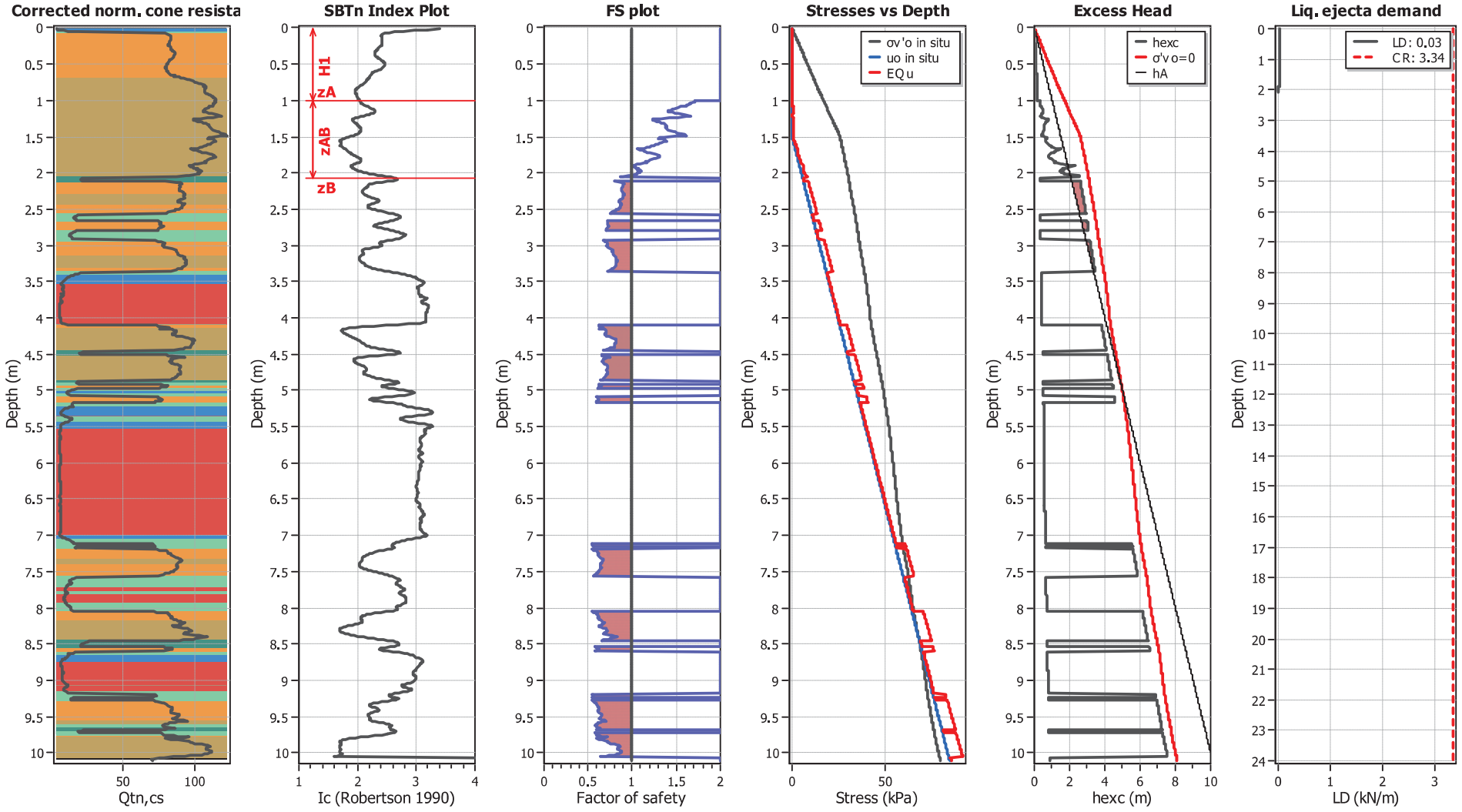
F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Ejecta Severity Estimation



12 Marylands Place, Middleton, Christchurch 8024
PO Box 10043 Phillipstown, Christchurch 8145
office@geoconsult.co.nz
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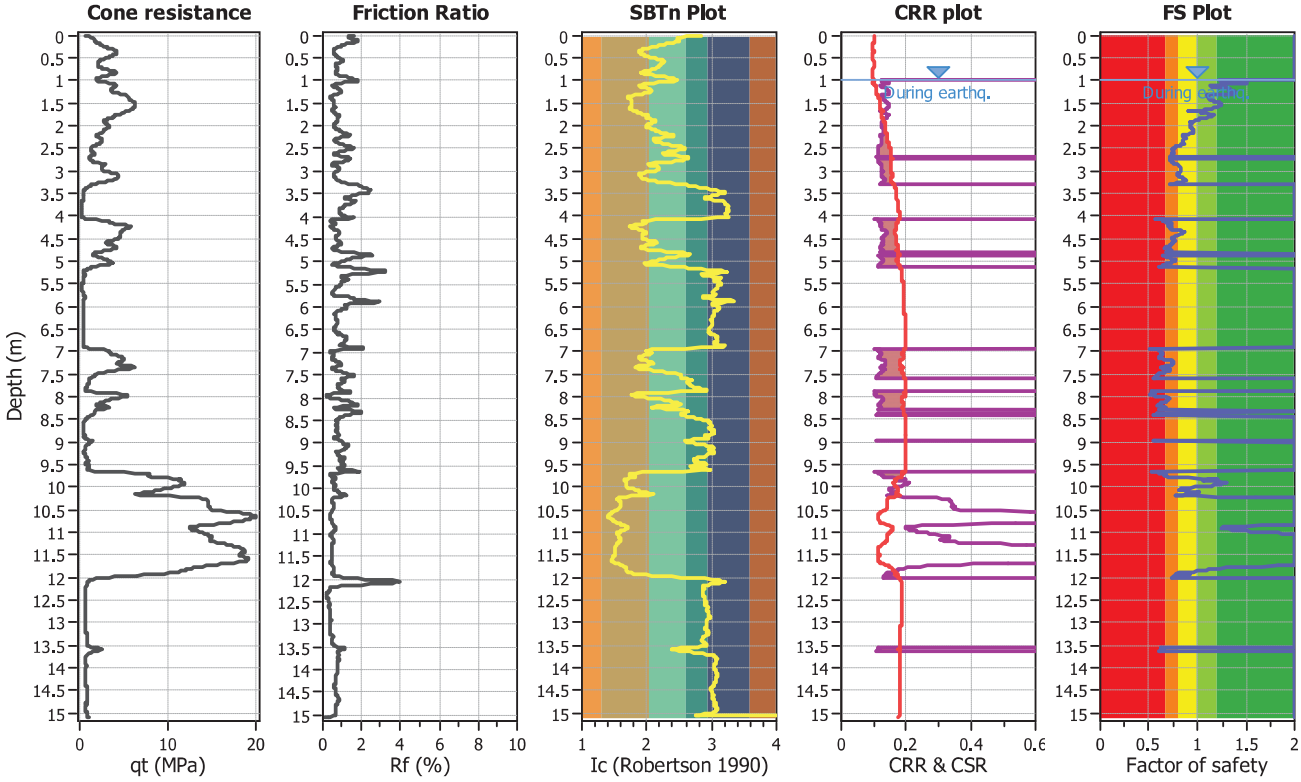
LIQUEFACTION ANALYSIS REPORT

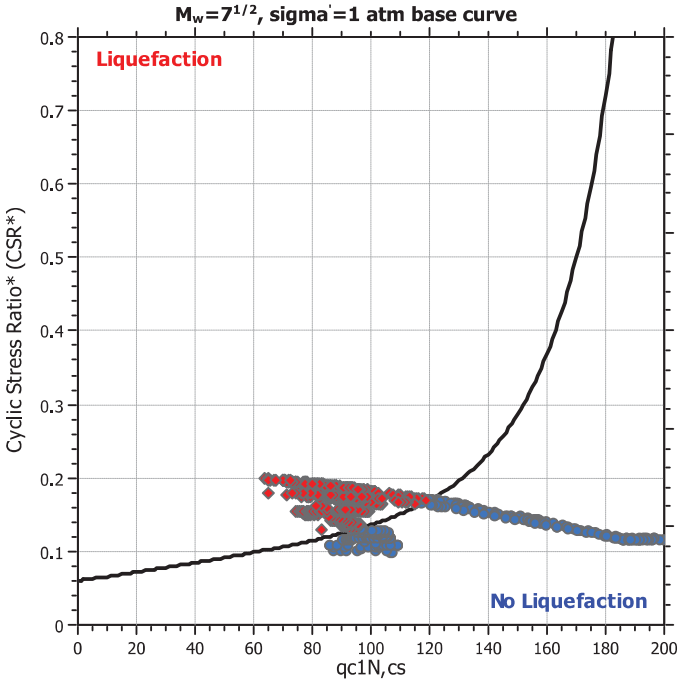
Project title : CO124 **Location : 606 Ridge Road, Motukarara**

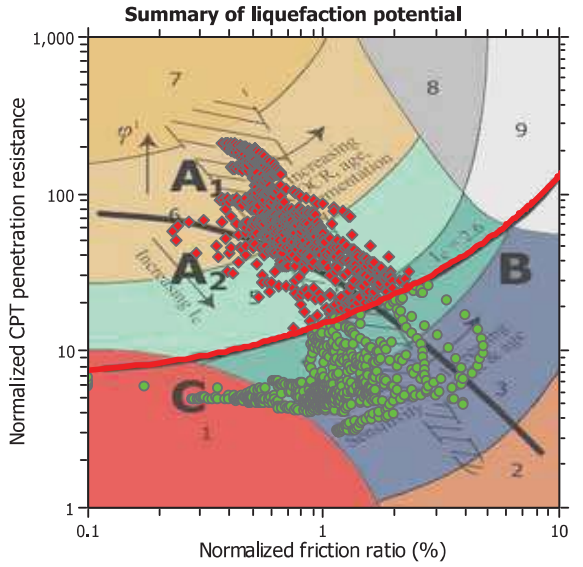
CPT file : CPT 3 - SLS2

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

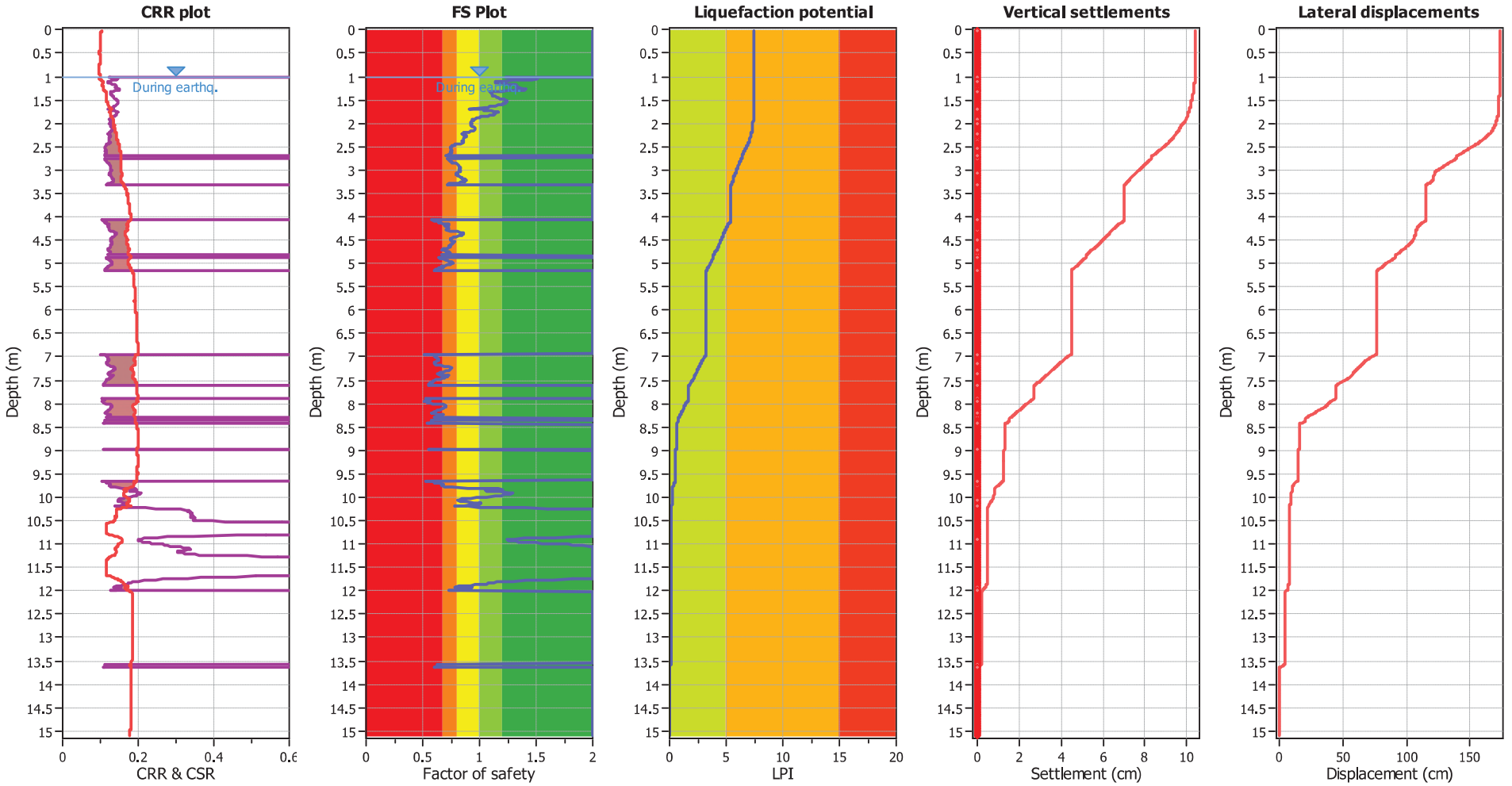






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

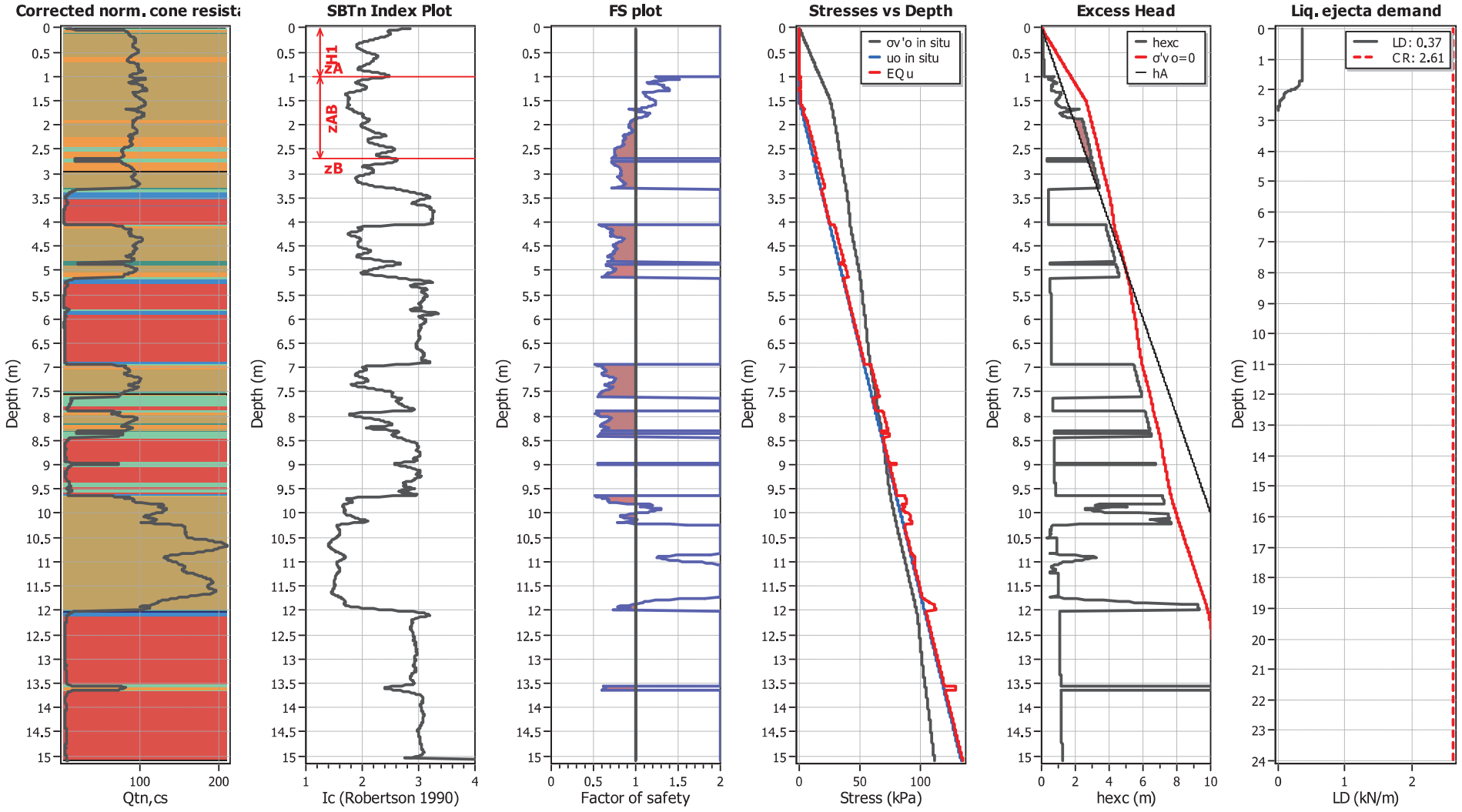
F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Ejecta Severity Estimation



12 Marylands Place, Middleton, Christchurch 8024
PO Box 10043 Phillipstown, Christchurch 8145
office@geoconsult.co.nz
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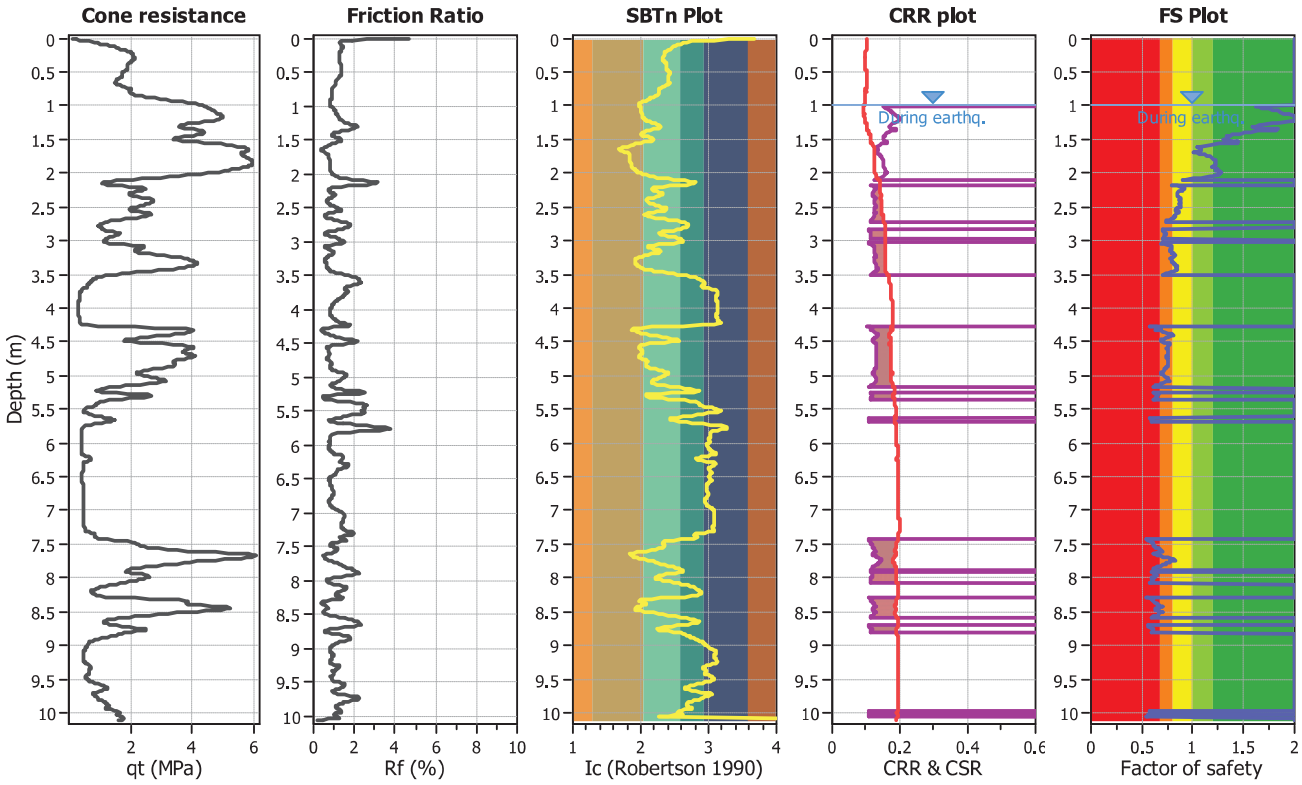
LIQUEFACTION ANALYSIS REPORT

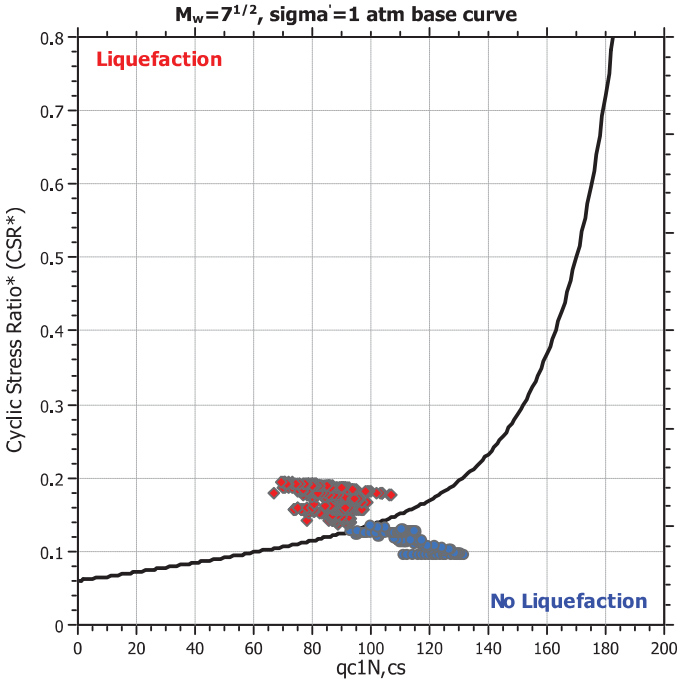
Project title : CO124 **Location : 606 Ridge Road, Motukarara**

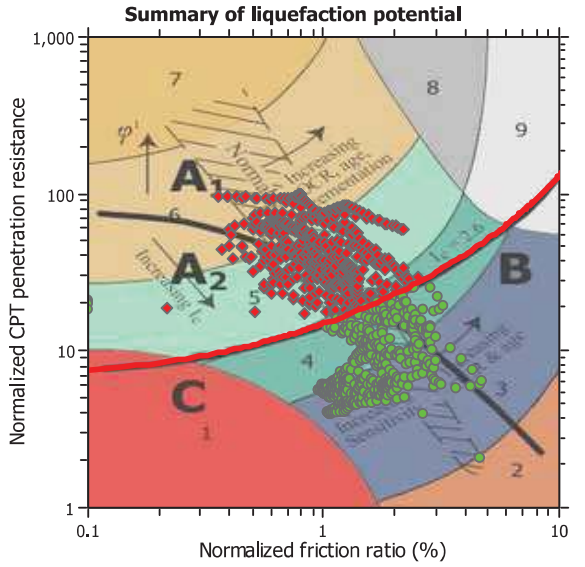
CPT file : CPT 4 - SLS2

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

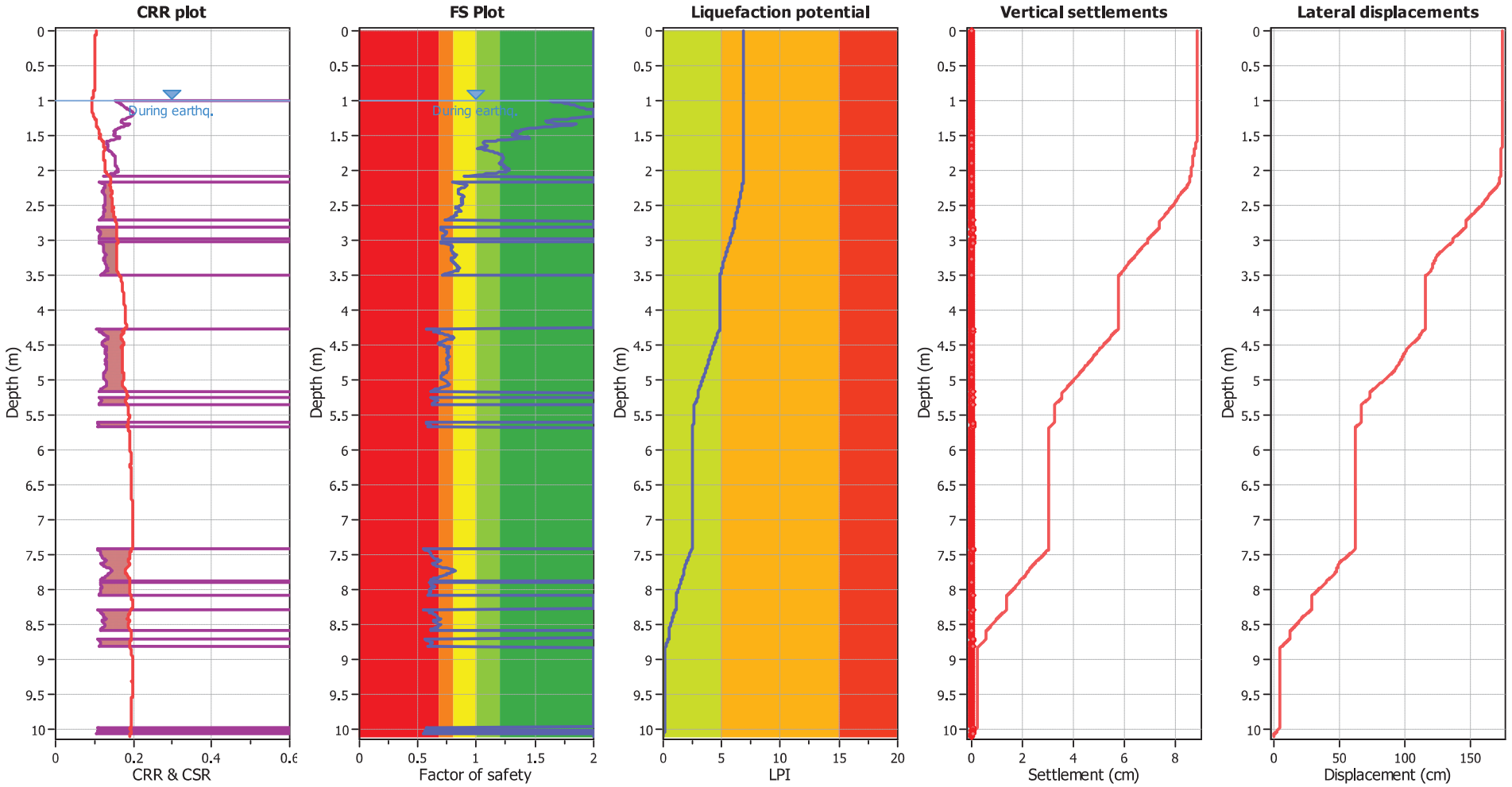






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

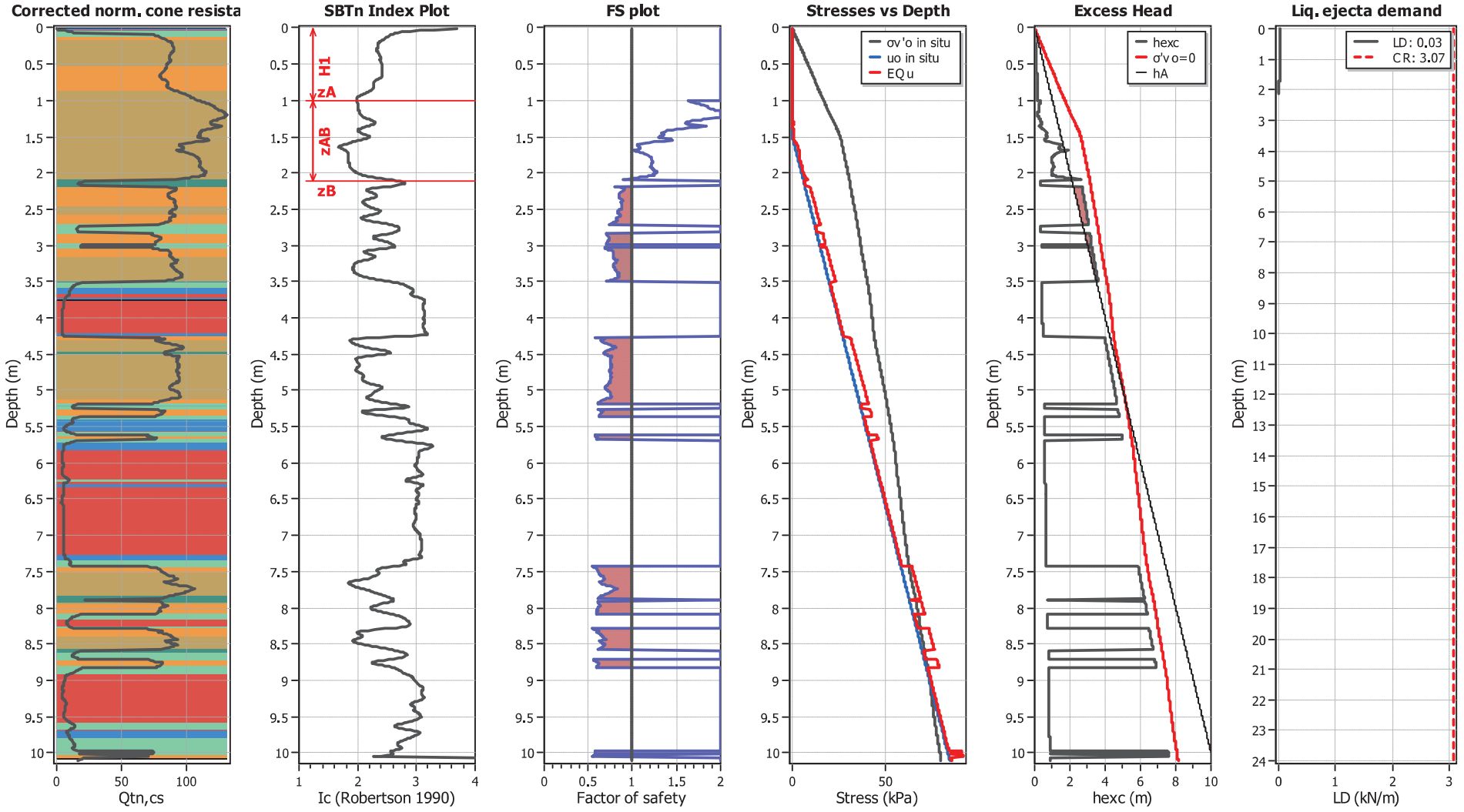
F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Ejecta Severity Estimation



12 Marylands Place, Middleton, Christchurch 8024
PO Box 10043 Phillipstown, Christchurch 8145
office@geoconsult.co.nz
https://www.geoconsult.co.nz/

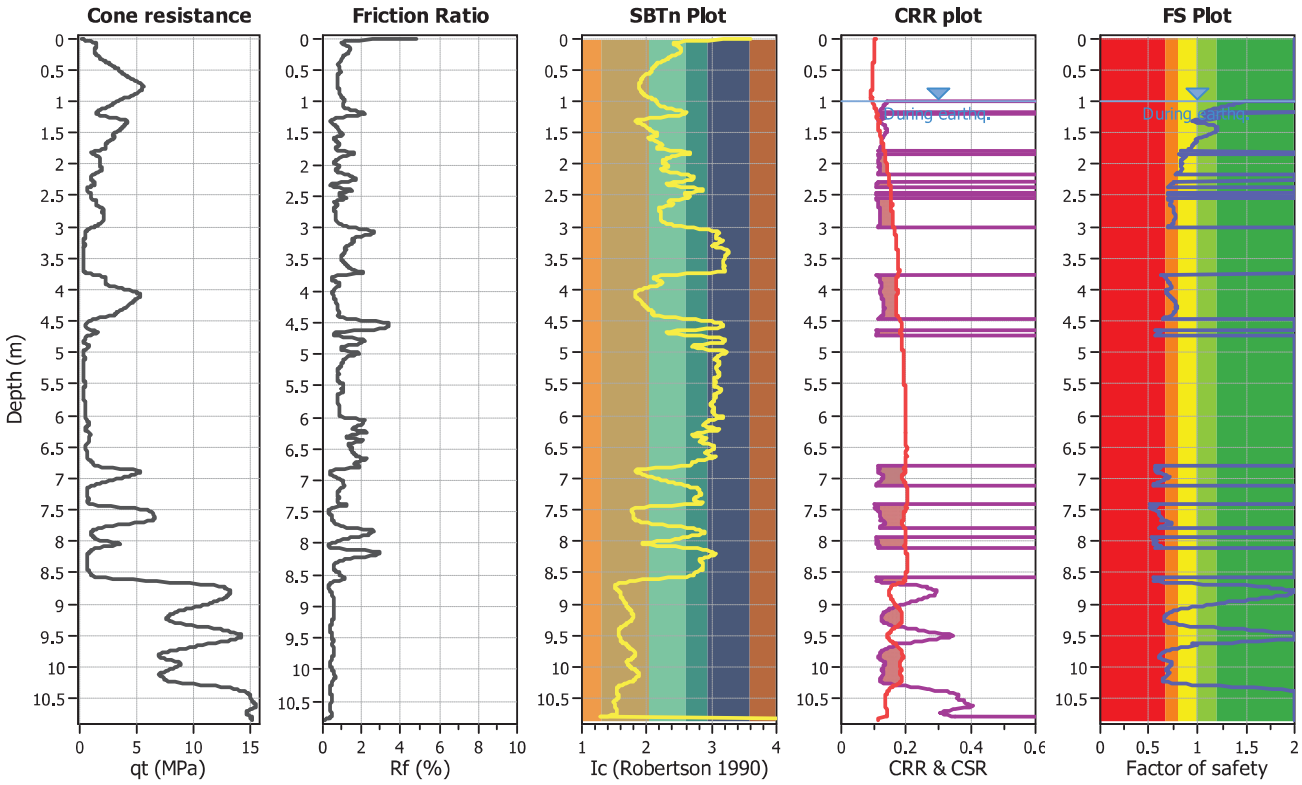
LIQUEFACTION ANALYSIS REPORT

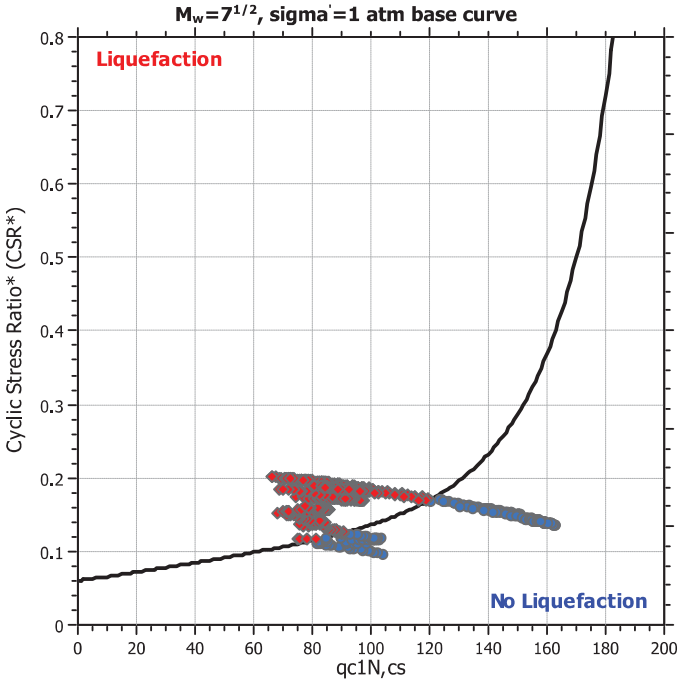
Project title : CO124 **Location : 606 Ridge Road, Motukarara**

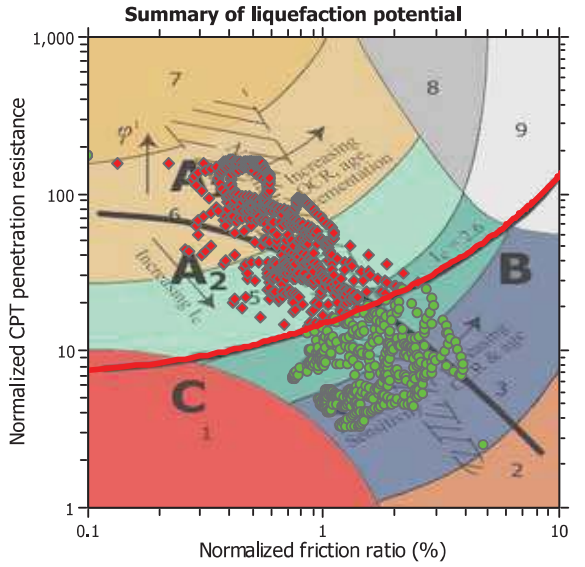
CPT file : CPT 5 - SLS2

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

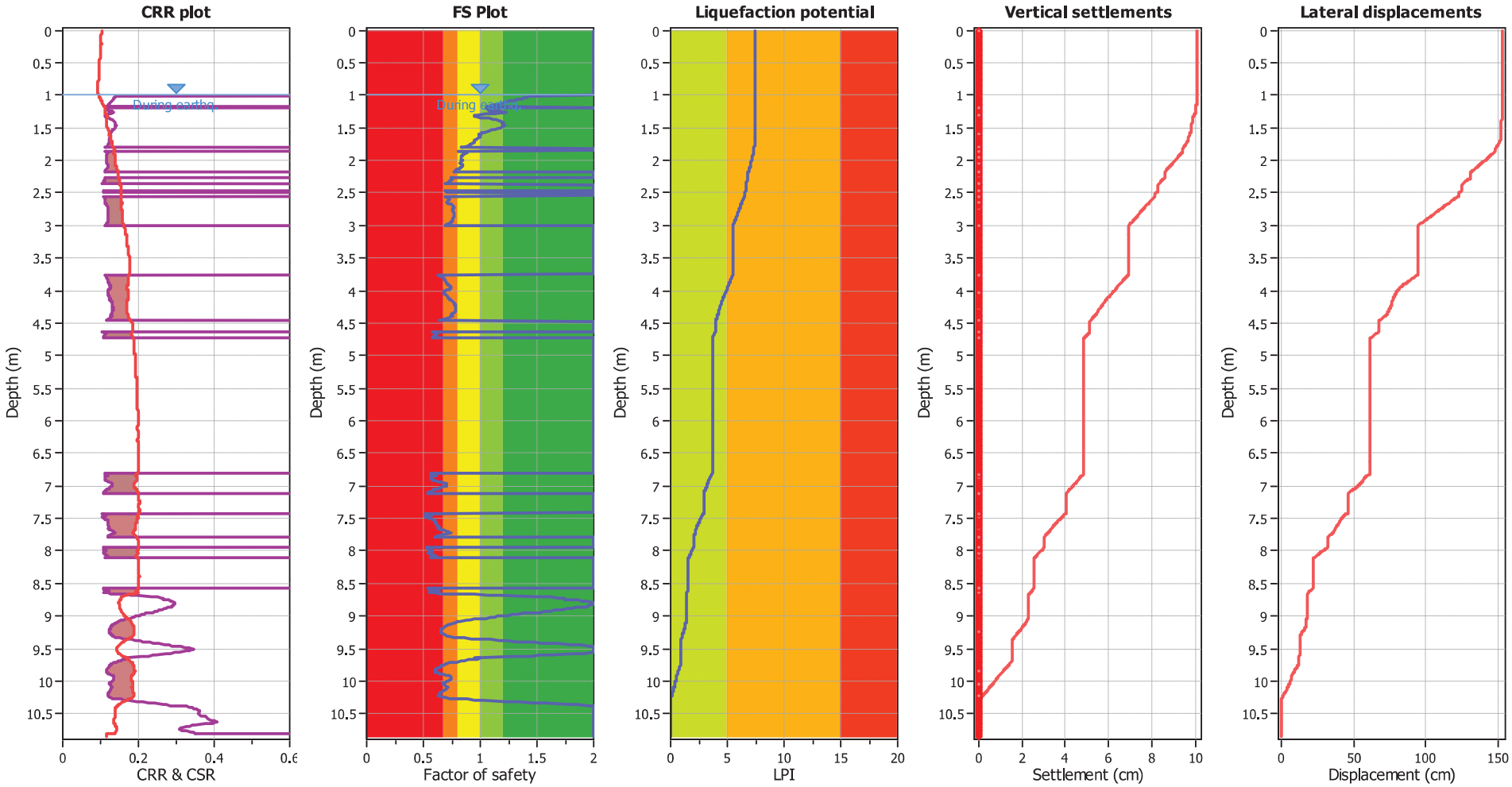






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

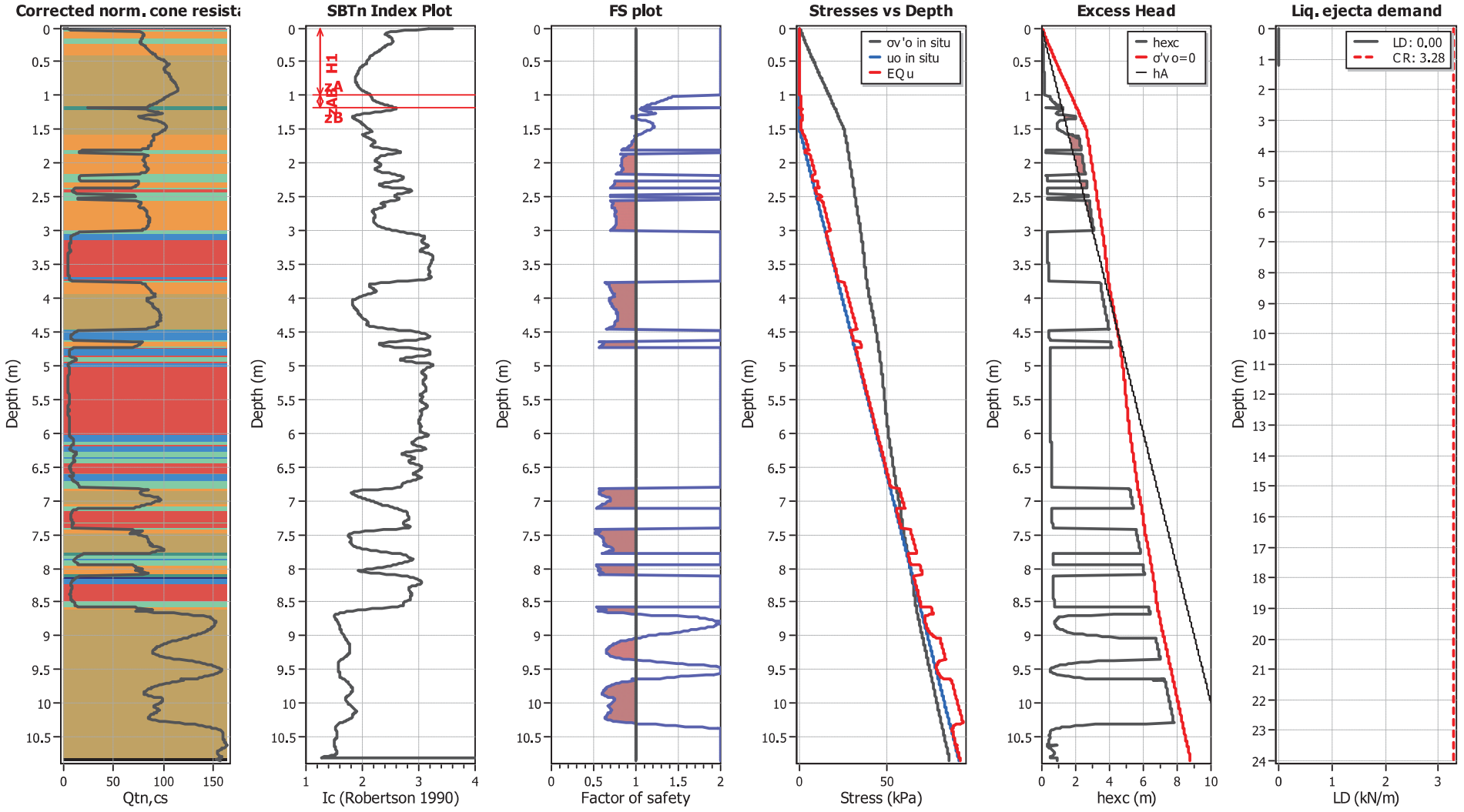
F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Ejecta Severity Estimation



12 Marylands Place, Middleton, Christchurch 8024
PO Box 10043 Phillipstown, Christchurch 8145
office@geoconsult.co.nz
https://www.geoconsult.co.nz/

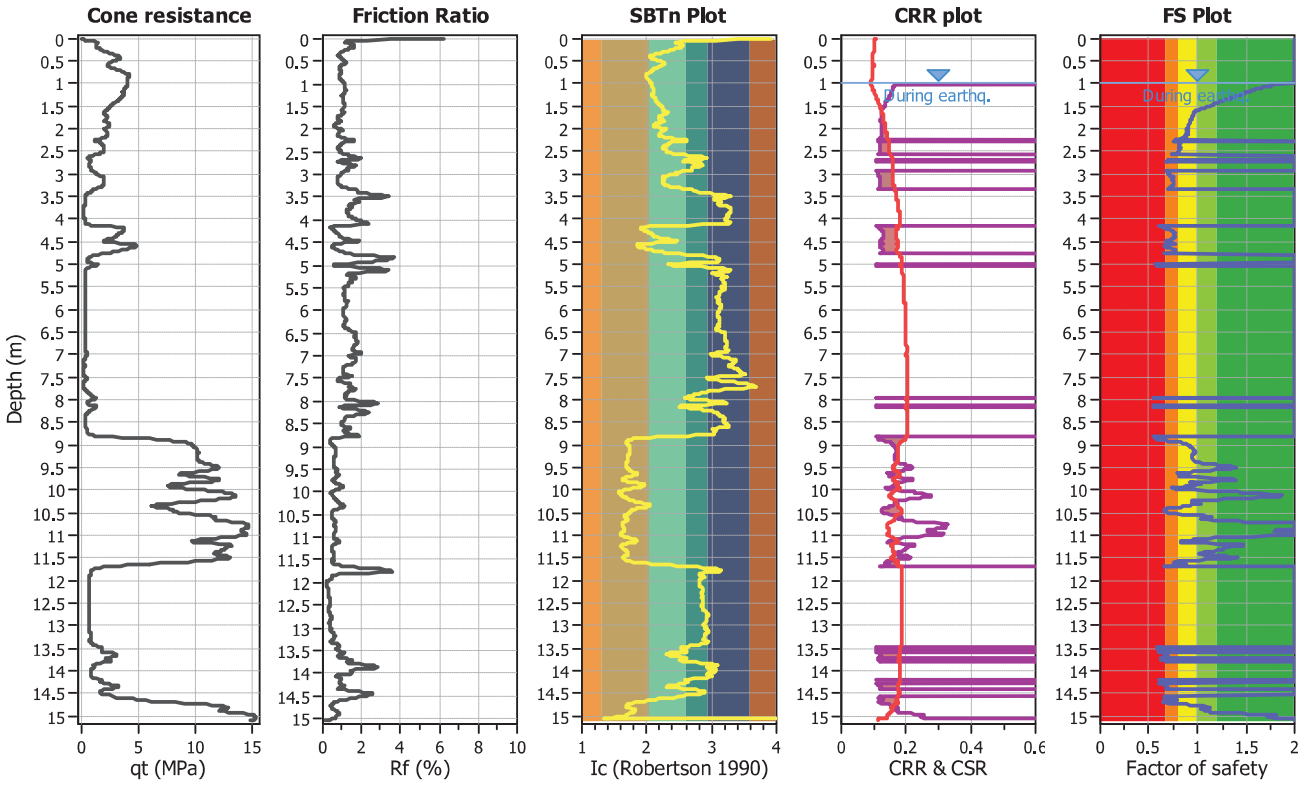
LIQUEFACTION ANALYSIS REPORT

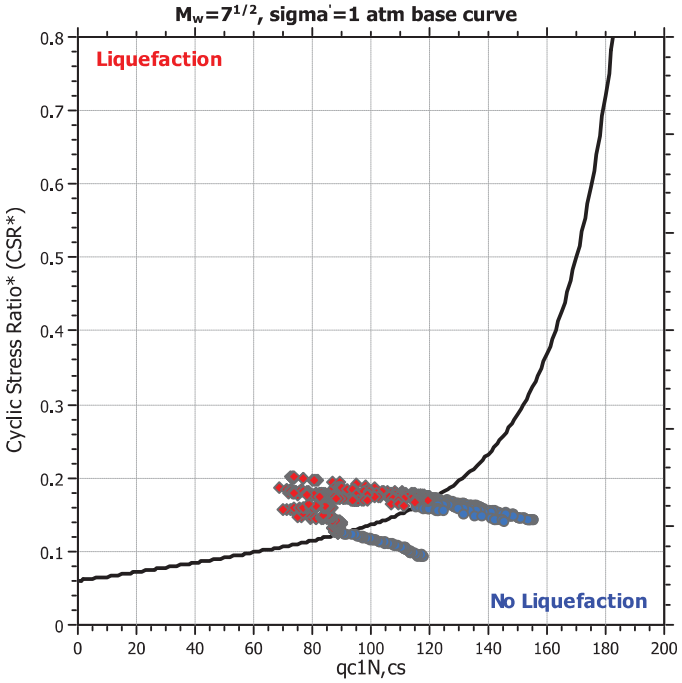
Project title : CO124 **Location : 606 Ridge Road, Motukarara**

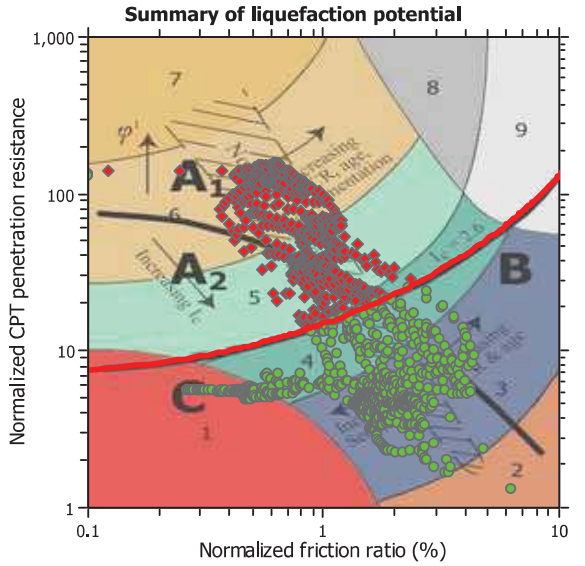
CPT file : CPT 6 - SLS2

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	6.00	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.19	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

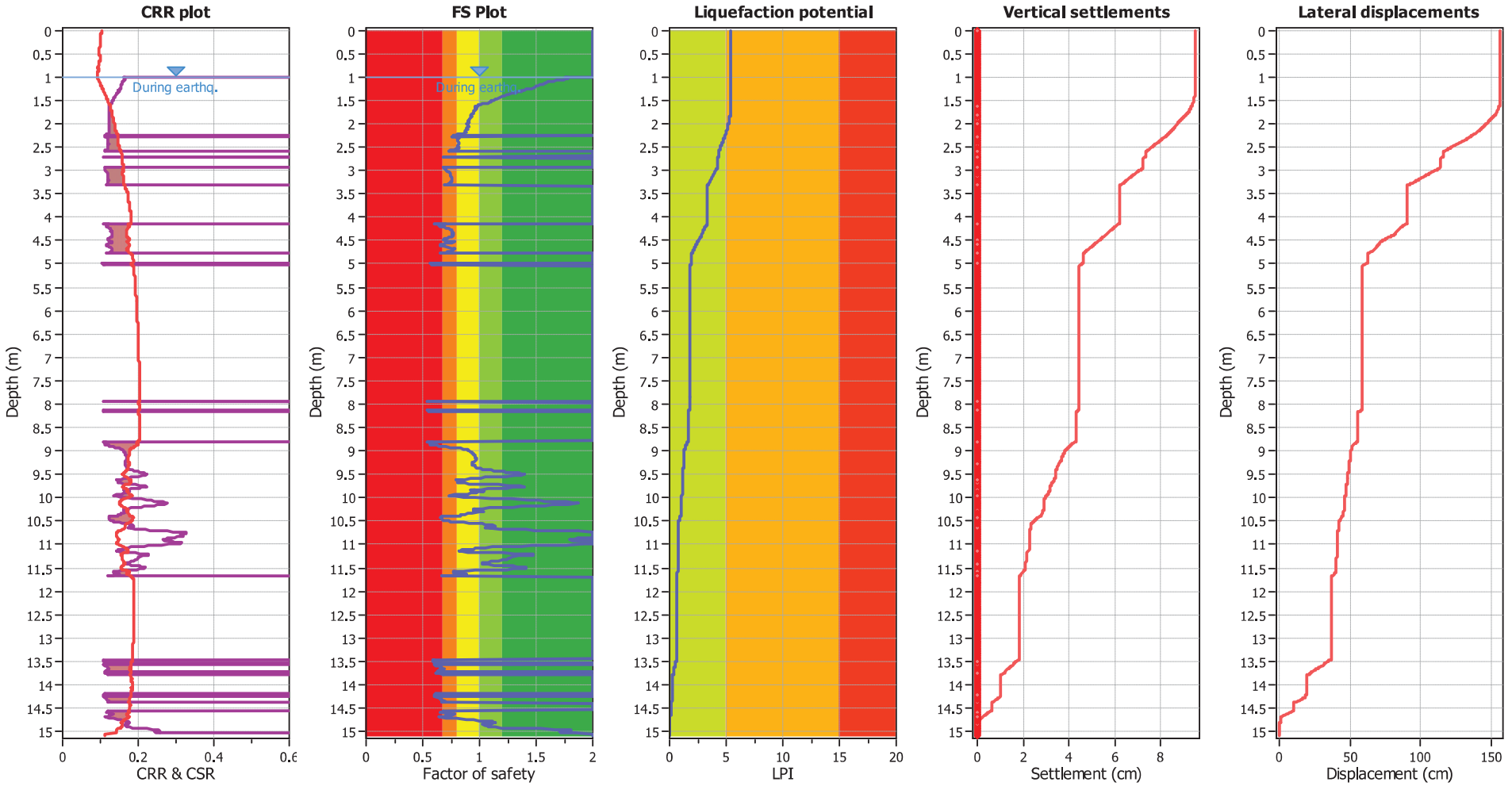






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	6.00	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.19	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

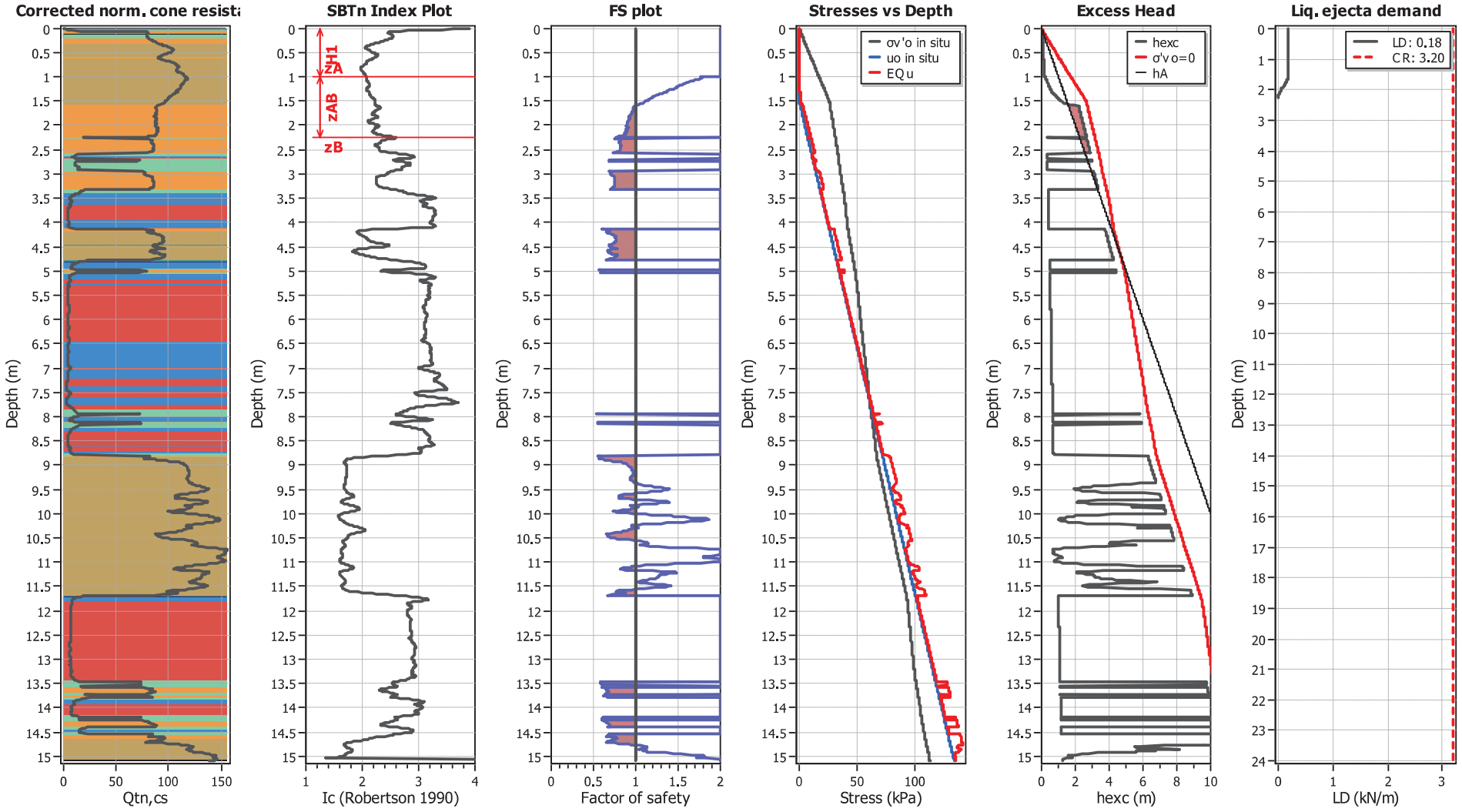
F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Ejecta Severity Estimation



12 Marylands Place, Middleton, Christchurch 8024
PO Box 10043 Phillipstown, Christchurch 8145
office@geoconsult.co.nz
https://www.geoconsult.co.nz/

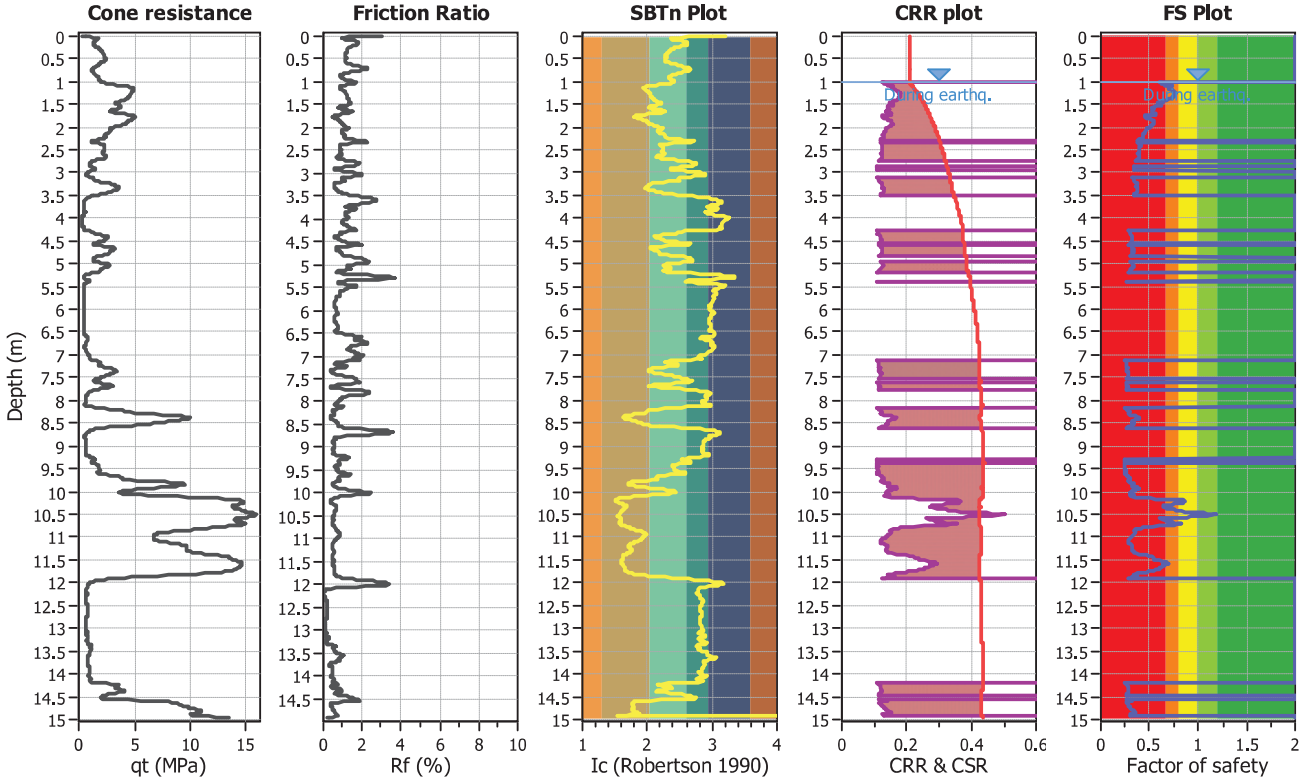
LIQUEFACTION ANALYSIS REPORT

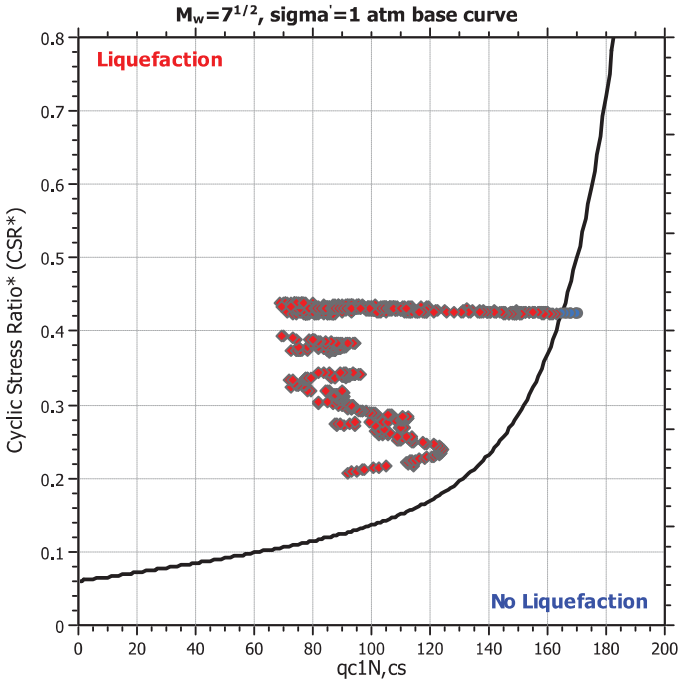
Project title : CO124 **Location : 606 Ridge Road, Motukarara**

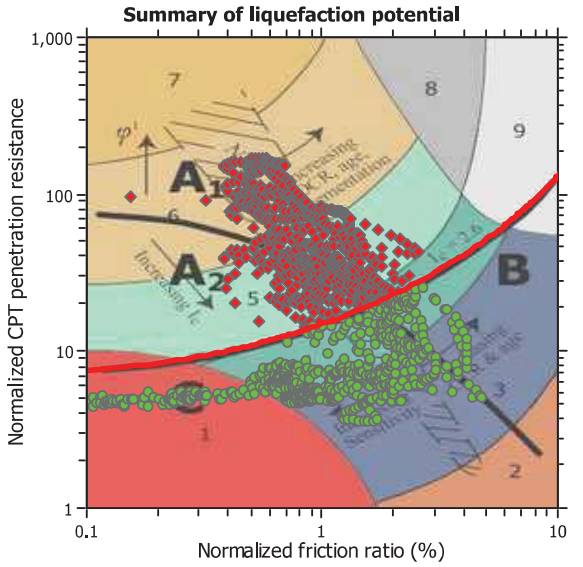
CPT file : CPT 1 - ULS

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

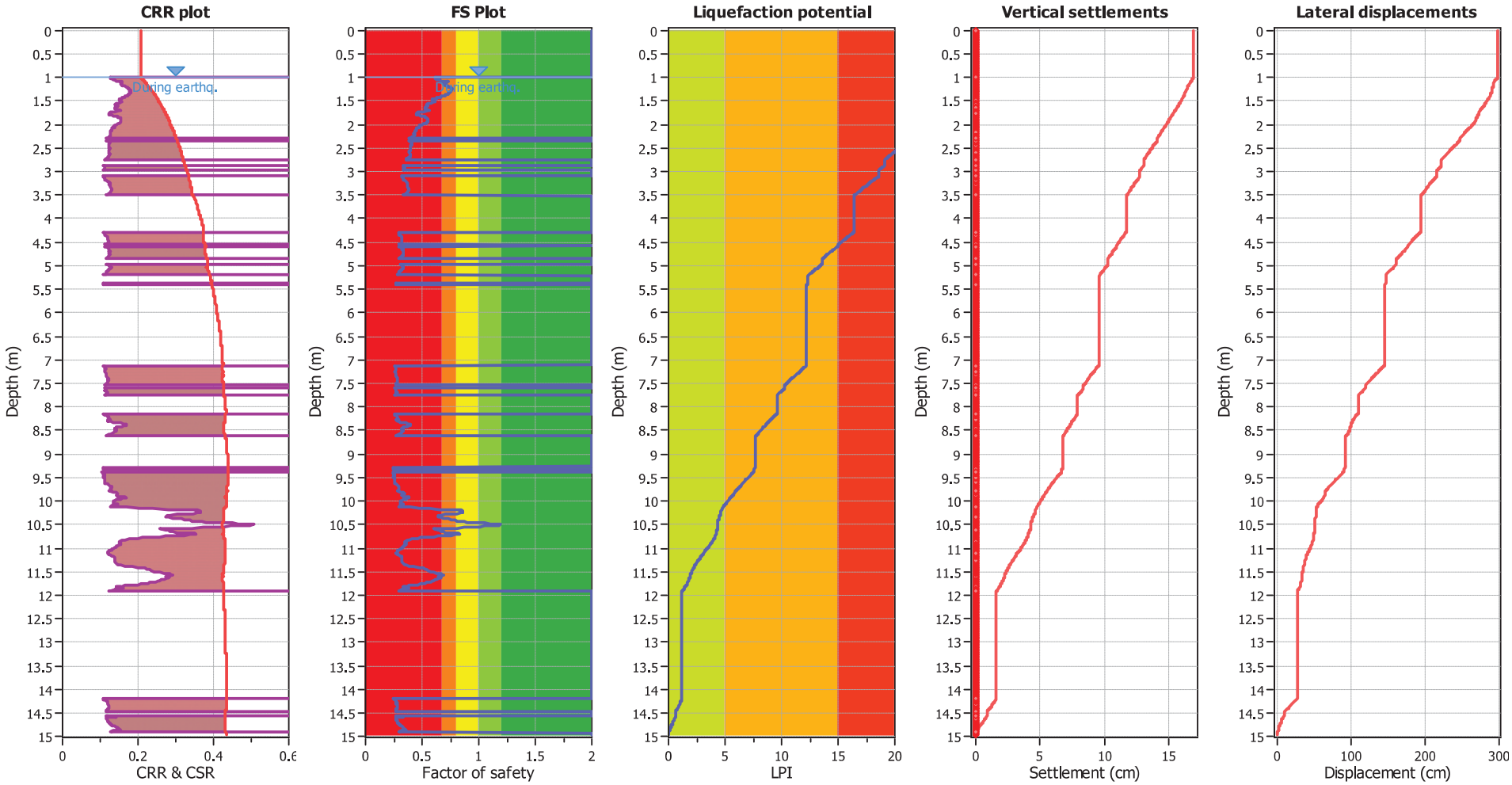






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

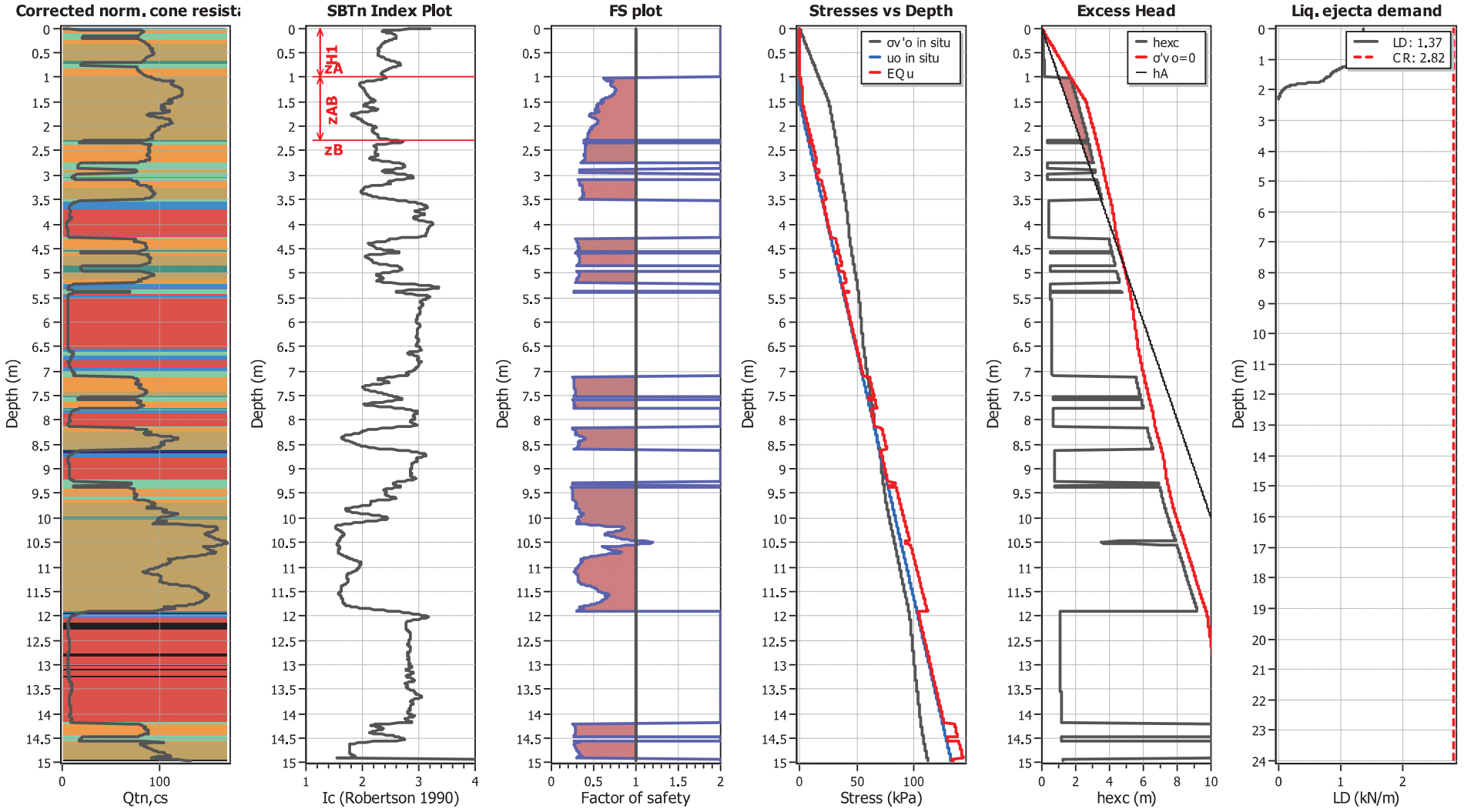
F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Ejecta Severity Estimation



12 Marylands Place, Middleton, Christchurch 8024
PO Box 10043 Phillipstown, Christchurch 8145
office@geoconsult.co.nz
https://www.geoconsult.co.nz/

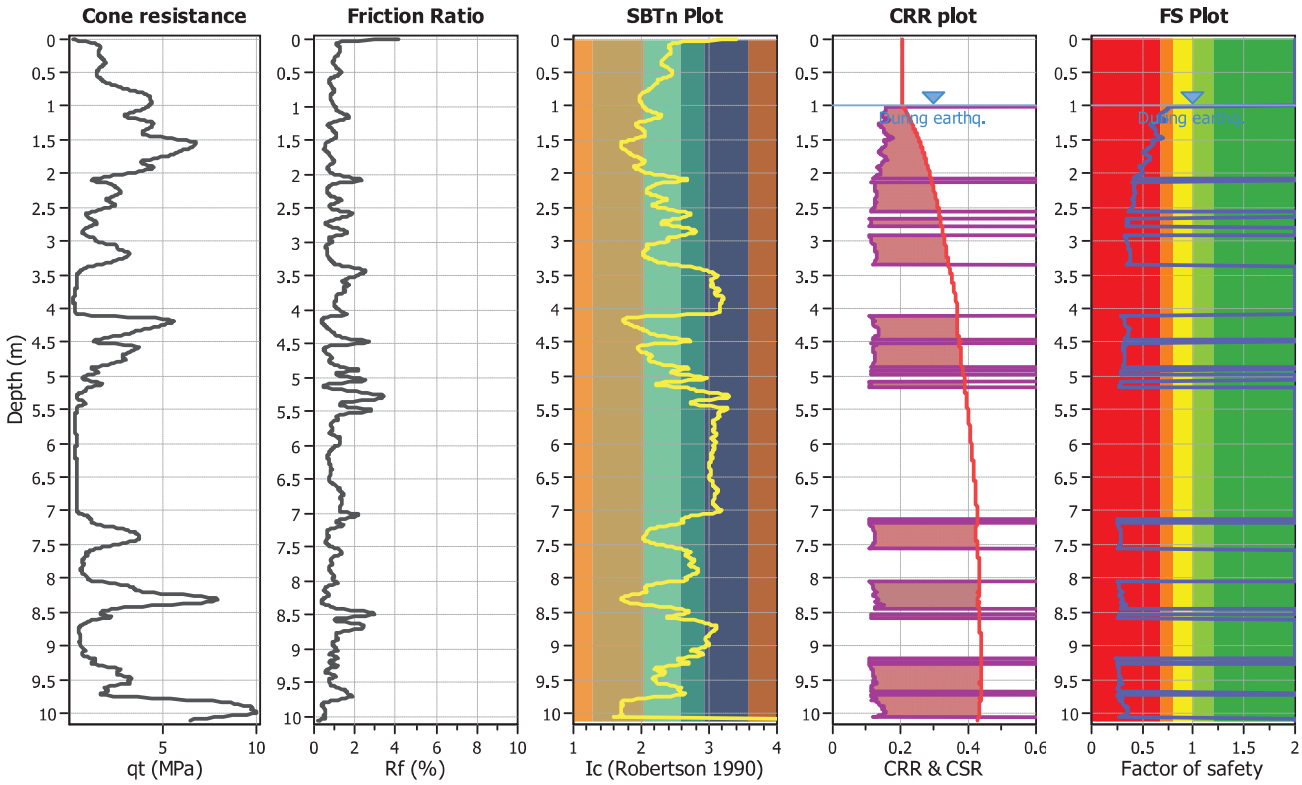
LIQUEFACTION ANALYSIS REPORT

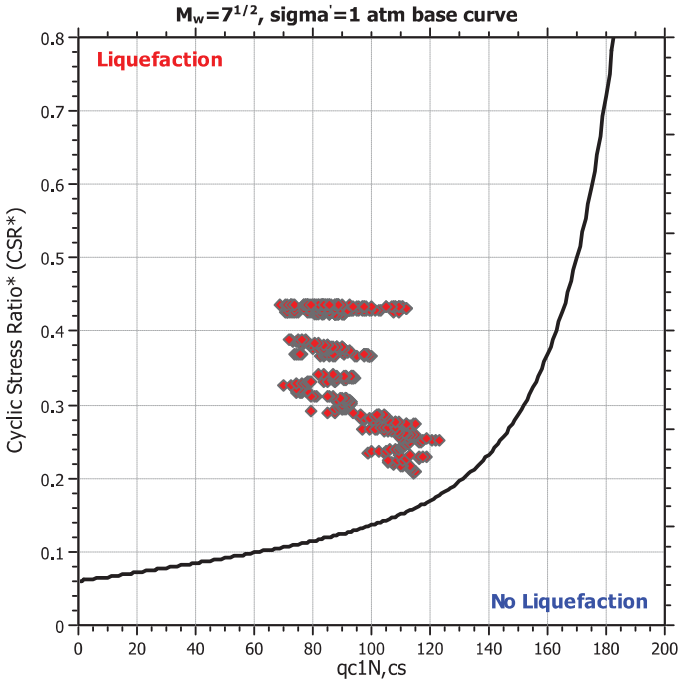
Project title : CO124 **Location : 606 Ridge Road, Motukarara**

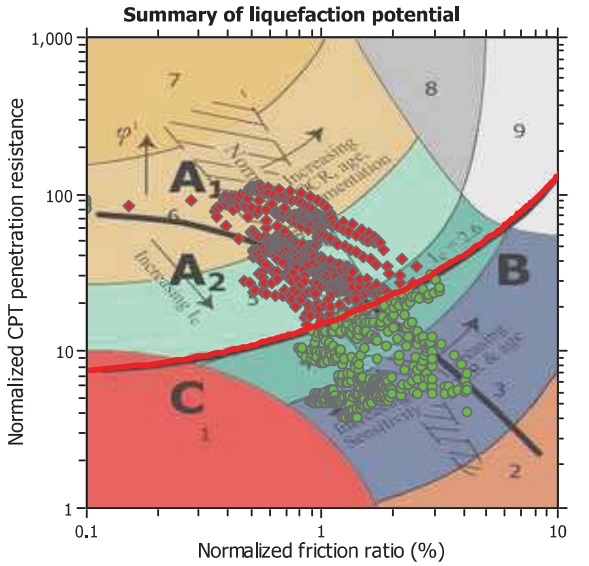
CPT file : CPT 2 - ULS

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

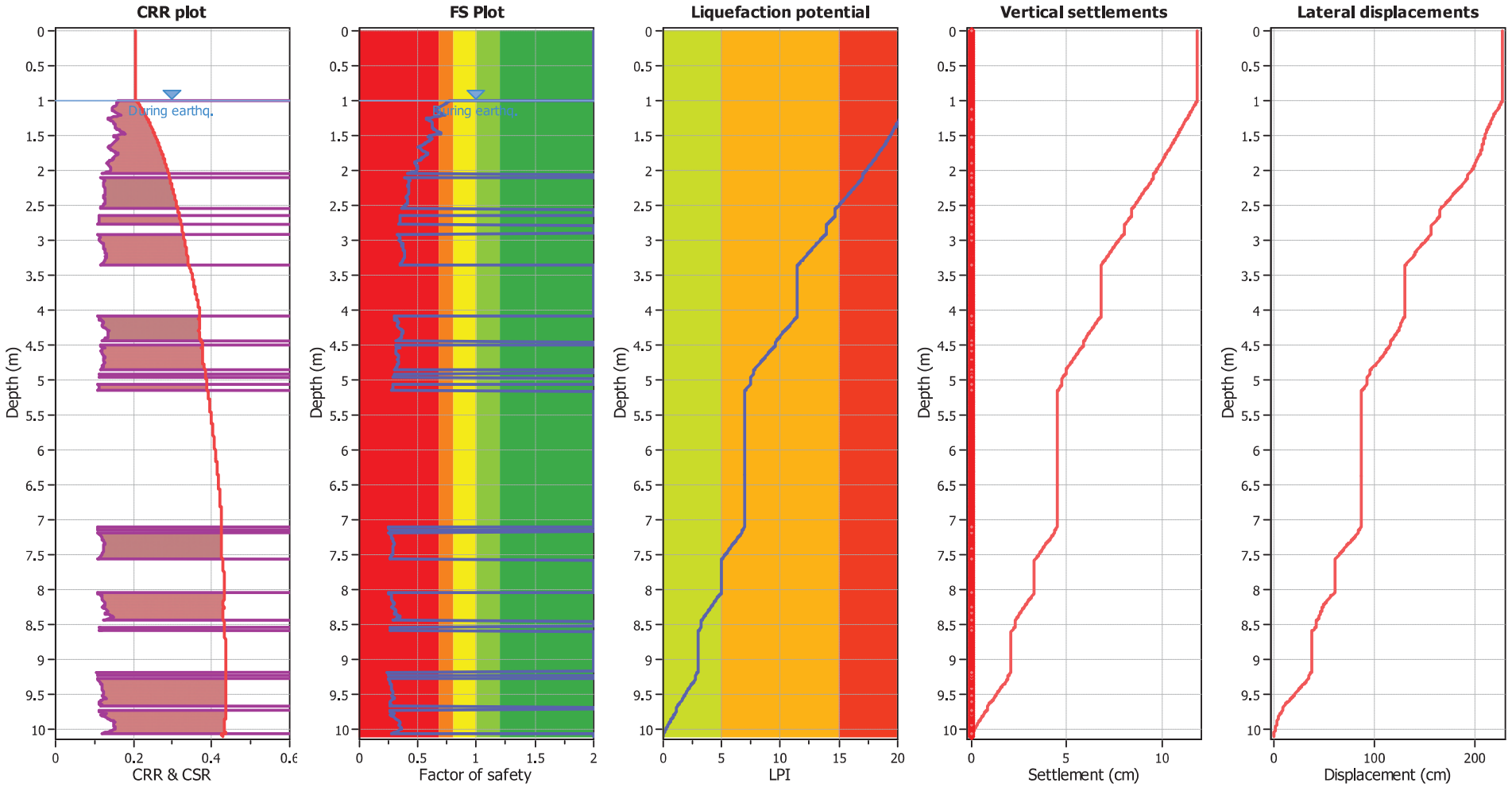






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

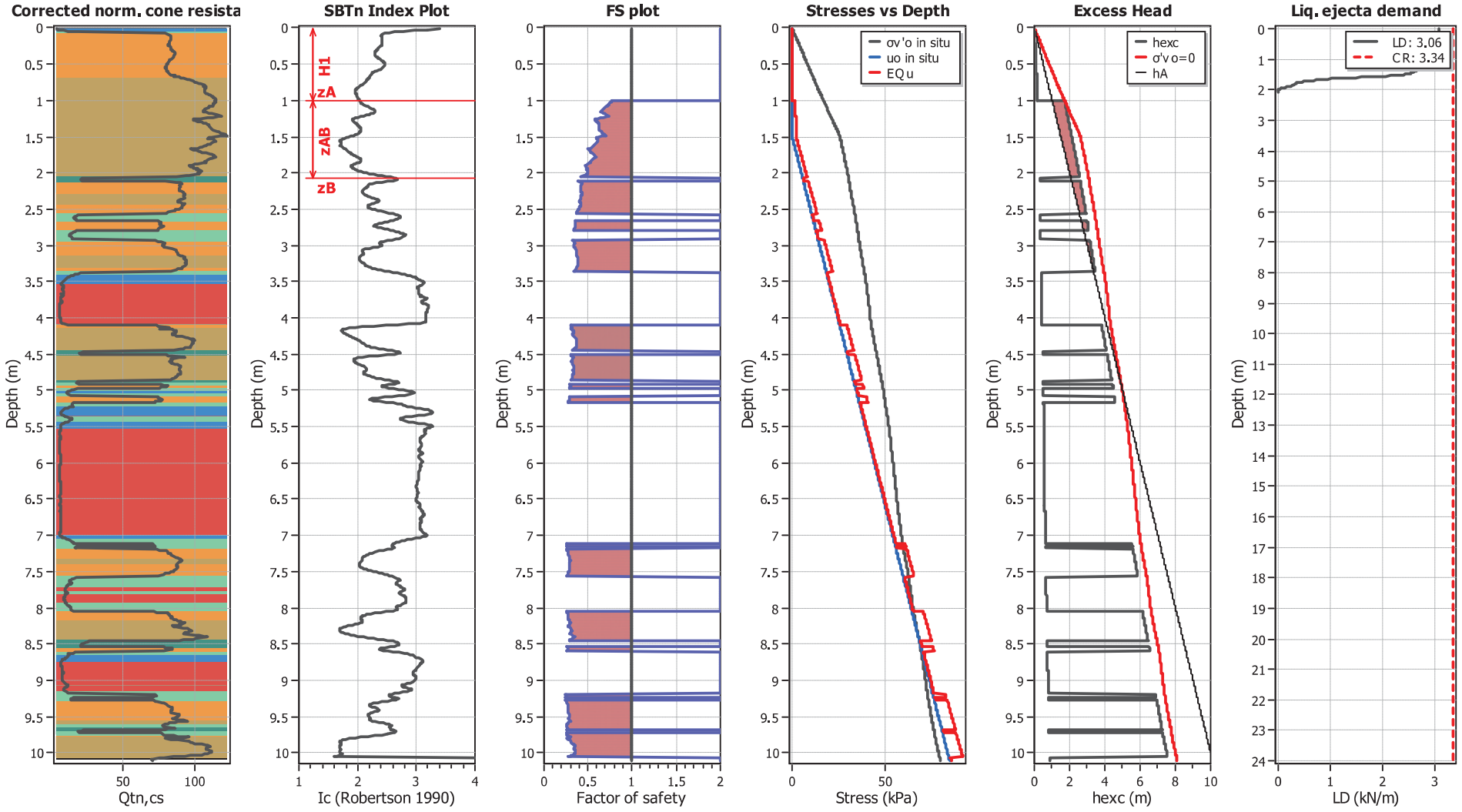
F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Ejecta Severity Estimation



12 Marylands Place, Middleton, Christchurch 8024
PO Box 10043 Phillipstown, Christchurch 8145
office@geoconsult.co.nz
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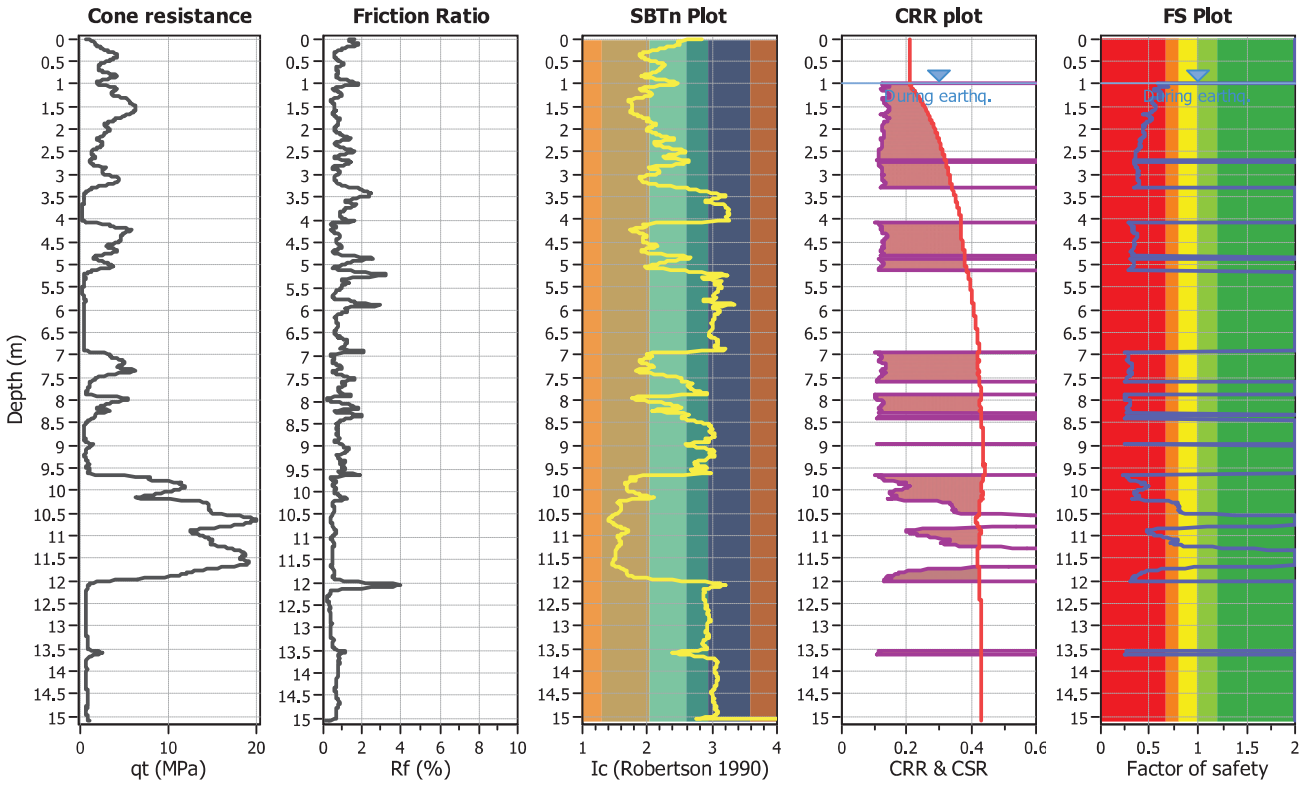
LIQUEFACTION ANALYSIS REPORT

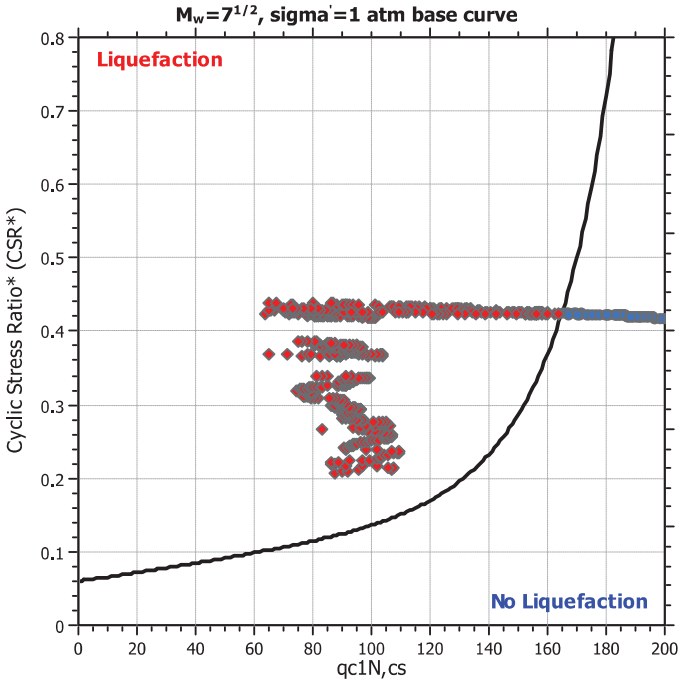
Project title : CO124 **Location : 606 Ridge Road, Motukarara**

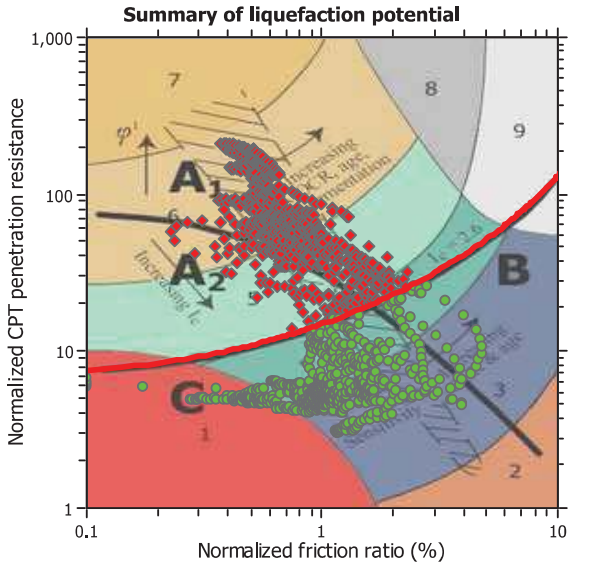
CPT file : CPT 3 - ULS

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

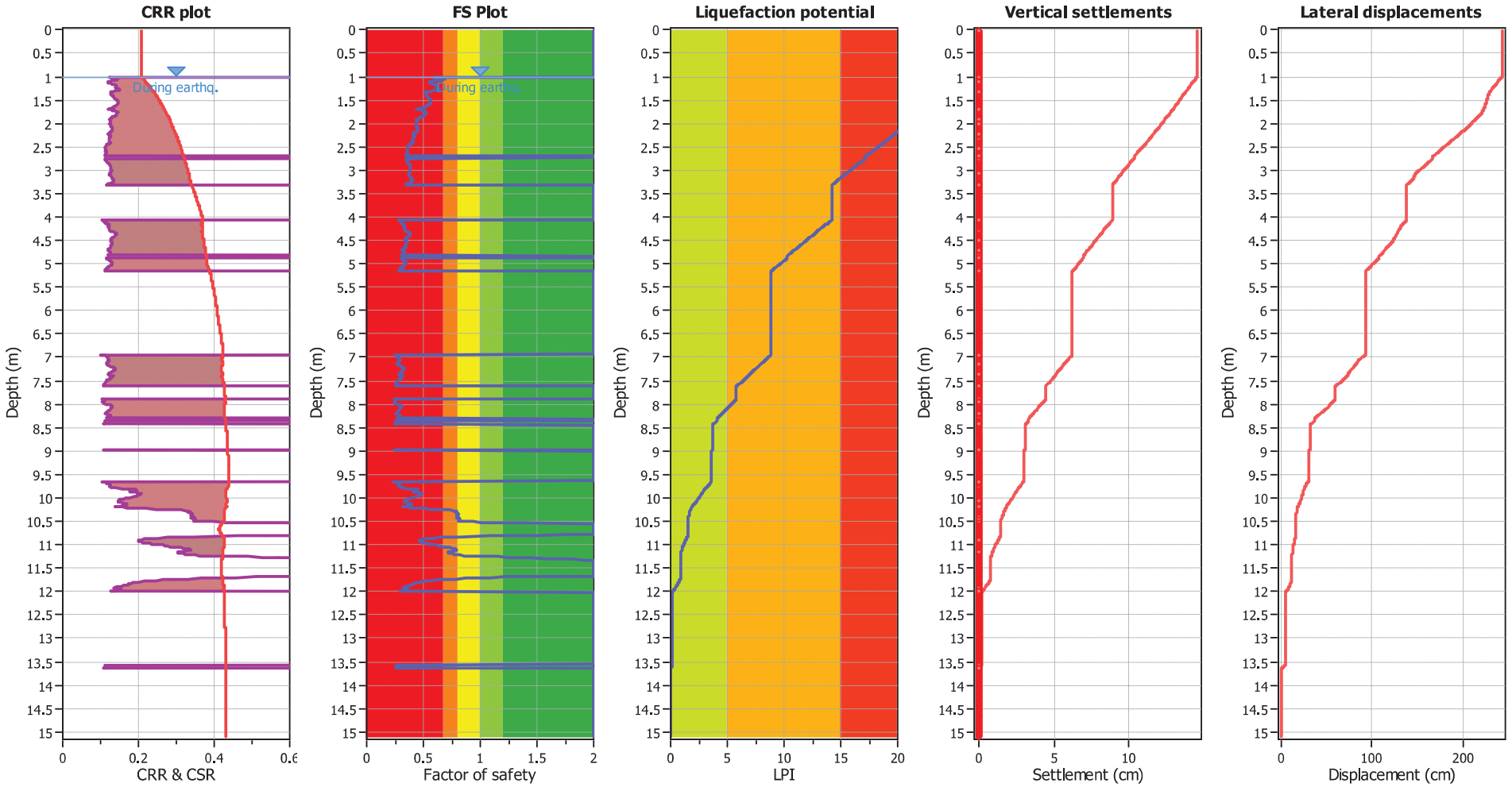






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

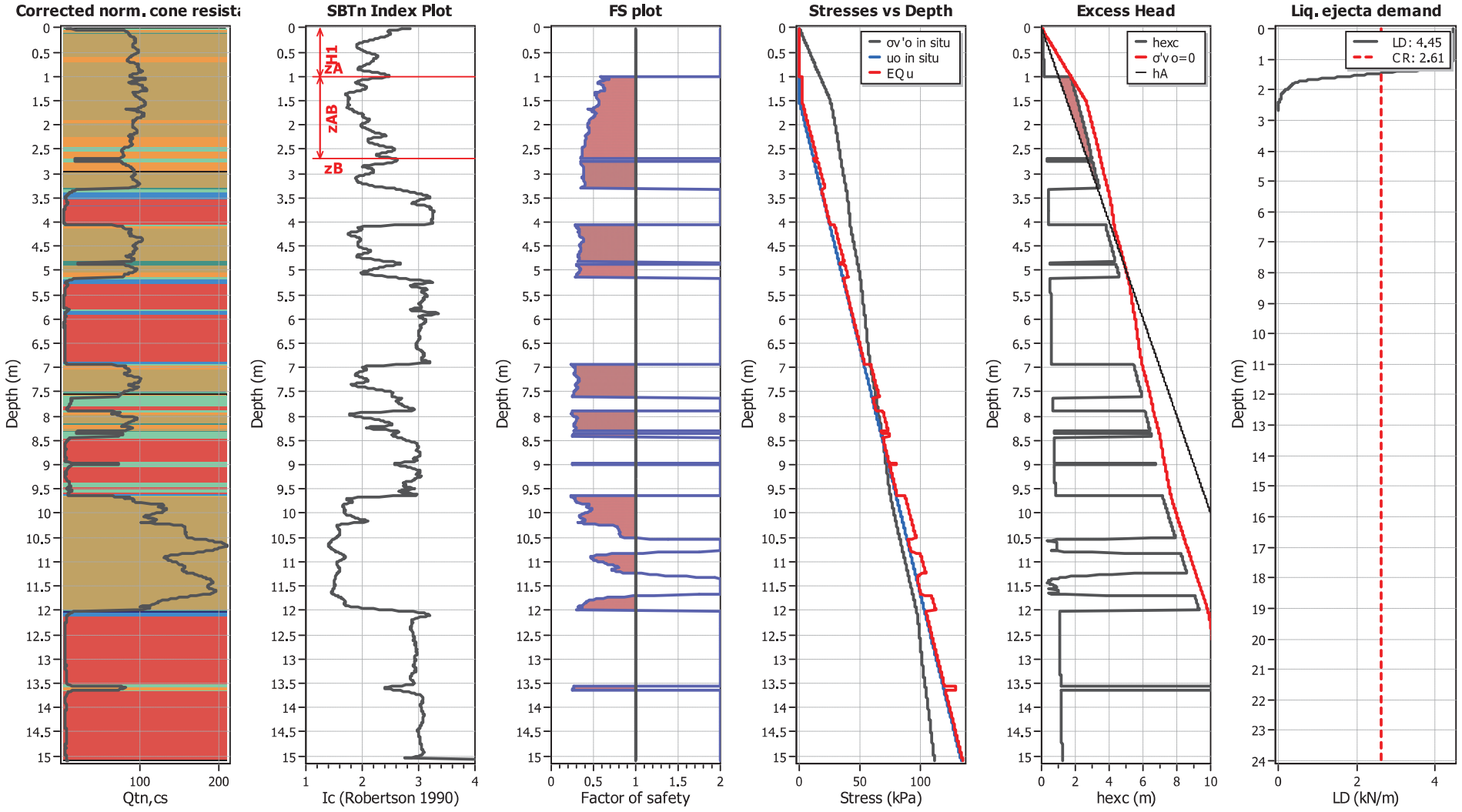
F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Ejecta Severity Estimation



12 Marylands Place, Middleton, Christchurch 8024
PO Box 10043 Phillipstown, Christchurch 8145
office@geoconsult.co.nz
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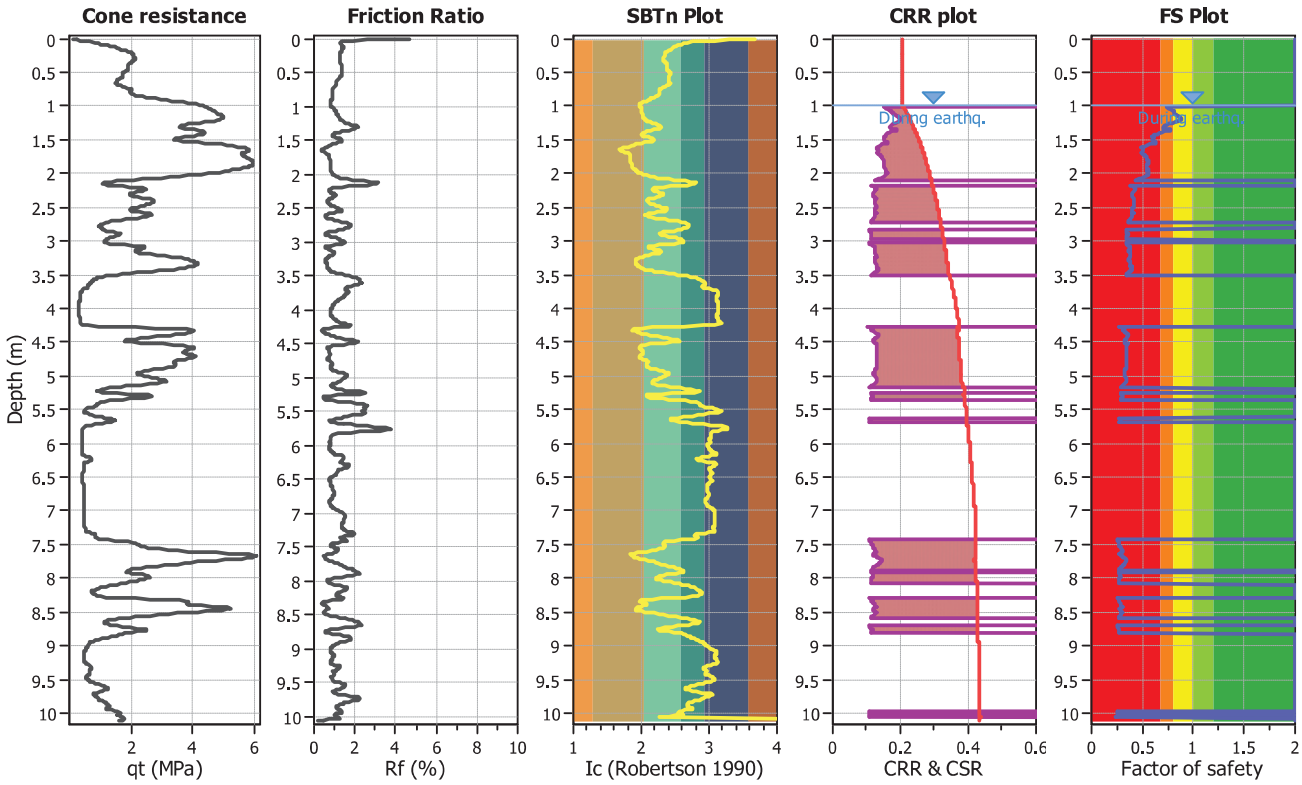
LIQUEFACTION ANALYSIS REPORT

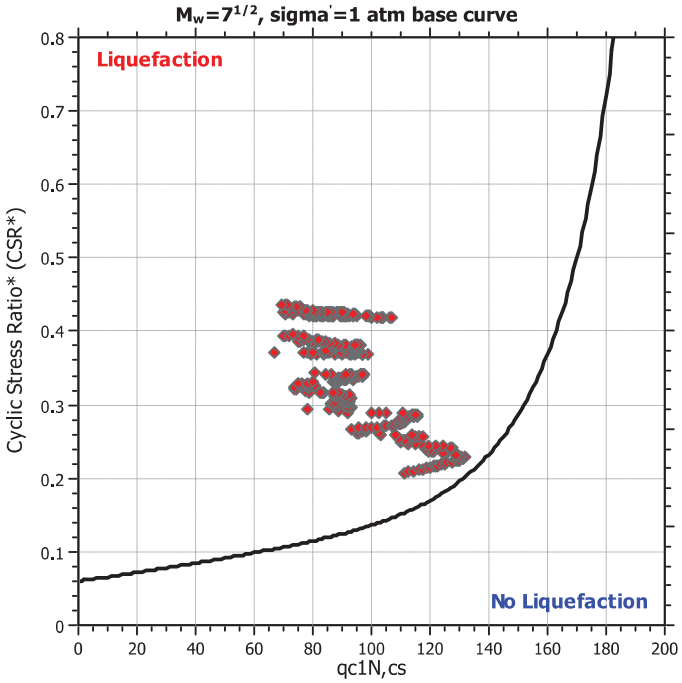
Project title : CO124 **Location : 606 Ridge Road, Motukarara**

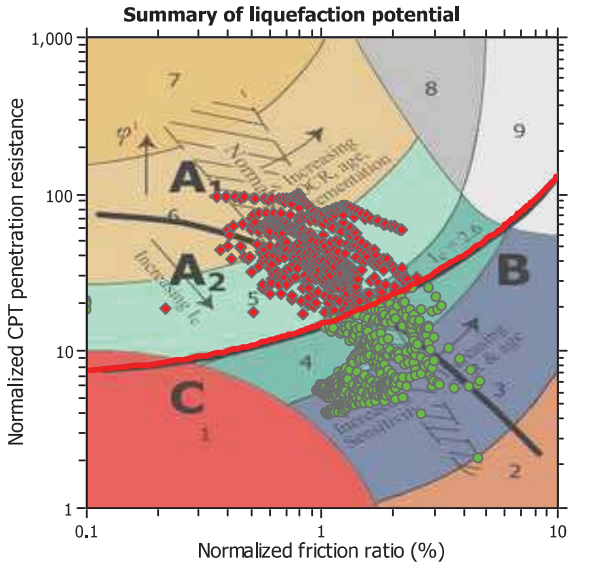
CPT file : CPT 4 - ULS

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

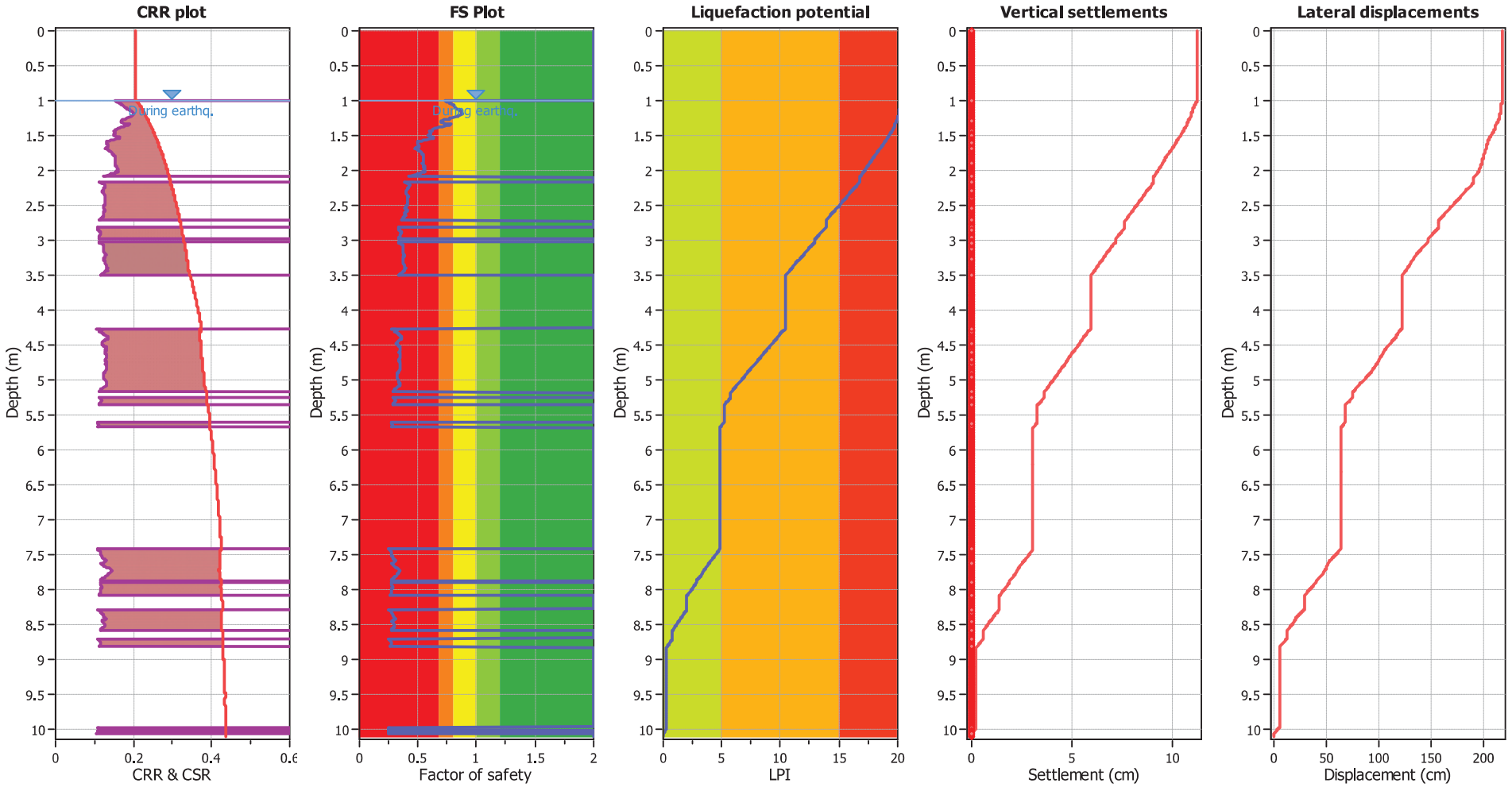






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

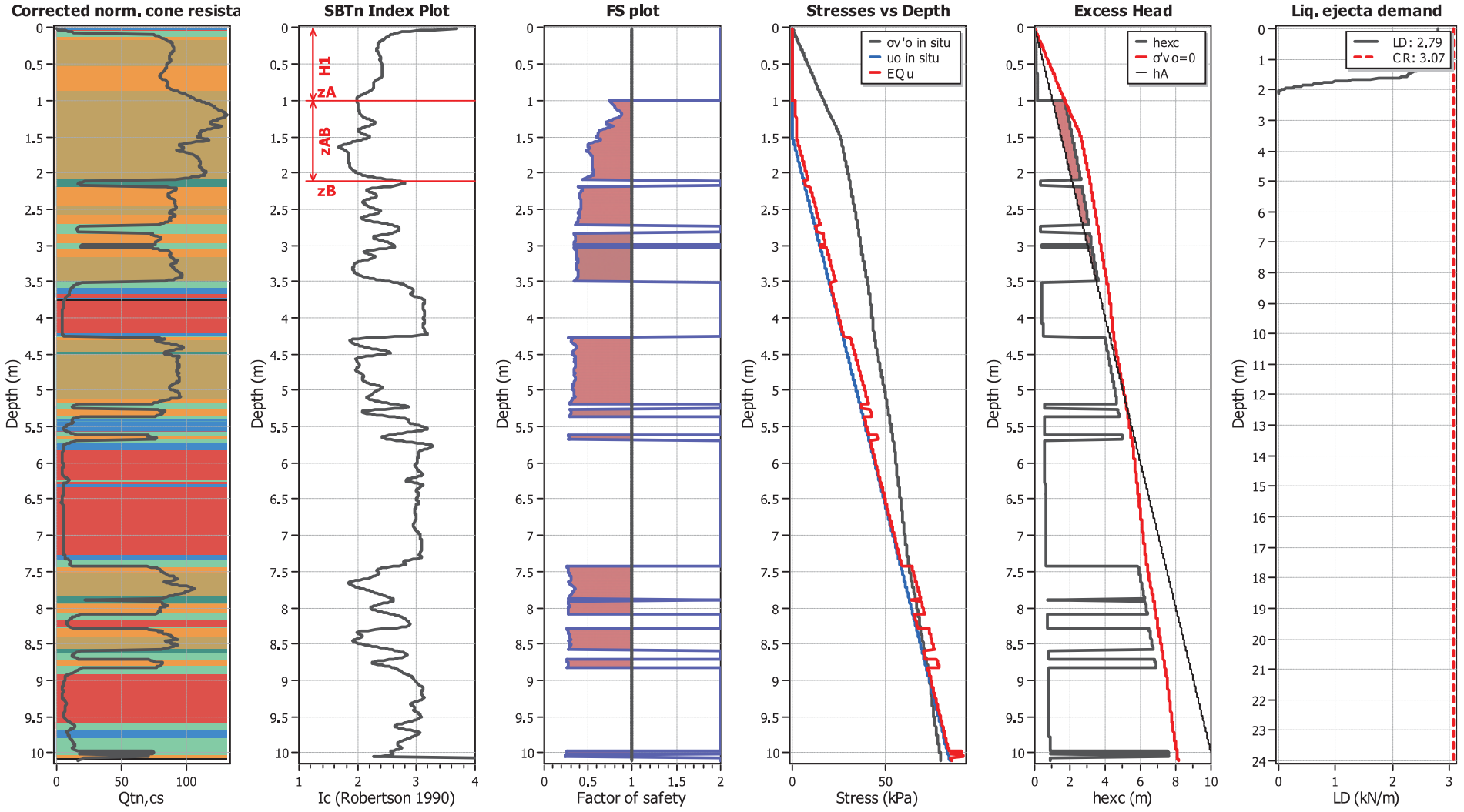
F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Ejecta Severity Estimation



12 Marylands Place, Middleton, Christchurch 8024
PO Box 10043 Phillipstown, Christchurch 8145
office@geoconsult.co.nz
https://www.geoconsult.co.nz/

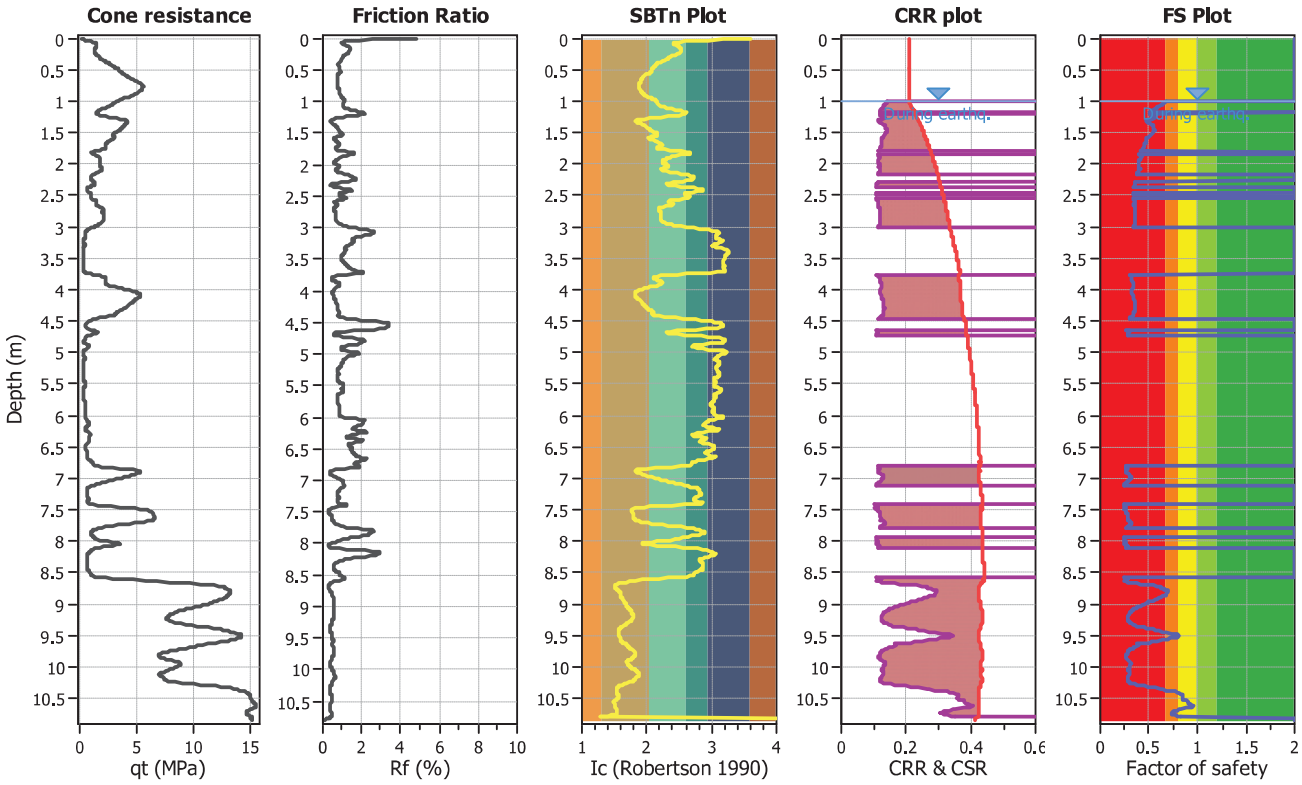
LIQUEFACTION ANALYSIS REPORT

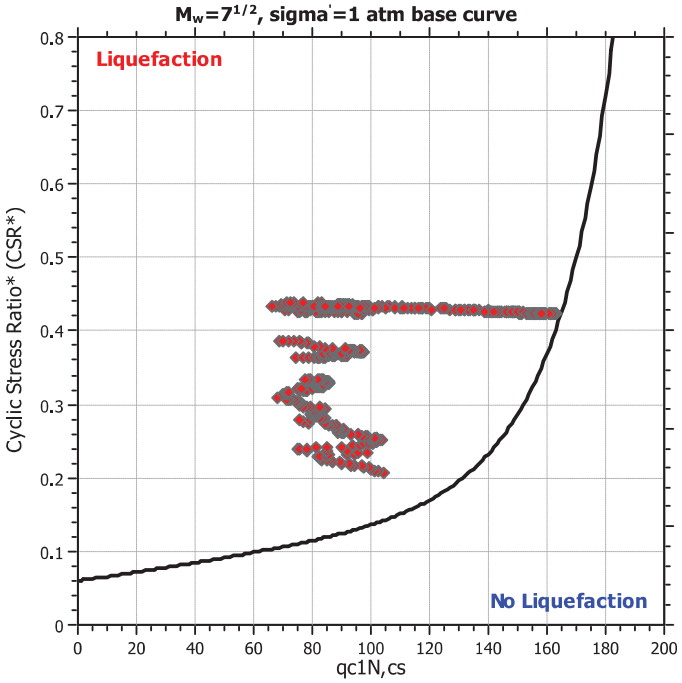
Project title : CO124 **Location : 606 Ridge Road, Motukarara**

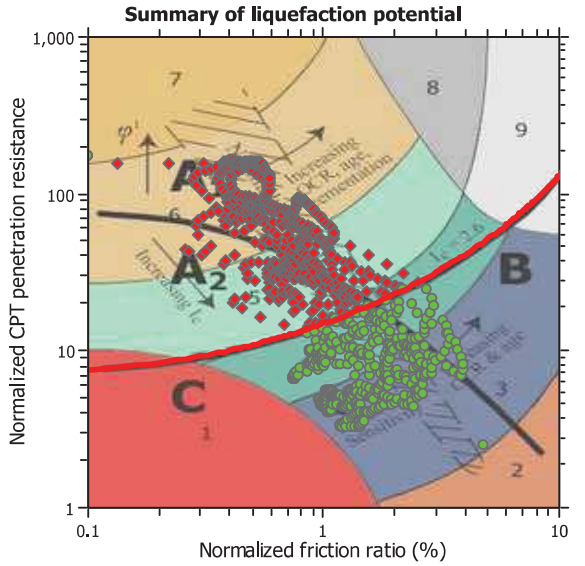
CPT file : CPT 5 - ULS

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		

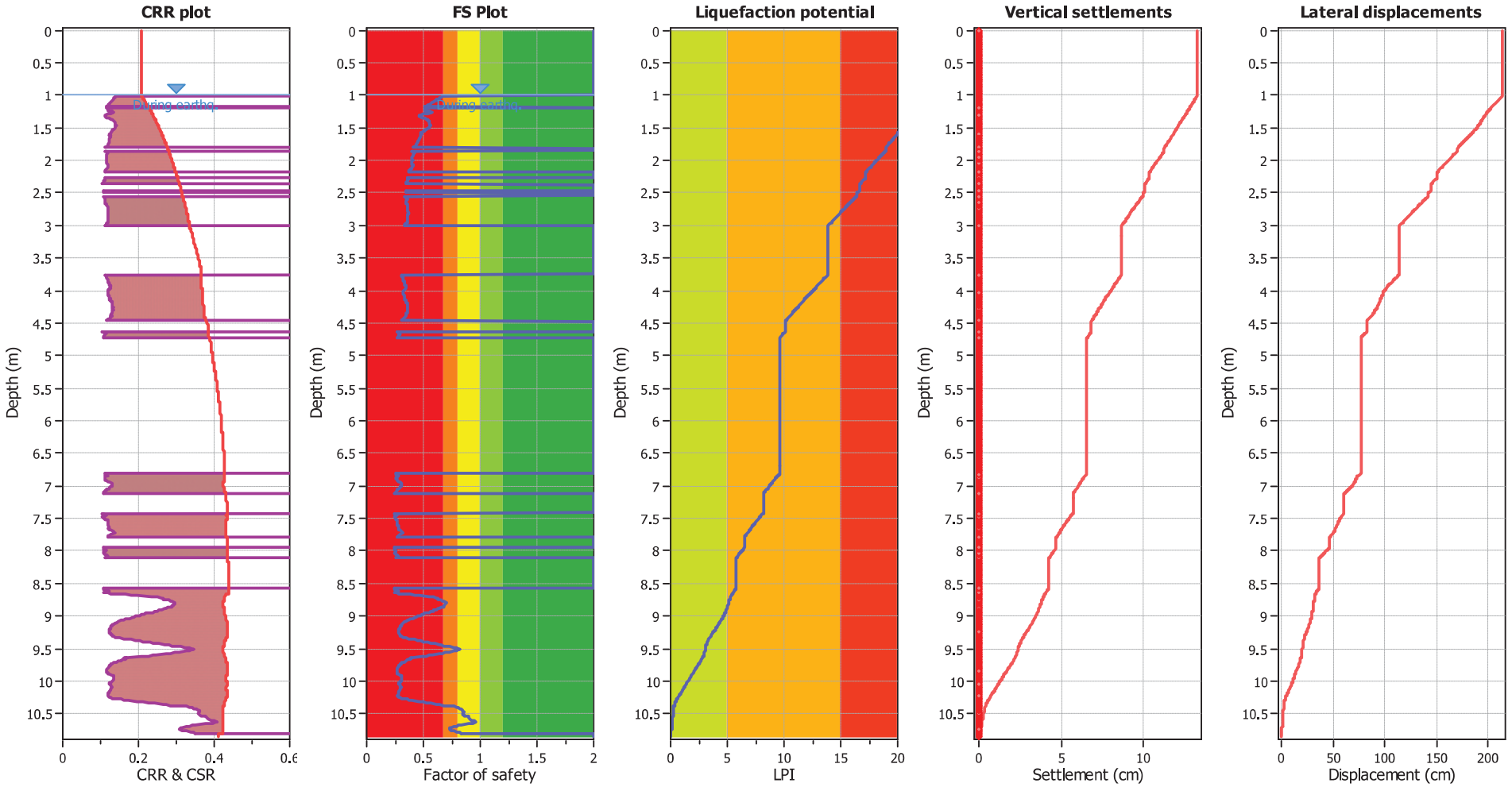






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

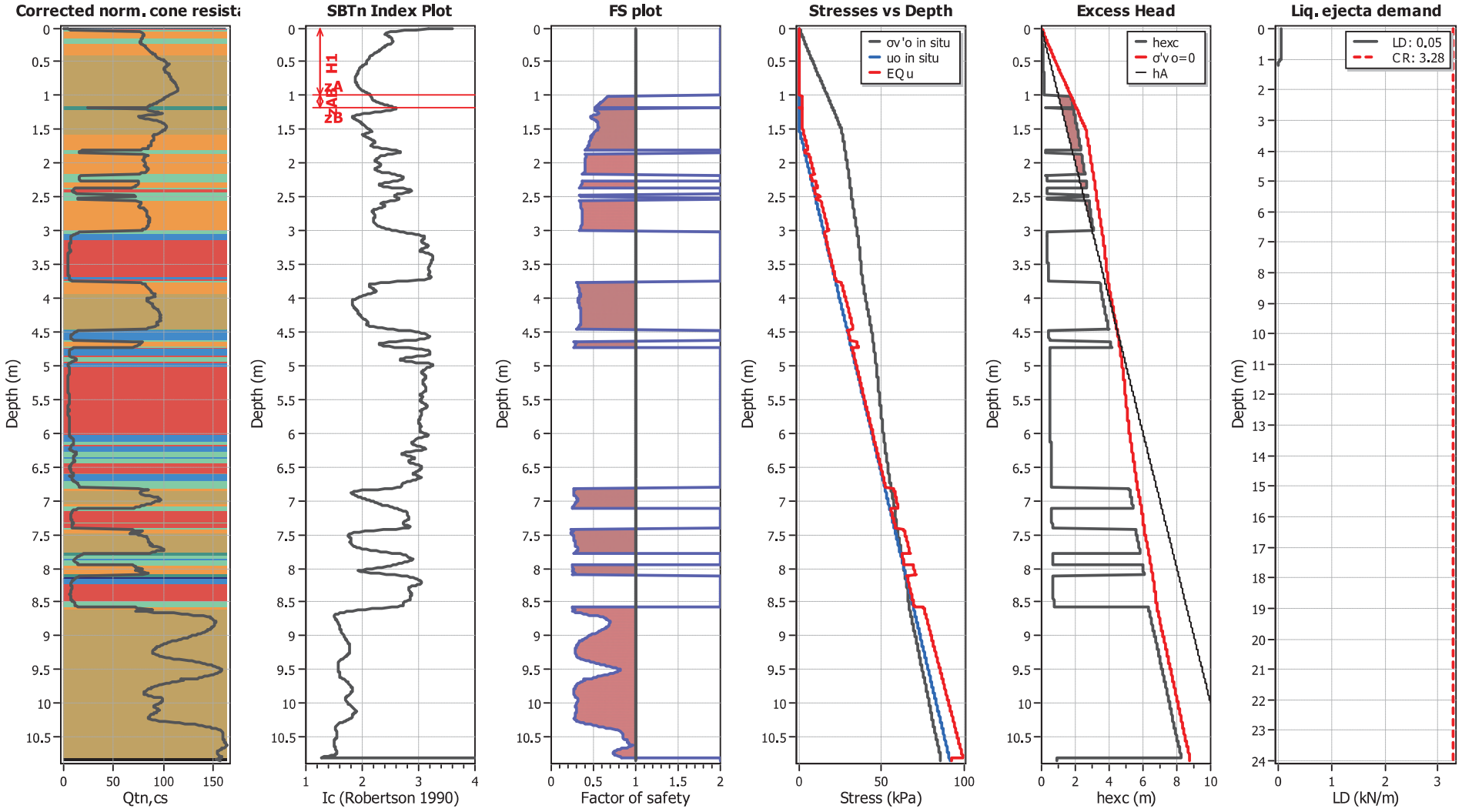
F.S. color scheme

- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

LPI color scheme

- Very high risk
- High risk
- Low risk

Ejecta Severity Estimation



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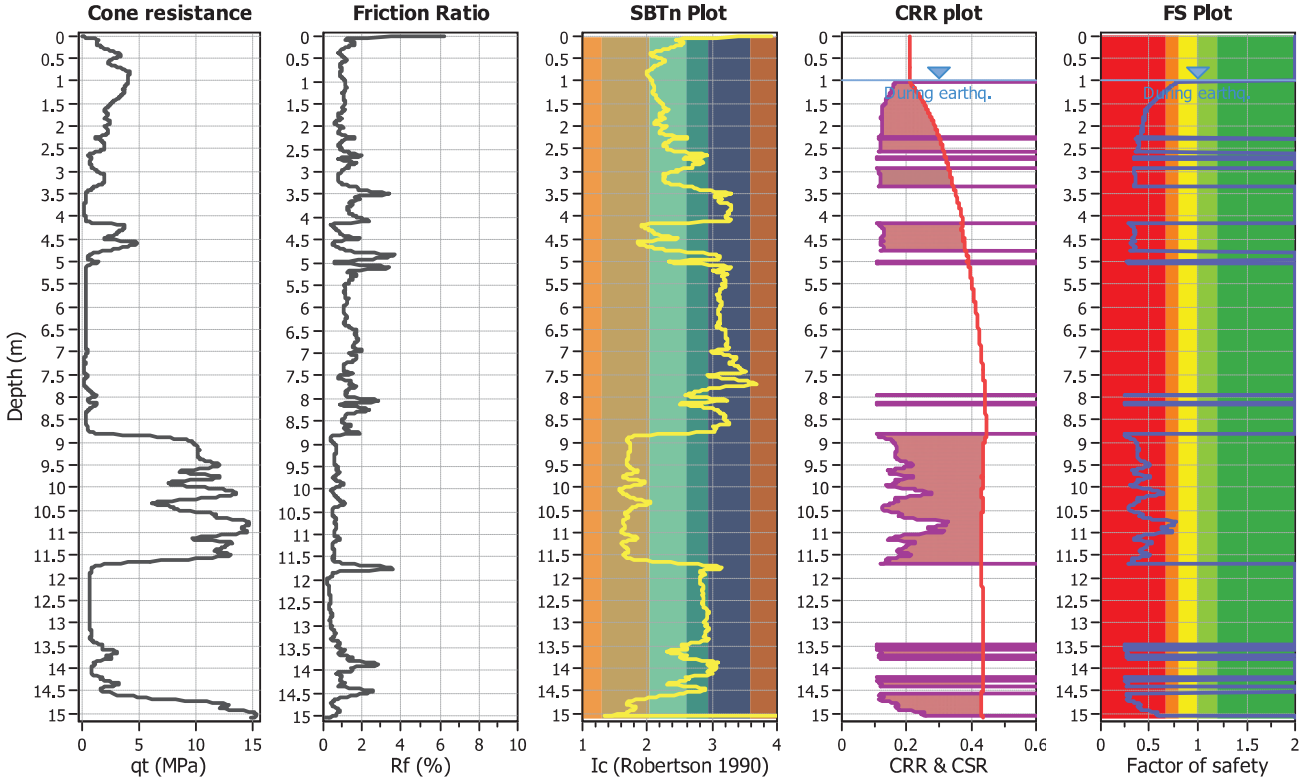
LIQUEFACTION ANALYSIS REPORT

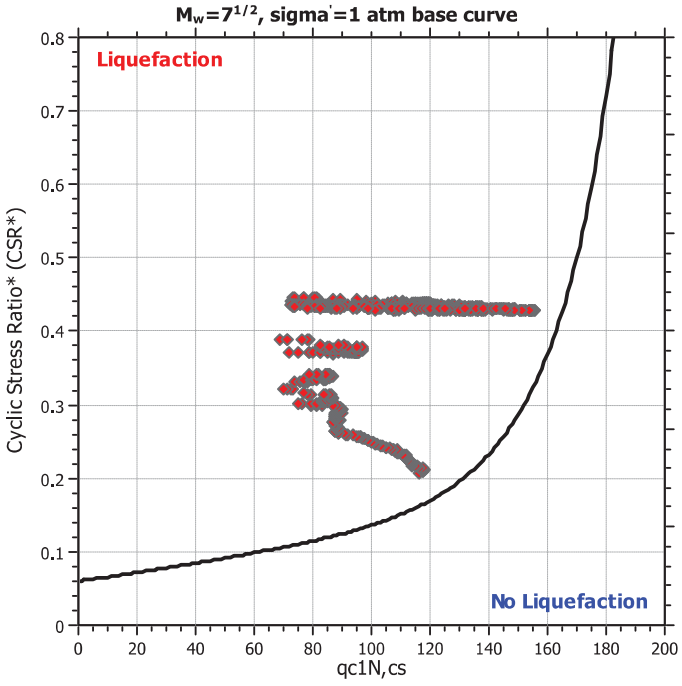
Project title : CO124 **Location : 606 Ridge Road, Motukarara**

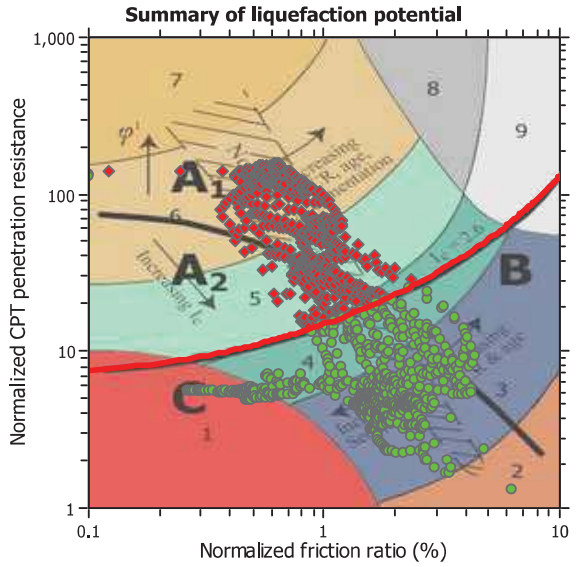
CPT file : CPT 6 - ULS

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.50 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.00 m	Fill height:	N/A	Limit depth applied:	No
Points to test:	Based on Ic value	Average results interval:	5	Fill weight:	N/A	Limit depth:	N/A
Earthquake magnitude M_w:	7.50	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.35	Unit weight calculation:	Based on SBT	K_σ applied:	Yes		







Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
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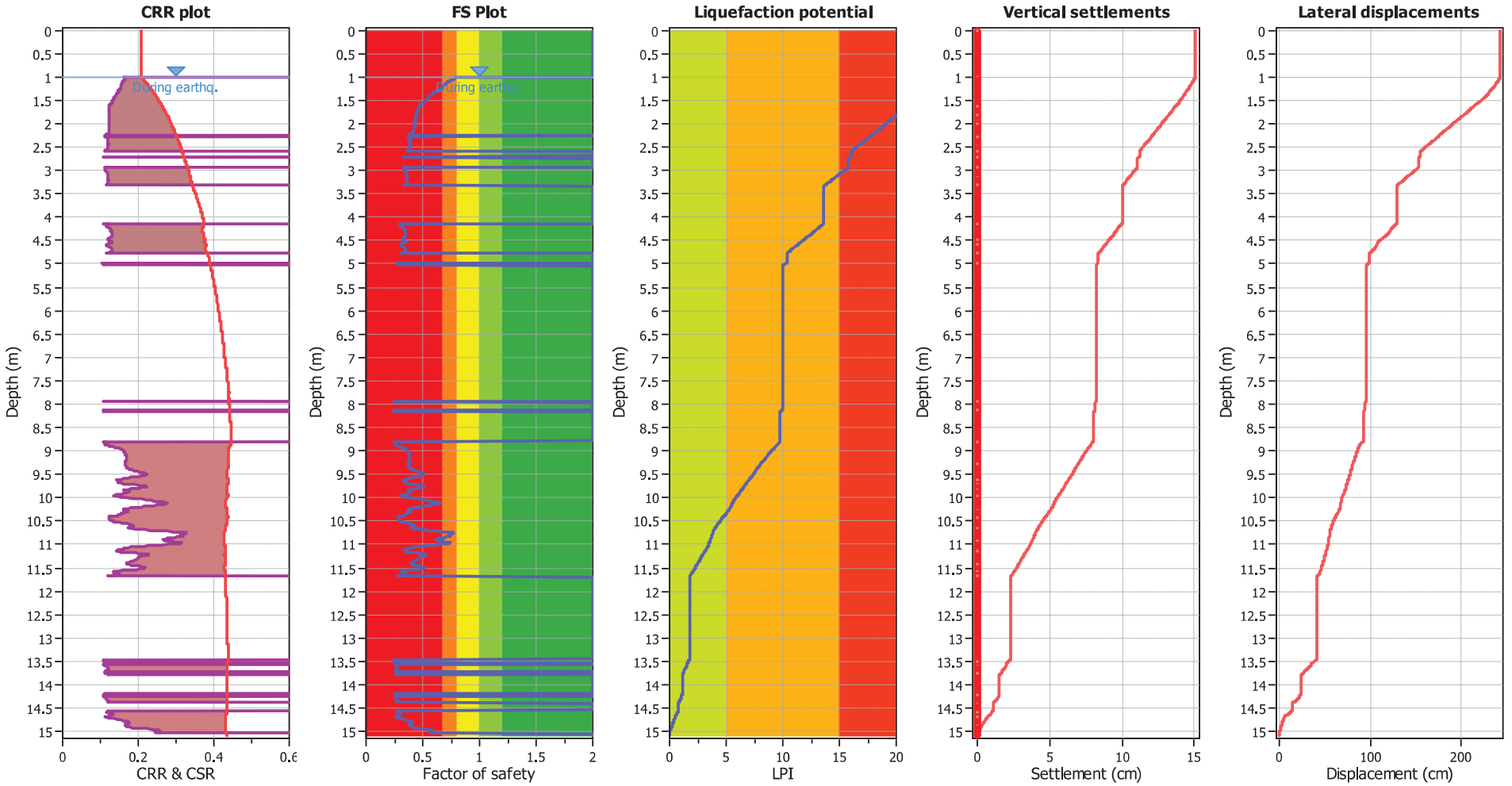
Zone C: Cyclic liquefaction and strength loss possible depending on soil plasticity, brittleness/sensitivity, strain to peak undrained strength and ground geometry

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.00 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	5	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	Yes
Earthquake magnitude M_w:	7.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.35	Use fill:	No	Limit depth applied:	No
Depth to water table (insitu):	1.50 m	Fill height:	N/A	Limit depth:	N/A

F.S. color scheme

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LPI color scheme

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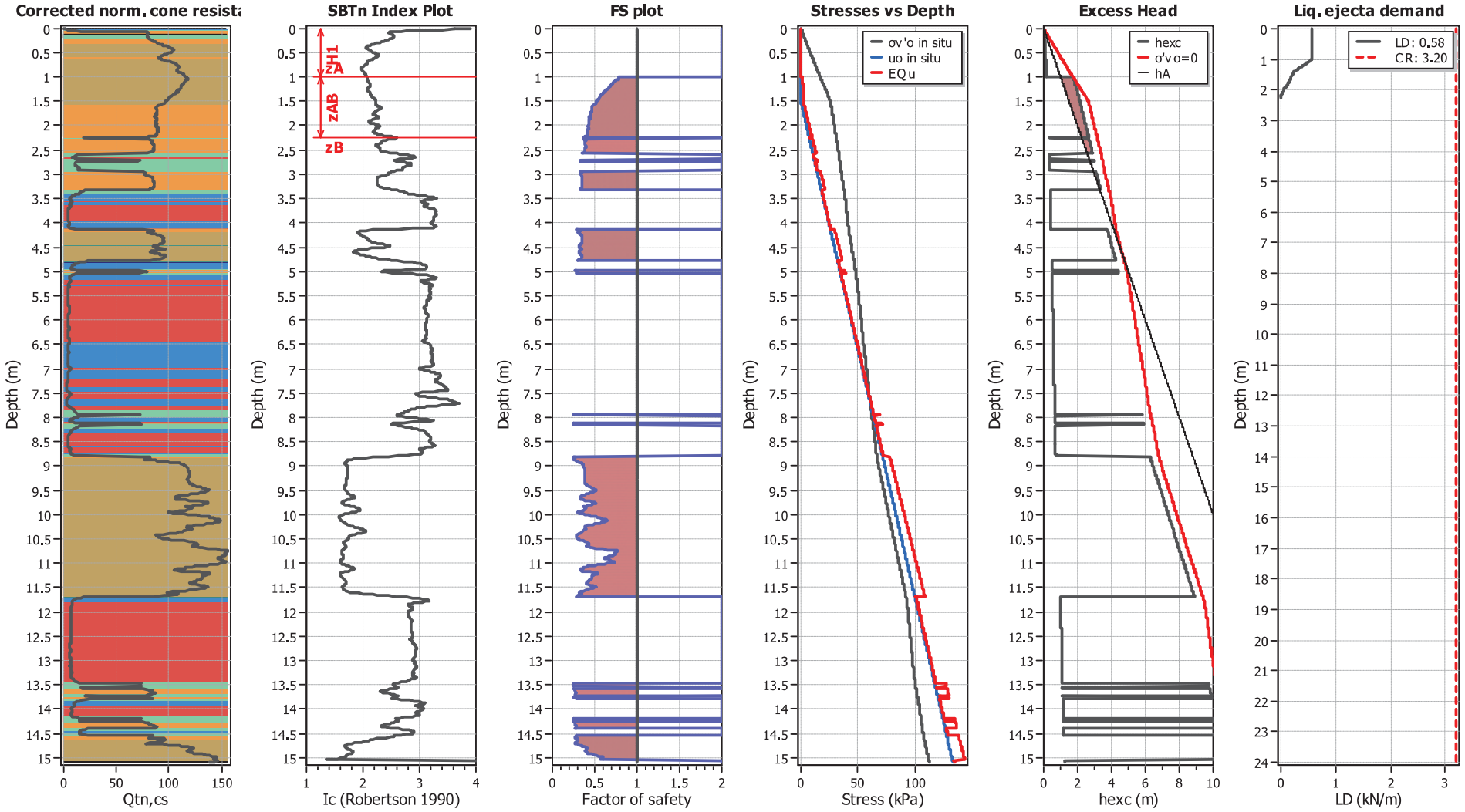
Ejecta Severity Estimation



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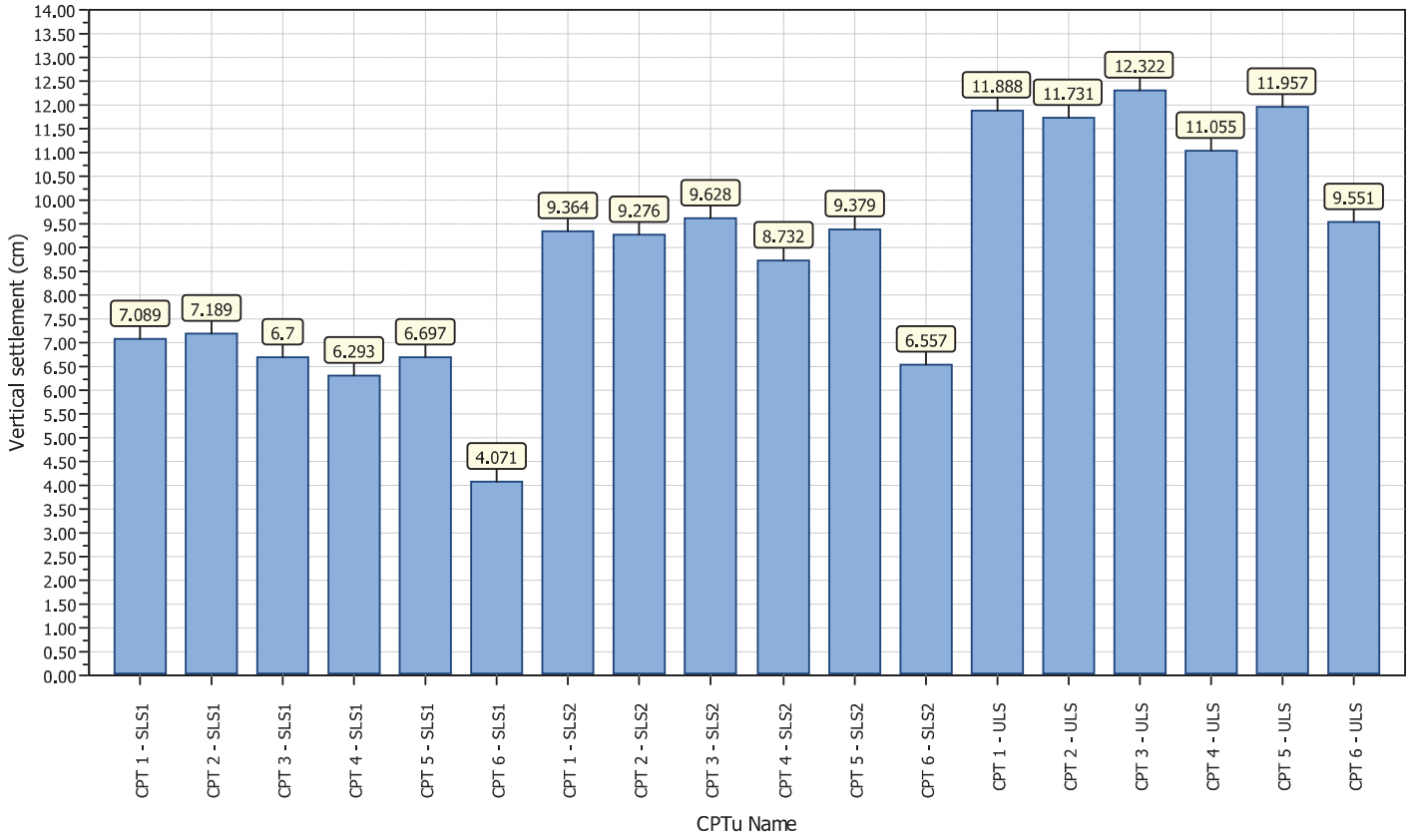
Overall vertical settlements report



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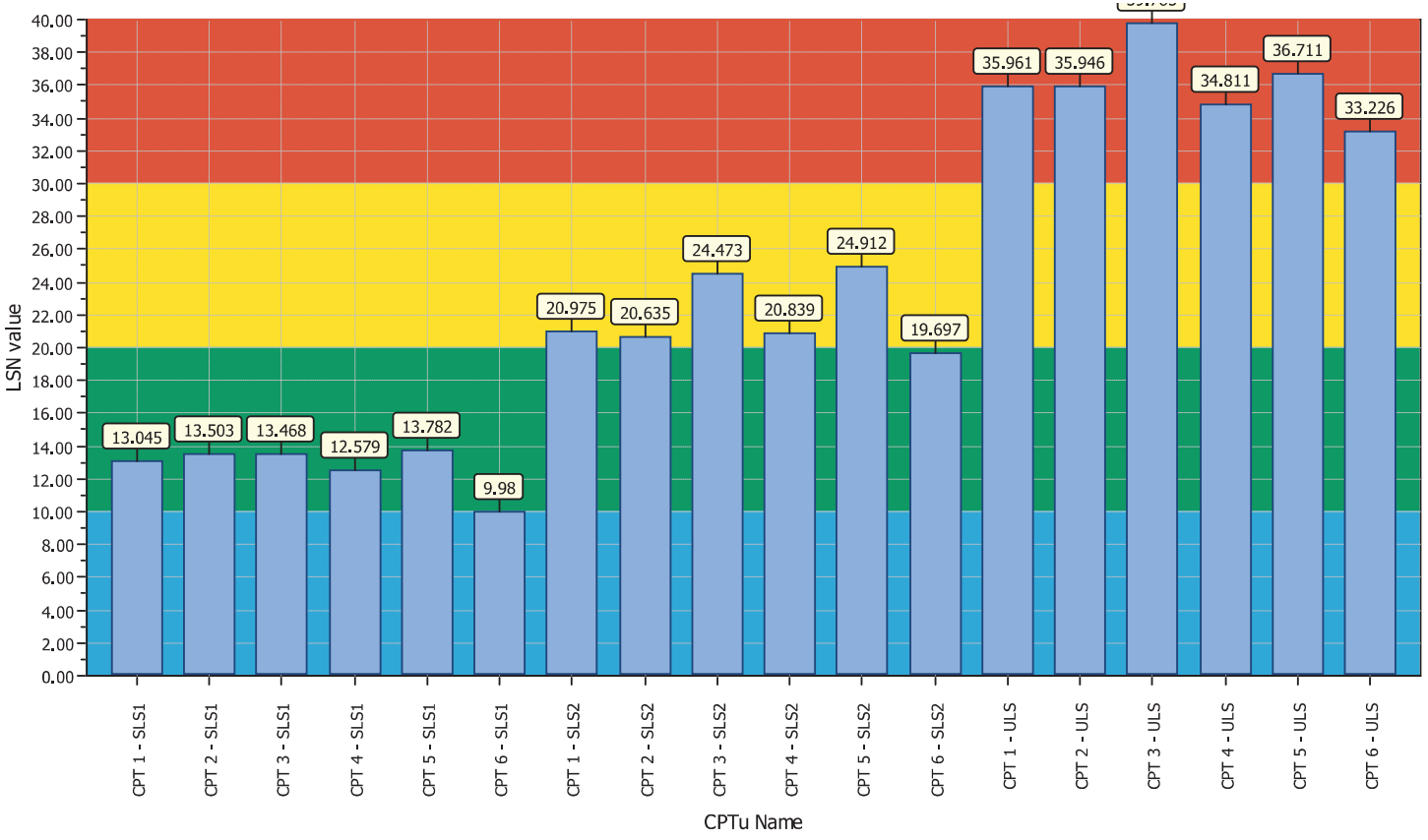
Project title : CO124

Location : 606 Ridge Road, Motukarara

Overall Liquefaction Severity Number report



LSN color scheme

- Severe damage
- Major expression of liquefaction
- Moderate to severe exp. of liquefaction
- Moderate expression of liquefaction
- Minor expression of liquefaction
- Little to no expression of liquefaction

Basic statistics

Total CPT number: 18
6% little liquefaction
33% minor liquefaction
28% moderate liquefaction
33% moderate to major liquefaction
0% major liquefaction
0% severe liquefaction