Chris Hansen Consultants Ltd
PO Box 16-531
Bethlehem
Tauranga 3147
New Zealand
Email: chris@rmaexpert.co.nz
Mobile: 02102645108

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Marnie Rydon
Consultant Planner
Kapiti Coast District Council
Private Bag 60601
Paraparaumu 5032

Dear Marnie

RE: RM210147 POST NOTIFICATION FURTHER INFORMATION REQUEST UNDER SECTION 92(1) OF THE RESOURCE MANAGEMENT ACT 1991 PROPOSED OTAIHANGA ESTATES SUBDIVISION

I refer to your request for further information letter dated 21 January 2022 relating to the proposed subdivision for the Otaihanga Estates located at 48 & 58 Tieko Street; 131, 139 & 147 Otaihanga Road, Paraparaumu [RM210147].

The following addresses the information requested in your letter corresponding to the paragraph numbers used. Attached is a set of revised suggested draft conditions that are offered by the applicant to address some of the matters included in the post notification s.92 request as appropriate.

Geotechnical Report Peer Review

1 *Inclusion of the ground elevation (R.L.) to the presented geotechnical investigation logs and reported ground water levels in Table 1.*

Response:
Elevations as taken from the earthworks and survey plans are now included in the header section for all investigation logs (Appendix A) and are shown against natural contours and proposed earthworks plans (Figures 1, 2A and 2B) in the revised RDCL Geotechnical Investigations Report dated 10 March 2022 (**Attachment 1** to this letter).

2 *A large depth variation is given for the reported 200 and 300kPa ultimate values for the current ground conditions, which are not representative or 'usable' for the final subdivision levels considering the cuts and fills. Please provide updated information that does allow for comparison with the final subdivision levels.*

Response:
As above, elevations as taken from the earthworks and survey plans are now included in the header section for all investigation logs (Appendix A) and are shown against natural contours and proposed earthworks plans (Figures 1, 2A and 2B) in the revised RDCL Geotechnical Investigations Report (**Attachment 1**).

The depth to the Ultimate Bearing Capacity and RL (m) of the elevation at which the bearing capacity has been achieved are also listed in Table 2 Section 4.1 of the revised RDCL Report.

3 *Although agreeing with the presented liquefaction triggering analysis, depending on the ground water level (hence why inclusion of R.L. considered necessary), liquefaction triggering is likely within the top 2.0*

to 3.0m along the transition layer before getting into the medium dense or dense sands. The location of the lower elevation CPTs, such as CPT 1 as shown below with a cut and fill for the construction of the required fill and a wetland, should be carefully considered for the slope stability of the final development under static, and more importantly, under seismic and post-seismic conditions.

Response:
RDCL advise that the liquefaction response under seismic conditions has been checked for the earthworked topography with no significant change in magnitude of ground response. Assessed profiles are in Appendix B with deformations in Table 5 Section 4.3.4 of the revised RDCL Report (**Attachment 1**).

Seismic assessment has been conducted using updated parameters from MBIE (Nov. 2021) Earthquake Geotechnical Engineering Practice; Module 1. Overview of the guidelines.

4 *Although agreeing the site is geotechnically suitable for the proposed land development, the conditions included in RDCL's geotechnical report section 5 should be further detailed by providing the required backfill material suitability criteria (i.e., compaction characteristic and/or soil classification), and minimum strength parameters to satisfy future stability of the fill slopes (with critical care for the conditions of the 8.2m maximum slope height). Please provide this additional detail.*

Response:
General specifications for engineering fills (including backfill material) have been included in a new Section 5.5 of the revised RDCL Report (**Attachment 1**).

5 *Section 5.3 proposed setback from slopes are not consistent with the parameters given in section 5.4 (i.e. permanent batters and estimated effective stress strength values), and are not supported by some form of limit equilibrium slope stability checks. We are not certain how the proposed 3.0m setback derived, or how they were revised from 5.0 to 3.0m, hence our proposed need to clarify and supported with slope stability analysis capturing future loading conditions. Miyamoto's preliminary stability checks using the proposed slopes and Table 5 effective strength parameters cannot justify the given setback under the investigated loading conditions (i.e. static, seismic and increased pore water pressure using an ru value of 0.15) for a loose silty sand slope, and a denser slope. A yield or critical acceleration value ky of 0.119 and 0.204g identified for the examined slopes.*

Response:
RDCL advise that stability analyses for natural and fill slopes have been undertaken to confirm the setback of 5m from the crest of all slopes.

Stability analyses suggest only the natural slope with the loose mantle under saturated conditions and the ULS earthquake does not achieve adequate factors of safety. In that case deformation analyses using finite element program RS2 suggest displacement of < 0.5m within the loose surface material and < 0.05m within the 5m setback. Based on the expected displacement, the slope is considered acceptable.

All other sections are considered acceptable for factors of safety with slope deformation < 0.5m. A summary of this work is included in Section 4.5, with analytical outputs in Appendix C of the revised RDCL Report (**Attachment 1**).

Seismic assessment has been conducted using updated parameters from MBIE (Nov. 2021) Earthquake Geotechnical Engineering Practice; Module 1. Overview of the guidelines.

Roading

6 *Tieko Street traffic effects and proposed road/footpath improvements – there is significant concern over the effect of additional [sic] Our major concern is the effect of additional traffic generated by the*

development (including construction traffic) on the safe and efficient operation of Tieko Street and the intersection of Tieko Street and Otaihanga Road.

Please provide in depth detail on the proposed improvements, including road widening. If there are limitations on the ability to be able to provide improvements and widening for the continued safe use of Tieko Street, please detail why this is the case.

Response:

The Applicant provided traffic count data in response to matter #5 in the request for further information s.92 letter dated 26 July 2021 that supported the findings of the Transport Assessment Report (dated 290621 submitted with the consent application) that the proposed subdivision will generate little additional traffic through the Tieko Street (around one turning movement per minute at the busiest times).

Details regarding the proposed earthworks and civil works associated with Tieko Street has been provided to Council in the plan included in the Engineer's Estimate prepared by Cuttriss (dated 10 December 2021) and included as Attachment 1 to the response to the Action Points (dated 16 February 2022) from the meeting between the Roading Team and applicant on 15 November 2021. These proposed works are offered up by the Applicant to improve the existing part of Tieko Street as part of the extension of Tieko Street to service the proposed subdivision, and are not in response to any effect that the proposal causes. For completeness, a copy of these plans for the Tieko Street works are included as **Attachment 2** to this response.

Please note it is not possible to widen the carriageway along part of Tieko Street to a full two-lane width due to the wetland located on private property on the eastern side of Tieko St. This wetland is likely to be a natural inland wetland in terms of the National Policy Statement Freshwater Management. Discussions with Council's roading team have confirmed that neither the Applicant or KCDC have a viable consent route available under the NPS-FW or GWRC PNRP to widen the road in these circumstances. The opposite side of the road also contains large Kanuka which Wildlands have advised (and we understand Council accept) are considered significant indigenous vegetation that is protected under both plans making removal difficult.

In relation to construction traffic, this matter was also addressed in the response to the Action Points (dated 16 February), with the provision of scoping points for a Construction Traffic Management Plan. These matters have been brought through into a revised set of suggested consent conditions (Condition R3) included in **Attachment 3**.

7 *Shared path connecting the two proposed access roads – We have confirmed with the applicant that this shared path is not a recreational loop path but a connecting shared path as required by NZS 4404:2010 and outlined the link between subdivision consents, the district plan-SDPR and NZS 4404:2010. We require a 2.5m wide (within a 5.5m wide corridor) shared path which is lit and surfaced in concrete or asphaltic cement. This needs to be confirmed as acceptable to the applicant. We are not prepared to accept a shared unlit path in metal as an appropriate and safe type of facility which can be accessed and used by all users. Guidance on the formation of cycle path is contained within Austroads Part 6A - [extracts from Austroads Guide included in the s.92 request].*

Response:
In response to this matter being discussed with the Roading Team at the meeting on 15 November 2021, the applicant has responded to these matters as part of the Action Points from that meeting dated 16 February 2022. For completeness, the following is a summary of this response which outlines the applicants position on the matters raised above.

The applicant never intended the shared path to be a roading asset, and notes the resource consent application clearly stated that Lot 104 is to be vested in Council as a local purpose reserve (walkway / cycleway / bridleway) linking the two internal roads (Section 3.1 of the Project Description in the AEE).

The Applicant is therefore unclear on what basis Council can change the status of the shared path from the original application, and then seek to apply NZS4404:2010.

The Applicant has received the following advice from Harriet Fraser (Transport Planner) regarding the shared path:

"The shared path provides the following functions in order of importance:

1. *Pedestrian and cyclist connection between the two parts of the development. With a connecting road no longer being viable due to needing to avoid wetland areas, the inclusion of a pedestrian/cyclist link ensures connectivity for at least some travel modes. This will enable efficient active mode movement between households. The alternative existing route via Tieko Street and Otaihanga Road is considerably longer.*
2. *Pedestrian and cyclist connection from the northern part of the proposed development to the existing Otaihanga Road shared path and beyond to the Expressway corridor. This can be expected to be used for walking and cycling recreation and for cycle commuting. The alternative existing route via Tieko Street and Otaihanga Road is longer.*
3. *Pedestrian and cyclist connection from the existing properties at the northern end of Tieko Street to the properties within the proposed development and beyond to the existing Otaihanga Road shared path and Expressway corridor. This can be expected to be used for walking and cycling recreation and for cycle commuting. The alternative existing route via Tieko Street and Otaihanga Road is longer.*
4. *The creation of a walking (and to lesser degree cycling) loop, including the proposed shared path, the existing shared path on Otaihanga Road and Tieko Street. This would be expected to be a recreational walking loop used by nearby existing residents and future residents of the proposed development.'*

Therefore,

- *Given the limited catchment (i.e., the northern end of Tieko Street and residents of the proposed development), usage of the path can reasonably be expected to be noticeably less than that of the existing Otaihanga Road shared path.*
- *The existing Otaihanga Road shared path has an unsealed surface and is not lit, other than by intersection flag lighting. Tieko Street is also not lit.*
- *For consistent tie-in with the existing environment, the provision of a path with similar amenity to the existing Otaihanga Road shared path, that is an unsealed surface and no lighting is appropriate.*
- *Other matters for consideration include CPTED (user personal safety), stormwater drainage (path surface) and ecology (lighting)."*

Iwi have expressed a desire to have their identify reflected in the proposed subdivision and development. In particular the shared path in part follows the old Dray Track across the site which is important to iwi. Ra Higgott is representing Ātiawa on this matter, and has undertaken a site visit and has provided a Report **(Attachment 4)** that provides an account of the history of the area that could be communicated to the users of the shared path. Essentially iwi wish to see the Dray Track be kept as natural as possible and would not want any lighting to be installed. The Applicant will be working with the iwi through the final design of the Project, should consent be granted, to incorporate the opportunities identified in Ra Higgott's Report.

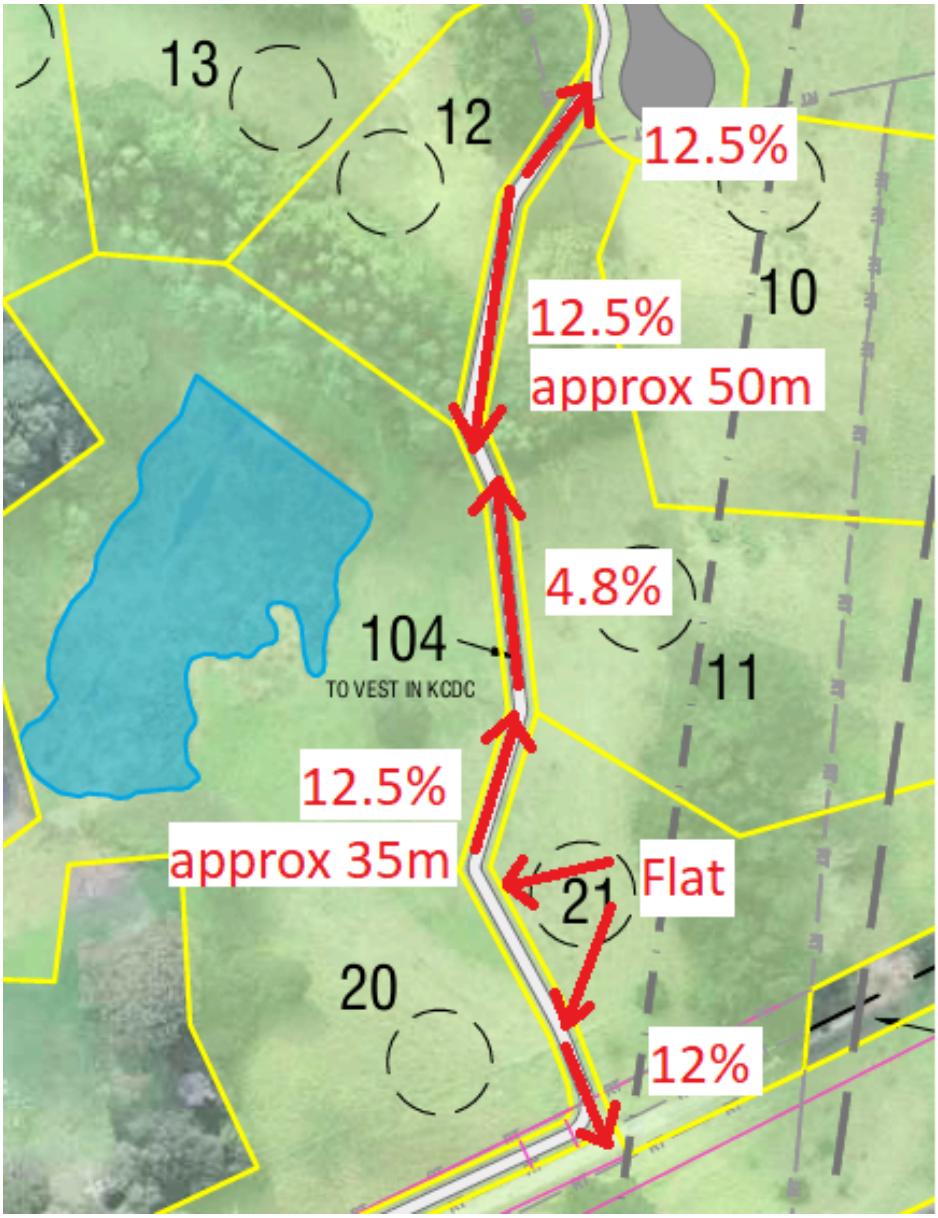
The Applicant as part of the discussions with the Roading Team obtained an CPTED assessment. A copy of this is enclosed at **Attachment 5.** In summary that has assessed the proposal against the CPTED issues in NZS4404:2010 Footpaths and Accessway and determines the proposal is appropriate for its setting in a rural-residential environment and meets good CPTED Principles.

It is also noted that a number of submitters, for example Mr and Mrs Earl, have raised concerns about this track being sealed, lit and the type of users that it could attract (i.e. the expectation that the proposed width could suggest motorised recreational vehicles were permitted there creating a danger for users). They support a narrower metaled track.

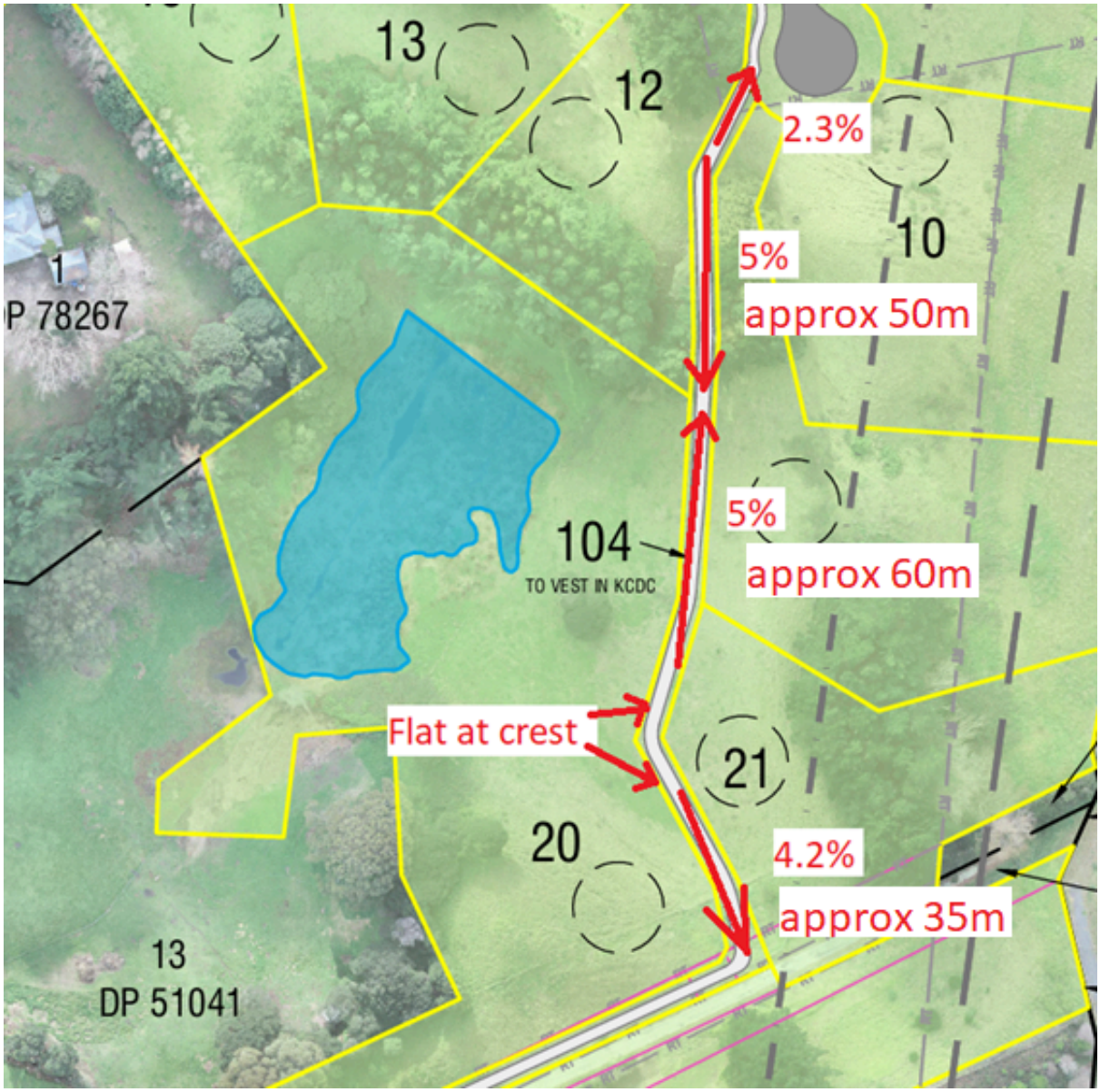
In terms of lighting, the Applicant proposes to provide reflectors along the shared path, and particularly denoting the sharp corner at the southern end between Lots 20 and 21 . We understand that the Council's landscape Peer Reviewer is in agreement that lighting in this area be kept to a minimum/ low level.

8 *As can be seen from the above, the use of a gravel path is seen as a temporary arrangement by the reference to this type of facility as the first stage of development. Also, please provide the gradient of the path, if it is steeper than 3% it should not be metal. Further advice on the formation of unsealed shared paths is provided by NZTA: [extracts from NZTA Guidelines included in the s.92 request].*

Response:
The applicant's position on the status of the shared path is discussed in detail above. In terms of the gradient, the steepest grade shown on the notified plans is 12.5%, as shown in the plan below. This grade was set to minimise earthworks in the vicinity of the central wetland located in Lot 20.



As a result of a further meeting and discussions with the Council's Roading Team, and regardless of whether the shared path ends up being a roading or parks & recreation asset, the Applicant agrees that the grades included in the original proposal are not ideal for pedestrians or cyclists, and has designed an amendment of the route of the shared path to achieve grades that do not exceed 5%, but are greater than 3%, as per the plan below.



Based on these grades, the Applicant does not consider sealing the full length of the shared path is necessary, but does propose to seal the sharp corner, as shown on the revised Shared Path plan in **Attachment 6** which shows the design of the amended Shared Path.

9 *Part of the intention for the shared path is that it avoids the need for cyclists to use Tieko Street, which is narrow, as seen above the disadvantages of an unsealed path is that it will not attract cyclists with narrow tyres and is also not suitable for mobility impaired pedestrians, given the demographic on the Kapiti Coast this point is also very important for us. To clarify we would only seek a 2.5m wide shared path if surfaced in Concrete or Asphalt not the full 5.5m width.*

Response:
Harriet Fraser advises that cyclists can safely use Tieko Street if they choose. It will remain a low volume road and there is excellent forward inter-visibility between road users. The formalized narrow section will also assist with keeping vehicle speeds down. The addition of the footpath on Tieko Street will be a benefit to mobility impaired pedestrians and this path will connect into the footpath on Otaihanga Road.

It is confirmed that a minimum 2.5m wide shared path is to be provided.

10 Construction traffic – please confirm if all construction traffic is able to gain access from Otaihanga Road only given the narrow width of Tieko Street, there are significant safety concerns. If all construction traffic is not able to use Otaihanga Road for access, please provide details of exactly what proportion/type of traffic can be assigned to each road (Tieko or direct access to Otaihanga from the development).

Response:
Harriet Fraser has proposed a Construction Traffic Management Plan (CTMP) and has included the matters a CTMP would address as part of the Action Points from the meeting with the Roading Team in November last year, dated 16 February 2022. These matters have been incorporated into the revised suggested draft consent conditions (Condition R3) (**Attachment 3**).

The intent of the CTMP is to minimise the use of Tieko Street by construction traffic, but that there has to be some use made of it. A CTMP and temporary traffic management will be used to ensure safe interaction between road users.

Landscape and Visual Peer Review

11 Please provide visual simulations/3D modelling of the proposal from key views such as Otaihanga Road to assist in the writing of Council's 42A report.

Response:

See attached set of plans for the views from Otaihanga Road (**Attachment 7**). Please note that the small dune adjacent to the proposed recreation reserve will be protected by way of a Consent Notice on the Certificate of Title and is included in Lot 47 (in totality). The dune (+14m above sea level (asl)) is approximately 5-6m above Otaihanga Road (8-9masl) and blocks a significant portion of the development from this view when combined with the retention of existing vegetation. The building platform for Lot 47 is 10.60masl. The building platform for Lot 23 is also at 10.60masl with the dune behind rising to approximately 24masl and will visually enclose the space/view in this direction.

To assist with views from Otaihanga Road when travelling west towards the coast, additional planting is proposed along the edge of the Otaihanga Road and on the inside edge of the proposed constructed wetland. This can be seen in the illustrations on figures 1-5 of the attached figures.

12 As outlined in 3.1.1 of the review undertaken by Robin Simpson Design, please provide a more detailed contour information plan, with further explanation of levels of cut and fill to clearly articulate the scheme and its context.

Response:

Detailed contours and earthworks cut/fill areas (22208SCH Sheets 4 and 5 (k)) are shown in the Scheme Plans, noting the following table addressing the visibility of any buildings from the expressway (@ ~8masl) or VP6 and VP7 from the original application:

Lot No.	Height of dune between house and expressway (masl)	Height of building platform (PAD RL)(masl)	Top of dwelling if assume a 5.5m high building(masl)	Visible portion
5	10-13	7	12.5	0-2.5m (on angle – only visible to southbound)
6	10-20	7.05	12.55	0.2.5m (on angle – only

				visible to southbound)
7	15-20	7.9	13.4	0
8	16-19	9.3	14.8	0
9	17-18	11.3	16.8	0
10	17-19	11.7	17.2	0
11	14-17	16	21.5	Visible between dunes
12	18-22	19	24.5	2.5m
20	15	15	20.5	5.5m although existing vegetation on the boundary will screen any development
21	15	15	20.5	
22	10-23m	12.7	17.7	Screened by dunes, partial intermittent view possible

For the views from Otaihanga Road (~8-9masl), the following table addresses the visibility of any buildings from the Otaihanga Road (VP3 and VP4) from the original application:

Lot No.	Height of Otaihanga Road (masl)	Height of building platform (PAD)(masl)	Additional Mitigation Measures
37-47	8-9	9.35 – 10.6	Reduced number of lots from 49 to 47 Larger average lot sizes for the remaining lots. A 5m wide planting strip on the northern side of the constructed wetland Additional planting on the southern bank of the constructed wetland including flax, titoki and totara to supplement existing kanuka species. Eventually all of these species will form a dense screen over 3m in height. Retention of the small hillock on the Lot 47 which rises to approx. 5 -6m above Otaihanga Rd (excluding vegetation)

13 Please provide further detail on:

- *Otaihanga in context of regional structure e.g. relationship to coastal dune and Waikanae River;*
- *Role of Otaihanga as an unbuilt area between townships;*
- *Distance to local centres at Mazengarb Road;*
- *Proximity to Paraparaumu low density housing areas.*

Response:

The proposed development is 2km from the coastal edge, 1.2km from the Waikanae River, and considered to form part of the Otaihanga residential area, with the expressway creating an 'edge' or barrier to residential development to the east. The Waikanae River forms a physical barrier to development to the north, and a natural edge to Paraparaumu Beach/Otaihanga and Waikanae Beach. Pedestrian access is possible via the Otaihanga Bridge, Tieko St, Pitoitoi St and Ruru St. All of the streets in Otaihanga are somewhat disjointed in this respect with limited connectivity. This is largely due to the underlying landform and this is no different with this proposal. Originally the proposal included a public road link the northern end of Tieko St round to Otaihanga Road but following the introduction of the National Policy Statement Freshwater Management (NPS-FW) and the identification of natural inland wetlands on the site, the proposed shared path was considered a preferrable design option to reduce earthworks and stormwater discharge close to the wetlands.

On the eastern side of the expressway the character is more rural residential with larger lots and larger houses typically found in Otaihanga. There are also several commercial activities including Composting New Zealand Limited and Southward Car Museum with the area largely compartmentalised into relatively small catchments as opposed to wide sways of rural farmland. Vegetation, including plantations and shelter belts are common as well as tracts of native vegetation along the river corridor. The level of stewardship and the quality of the rural-residential environment varies greatly through the area, with the expressway itself being a significant piece of infrastructure cutting through the landscape.

In terms of the role the Otaihanga plays as an unbuilt area between Paraparaumu and Waikanae, Otaihanga is already a built environment which is slowly extending south and east away from the river and coast respectively. It is clear from the road pattern that The Drive will eventually connect through to Otaihanga Road with only a small corridor (350m wide) of remnant farmland between Paraparaumu Beach and Otaihanga. The corridor is not wide enough to create a significant role of 'open space' between the settlement and appears more as a remnant than having a positive role to define settlements. It is likely overtime, the residential areas will merge.

In terms of local amenities, the proposal is:

- 1.4km from Paraparaumu College
- 1.2km to Waikanae River
- 1.6km from Jolly Pub and Kitchen Kapiti
- 700m from Little Farm Preschool and Nursery
- 1.1km from Kapiti Learn to Swim
- 20m to NZ Native Oils
- 3.5km to the Kena Kena Shopping Centre (4 Square, Bottle Store, Café and Dairy)
- 3.0km to the commercial area on Kapiti Road/expressway via the shared path running adjacent
- 1.5km to the Mazengarb Rd commercial area. This area is yet to be developed to its full potential but is consented for commercial activity, forming part of the receiving environment. At the moment the development consists of a coffee cart, church and dentist.

All of these amenities are readily accessible to future residents either by foot, bicycle or car with the distances not considered greater than many urban areas in Kapiti or New Zealand. The character of the area is considered urban fringe, with the proposed northern area (lots 1-22) being rural-residential in character and the southern section (lots 23-47) being in keeping with residential development on Tieko and Pitoitoi Streets. Both of these streets are within 500m of the proposal, with the closest General Residential zone on the western side of Tieko Street only being 50m away from the proposal and therefore considered part of the receiving environment, with the proposal a natural extension of this urban area.

14 Please provide detail of the hydrological aspects of topography as per 3.1.2 of the review.

Response:

The proposal has identified and is protecting and enhancing existing natural wetlands within the site. Extensive detail is provided in the Technical Reports accompanying the consent application prepared by Wildlands, Awa Environmental, and RDCL on how these hydrological aspects of topography function. These

parties have worked closely with the design team to ensure these natural wetlands still function. Greater Wellington Regional Council has granted consent for the earthworks and stormwater components of the project, and part of that considered the discharge of contaminants within 100m of the wetlands as per the NPS-FW.

15 Please provide further detail on built structure to include:

- *Farmlets on steep dunes to the west;*
- *Farmlets on undulating slopes to the northwest; and*
- *Rural land to the north and northeast.*

And any other information considered necessary to substantiate that built form has a low sensitivity to change.

Response:
Built form, including the expressway, is common within the receiving environment with urban infrastructure present. Roads, overhead powerlines, large scale warehouse and glasshouses, as well as large dwellings on large properties are common surrounding the proposal, including to the west, and northwest. These dwellings are farmlets but in most cases are rural residential activity with the size of the farmlets unlikely to be commercially viable as a farming enterprise. There is a notable character change between the land on the western side of the expressway and the eastern side although both exhibit a large number of 'human elements' including farmlets. There is no or little visual coherence in building style, materials used or the size of buildings within the area with a high level of compartmentalisation created by the dune landform and vegetation. If anything, the receiving environment could be noted for its eclectic character with densities ranging from low density residential (Otaihanga, Paraparaumu), rural residential development to the west and northwest with large residential dwellings and implement sheds, to large rural, but commercial, activities such as Compost NZ, NZ Native Oils and the Southward Car Museum. In this respect, built form in the area has a low sensitivity to change.

16 With respect to character, the effect of removal of mature pines on neighbouring properties is considered to cause a significant loss of privacy, rural amenity, views and ease of access for Tieko Street. Please provide details of further mitigation, especially with respect to the removal of the mature pine trees.

Response:
I am advised the pines were planted as a cash crop quite some time ago (they were there when the property was purchased by the Mansell's at least 20 years ago) and are at an age when milling them is appropriate.

The Applicant has advised that in relation to the pines in proposed Lot 19, that they now intend to retain the pines if at all possible. They are a risk as they could fall over the access road (to be vested in Council) and their root system may be affected by the earthworks to form the new access to the extent that it is not possible to keep them. Overtime these trees will need replacing as they will reach a size and age when they are not suitable for this location, close to existing dwellings. If these trees do need to be removed, the trees can be replaced with native species which are more suitable for the location and will in time provide screening/privacy.

It is worth noting that pine trees are not a protected species and the applicant could remove these trees as of right. Therefore, any effects on privacy, rural amenity or views that may occur from their removal as a permitted activity need to be considered.

17 The effects on visually sensitive receptors (viewpoints 2, 3 and 4) are considered to be more than minor, please advise if any mitigation measures are proposed to reduce the adverse effects identified. If mitigation is proposed over what has already been detailed in the DCM Landscape and Visual Assessment, please provide detail of this.

Response:
Following a site visit with Ms Simpson, the number of lots in the southern area (viewpoints 2, 3 and 4) have been reduced. Additional planting is proposed, over and above the previous mitigation measures, with a 5m wide native strip on the northern side of the constructed wetland and additional planting of flax, titoki and kanuka along the edge of Otaihanga St, on the southern bank of the constructed wetland. The constructed wetland is to be heavily planted with native species (to be agreed with GWRC and mana whenua at Engineering Design Approval stage) to create a significant vegetated buffer between Otaihanga Road and residential development. I also note that the dwellings on the southern side of Otaihanga Road are heavily planted along their front boundaries.

18 *The review identifies six areas (pages 9-11) where effects would be more than minor/significant. Please provide further detail of mitigation measures that would result in the reduction of adverse effects from more than minor/significant.*

Response:

Please note the following mitigation measures are proposed:

Area	**Element Aspect**	**Concept Design Changes / Clarifications**
Lots 1-22 (northern)	Topography	The main dune running between the expressway and proposed development will be untouched and protected from future development, while existing drainage patterns are retained and will allow for the wetlands to function unaffected. The proposal protects and enhances existing wetlands, noting that the underlying topography will be retained to ensure drainage patterns are maintained.
Lots 23-47 (southern)	Character	The key dune features are being retained while the number of lots is reduced, allowing for larger sections. Earthworks have been minimised as much as possible with the reserve filling at the request of KCDC reserves to allow for ease of maintenance. The larger slopes are to be retained and hopefully will be incorporated into play areas. The small dune on the corner of the reserve of Otaihanga has been incorporated into a single lot (47) and will be protected by way of a Consent Notice on the Certificate of Title. The large dune which rises to +24masl at the rear of the site is protected from development and fencing limited to ensure its 'form' is protected.
	Topography	
	Vegetation	Vegetation of note (kanuka) is to be retained and enhanced with additional native plantings. The recreation reserve provides an opportunity for native planting which will be developed/design by KCDC at a later date. The constructed wetland is to be heavily planted with native wetland species which will improve biodiversity in the area, replacing areas of rank grass, gorse and blackberry. A 5m strip is to be planted on the northern side of the constructed wetland to provide screening as well as additional tree/canopy species.
	Waterways	Wetland 4 (constructed wetland) will be enhanced to a level with native plantings. The number lots have been reduced and the key topographical features will be retained adjacent to Otaihanga Road and at the rear of the cluster.

	Built Structures	Number of lots has been reduced closest to Otaihanga Road. Additional planting proposed to screen views from dwellings on the southern side of Otaihanga Road.

19 Page 21 identifies additional mitigation measures with respect to the eight mitigation measures identified by DCM. Please advise if these mitigation measures are accepted, if not accepted, please advise why.

Response:
Yes. These mitigation measures have been included in the design included in the Proposal as well as in the further detailed provided in the attached figures (addendum 1).

20 Please provide detail on animal pest management prior to the commencement of construction, during construction and post construction to ensure animal pest species disturbed by the works do not move to surrounding properties.

Response:

Rabbits are the main animal pest across the whole site. Although rabbits are not a direct threat to lizards, high numbers will increase the likelihood of stoats being present, which in turn can prey on lizards. It is therefore proposed that within 1 month prior to the commencement of earthworks, two night shoots are undertaken using a .22 calibre rifle with sub-sonic bullets and a suppressor. If available, a thermal scope should be used instead of a spotlight. At least one week between shoots is proposed.

In addition, animal pest control will be undertaken for the proposed Lizard Habitat in Lot 5 within 1 month prior to and during construction. This control would involve targeting key species being mustelids, hedgehogs and rats, and include:

- For control of mustelids and hedgehogs, place a line of DOC200 traps around the perimeter of the habitat, spaced at 100m intervals.
- Bait with dried rabbit and an egg. Traps should be checked monthly.

- For control of rats, install a grid of bait stations spaced at 50m throughout the lot, avoiding areas that are prone to flooding. Bait stations will be filled with Double Tap Pellet Bait (sold by Connovation). Bait stations will be pinned to the ground or attached to trees and/or fence posts. Bait stations should be inspected and filled as required on a quarterly basis (April-June-October-Jan). Double Tap will also target any possums that access the bait stations.

Cats may also be present on the site, but trying to control them in peri-urban areas is difficult and not proposed.

Post construction, the applicant will continue to manage animal pests until the lots are sold. Once a lot is sold, it will be an individual landowner's responsibility.

The above animal pest control prior to and during construction would be included in the Construction Management Plan required by suggested draft condition Earthworks E1 (refer to **Attachment 3).**

The Applicant has agreed with Council's Stormwater Team to offer up a voluntary condition that requires the Applicant to continue to undertake pest control in the constructed wetland and to ensure that the plants are established and maintained for five years after it vests the constructed wetland in Council in recognition of the Applicant's obligations as consent holder under its Regional Consent.

Concluding Statement

I trust the above information and responses address the information request points sufficiently for you to proceed to restart the resource consent application process and confirm a Commissioner and schedule a hearing.

Yours sincerely

Chris Hansen
RMA Principal Planner
E-mail: chris@rmaexpert.co.nz
Mobile: 02102645108

Attachments (by email):

Attachment 1 – Revised RDCL Geotechnical Investigation Report dated 10 March 2022
Attachment 2 - Plans included in the Engineer's Estimate for Earthworks and Civil Works for Tieko Street – Cuttriss (10.12.2021)
Attachment 3 – Revised suggested draft Consent Conditions
Attachment 4 - Report from Ra Higgott on Shared Path dated 03.02.22
Attachment 5 – CPTED Assessment
Attachment 6 – Plan showing revised Shared Path (Cuttriss March 2022)
Attachment 7 - Landscape and Visual Plans

REPORT ON:
GEOTECHNICAL INVESTIGATION

PROJECT:

MANSELL FARM SUBDIVISION
OTAIHANGA RD, PARAPARAUMU

CLIENT: MR RICHARD & MR ALASTAIR MANSELL

C/- CHRIS HANSEN CONSULTANTS LTD
220 ROSS RD
RD 7 WHAKAMARAMA
TAURANGA 3179

R-195340402-03

EXECUTIVE SUMMARY

Chris Hansen Consultants Ltd (CHC), on behalf of Mr Richard and Mr Alastair Mansell, engaged Resource Development Consultants Ltd (RDCL) to complete a geotechnical investigation at 131 Otaihanga Rd, Paraparaumu.

We understand the intent is to subdivide the site into forty-nine (49) rural lifestyle and residential lots. Currently the land is being used as farmland. Our geotechnical investigation and reporting are required to support resource consent application. For geotechnical assessment, the proposed development is assumed to be of Importance Level (IL) 2.

Based on results from this investigation we have developed the following generalised soil profile:

- Silty/sandy TOPSOIL to ~0.25m bgl; overlying
- Loose to dense silty SAND to 16m bgl.

Ultimate Bearing Capacity of 300kPa is generally available:

- Between 0.3m and 1.7m bgl.

Liquefaction assessment results indicate little to no risk of liquefaction hazards across the site, including free field settlement and lateral spreading.

Based on the results of our investigation, we consider the proposed development is suitable from a geotechnical perspective following:

- Building setback of 5m is maintained from slopes > 15°;
    - Specific engineering design of foundations is required to build within the set-back zone.
- NZS3604:2011 foundations are appropriate outside of the setback zone.

CONTENTS

FIGURES

APPENDICES

1 OVERVIEW

Chris Hansen Consultants Ltd (CHC), on behalf of Mr Richard and Mr Alastair Mansell, engaged Resource Development Consultants Ltd (RDCL) to complete a geotechnical investigation at 131 Otaihanga Rd, Paraparaumu.

The legal description of the site is LOT 6 DP 53191, SEC 31 SO 505428, PT LOT 5 DP 84524, LOT 1 & LOT 3 DP 303764, LOT 4 DP 84524, LOT 3 DP 84524, LOT 2 DP 84524.

This geotechnical investigation report is to meet the requirements for:

- Resource consent application, including:
  - Confirmation of site suitability; and
  - Recommendations for foundations and earthworks.

1.1 UNDERSTANDING OF THE PROJECT

RDCL have been supplied with scheme plans for the proposed subdivision, prepared by Cuttriss Consultants Ltd (Ref. 22208 SCH1, Revision C, dated November 2020).

We understand the intent is to subdivide the site into forty-nine (49) rural lifestyle and residential lots. A detailed Project Description is provided in Section 3 of the AEE accompanying the resource consent applications.

In summary, the proposal involves the subdivision of 17ha (western) portion of the Mansell Farm into 49 lots: 22 rural lifestyle lots in the northern part of the site, and 27 residential lots adjacent to Otaihanga Road in the south of the site. Access to 19 of the rural lifestyle lots in the north will be via Tieko Street, and the remainder of the rural-lifestyle and residential lots will be accessed via Otaihanga Road.

The proposed subdivision of this area involves earthworks, construction of roads, installation of services and identification of notional 20m building circle areas on the rural lifestyle lots.

1.2 SCOPE OF WORK

This work was completed in general accordance with RDCL proposal 19534, issued to the client on 16th August 2019 and which has been reported:

- RDCL report No. R-195340402-02_Rev01; "Geotechnical Investigation at Otaihanga Road, Paraparaumu", issued 25 April 2021 (project); and

- RDCL report No. R-195340402-03; "Geotechnical Investigation at Otaihanga Road, Paraparaumu", issued 10 March 2022 (this report).

2 SITE DESCRIPTION

The proposed subdivision is located within sand dunes in the centre of Otaihanga.

The site is currently farmland comprising:

- Predominantly gently to steeply sloping rolling dunes (approximately 18.15ha).

2.1 REGIONAL GEOLOGICAL MAPPING

GNS maps indicate the proposed subdivision is underlain by:

- Holocene windblown sand deposits (inactive sand dunes).

2.2 GEOHAZARDS

2.2.1 ACTIVE FAULTS

No active faults directly impacting the site have been identified in the New Zealand Active Faults Database (GNS Science, 2018).

The Wairau Fault is approximately 17km east of the site. This fault requires a near fault factor in accordance with NZS1170.5:2004.

2.2.2 FLOODING

The KCDC natural hazard maps indicate the proposed subdivision site is:

- Susceptible to ponding within low lying areas.

2.2.3 LIQUEFACTION RISK

GWRC hazard mapping for this region indicates that the proposed development has:

- A liquefaction risk category of "high";
- A ground shaking hazard rating of "moderate"; and
- A combined hazard rating of "moderate-high".

3 SITE INVESTIGATION

RDCL carried out a general site walkover and subsurface field testing (Figure 1), which comprised:

- Seventeen (17) test pits;
  - Terminated between 1.7-3.0m bgl;
- Sixteen (16) Dynamic Cone Penetrometer (DCP) tests;
  - Terminated between 0.5-2.4m bgl, and
- Eleven (11) CPT tests,
  - Terminated between 4.5-16.6m bgl.

Test pits and DCPs were completed in dry summer conditions.

CPTs were carried out in spring conditions.

Site investigation logs are in Appendix A.

3.1 SUBSURFACE CONDITIONS

We have developed several simplified soil profiles based on our investigations. Shallow profiles were developed based on results of test pit investigations. Deep soil profiles were developed based on results from CPT testing.

Full investigation logs are available in Appendix A.

3.1.1 SHALLOW SOIL PROFILE

Test pit investigations show that shallow conditions generally comprise:

- Silty/sandy TOPSOIL to ~0.25 – 0.6m bgl; underlain by
- Loose to dense silty SAND to at least 3.0m bgl.

Test locations fell into categories; dune crests, or low-lying dune edges and valleys.

- Dune crest materials generally comprise dry, silty, sand (fine) that is loose at surface and becomes denser with depth.
- Low lying dune edges and valleys generally comprise medium dense to dense, silty sand that is wet to saturated and tends to be dilatant.
- Topsoil in TP03 was deep (0.6m bgl) and highly peaty.

3.1.2 Deep Soil Profile

Deep soil testing comprised CPT testing. A simplified soil profile correlated to Soil Behaviour Type (SBT) indicate the site is generally underlain by:

- Sand and silty sand (sands) interbedded with silty sand to sandy silt (sand mixtures) to at least 16.62m bgl.

3.2 Groundwater

Groundwater levels encountered during site investigations are in Table 1.

Table 1:Depth to Groundwater as Encountered During Site Investigations

Test ID	Test Pit Elevation	Test Pit Depth	Groundwater Level (m bgl)	Groundwater Level (RL, m)
TP01	8	2.1	1.7	6.3
TP02	7	2.5	2.5	4.5
TP03	7	2.2	1.6	5.4
TP04	13	2.3	-	-
TP05	9	2.6	-	-
TP06	7	1.9	1.6	5.4
TP07	17	3.0	-	-
TP08	20	1.8	-	-
TP09	19	1.7	-	-
TP10	6	2.2	1.8	4.2
TP11	5	2.0	1.4	3.6
TP12	5	2.1	2.1	2.9
TP13	6	2.9	2.9	3.1
TP14	14	1.8	-	-
TP15	10	1.9	-	-
TP16	13	2.9	-	-
TP17	19	2.5	-	-

4 GEOTECHNICAL ASSESSMENT

4.1 SHALLOW BEARING CAPACITY

We identified no significant peat or organic soil deposits in this investigation regarding potential for static settlements.

DCP test results have been correlated to Ultimate Bearing Capacity (UBC) in accordance with Stockwell (1977) (Table 2).

Depth to 200kPa ultimate soil bearing capacity was identified:

- Between 0.2m and 1.3m below current ground level (m bgl).

Depth to 300kPa ultimate soil bearing capacity was identified:

- Between 0.3m and 1.7m bgl.

TABLE 2:SUMMARY OF SHALLOW ULTIMATE BEARING CAPACITY

Test ID		200 kPa UBC		300 kPa UBC	
Test ID	**Collar RL (m)**	**Depth (m bgl)**	**~RL (m)**	**Depth (m bgl)**	**~RL (m)**
DCP01	9	0.2	8.8	0.3	8.7
DCP02	13	1.3	11.7	1.7	11.3
DCP03	14	1.1	12.9	1.4	12.6
DCP04	7	0.6	6.4	0.7	6.3
DCP05	7	0.4	6.6	0.4	6.6
DCP06	7	0.4	6.6	0.9	6.1
DCP07	7	0.3	6.7	0.9	6.1
DCP08	17	0.7	16.3	1.1	15.9
DCP09	19	0.3	18.7	1.2	17.8
DCP10	21	0.4	20.6	0.9	20.1
DCP11	19	0.2	18.8	0.8	18.2
DCP12	6	0.4	5.6	1.1	4.9
DCP13	6	0.2	5.8	1.1	4.9
DCP14	5	0.9	4.1	1	4
DCP15	6	1.1	4.9	1.1	4.9
DCP16	14	0.4	13.6	0.9	13.1

4.2 SEISMIC SOIL CLASS

The site is classified as site subsoil "Class D Site" in accordance with NZS1170.5:2004, part 5: Earthquake Actions – New Zealand; based on

- NZGD borehole record BH_76860 to a depth of 63m bgl, roughly 150m southeast of the south corner of the site.

4.3 LIQUEFACTION ASSESSMENT

4.3.1 LIQUEFACTION POTENTIAL

A liquefaction assessment was carried out on the results of the CPT investigation, which indicates:

- Low risk of liquefaction during Serviceability Limit State (SLS) design seismic event, with
  - LSN of 0, indicating little to no expression of liquefaction; and
- Low risk of liquefaction during Ultimate Limit State (ULS) design seismic event, with
  - LSN of 0 to 0.461, indicating little to no expression of liquefaction.

Results are in Appendix B.

4.3.2 VERTICAL SETTLEMENT

The settlements presented in Table 3 are estimates of the free field settlement, which is the amount of vertical settlement anticipated in the site. These values do not necessarily represent actual building settlement resulting from structural loading. Estimated vertical settlement during SLS and ULS design seismic events is in Table 3.

TABLE 3:ESTIMATED VERTICAL SETTLEMENT DURING SLS AND ULS DESIGN SEISMIC EVENTS

Design Seismic Event	Test ID	Vertical Settlement (cm)	LSN
SLS	CPT01	0	0
	CPT02	0.02	0.04
	CPT03	0	0
	CPT04	0	0
	CPT05	0	0
	CPT06	0	0
	CPT07	0	0
	CPT08	0	0
	CPT09	0	0
	CPT10	0	0
	CPT11	0.05	0.07
ULS	CPT01	0.8	3.7
	CPT02	3.1	12.0
	CPT03	0.8	1.0
	CPT04	0.7	3.2
	CPT05	0.05	0.09
	CPT06	0.06	0.3
	CPT07	0.6	2.3
	CPT08	1.0	1.7
	CPT09	0.9	3.1
	CPT10	1.5	6.7
	CPT11	3.5	12.7

4.3.3 LATERAL SPREAD ASSESSMENT – NATURAL TOPOGRAPHY

Lateral spreading occurs on sites which have un-retained free faces or slopes combined with liquefaction risk. When the site liquefies, soil moves towards the free face or slope resulting in cracks developing as the soil displaces.

Estimated lateral spread during SLS and ULS design seismic events is in Table 4.

TABLE 4:ESTIMATED LATERAL SPREAD DURING SLS AND ULS DESIGN SEISMIC EVENTS

Design Seismic Event	Test ID	Lateral Spread (cm)	LSN
SLS	CPT01	0	0
	CPT02	0	0.04
	CPT03	0	0
	CPT04	0	0
	CPT05	0	0
	CPT06	0	0
	CPT07	0	0
	CPT08	0	0
	CPT09	0.2	0
	CPT10	0	0
	CPT11	0.4	0.07
ULS	CPT01	10.4	3.7
	CPT02	31.5	12.0
	CPT03	12.6	1.0
	CPT04	6.2	3.2
	CPT05	3.6	0.09
	CPT06	0.7	0.3
	CPT07	8.5	2.3
	CPT08	15.6	1.7
	CPT09	9.2	3.1
	CPT10	12	6.7
	CPT11	36.4	12.7

4.3.4 LATERAL SPREAD ASSESSMENT EARTHWORKED TOPOGRAPHY

Lateral spread has been checked against the effect of earthworks on the changed topography as in Table 5.

TABLE 5: TABLE 5 LATERAL SPREAD – EARTHWORKED TOPOGRAPHY

Design Seismic Event	Test ID	Original Ground (RL)	Finished Level (RL)	Earthworks		Lateral Spread (cm)
				Cut (m)	Fill (m)	
SLS	CPT01		1.35		1.35	0
	CPT02		1.6		1.6	00.06
	CPT03		1.7		1.7	0.2
	CPT06		1.3		1.3	0.13
	CPT07	5.0		5.0		0.3
	CPT08	0.9		0.9		0.6
ULS	CPT01		1.35		1.35	9.0
	CPT02		1.6		1.6	17.2
	CPT03		1.7		1.7	10.4
	CPT06		1.3		1.3	11.9
	CPT07	5.0		5.0		15
	CPT08	0.9		0.9		11.3

4.3.5 BASIS OF ASSESSMENT

The liquefaction assessment for the site was carried out using CLiq (accepted industry software package), CPT data of current ground conditions and the following input parameters (NZTA Bridge Manual v.3.2 section 5 [NZ Transport Agency, 2013]) including updated PGA and Earthquake Magnitude in accordance with MBIE Guidance Earthquake Engineering Practice Module 1, November 2021:

- Magnitude (M) = 6.5 SLS & 7.7 ULS;
- PGA = 0.13g (SLS) & 0.68g (ULS), based on:
  - $C_{0,\,1000}$ = 0.44 (map 6.1a),
  - f = 1.0 (Class D Soil), and
  - R = 0.25 (SLS) & 1 (ULS)

Lateral spreading assessment was carried out for a generic model of gently sloping ground with a slope grade of S (%) = 1.00.

The design earthquake was chosen based on probability of recurrence, which is based on historical earthquakes. A 50 year design life was assigned. For an importance level 2 building, this correlates with a 25 year return period (SLS) and 500 year return period (ULS).

4.4 BORROW FOR STRUCTURAL FILL

4.4.1 SUITABILITY FOR USE

Test pit investigations and visual / tactile assessment suggests:

- Site won material excluding topsoil and organic materials will be suitable for use as structural fill;
- Topsoil, organic and deleterious materials are not suitable for use as structural fill.
  - This material should be stripped from 0.6m below ground in the locations tested and could be deeper in some areas.
  - Organic and non-structural fill should likely be stockpiled to help revegetate stripped and filled surfaces.

4.4.2 GEOTECHNICAL PARAMETERS

Geotechnical parameters for structural fill placed in accordance with the general specifications set out in Section 5.5 are expected to be as in Table 6:

TABLE 6:ESTIMATED EFFECTIVE SOIL PARAMETERS (DRAINED)

Condition	Soil Type	Friction Angle, ϕ' (°)	Cohesion, c' (kPa)	Density (kN/m^3)
Natural	Loose Silty Sand	30	0	15
Natural	Dense Silty Sand	40	0	20
Structural Fill	Dense Silty Sand	40	0	20

4.5 SLOPE STABILITY FOR SETBACKS

4.5.1 DESIGN CASES

Slope stability numerical assessment has been undertaken to assess the setback for natural and fill slopes (Appendix C) by:

- Limit equilibrium analyses; using
  - Industry standard software SLIDE 9.0 by Rocscience Inc; and
  - Bishops Simplified method.
- Seismic induced displacement has been assessed using industry standard:
  - Finite element (FEM) methods using program RS2 by Rocscience Inc.

Design cases assessed are for:

- Natural Slopes;
- Fill Slopes;

Considering earthquake scenarios:

- Static
- Serviceability and Ultimate Limit States;
- Design values calculated as in Section 4.3.5; and
- Applying pseudo-static loads

4.5.2 GROUNDWATER LEVELS

Groundwater levels have been conservatively taken at 1.4m below current ground as indicated only in TP11 in the lower part of the development at ~5m RL.

4.5.3 RESULT OF ASSESSMENT

Results of stability analyses are in Table 7.

TABLE 7: RESULTS OF STABILITY ANALYSES

Slope	Groundwater (m bgl)	Load Condition	Regional PGA (MBIE, 2021)	Applied PGA (g)	Limit Equilibrium Factor of Safety	FEM	
						Critical SRF	Slope Displacement (m)
Natural	1.4	Static	0	0	1.5	1.2	< 0.05
	1.4	SLS	0.13	0.13	1.3	0.9	
	1.4	ULS	0.68	0.34*	0.9	0.6	< 0.5
Fill	1.4	Static	0	0	1.5	1.5	< 0.05
	1.4	SLS	0.13	0.13	1.2	1.1	
	1.4	ULS	0.68	0.34*	0.9	0.7	

* Applied PGA for ULS slope stability is ½ Recommended PGA (MBIE, 2021)

4.5.4 DISCUSSION

Stability modelling (Appendix C) has been undertaken using conservative groundwater levels at 1.4m below ground level suggest for:

Limit Equilibrium Methods

- Acceptable Factor of Safety for static and SLS conditions; and
- Marginal Factors of Safety for ULS conditions.

FEM displacement modelling

- Natural slopes with loose material in place displacement:
  - < 0.5m in outer slope, and
  - < 0.05m within 5m setback.
- Cut natural slopes (loose material removed) and fill materials displacement:
  - < 0.05m for all conditions except for all conditions.

5 GEOTECHNICAL RECOMMENDATIONS

5.1 GEOTECHNICAL SITE SUITABILITY

Results of our liquefaction assessment indicate little to no risk of liquefaction for this site.

Based on the results of this investigation, we consider the proposed development is suitable from a geotechnical perspective, following our recommendations below.

5.2 FOUNDATION RECOMMENDATIONS

5.2.1 CUT AND NATURAL GROUND

Within cut and natural ground, NZS3604:2011 shallow foundations are considered suitable for the overall site from a level:

- Cleared of topsoil, organic and deleterious materials.

Building platforms will require testing to confirm site requirements in accordance with NZS3604:2011.

5.2.2 FILL SURFACES

Fills are expected to be placed in accordance with general specifications as set out in Section 5.5.

5.3 BUILDING PLATFORM SETBACKS FROM SLOPES

5.3.1 NATURAL SLOPES

Shallow slope instability localised to the loose layer that mantles the topography was observed in a single dune, with no other obvious indication of deep instability.

- A setback of 5m from slopes > 15° is recommended to protect against the potential for shallow slope instability.
  - Outside of the setback zone, foundations may be in accordance with NZS3604:2011;
  - Within the set-back zone, specific engineering design of foundations is required considering the risk of shallow instability.

5.3.2 Fill and Cut Slopes

Slopes in fill will be formed at 1Vertical (V) : 2 Horizontal (H) (Section 5.4.2) with fill placed in accordance with the general specifications in Section 5.5.

Cut slopes will be excavated in all cases sufficient depth to remove the loose and organic materials that mantle the natural slopes.

- A setback of 5m from slopes > 15° is recommended to protect against the potential for shallow slope instability.
  - Outside of the setback zone, foundations may be in accordance with NZS3604:2011;
  - Within the set-back zone, specific engineering design of foundations is required considering the risk of shallow instability.

5.4 Geotechnical Parameters for Earthworks

5.4.1 Cut Slopes

We recommend the following slope limits for earthworks design; for:

- Unsupported Permanent batters in:
  - Loose material 1V:2H; and
  - Dense material 1V:1.5H.
- Unsupported Temporary batters in:
  - Loose Material 1V:1.5H; and
  - Dense material 1V:1H.

5.4.2 Fill Slopes

Fill slopes should be finished at 1V: 2H.

5.4.3 GEOTECHNICAL PARAMETERS FOR DESIGN

We recommend the following geotechnical parameters are adopted for retaining wall design as in Table 6 (repeated here).

TABLE 6: ESTIMATED EFFECTIVE SOIL PARAMETERS (DRAINED)

Condition	Soil Type	Friction Angle, ϕ' (°)	Cohesion, c' (kPa)	Density (kN/m^3)
Natural	Loose Silty Sand	30	0	15
Natural	Dense Silty Sand	40	0	20
Structural Fill	Dense Silty Sand	40	0	20

5.5 GENERAL SPECIFICATIONS FOR ENGINEERED FILLS

5.5.1 ENGINEERED FILL

Earthwork drawings provided indicate significant cut and fill using site-won materials.

- Cut is suitable for use as structural fill with topsoil, organic and deleterious materials removed.
- All topsoil, organic or weak materials classified as being unsuitable shall be excavated and cut to waste prior to filling commencement.
- All fills will be placed under engineering control of a Chartered Professional Geotechnical Engineer.

Site materials are expected to be suitable with confirmation of parameters including but not necessarily limited to:

- Grading (Particle Size Distribution);
- Atterberg Limit testing;
- Compaction testing.

Engineering testing during earthworks will be undertaken in accordance with NZS 4431:1989 with testing including but not necessarily limited to:

- Soil moisture content during filling:
  - Nominal target 2% of optimum moisture content.
- Dry density achieved by compaction:
  - Nominal target 98% of Maximum Dry Density (MDD).

5.6 ROAD CONSTRUCTION

Results of DCP testing have been correlated with California Bearing Ratio (CBR).

For loose silty sands, we recommend an average of 7% CBR for roading construction.

CBR values presented here are based on test results at the time of our investigations and should be re-evaluated once the project enters the building consent stage.

6 FURTHER GEOTECHNICAL INPUT

We recommend a suitably qualified geotechnical professional be engaged:

- To confirm bearing for specific house foundations at the time of construction;
- To provide construction monitoring and issue a Statement of Professional Opinion on Suitability of Land for Construction; and/or
- Should ground conditions be found to differ from those contained in this report.

7 REFERENCES

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9. Stockwell, M. 1977. *Determination of allowable bearing pressure under small structures*. New Zealand Engineering, 32(6), pp.132-135.

8 LIMITATIONS

- This report has been prepared for the particular purpose outlined in the project brief and no responsibility is accepted for the use of any part in other contexts or for any other purpose.
- Ground conditions assessed in this report are inferred from published sources, site inspection and the investigations described. Variations from the interpreted conditions may occur, and special conditions relating to the site may not have been revealed by this investigation, and which are therefore not taken into account. No warranty is included either expressed or implied that the actual conditions will conform to the interpretation contained in this report.
- No responsibility is accepted by Resource Development Consultants Ltd for inaccuracies in data supplied by others. Where data has been supplied by others, it has been assumed that this information is correct.
- Groundwater conditions can vary with season or due to other events. Any comments on groundwater conditions are based on observations at the time.
- This report is provided for sole use by the client and Kāpiti Coast District Council (KCDC) and is confidential to the client and their professional advisors. No responsibility whatsoever for the contents of this report shall be accepted for any person other than the client.

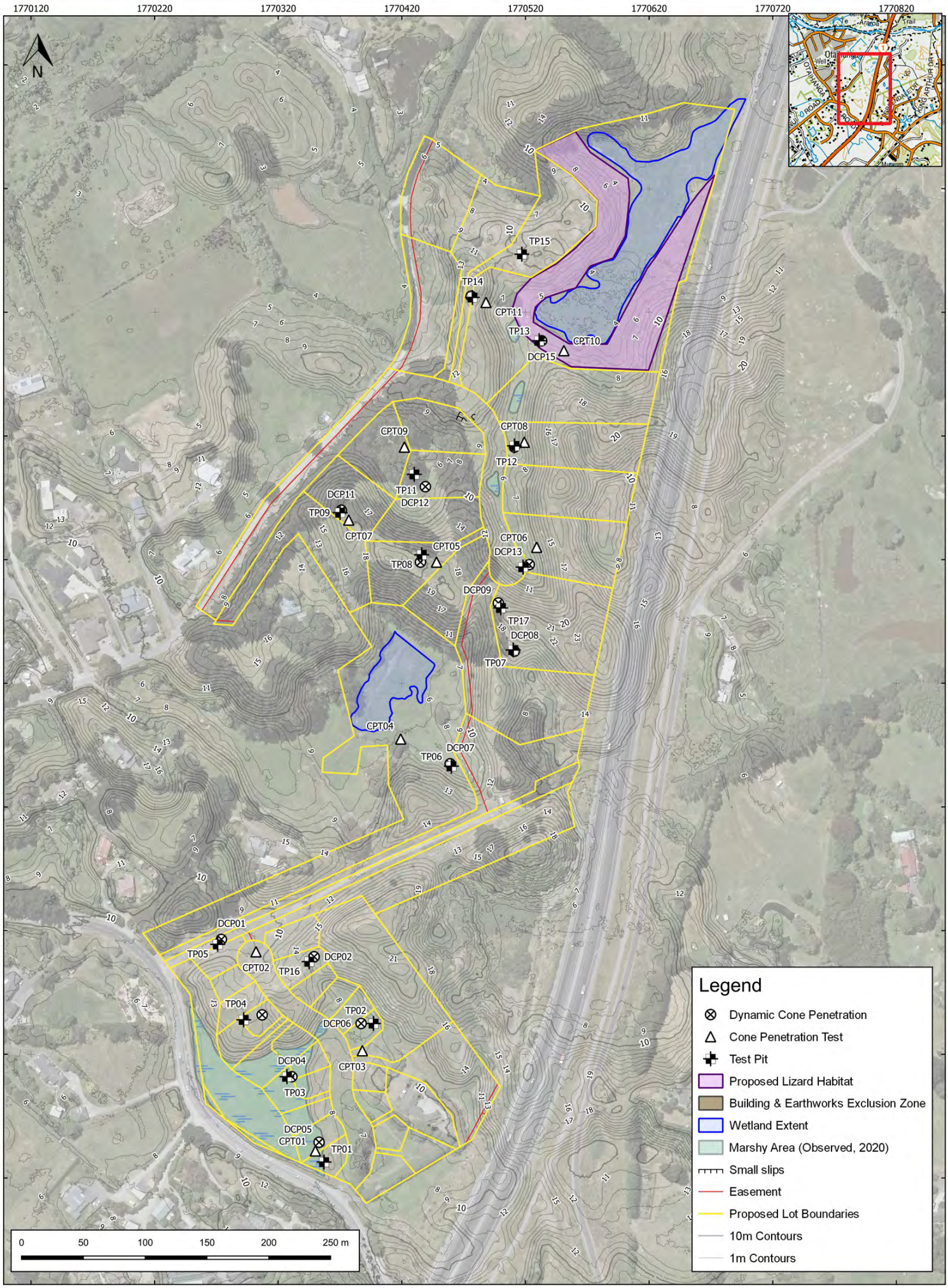
9 CLOSURE

We trust this meets your current needs. Should you wish to discuss any aspect of the contents of this document please contact the undersigned on 06 877-1652.

Sincerely,

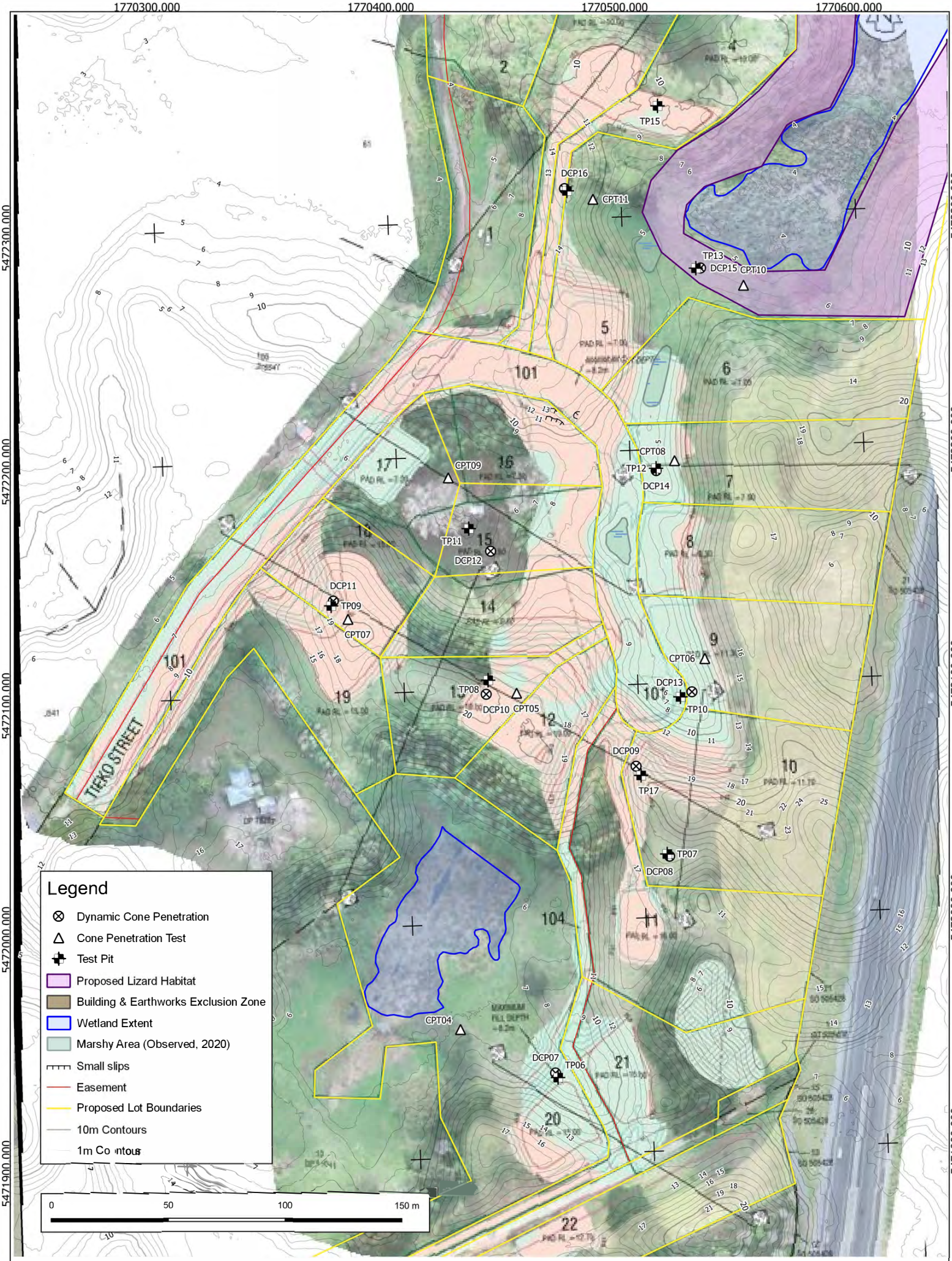
Jethro Neeson	Cam Wylie
BEng, NZGS	MSc; MIPENZ; CPEng
Geotechnical Engineer	Principal

FIGURE 1: SITE INVESTIGATION LAYOUT

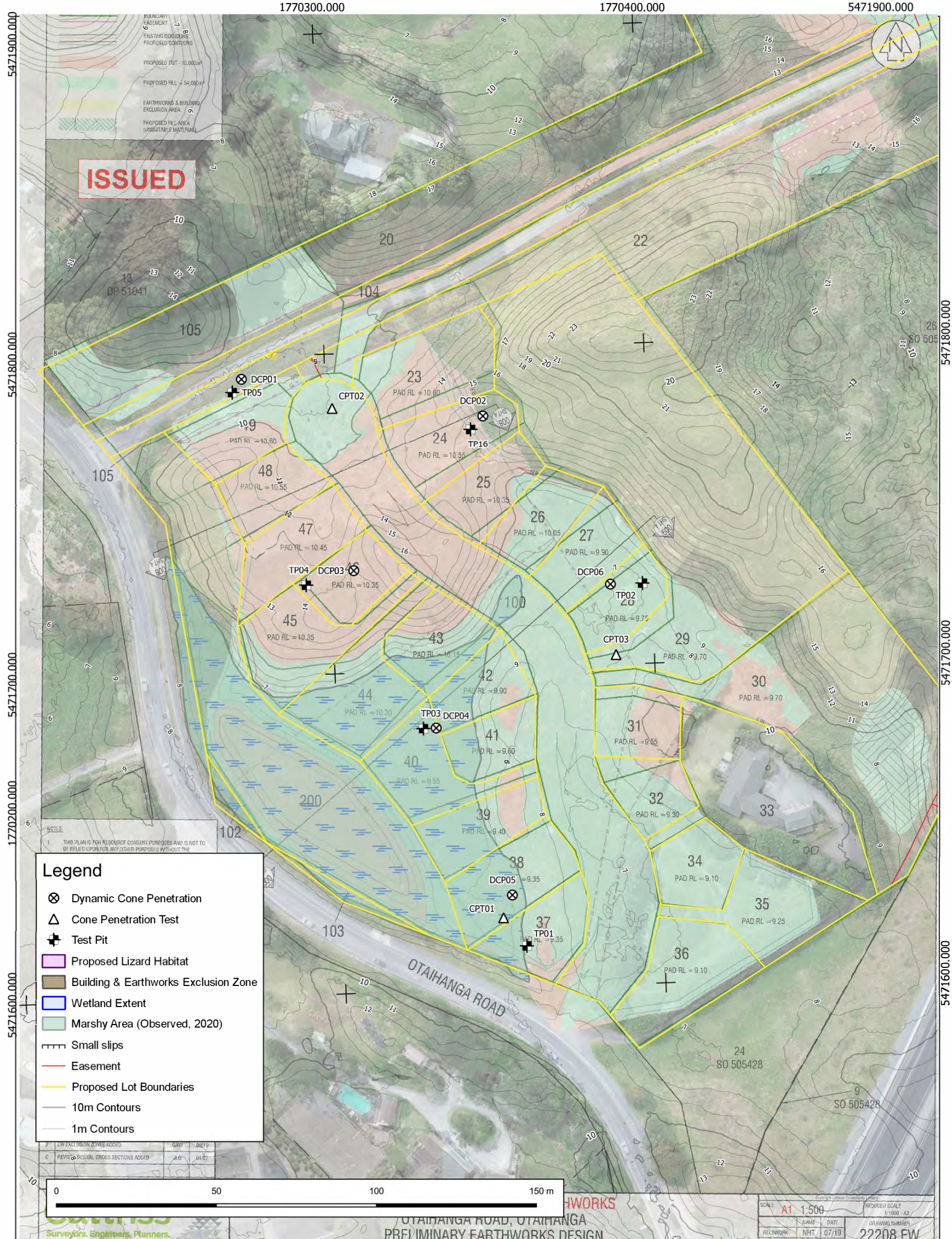


RDCL PO Box 28057 8/308 Queen St East Hastings, NZ Tel: +64 6 8771652 Fax: +64 6 877 5015 Email: info@rdcl.co.nz	Title	Investigation Layout	Drawn By	RD	Date 22/02/21	A3
	Project	195340402 - 131 Otaihanga Rd	Checked By	JJN	Date 22/02/21	Figure 1
	Client	Mr Richard & Mr Alastair Mansell	Approved By	JJN	Date 22/02/21	Rev. 3

FIGURE 2: SITE INVESTIGATION AGAINST EARTHWORKS PLANS



RDCL	RDCL PO Box 28057 8/308 Queen St East Hastings, NZ Tel: +64 6 8771652 Fax: +64 6 877 5015 Email: info@rdcl.co.nz	Title	Test Location Against Earthworks	Drawn By TT	Date 22/02/21	A3
		Project	195340402 - 131 Otaihanga Rd	Checked By BB	Date 22/02/21	Figure2A
		Client	Mr Richard & Mr Alastair Mansell	Approved By CW	Date 22/02/21	Rev. 3



RDCL PO Box 28057 8/308 Queen St East Hastings, NZ Tel: +64 6 8771652 Fax: +64 6 877 5015 Email: info@rdcl.co.nz	Title	Test Location Against Earthworks	Drawn By	TT	Date 22/02/21	A3
	Project	195340402 - 131 Otaihanga Rd	Checked By	BB	Date 22/02/21	Figure2B
	Client	Mr Richard & Mr Alastair Mansell	Approved By	CW	Date 22/02/21	Rev. 3

APPENDIX A: SITE INVESTIGATION LOGS

TEST PIT LOG

TP01

SHEET 1 OF 17

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	STARTED:	27-02-2020
PROJECT:	195340402	EASTING:	1770357.00	FINISHED:	27-02-2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5471613.00		
		DATUM:	NZVD2016	LOGGED BY:	MT/RD DATE: 27-02-2020
OFFICE:	RDCL - Hastings	ELEVATION:	8	CHECKED BY:	JJN DATE: 14-04-2020
ENGINEER:		DIMENSIONS:	m x m	STATUS:	Final data
CONTRACTOR:		MACHINE TYPE & MODEL:			

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
0.0	8.0		TS	Silty TOPSOIL, with trace sand; dark brown. Moist; sand, fine; rootlets.	M					
				Silty SAND, with trace clay; brown; blocky. Soft to firm; non-plastic; moist; sand, fine; rootlets.		S - FM				
0.5	7.5			Silty SAND, with trace rootlets; dark brown. Loose; wet; sand, fine; becoming blocky and tannish grey with depth.	W	L				
1.0	7.0									
				Silty SAND; blue; blocky. Medium dense; dilatant; saturated; sand, fine.	S	MD				
1.5	6.5	▼								
2.0	6.0			EOH: 2.10m						
2.5	5.5									

REMARKS

Soils logged in accordance with NZGS (2005) Field Description of Soil and Rock

SYMBOLS

▼ Standing Water Level

◁ Out flow

▷ In flow

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TEST PIT LOG

TP02

SHEET 2 OF 17

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	STARTED:	27-02-2020
PROJECT:	195340402	EASTING:	1770397.00	FINISHED:	27-02-2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5471725.00		
		DATUM:	NZVD2016	LOGGED BY:	MT/RD DATE: 27-02-2020
OFFICE:	RDCL - Hastings	ELEVATION:	7	CHECKED BY:	JJN DATE: 14-04-2020
ENGINEER:		DIMENSIONS:	m x m	STATUS:	Final data
CONTRACTOR:		MACHINE TYPE & MODEL:			

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
			TS	Silty TOPSOIL, with some clay, with trace sand; brown. Moist; sand, fine; rootlets.	M					
0.5	6.5			Silty SAND, with some rootlets; tan; blocky. Loose to medium dense; moist becoming wet; sand, fine; becoming yellowish tan with trace iron staining with depth.	M becoming W	L - MD				
1.0	6.0									
1.5	5.5			Silty SAND; greyish blue. Medium dense; dilatant; wet; sand, fine.	W	MD				
2.0	5.0									
2.5	4.5	▼		EOH: 2.50m						

REMARKS

Soils logged in accordance with NZGS (2005) Field Description of Soil and Rock

SYMBOLS

▼ Standing Water Level

◁ Out flow

▷ In flow

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TEST PIT LOG

TP03

SHEET 3 OF 17

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	STARTED:	27-02-2020
PROJECT:	195340402	EASTING:	1770327.00	FINISHED:	27-02-2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5471682.00		
		DATUM:	NZVD2016	LOGGED BY:	MT/RD DATE: 27-02-2020
OFFICE:	RDCL - Hastings	ELEVATION:	7	CHECKED BY:	JJN DATE: 14-04-2020
ENGINEER:		DIMENSIONS:	m x m	STATUS:	Final data
CONTRACTOR:		MACHINE TYPE & MODEL:			

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
0.0	6.5		TS	TOPSOIL (PEATY), with trace sand; very dark brown. Soft; moist to dry; peat, fibrous; sand, fine; trace logs up to 1.0m long; eggy odour; rootlets.	M - D	S				
0.5	6.0			Silty SAND, with trace rootlets; dark brown; blocky. Medium dense; non-plastic; wet; sand, fine.	W	MD				
1.0	5.5	▼		Silty SAND; blueish grey. Medium dense; wet; sand, fine.						
1.5	5.0			Silty SAND, with trace rootlets; greyish blue becoming blue; blocky. Medium dense; wet to saturated; sand, fine.	W - S					
2.0				EOH: 2.20m						
2.5	4.5									

REMARKS

Soils logged in accordance with NZGS (2005) Field Description of Soil and Rock

SYMBOLS

▼ Standing Water Level

◁ Out flow

▷ In flow

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TEST PIT LOG

TP04

SHEET 4 OF 17

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	STARTED:	27-02-2020
PROJECT:	195340402	EASTING:	1770292.00	FINISHED:	27-02-2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5471728.00		
		DATUM:	NZVD2016	LOGGED BY:	MT/RD DATE: 27-02-2020
OFFICE:	RDCL - Hastings	ELEVATION:	13	CHECKED BY:	JJN DATE: 14-04-2020
ENGINEER:		DIMENSIONS:	m x m	STATUS:	Final data
CONTRACTOR:		MACHINE TYPE & MODEL:			

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
0.0	12.5	Groundwater Not Encountered	TS	Silty TOPSOIL, with some sand; dark brown. Moist; sand, fine; rootlets.	M	L				
0.5				Silty SAND; yellowish tan. Loose; moist; sand, fine; becoming greyish tan at 1.1m bgl.						
1.0	12.0									
1.5	11.5									
2.0	11.0			EOH: 2.30m						
2.5	10.5									

REMARKS

Soils logged in accordance with NZGS (2005) Field Description of Soil and Rock

SYMBOLS

- Standing Water Level
- Out flow
- In flow

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TEST PIT LOG

TP05

SHEET 5 OF 17

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	STARTED:	27-02-2020
PROJECT:	195340402	EASTING:	1770271.00	FINISHED:	27-02-2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5471789.00		
		DATUM:	NZVD2016	LOGGED BY:	MT/RD DATE: 27-02-2020
OFFICE:	RDCL - Hastings	ELEVATION:	9	CHECKED BY:	JJN DATE: 14-04-2020
ENGINEER:		DIMENSIONS:	m x m	STATUS:	Final data
CONTRACTOR:		MACHINE TYPE & MODEL:			

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
0.0	9.0	Groundwater Not Encountered	TS	Silty TOPSOIL, with trace sand; dark brown. Moist; sand, fine; rootlets.	M					
0.5	8.5			Silty SAND; tan. Very loose; non-plastic; dry becoming moist; sand, fine.	D becoming M	VL				
1.0	8.0									
1.5	7.5									
2.0	7.0									
2.5	6.5			EOH: 2.60m						

REMARKS

Soils logged in accordance with NZGS (2005) Field Description of Soil and Rock

SYMBOLS

- Standing Water Level
- Out flow
- In flow

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TEST PIT LOG

TP06

SHEET 6 OF 17

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	STARTED:	27-02-2020
PROJECT:	195340402	EASTING:	1770460.00	FINISHED:	27-02-2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5471933.00		
		DATUM:	NZVD2016	LOGGED BY:	MT/RD DATE: 27-02-2020
OFFICE:	RDCL - Hastings	ELEVATION:	7	CHECKED BY:	JJN DATE: 14-04-2020
ENGINEER:		DIMENSIONS:	m x m	STATUS:	Final data
CONTRACTOR:		MACHINE TYPE & MODEL:			

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
0.0	7.0		TS	Silty TOPSOIL, with trace sand; dark brown. Dry to moist; sand, fine; rootlets.	D - M					
0.5	6.5			Sandy SILT; tan; blocky. Loose to medium dense; moist; sand, fine; rootlets.	M	L - MD				
1.0	6.0			Silty SAND; blueish grey. Medium dense; wet; sand, fine.	W	MD				
1.5	5.5	▼		EOH: 1.90m						
2.0	5.0									
2.5	4.5									

REMARKS

Soils logged in accordance with NZGS (2005) Field Description of Soil and Rock

SYMBOLS

▼ Standing Water Level
◁ Out flow
▷ In flow

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TEST PIT LOG

TP07

SHEET 7 OF 17

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	STARTED:	27-02-2020
PROJECT:	195340402	EASTING:	1770510.00	FINISHED:	27-02-2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5472027.00		
		DATUM:	NZVD2016	LOGGED BY:	MT/RD DATE: 27-02-2020
OFFICE:	RDCL - Hastings	ELEVATION:	17	CHECKED BY:	JJN DATE: 14-04-2020
ENGINEER:		DIMENSIONS:	m x m	STATUS:	Final data
CONTRACTOR:		MACHINE TYPE & MODEL:			

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
0.0	17.0	Groundwater Not Encountered	TS	Silty TOPSOIL, with trace sand; brown. Moist to dry; sand, fine; rootlets.	M - D					
0.5	16.5			Sandy SILT, with some roots; tan/greyish brown. Loose; dry; sand, fine.	D	L				
1.0	16.0									
1.5	15.5			Silty SAND; yellowish tan; blocky. Loose to dense; dry; sand, fine; becoming moist with depth.		L - D				
2.0	15.0									
2.5	14.5			EOH: 3.00m						

REMARKS

Soils logged in accordance with NZGS (2005) Field Description of Soil and Rock
Pine roots throughout.

SYMBOLS

- Standing Water Level
- Out flow
- In flow

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TEST PIT LOG

TP08

SHEET 8 OF 17

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	STARTED:	28-02-2020
PROJECT:	195340402	EASTING:	1770436.00	FINISHED:	28-02-2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5472104.00		
		DATUM:	NZVD2016	LOGGED BY:	MT/RD DATE: 28-02-2020
OFFICE:	RDCL - Hastings	ELEVATION:	20	CHECKED BY:	JJN DATE: 14-04-2020
ENGINEER:		DIMENSIONS:	m x m	STATUS:	Final data
CONTRACTOR:		MACHINE TYPE & MODEL:			

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
0.0	20.0	Groundwater Not Encountered	TS	Sandy TOPSOIL, with some silt; dark brown. Dry to moist; sand, fine; rootlets.	D - M	L				
0.5	19.5			Silty SAND; tan. Loose; dry to moist; sand, fine; becoming moist with depth.						
1.0	19.0									
1.5	18.5			EOH: 1.80m						
2.0	18.0									
2.5	17.5									

REMARKS

Soils logged in accordance with NZGS (2005) Field Description of Soil and Rock

SYMBOLS

- Standing Water Level
- Out flow
- In flow

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TEST PIT LOG

TP09

SHEET 9 OF 17

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	STARTED:	28-02-2020
PROJECT:	195340402	EASTING:	1770370.00	FINISHED:	28-02-2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5472138.00		
		DATUM:	NZVD2016	LOGGED BY:	MT/RD DATE: 28-02-2020
OFFICE:	RDCL - Hastings	ELEVATION:	19	CHECKED BY:	JJN DATE: 14-04-2020
ENGINEER:		DIMENSIONS:	m x m	STATUS:	Final data
CONTRACTOR:		MACHINE TYPE & MODEL:			

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
0.0	18.5	Groundwater Not Encountered	TS	Sandy TOPSOIL, with some silt; dark brown. Dry to moist; sand, fine; rootlets.	D - M					
0.5	18.5			Silty SAND; tan. Loose; dry; sand, fine; rootlets.	D	L				
1.0	18.0									
1.5	17.5			EOH: 1.70m						
2.0	17.0									
2.5	16.5									

REMARKS

Soils logged in accordance with NZGS (2005) Field Description of Soil and Rock
Pine roots throughout.

SYMBOLS

- Standing Water Level
- Out flow
- In flow

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TEST PIT LOG

TP10

SHEET 10 OF 17

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	STARTED:	28-02-2020
PROJECT:	195340402	EASTING:	1770518.00	FINISHED:	28-02-2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5472094.00		
		DATUM:	NZVD2016	LOGGED BY:	MT/RD DATE: 28-02-2020
OFFICE:	RDCL - Hastings	ELEVATION:	6	CHECKED BY:	JJN DATE: 14-04-2020
ENGINEER:		DIMENSIONS:	m x m	STATUS:	Final data
CONTRACTOR:		MACHINE TYPE & MODEL:			

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
			TS	Sandy TOPSOIL, with trace silt; dark brown. Moist to dry; sand, fine; rootlets.	M - D					
0.5	5.5			Silty SAND, with trace rootlets; tan. Loose to medium dense; moist; sand, fine.	M	L - MD				
1.0	5.0									
				Silty SAND; grey with orange mottle. Medium dense; dilatant; saturated; sand, fine; orange mottle inferred to be iron staining.	S	MD				
1.5	4.5	▼								
2.0	4.0			EOH: 2.20m						
2.5	3.5									

REMARKS

Soils logged in accordance with NZGS (2005) Field Description of Soil and Rock

SYMBOLS

▼ Standing Water Level

◁ Out flow

▷ In flow

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TEST PIT LOG

TP11

SHEET 11 OF 17

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	STARTED:	28-02-2020
PROJECT:	195340402	EASTING:	1770430.00	FINISHED:	28-02-2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5472169.00		
		DATUM:	NZVD2016	LOGGED BY:	MT/RD DATE: 28-02-2020
OFFICE:	RDCL - Hastings	ELEVATION:	5	CHECKED BY:	JJN DATE: 14-04-2020
ENGINEER:		DIMENSIONS:	m x m	STATUS:	Final data
CONTRACTOR:		MACHINE TYPE & MODEL:			

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
0.0	5.0		TS	Sandy TOPSOIL, with trace silt; dark brown; blocky. Moist; sand, fine.						
0.5	4.5			Silty SAND; reddish brown. Loose; moist; sand, fine.	M	L				
1.0	4.0			Silty SAND, with trace rootlets; grey; blocky. Medium dense; wet; sand, fine.	W	MD				
1.5	3.5	▼								
2.0	3.0			EOH: 2.00m						
2.5	2.5									

REMARKS

Soils logged in accordance with NZGS (2005) Field Description of Soil and Rock
Roots throughout.

SYMBOLS

▼ Standing Water Level
◁ Out flow
▷ In flow

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TEST PIT LOG

TP12

SHEET 12 OF 17

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	STARTED:	28-02-2020
PROJECT:	195340402	EASTING:	1770511.00	FINISHED:	28-02-2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5472192.00		
		DATUM:	NZVD2016	LOGGED BY:	MT/RD DATE: 28-02-2020
OFFICE:	RDCL - Hastings	ELEVATION:	5	CHECKED BY:	JJN DATE: 14-04-2020
ENGINEER:		DIMENSIONS:	m x m	STATUS:	Final data
CONTRACTOR:		MACHINE TYPE & MODEL:			

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
			TS	Sandy TOPSOIL, with some silt, with trace clay; dark brown. Moist; sand, fine; rootlets.						
0.5	4.5			Silty SAND, with trace iron stain; tan. Loose to medium dense; moist; sand, fine.	M	L - MD				
1.0	4.0			Silty SAND, with trace iron stain; grey. Medium dense; wet; sand, fine.						
1.5	3.5				W	MD				
2.0	3.0	▼		EOH: 2.10m						
2.5	2.5									

REMARKS

Soils logged in accordance with NZGS (2005) Field Description of Soil and Rock

SYMBOLS

▼ Standing Water Level

◁ Out flow

▷ In flow

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TEST PIT LOG

TP13

SHEET 13 OF 17

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	STARTED:	28-02-2020
PROJECT:	195340402	EASTING:	1770531.00	FINISHED:	28-02-2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5472277.00		
		DATUM:	NZVD2016	LOGGED BY:	MT/RD DATE: 28-02-2020
OFFICE:	RDCL - Hastings	ELEVATION:	6	CHECKED BY:	JJN DATE: 14-04-2020
ENGINEER:		DIMENSIONS:	m x m	STATUS:	Final data
CONTRACTOR:		MACHINE TYPE & MODEL:			

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
0.0	6.0		TS	Sandy TOPSOIL, with trace silt; dark brown. Moist; sand, fine; rootlets.	M					
0.5	5.5			Silty SAND; tan. Loose; moist to dry; sand, fine.	M - D	L				
1.0	5.0			Silty SAND; dark tan. Loose to medium dense; moist; sand, fine; becoming wet and greyish tan from 1.9m bgl.	M	L - MD				
1.5	4.5									
2.0	4.0									
2.5	3.5	▼		EOH: 2.90m						

REMARKS

Soils logged in accordance with NZGS (2005) Field Description of Soil and Rock

SYMBOLS

▼ Standing Water Level

◁ Out flow

▷ In flow

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TEST PIT LOG

TP14

SHEET 14 OF 17

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	STARTED:	28-02-2020
PROJECT:	195340402	EASTING:	1770477.00	FINISHED:	28-02-2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5472312.00		
		DATUM:	NZVD2016	LOGGED BY:	MT/RD DATE: 28-02-2020
OFFICE:	RDCL - Hastings	ELEVATION:	14	CHECKED BY:	JJN DATE: 14-04-2020
ENGINEER:		DIMENSIONS:	m x m	STATUS:	Final data
CONTRACTOR:		MACHINE TYPE & MODEL:			

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
0.0	14.0	Groundwater Not Encountered	TS	Silty TOPSOIL, with trace sand; dark brown. Dry; sand, fine; rootlets.	D	L				
				Silty SAND, with trace rootlets; tan. Loose; dry; sand, fine; some iron staining starting at 0.9m bgl.						
0.5	13.5									
1.0	13.0									
1.5	12.5			EOH: 1.80m						
2.0	12.0									
2.5	11.5									

REMARKS

Soils logged in accordance with NZGS (2005) Field Description of Soil and Rock

SYMBOLS

- Standing Water Level
- Out flow
- In flow

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TEST PIT LOG

TP15

SHEET 15 OF 17

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	STARTED:	28-02-2020
PROJECT:	195340402	EASTING:	1770517.00	FINISHED:	28-02-2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5472347.00		
		DATUM:	NZVD2016	LOGGED BY:	MT/RD DATE: 28-02-2020
OFFICE:	RDCL - Hastings	ELEVATION:	10	CHECKED BY:	JJN DATE: 14-04-2020
ENGINEER:		DIMENSIONS:	m x m	STATUS:	Final data
CONTRACTOR:		MACHINE TYPE & MODEL:			

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
0.0	10.0	Groundwater Not Encountered		Sandy TOPSOIL, with some silt; light brown. Dry; sand, fine; rootlets.	D					
0.5	9.5			Silty SAND; tan. Loose becoming medium dense; dry becoming moist; sand, fine; rootlets.	D becoming M	L becoming MD				
1.0	9.0									
1.5	8.5			EOH: 1.90m						
2.0	8.0									
2.5	7.5									

REMARKS

Soils logged in accordance with NZGS (2005) Field Description of Soil and Rock

SYMBOLS

- Standing Water Level
- Out flow
- In flow

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TEST PIT LOG

TP16

SHEET 16 OF 17

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	STARTED:	27-02-2020
PROJECT:	195340402	EASTING:	1770345.00	FINISHED:	27-02-2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5471775.00		
		DATUM:	NZVD2016	LOGGED BY:	MT/RD DATE: 27-02-2020
OFFICE:	RDCL - Hastings	ELEVATION:	13	CHECKED BY:	JJN DATE: 14-04-2020
ENGINEER:		DIMENSIONS:	m x m	STATUS:	Final data
CONTRACTOR:		MACHINE TYPE & MODEL:			

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
0	13	Groundwater Not Encountered	TS	Silty TOPSOIL, with trace sand; dark brown. Moist to dry; sand, fine.	M - D					
0.5	12.5			Silty SAND, with trace rootlets; tan. Loose; dry to moist; sand, fine.	D - M	L				
1.0	12.0			Silty SAND, with trace iron stain; tan; blocky. Loose to medium dense; moist; sand, fine; trace rootlets.	M	L - MD				
1.5	11.5									
2.0	11.0									
2.5	10.5			EOH: 2.90m						

REMARKS

Soils logged in accordance with NZGS (2005) Field Description of Soil and Rock
Buried topsoil (likely ancient) at 0.6m bgl.

SYMBOLS

- Standing Water Level
- Out flow
- In flow

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TEST PIT LOG

TP17

SHEET 17 OF 17

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	STARTED:	27-02-2020
PROJECT:	195340402	EASTING:	1770500.00	FINISHED:	27-02-2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5472061.00		
		DATUM:	NZVD2016	LOGGED BY:	MT/RD DATE: 27-02-2020
OFFICE:	RDCL - Hastings	ELEVATION:	19	CHECKED BY:	JJN DATE: 14-04-2020
ENGINEER:		DIMENSIONS:	m x m	STATUS:	Final data
CONTRACTOR:		MACHINE TYPE & MODEL:			

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	ROCK / SOIL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY / DENSITY	CLASSIFICATION	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
0.0	19.0	Groundwater Not Encountered	TS	Sandy TOPSOIL, with trace silt; dark brown. Moist; sand, fine; rootlets.	M					
0.5	18.5			Silty SAND; tan. Dry to moist; sand, fine; trace blocky iron-pan inclusions.	D - M					
1.0	18.0									
1.5	17.5									
2.0	17.0									
2.5	16.5			EOH: 2.50m						

REMARKS

Soils logged in accordance with NZGS (2005) Field Description of Soil and Rock

SYMBOLS

- Standing Water Level
- Out flow
- In flow

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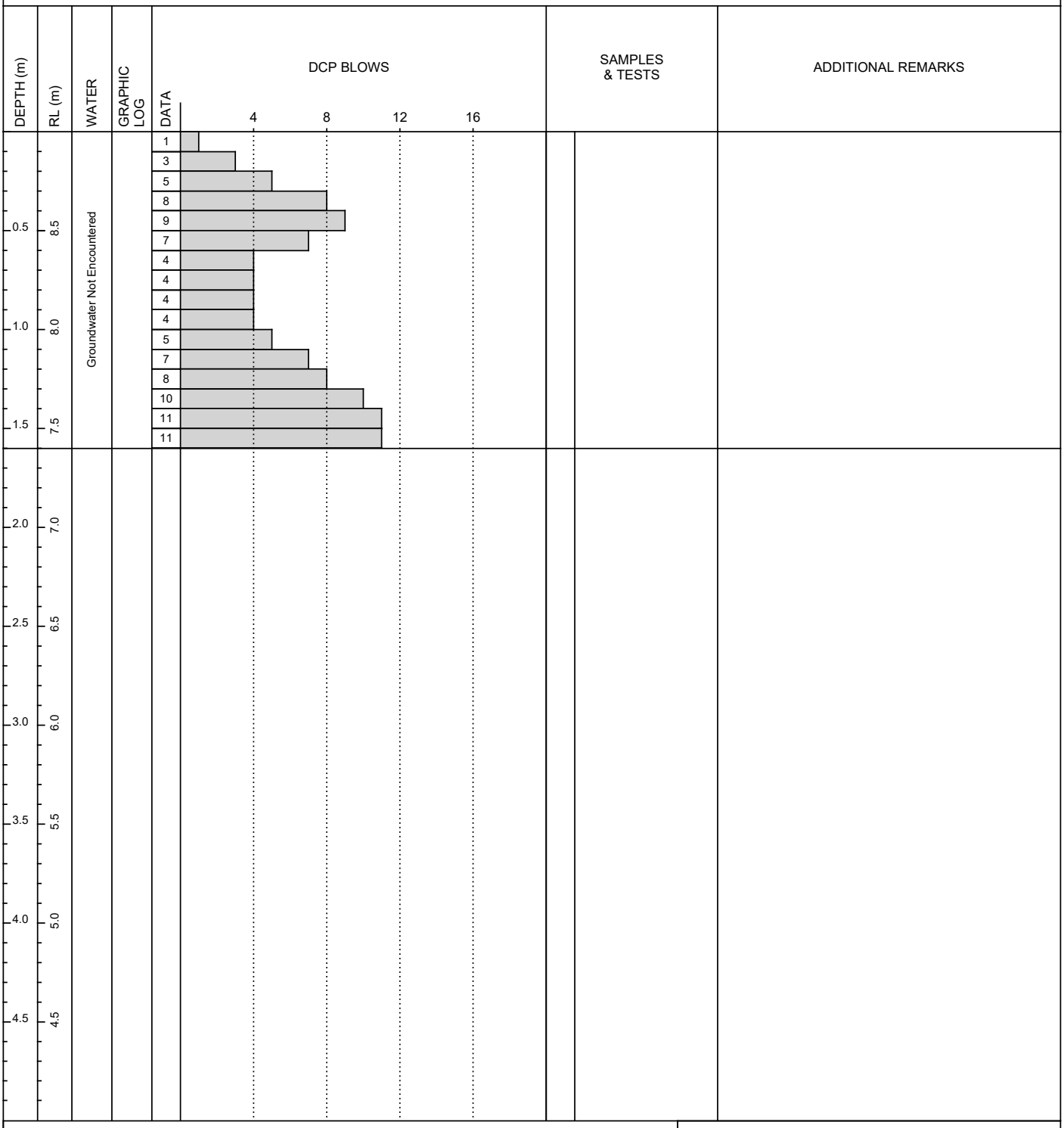
DCP LOG

DCP01

SHEET 1 OF 16

CLIENT: Richard Mansell	PROJECTION: NZTM2000	SUB-LOCATION:
PROJECT: 195340402	EASTING: 1770274.00	STARTED: 27-02-2020
LOCATION: 131 Otaihanga Rd	NORTHING: 5471793.00	FINISHED: 27-02-2020
	DATUM: NZVD2016	LOGGED BY: MT/RD DATE: 27-02-2020
OFFICE: RDCL - Hastings	ELEVATION: 9	CHECKED BY: JJN DATE: 14-04-2020
ENGINEER:	AZIMUTH: PLUNGE: 90°	STATUS: Final data



REMARKS

Soils tested in accordance with NZGS

SYMBOLS

- Standing Water Level
- Out flow
- In flow

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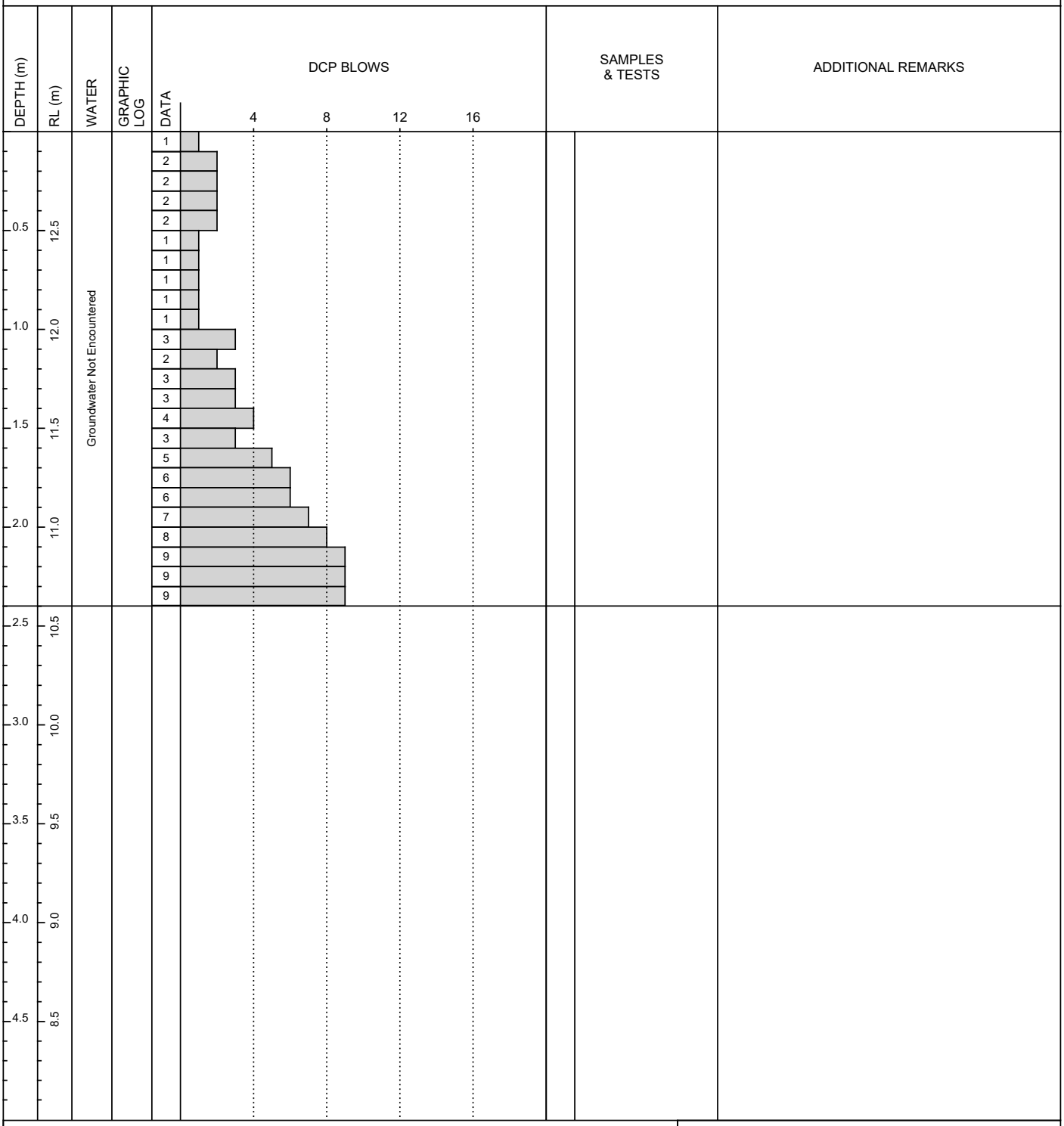
DCP LOG

DCP02

SHEET 2 OF 16

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	SUB-LOCATION:	
PROJECT:	195340402	EASTING:	1770349.00	STARTED:	27-02-2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5471779.00	FINISHED:	27-02-2020
		DATUM:	NZVD2016	LOGGED BY:	MT/RD DATE: 27-02-2020
OFFICE:	RDCL - Hastings	ELEVATION:	13	CHECKED BY:	JJN DATE: 14-04-2020
ENGINEER:		AZIMUTH:	PLUNGE: 90°	STATUS:	Final data



REMARKS

Soils tested in accordance with NZGS

SYMBOLS

- Standing Water Level
- Out flow
- In flow

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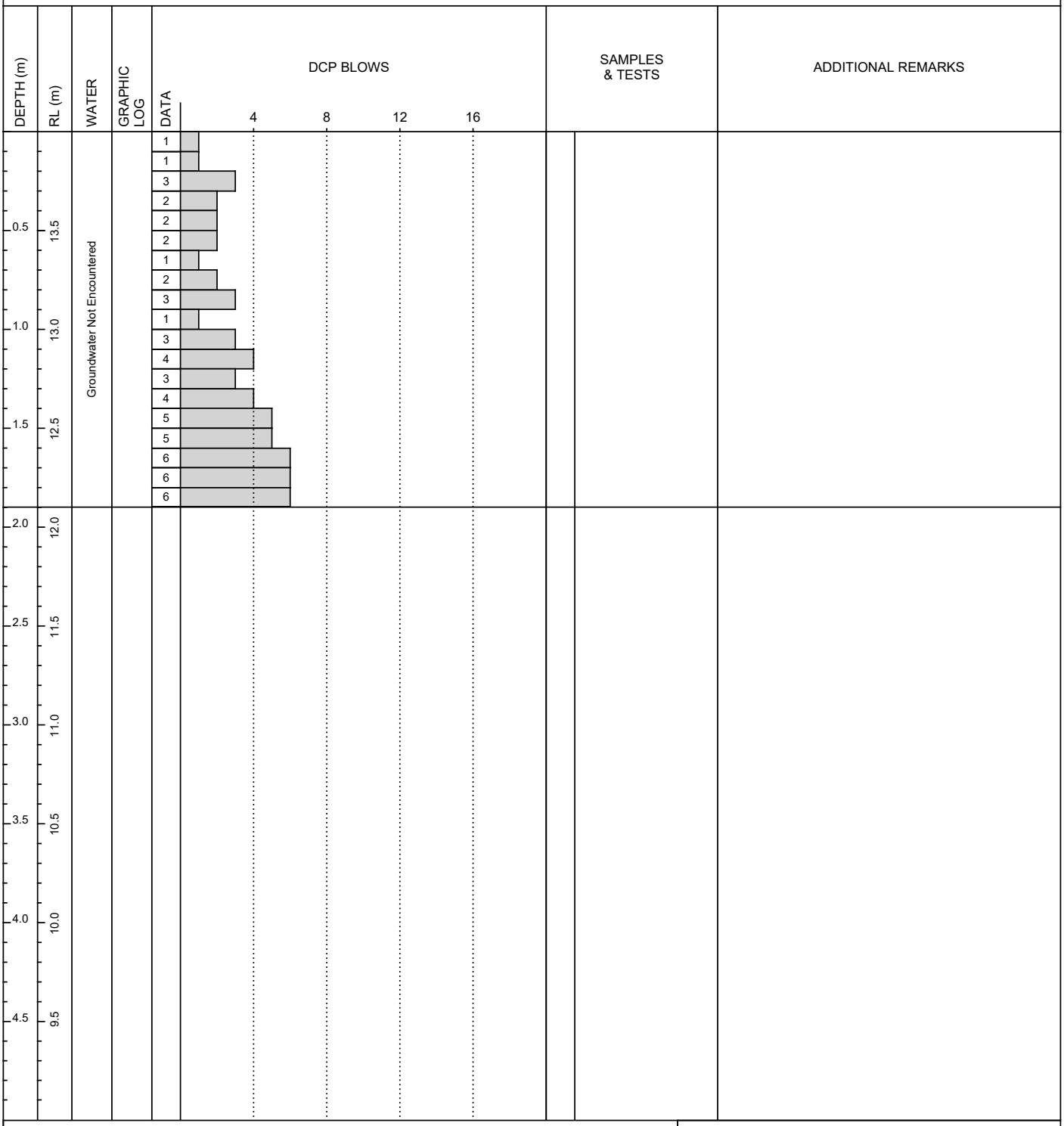
DCP LOG

DCP03

SHEET 3 OF 16

CLIENT: Richard Mansell	PROJECTION: NZTM2000	SUB-LOCATION:
PROJECT: 195340402	EASTING: 1770307.00	STARTED: 27-02-2020
LOCATION: 131 Otaihanga Rd	NORTHING: 5471732.00	FINISHED: 27-02-2020
	DATUM: NZVD2016	LOGGED BY: MT/RD DATE: 27-02-2020
OFFICE: RDCL - Hastings	ELEVATION: 14	CHECKED BY: JJN DATE: 14-04-2020
ENGINEER:	AZIMUTH: PLUNGE: 90°	STATUS: Final data



REMARKS
Soils tested in accordance with NZGS

SYMBOLS
- Standing Water Level
- Out flow
- In flow

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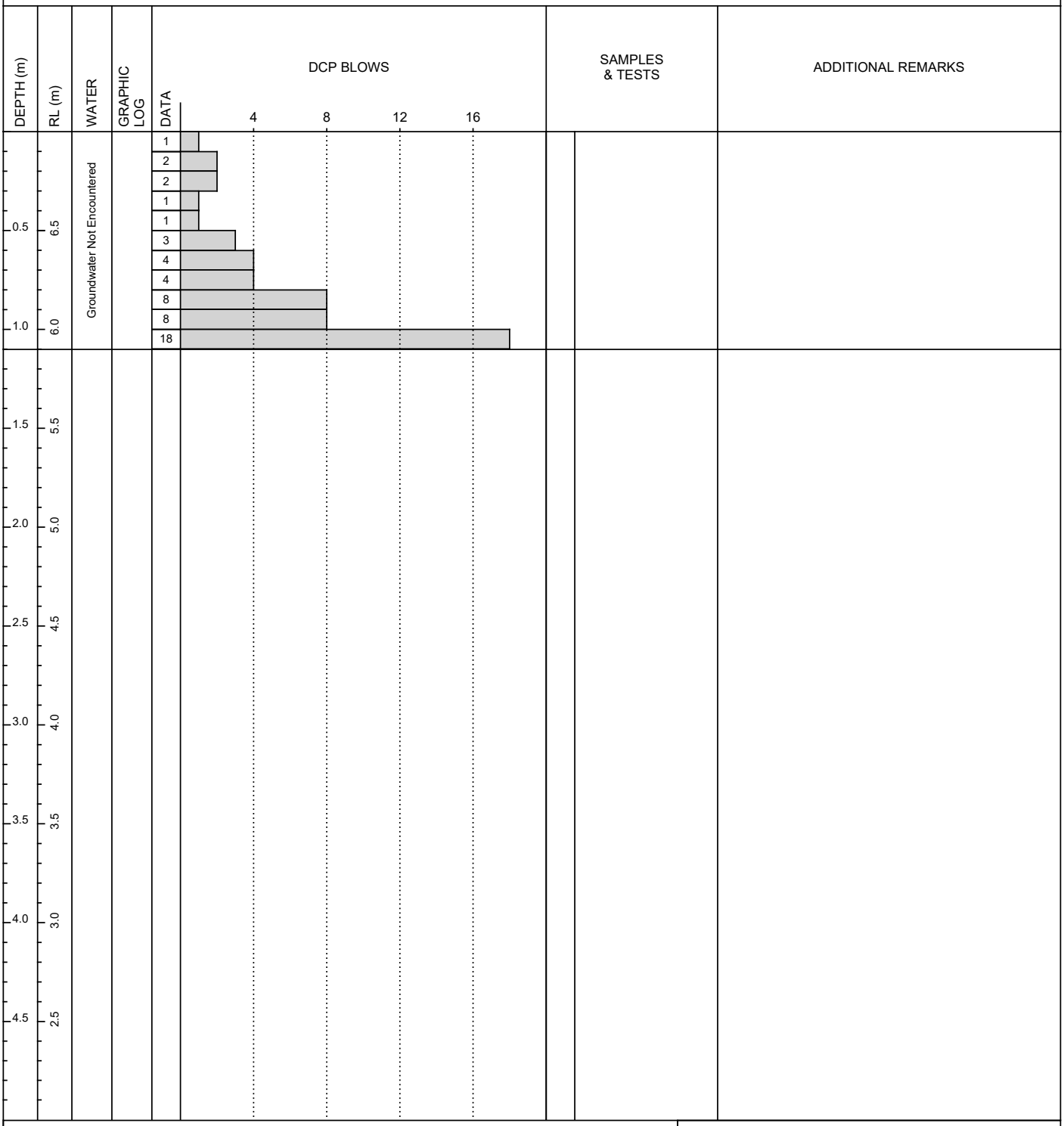
DCP LOG

DCP04

SHEET 4 OF 16

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	SUB-LOCATION:	
PROJECT:	195340402	EASTING:	1770331.00	STARTED:	27-02-2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5471682.00	FINISHED:	27-02-2020
		DATUM:	NZVD2016	LOGGED BY: MT/RD	DATE: 27-02-2020
OFFICE:	RDCL - Hastings	ELEVATION:	7	CHECKED BY: JJN	DATE: 14-04-2020
ENGINEER:		AZIMUTH:	PLUNGE: 90°	STATUS: Final data	



REMARKS

Soils tested in accordance with NZGS

SYMBOLS

- Standing Water Level
- Out flow
- In flow

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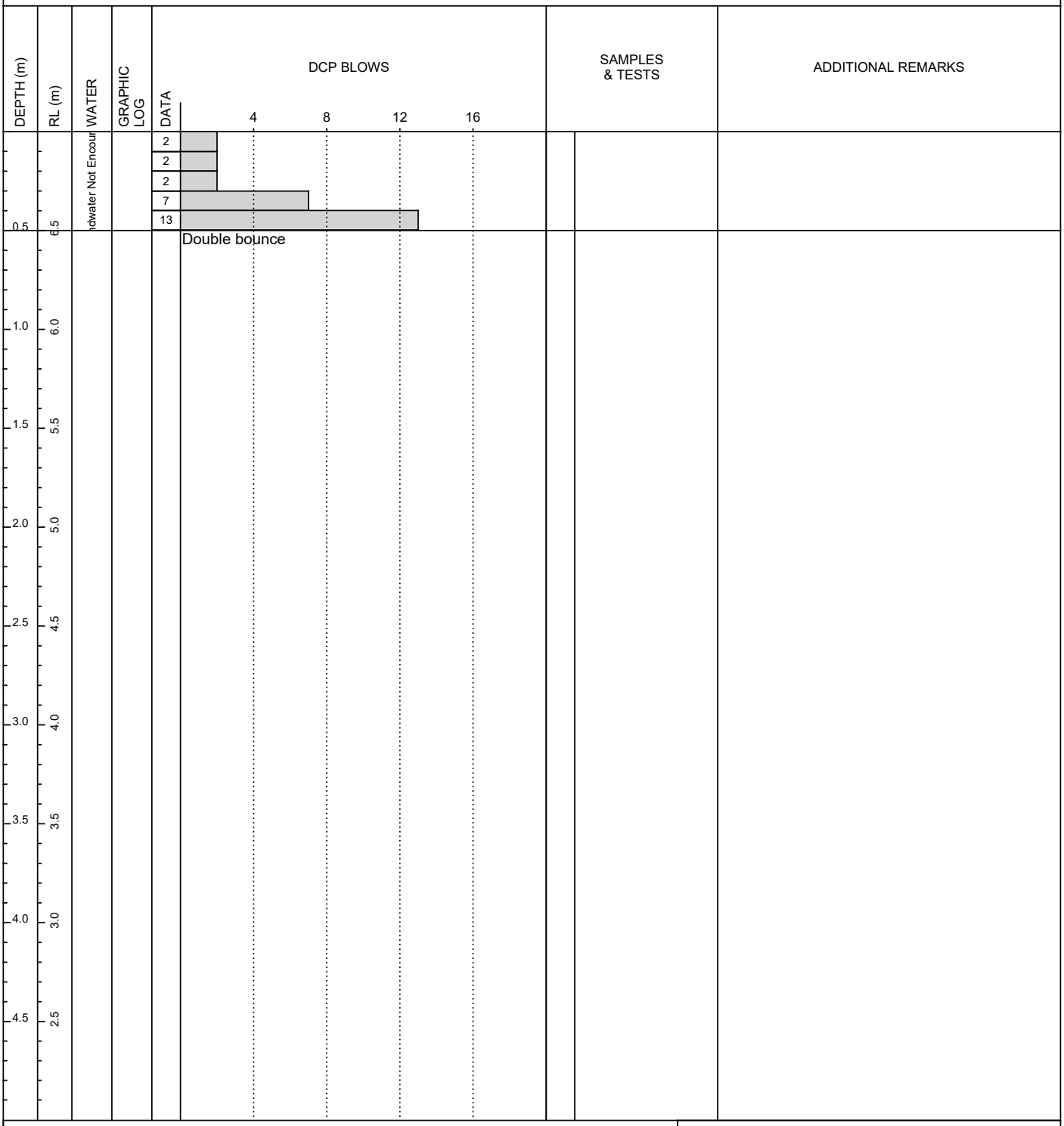
DCP LOG

DCP05

SHEET 5 OF 16

CLIENT: Richard Mansell	PROJECTION: NZTM2000	SUB-LOCATION:
PROJECT: 195340402	EASTING: 1770353.00	STARTED: 27-02-2020
LOCATION: 131 Otaihanga Rd	NORTHING: 5471629.00	FINISHED: 27-02-2020
	DATUM: NZVD2016	LOGGED BY: MT/RD DATE: 27-02-2020
OFFICE: RDCL - Hastings	ELEVATION: 7	CHECKED BY: JJN DATE: 14-04-2020
ENGINEER:	AZIMUTH: PLUNGE: 90°	STATUS: Final data



REMARKS
Soils tested in accordance with NZGS

SYMBOLS
- Standing Water Level
- Out flow
- In flow

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DCP LOG

DCP06

SHEET 6 OF 16

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	SUB-LOCATION:	
PROJECT:	195340402	EASTING:	1770387.00	STARTED:	27-02-2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5471725.00	FINISHED:	27-02-2020
		DATUM:	NZVD2016	LOGGED BY: MT/RD	DATE: 27-02-2020
OFFICE:	RDCL - Hastings	ELEVATION:	7	CHECKED BY: JJN	DATE: 14-04-2020
ENGINEER:		AZIMUTH:	PLUNGE: 90°	STATUS: Final data	

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	DATA	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
0.5	6.5	Groundwater Not Encountered		1			
				2			
				2			
				3			
				2			
				3			
1.0	6.0			3			
				3			
				4			
				5			
				4			
				7			
1.5	5.5			8			
				8			
				7			
				10			
				12			
				13			
2.0	5.0						
2.5	4.5						
3.0	4.0						
3.5	3.5						
4.0	3.0						
4.5	2.5						

DCP BLOWS: 4, 8, 12, 16

REMARKS

Soils tested in accordance with NZGS

SYMBOLS

- Standing Water Level
- Out flow
- In flow

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DCP LOG

DCP07

SHEET 7 OF 16

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	SUB-LOCATION:	
PROJECT:	195340402	EASTING:	1770459.00	STARTED:	27-02-2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5471935.00	FINISHED:	27-02-2020
		DATUM:	NZVD2016	LOGGED BY:	MT/RD DATE: 27-02-2020
OFFICE:	RDCL - Hastings	ELEVATION:	7	CHECKED BY:	JJN DATE: 14-04-2020
ENGINEER:		AZIMUTH:	PLUNGE: 90°	STATUS:	Final data

DEPTH (m)	RL (m)	WATER	GRAPHIC LOG	DATA	DCP BLOWS	SAMPLES & TESTS	ADDITIONAL REMARKS
0.5	6.5	Groundwater Not Encountered		1			
				1			
				3			
				3			
				3			
				3			
				2			
				3			
				4			
1.0	6.0			5			
				9			
				9			
				9			
				8			
1.5	5.5			9			
2.0	5.0						
2.5	4.5						
3.0	4.0						
3.5	3.5						
4.0	3.0						
4.5	2.5						

DCP BLOWS: 4, 8, 12, 16

REMARKS
Soils tested in accordance with NZGS

SYMBOLS
- Standing Water Level
- Out flow
- In flow

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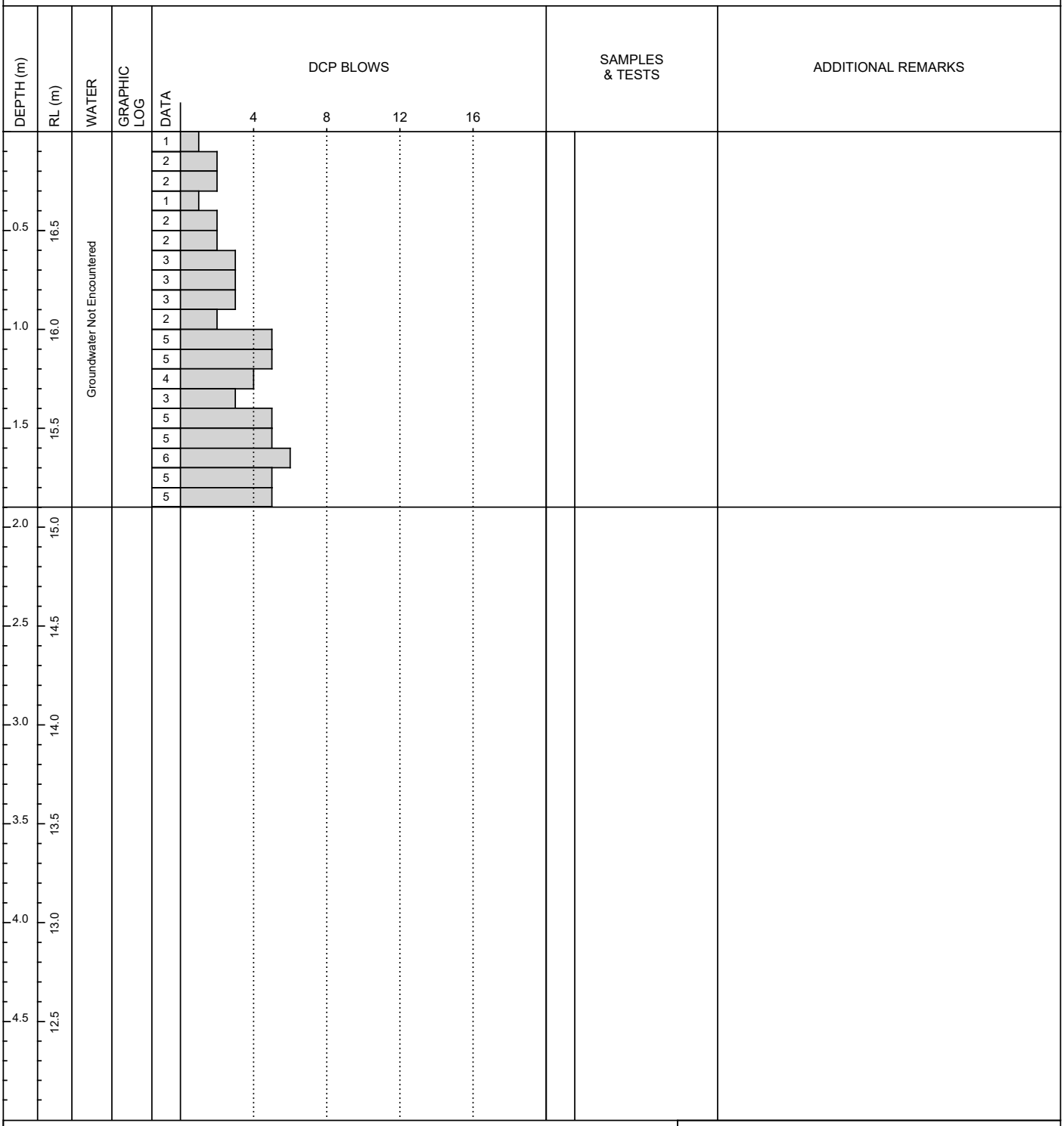
DCP LOG

DCP08

SHEET 8 OF 16

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	SUB-LOCATION:	
PROJECT:	195340402	EASTING:	1770511.00	STARTED:	27-02-2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5472026.00	FINISHED:	27-02-2020
		DATUM:	NZVD2016	LOGGED BY: MT/RD	DATE: 27-02-2020
OFFICE:	RDCL - Hastings	ELEVATION:	17	CHECKED BY: JJN	DATE: 14-04-2020
ENGINEER:		AZIMUTH:	PLUNGE: 90°	STATUS: Final data	



REMARKS

Soils tested in accordance with NZGS

SYMBOLS

- Standing Water Level
- Out flow
- In flow

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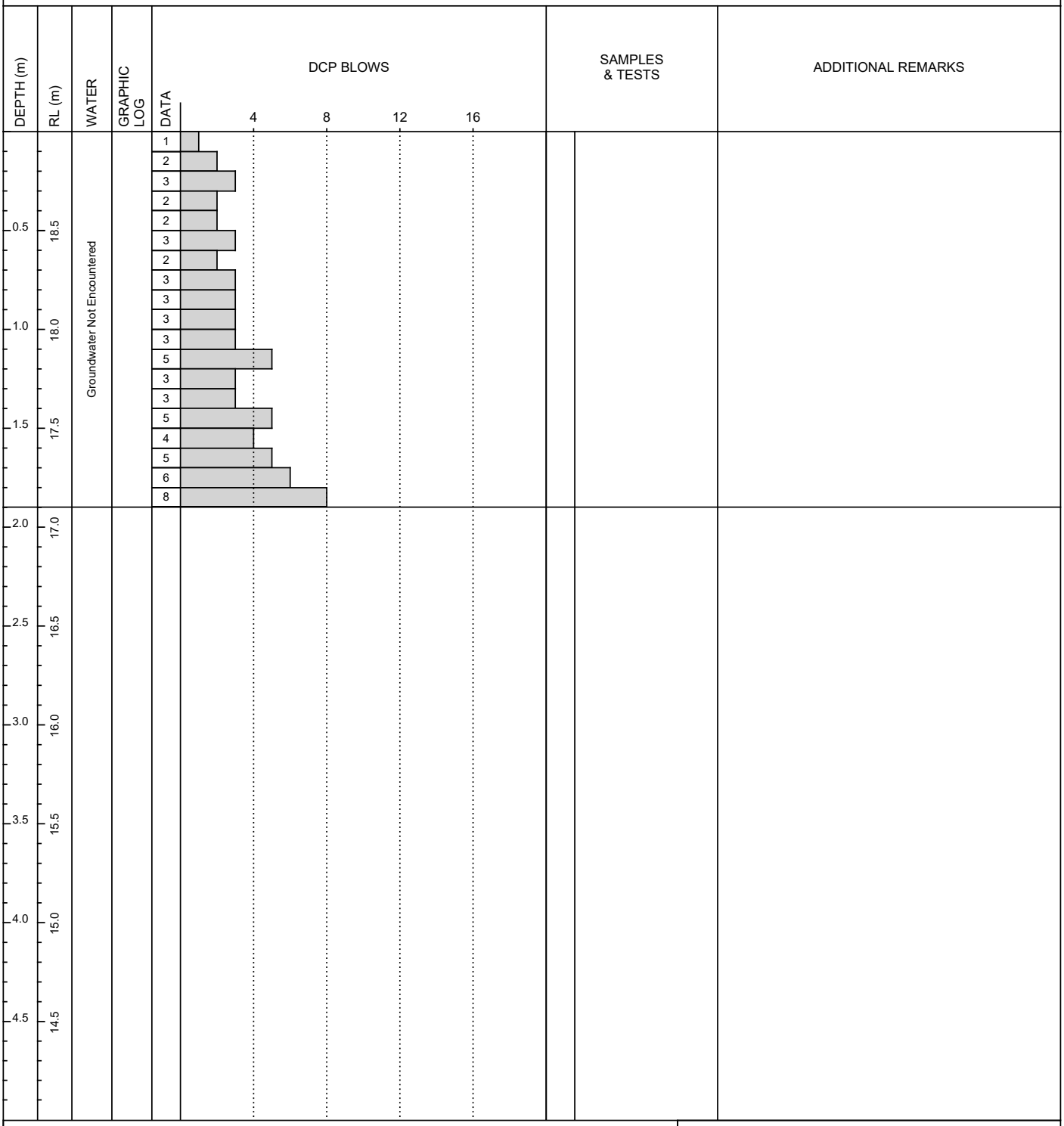
DCP LOG

DCP09

SHEET 9 OF 16

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	SUB-LOCATION:	
PROJECT:	195340402	EASTING:	1770498.00	STARTED:	27-02-2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5472065.00	FINISHED:	27-02-2020
		DATUM:	NZVD2016	LOGGED BY: MT/RD	DATE: 27-02-2020
OFFICE:	RDCL - Hastings	ELEVATION:	19	CHECKED BY: JJN	DATE: 14-04-2020
ENGINEER:		AZIMUTH:	PLUNGE: 90°	STATUS: Final data	



REMARKS

Soils tested in accordance with NZGS

SYMBOLS

- Standing Water Level
- Out flow
- In flow

RDCL

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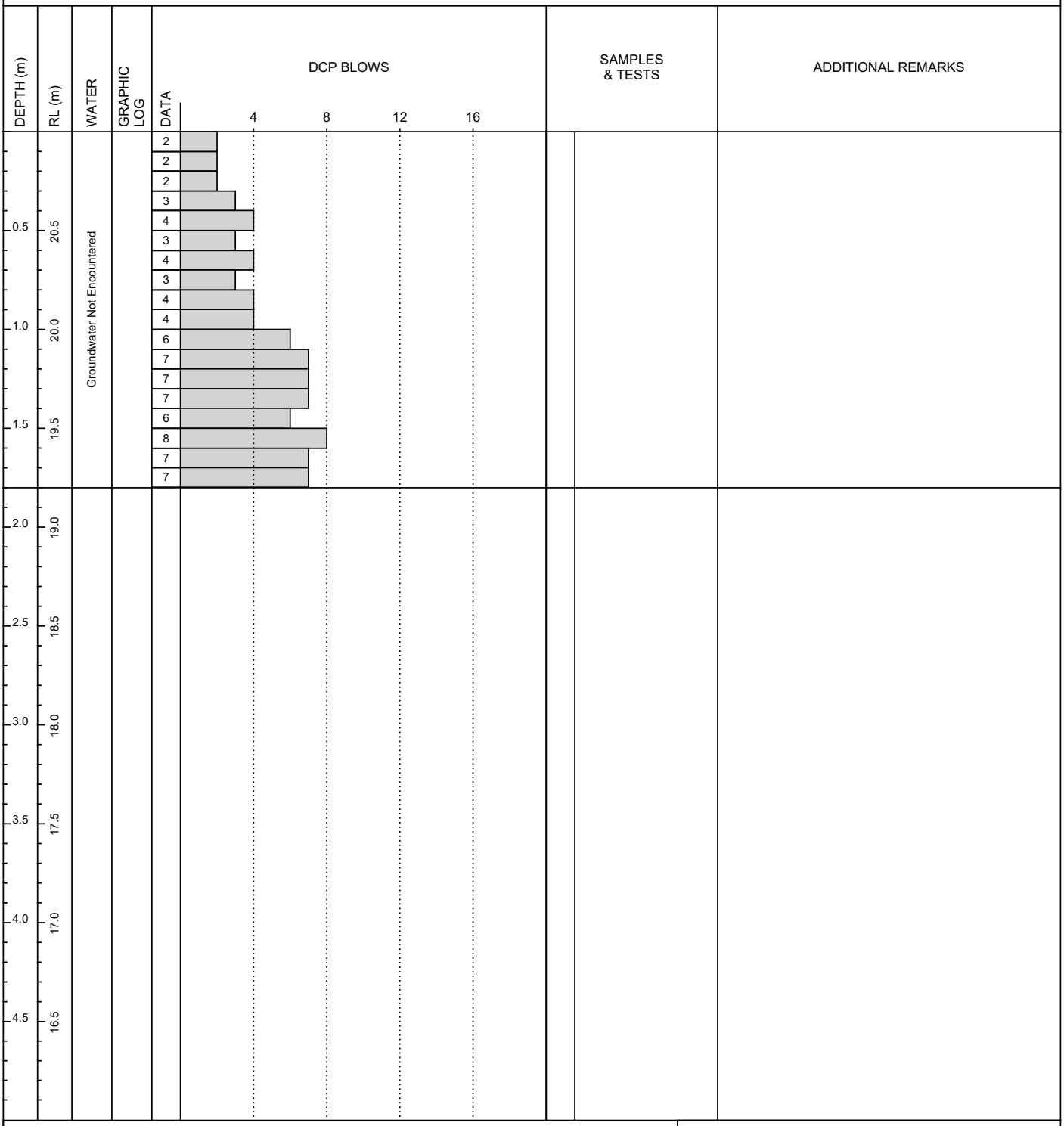
DCP LOG

DCP10

SHEET 10 OF 16

CLIENT: Richard Mansell	PROJECTION: NZTM2000	SUB-LOCATION:
PROJECT: 195340402	EASTING: 1770435.00	STARTED: 28-02-2020
LOCATION: 131 Otaihanga Rd	NORTHING: 5472098.00	FINISHED: 28-02-2020
	DATUM: NZVD2016	LOGGED BY: MT/RD DATE: 28-02-2020
OFFICE: RDCL - Hastings	ELEVATION: 21	CHECKED BY: JJN DATE: 14-04-2020
ENGINEER:	AZIMUTH: PLUNGE: 90°	STATUS: Final data



REMARKS
Soils tested in accordance with NZGS

SYMBOLS
- Standing Water Level
- Out flow
- In flow

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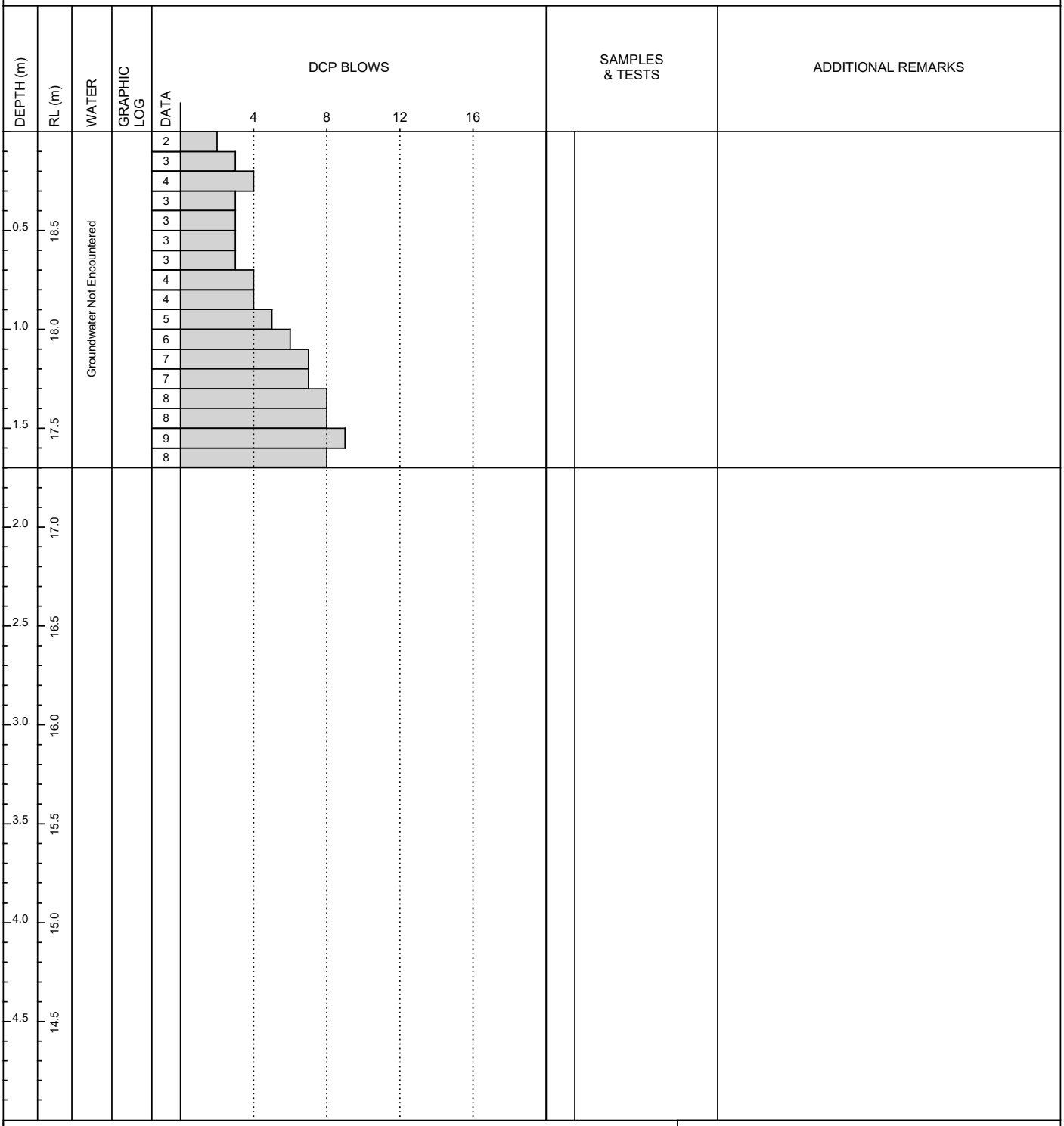
DCP LOG

DCP11

SHEET 11 OF 16

CLIENT: Richard Mansell	PROJECTION: NZTM2000	SUB-LOCATION:
PROJECT: 195340402	EASTING: 1770371.00	STARTED: 28-02-2020
LOCATION: 131 Otaihanga Rd	NORTHING: 5472140.00	FINISHED: 28-02-2020
	DATUM: NZVD2016	LOGGED BY: MT/RD DATE: 28-02-2020
OFFICE: RDCL - Hastings	ELEVATION: 19	CHECKED BY: JJN DATE: 14-04-2020
ENGINEER:	AZIMUTH: PLUNGE: 90°	STATUS: Final data



REMARKS

Soils tested in accordance with NZGS

SYMBOLS

- Standing Water Level
- Out flow
- In flow

RDCL

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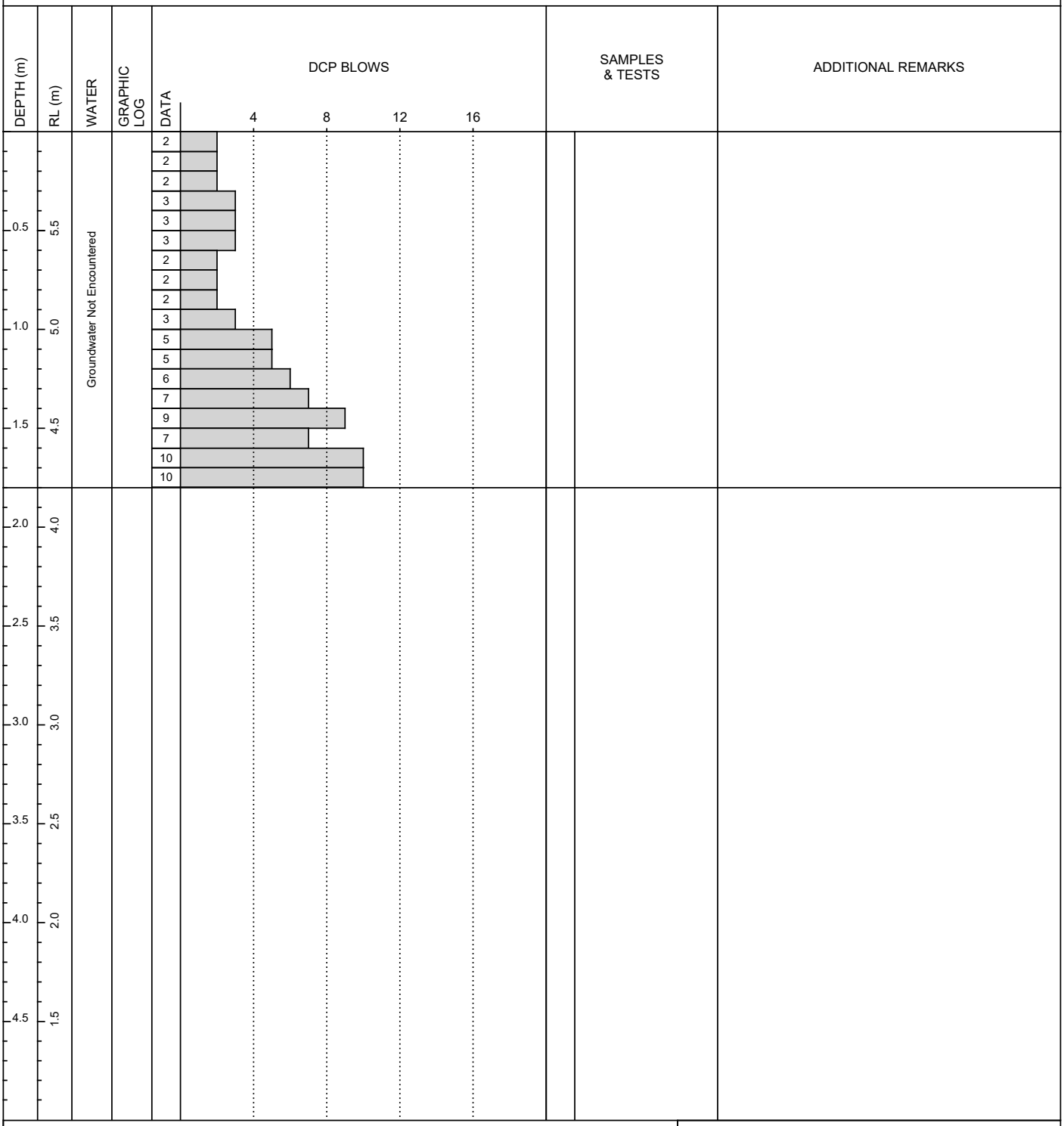
DCP LOG

DCP12

SHEET 12 OF 16

CLIENT: Richard Mansell	PROJECTION: NZTM2000	SUB-LOCATION:
PROJECT: 195340402	EASTING: 1770439.00	STARTED: 28-02-2020
LOCATION: 131 Otaihanga Rd	NORTHING: 5472159.00	FINISHED: 28-02-2020
	DATUM: NZVD2016	LOGGED BY: MT/RD DATE: 28-02-2020
OFFICE: RDCL - Hastings	ELEVATION: 6	CHECKED BY: JJN DATE: 14-04-2020
ENGINEER:	AZIMUTH: PLUNGE: 90°	STATUS: Final data



REMARKS

Soils tested in accordance with NZGS

SYMBOLS

- Standing Water Level
- Out flow
- In flow

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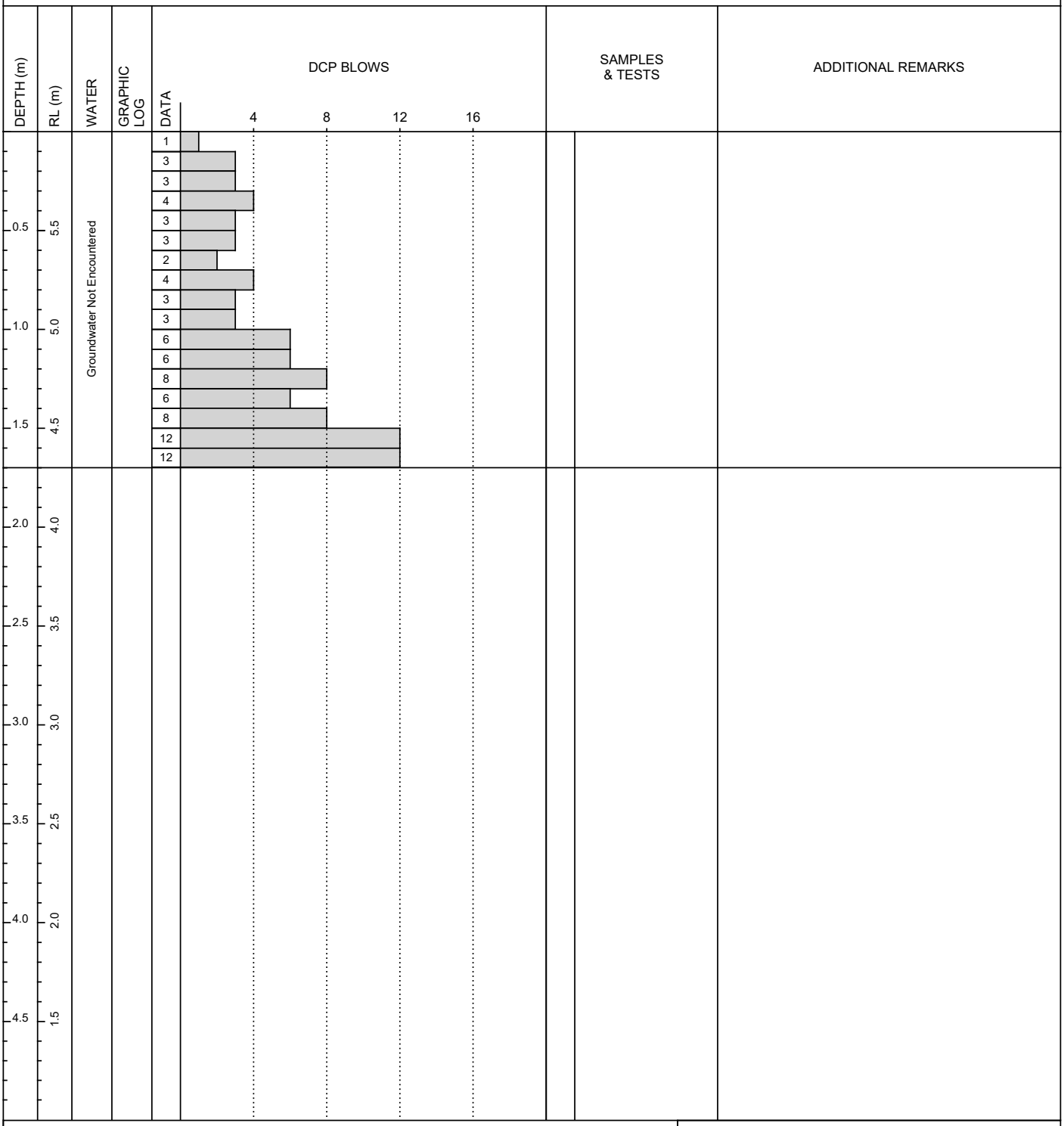
DCP LOG

DCP13

SHEET 13 OF 16

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	SUB-LOCATION:	
PROJECT:	195340402	EASTING:	1770523.00	STARTED:	28-02-2020
LOCATION:	131 Otaihanga Rd	NORTHING:	5472096.00	FINISHED:	28-02-2020
		DATUM:	NZVD2016	LOGGED BY: MT/RD	DATE: 28-02-2020
OFFICE:	RDCL - Hastings	ELEVATION:	6	CHECKED BY: JJN	DATE: 14-04-2020
ENGINEER:		AZIMUTH:	PLUNGE: 90°	STATUS: Final data	



REMARKS

Soils tested in accordance with NZGS

SYMBOLS

- Standing Water Level
- Out flow
- In flow

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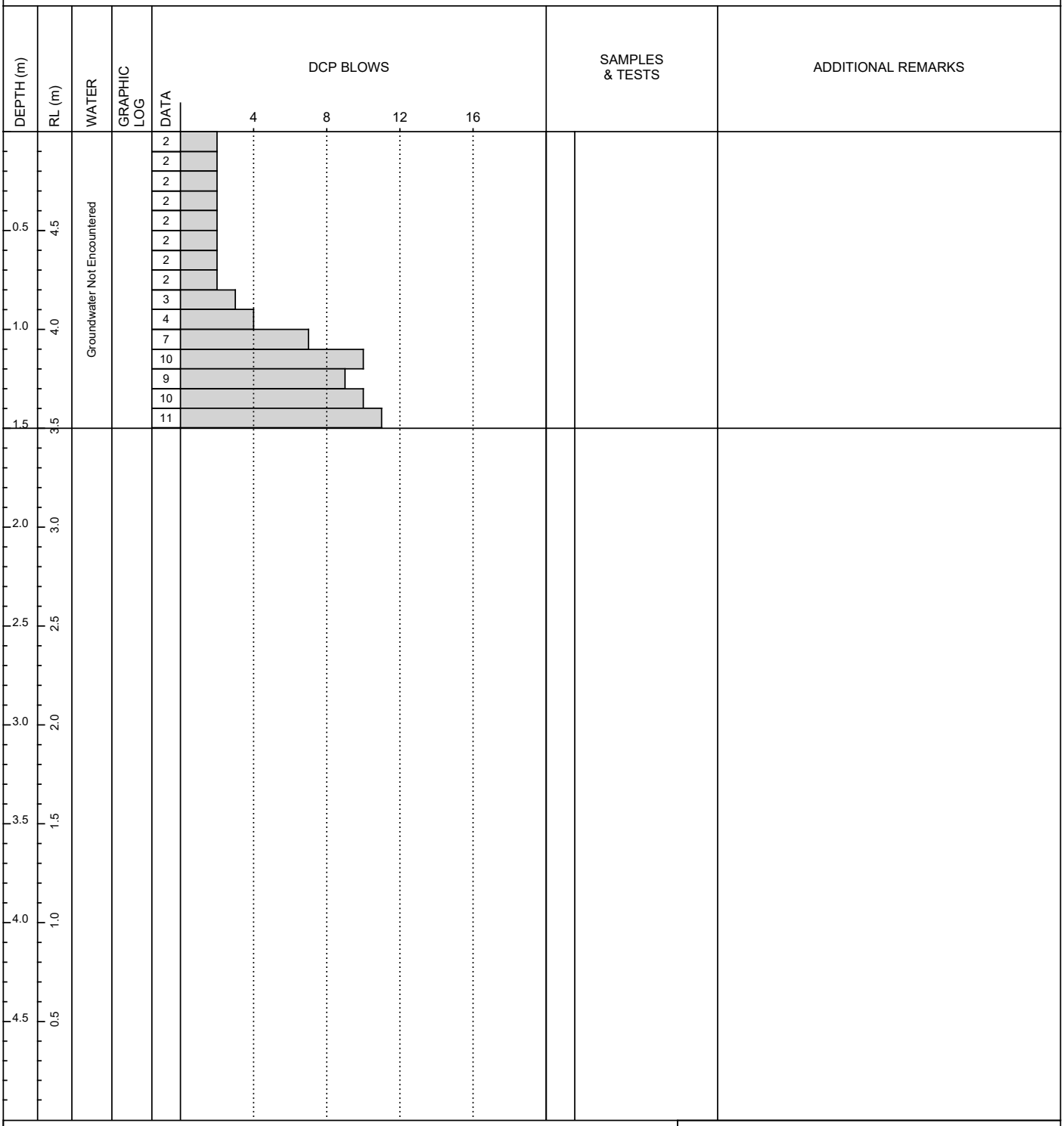
DCP LOG

DCP14

SHEET 14 OF 16

CLIENT: Richard Mansell	PROJECTION: NZTM2000	SUB-LOCATION:
PROJECT: 195340402	EASTING: 1770511.00	STARTED: 28-02-2020
LOCATION: 131 Otaihanga Rd	NORTHING: 5472191.00	FINISHED: 28-02-2020
	DATUM: NZVD2016	LOGGED BY: MT/RD DATE: 28-02-2020
OFFICE: RDCL - Hastings	ELEVATION: 5	CHECKED BY: JJN DATE: 14-04-2020
ENGINEER:	AZIMUTH: PLUNGE: 90°	STATUS: Final data



REMARKS

Soils tested in accordance with NZGS

SYMBOLS

- Standing Water Level
- Out flow
- In flow

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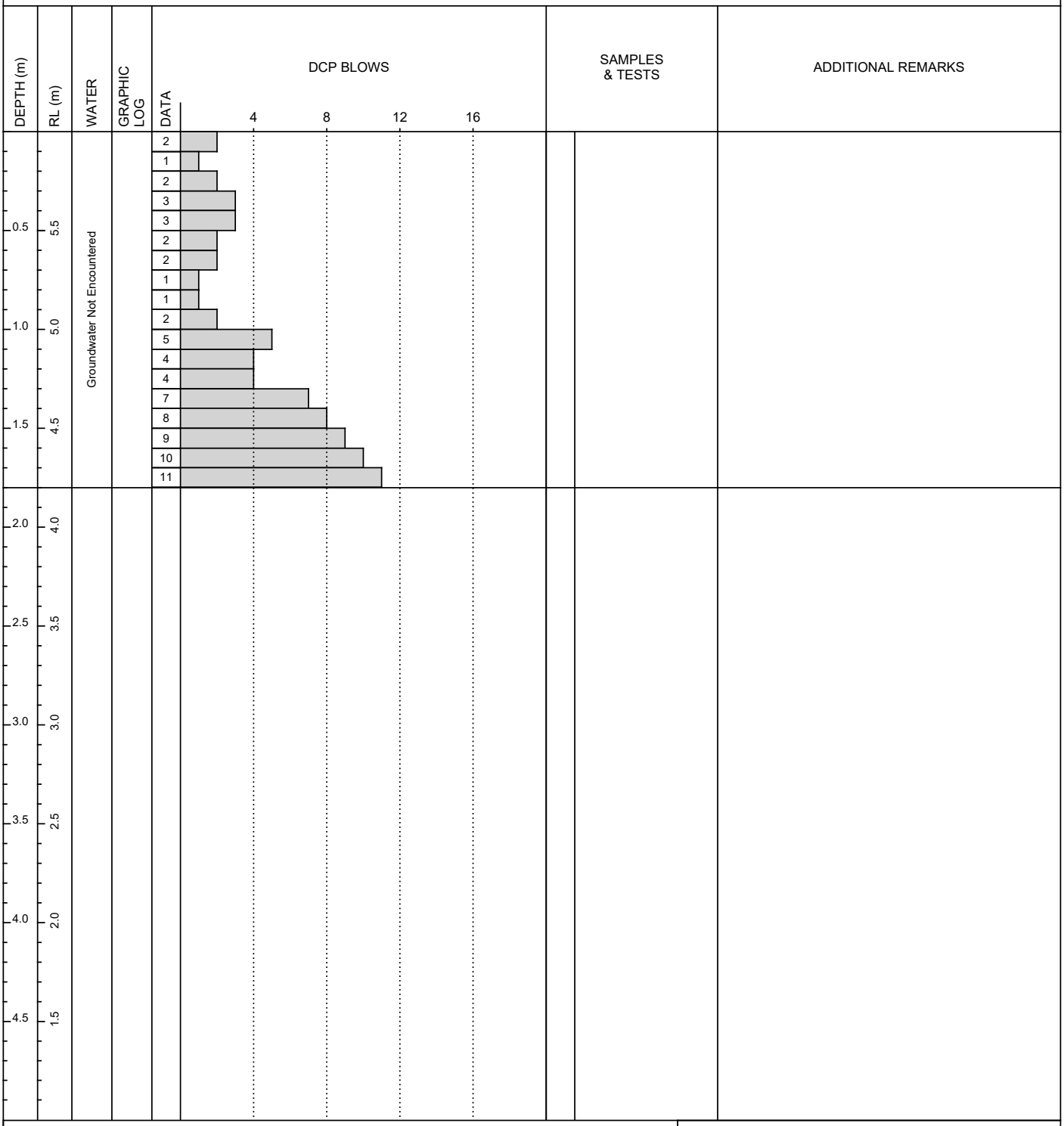
DCP LOG

DCP15

SHEET 15 OF 16

CLIENT: Richard Mansell	PROJECTION: NZTM2000	SUB-LOCATION:
PROJECT: 195340402	EASTING: 1770533.00	STARTED: 28-02-2020
LOCATION: 131 Otaihanga Rd	NORTHING: 5472277.00	FINISHED: 28-02-2020
	DATUM: NZVD2016	LOGGED BY: MT/RD DATE: 28-02-2020
OFFICE: RDCL - Hastings	ELEVATION: 6	CHECKED BY: JJN DATE: 14-04-2020
ENGINEER:	AZIMUTH: PLUNGE: 90°	STATUS: Final data



REMARKS
Soils tested in accordance with NZGS

SYMBOLS
- Standing Water Level
- Out flow
- In flow

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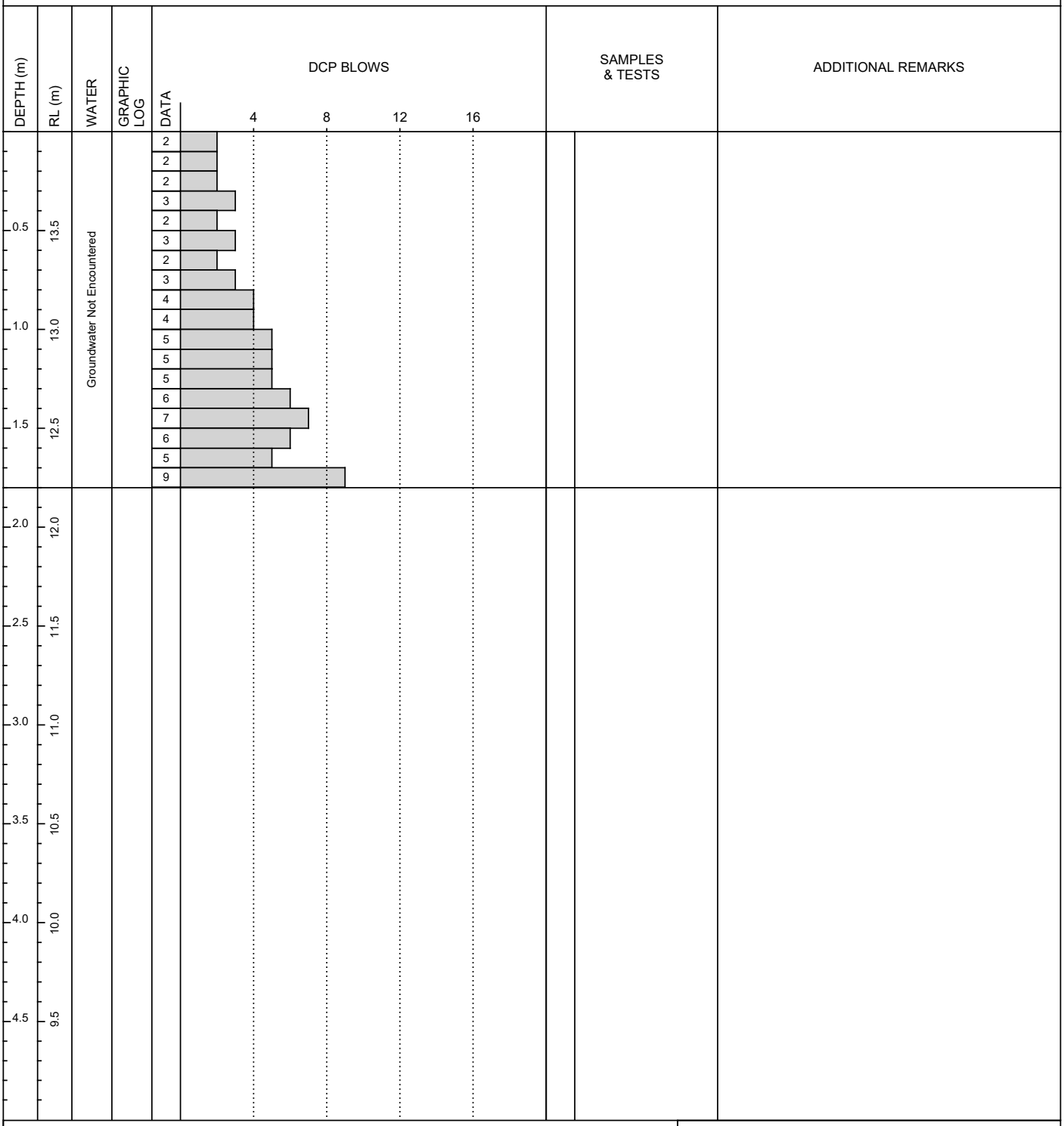
DCP LOG

DCP16

SHEET 16 OF 16

CLIENT: Richard Mansell	PROJECTION: NZTM2000	SUB-LOCATION:
PROJECT: 195340402	EASTING: 1770476.00	STARTED: 28-02-2020
LOCATION: 131 Otaihanga Rd	NORTHING: 5472313.00	FINISHED: 28-02-2020
	DATUM: NZVD2016	LOGGED BY: MT/RD DATE: 28-02-2020
OFFICE: RDCL - Hastings	ELEVATION: 14	CHECKED BY: JJN DATE: 14-04-2020
ENGINEER:	AZIMUTH: PLUNGE: 90°	STATUS: Final data



REMARKS
Soils tested in accordance with NZGS

SYMBOLS
- Standing Water Level
- Out flow
- In flow

RDCL
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Ph: +64 6 8771652 | Email: info@rdcl.co.nz

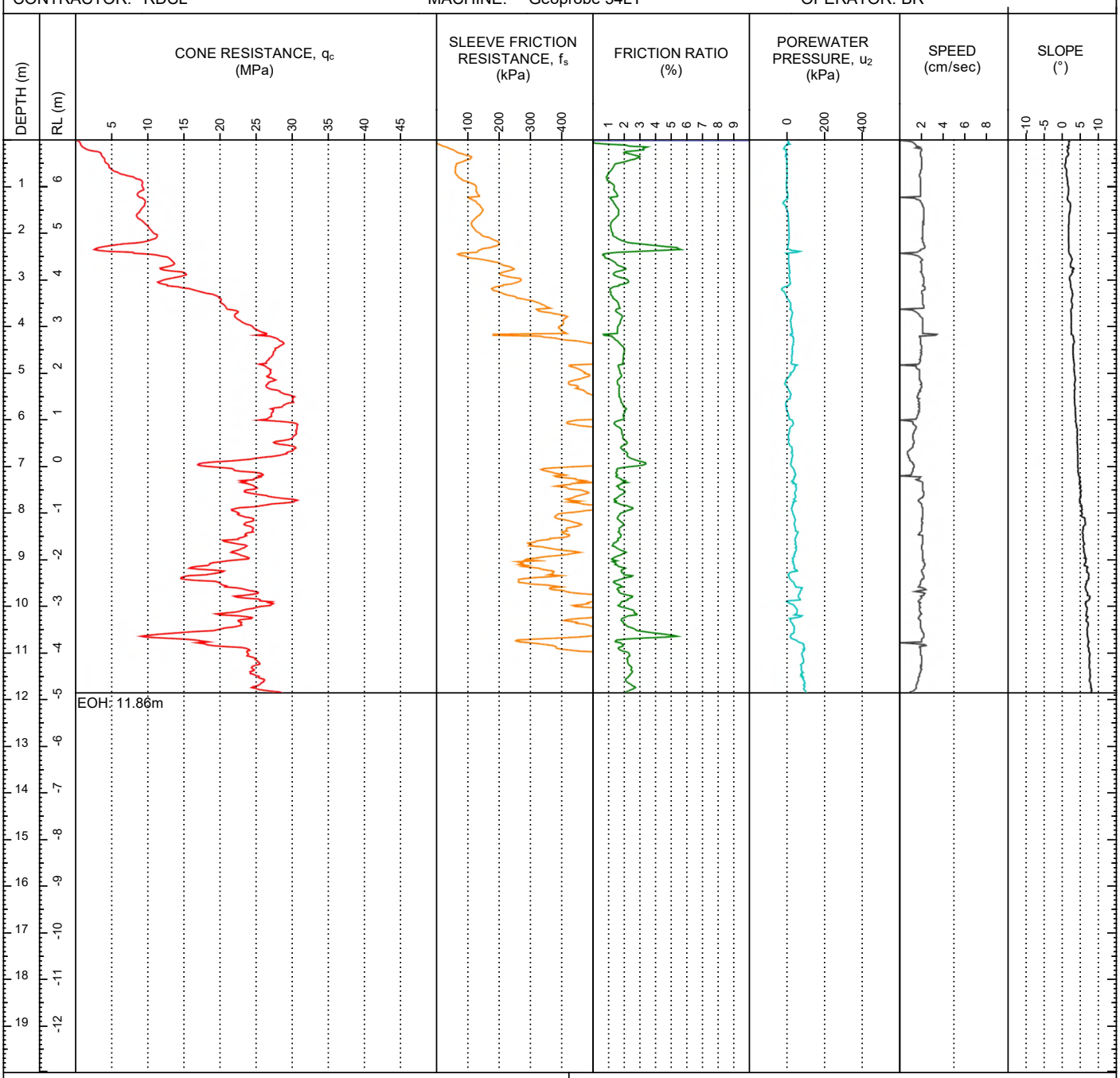
CONE PENETRATION TEST LOG

CPT01

SHEET 1 OF 1

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	SUB-LOCATION:	
PROJECT:	195340402	EASTING:	1770350.00	LOGGED ON:	11-Sep-19 12:00:00 AM
LOCATION:	131 Otaihanga Rd	NORTHING:	5471622.00	PREPARED BY:	BR DATE: 01-10-2019
		ELEVATION:	7.00	CHECKED BY:	JJN DATE: 14-04-2020
OFFICE:	RDCL - Hastings	DATUM:	NZVD2016	STATUS:	Final data

CONTRACTOR: RDCL MACHINE: Geoprobe 54LT OPERATOR: BR



REMARKS

CONE INFORMATION

CONE ID: 4483 CONE TYPE: -

	INITIAL	FINAL
CONE RESISTANCE:	6.8193	-0.038
SLEEVE FRICTION RESISTANCE:	128.8	-3
POREWATER PRESSURE:	264.2	-2.5

SYMBOLS

▼ Water level

RDCL

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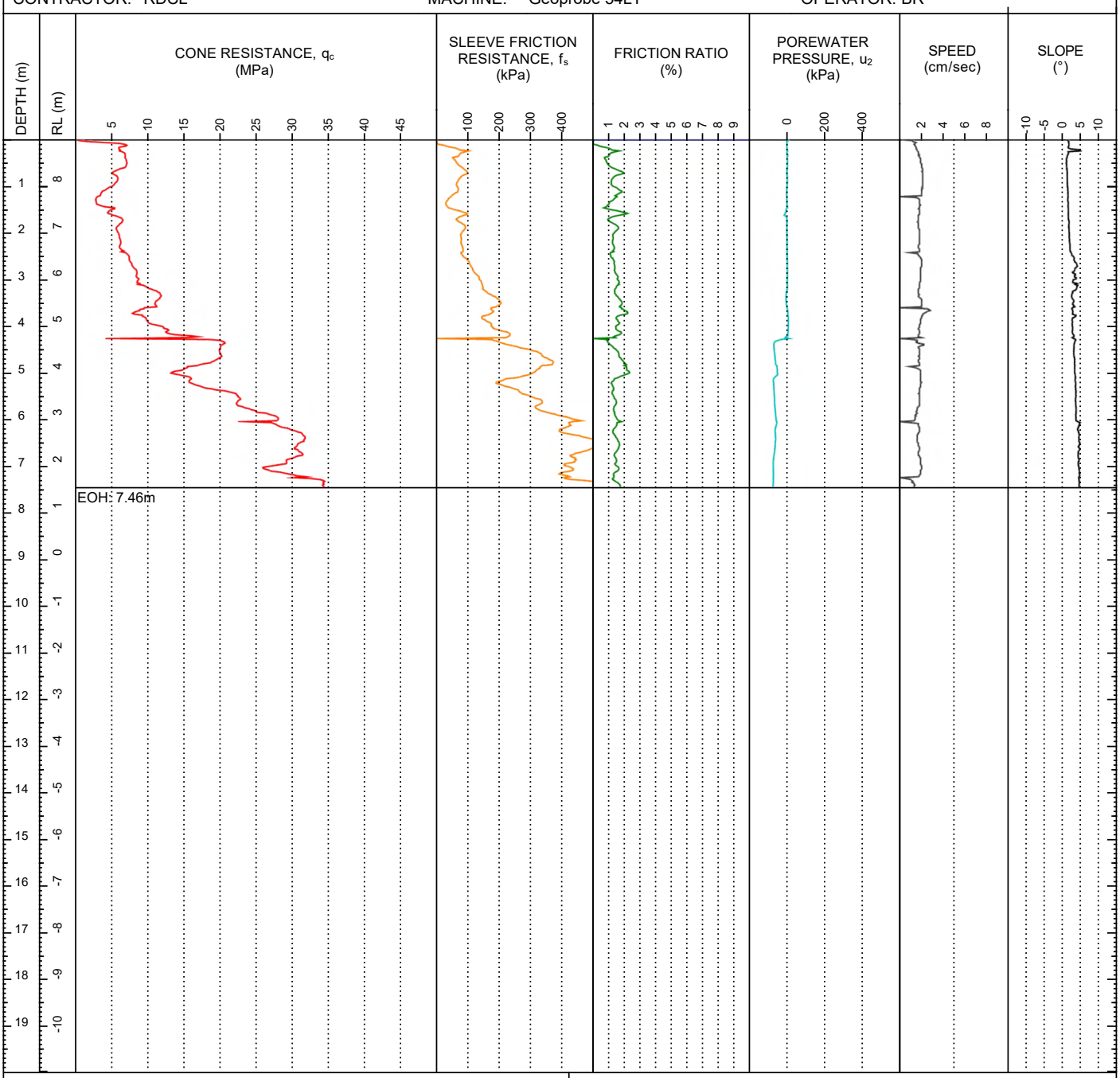
CONE PENETRATION TEST LOG

CPT02

SHEET 1 OF 1

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	SUB-LOCATION:	
PROJECT:	195340402	EASTING:	1770302.00	LOGGED ON:	11-Sep-19 12:00:00 AM
LOCATION:	131 Otaihanga Rd	NORTHING:	5471783.00	PREPARED BY:	BR DATE: 01-10-2019
		ELEVATION:	9.00	CHECKED BY:	JJN DATE: 14-04-2020
OFFICE:	RDCL - Hastings	DATUM:	NZVD2016	STATUS:	Final data

CONTRACTOR: RDCL MACHINE: Geoprobe 54LT OPERATOR: BR



REMARKS

CONE INFORMATION

CONE ID: 4483 CONE TYPE: -

	INITIAL	FINAL
CONE RESISTANCE:	6.8429	-0.0173
SLEEVE FRICTION RESISTANCE:	126.6	-1
POREWATER PRESSURE:	263.4	-1.4

SYMBOLS

▼ Water level

RDCL

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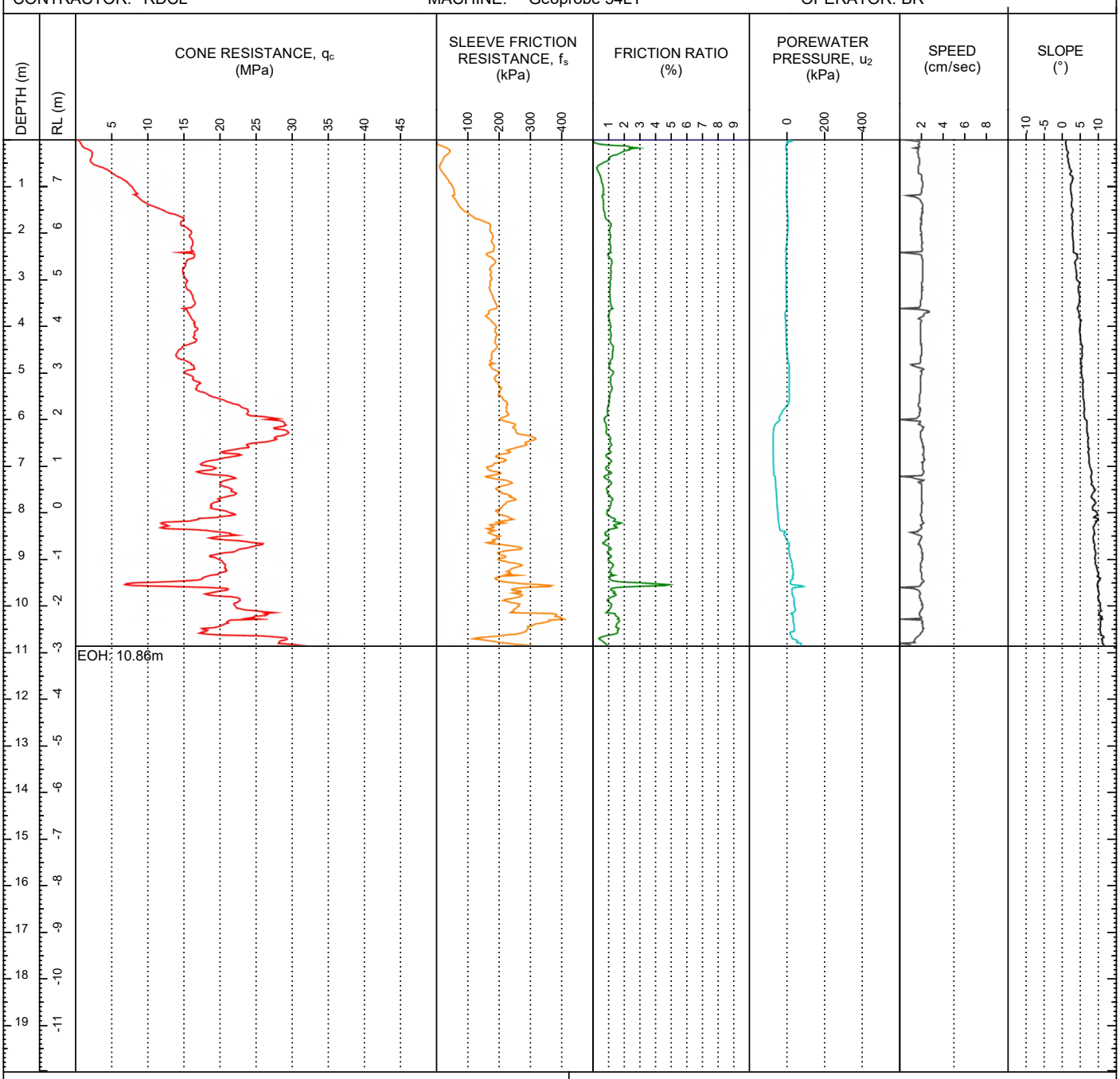
CONE PENETRATION TEST LOG

CPT03

SHEET 1 OF 1

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	SUB-LOCATION:	
PROJECT:	195340402	EASTING:	1770388.00	LOGGED ON:	11-Sep-19 12:00:00 AM
LOCATION:	131 Otaihanga Rd	NORTHING:	5471703.00	PREPARED BY:	BR DATE: 01-10-2019
		ELEVATION:	8.00	CHECKED BY:	JJN DATE: 14-04-2020
OFFICE:	RDCL - Hastings	DATUM:	NZVD2016	STATUS:	Final data

CONTRACTOR: RDCL MACHINE: Geoprobe 54LT OPERATOR: BR



REMARKS

CONE INFORMATION

CONE ID: 4483 CONE TYPE: -

	INITIAL	FINAL
CONE RESISTANCE:	6.836	-0.0317
SLEEVE FRICTION RESISTANCE:	128.2	-2.2
POREWATER PRESSURE:	263.9	-2.2

SYMBOLS

▼ Water level

RDCL
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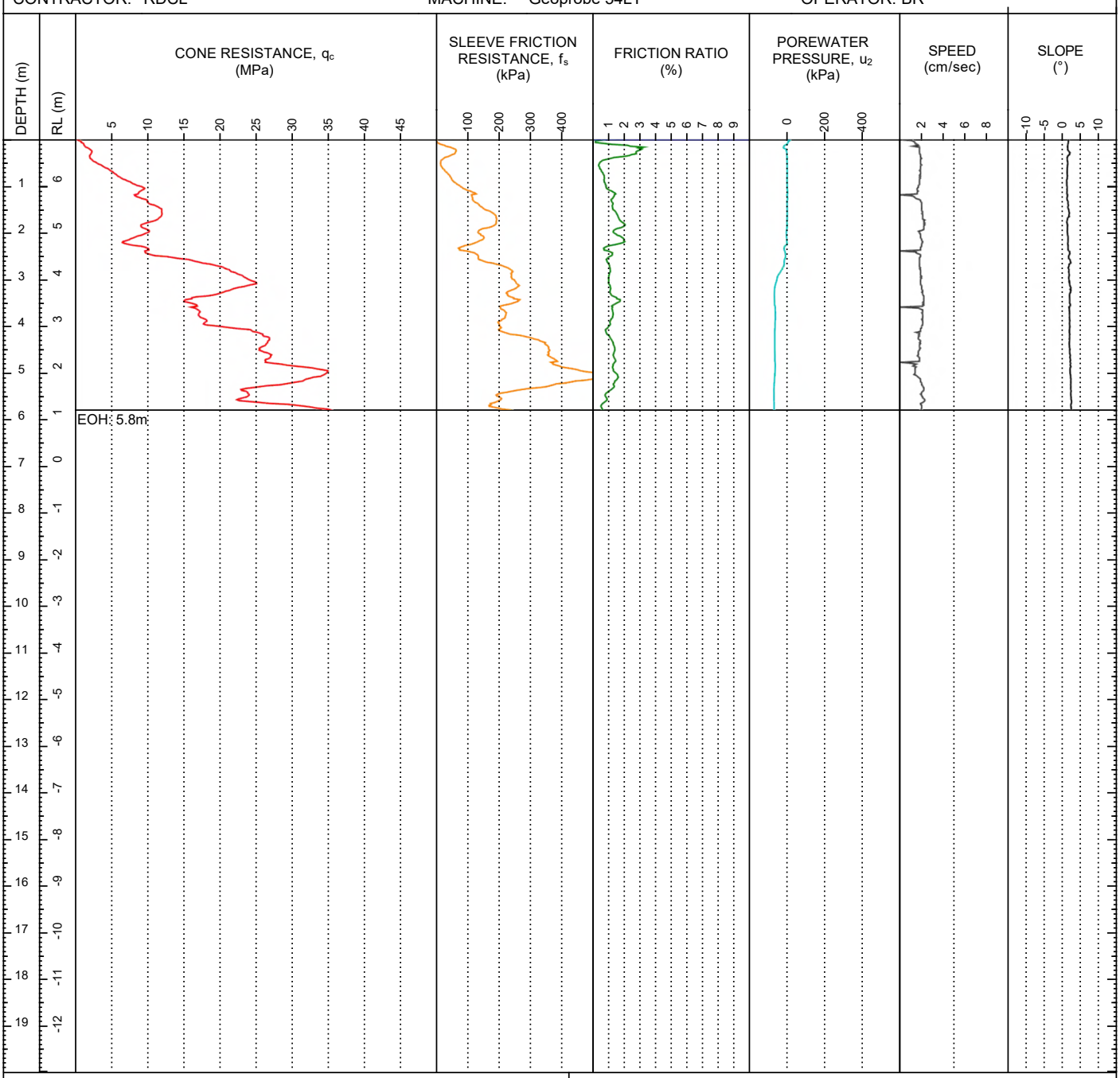
CONE PENETRATION TEST LOG

CPT04

SHEET 1 OF 1

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	SUB-LOCATION:	
PROJECT:	195340402	EASTING:	1770419.00	LOGGED ON:	11-Sep-19 12:00:00 AM
LOCATION:	131 Otaihanga Rd	NORTHING:	5471955.00	PREPARED BY:	BR DATE: 01-10-2019
		ELEVATION:	7.00	CHECKED BY:	JJN DATE: 14-04-2020
OFFICE:	RDCL - Hastings	DATUM:	NZVD2016	STATUS:	Final data

CONTRACTOR: RDCL MACHINE: Geoprobe 54LT OPERATOR: BR



REMARKS

CONE INFORMATION

CONE ID: 4483 CONE TYPE: -

	INITIAL	FINAL
CONE RESISTANCE:	6.8337	0.0017
SLEEVE FRICTION RESISTANCE:	127.2	-0.9
POREWATER PRESSURE:	263	-1

SYMBOLS

▼ Water level

RDCL

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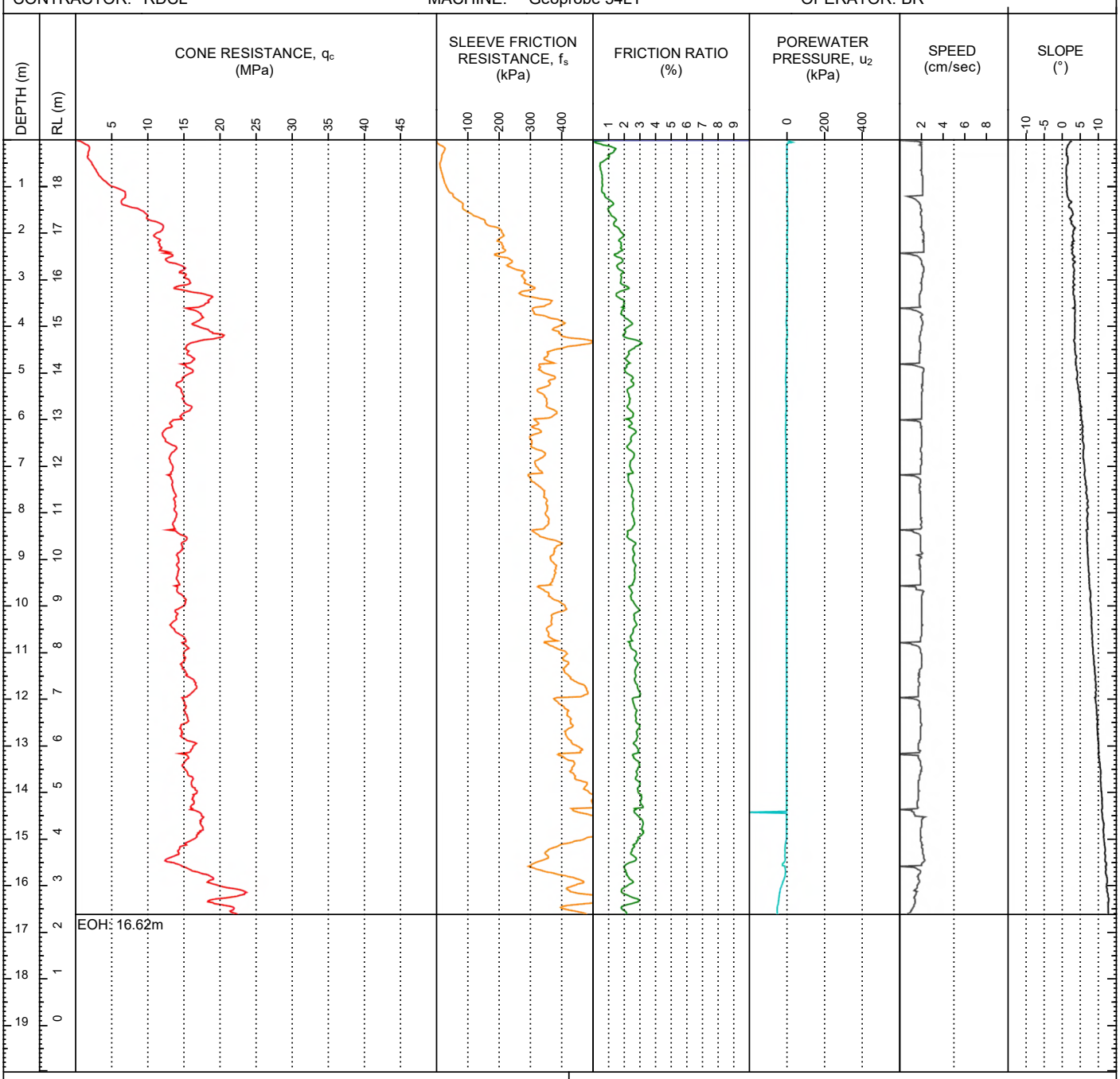
CONE PENETRATION TEST LOG

CPT05

SHEET 1 OF 1

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	SUB-LOCATION:	
PROJECT:	195340402	EASTING:	1770448.00	LOGGED ON:	11-Sep-19 12:00:00 AM
LOCATION:	131 Otaihanga Rd	NORTHING:	5472098.00	PREPARED BY:	BR DATE: 01-10-2019
		ELEVATION:	19.00	CHECKED BY:	JJN DATE: 14-04-2020
OFFICE:	RDCL - Hastings	DATUM:	NZVD2016	STATUS:	Final data

CONTRACTOR: RDCL MACHINE: Geoprobe 54LT OPERATOR: BR



REMARKS

CONE INFORMATION

CONE ID: 4483 CONE TYPE: -

	INITIAL	FINAL
CONE RESISTANCE:	6.836	-0.0455
SLEEVE FRICTION RESISTANCE:	127.9	-0.2
POREWATER PRESSURE:	264.4	-2.7

SYMBOLS

▼ Water level

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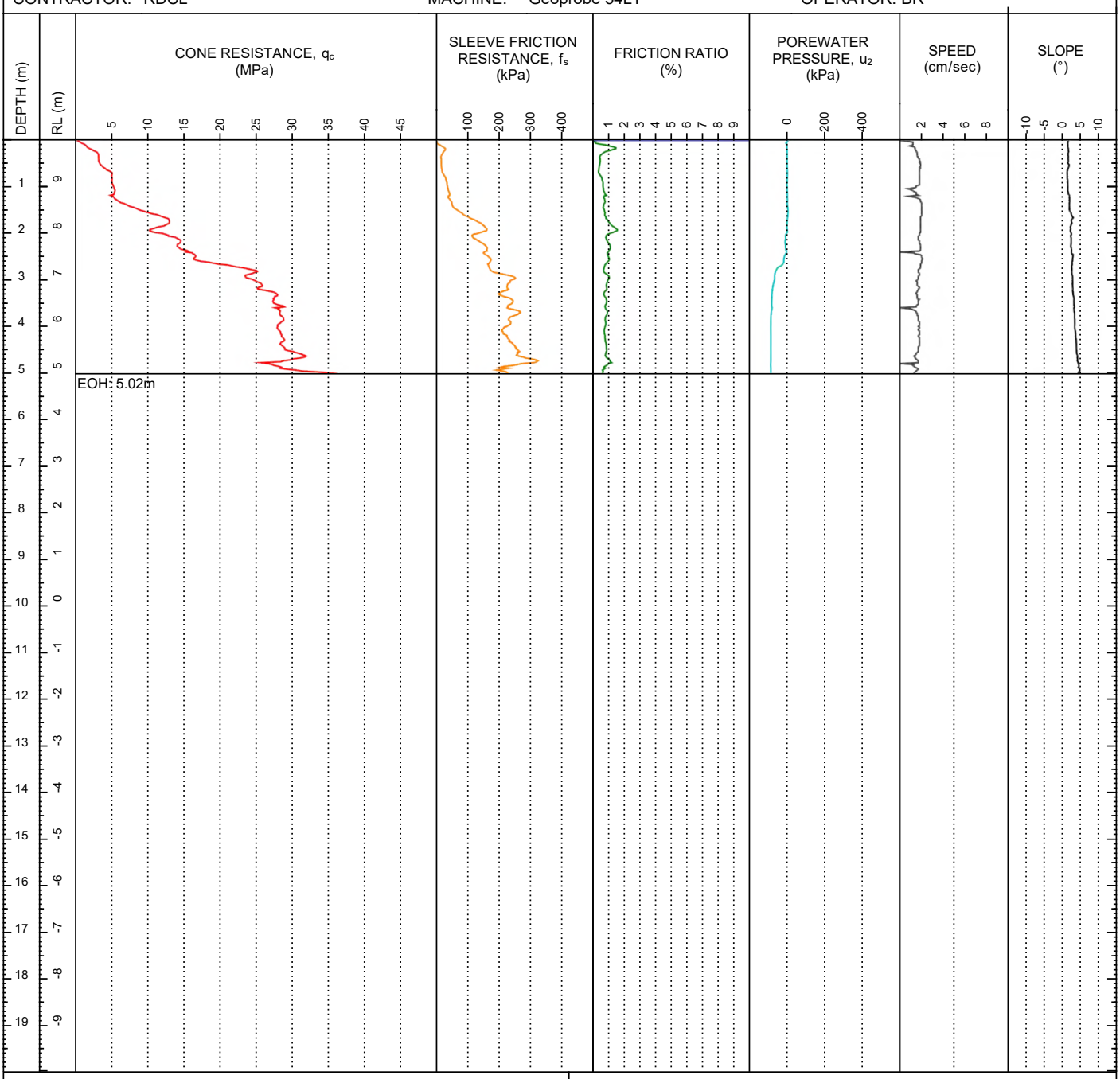
CONE PENETRATION TEST LOG

CPT06

SHEET 1 OF 1

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	SUB-LOCATION:	
PROJECT:	195340402	EASTING:	1770529.00	LOGGED ON:	11-Sep-19 12:00:00 AM
LOCATION:	131 Otaihanga Rd	NORTHING:	5472110.00	PREPARED BY:	BR DATE: 01-10-2019
		ELEVATION:	10.00	CHECKED BY:	JJN DATE: 14-04-2020
OFFICE:	RDCL - Hastings	DATUM:	NZVD2016	STATUS:	Final data

CONTRACTOR: RDCL MACHINE: Geoprobe 54LT OPERATOR: BR



REMARKS

CONE INFORMATION

CONE ID: 4483 CONE TYPE: -

	INITIAL	FINAL
CONE RESISTANCE:	6.8383	-0.004
SLEEVE FRICTION RESISTANCE:	128.1	-1.4
POREWATER PRESSURE:	263.4	-1.6

SYMBOLS

▼ Water level

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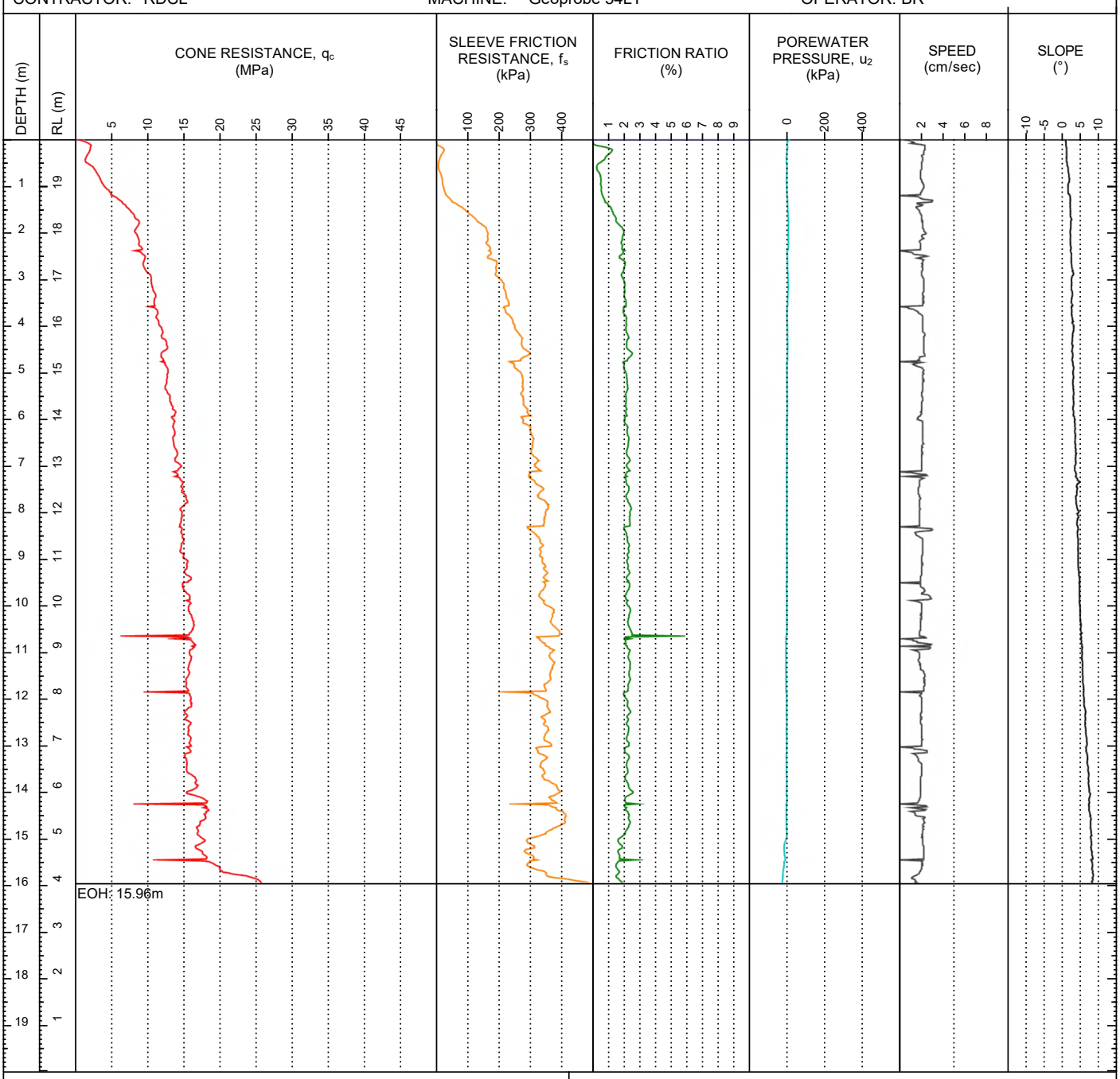
CONE PENETRATION TEST LOG

CPT07

SHEET 1 OF 1

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	SUB-LOCATION:	
PROJECT:	195340402	EASTING:	1770377.00	LOGGED ON:	11-Sep-19 12:00:00 AM
LOCATION:	131 Otaihanga Rd	NORTHING:	5472132.00	PREPARED BY:	BR DATE: 01-10-2019
		ELEVATION:	20.00	CHECKED BY:	JJN DATE: 14-04-2020
OFFICE:	RDCL - Hastings	DATUM:	NZVD2016	STATUS:	Final data

CONTRACTOR: RDCL MACHINE: Geoprobe 54LT OPERATOR: BR



REMARKS

CONE INFORMATION

CONE ID: 4483 CONE TYPE: -

	INITIAL	FINAL
CONE RESISTANCE:	6.8199	-0.0478
SLEEVE FRICTION RESISTANCE:	128.7	-0.2
POREWATER PRESSURE:	264	-2.8

SYMBOLS

▼ Water level

RDCL

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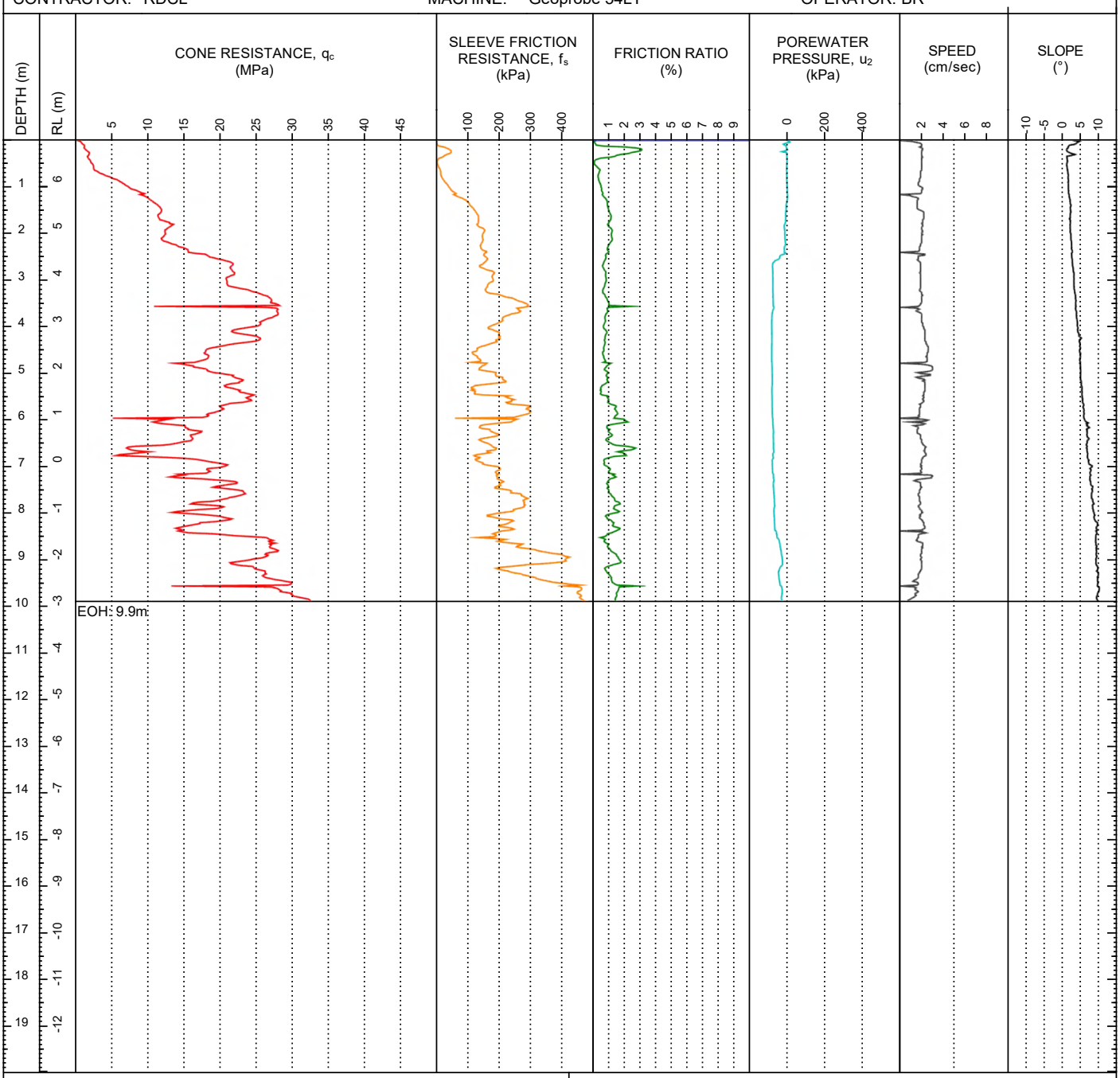
CONE PENETRATION TEST LOG

CPT08

SHEET 1 OF 1

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	SUB-LOCATION:	
PROJECT:	195340402	EASTING:	1770519.00	LOGGED ON:	11-Sep-19 12:00:00 AM
LOCATION:	131 Otaihanga Rd	NORTHING:	5472195.00	PREPARED BY:	BR DATE: 01-10-2019
		ELEVATION:	7.00	CHECKED BY:	JJN DATE: 14-04-2020
OFFICE:	RDCL - Hastings	DATUM:	NZVD2016	STATUS:	Final data

CONTRACTOR: RDCL MACHINE: Geoprobe 54LT OPERATOR: BR



REMARKS

CONE INFORMATION

CONE ID: 4483 CONE TYPE: -

	INITIAL	FINAL
CONE RESISTANCE:	6.7773	0.0063
SLEEVE FRICTION RESISTANCE:	129	-0.6
POREWATER PRESSURE:	263.9	-2.2

SYMBOLS

▼ Water level

RDCL

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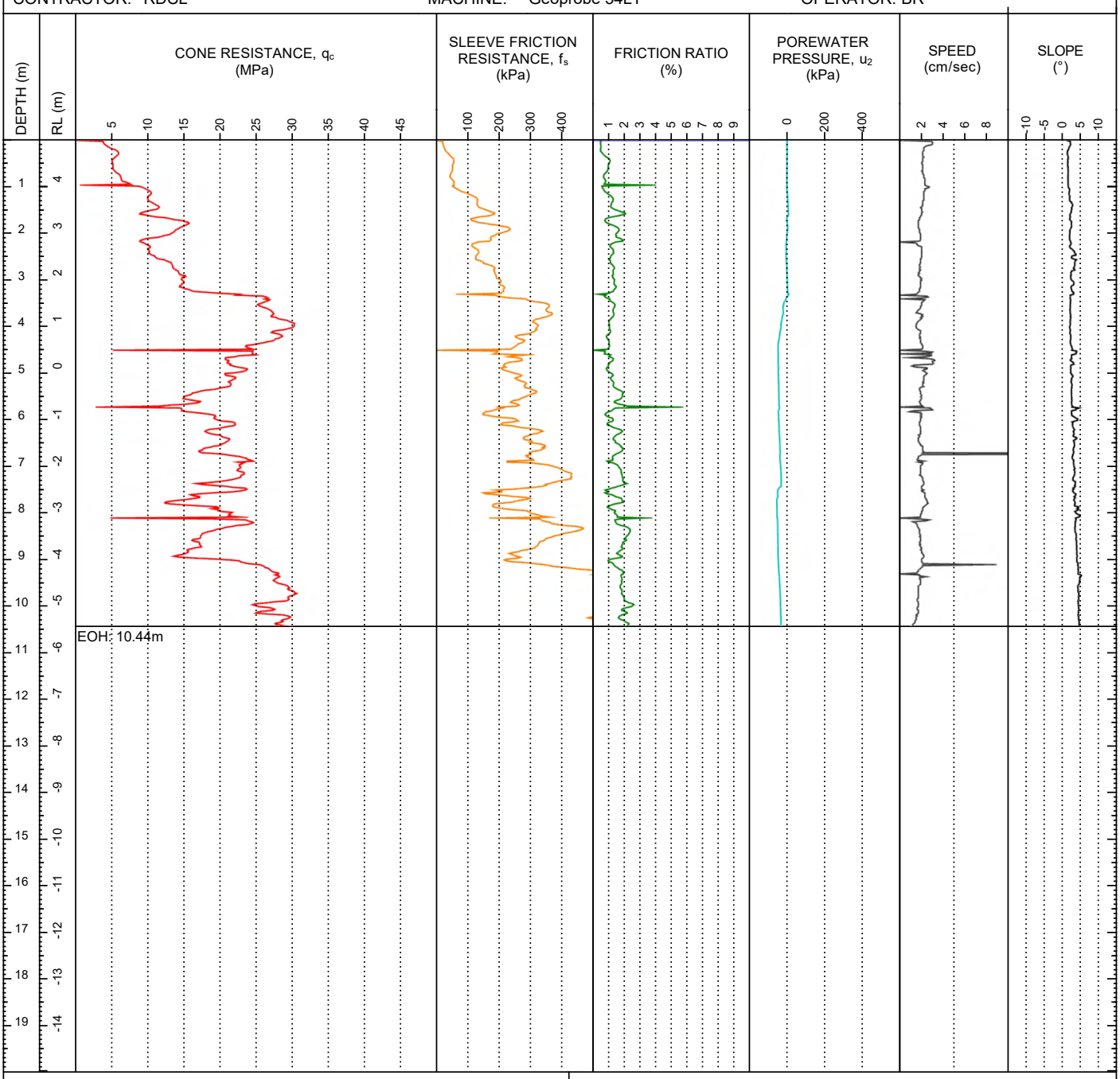
CONE PENETRATION TEST LOG

CPT09

SHEET 1 OF 1

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	SUB-LOCATION:	
PROJECT:	195340402	EASTING:	1770422.00	LOGGED ON:	11-Sep-19 12:00:00 AM
LOCATION:	131 Otaihanga Rd	NORTHING:	5472191.00	PREPARED BY:	BR DATE: 01-10-2019
		ELEVATION:	5.00	CHECKED BY:	JJN DATE: 14-04-2020
OFFICE:	RDCL - Hastings	DATUM:	NZVD2016	STATUS:	Final data

CONTRACTOR: RDCL MACHINE: Geoprobe 54LT OPERATOR: BR



REMARKS

CONE INFORMATION

CONE ID: 4483 CONE TYPE: -

	INITIAL	FINAL
CONE RESISTANCE:	6.8302	-0.0368
SLEEVE FRICTION RESISTANCE:	127.3	-0.7
POREWATER PRESSURE:	263.1	-2

SYMBOLS

▼ Water level

RDCL

8/308 QUEEN ST EAST, HASTINGS PO BOX 28057, HAVELOCK NORTH 4130 NEW ZEALAND

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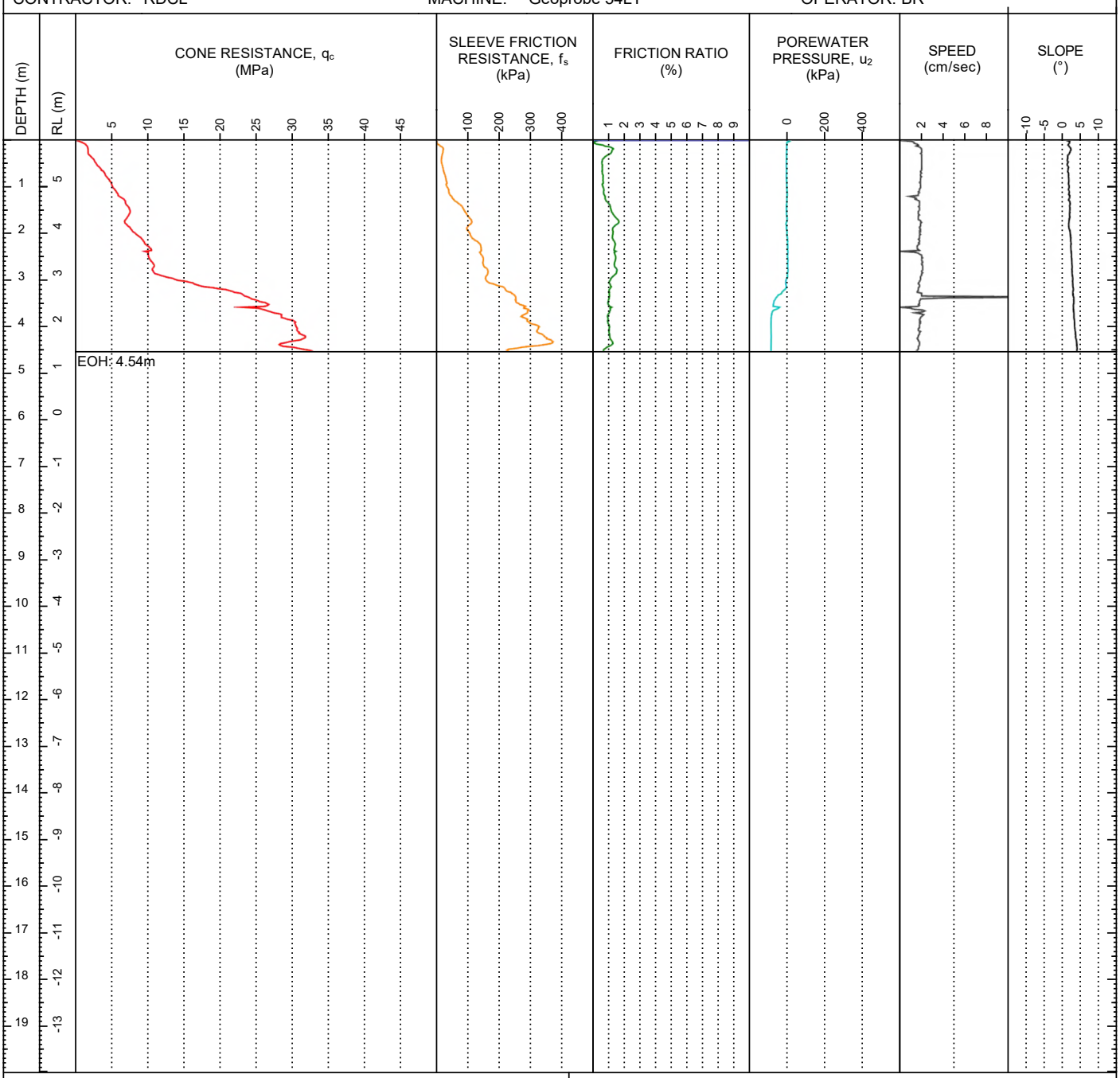
CONE PENETRATION TEST LOG

CPT10

SHEET 1 OF 1

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	SUB-LOCATION:	
PROJECT:	195340402	EASTING:	1770551.00	LOGGED ON:	11-Sep-19 12:00:00 AM
LOCATION:	131 Otaihanga Rd	NORTHING:	5472269.00	PREPARED BY:	BR DATE: 01-10-2019
		ELEVATION:	6.00	CHECKED BY:	JJN DATE: 14-04-2020
OFFICE:	RDCL - Hastings	DATUM:	NZVD2016	STATUS:	Final data

CONTRACTOR: RDCL MACHINE: Geoprobe 54LT OPERATOR: BR



REMARKS

CONE INFORMATION

CONE ID: 4483 CONE TYPE: -

	INITIAL	FINAL
CONE RESISTANCE:	6.7986	0.004
SLEEVE FRICTION RESISTANCE:	129.3	0
POREWATER PRESSURE:	264.2	-1.8

SYMBOLS

▼ Water level

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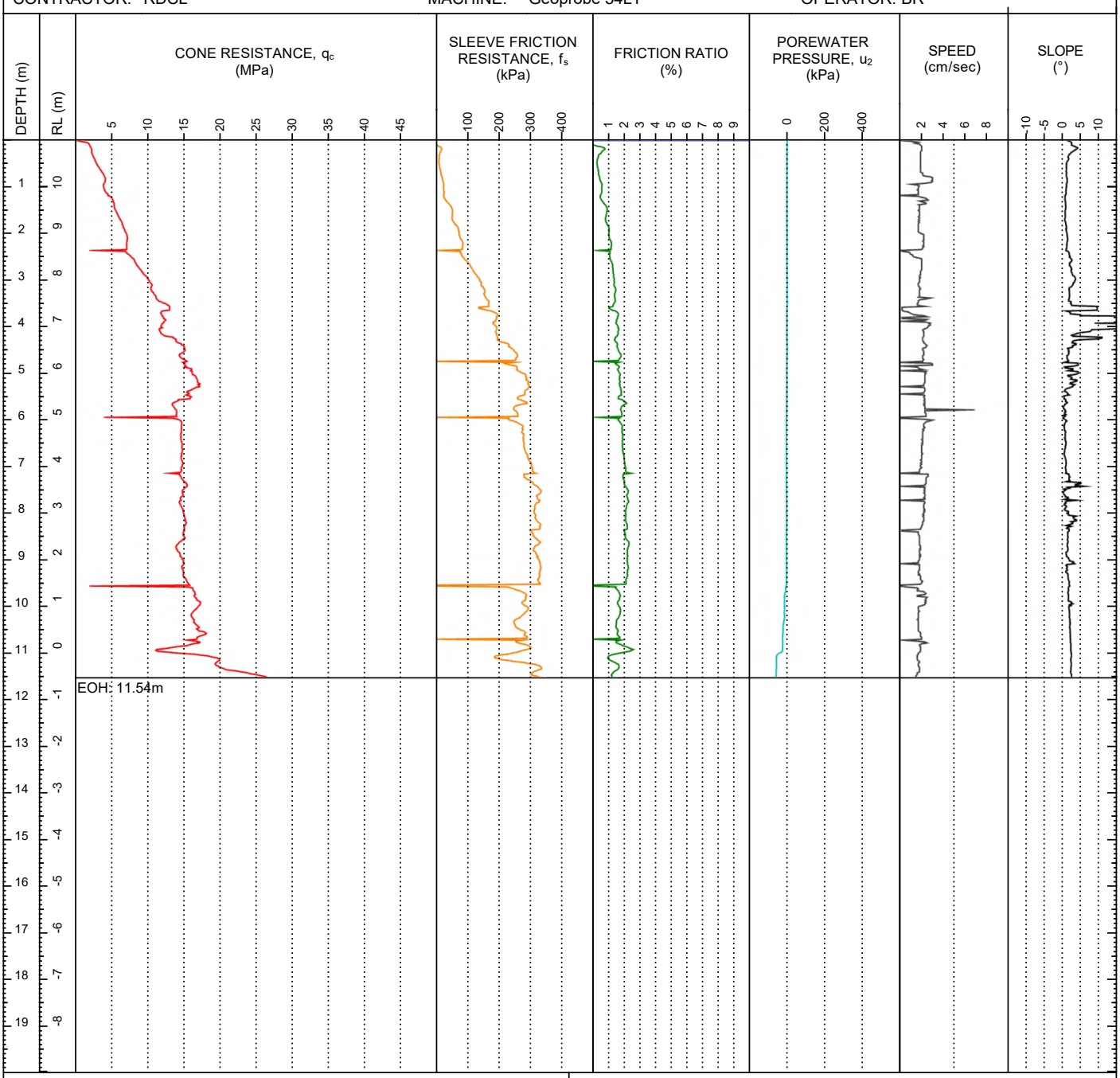
CONE PENETRATION TEST LOG

CPT11

SHEET 1 OF 1

CLIENT:	Richard Mansell	PROJECTION:	NZTM2000	SUB-LOCATION:	
PROJECT:	195340402	EASTING:	1770488.00	LOGGED ON:	11-Sep-19 12:00:00 AM
LOCATION:	131 Otaihanga Rd	NORTHING:	5472308.00	PREPARED BY:	BR DATE: 01-10-2019
		ELEVATION:	11.00	CHECKED BY:	JJN DATE: 14-04-2020
OFFICE:	RDCL - Hastings	DATUM:	NZVD2016	STATUS:	Final data

CONTRACTOR: RDCL MACHINE: Geoprobe 54LT OPERATOR: BR



REMARKS

CONE INFORMATION

CONE ID: 4483 CONE TYPE: -

	INITIAL	FINAL
CONE RESISTANCE:	6.7813	0.0092
SLEEVE FRICTION RESISTANCE:	129.1	-4.6
POREWATER PRESSURE:	262.9	-1.3

SYMBOLS

▼ Water level

RDCL

8/308 QUEEN ST EAST, HASTINGS PO BOX 28057, HAVELOCK NORTH 4130 NEW ZEALAND

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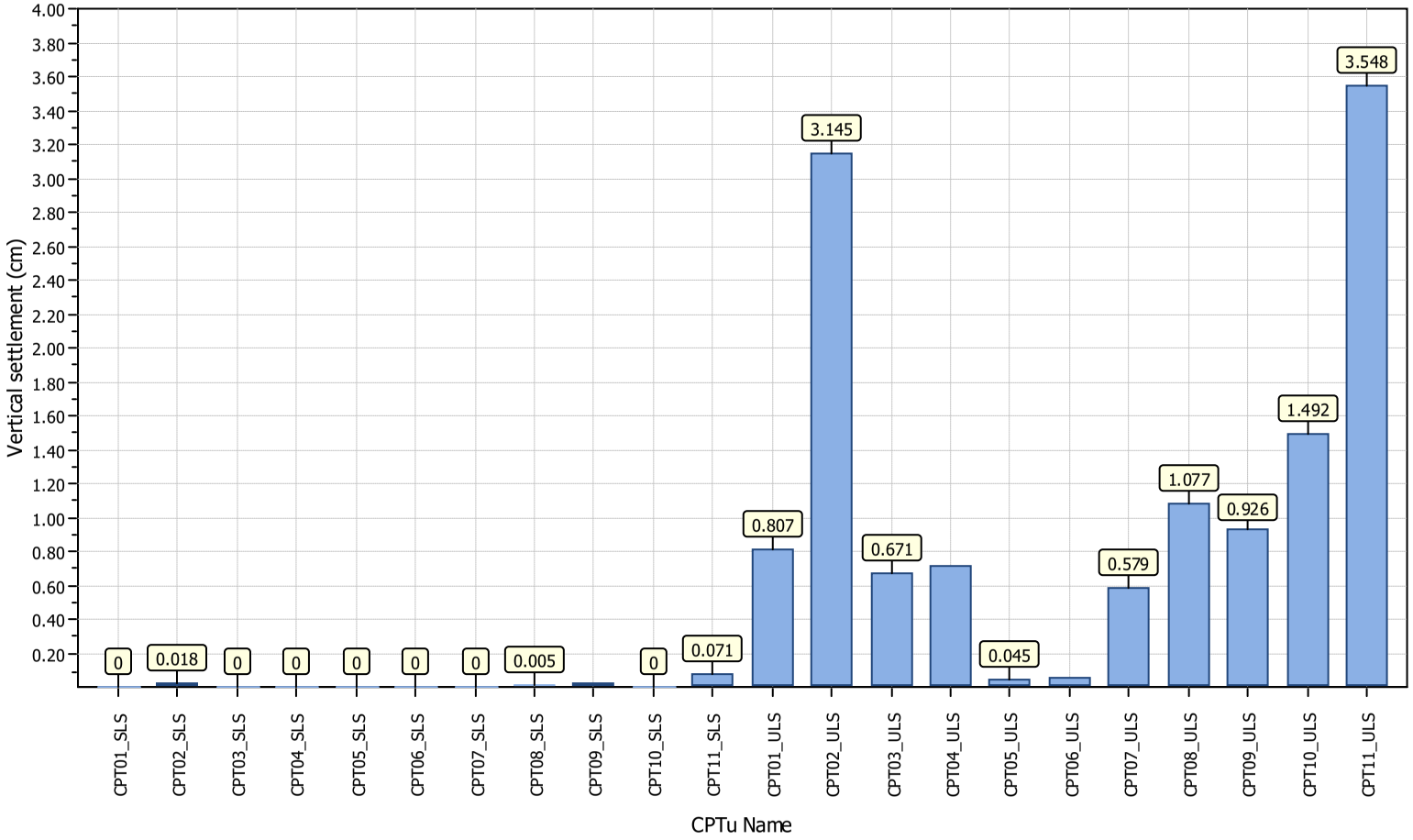
APPENDIX B: LIQUEFACTION ASSESSMENT RESULTS

RDCL
Geotechnical Engineers
2/182 Main Rd Tawa
www.rdcl.co.nz

Project title : 195340402

Location : 131 Otaihanga Rd, Paraparaumu

Overall vertical settlements report

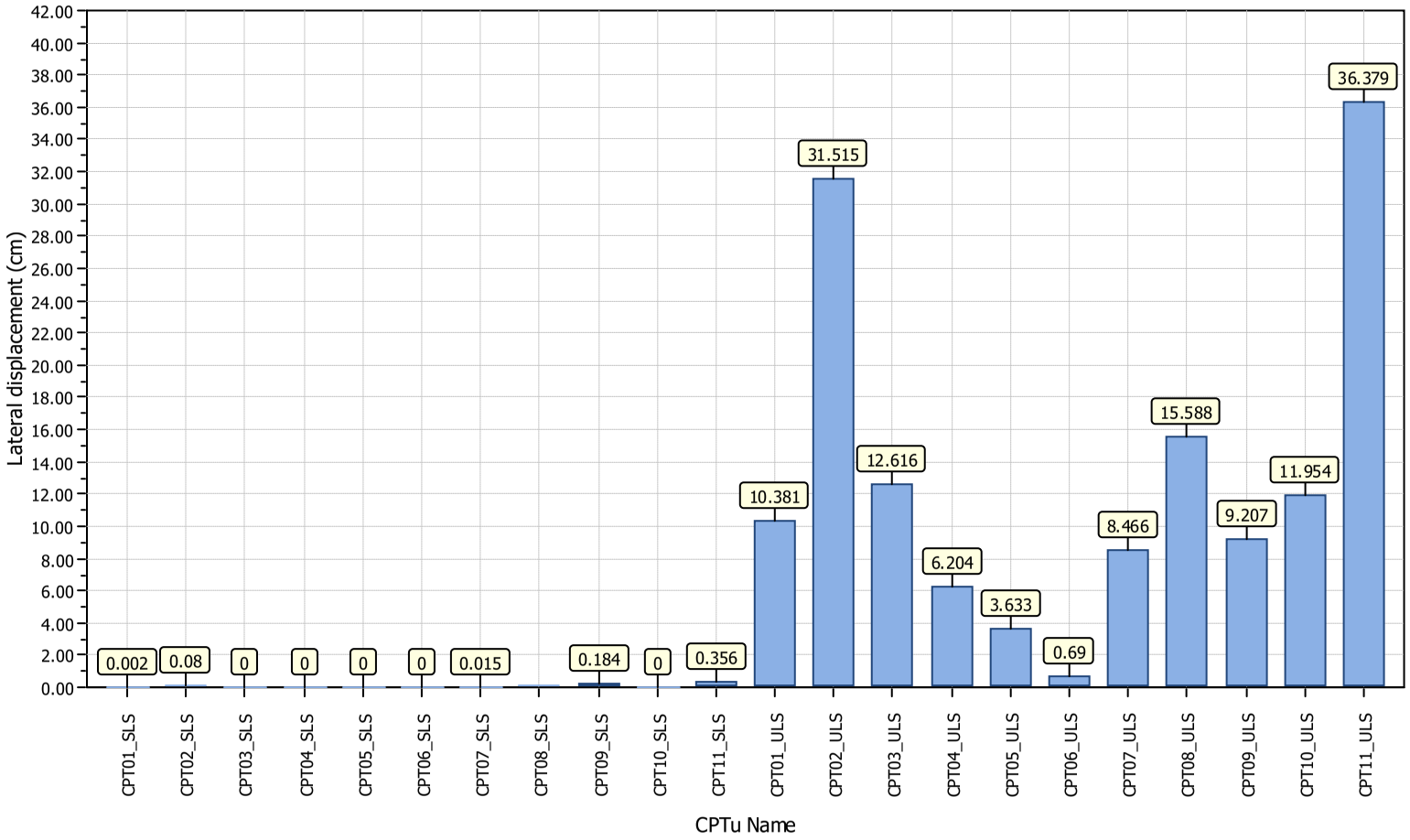


RDCL
Geotechnical Engineers
2/182 Main Rd Tawa
www.rdcl.co.nz

Project title : 195340402

Location : 131 Otaihanga Rd, Paraparaumu

Overall lateral displacements report

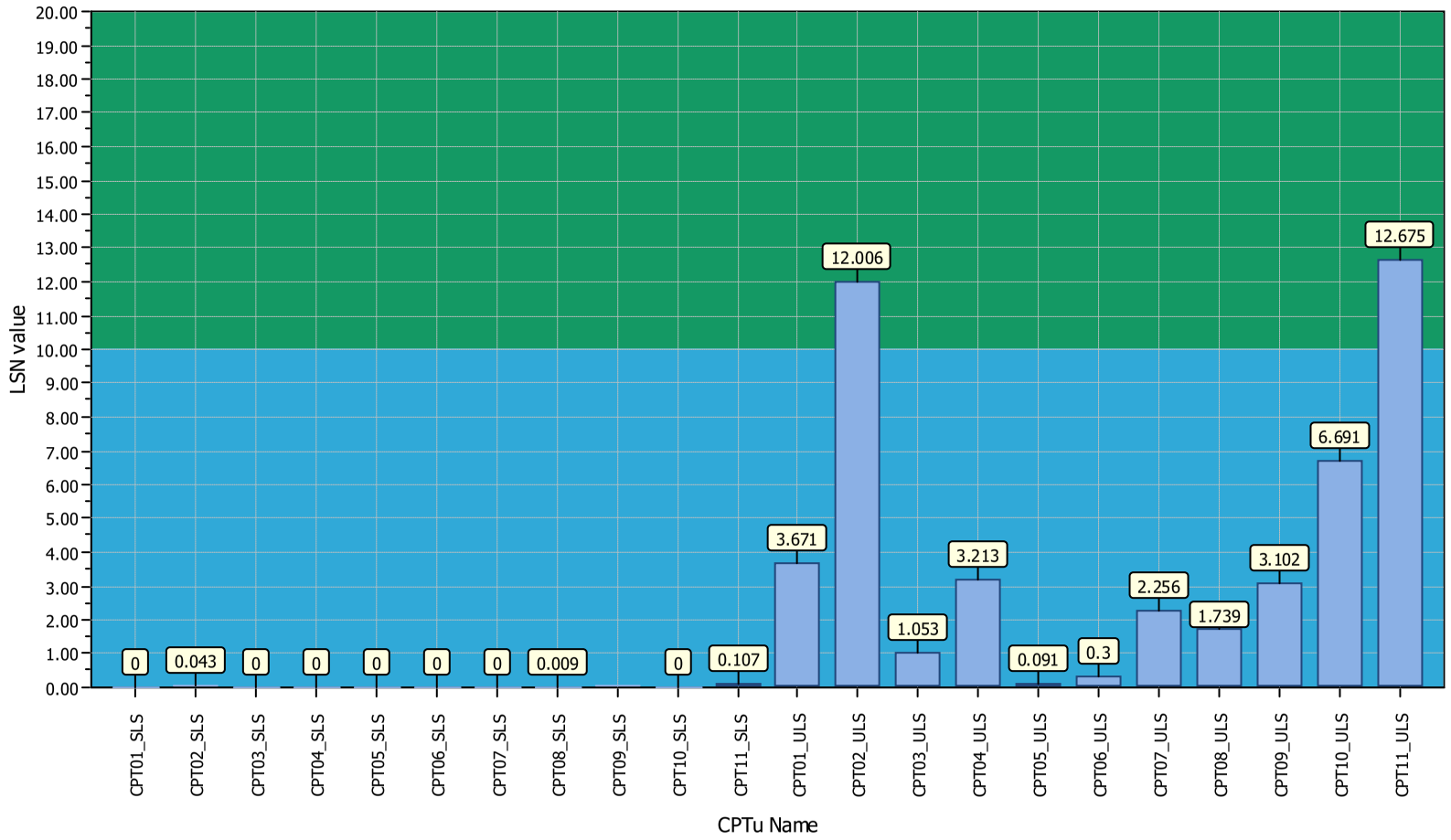


RDCL
Geotechnical Engineers
2/182 Main Rd Tawa
www.rdcl.co.nz

Project title : 195340402

Location : 131 Otaihanga Rd, Paraparaumu

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: 22

91% little liquefaction

9% minor liquefaction

0% moderate liquefaction

0% moderate to major liquefaction

0% major liquefaction

0% severe liquefaction

RDCL
Geotechnical Engineers
2/182 Main Rd Tawa
www.rdcl.co.nz

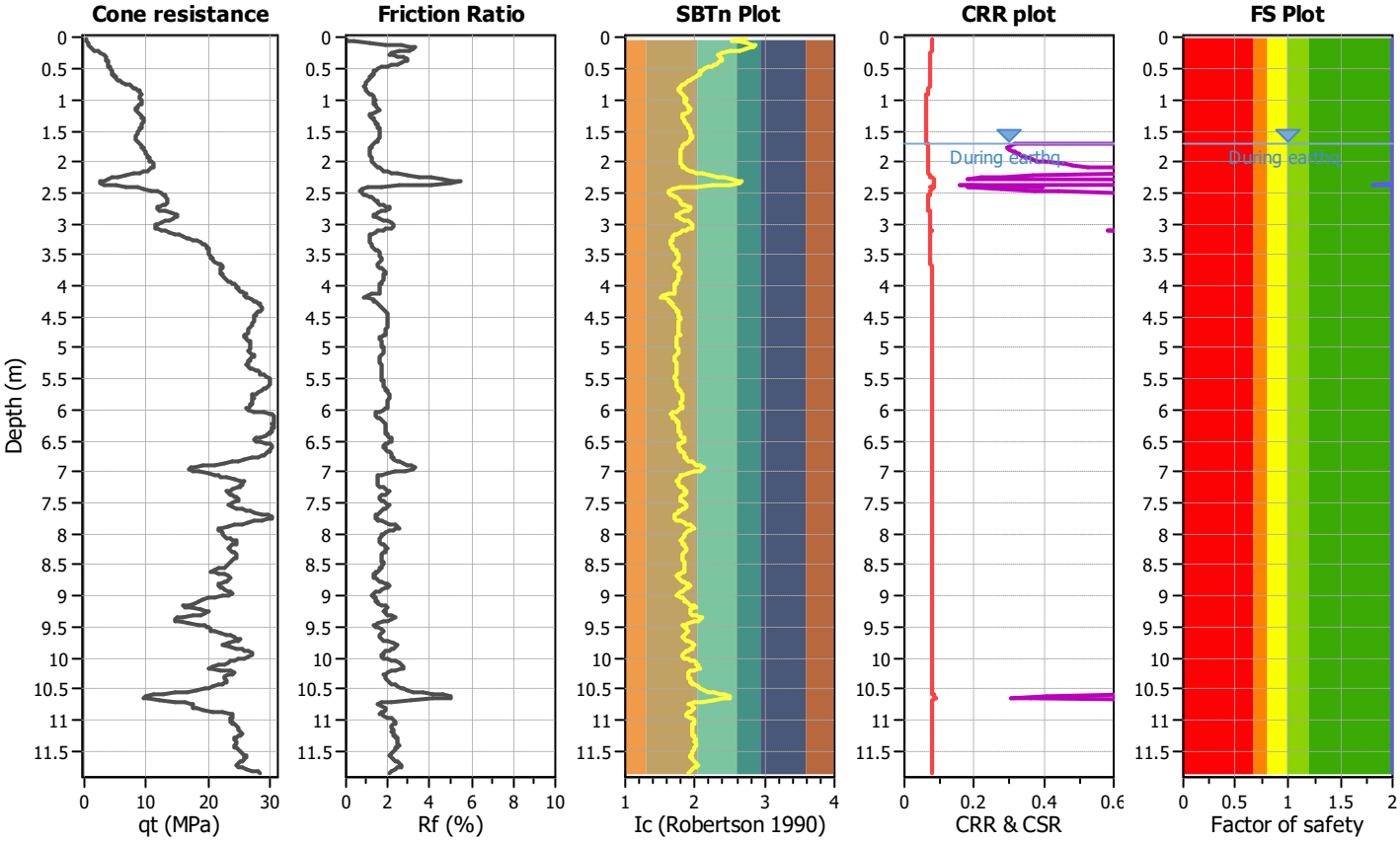
LIQUEFACTION ANALYSIS REPORT

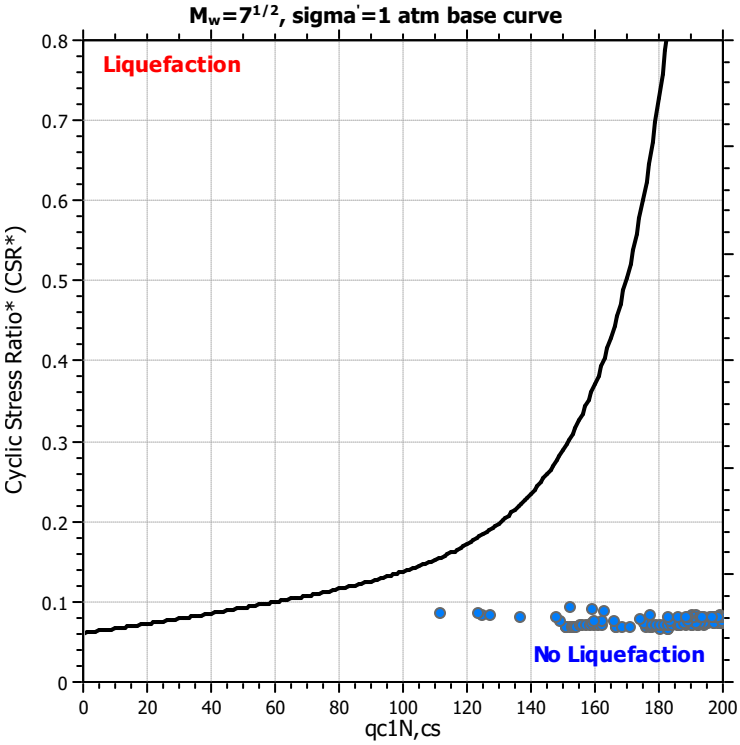
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

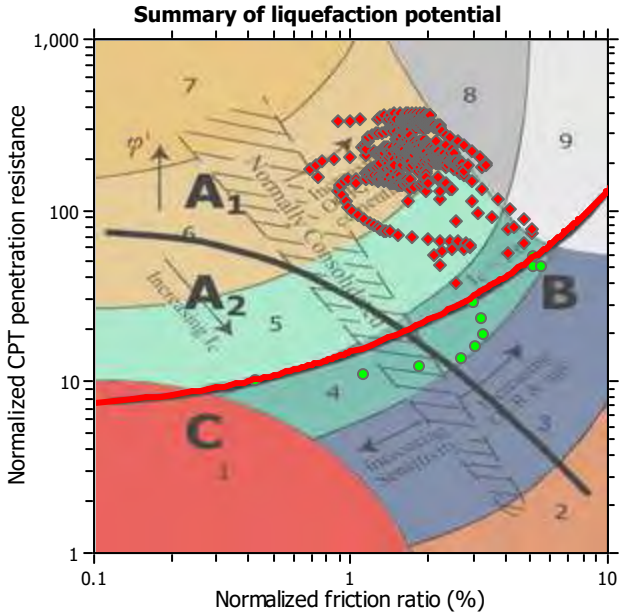
CPT file : CPT01_SLS

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.70 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	6.50	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:	No		

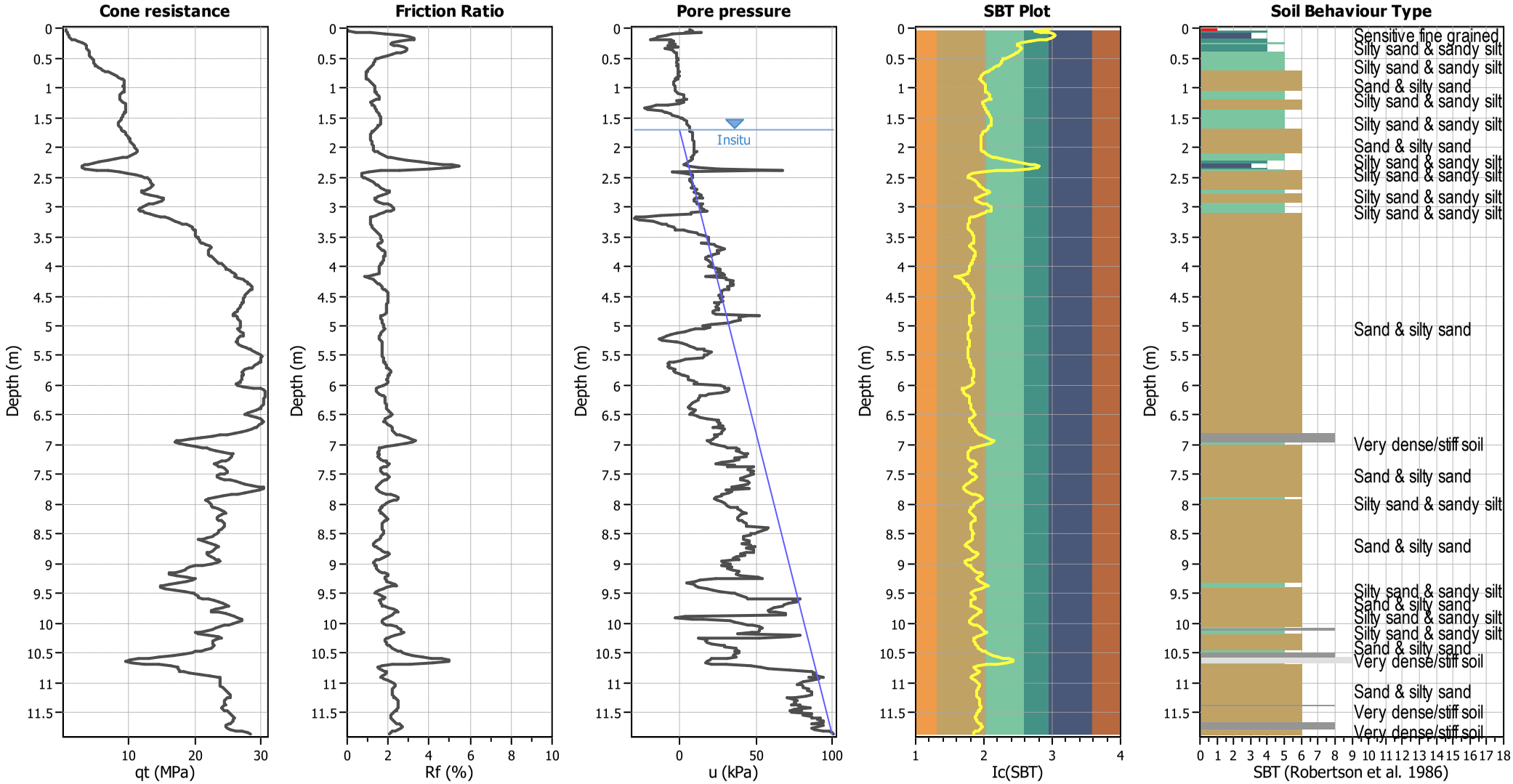






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



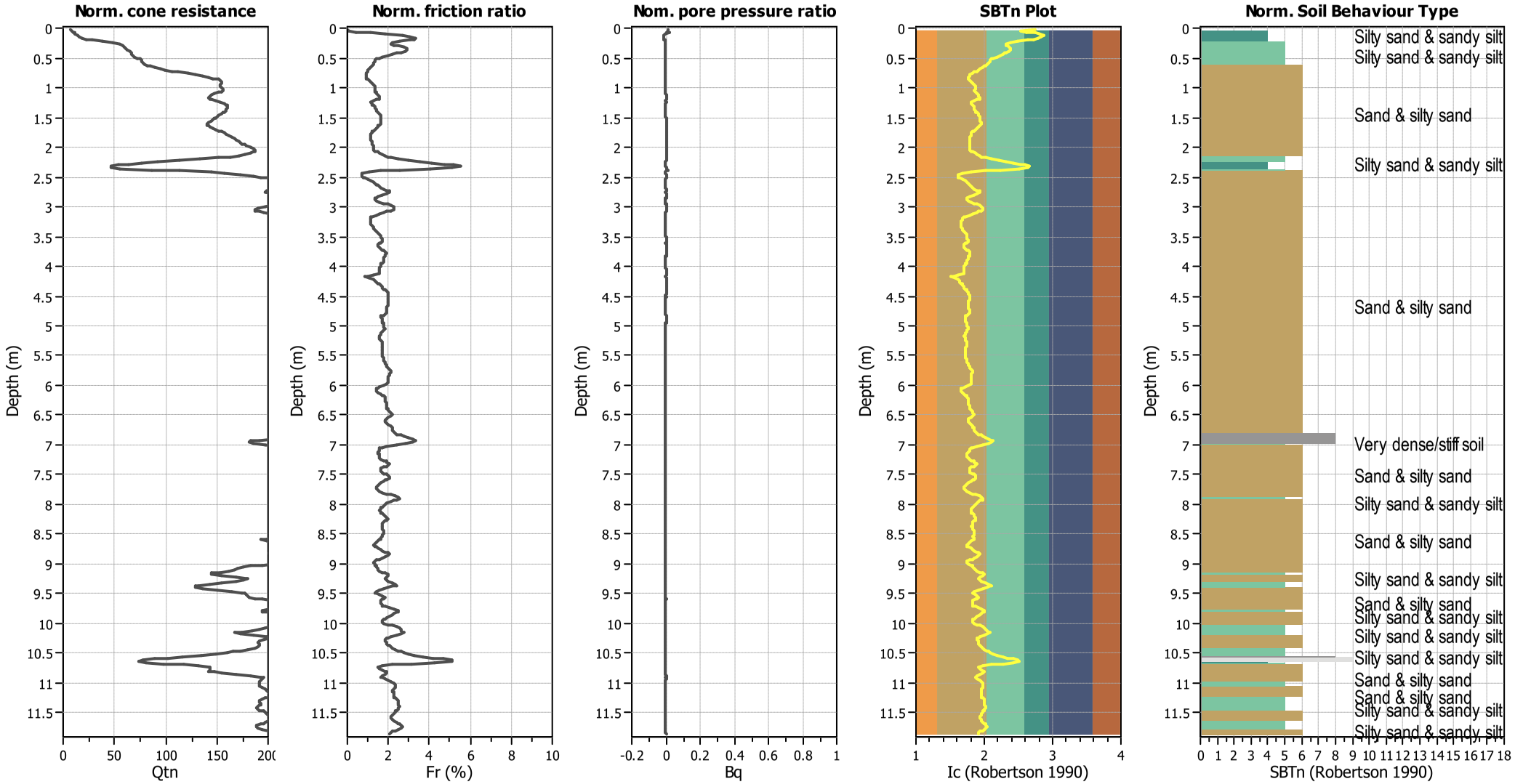
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

CPT basic interpretation plots (normalized)



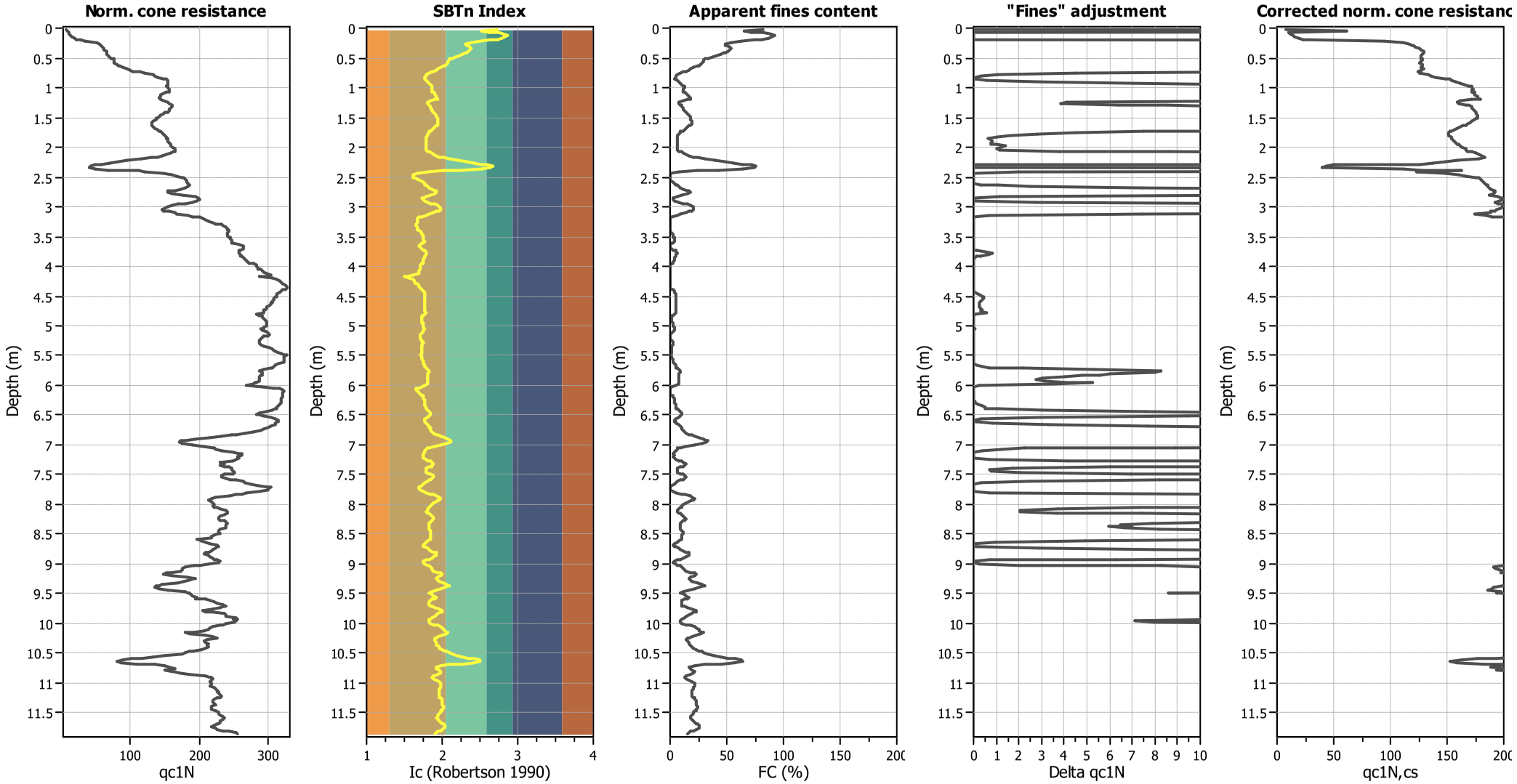
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

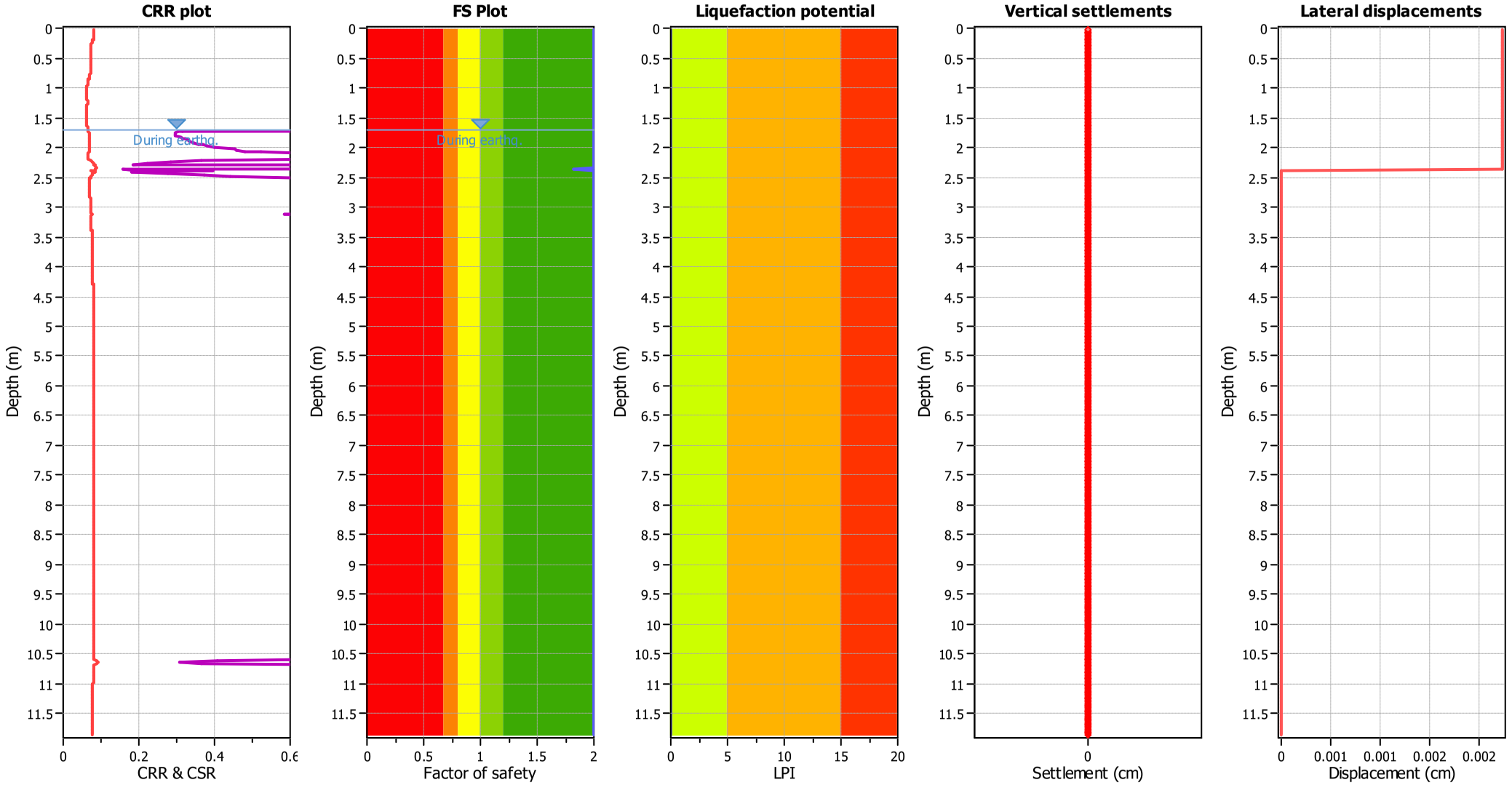
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

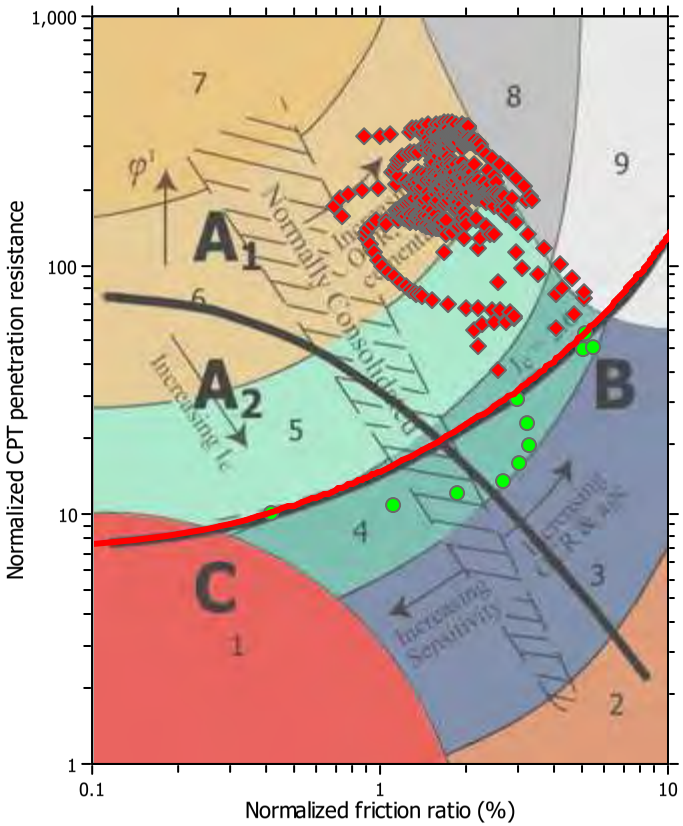
F.S. color scheme

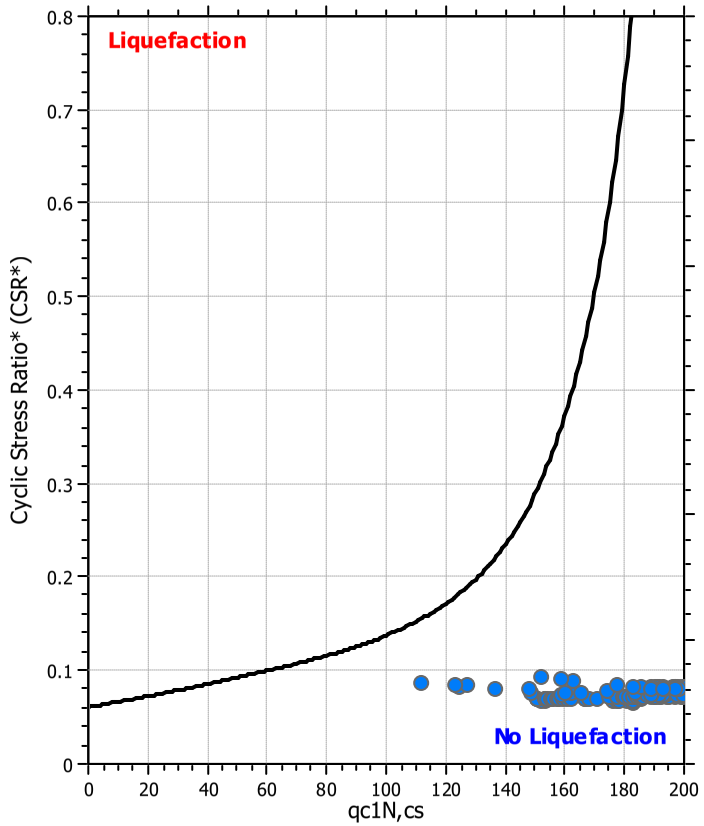
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

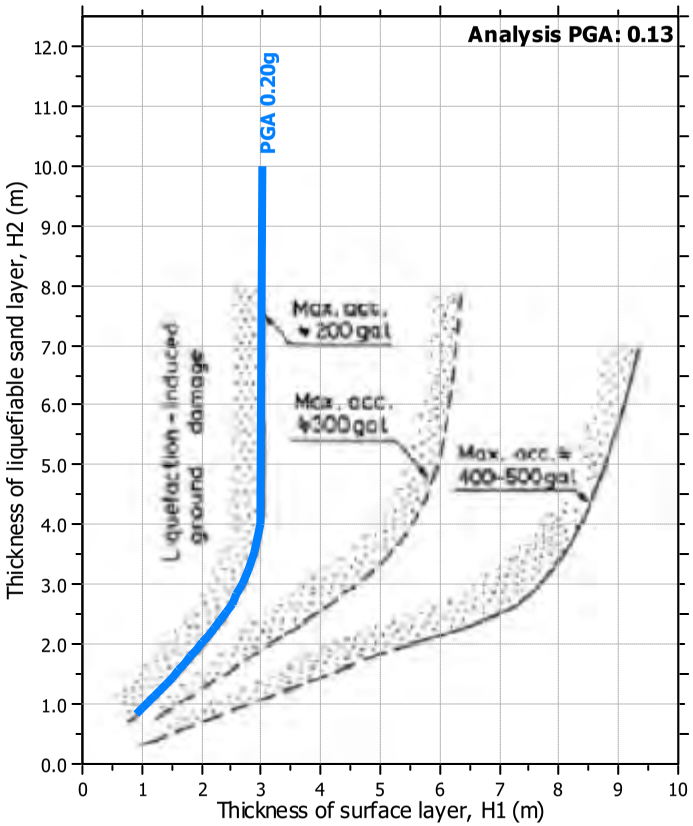
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



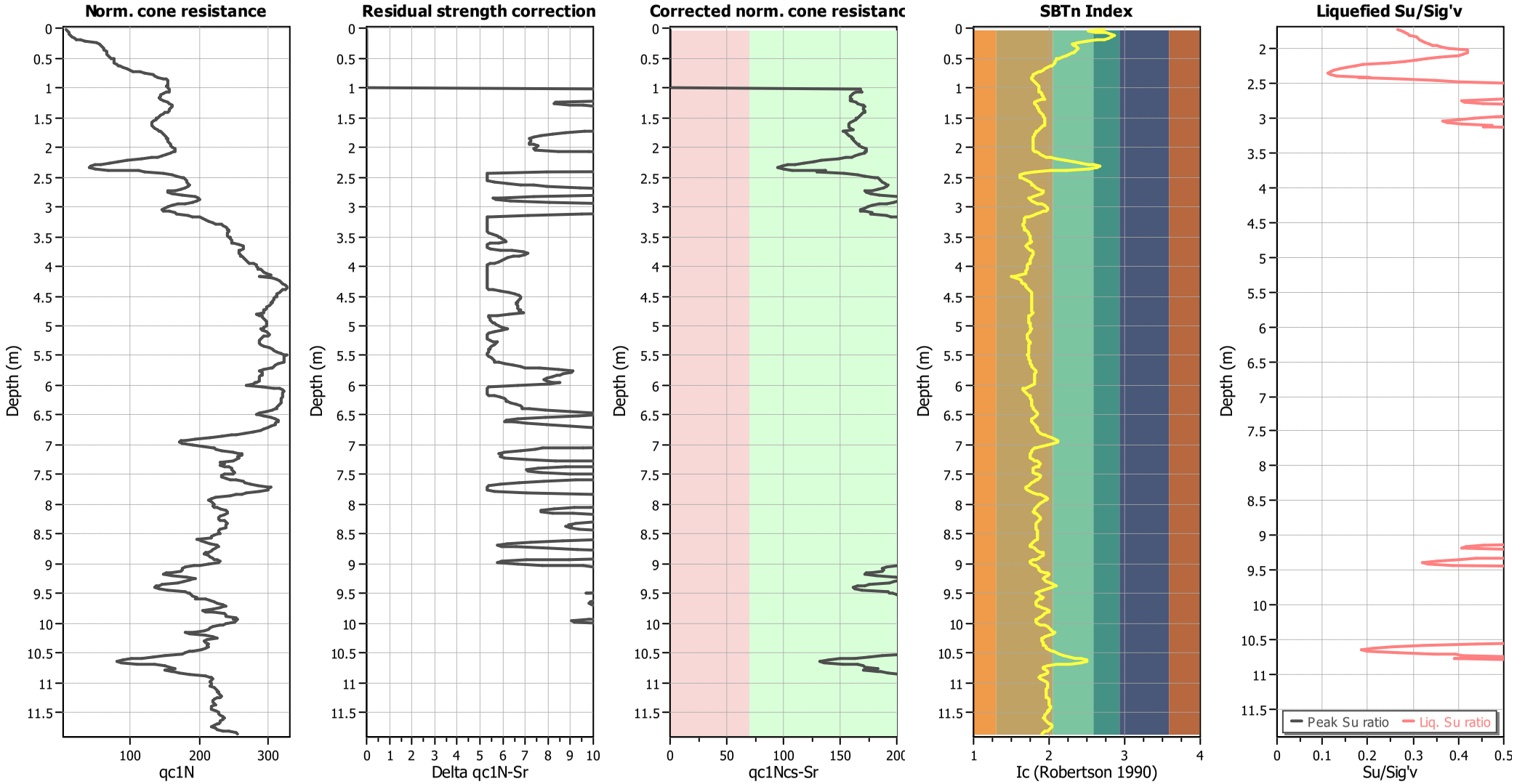




Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

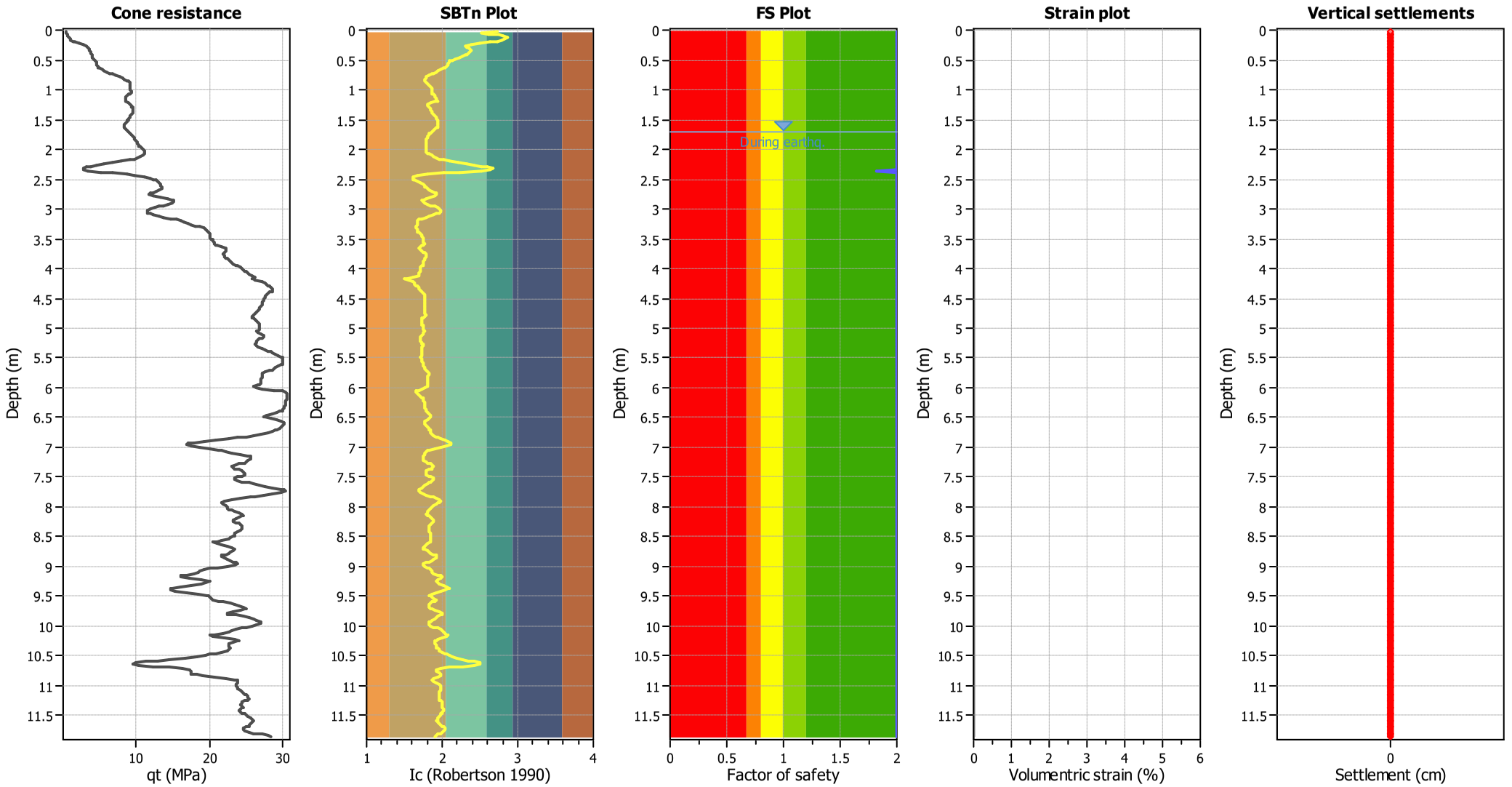
Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

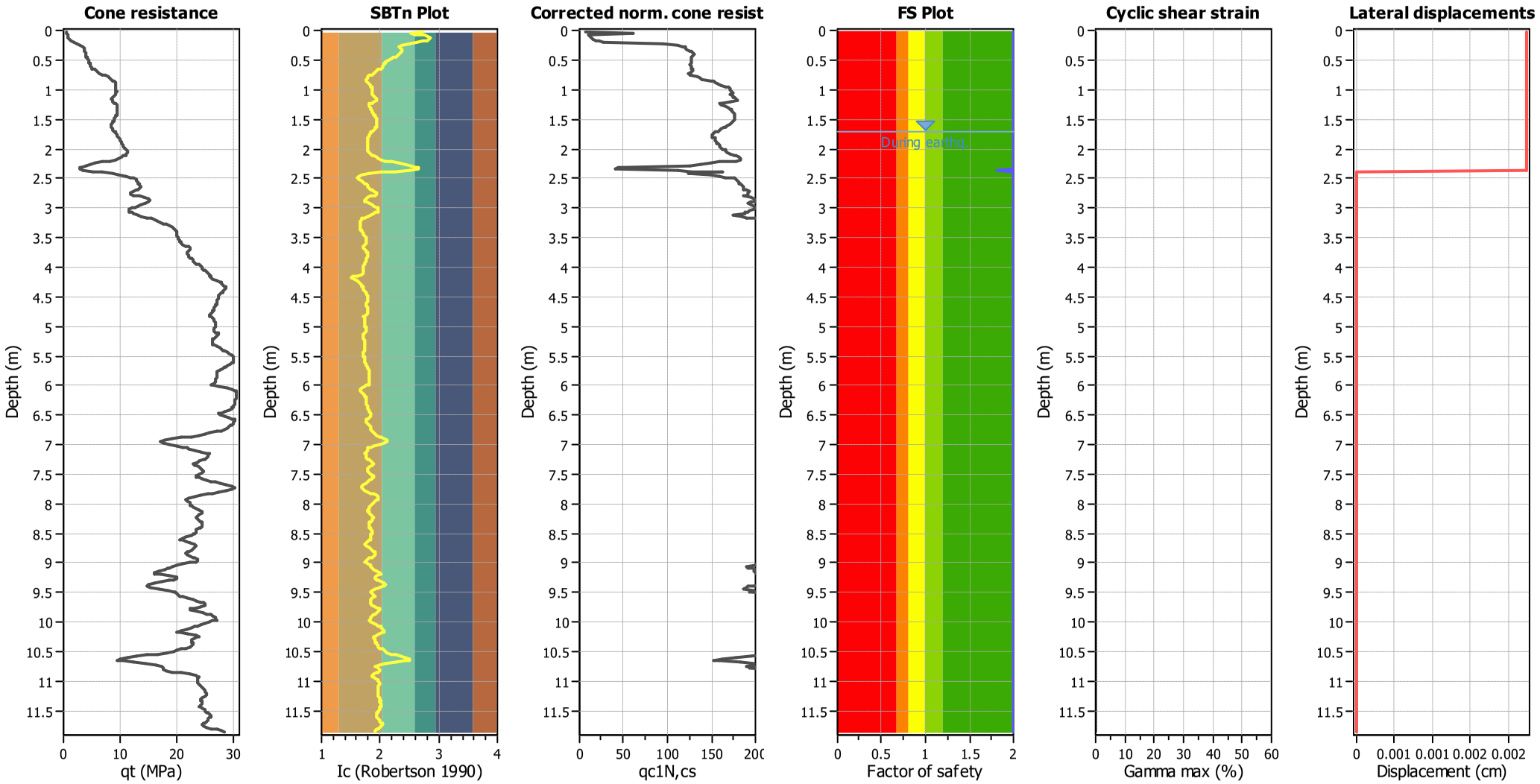
Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

Estimation of post-earthquake lateral Displacements



Abbreviations

q_t: Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c: Soil Behaviour Type Index
$q_{c1N,cs}$: Equivalent clean sand normalized CPT total cone resistance
F.S.: Factor of safety
γ_{max}: Maximum cyclic shear strain
LDI: Lateral displacement index

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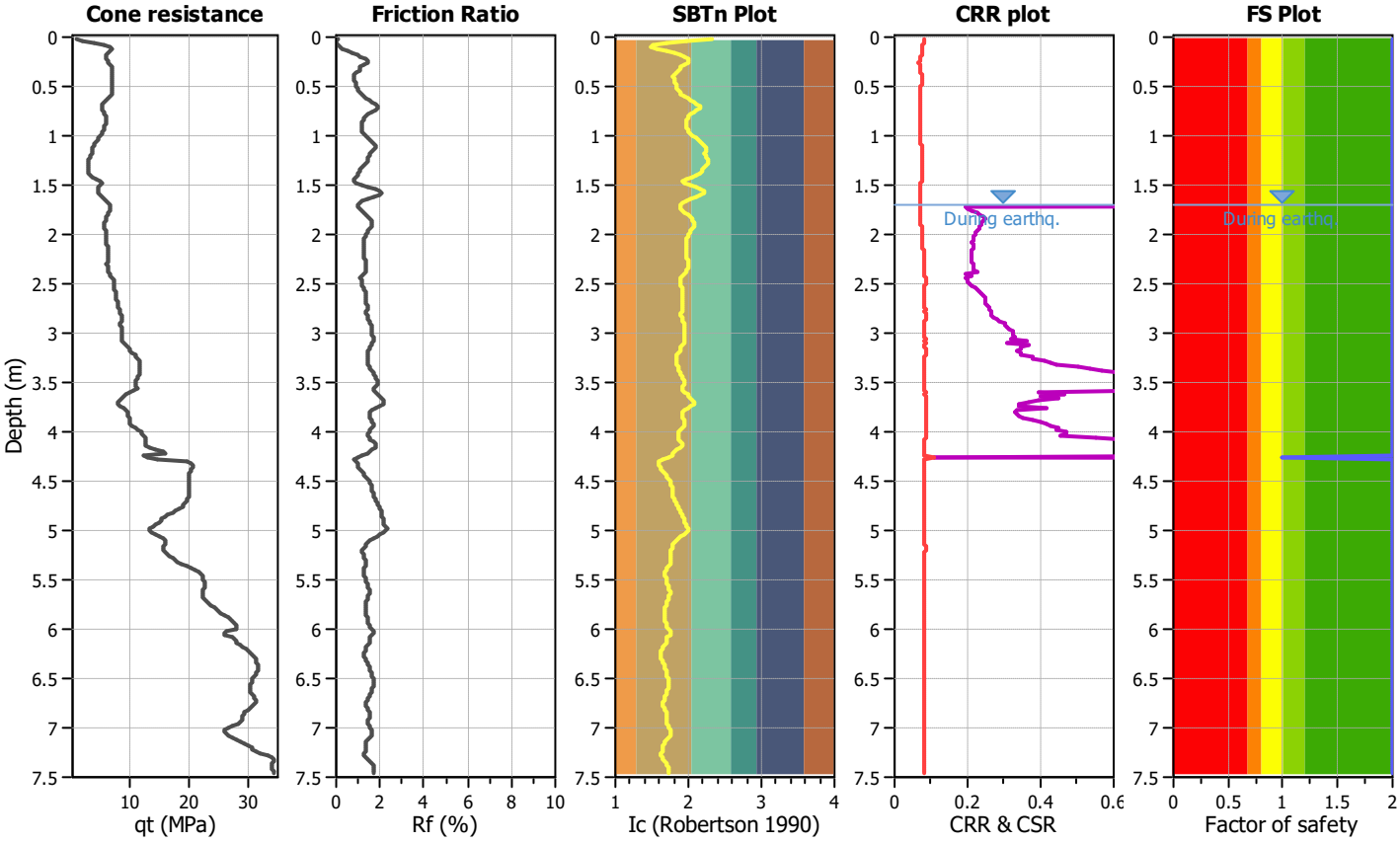
LIQUEFACTION ANALYSIS REPORT

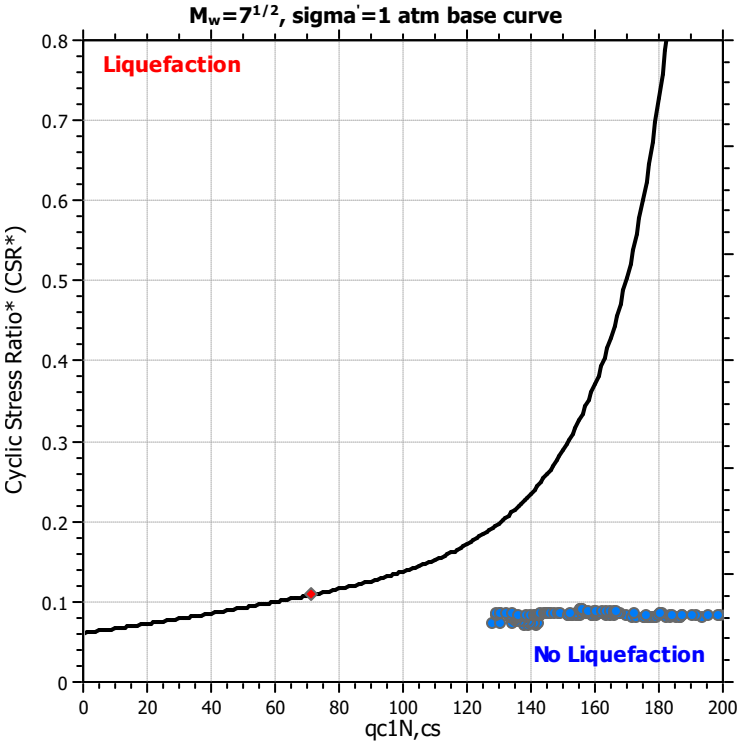
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

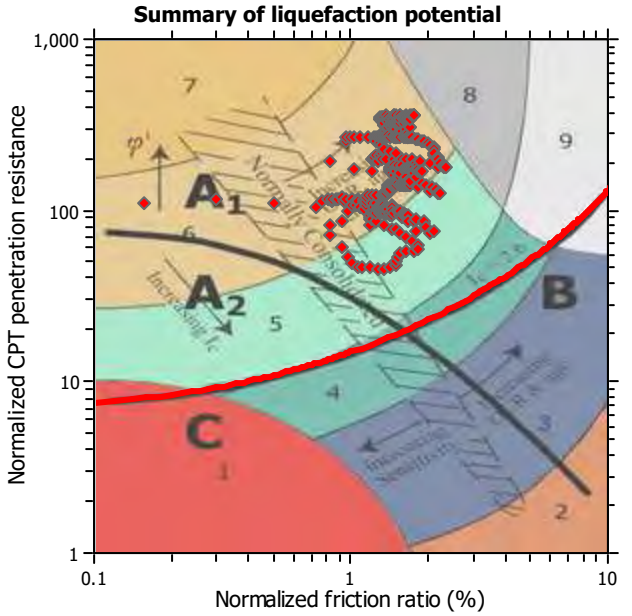
CPT file : CPT02_SLS

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.70 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	6.50	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:	No		

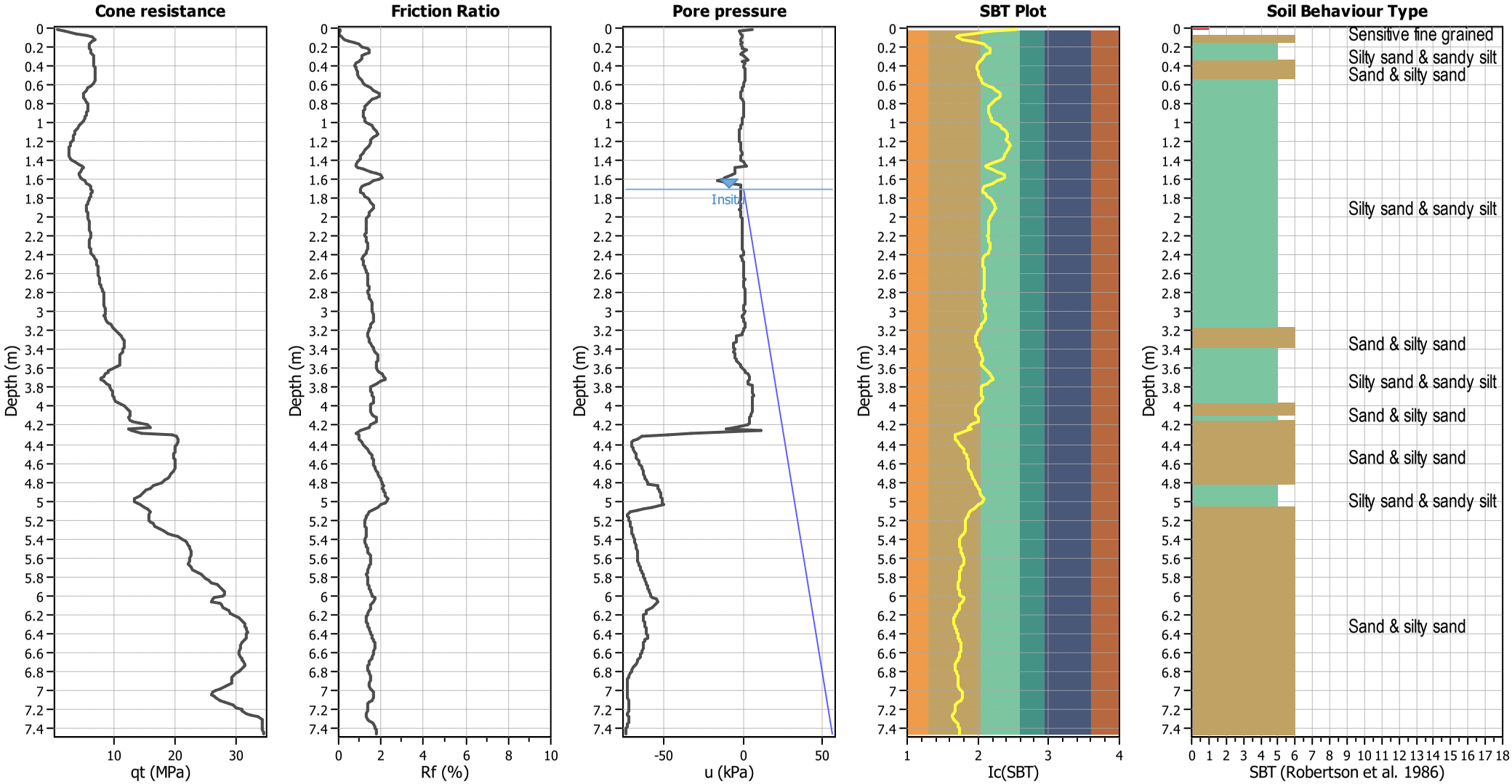






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



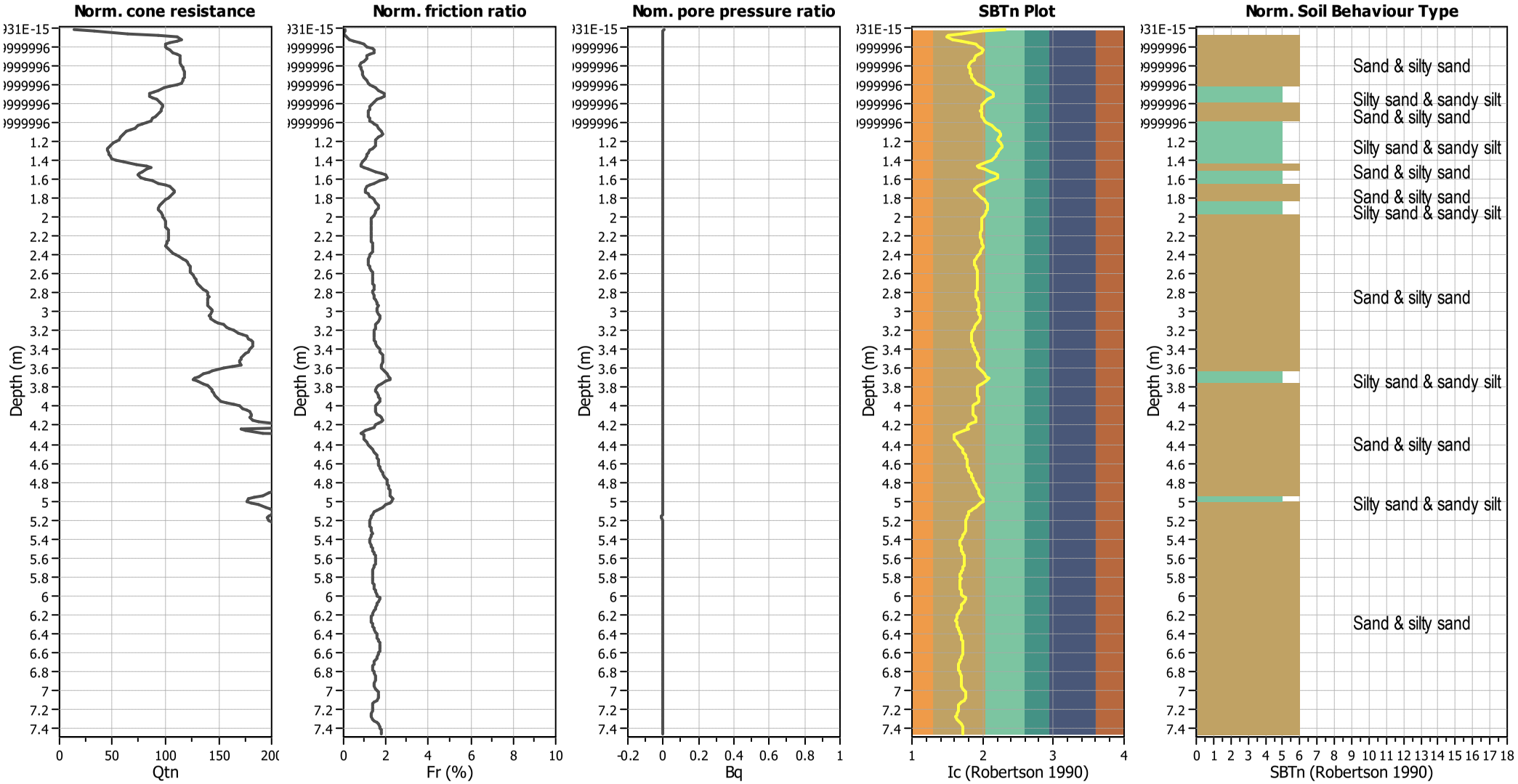
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

CPT basic interpretation plots (normalized)



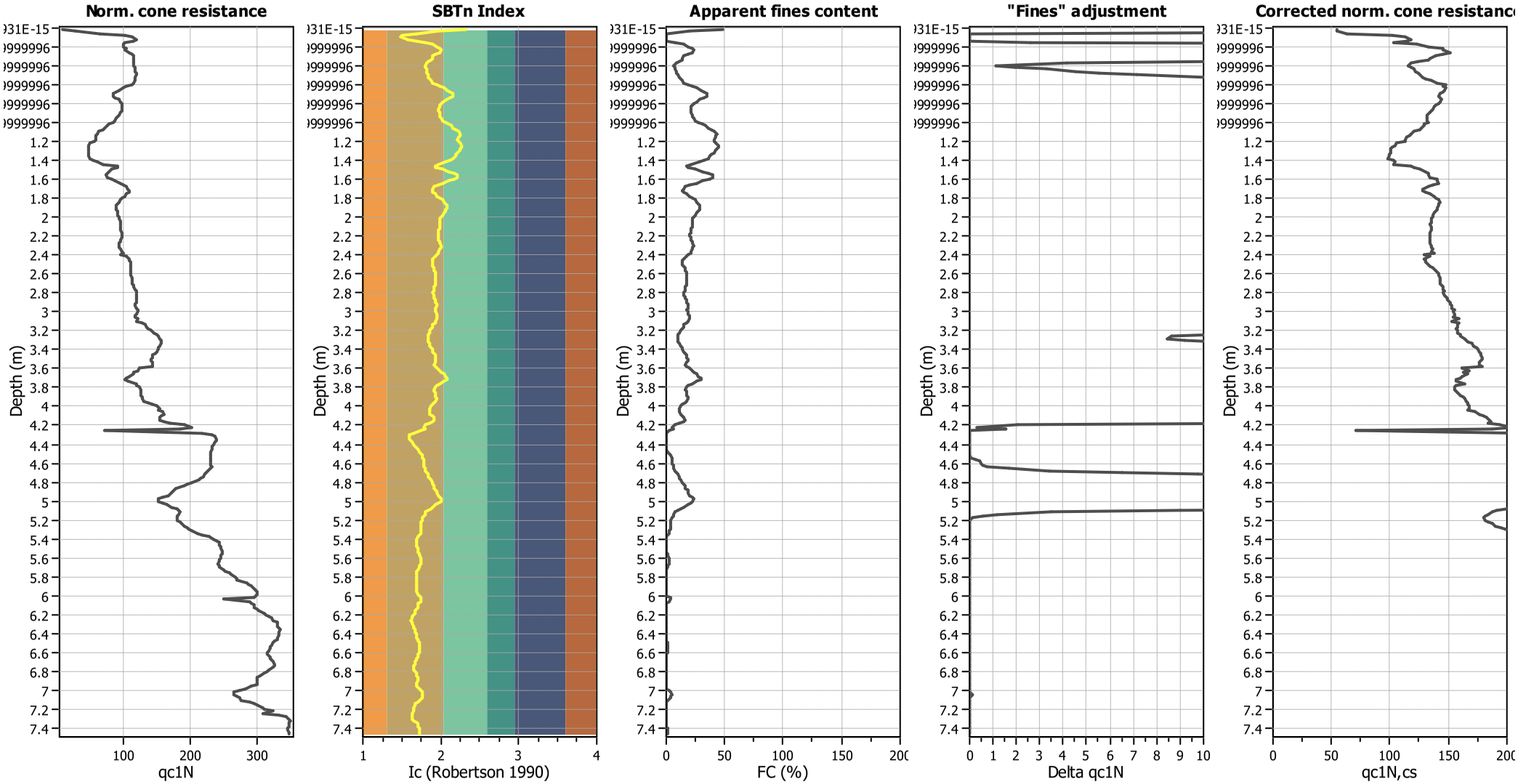
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

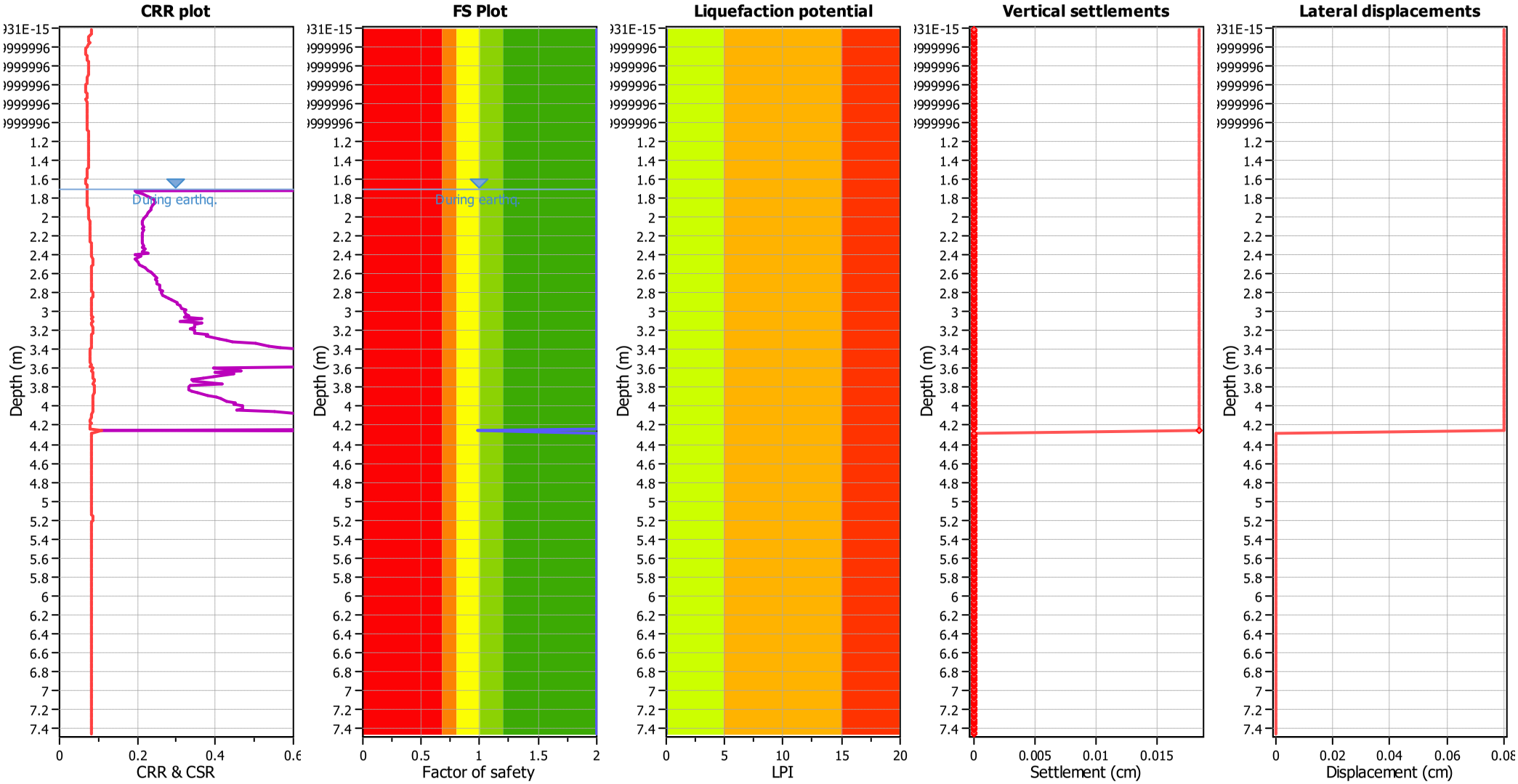
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

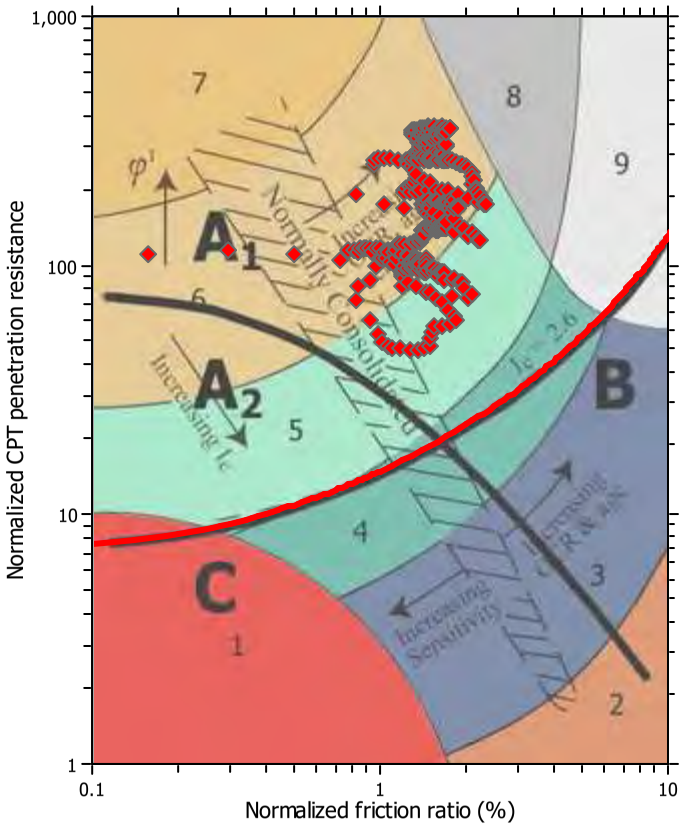
F.S. color scheme

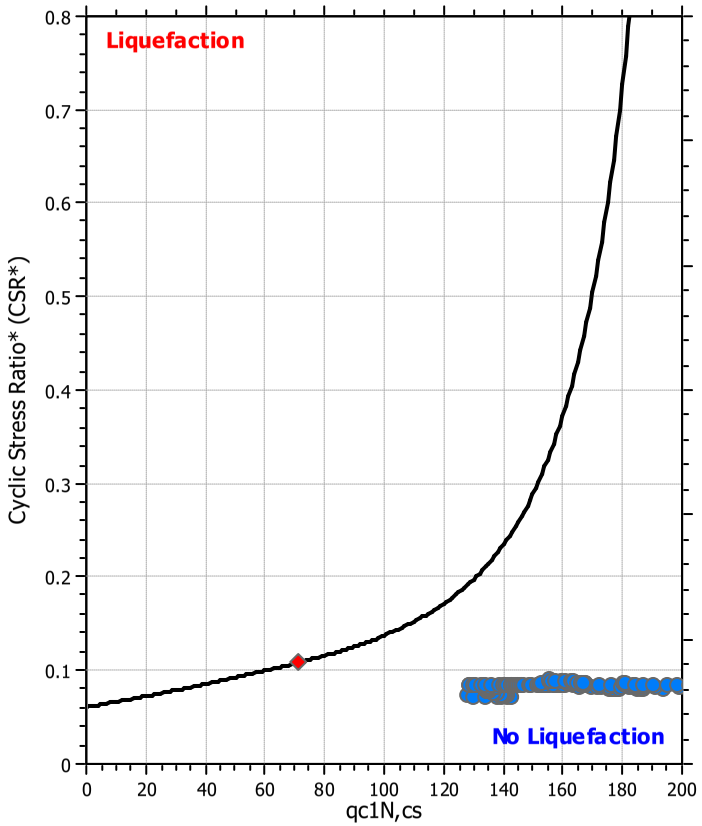
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

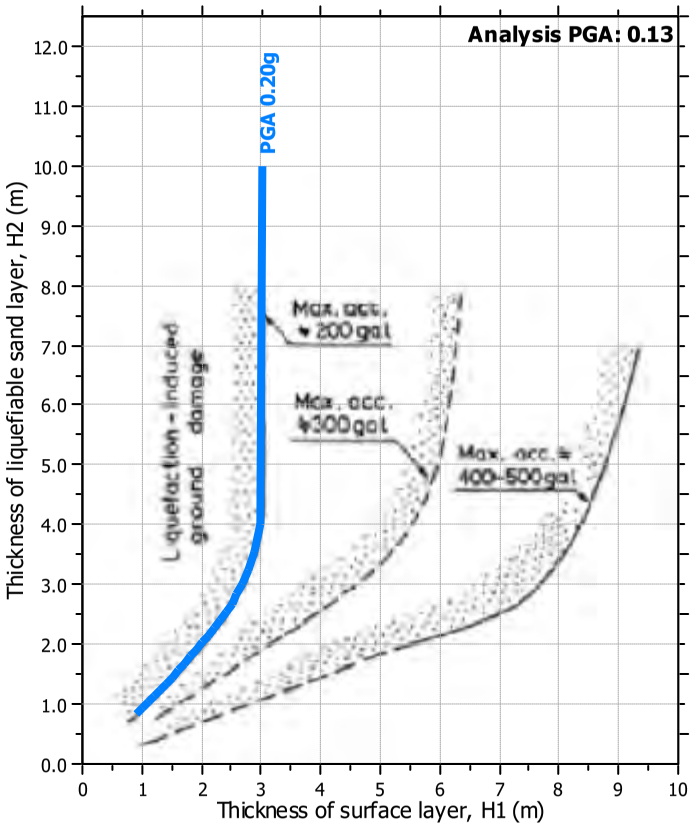
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



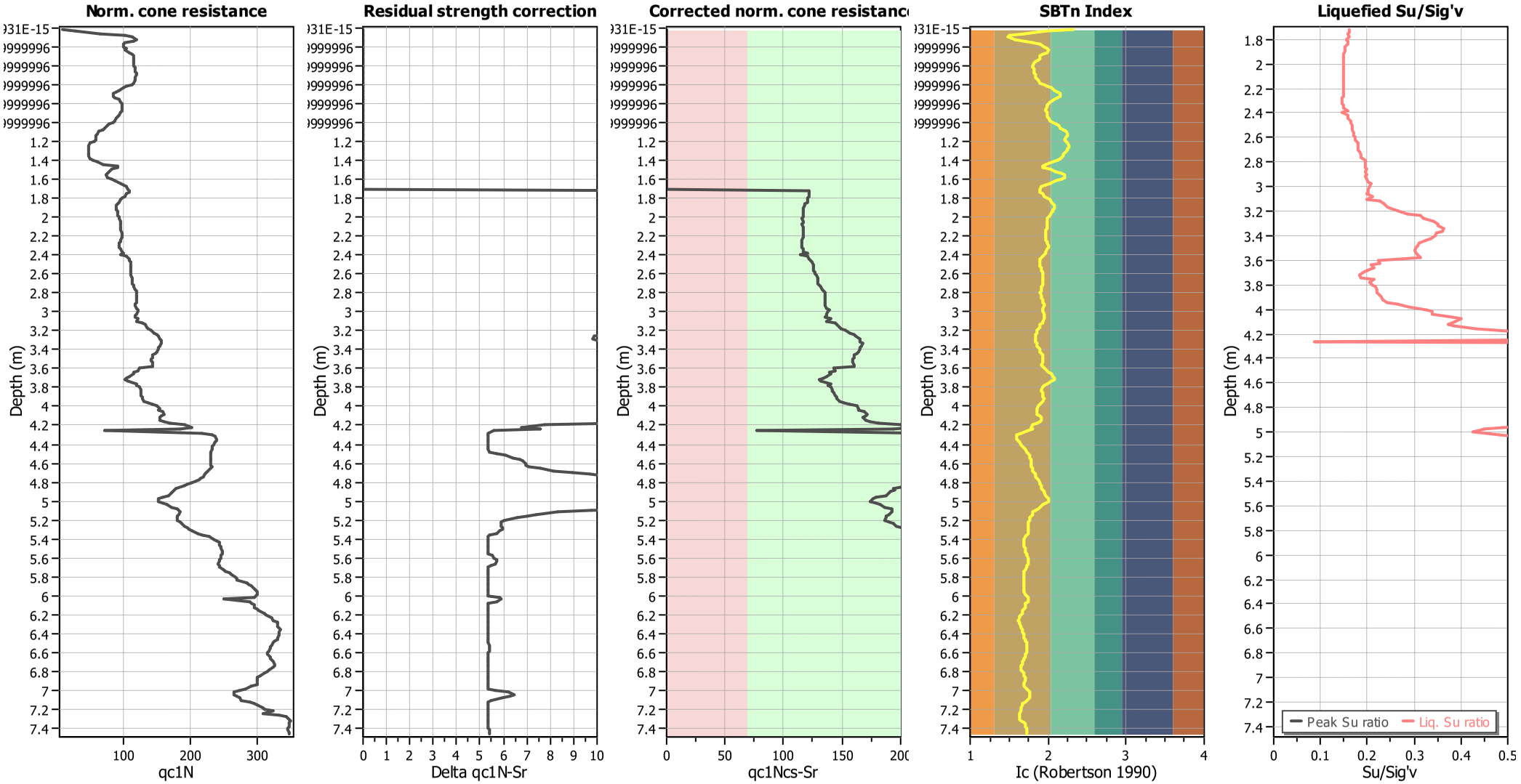




Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

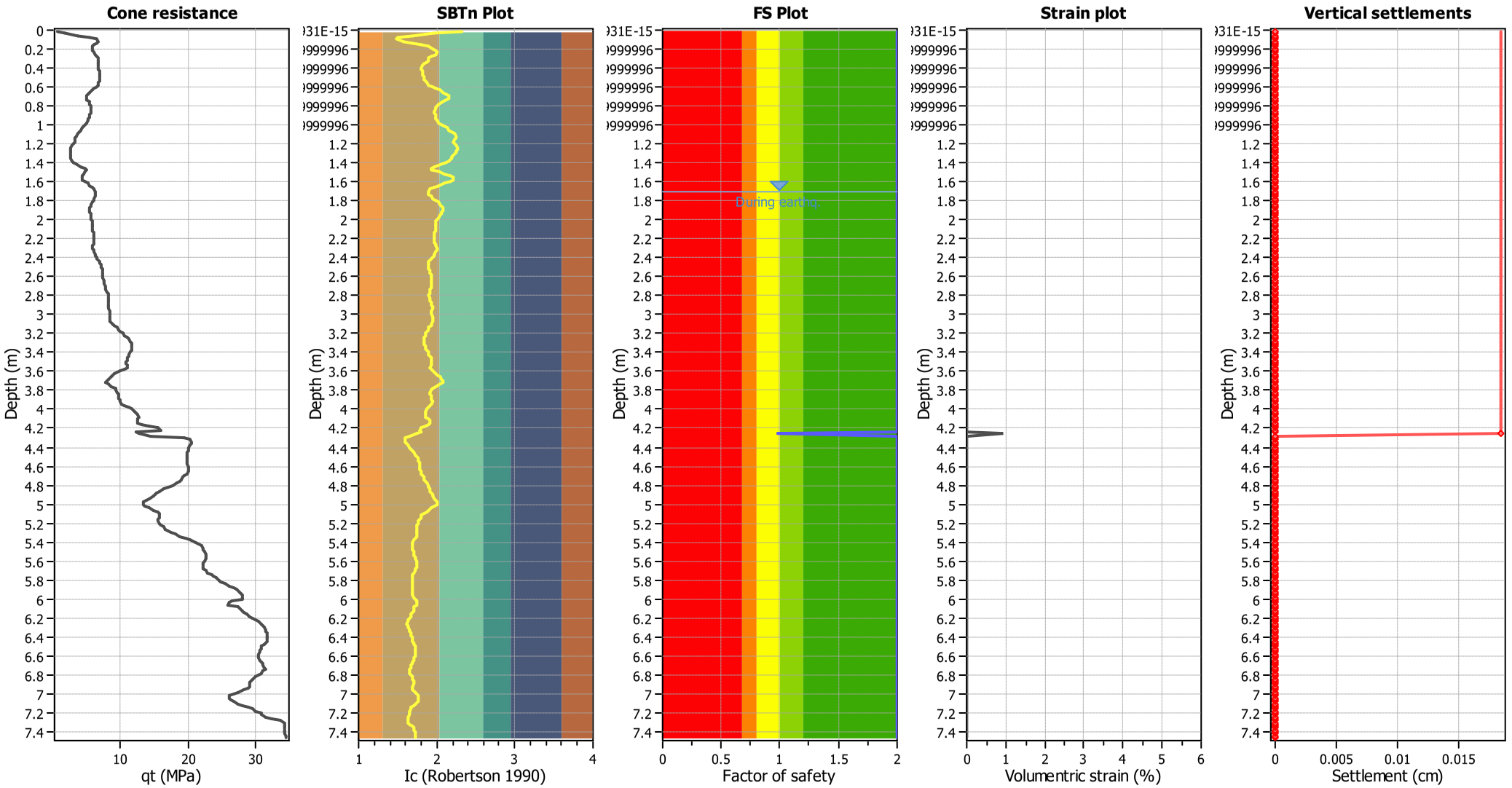
Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

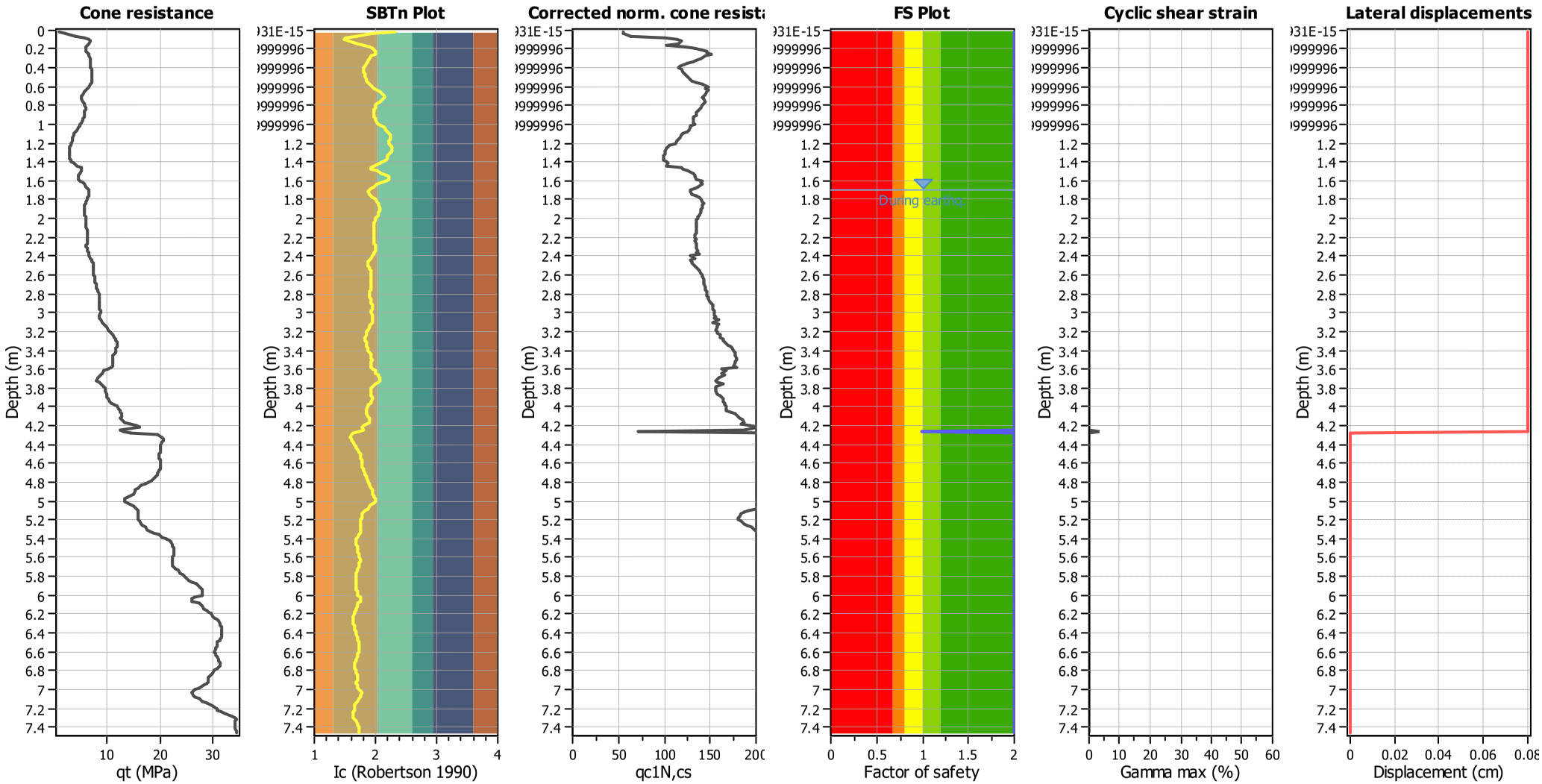
Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

Estimation of post-earthquake lateral Displacements



Abbreviations

q_t: Total cone resistance (cone resistance q_c corrected for pore water effects)
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$q_{c1N,cs}$: Equivalent clean sand normalized CPT total cone resistance
F.S.: Factor of safety
γ_{max}: Maximum cyclic shear strain
LDI: Lateral displacement index

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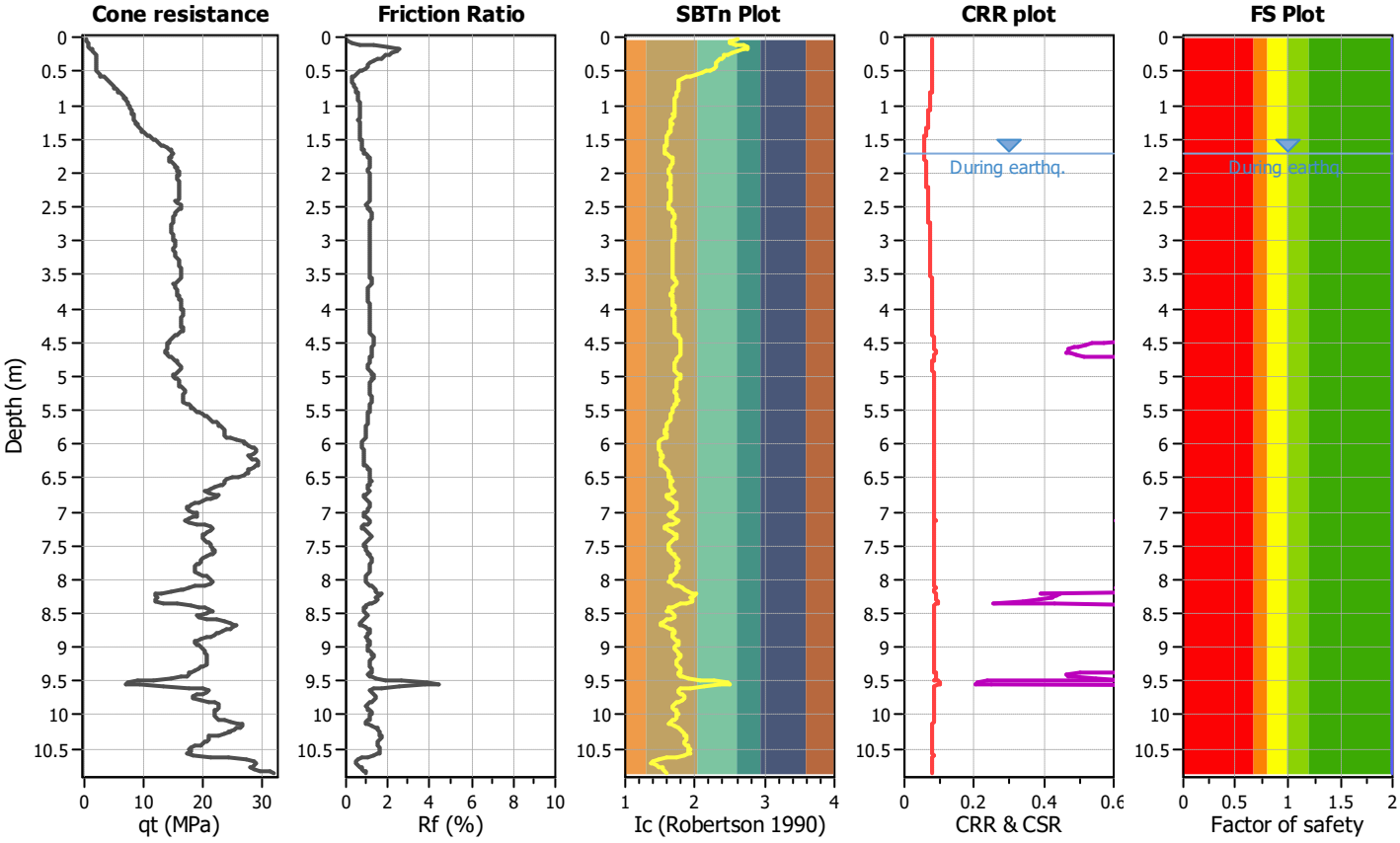
LIQUEFACTION ANALYSIS REPORT

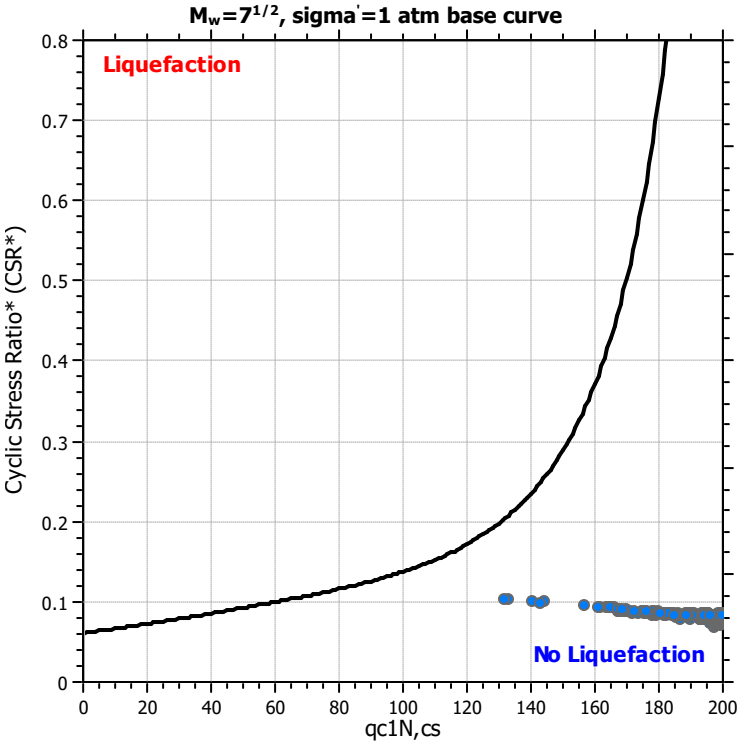
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

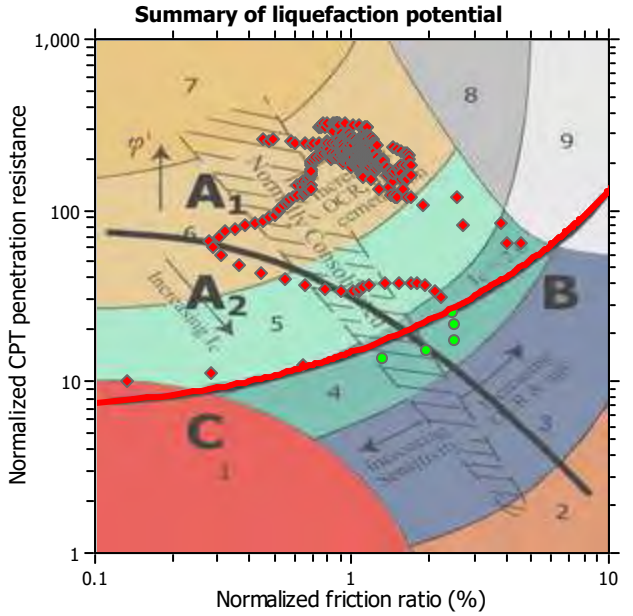
CPT file : CPT03_SLS

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.70 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	6.50	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:	No		

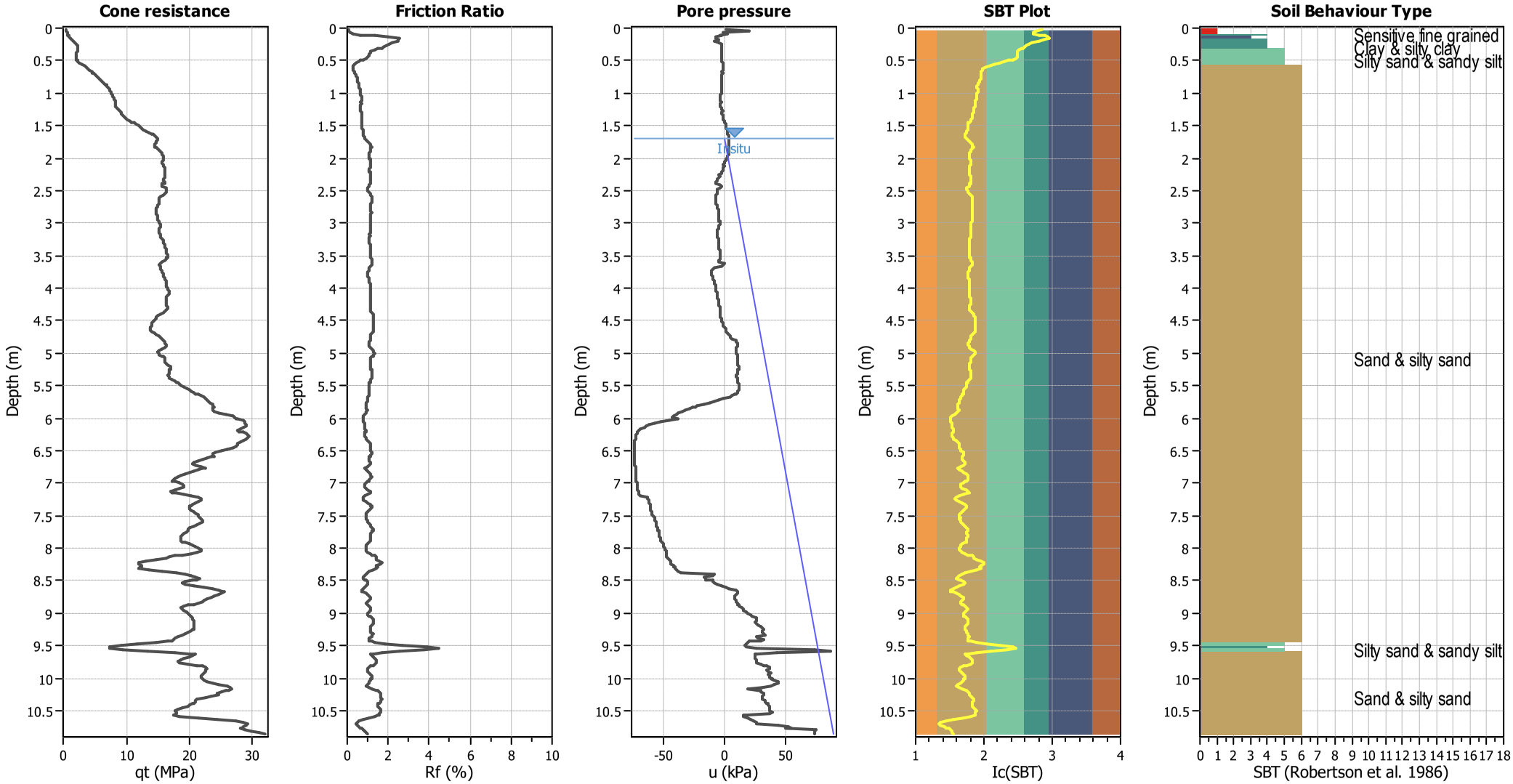






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



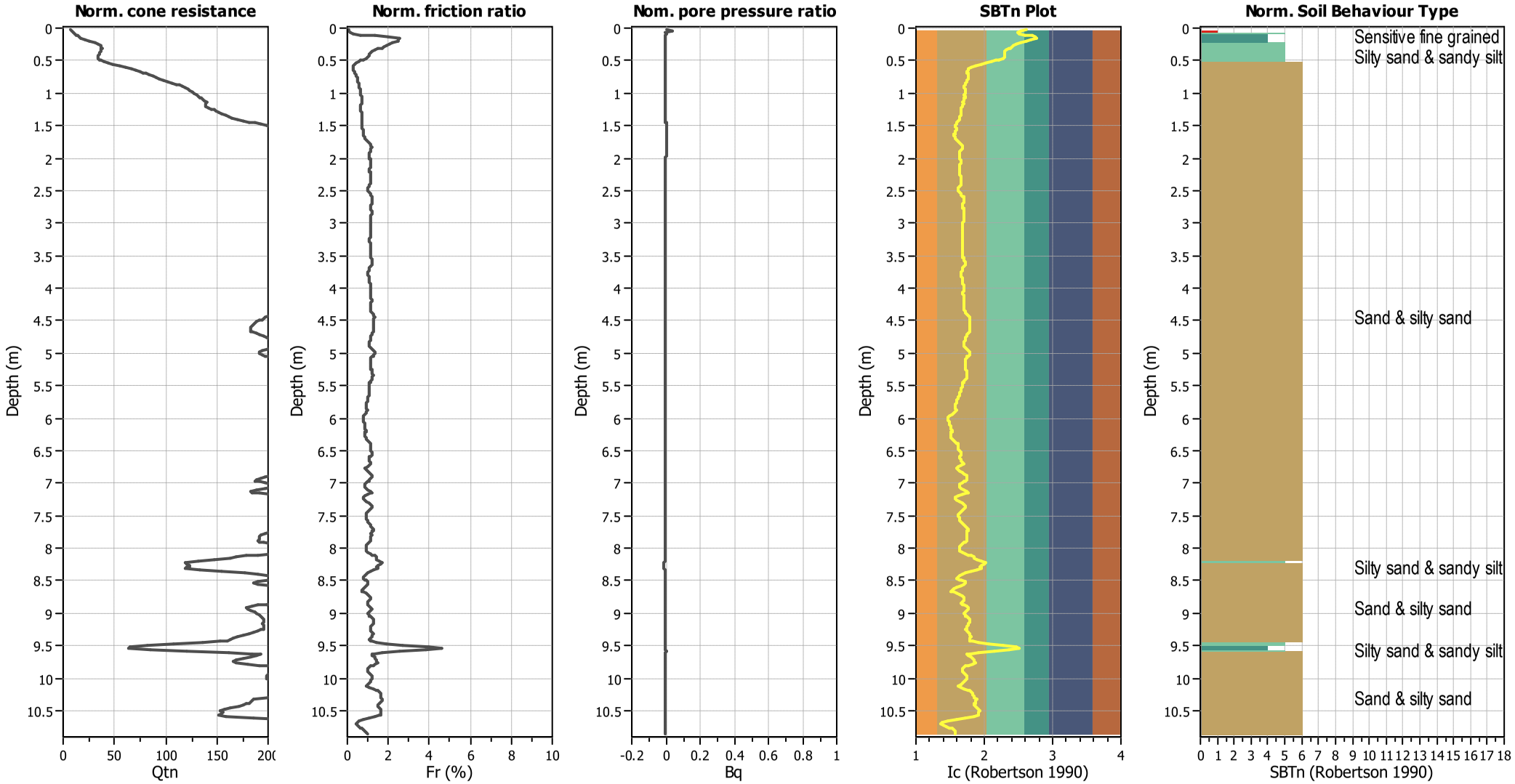
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

CPT basic interpretation plots (normalized)



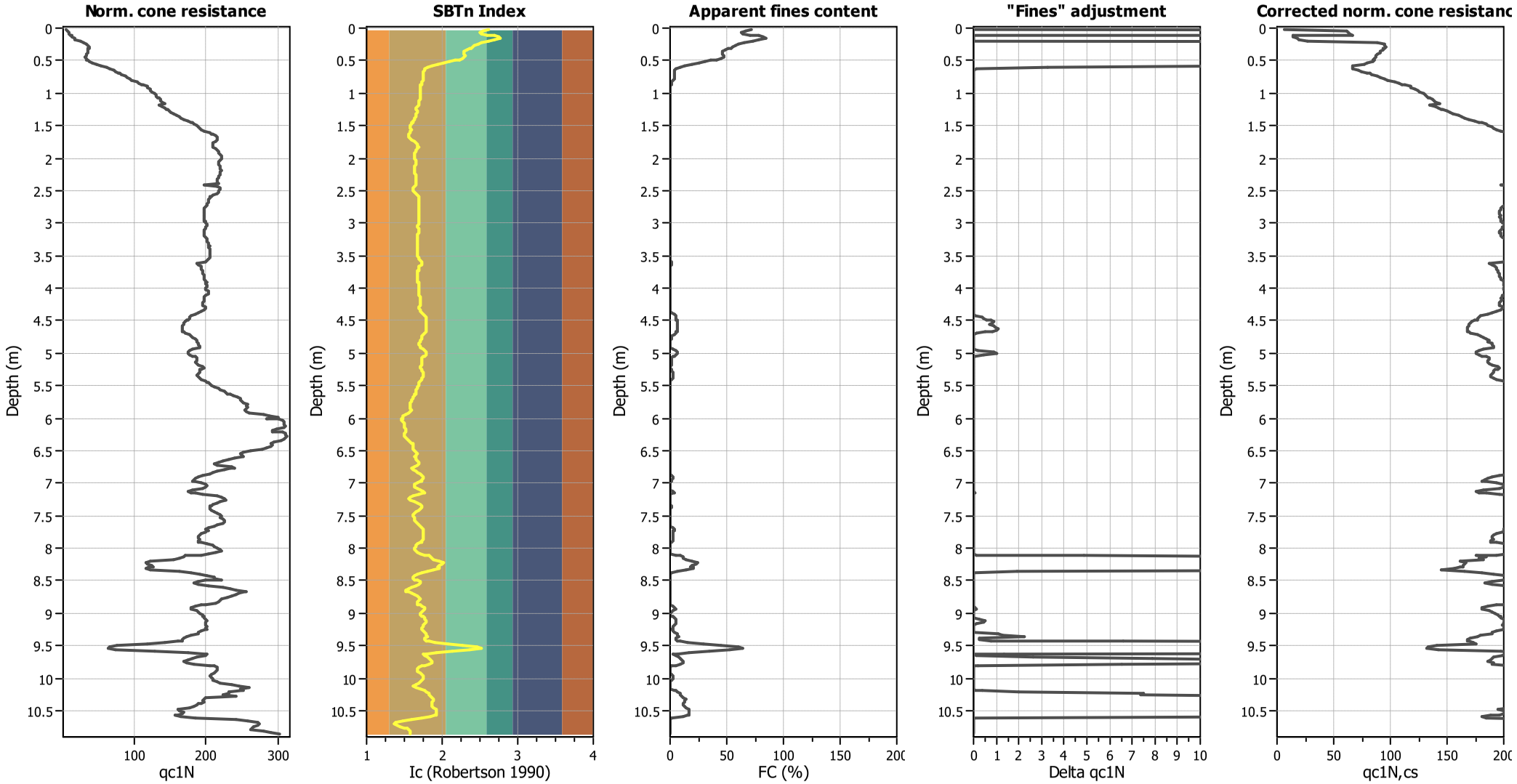
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

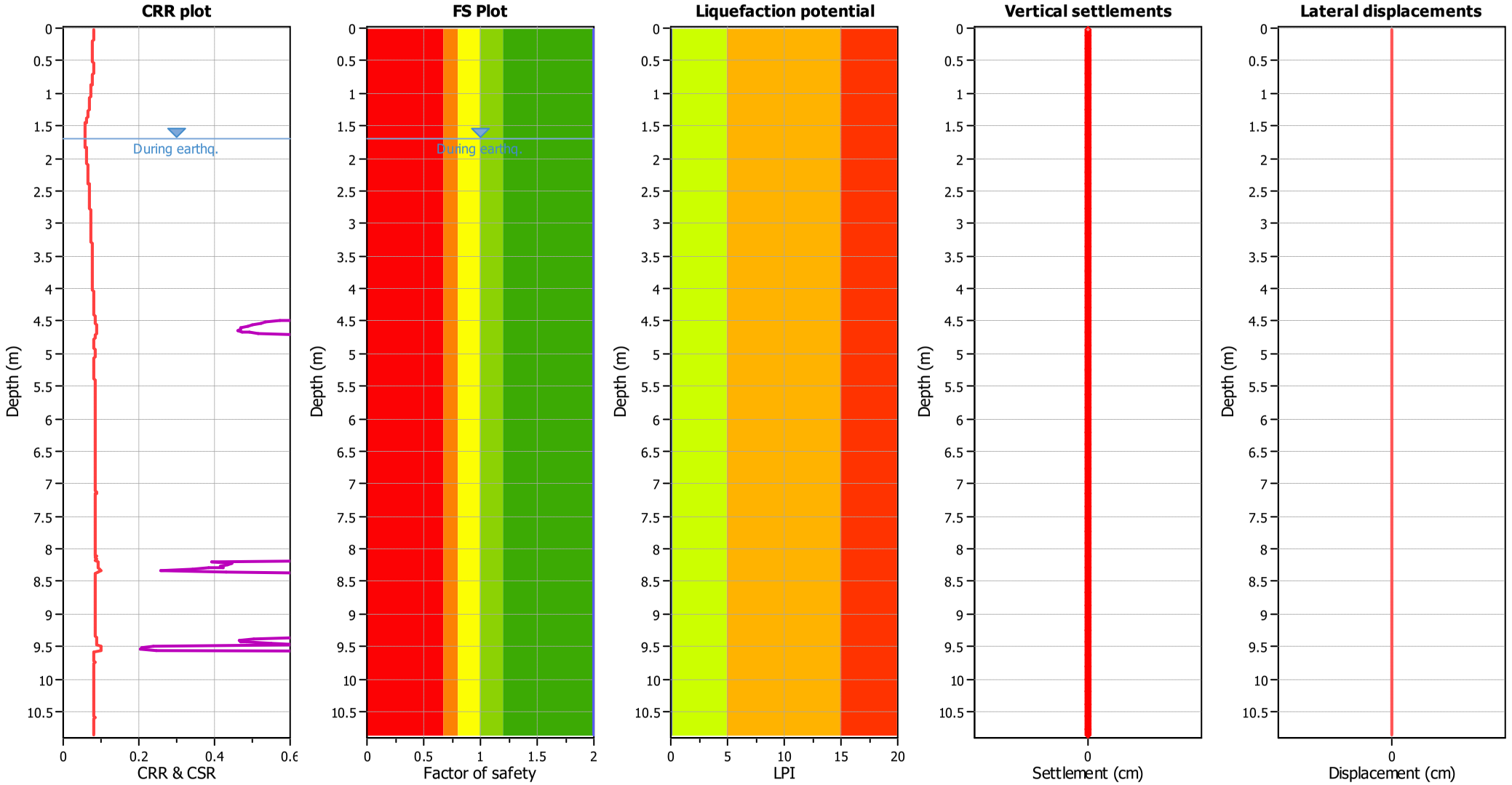
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

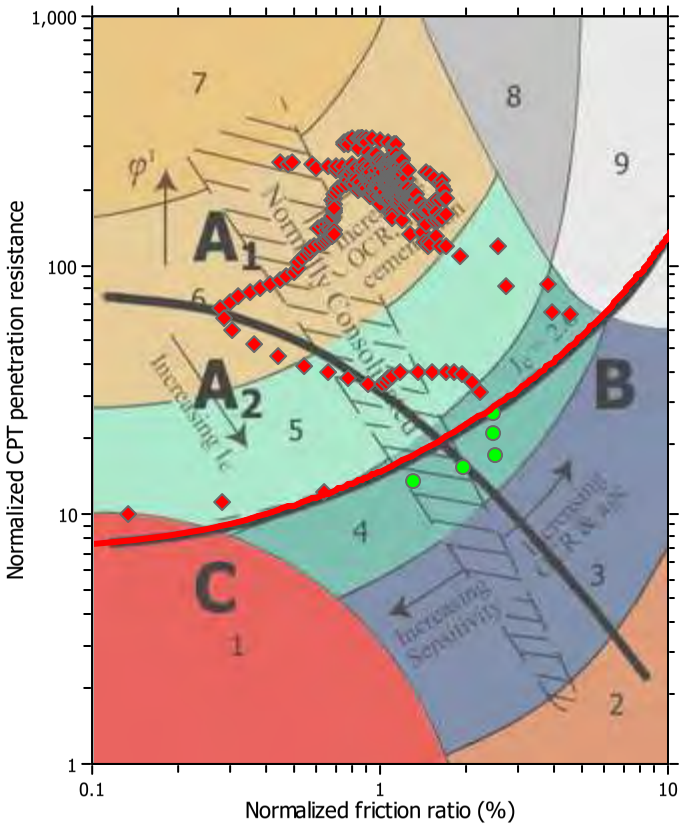
F.S. color scheme

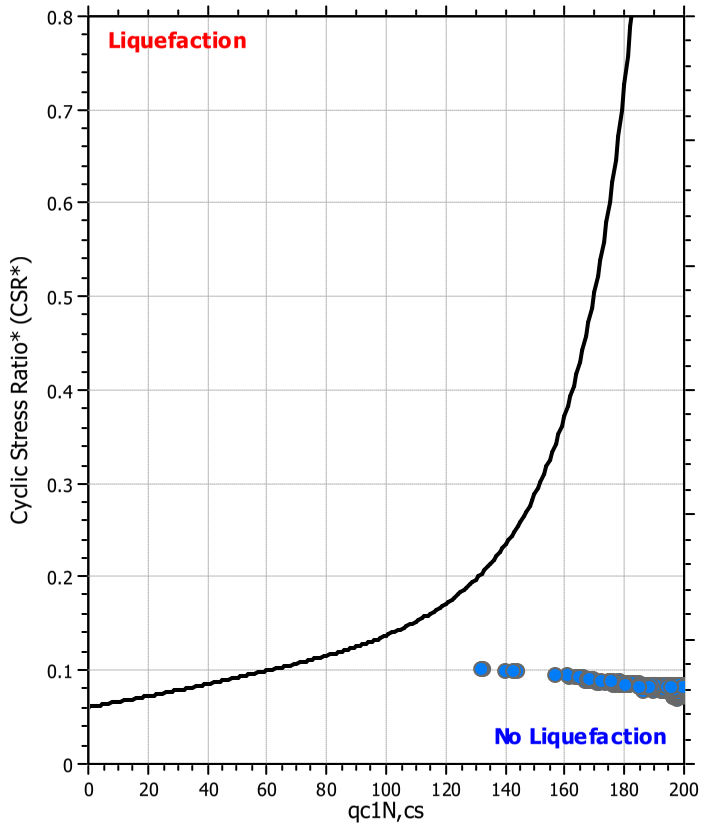
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

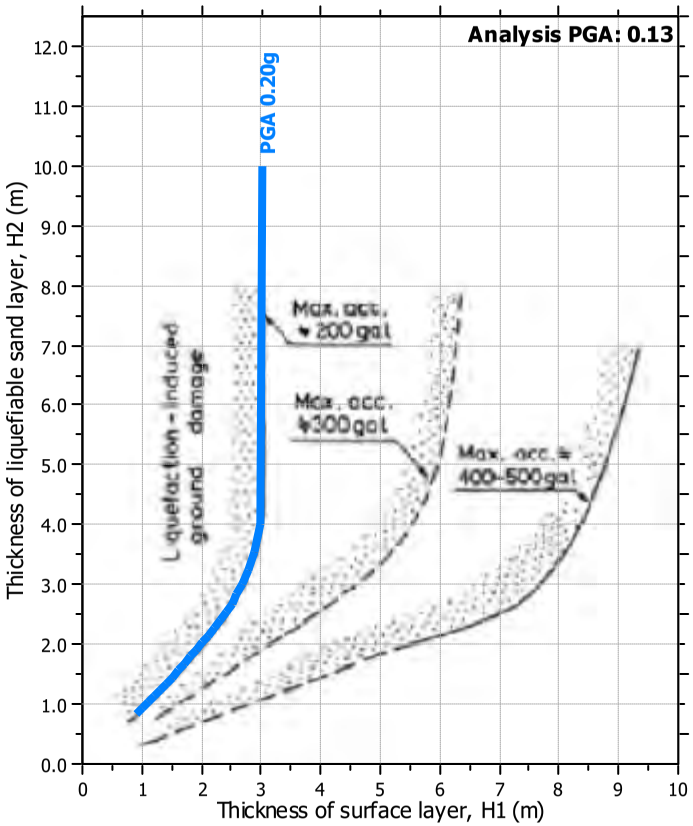
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



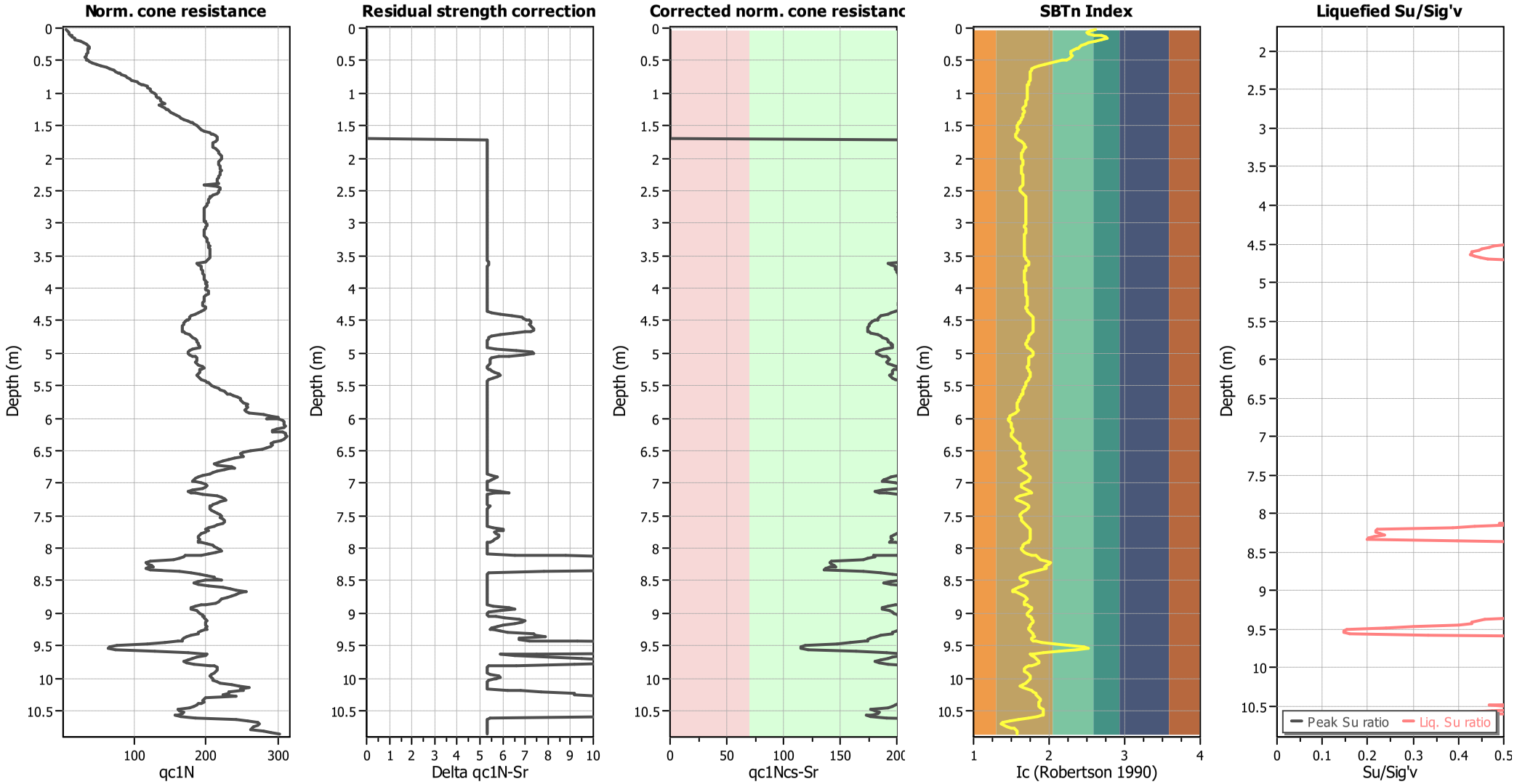




Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

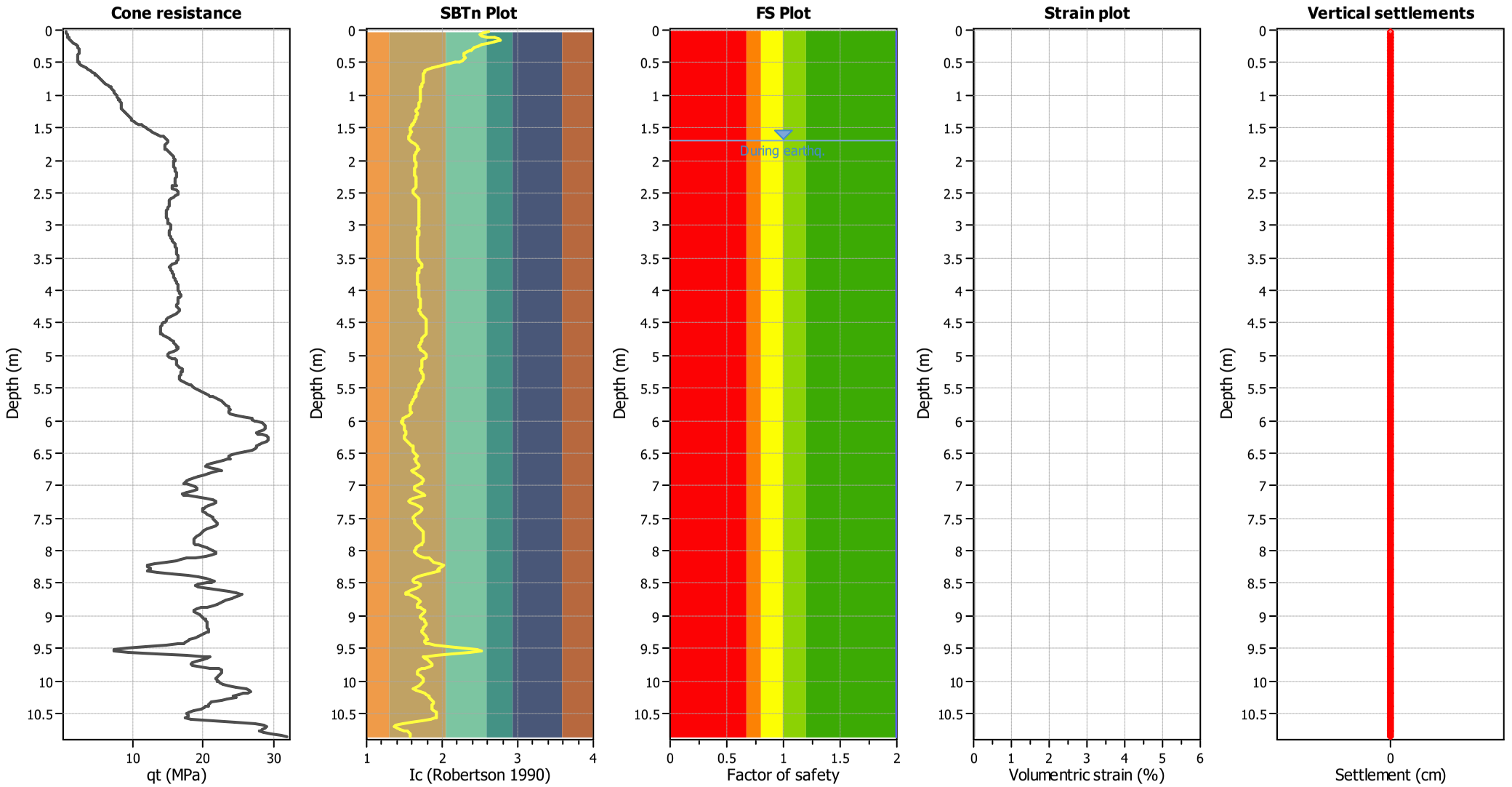
Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

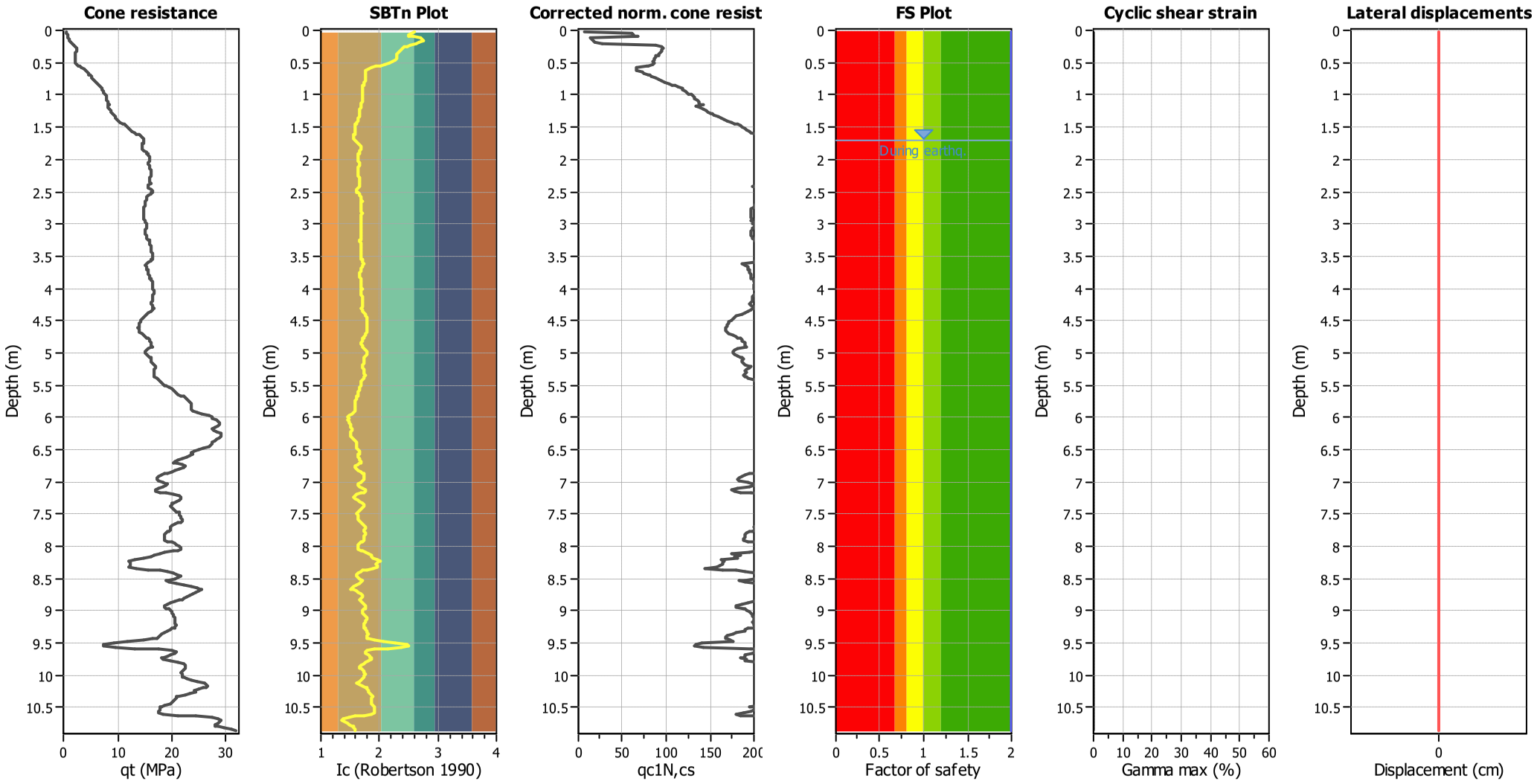
Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

Estimation of post-earthquake lateral Displacements



Abbreviations

q_t: Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c: Soil Behaviour Type Index
$q_{c1N,cs}$: Equivalent clean sand normalized CPT total cone resistance
F.S.: Factor of safety
γ_{max}: Maximum cyclic shear strain
LDI: Lateral displacement index

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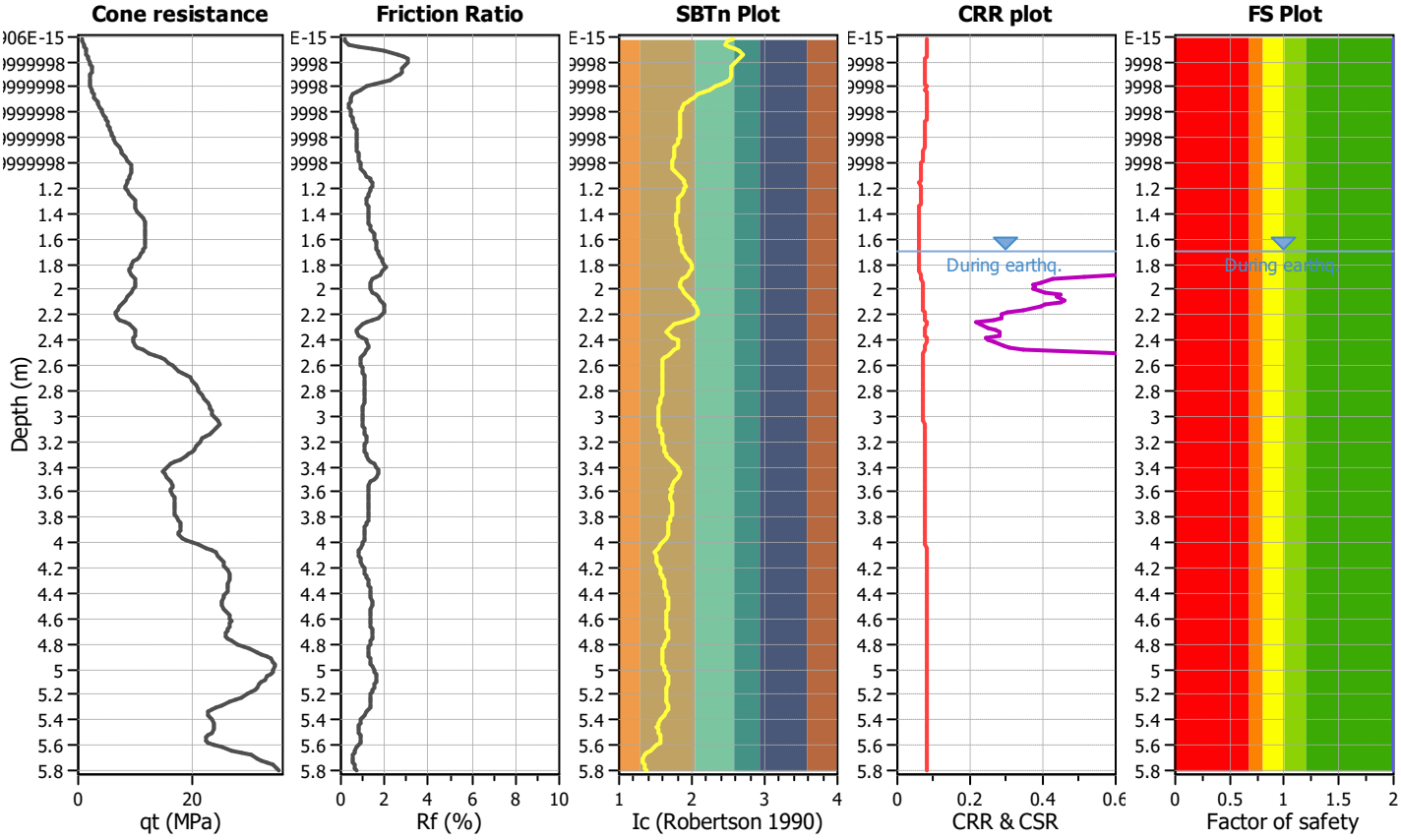
LIQUEFACTION ANALYSIS REPORT

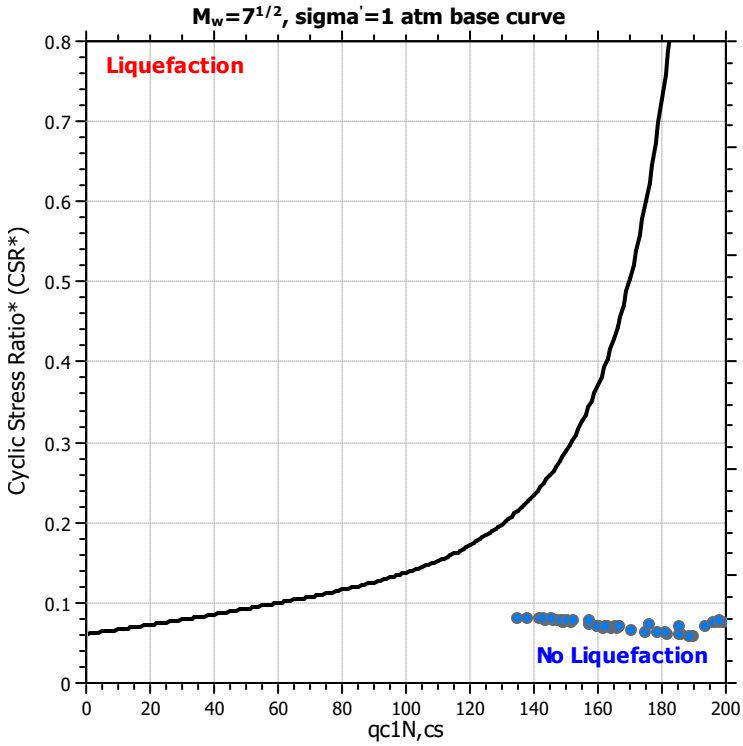
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

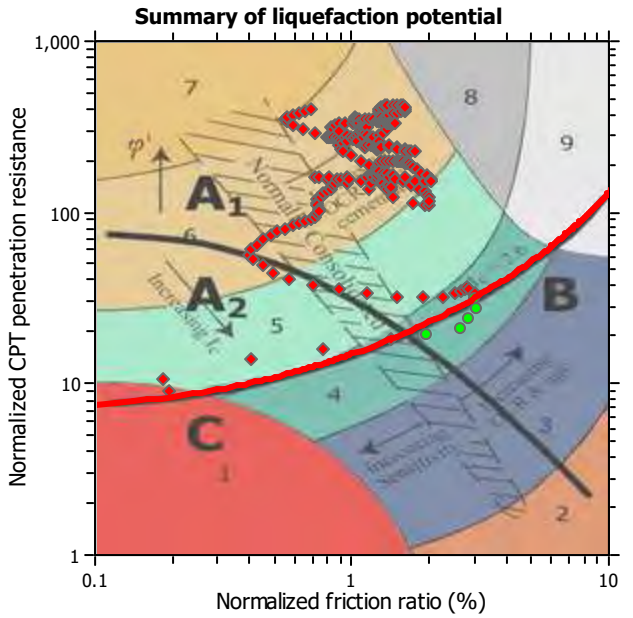
CPT file : CPT04_SLS

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.70 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	6.50	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:	No		

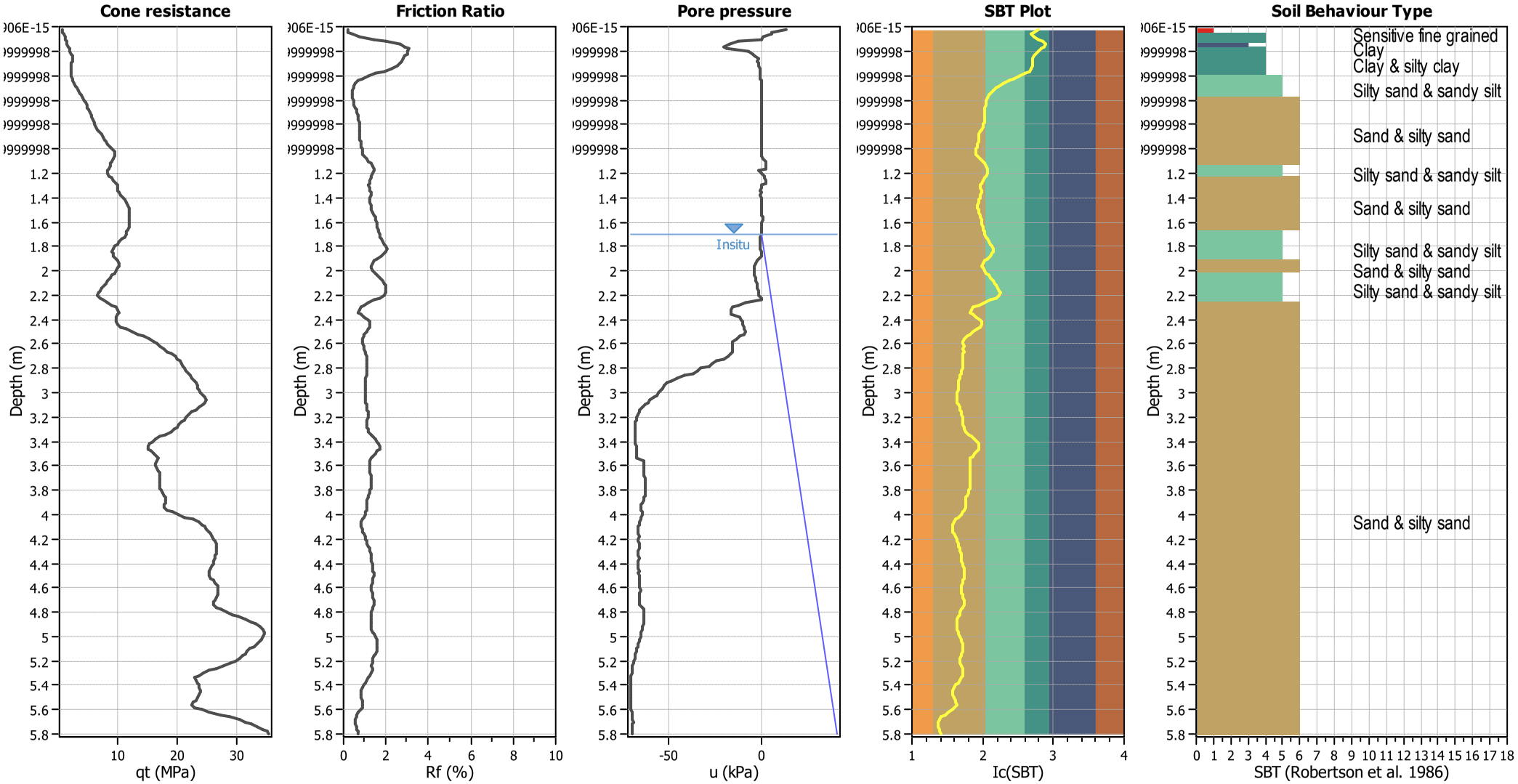






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



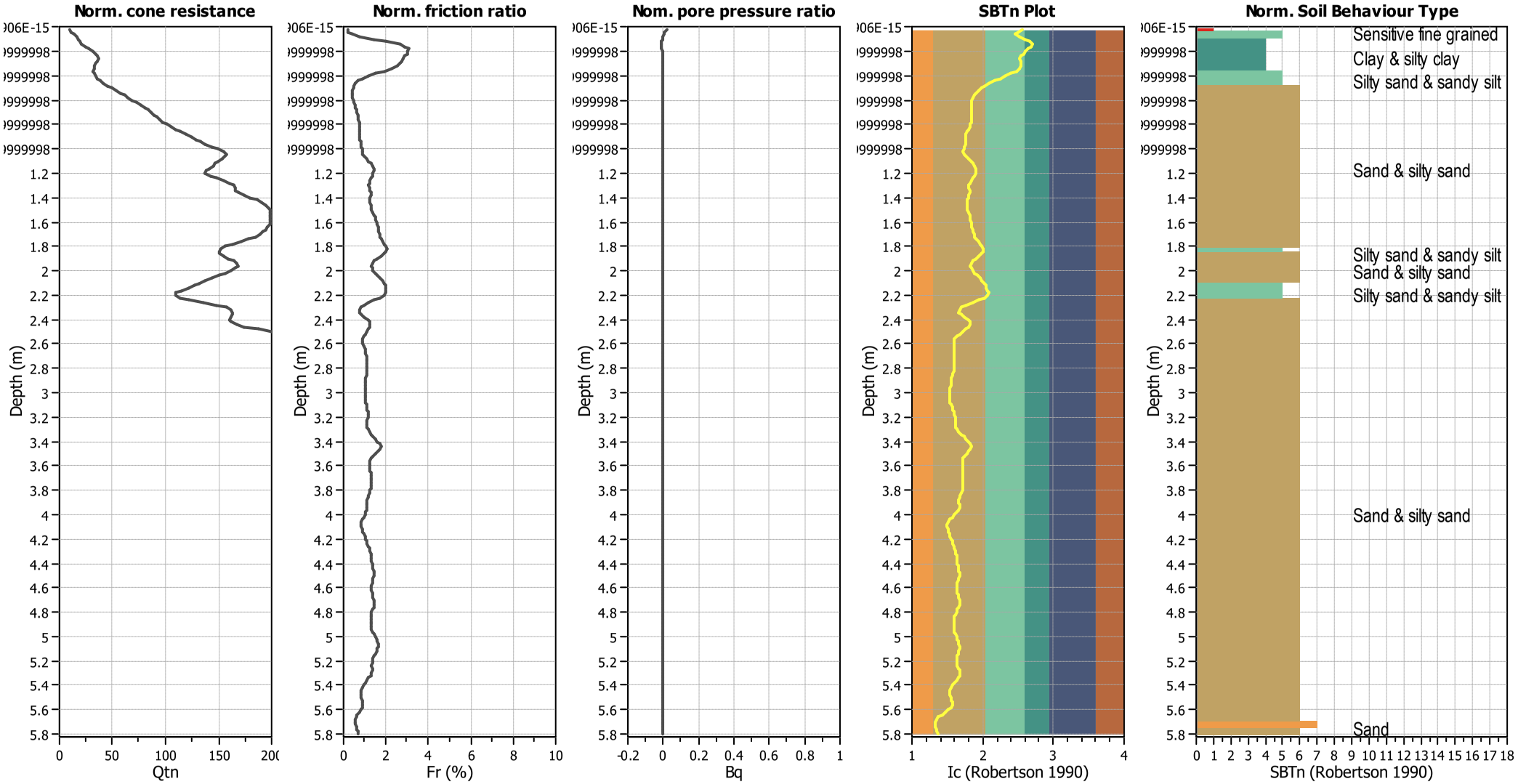
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

CPT basic interpretation plots (normalized)



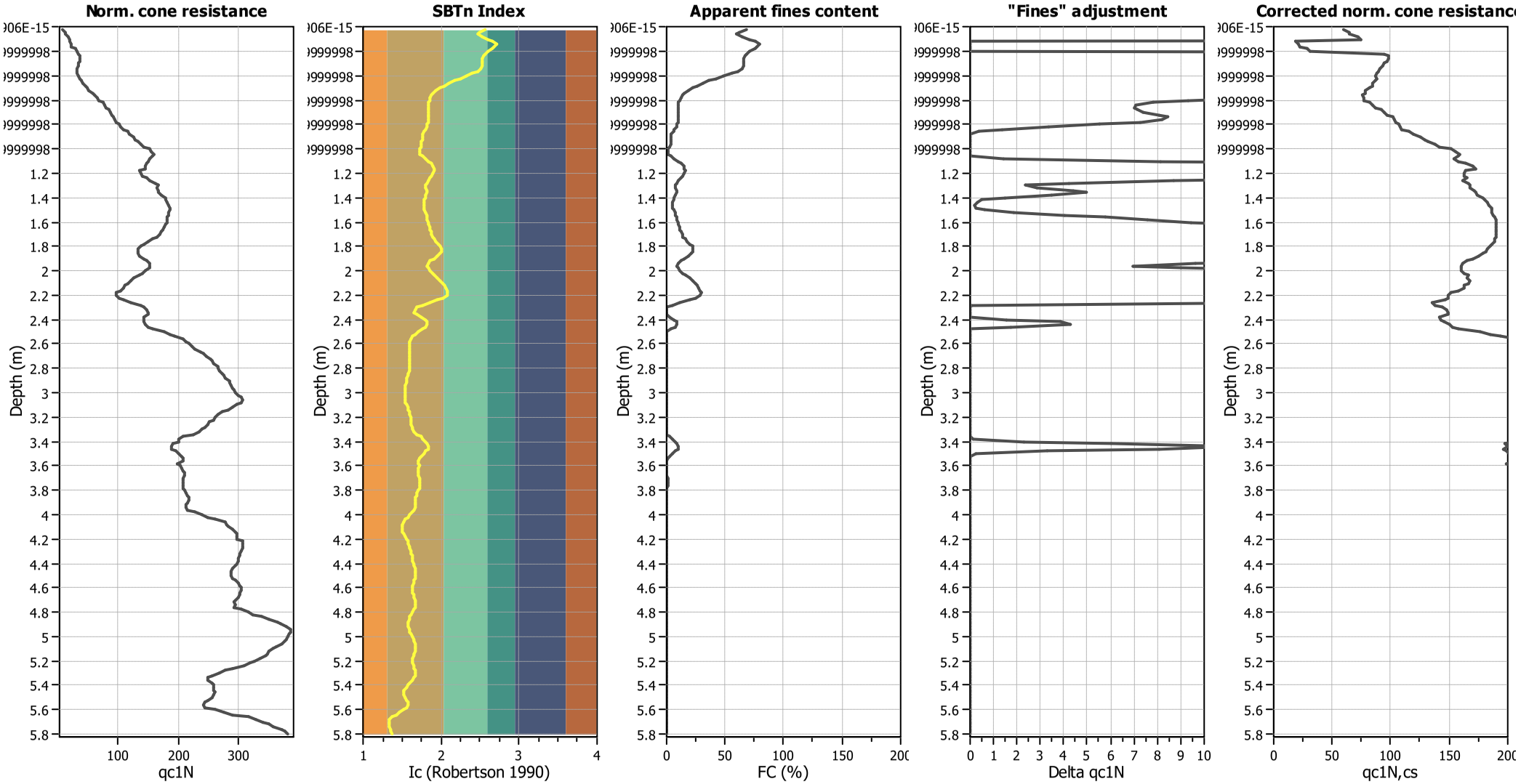
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

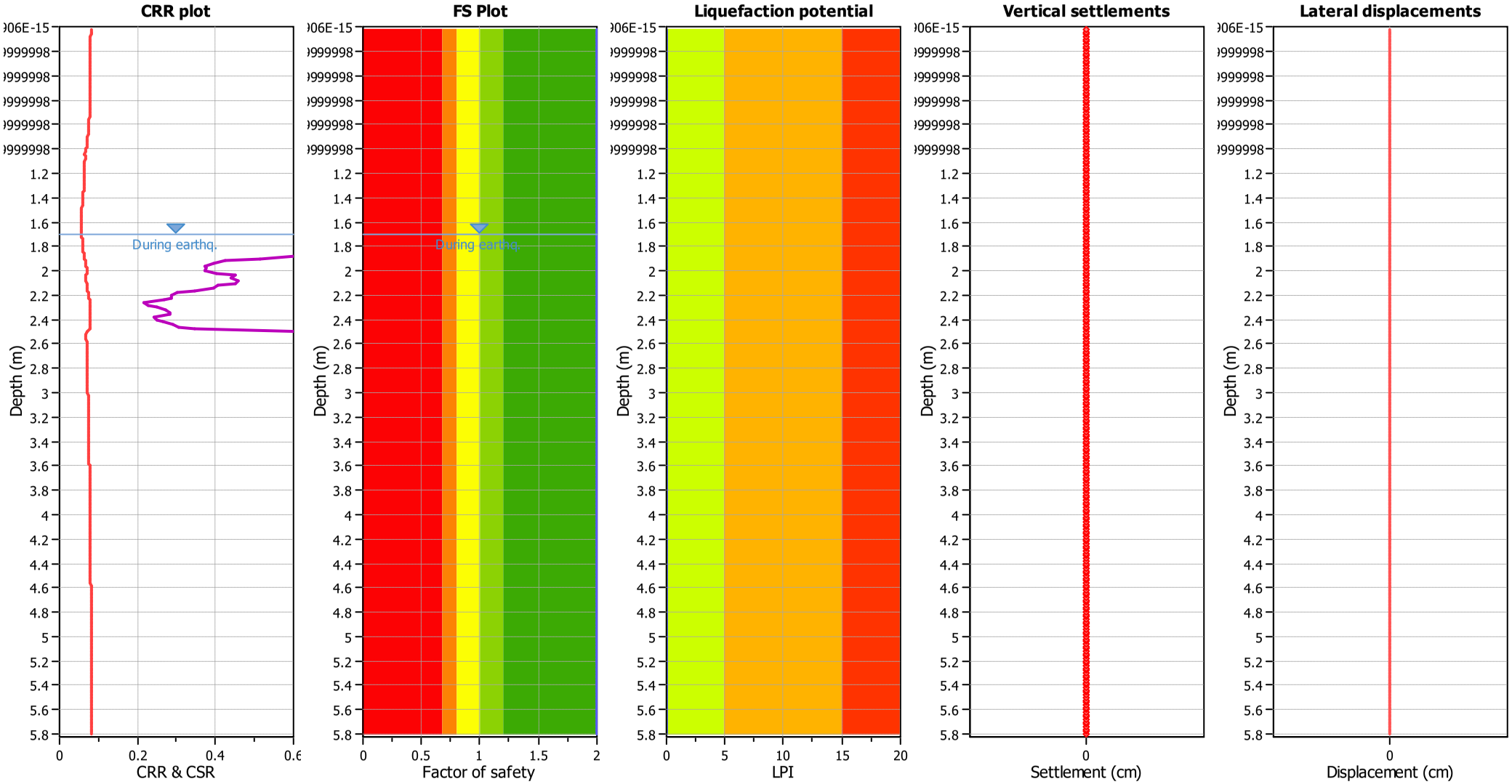
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

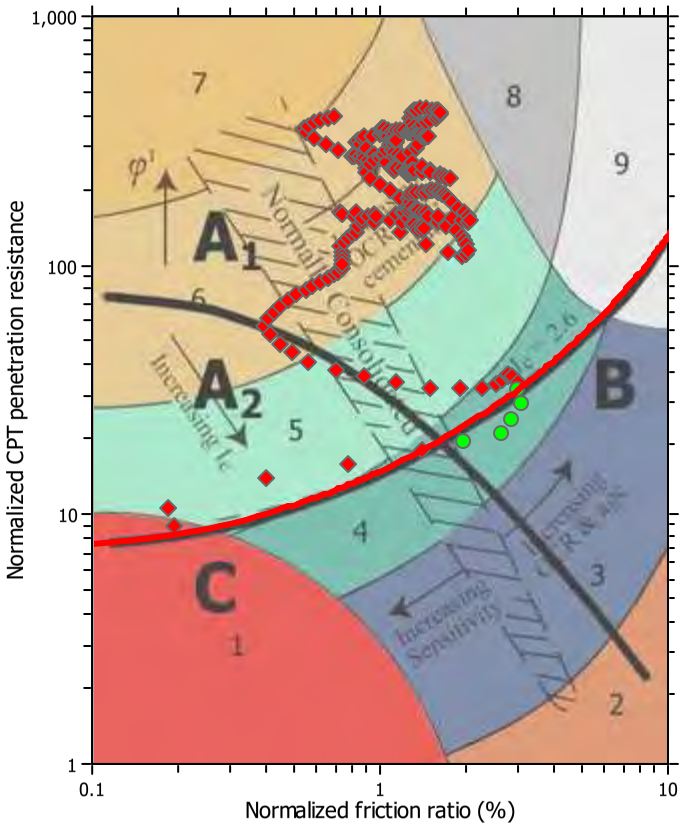
F.S. color scheme

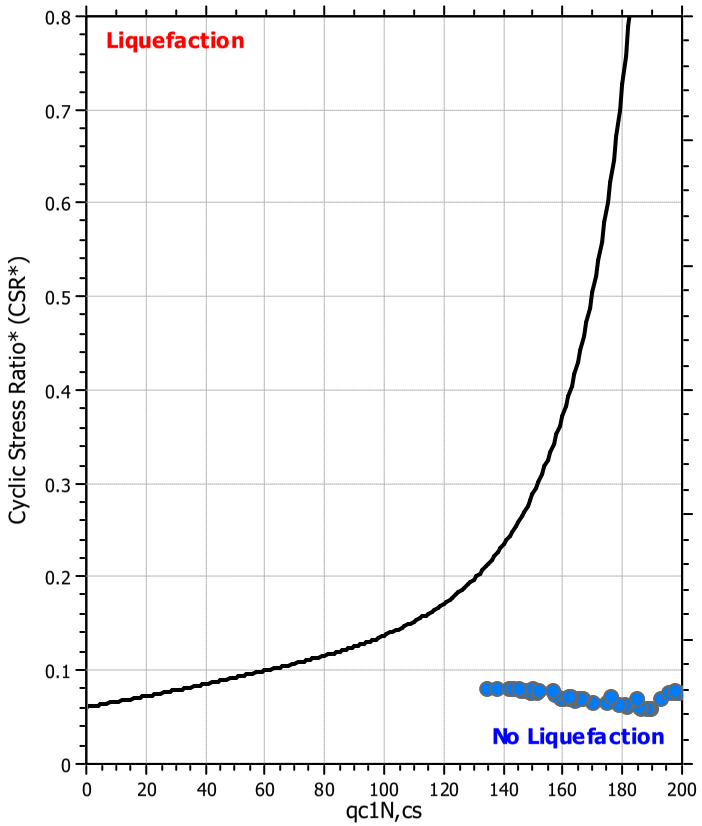
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

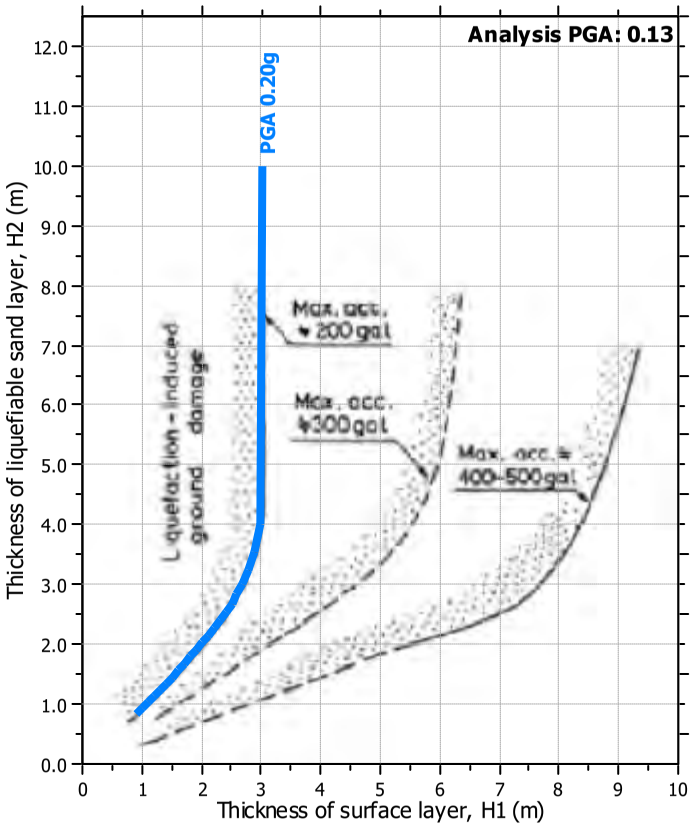
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



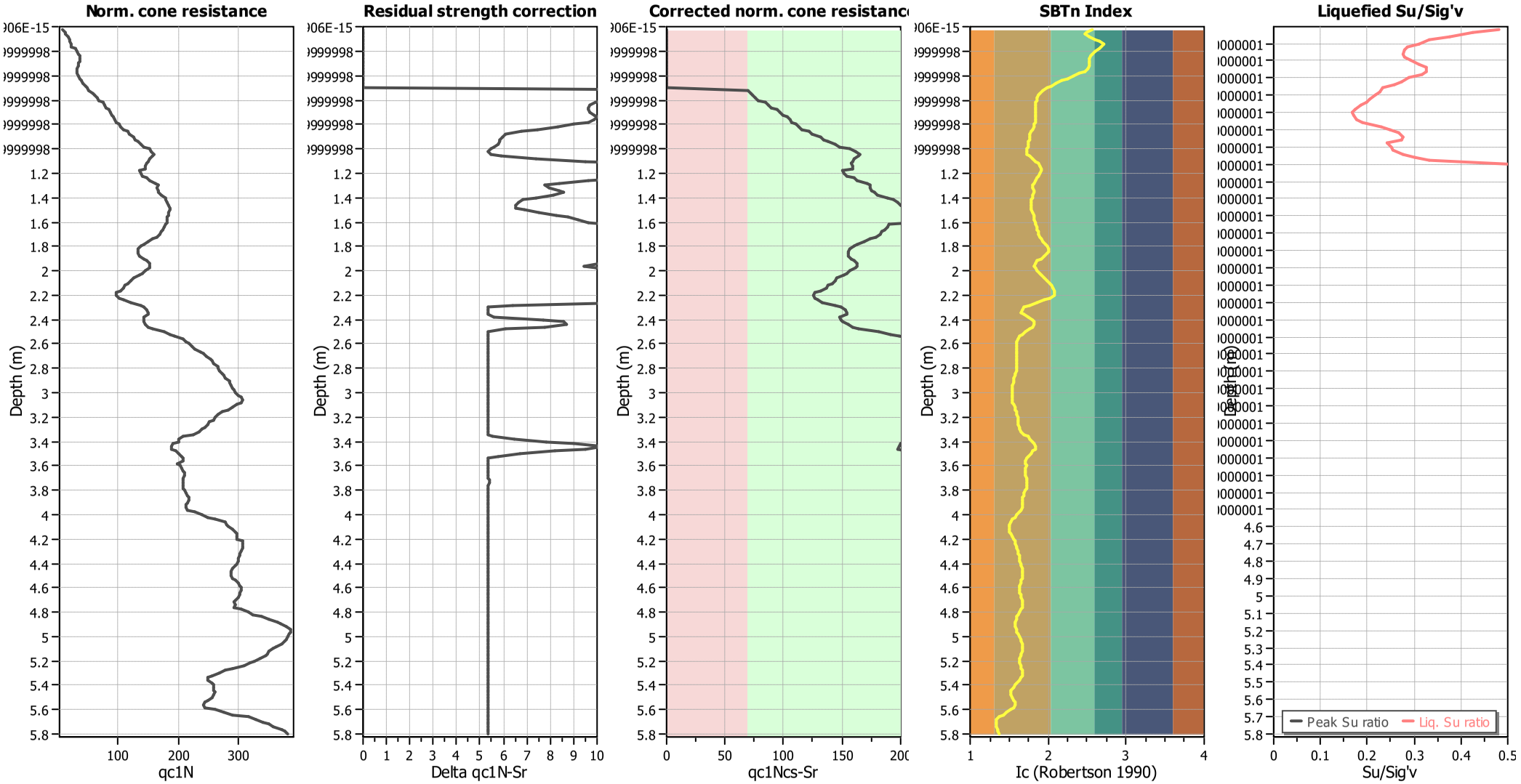




Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

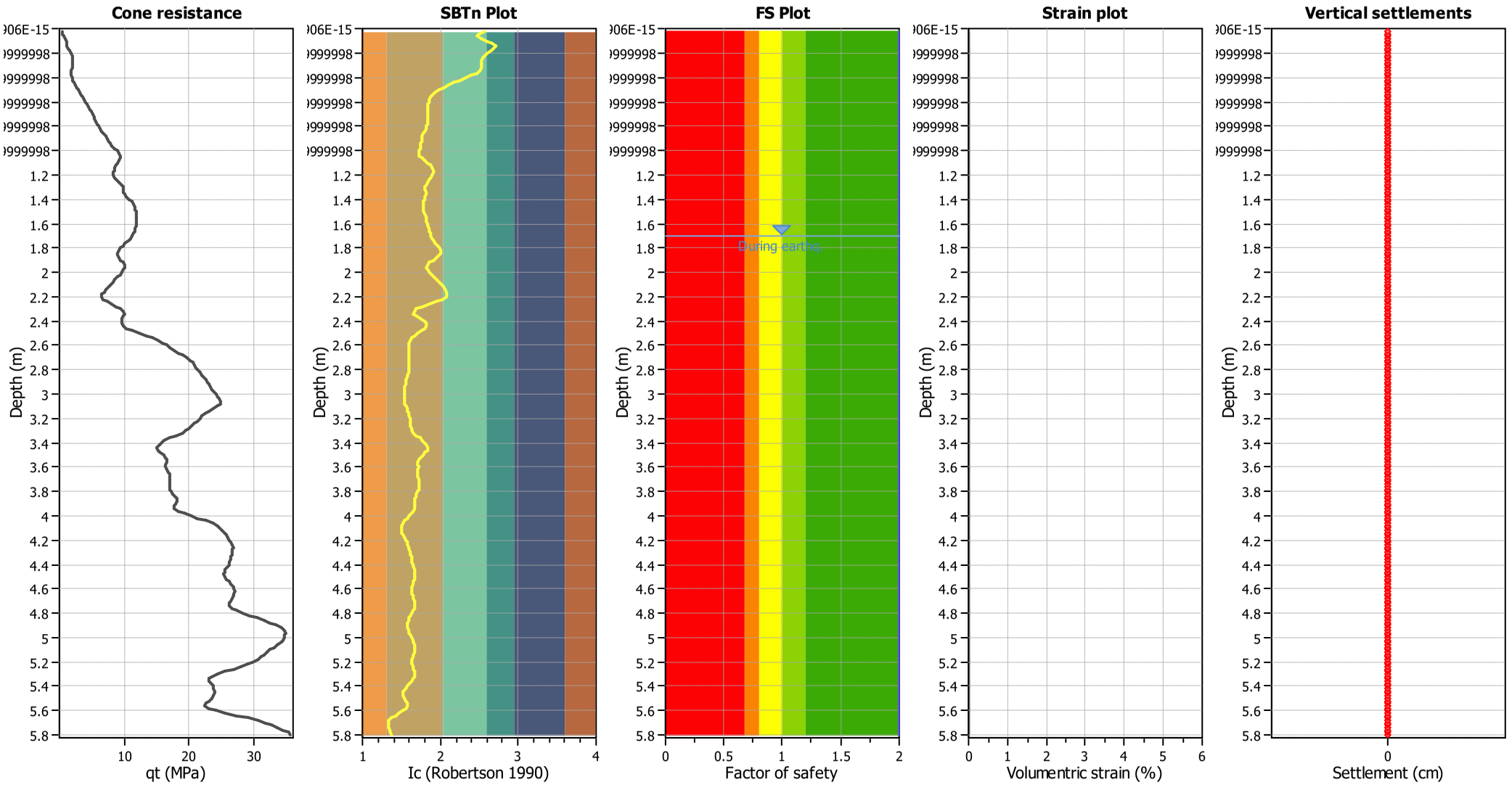
Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

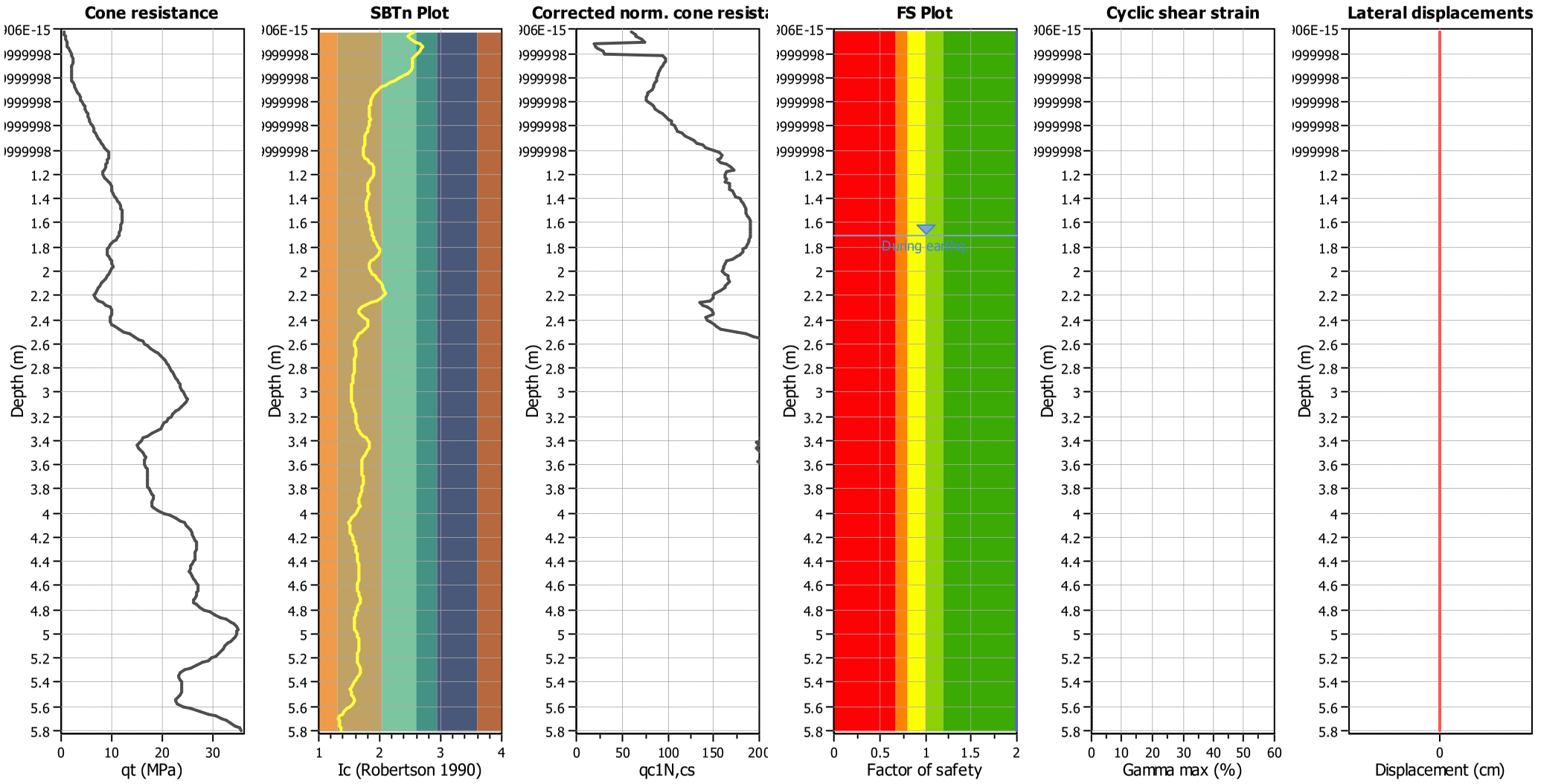
Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

Estimation of post-earthquake lateral Displacements



Abbreviations

q_t: Total cone resistance (cone resistance q_c corrected for pore water effects)
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$q_{c1N,cs}$: Equivalent clean sand normalized CPT total cone resistance
F.S.: Factor of safety
γ_{max}: Maximum cyclic shear strain
LDI: Lateral displacement index

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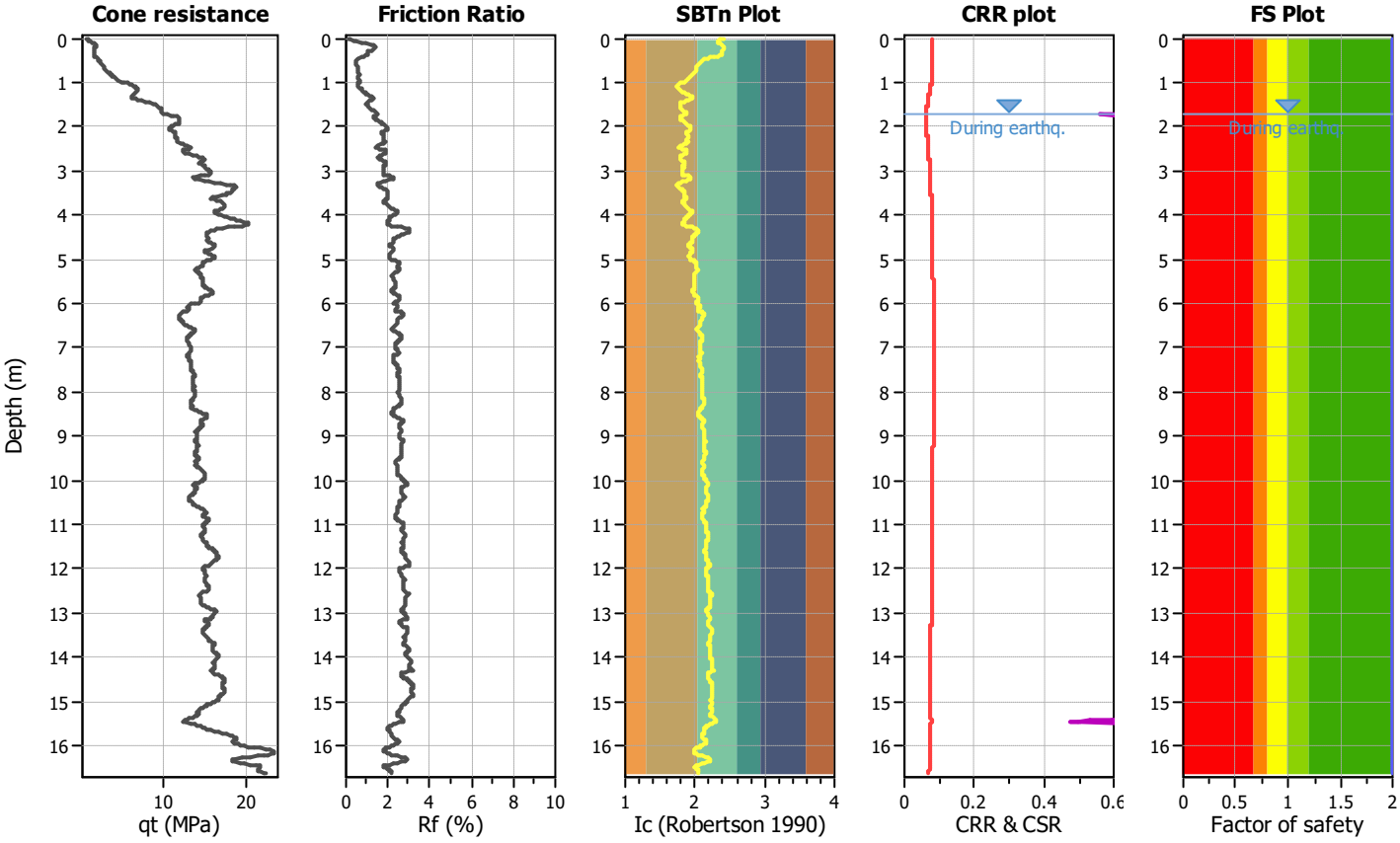
LIQUEFACTION ANALYSIS REPORT

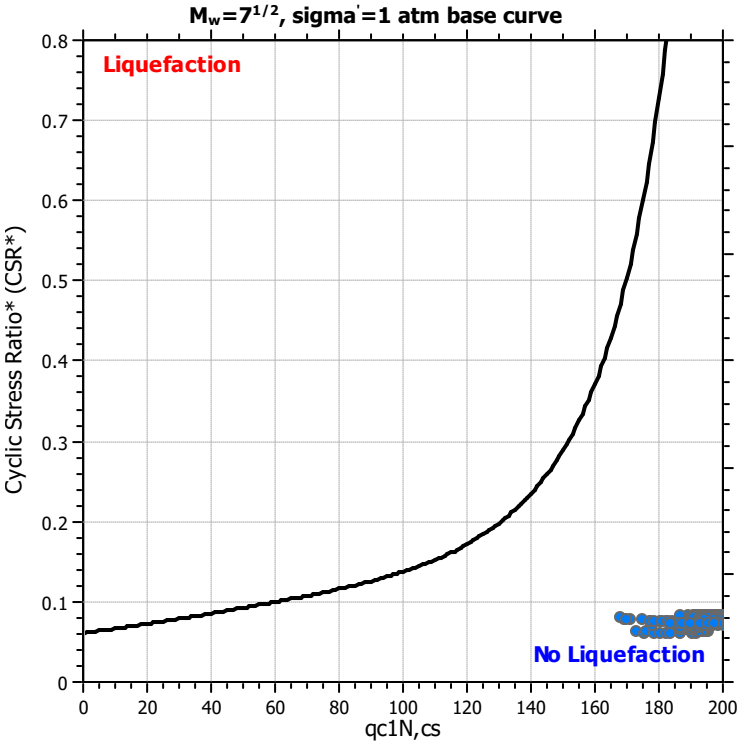
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

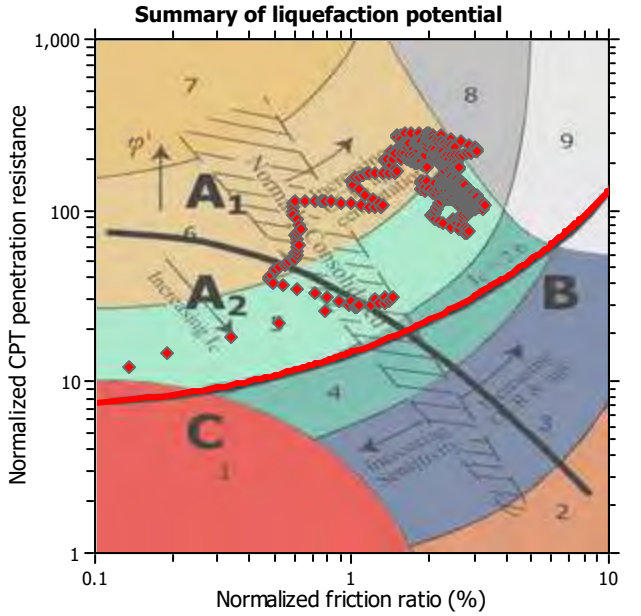
CPT file : CPT05_SLS

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.70 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	6.50	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:	No		

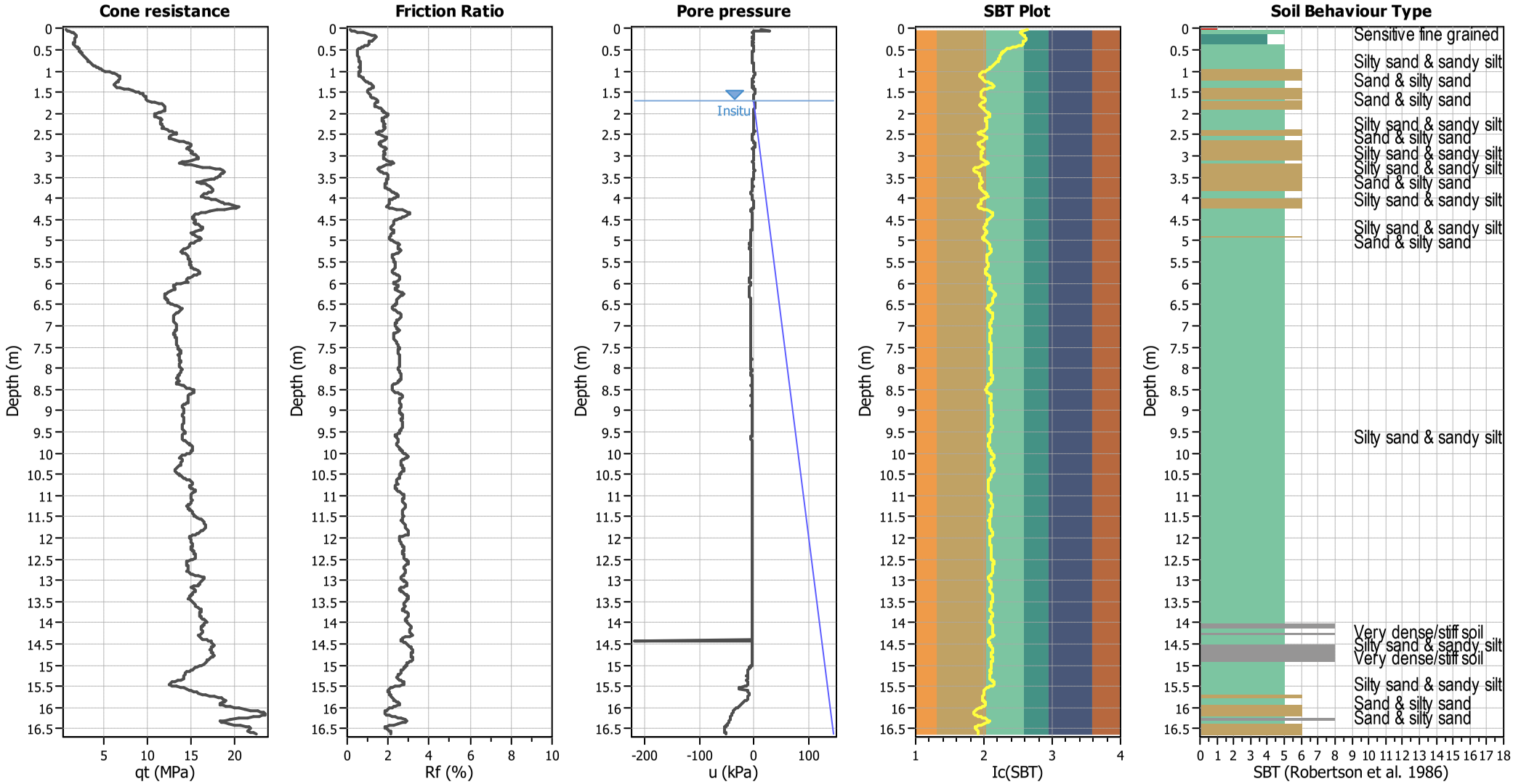






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



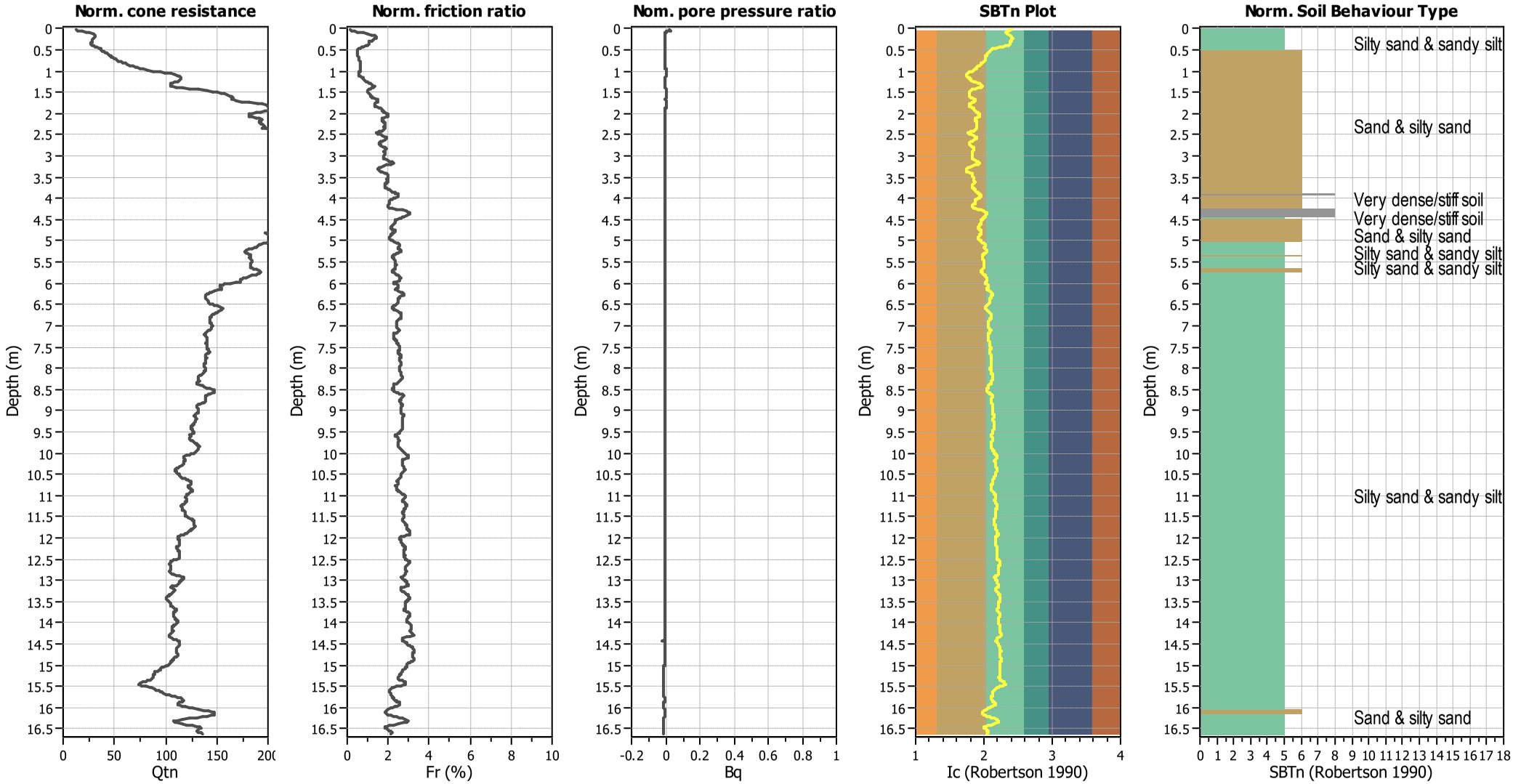
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

CPT basic interpretation plots (normalized)



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

1. Sensitive fine grained
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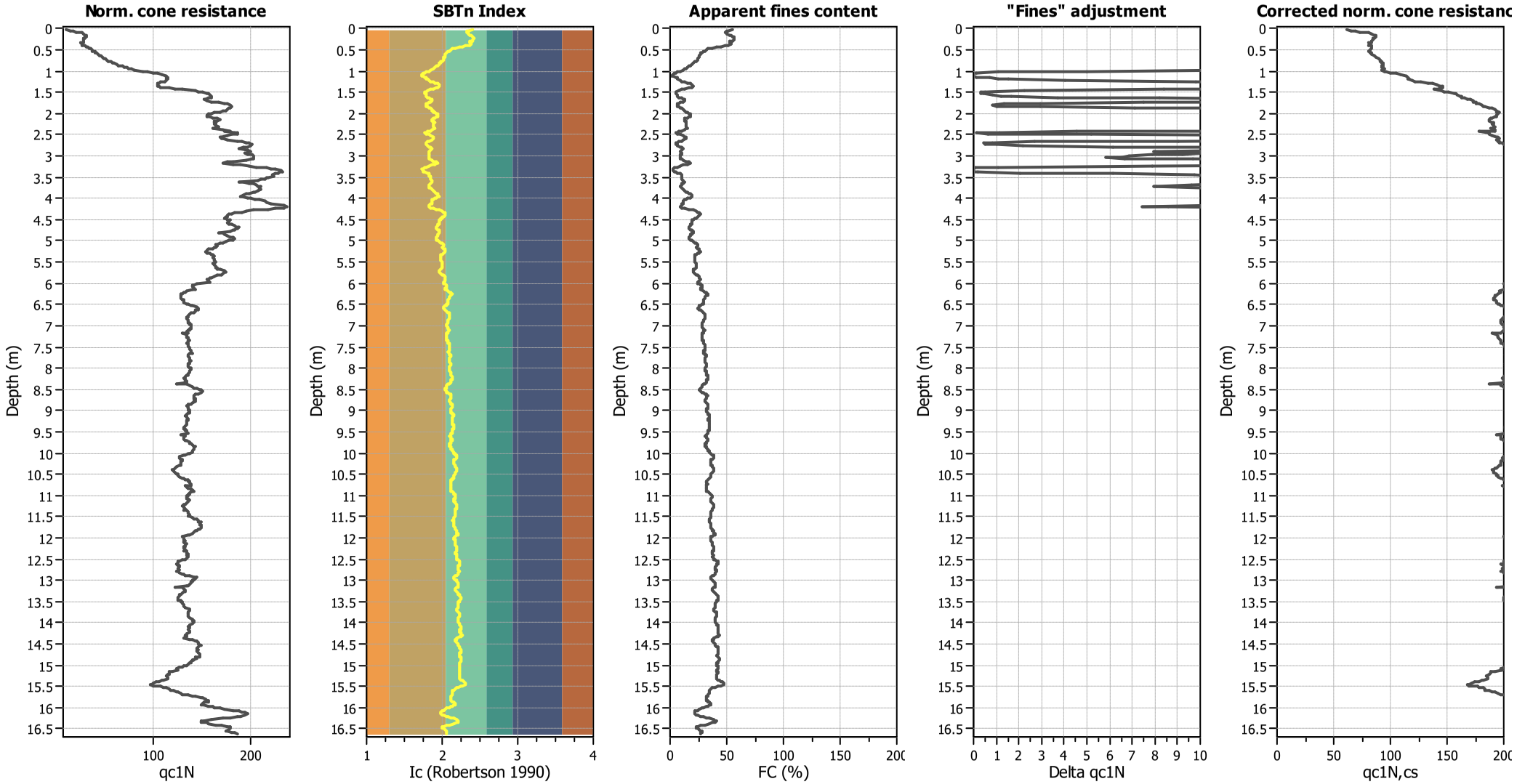
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

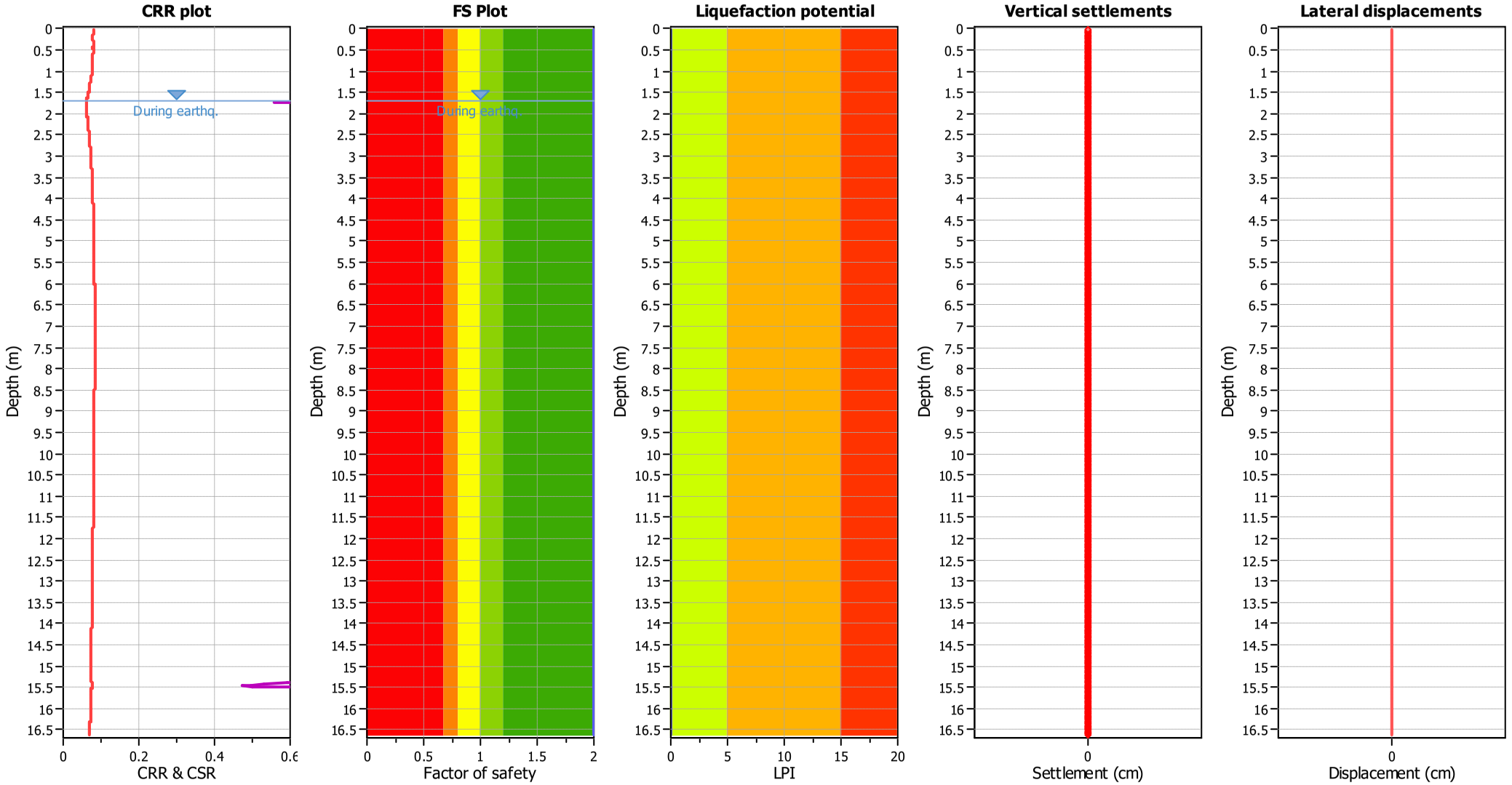
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

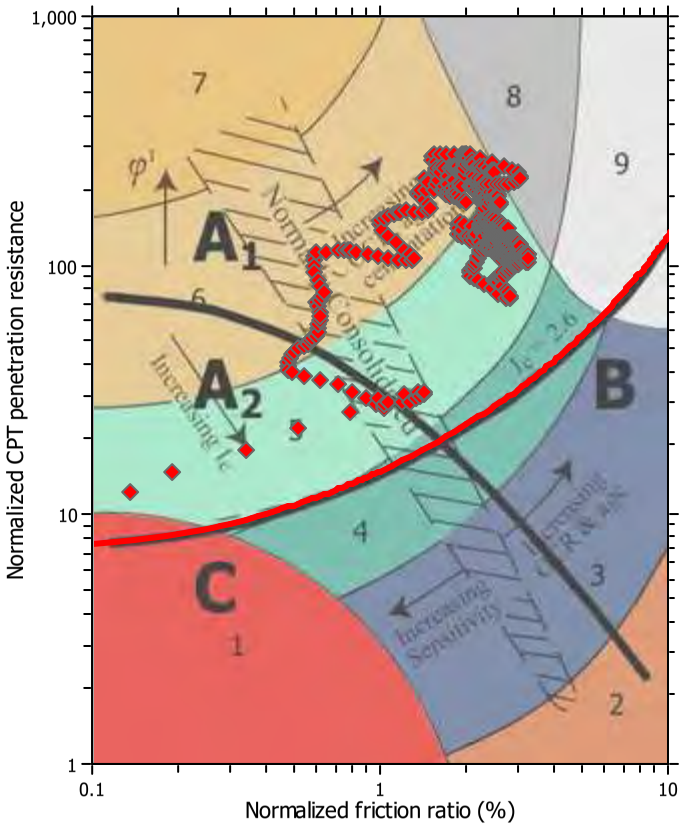
F.S. color scheme

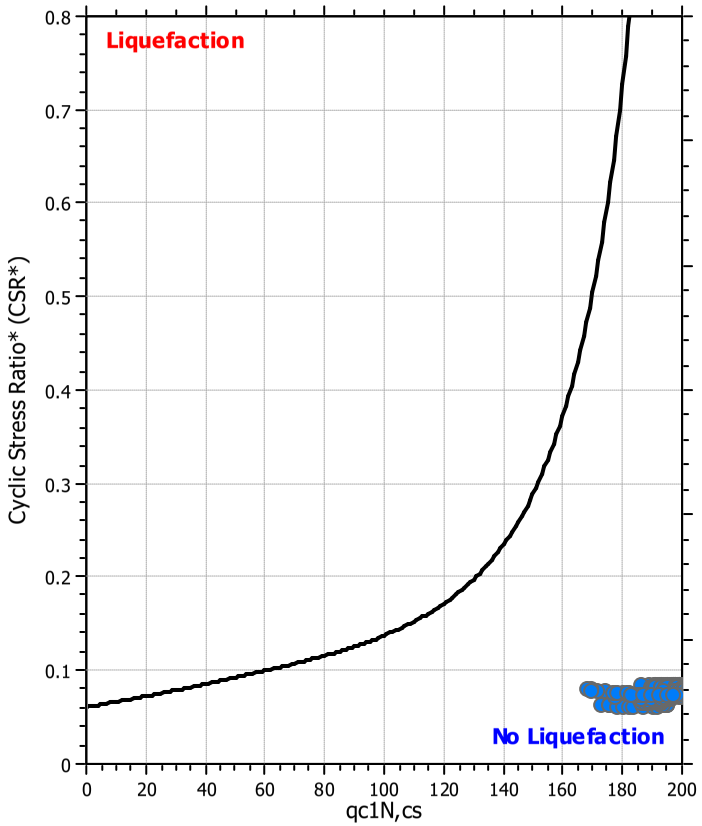
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

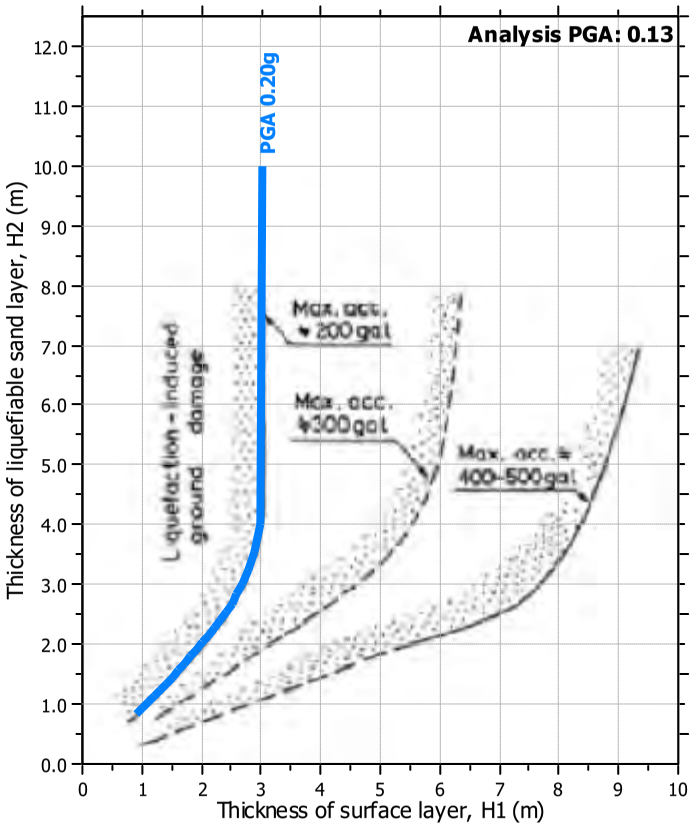
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



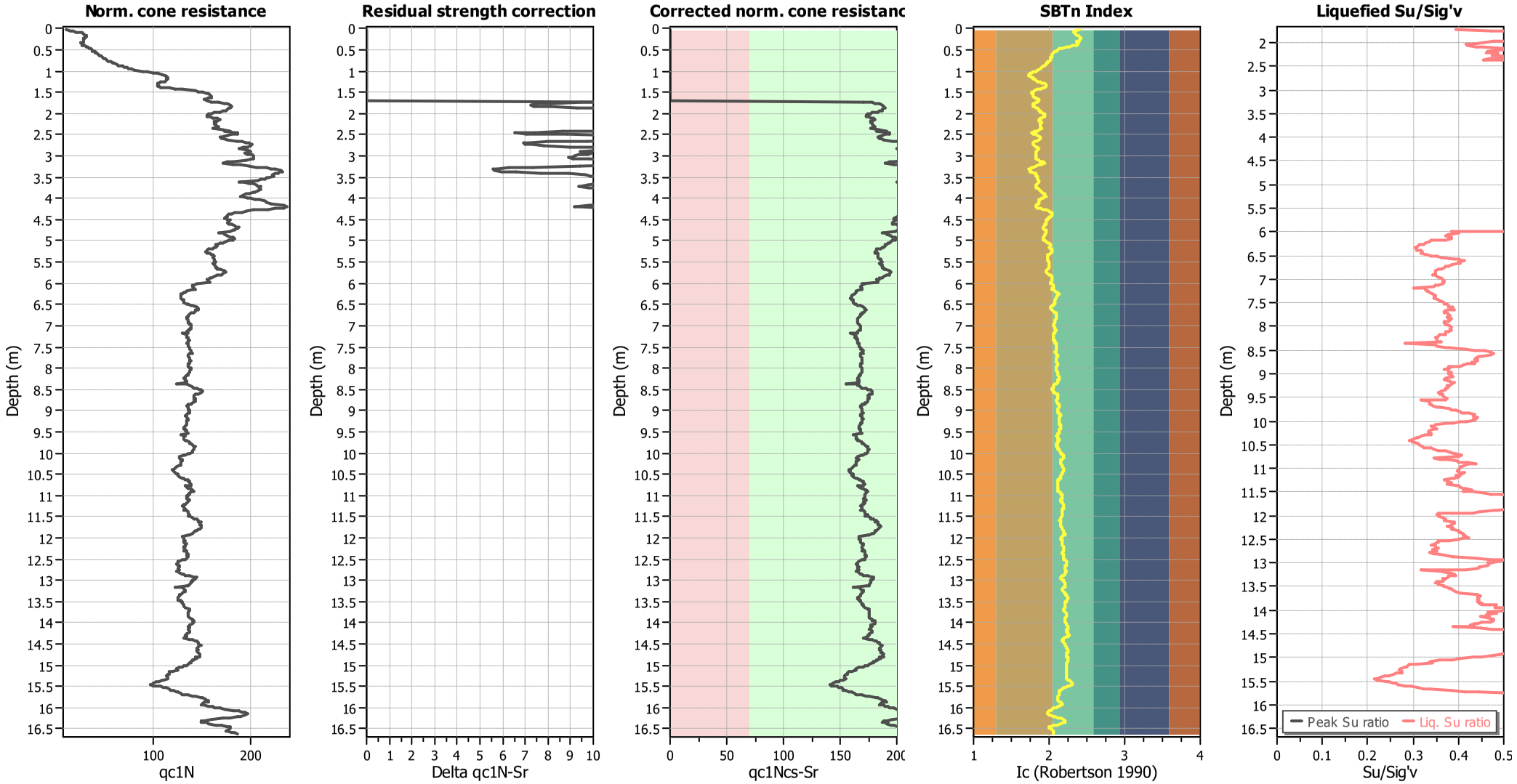




Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

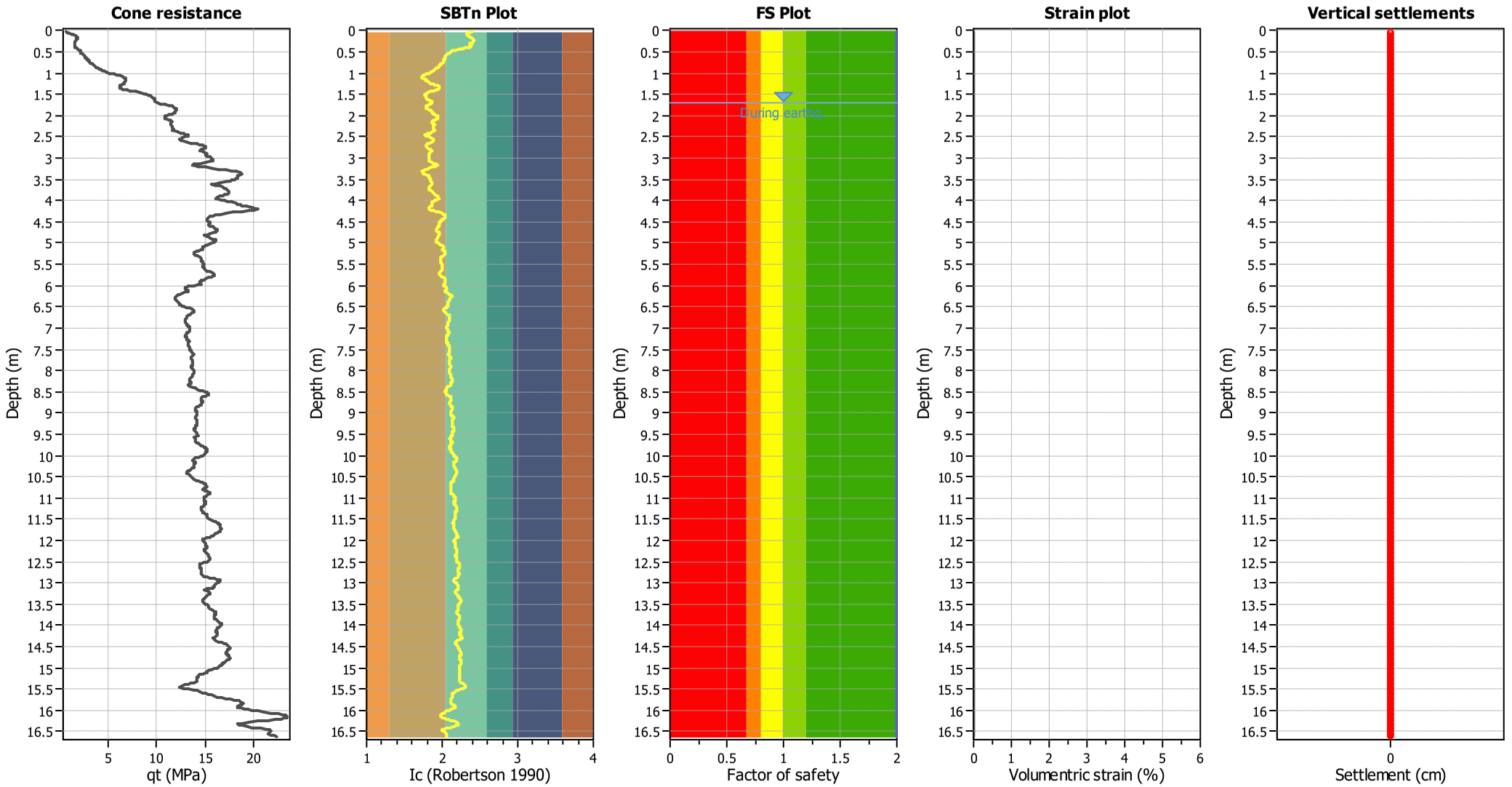
Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

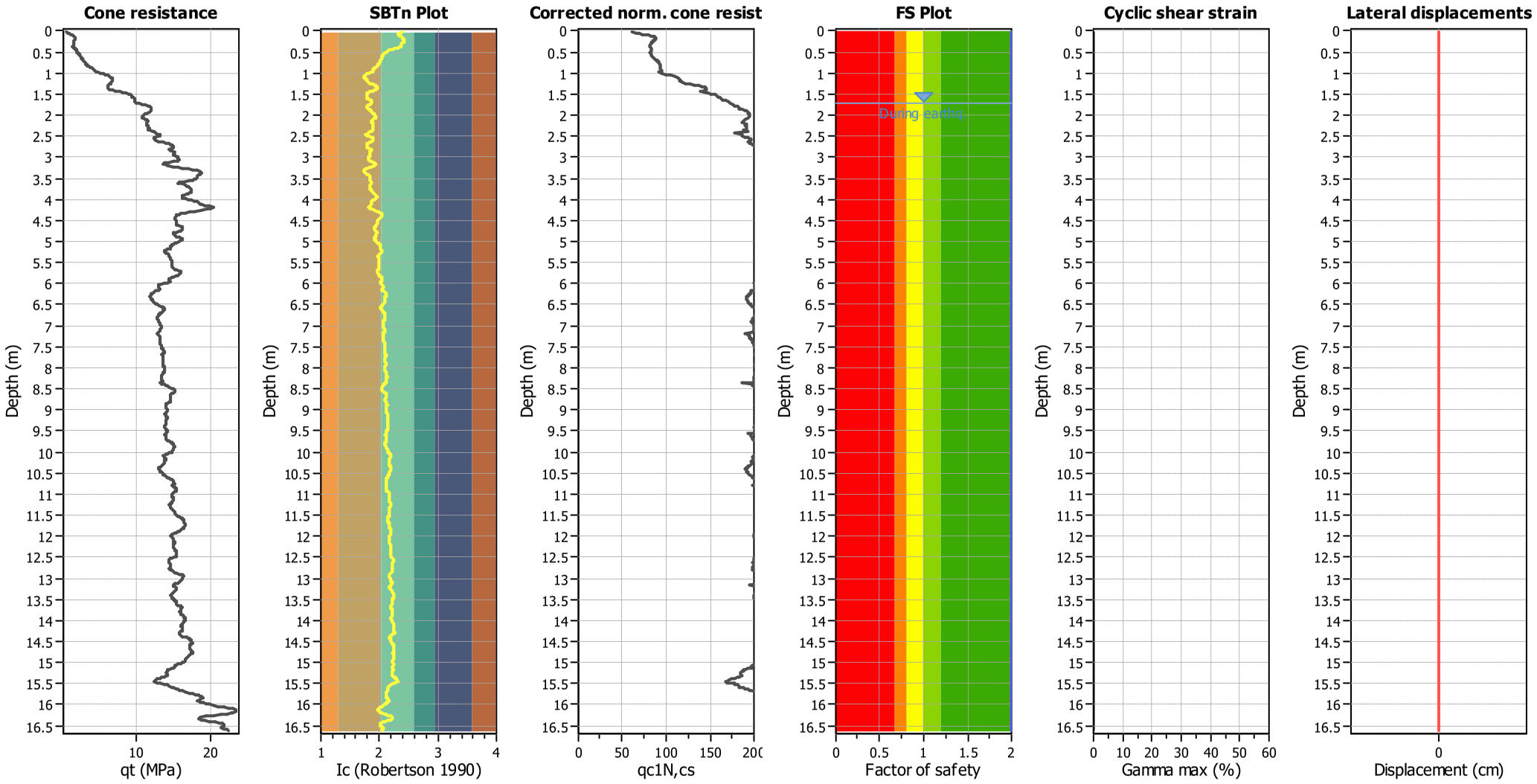
Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

Estimation of post-earthquake lateral Displacements



Abbreviations

q_t: Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c: Soil Behaviour Type Index
$q_{c1N,cs}$: Equivalent clean sand normalized CPT total cone resistance
F.S.: Factor of safety
γ_{max}: Maximum cyclic shear strain
LDI: Lateral displacement index

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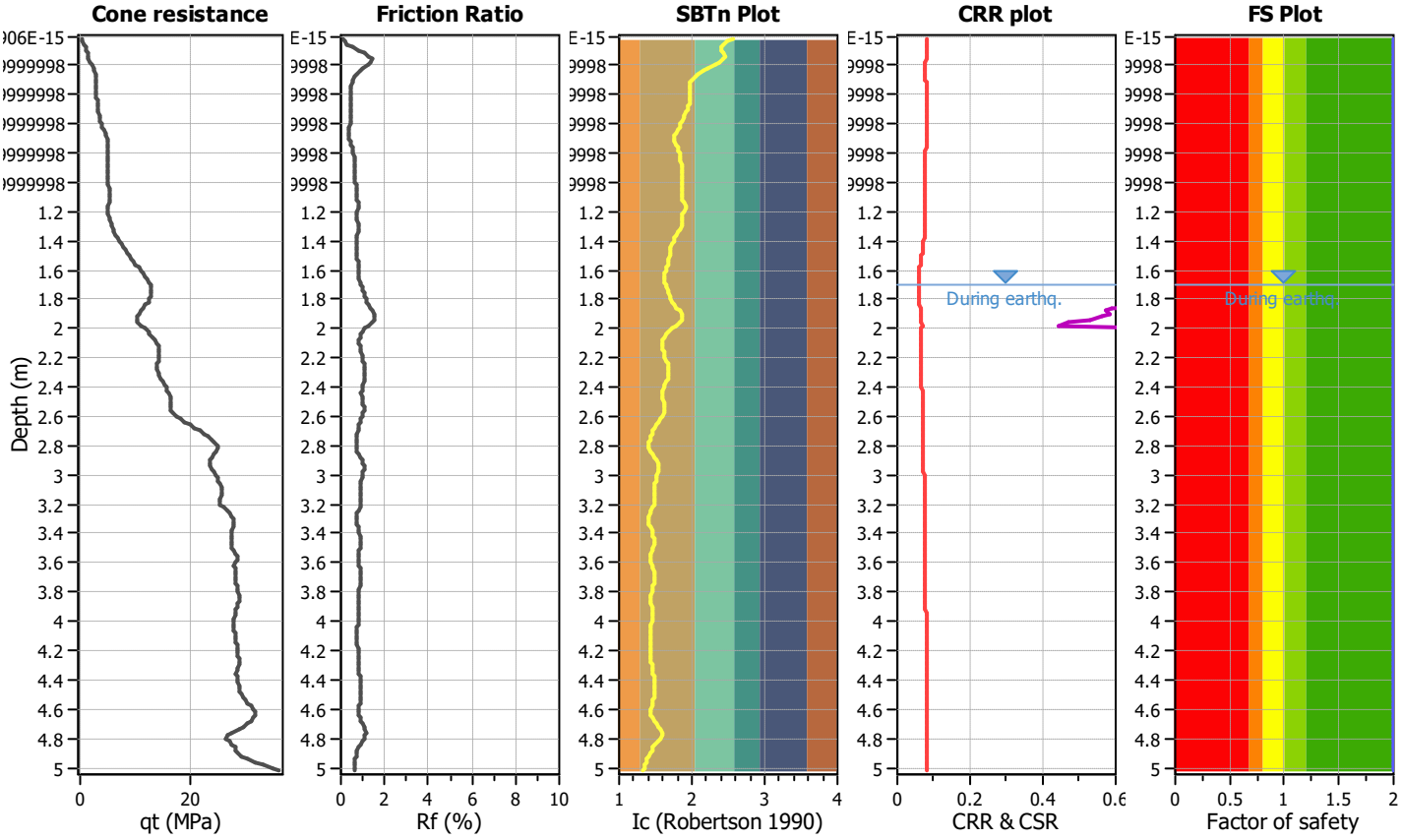
LIQUEFACTION ANALYSIS REPORT

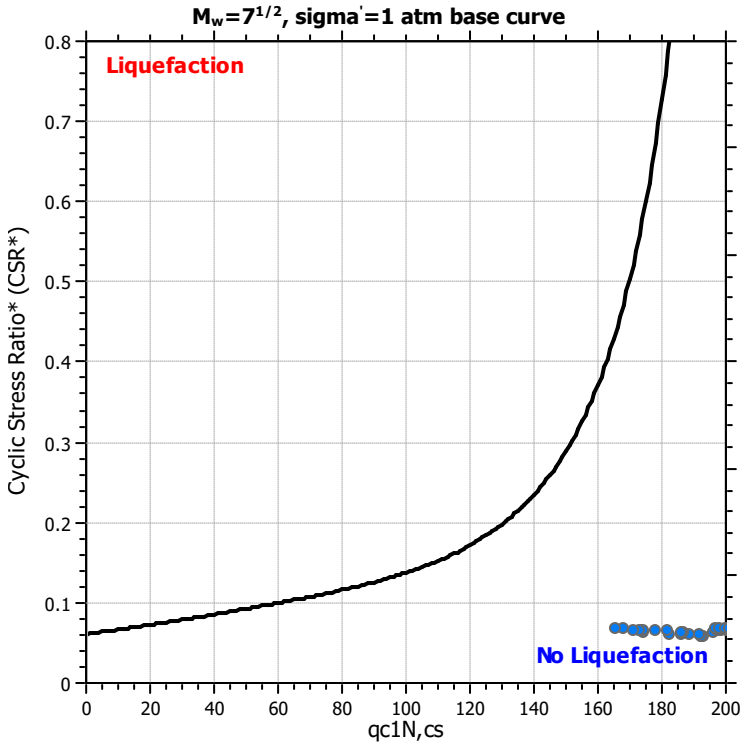
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

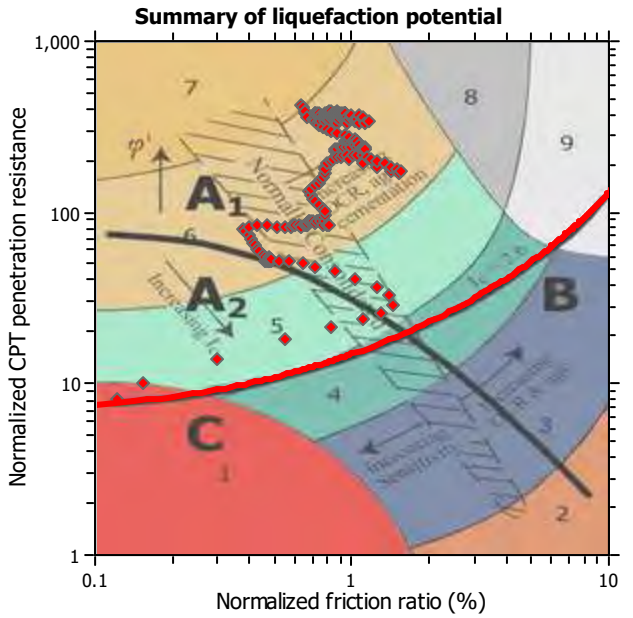
CPT file : CPT06_SLS

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.70 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	6.50	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:	No		

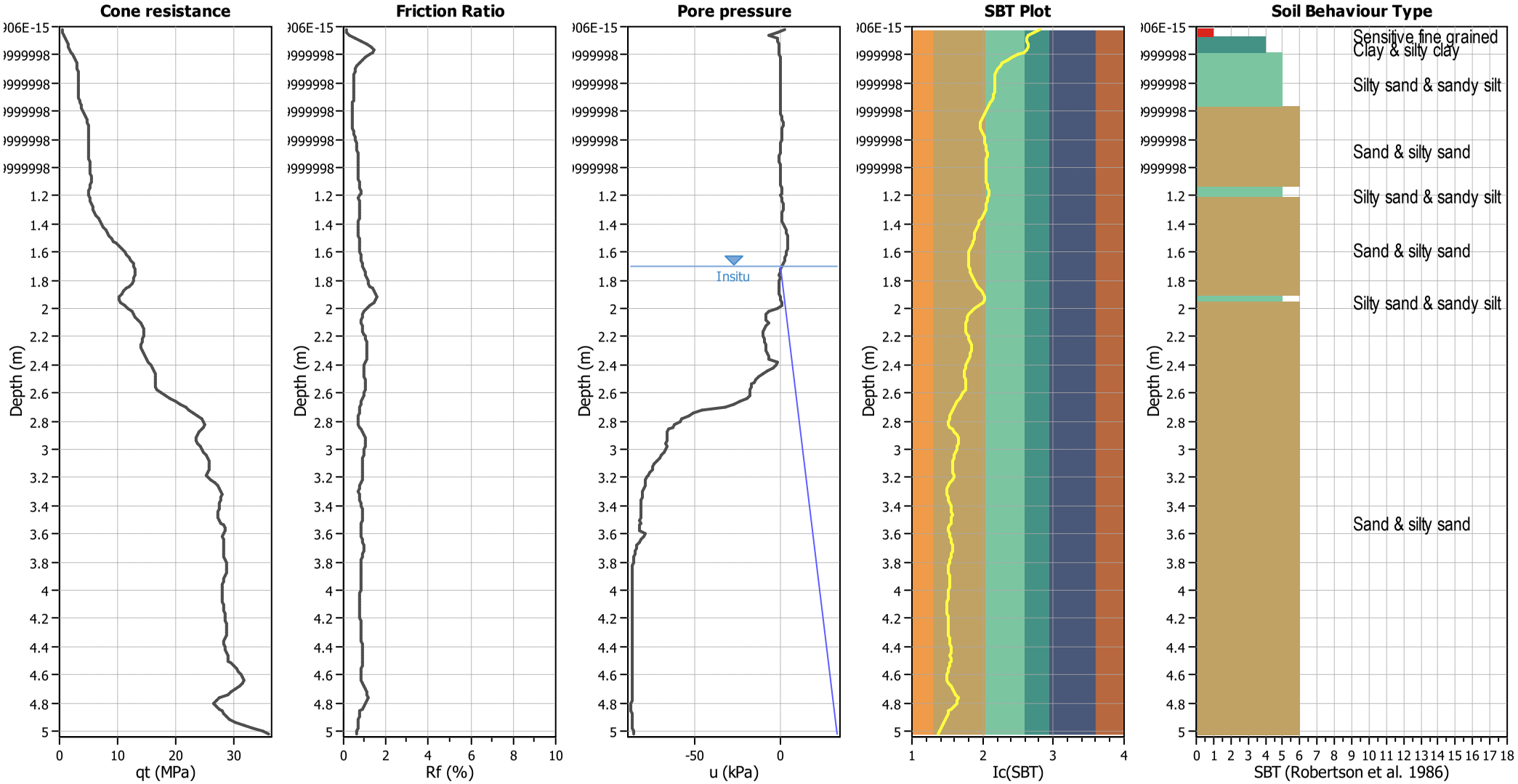






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



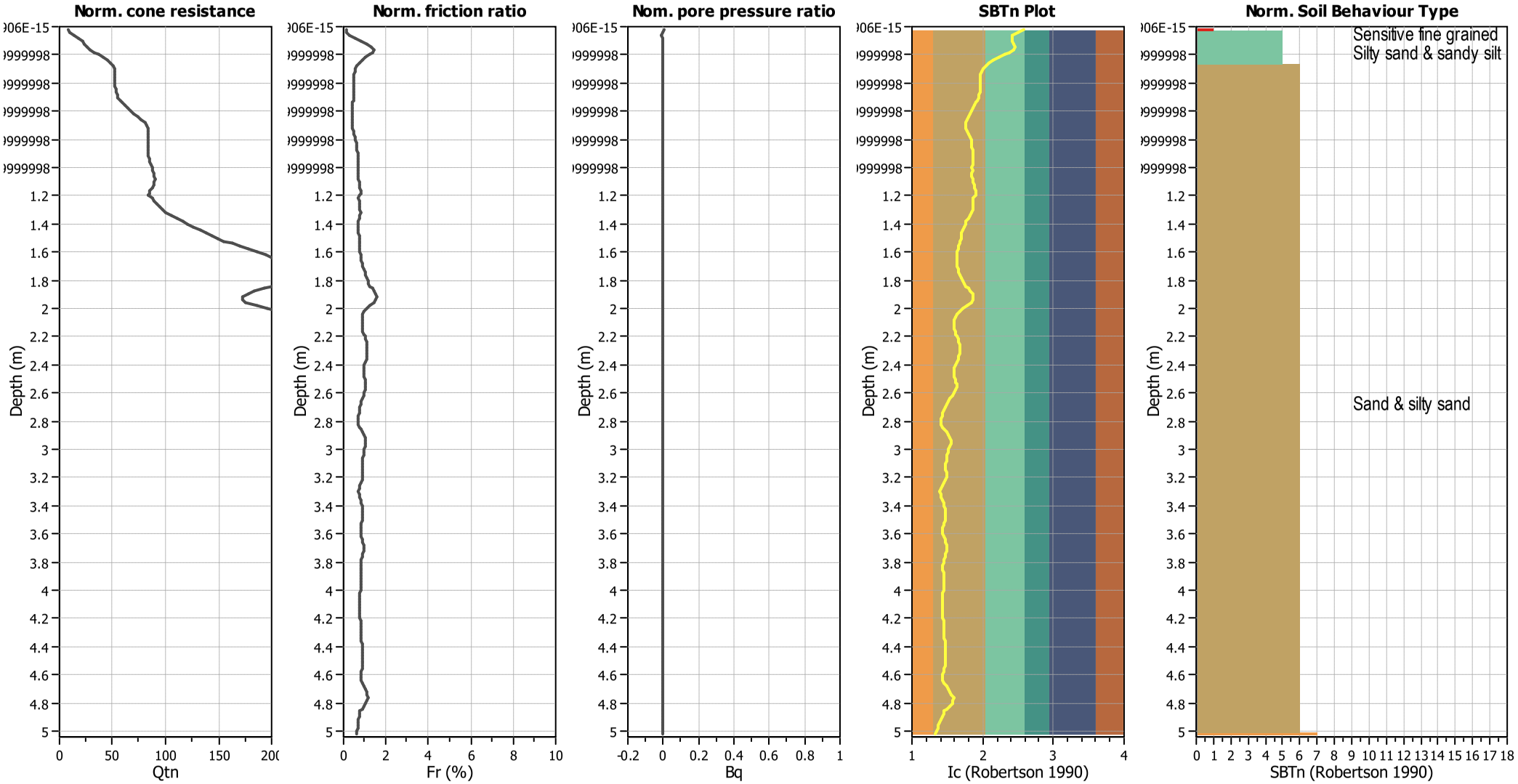
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

CPT basic interpretation plots (normalized)



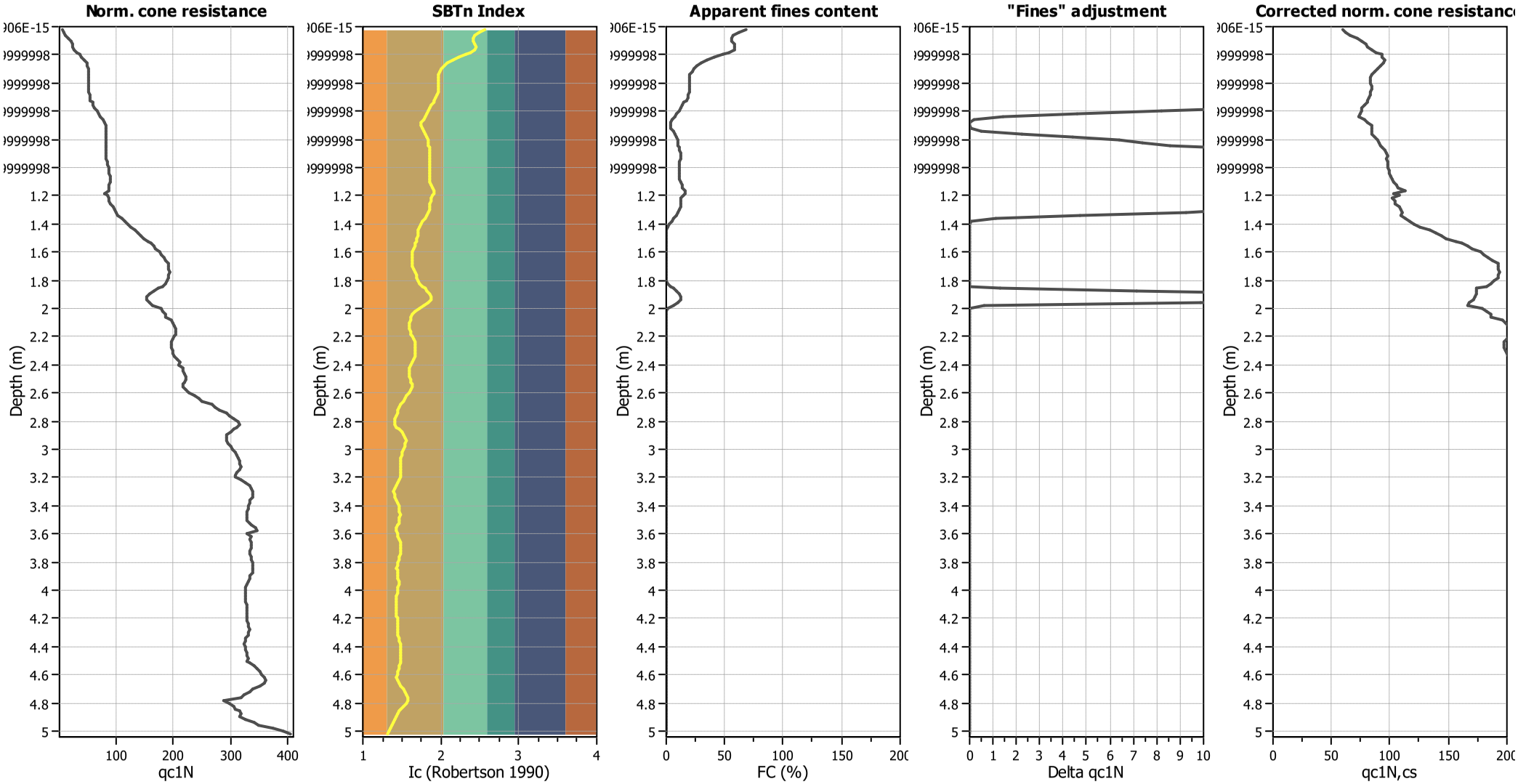
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

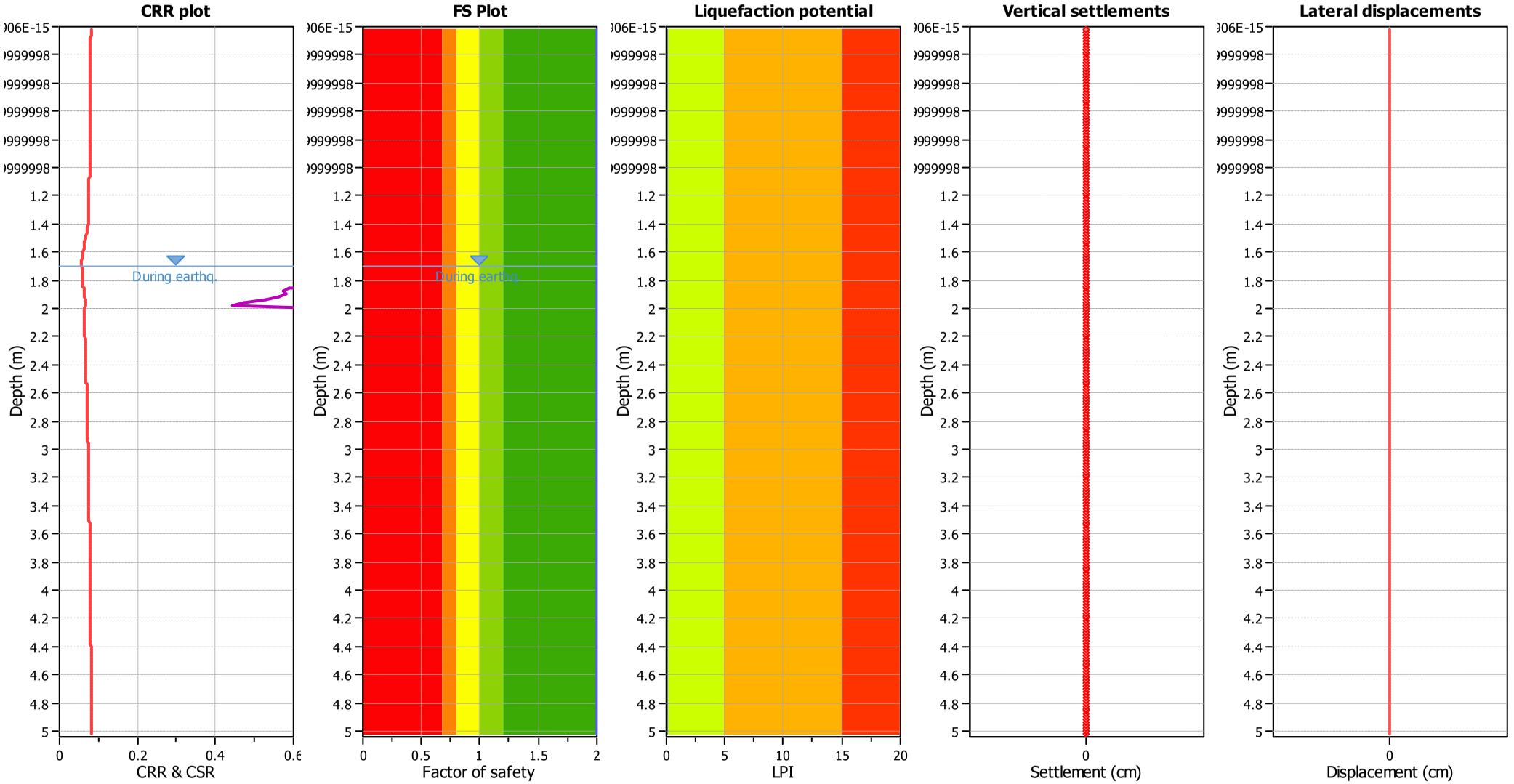
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

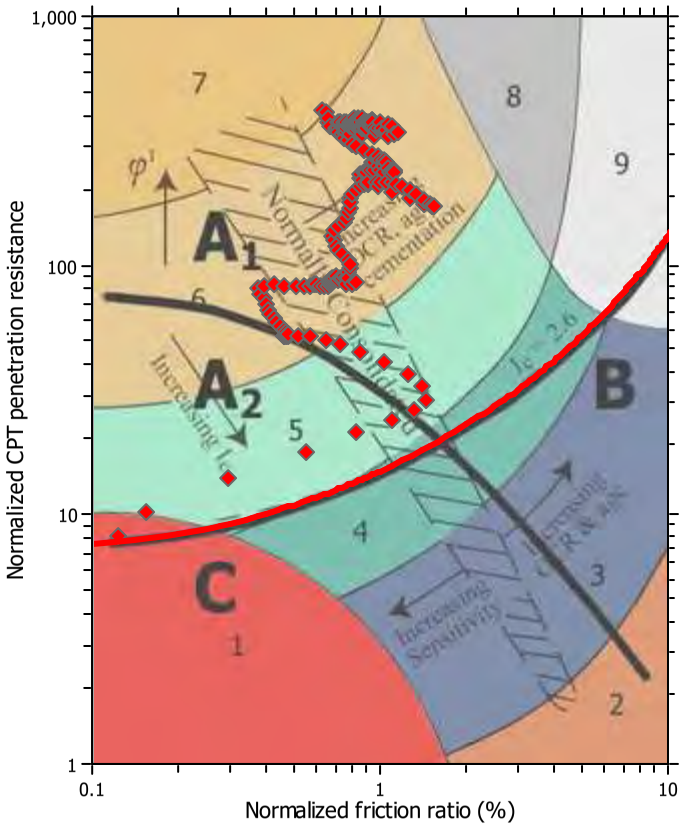
F.S. color scheme

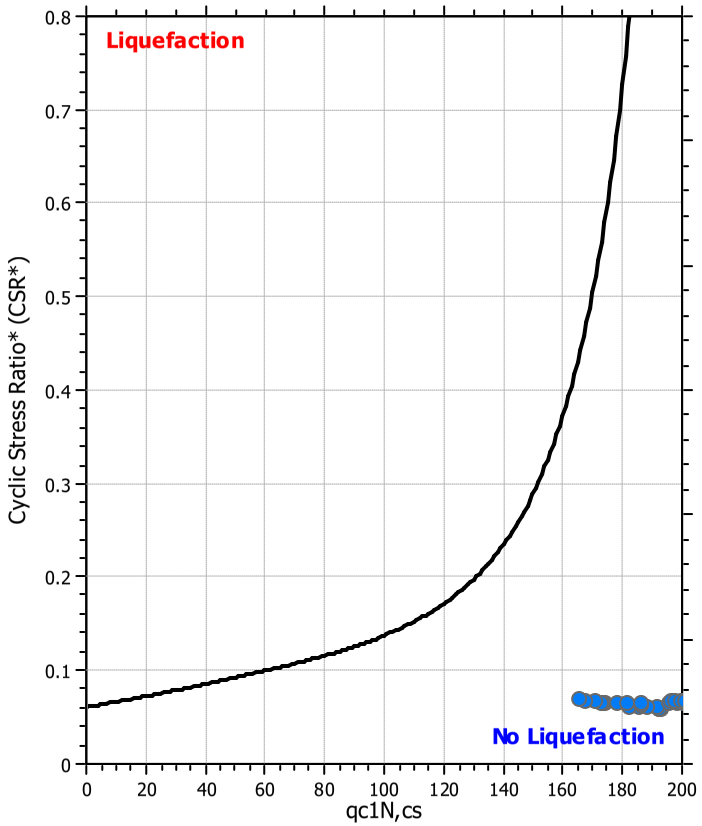
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

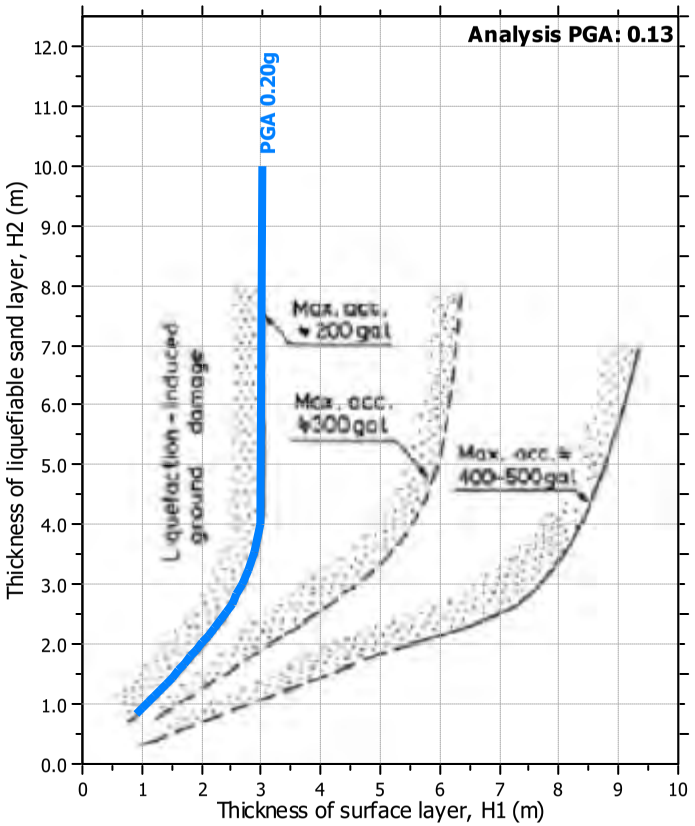
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



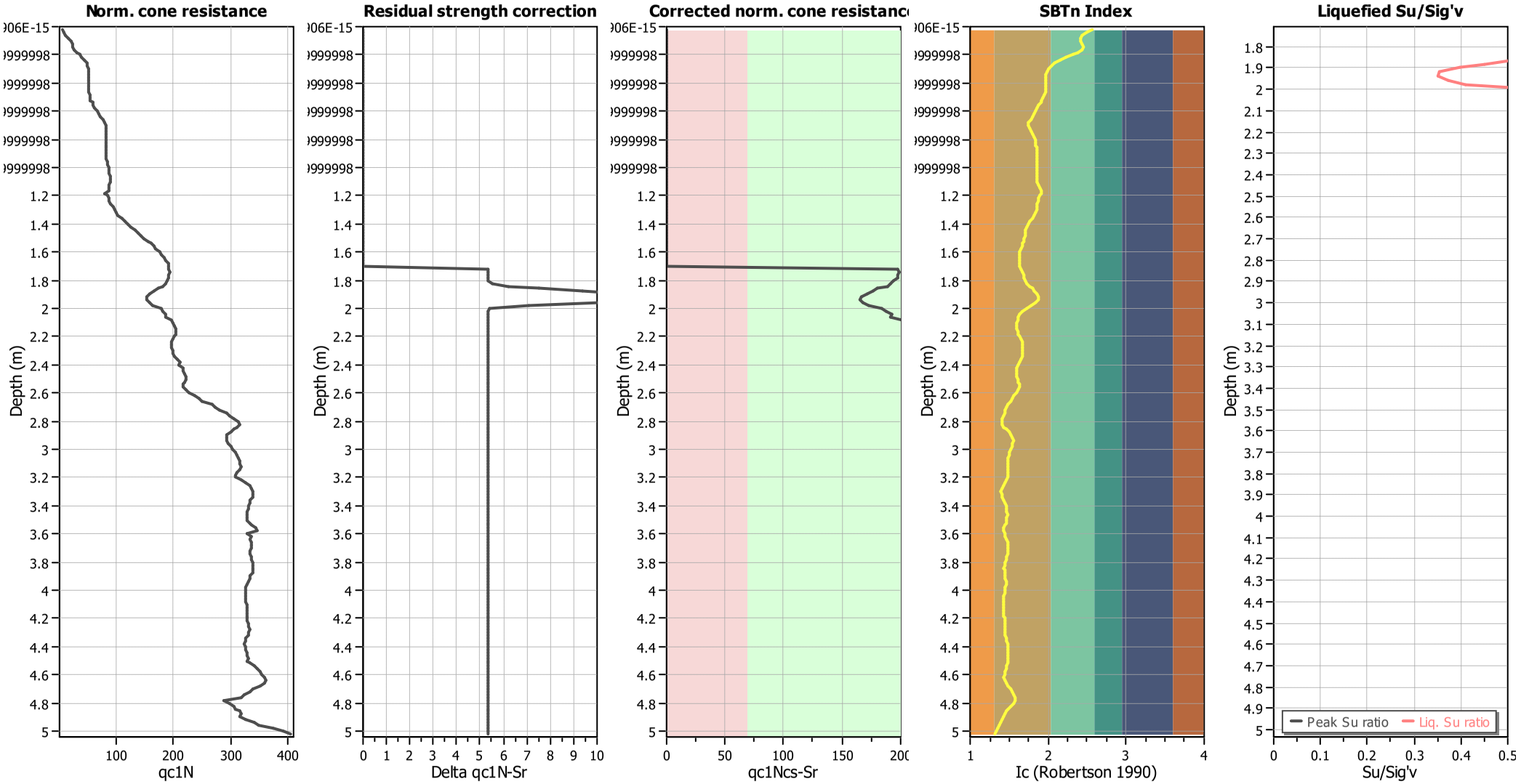




Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

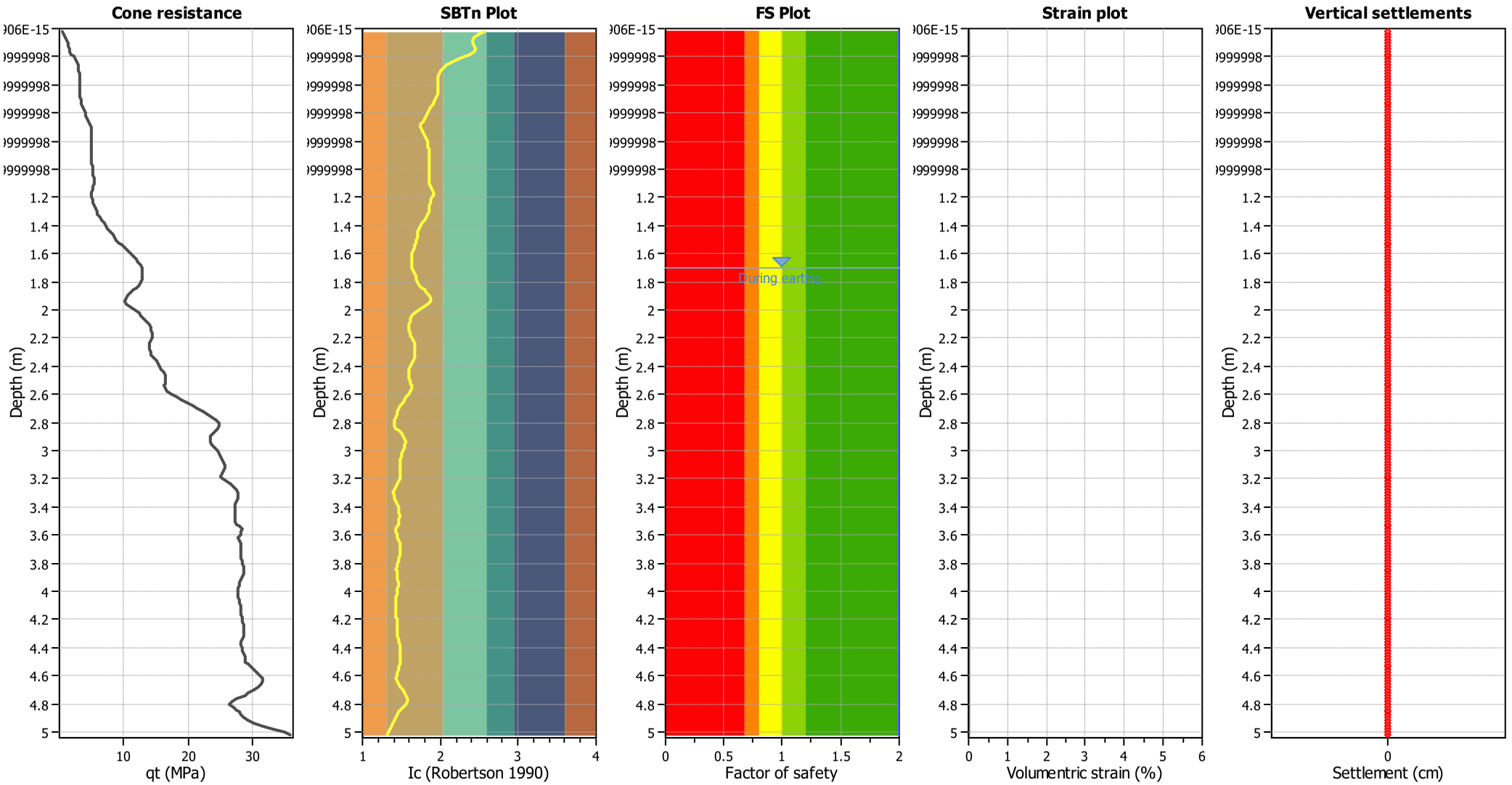
Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

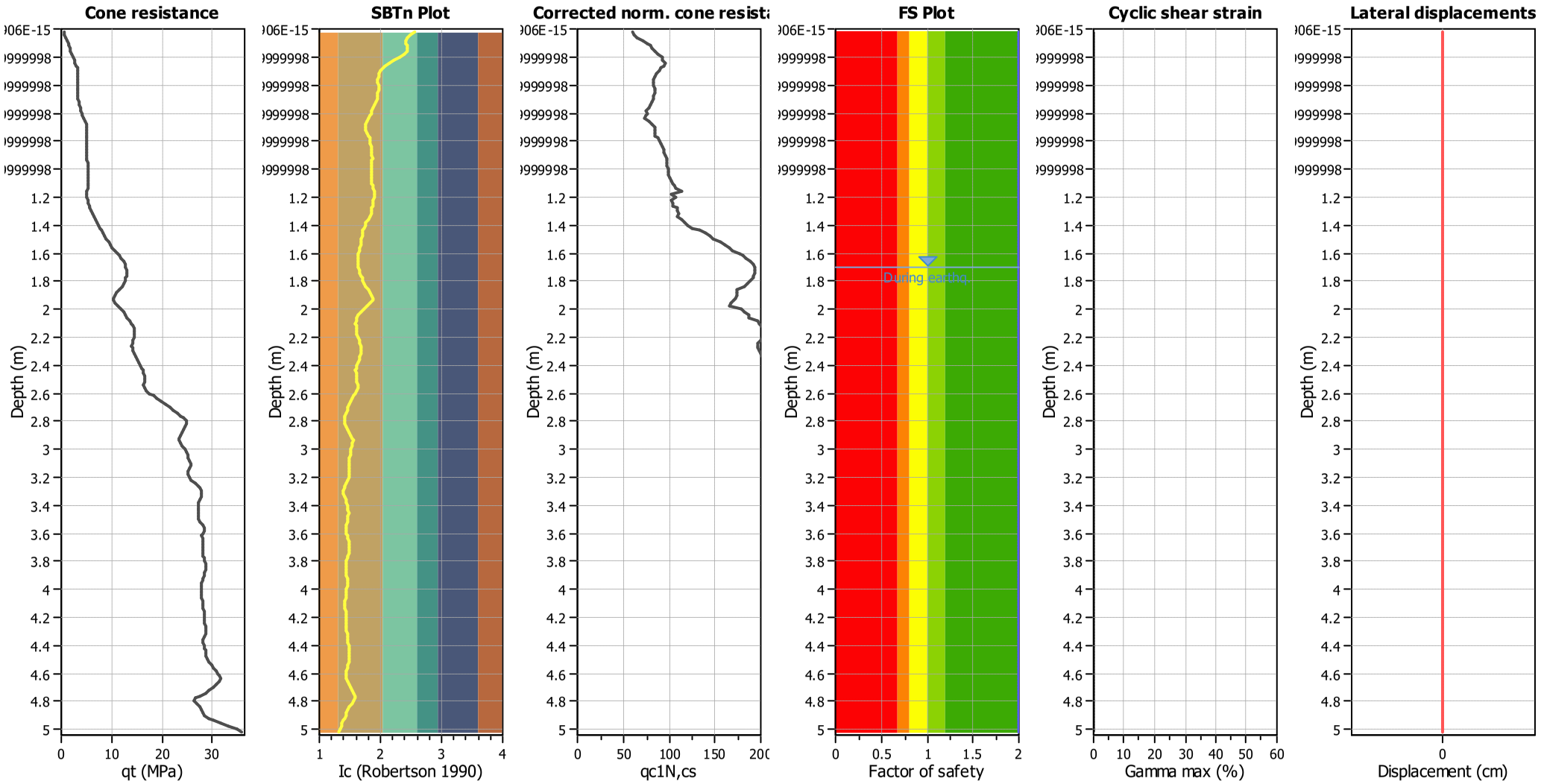
Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

Estimation of post-earthquake lateral Displacements



Abbreviations

q_t: Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c: Soil Behaviour Type Index
$q_{c1N,cs}$: Equivalent clean sand normalized CPT total cone resistance
F.S.: Factor of safety
γ_{max}: Maximum cyclic shear strain
LDI: Lateral displacement index

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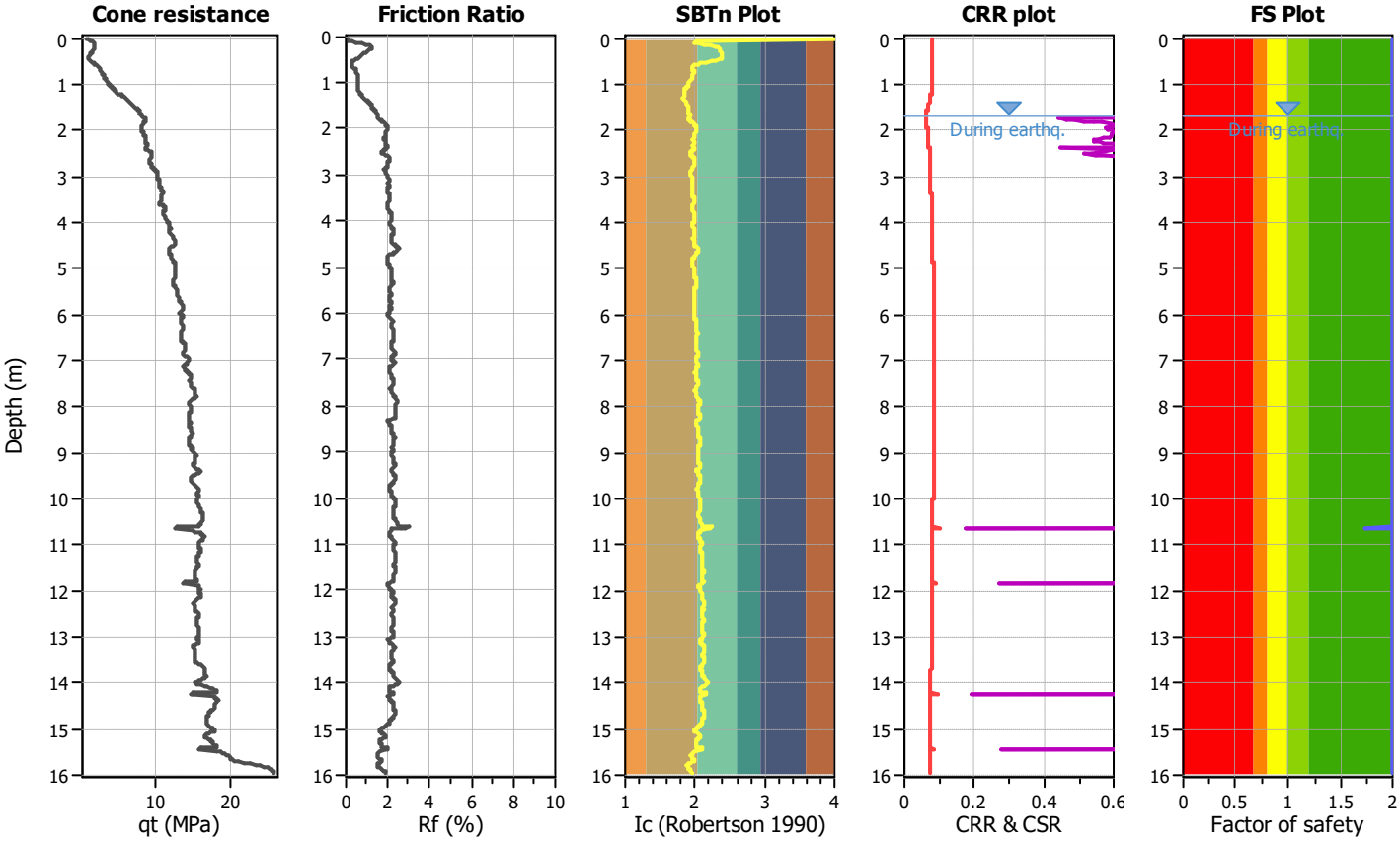
LIQUEFACTION ANALYSIS REPORT

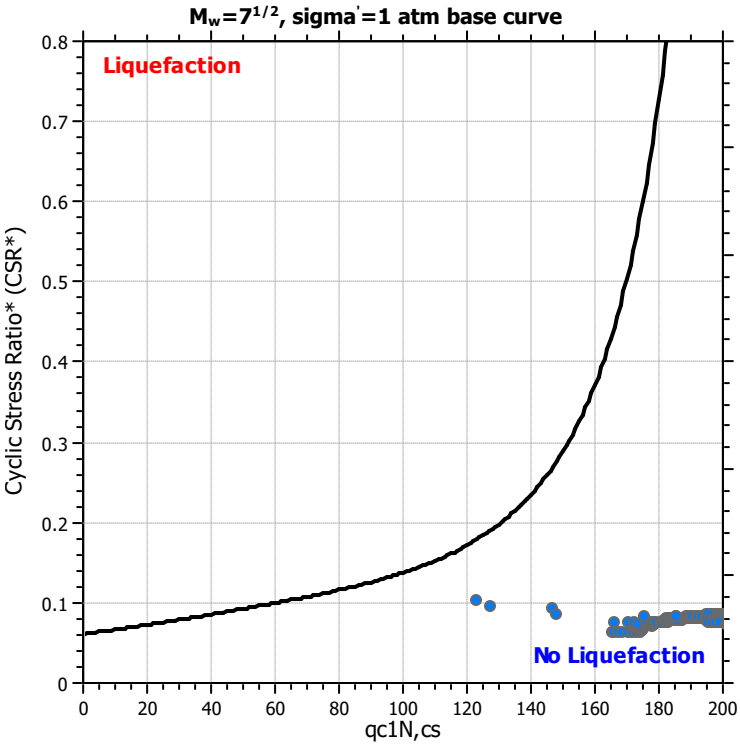
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

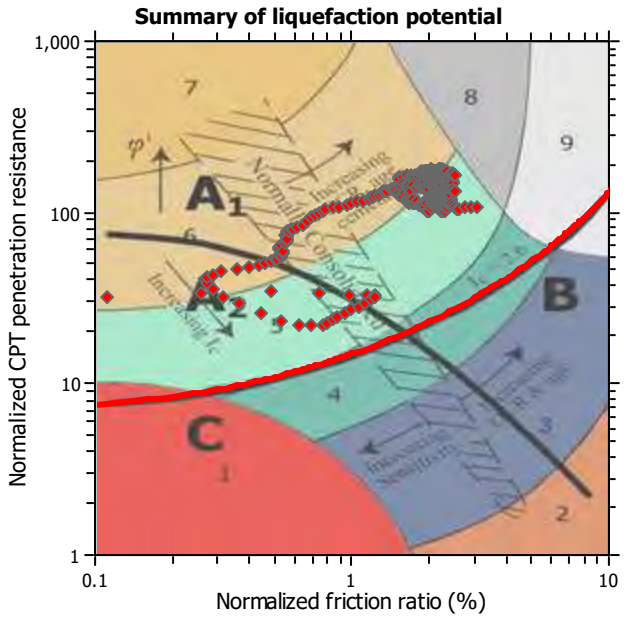
CPT file : CPT07_SLS

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.70 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	6.50	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:	No		

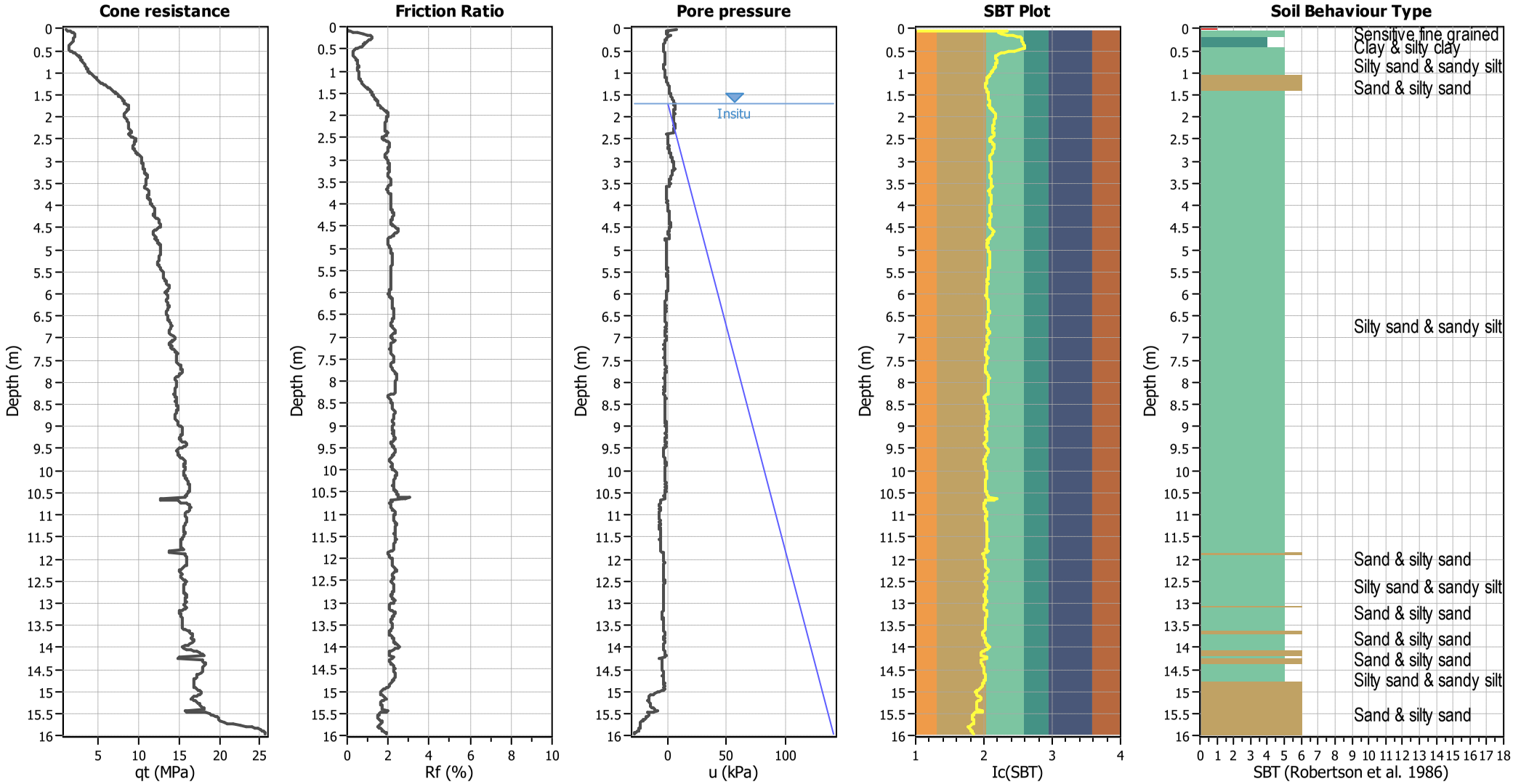






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



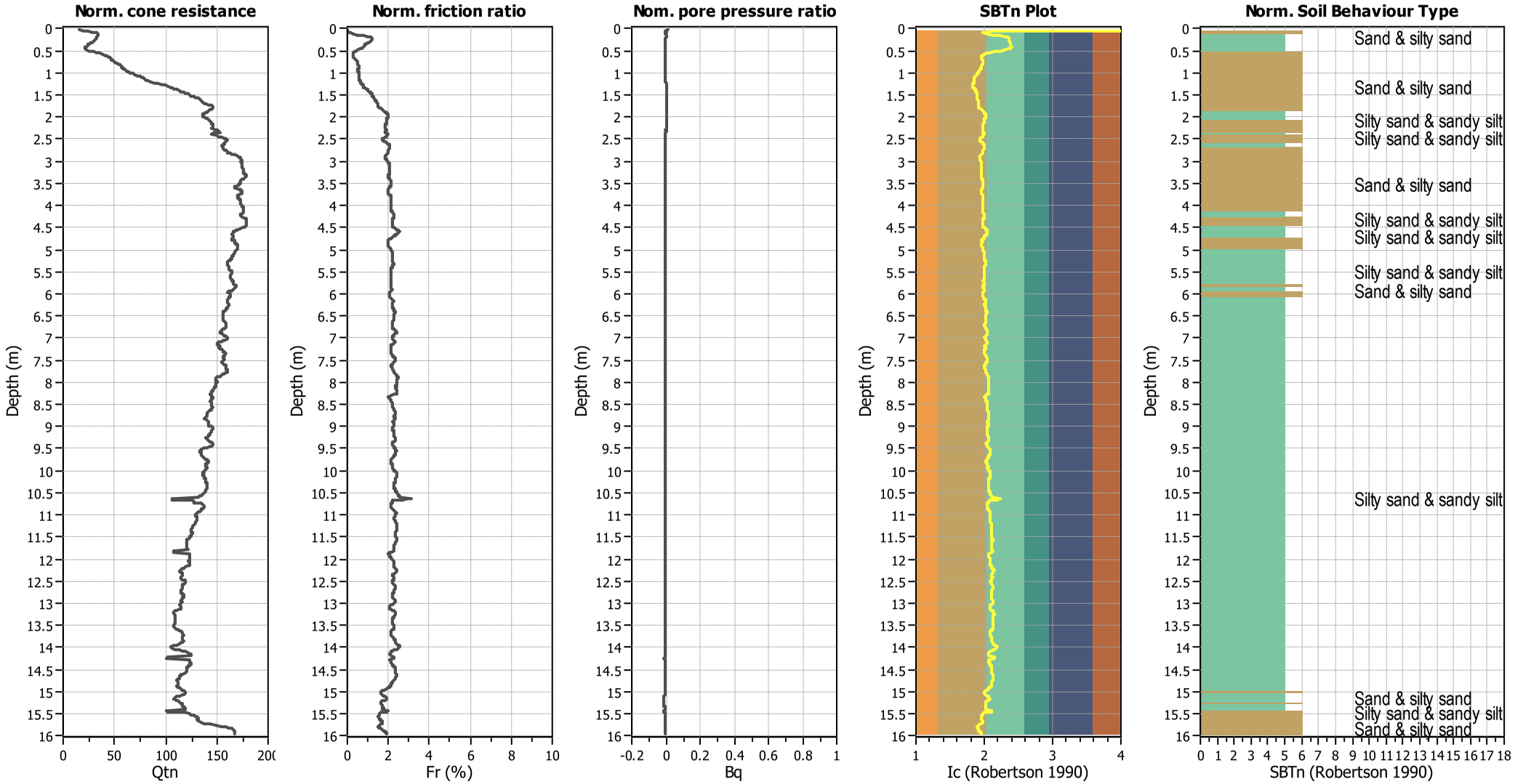
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

CPT basic interpretation plots (normalized)



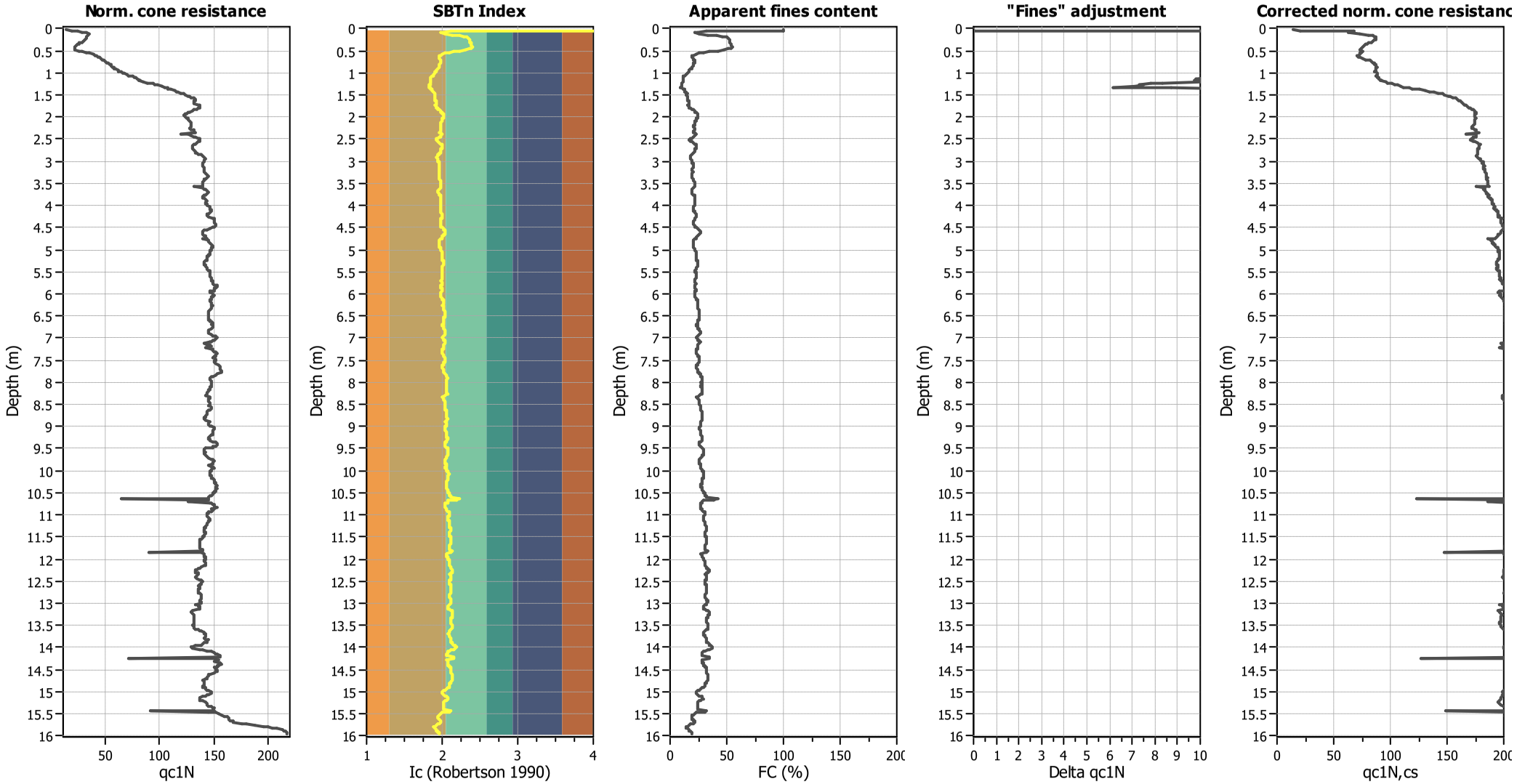
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

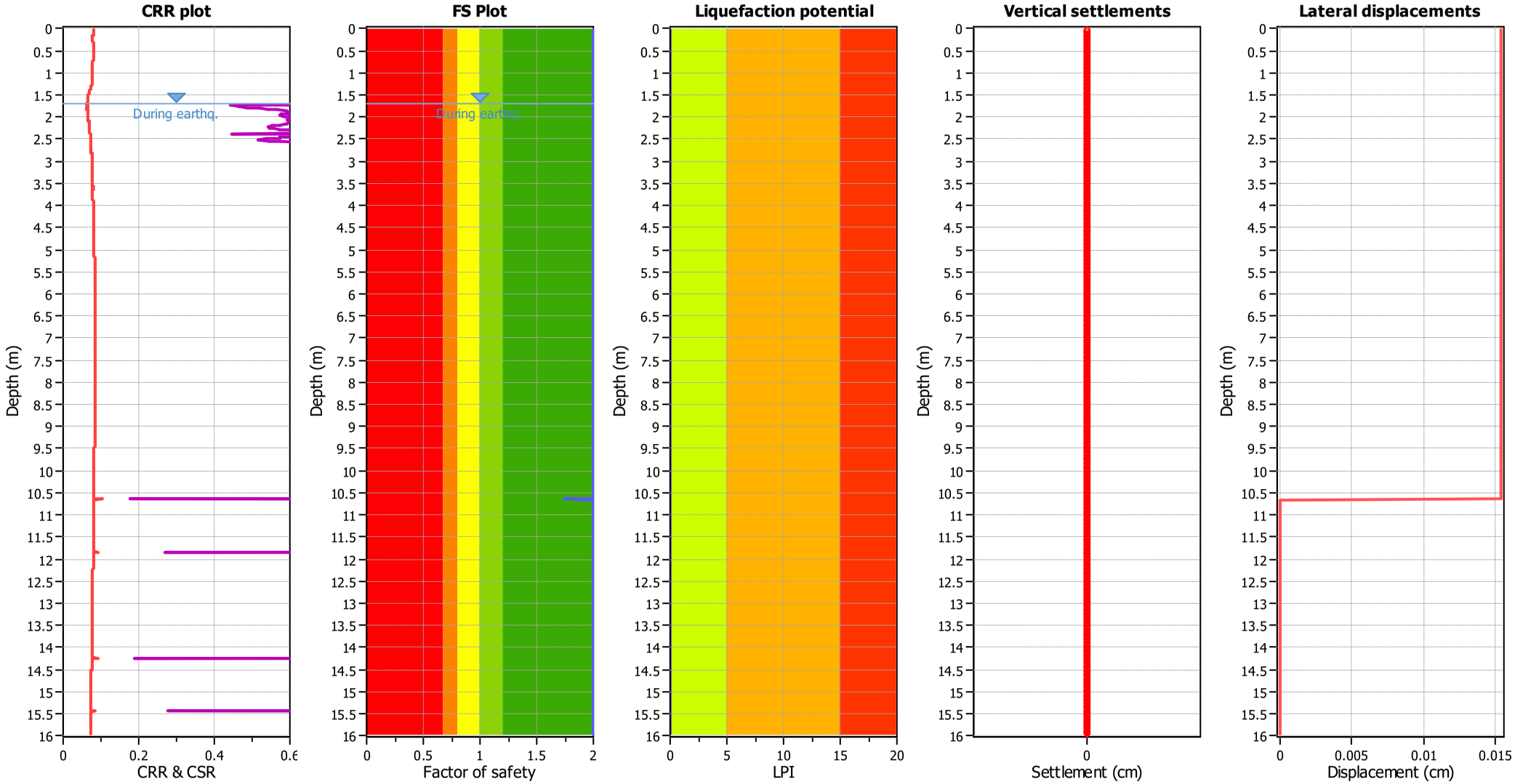
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

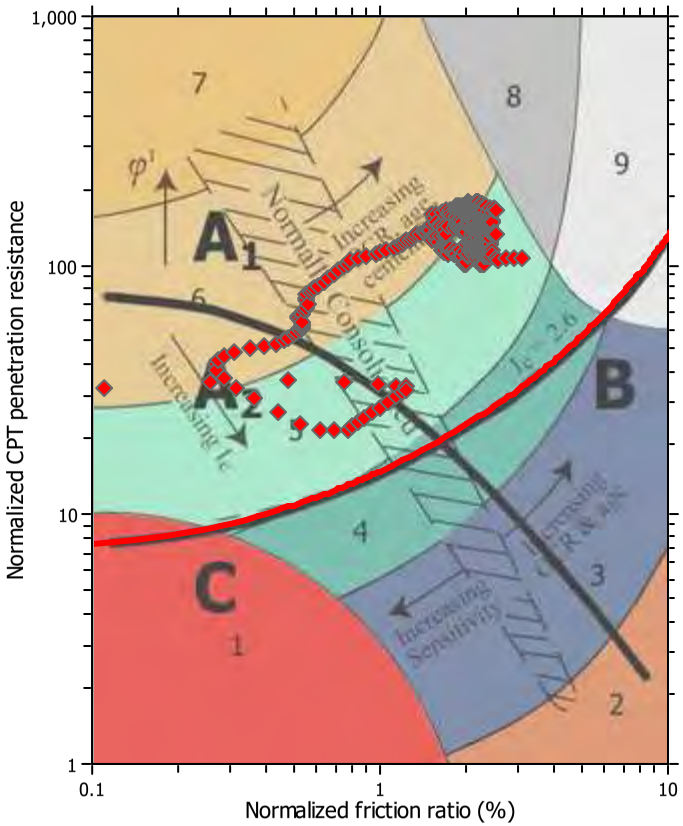
F.S. color scheme

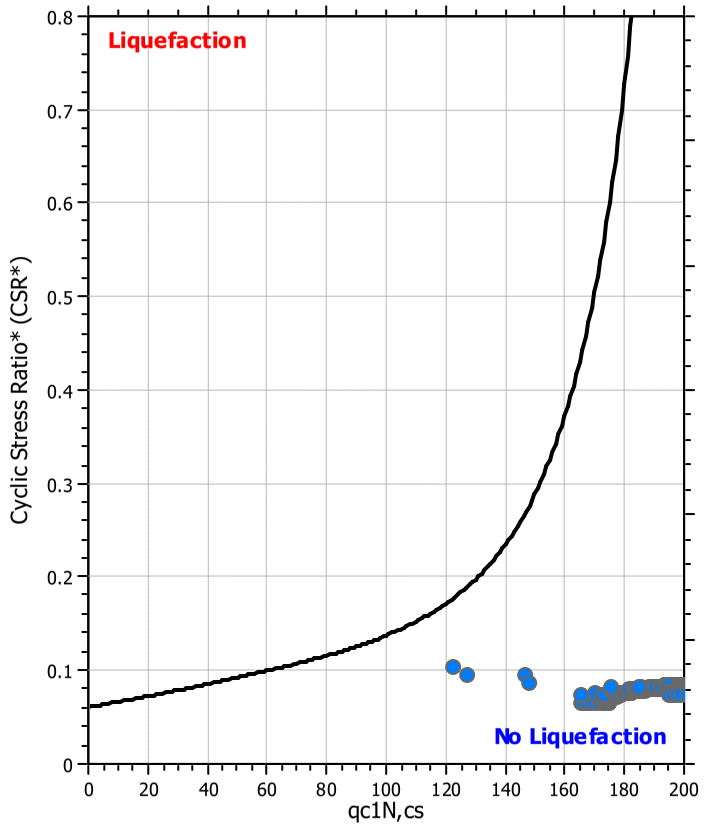
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

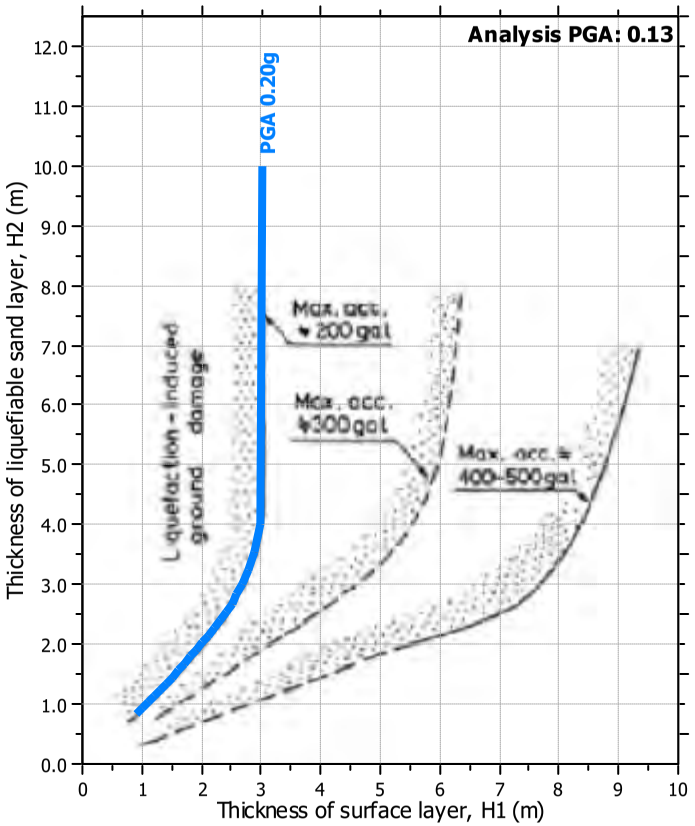
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



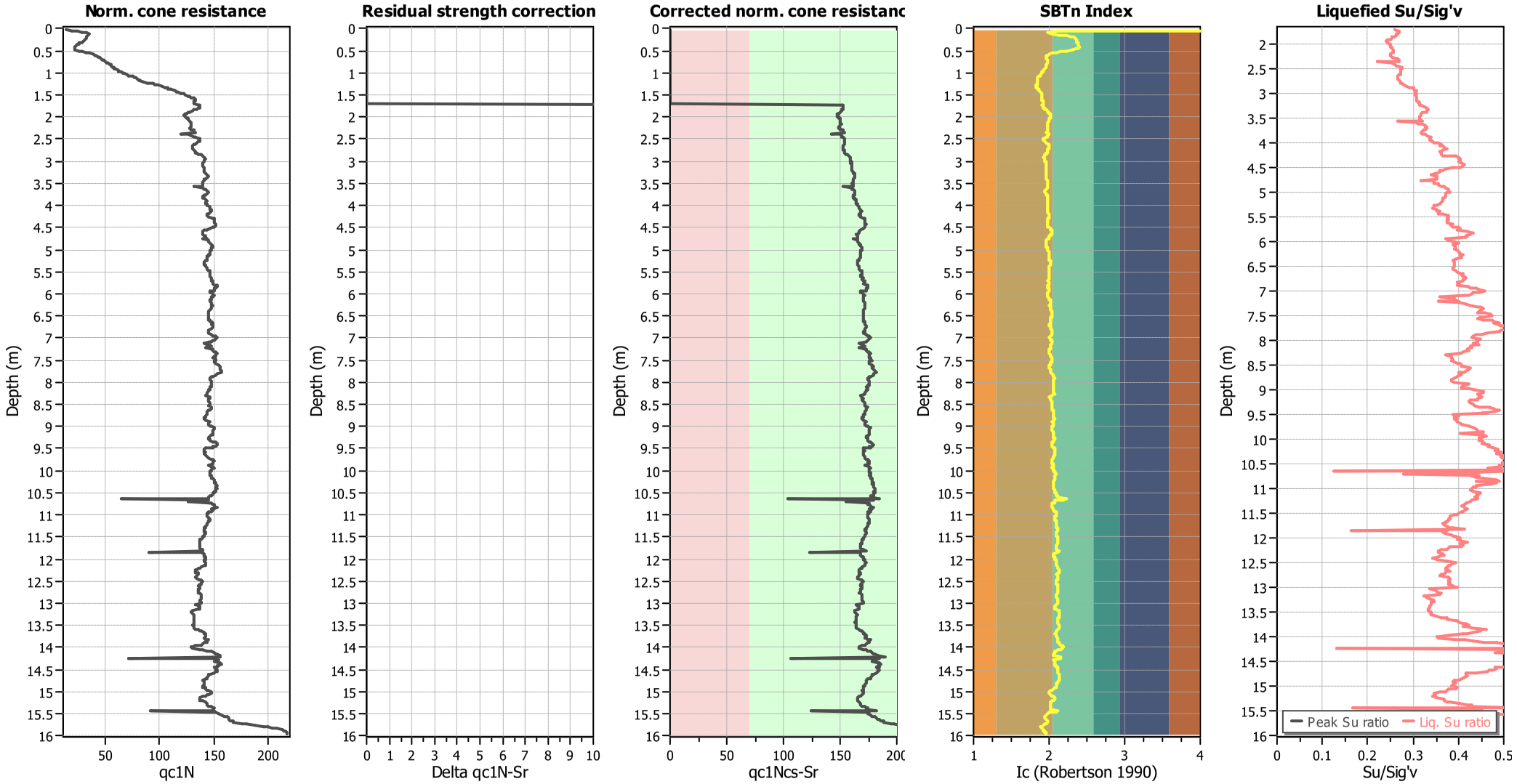




Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

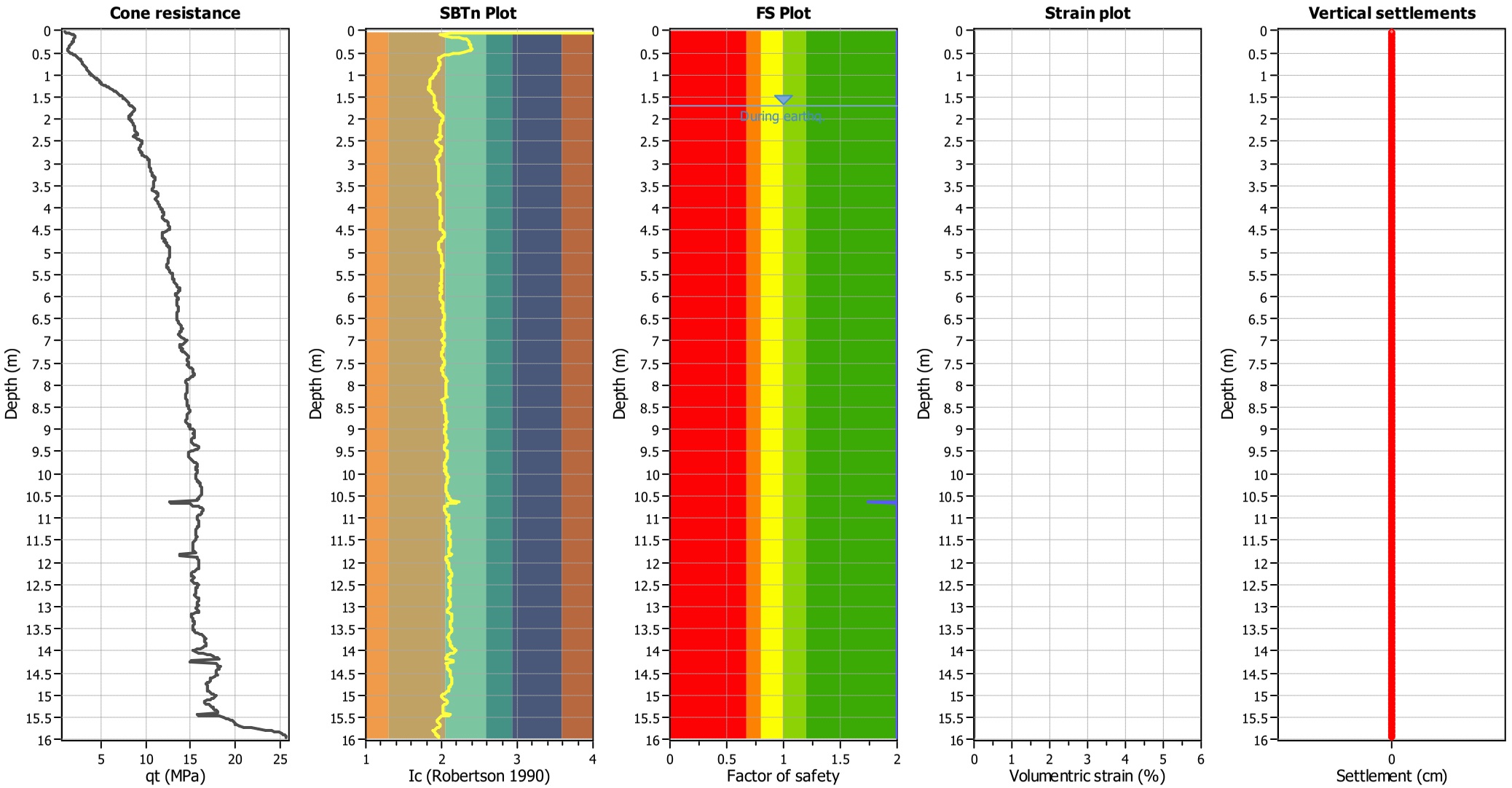
Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

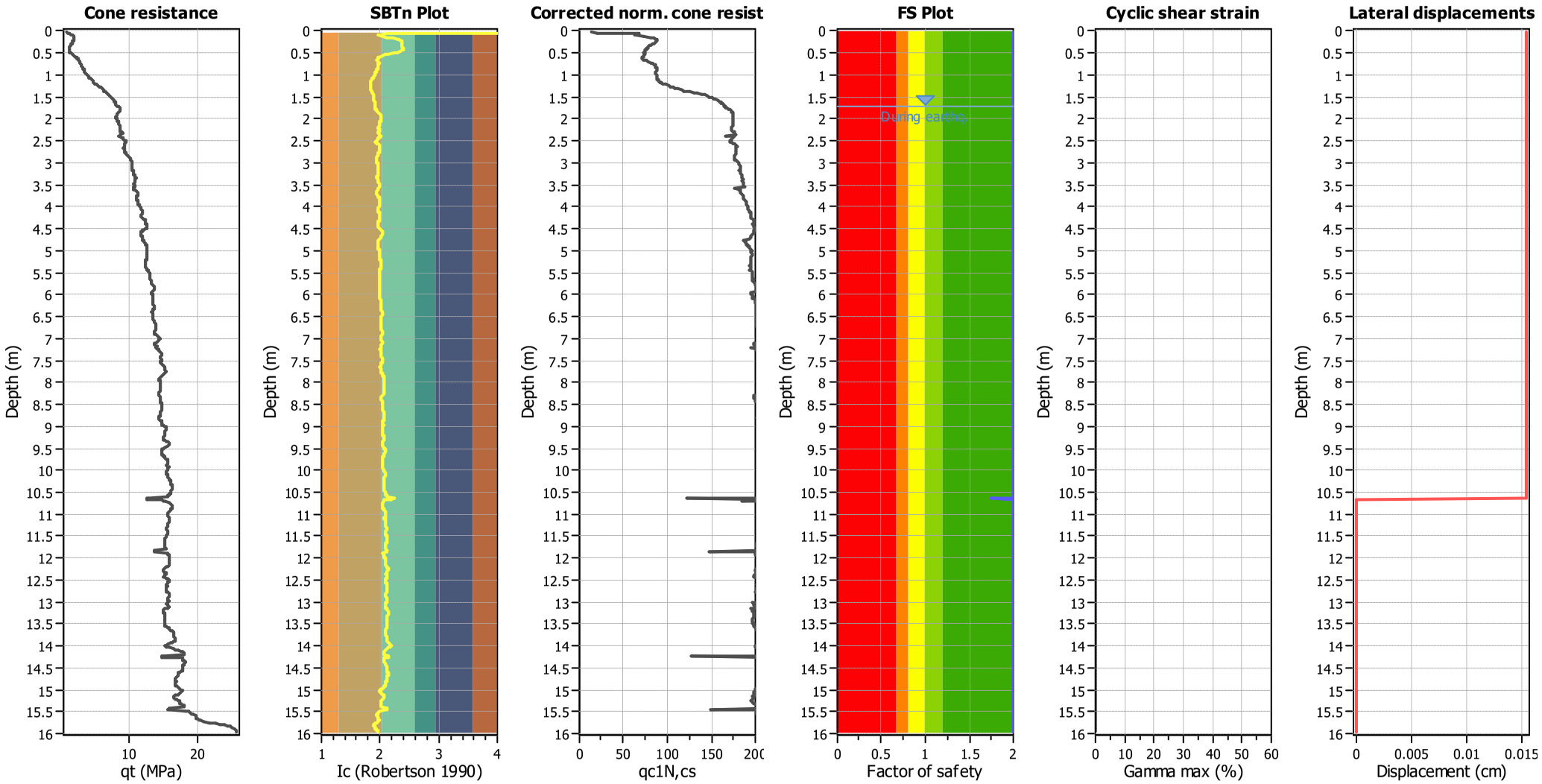
Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

Estimation of post-earthquake lateral Displacements



Abbreviations

q_t: Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c: Soil Behaviour Type Index
$q_{c1N,cs}$: Equivalent clean sand normalized CPT total cone resistance
F.S.: Factor of safety
γ_{max}: Maximum cyclic shear strain
LDI: Lateral displacement index

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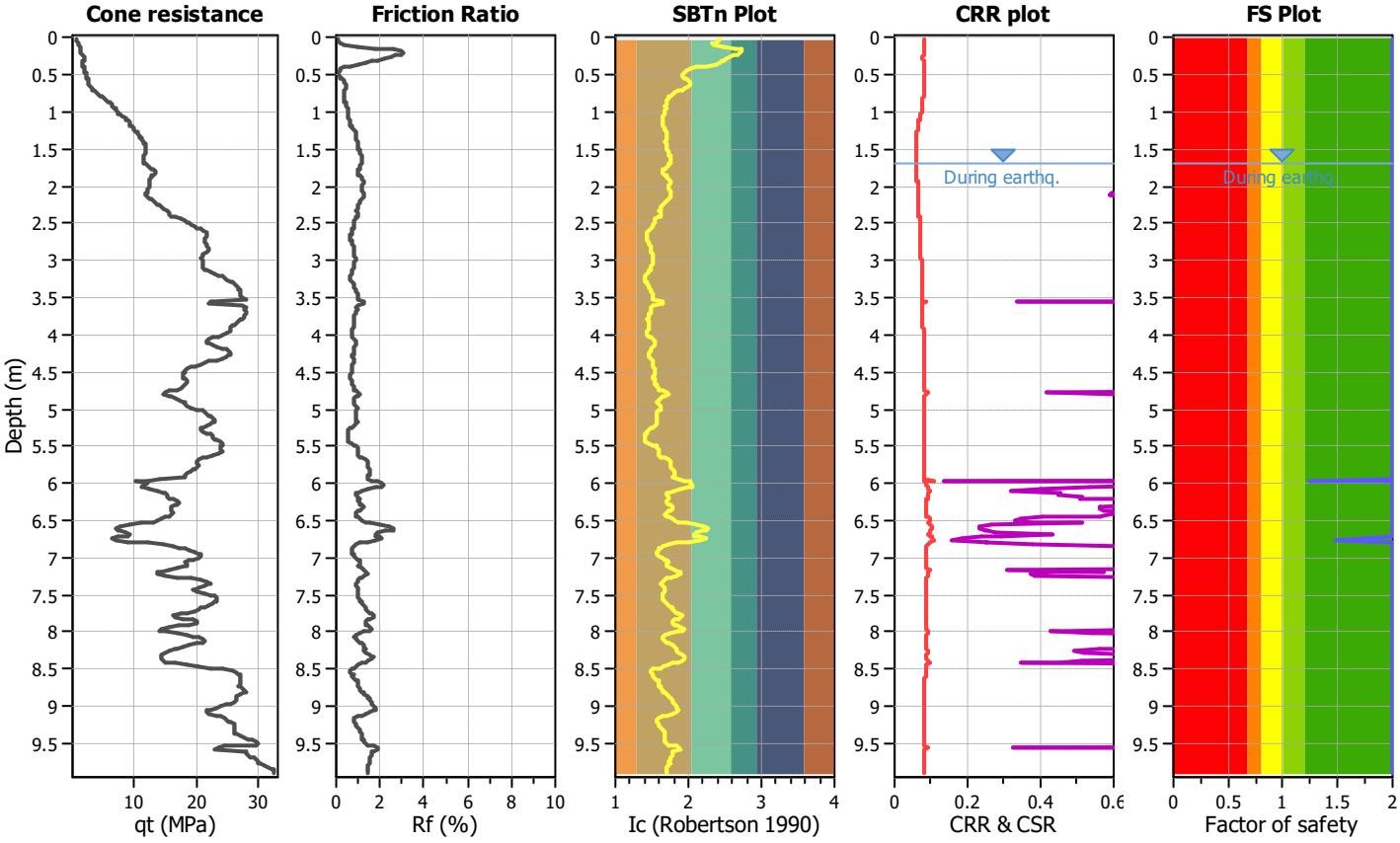
LIQUEFACTION ANALYSIS REPORT

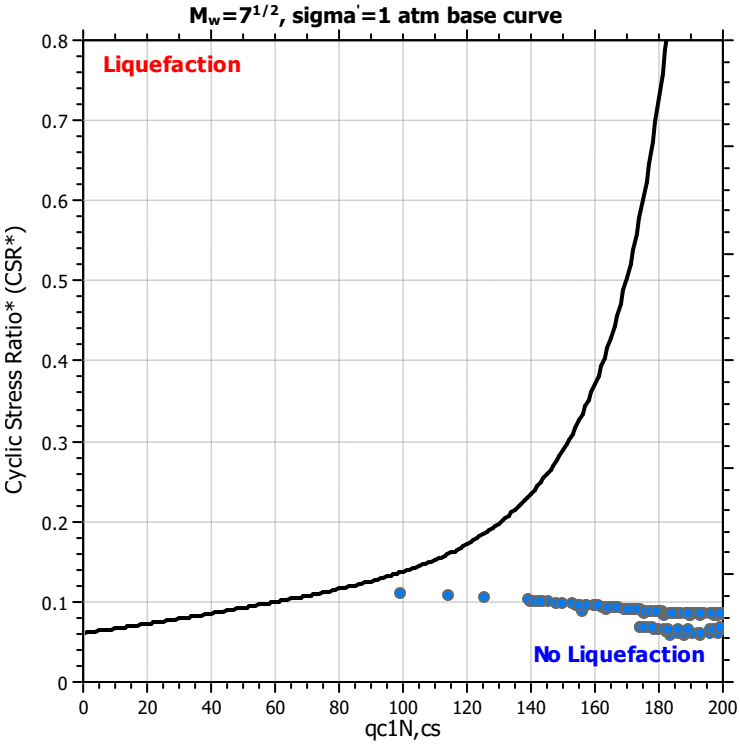
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

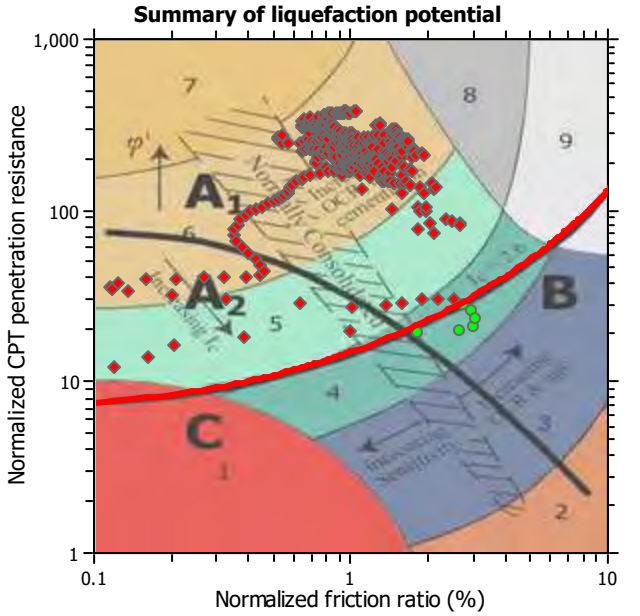
CPT file : CPT08_SLS

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.70 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	6.50	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:	No		

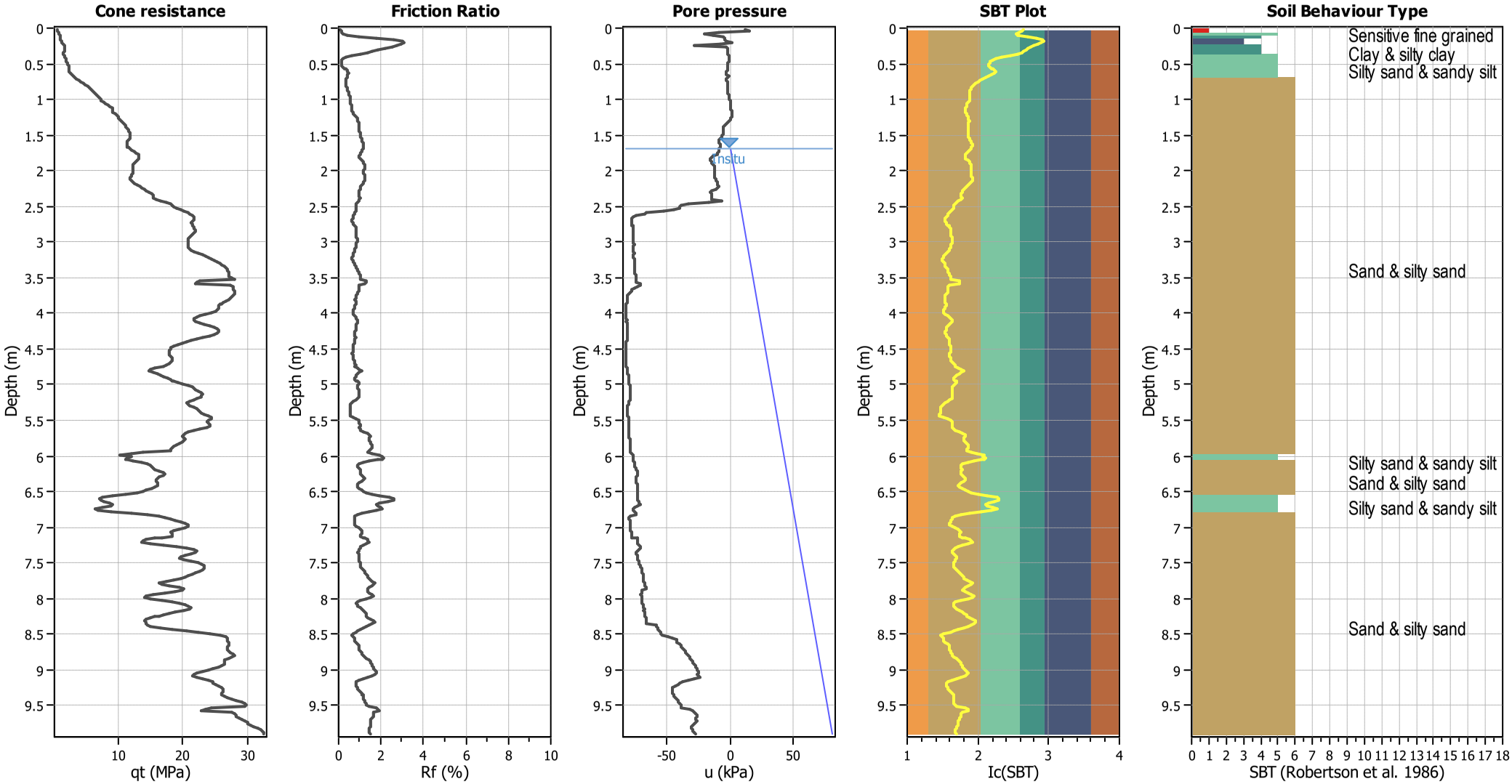






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



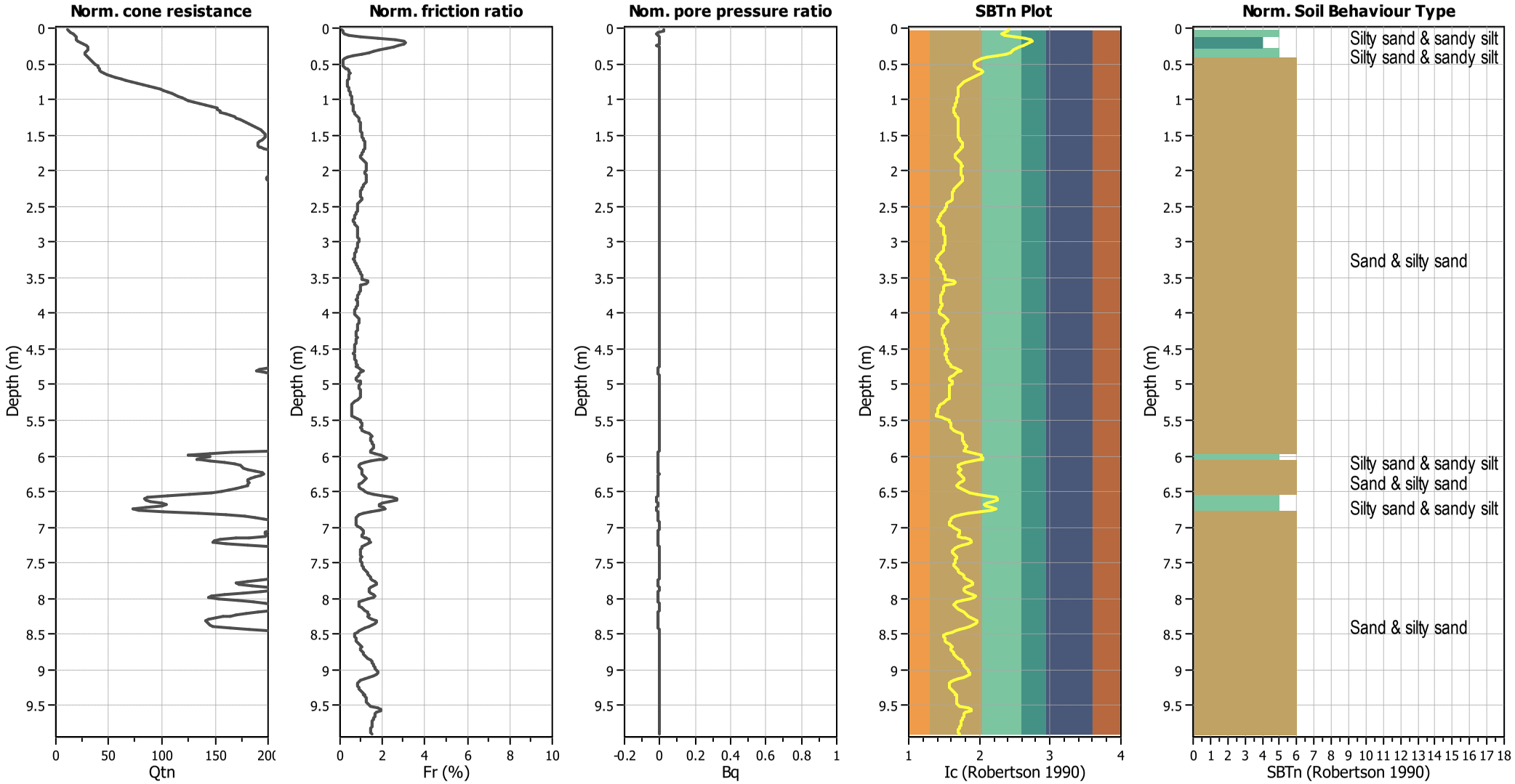
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

CPT basic interpretation plots (normalized)



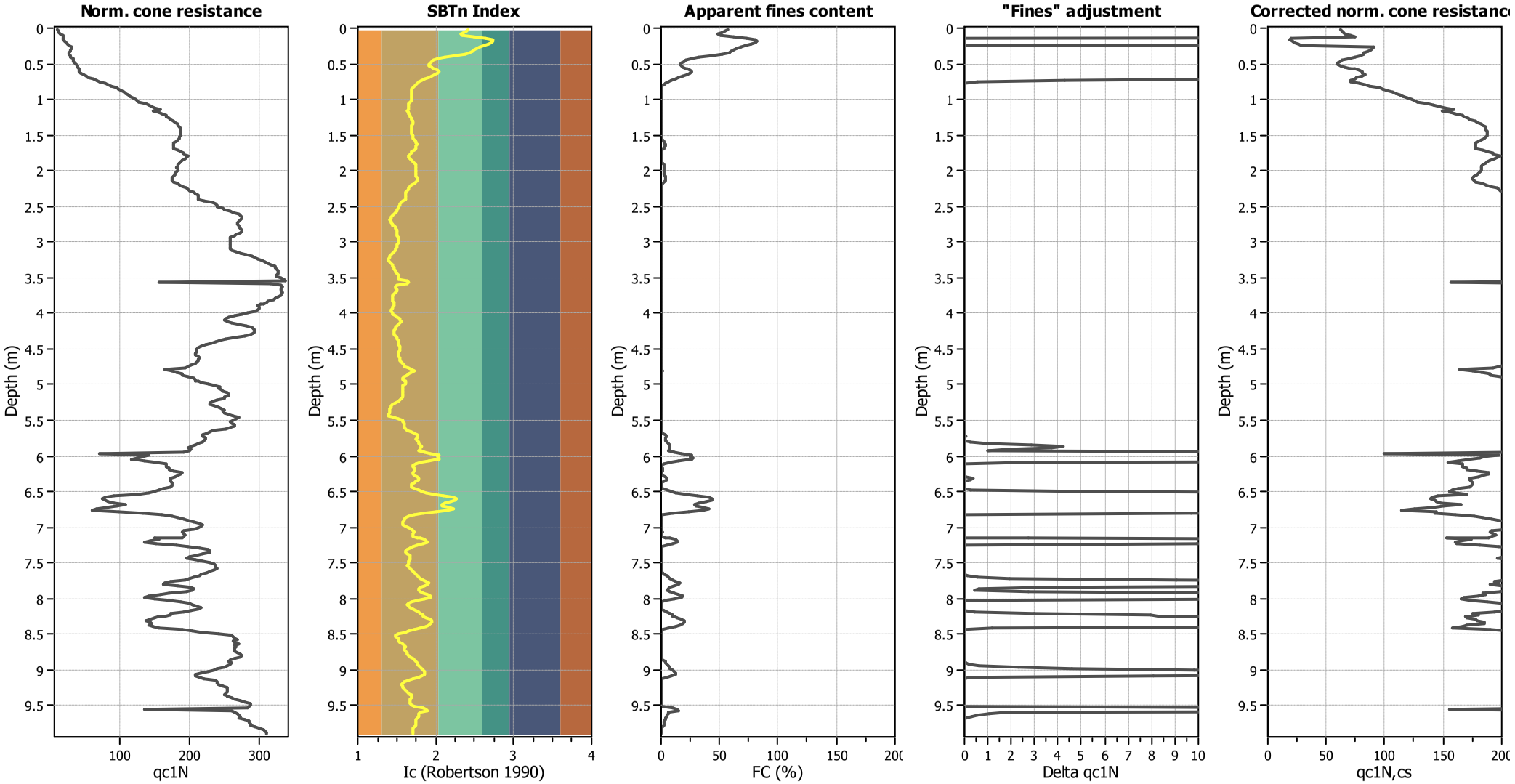
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

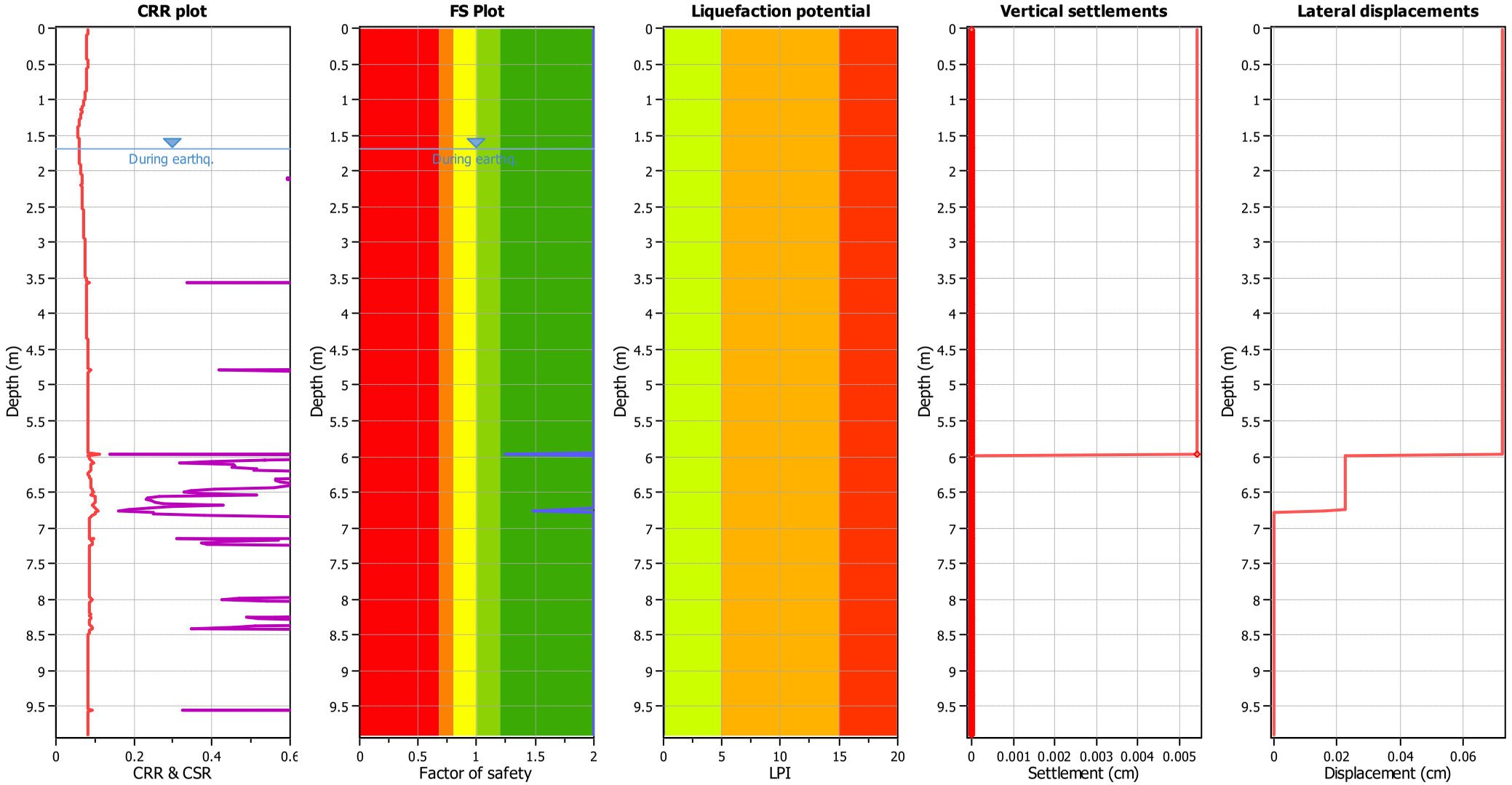
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

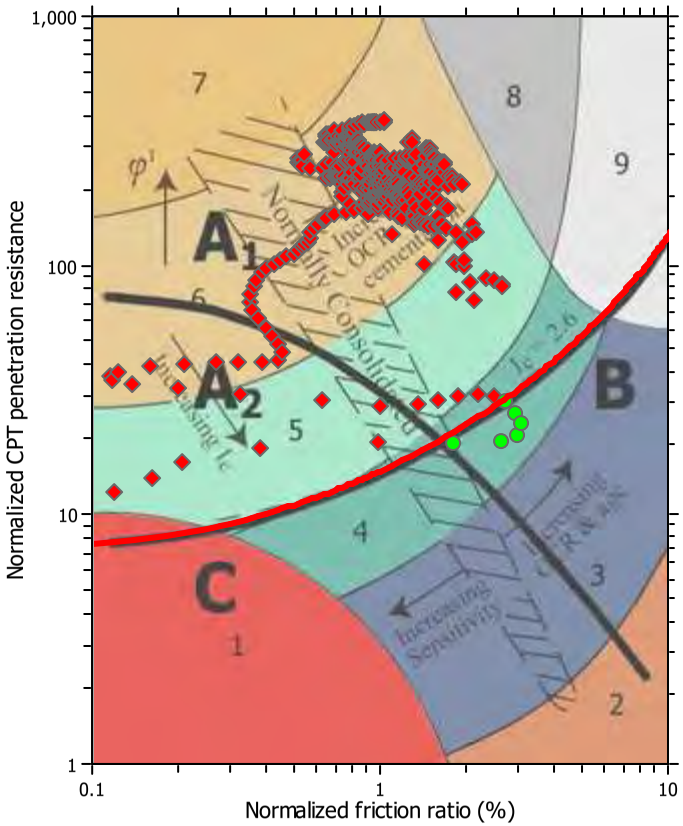
F.S. color scheme

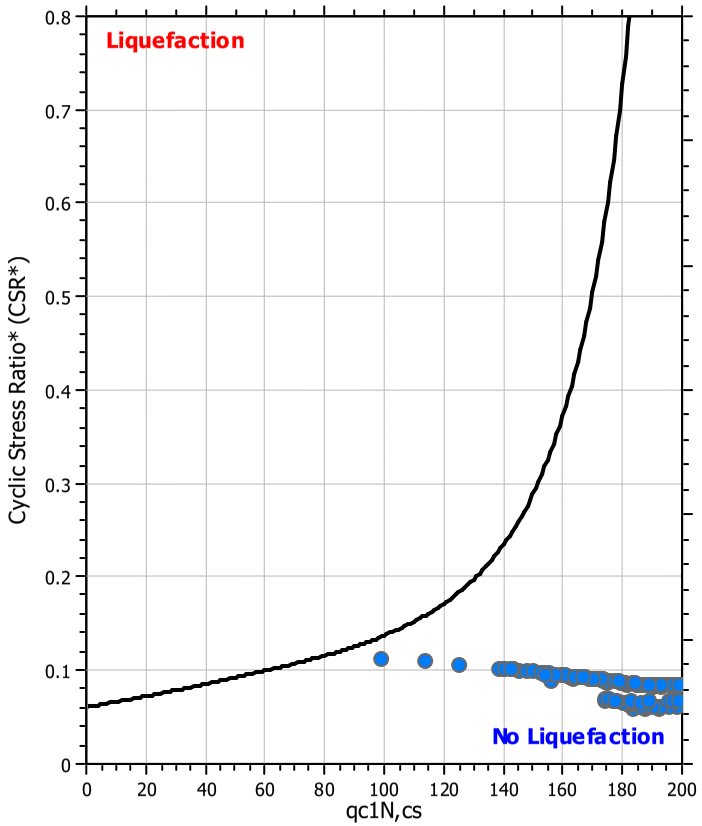
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

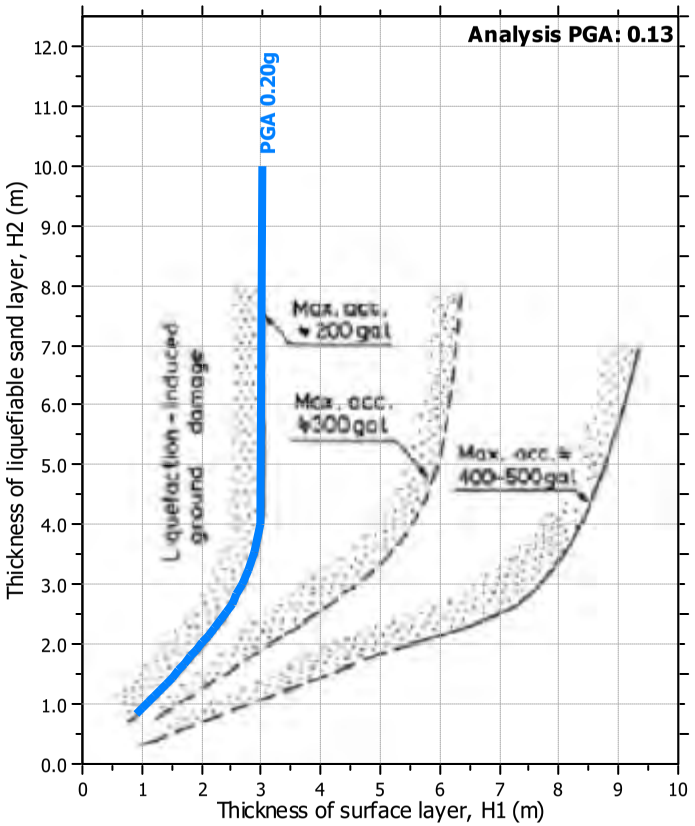
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



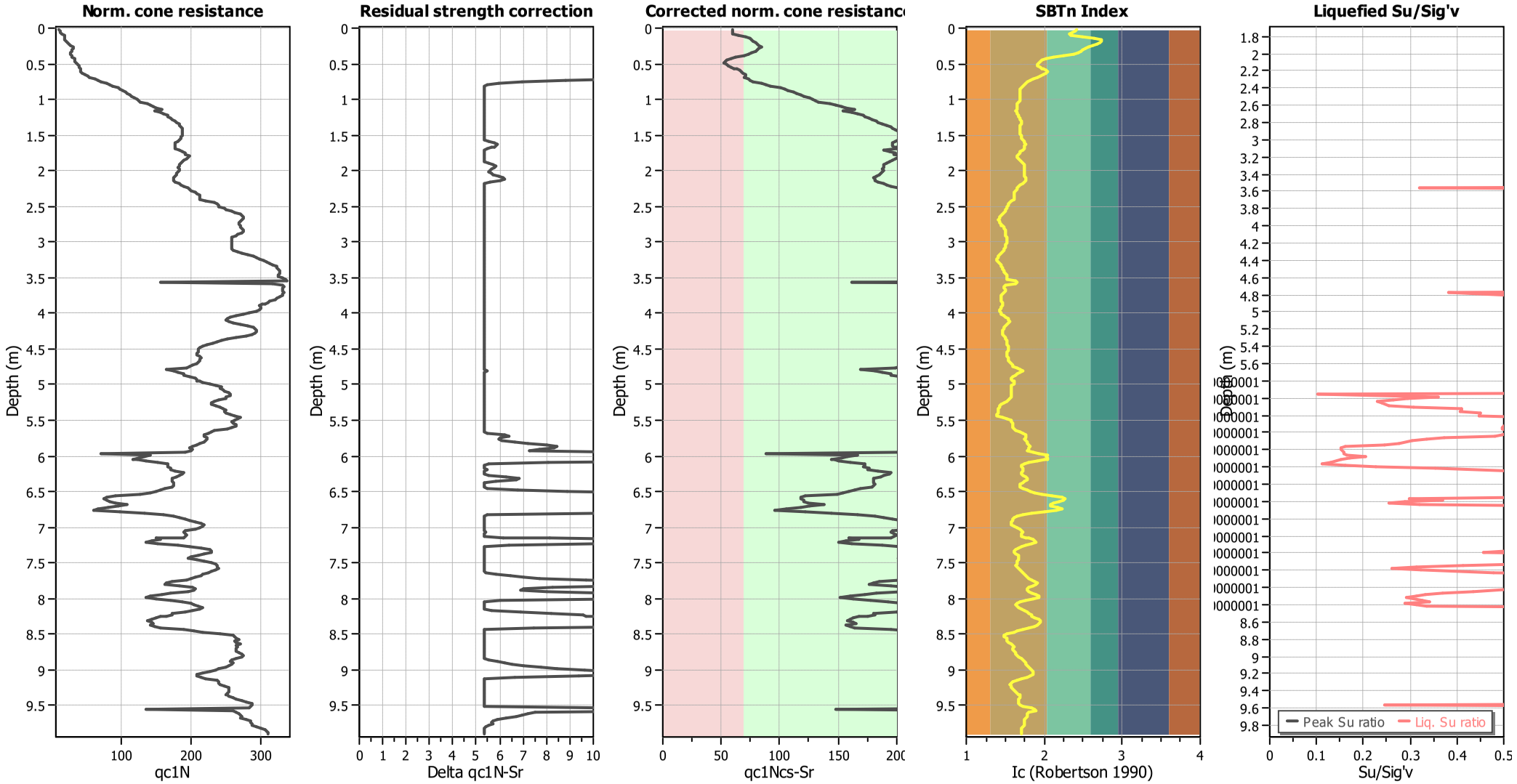




Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

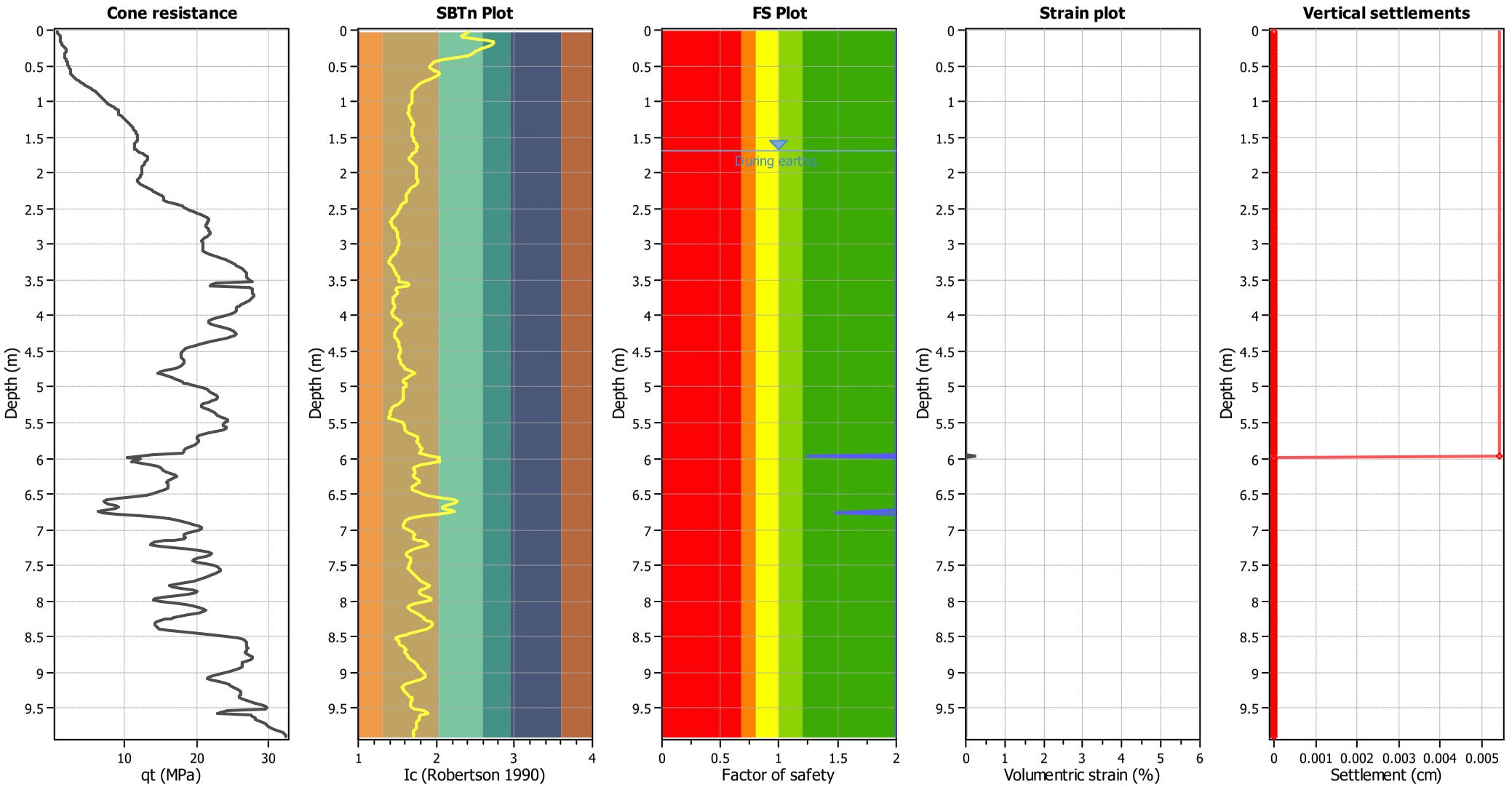
Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

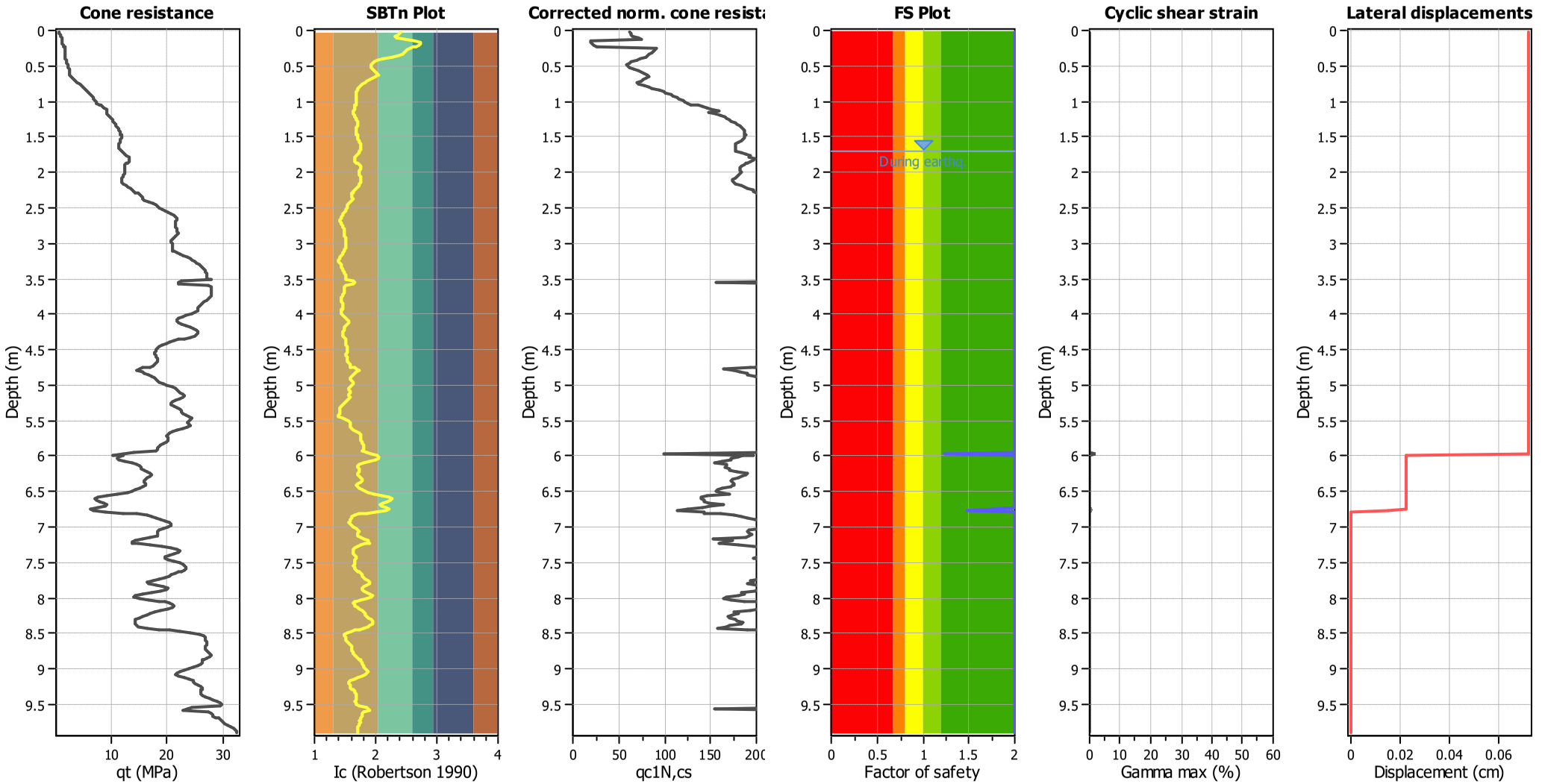
Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

Estimation of post-earthquake lateral Displacements



Abbreviations

q_t: Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c: Soil Behaviour Type Index
$q_{c1N,cs}$: Equivalent clean sand normalized CPT total cone resistance
F.S.: Factor of safety
γ_{max}: Maximum cyclic shear strain
LDI: Lateral displacement index

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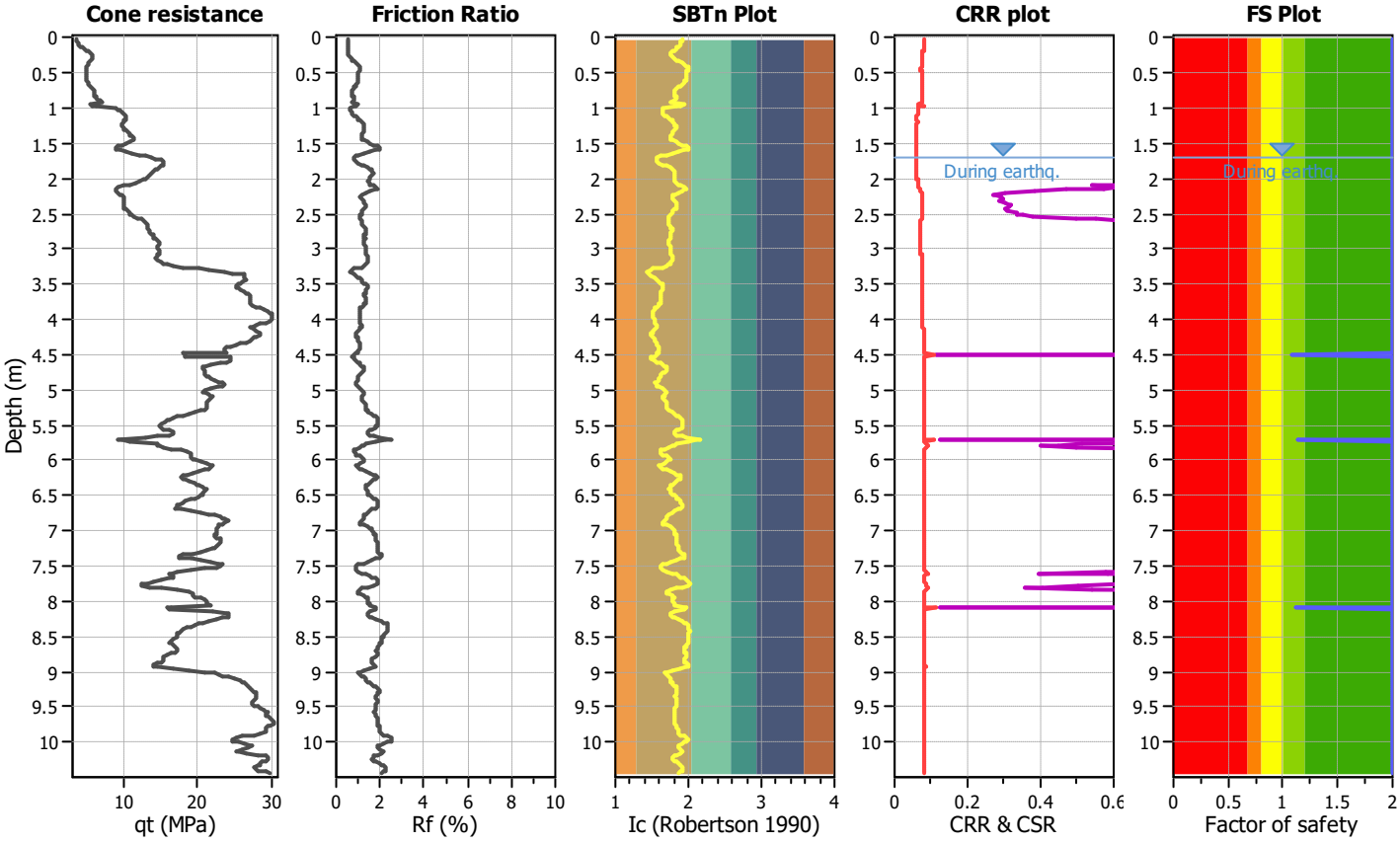
LIQUEFACTION ANALYSIS REPORT

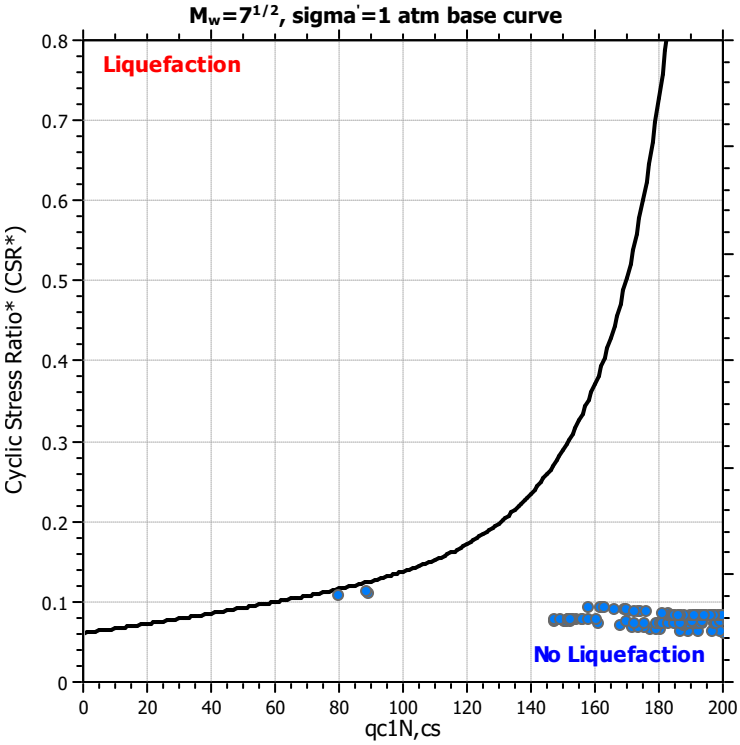
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

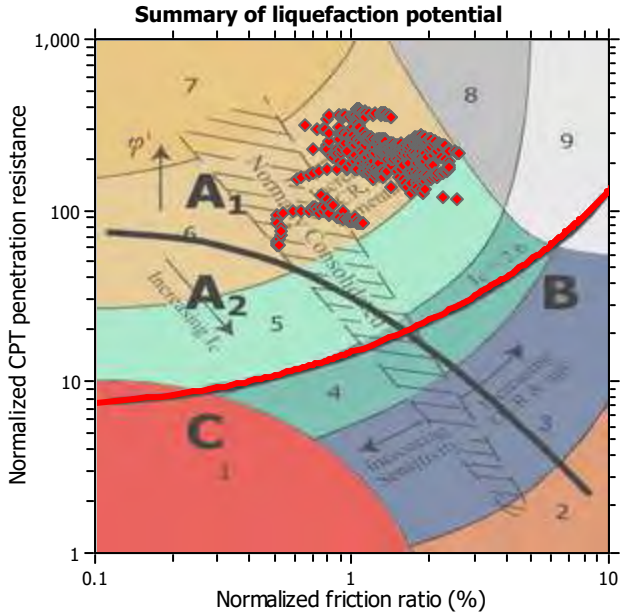
CPT file : CPT09_SLS

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.70 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	6.50	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:	No		

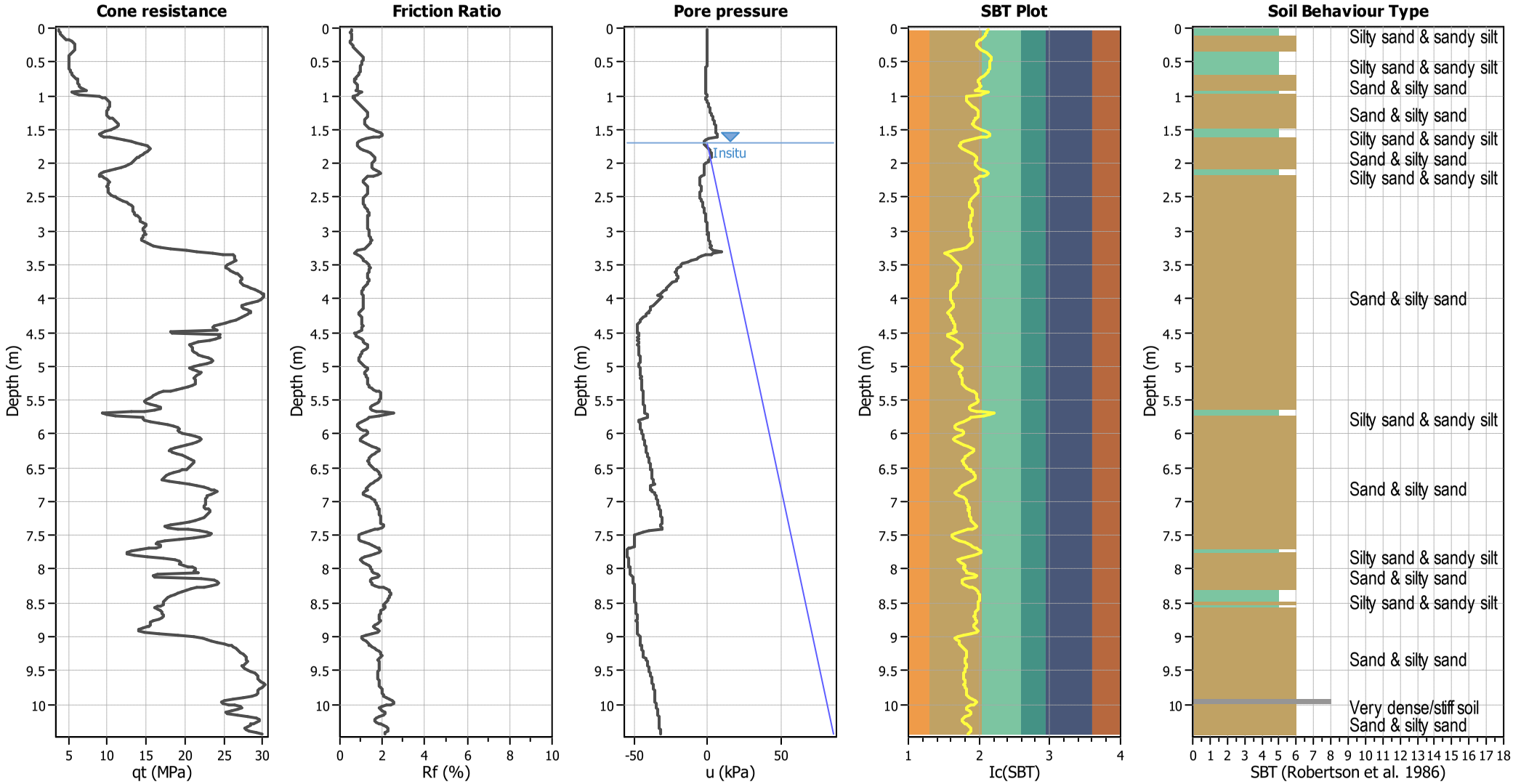






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



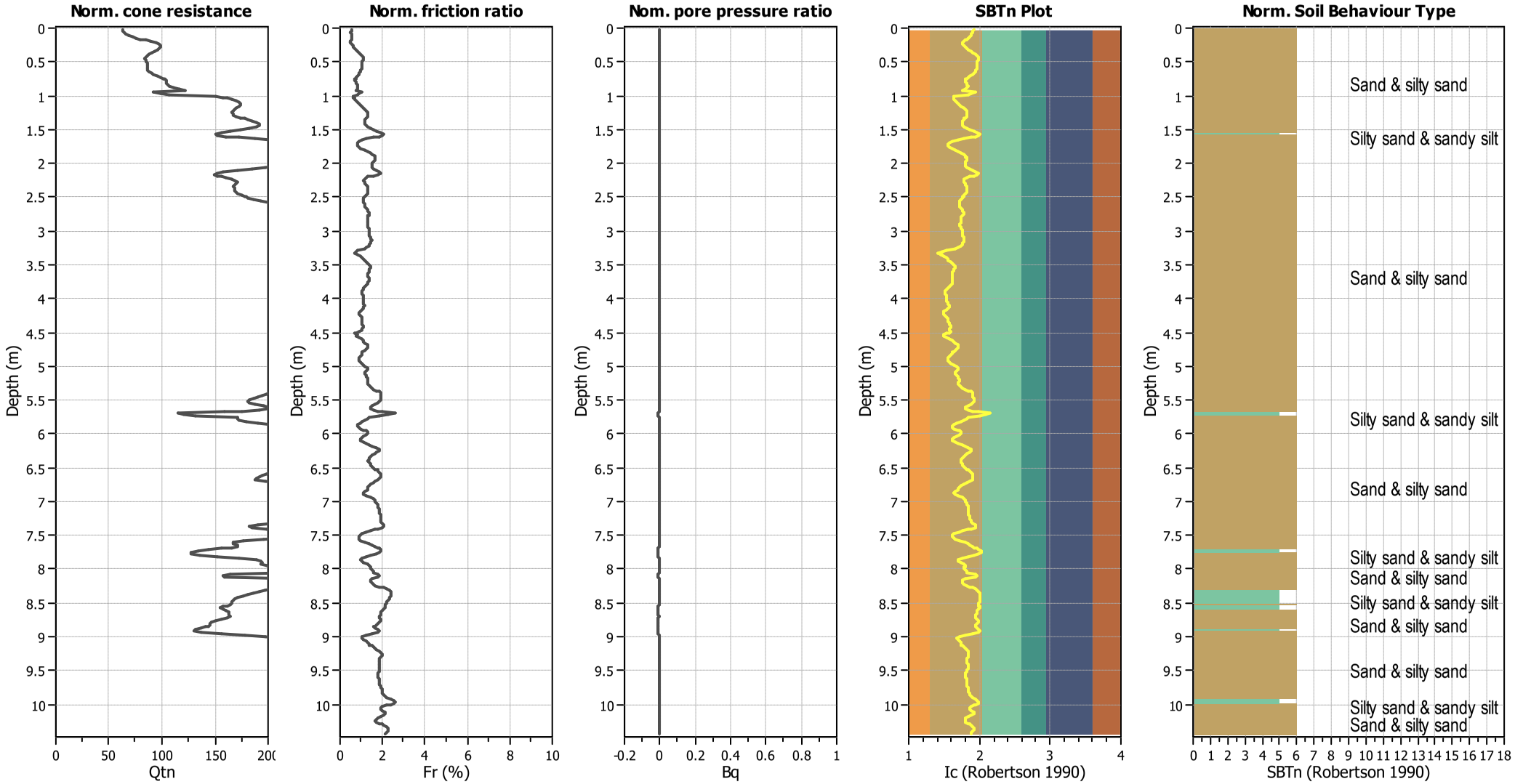
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

CPT basic interpretation plots (normalized)



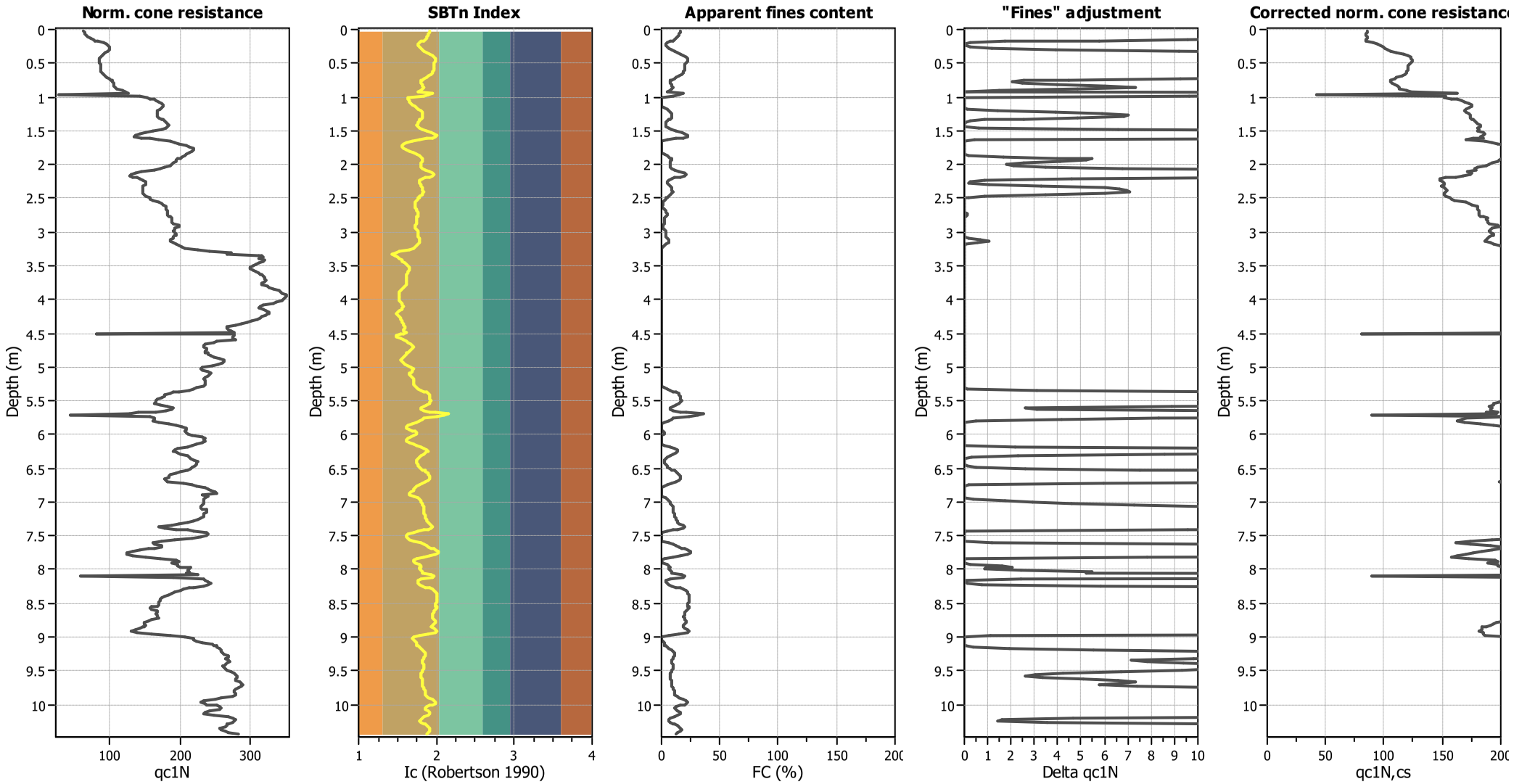
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

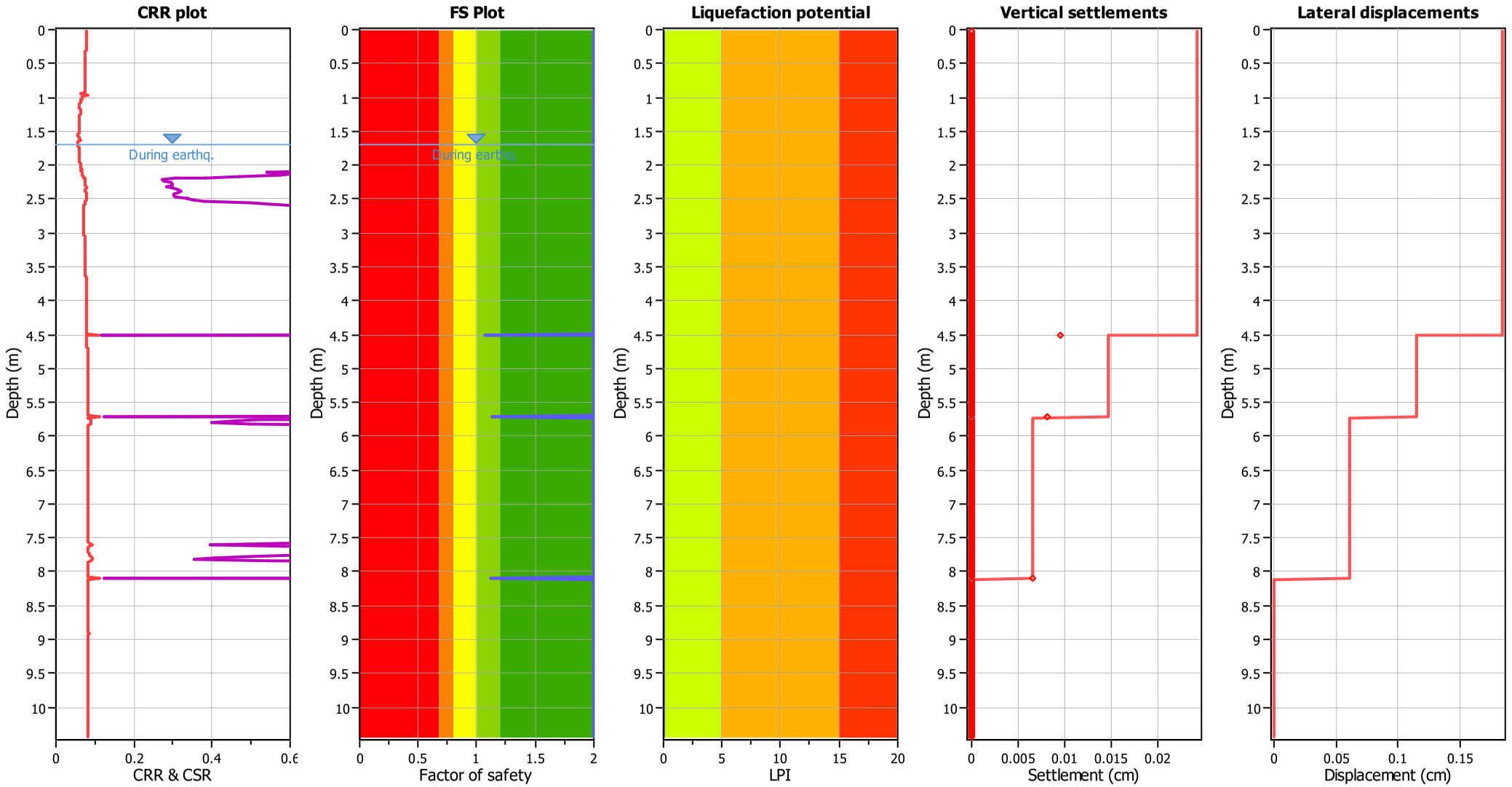
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

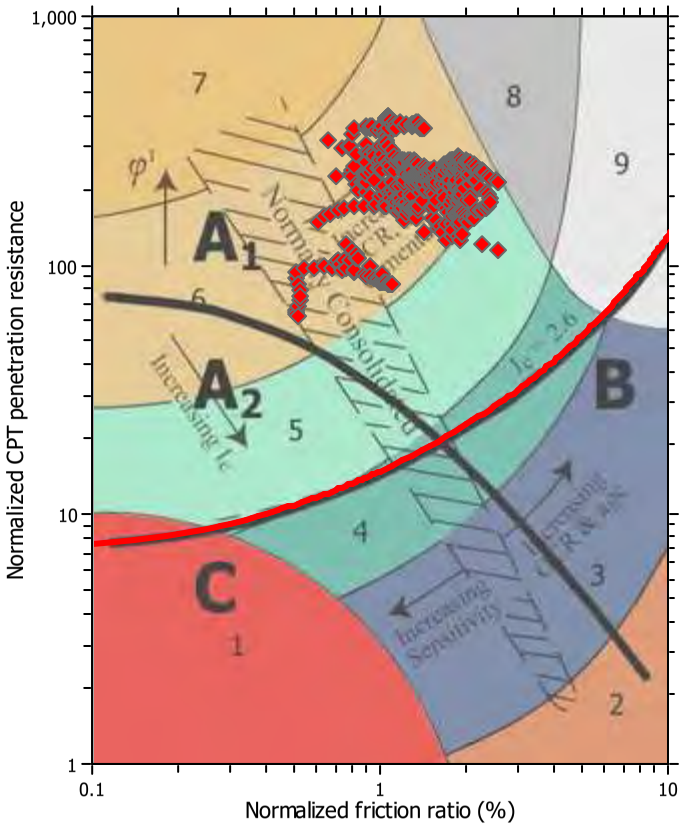
F.S. color scheme

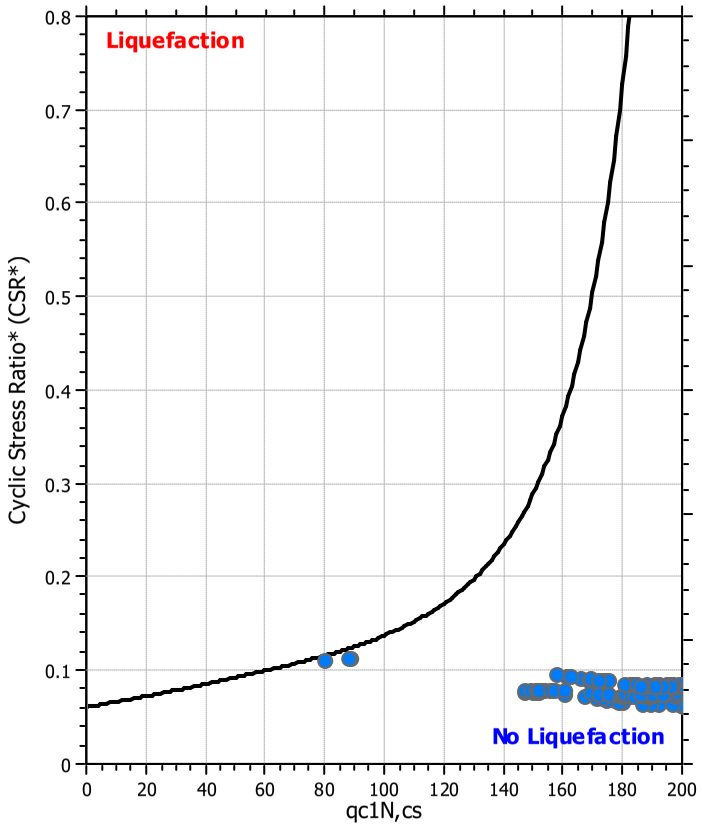
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

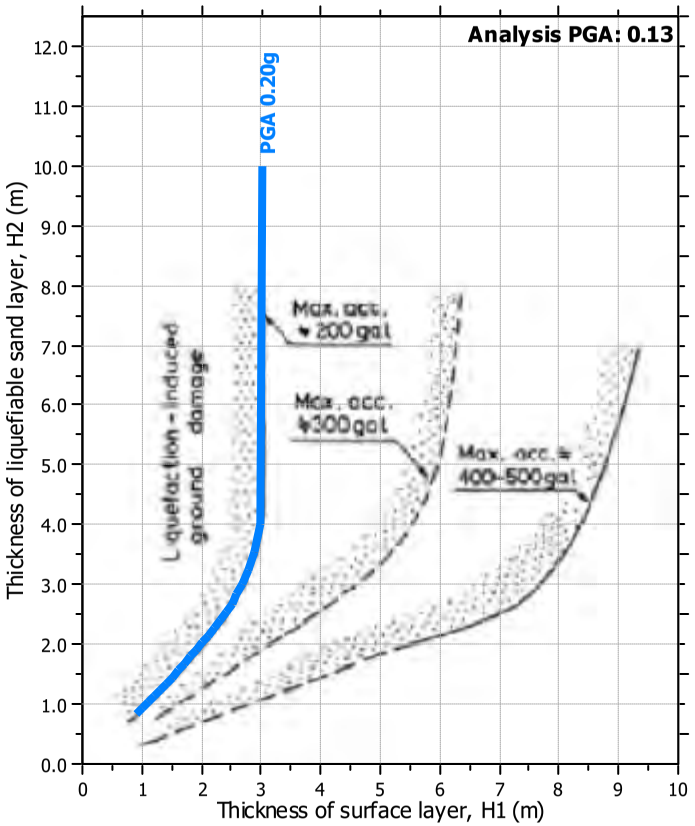
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



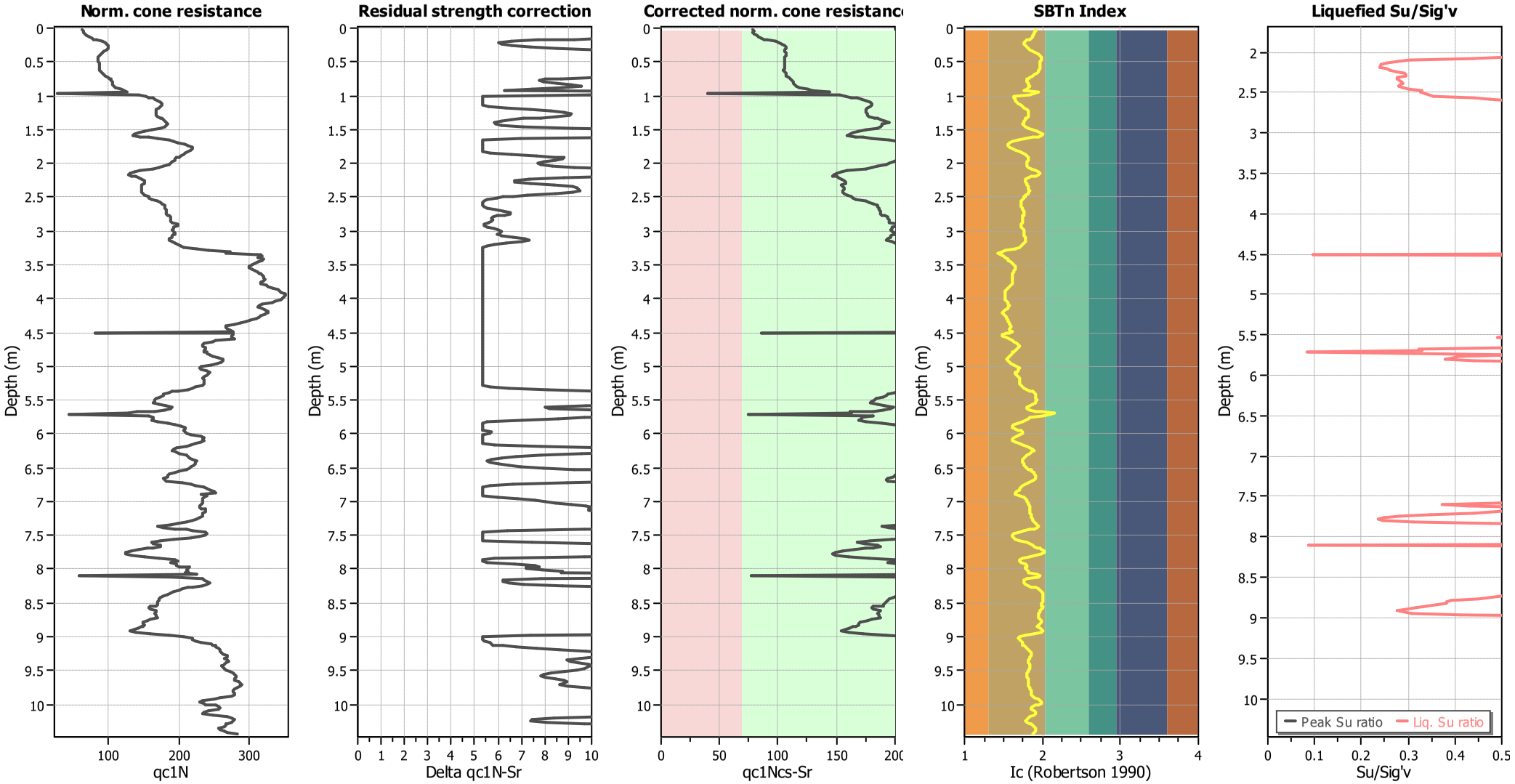




Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

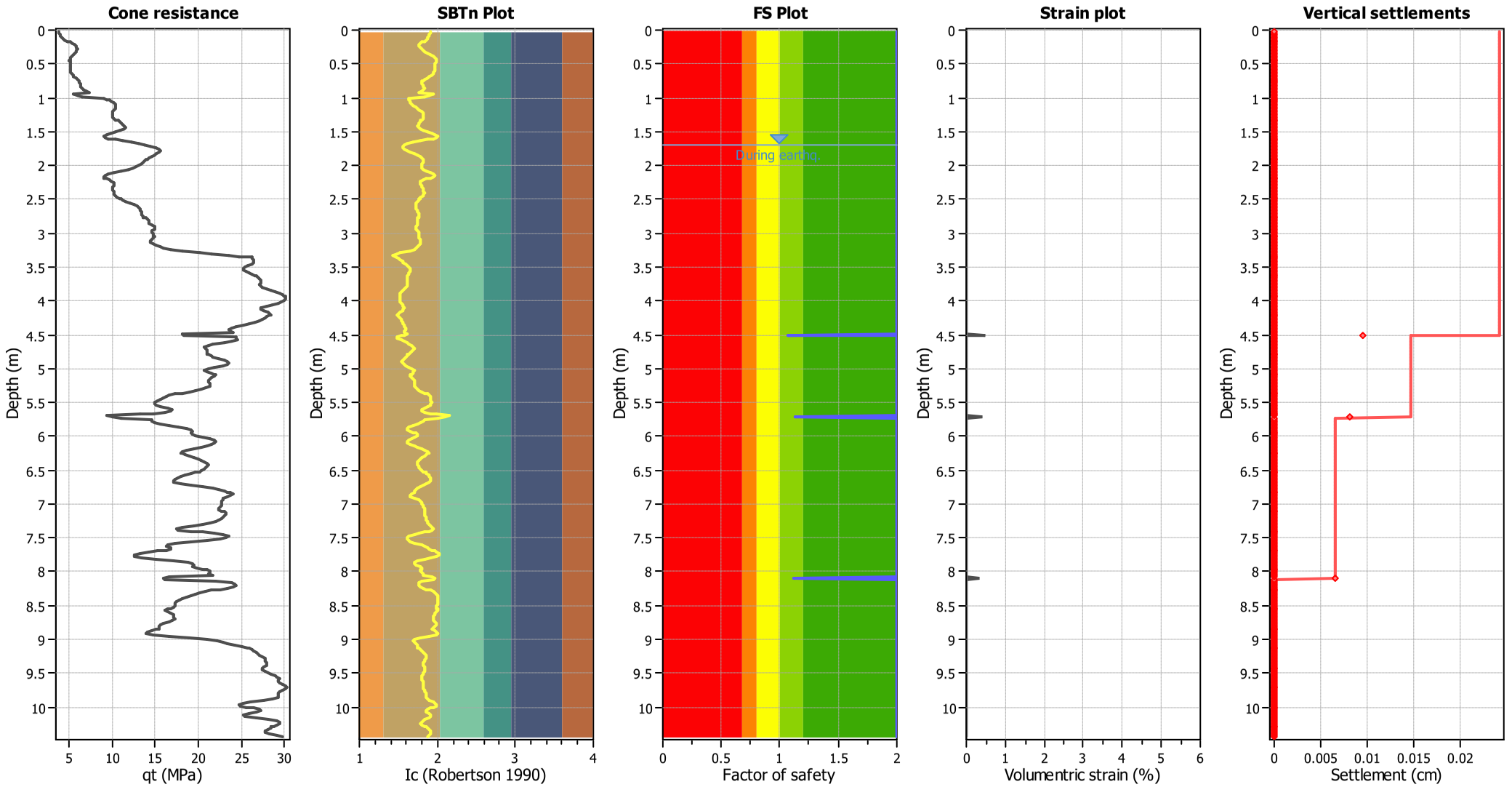
Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

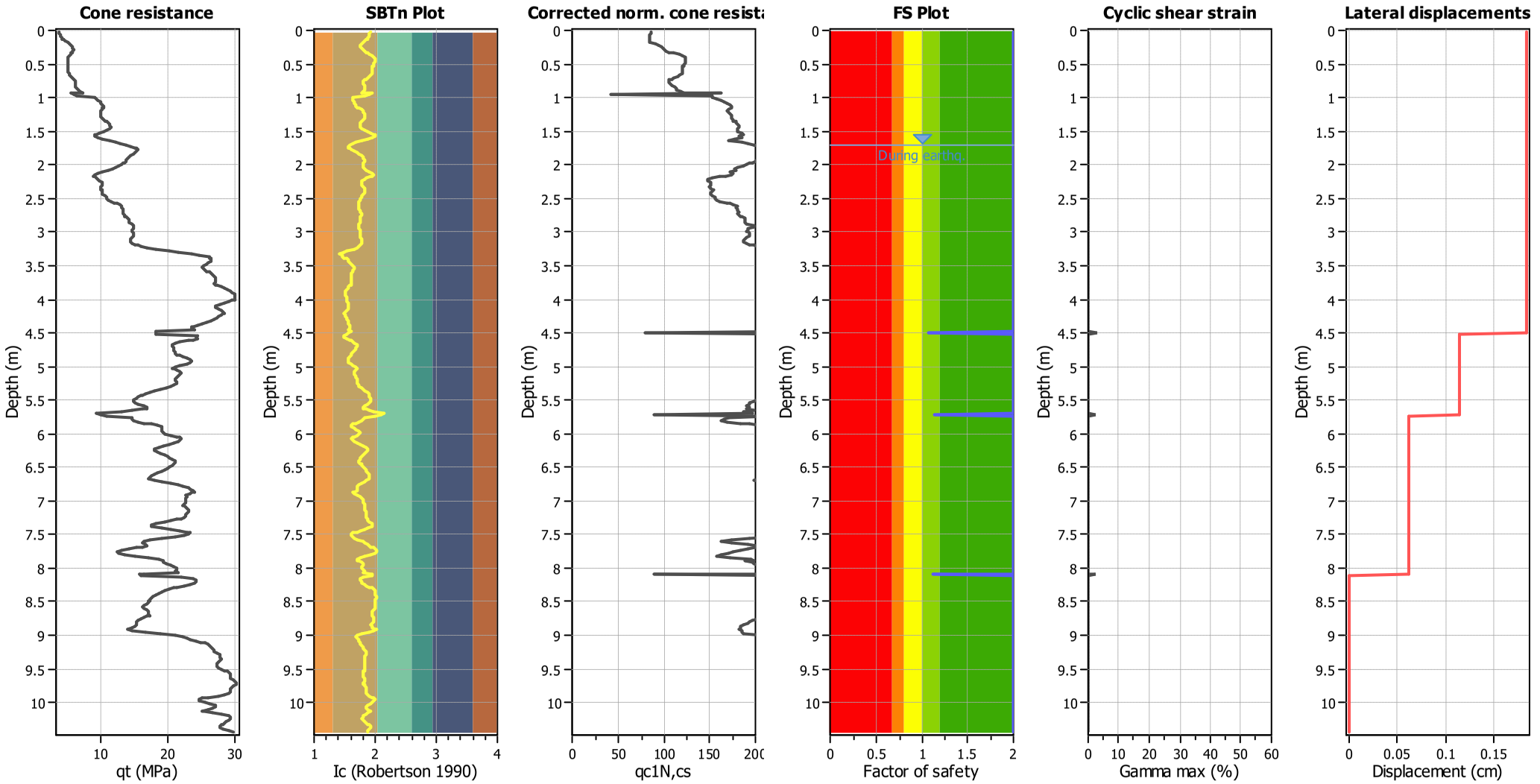
Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

Estimation of post-earthquake lateral Displacements



Abbreviations

q_t: Total cone resistance (cone resistance q_c corrected for pore water effects)
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$q_{c1N,cs}$: Equivalent clean sand normalized CPT total cone resistance
F.S.: Factor of safety
γ_{max}: Maximum cyclic shear strain
LDI: Lateral displacement index

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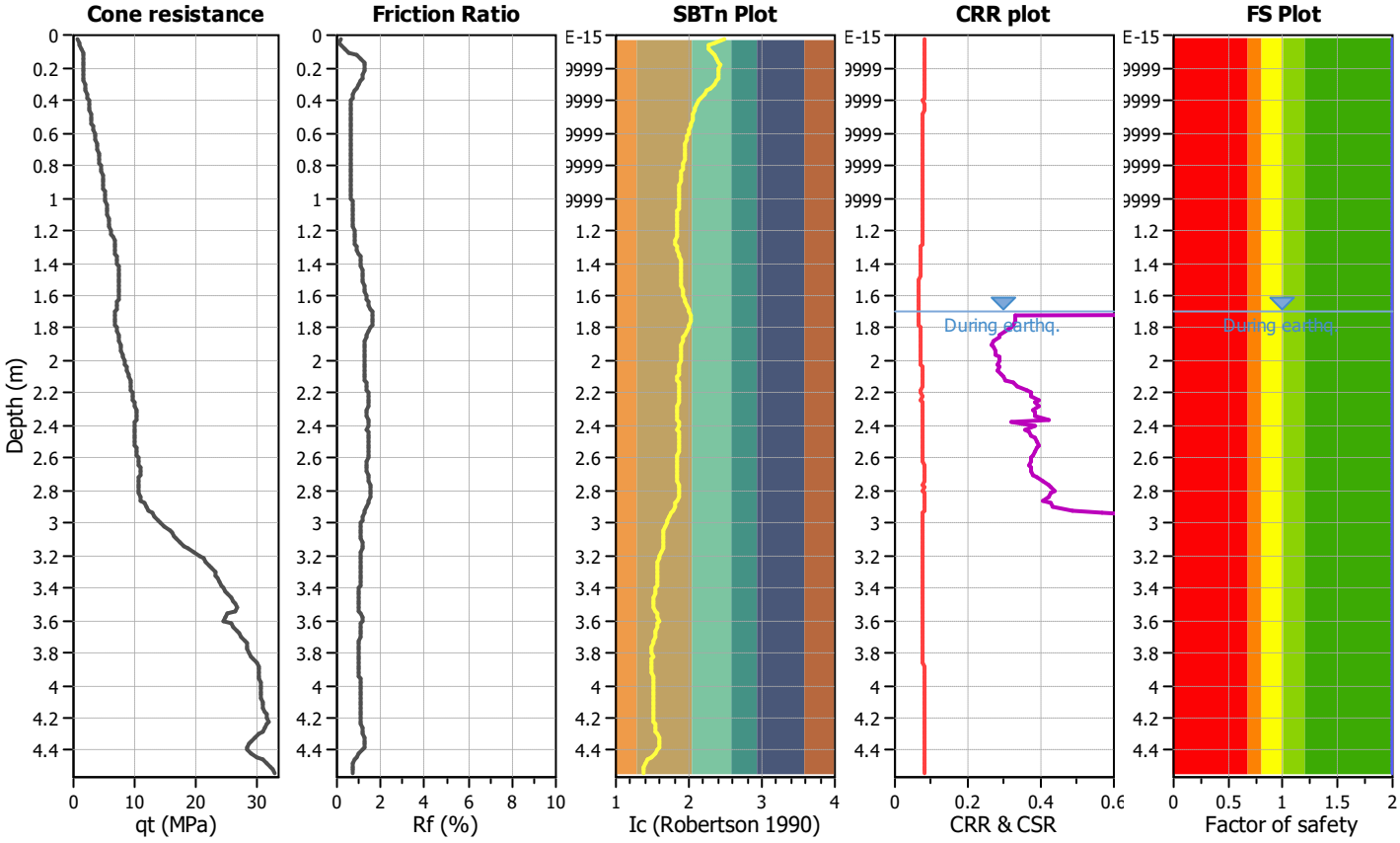
LIQUEFACTION ANALYSIS REPORT

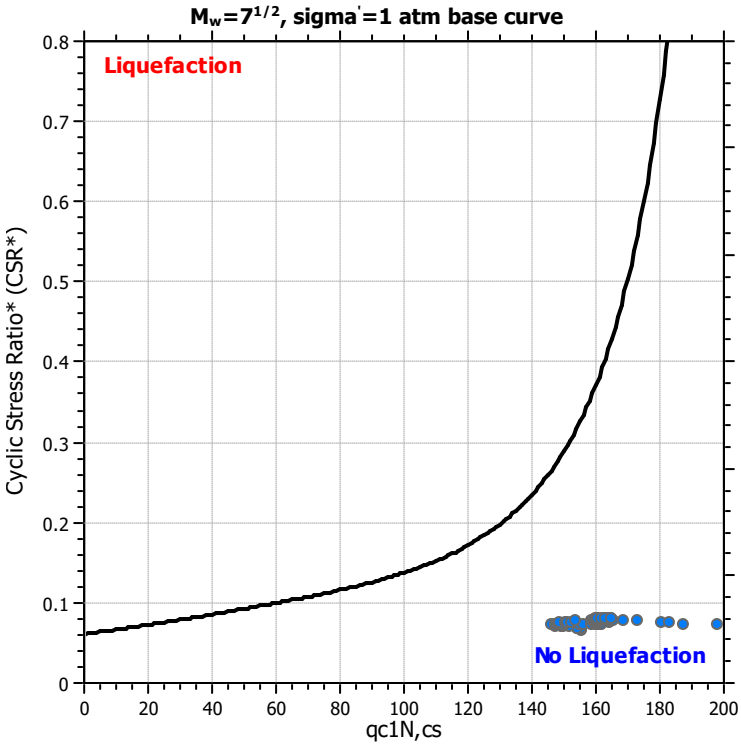
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

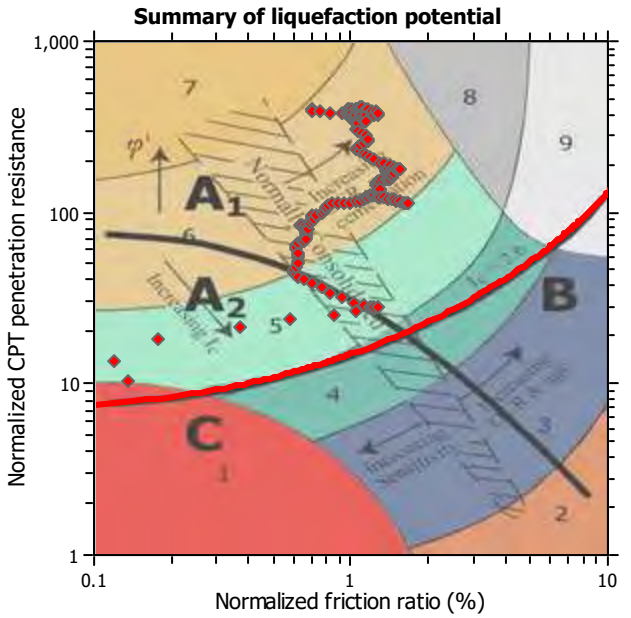
CPT file : CPT10_SLS

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.70 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	6.50	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:	No		

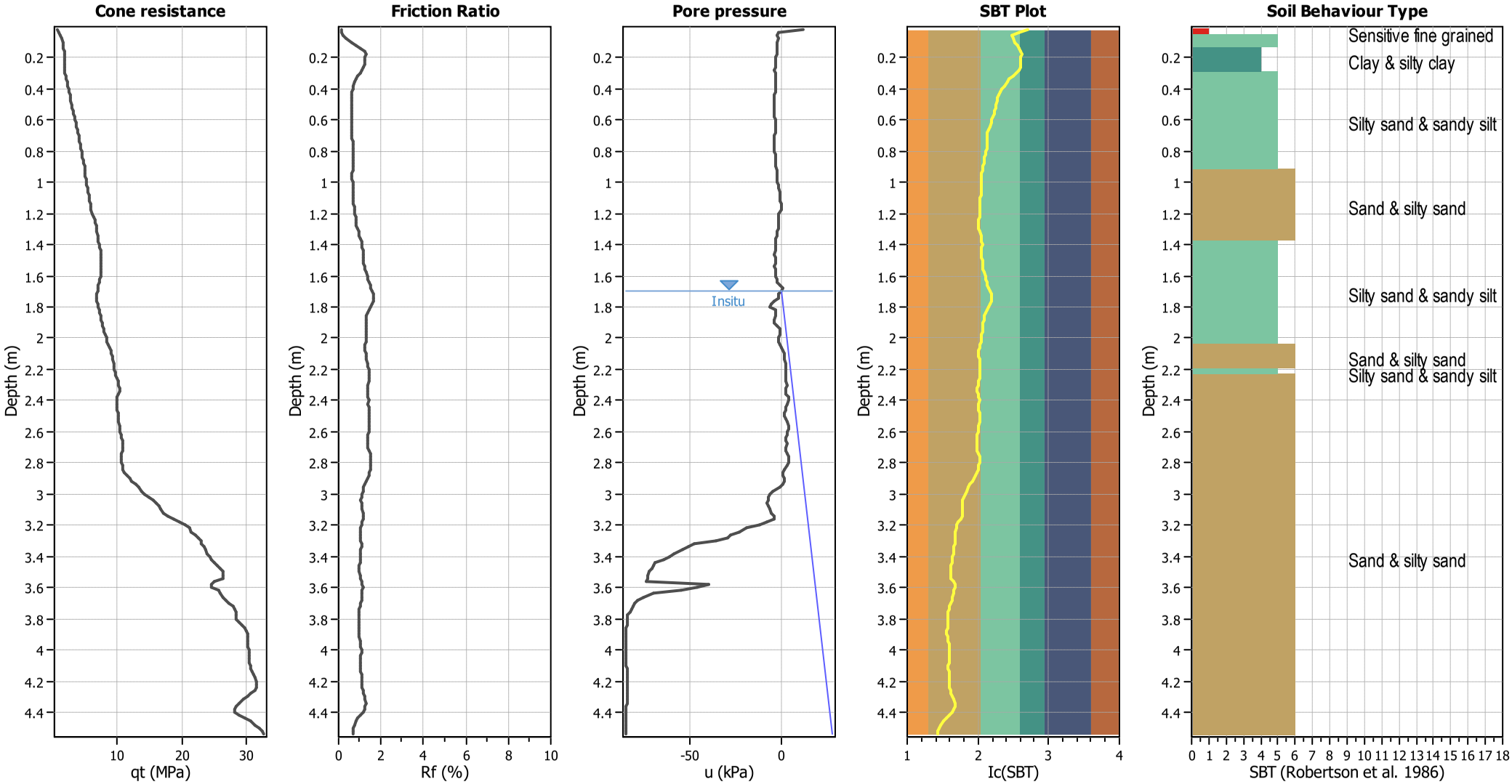






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



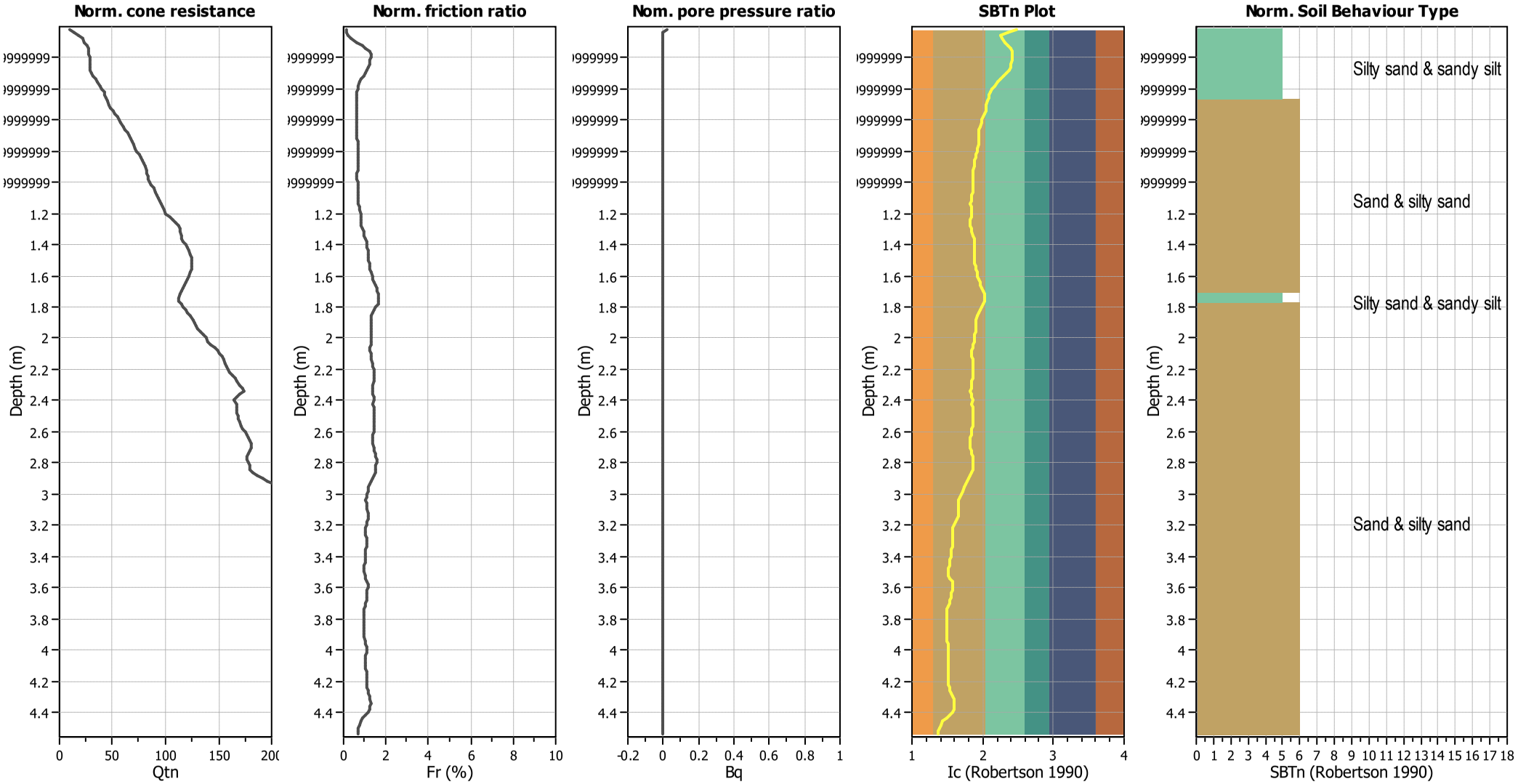
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

CPT basic interpretation plots (normalized)



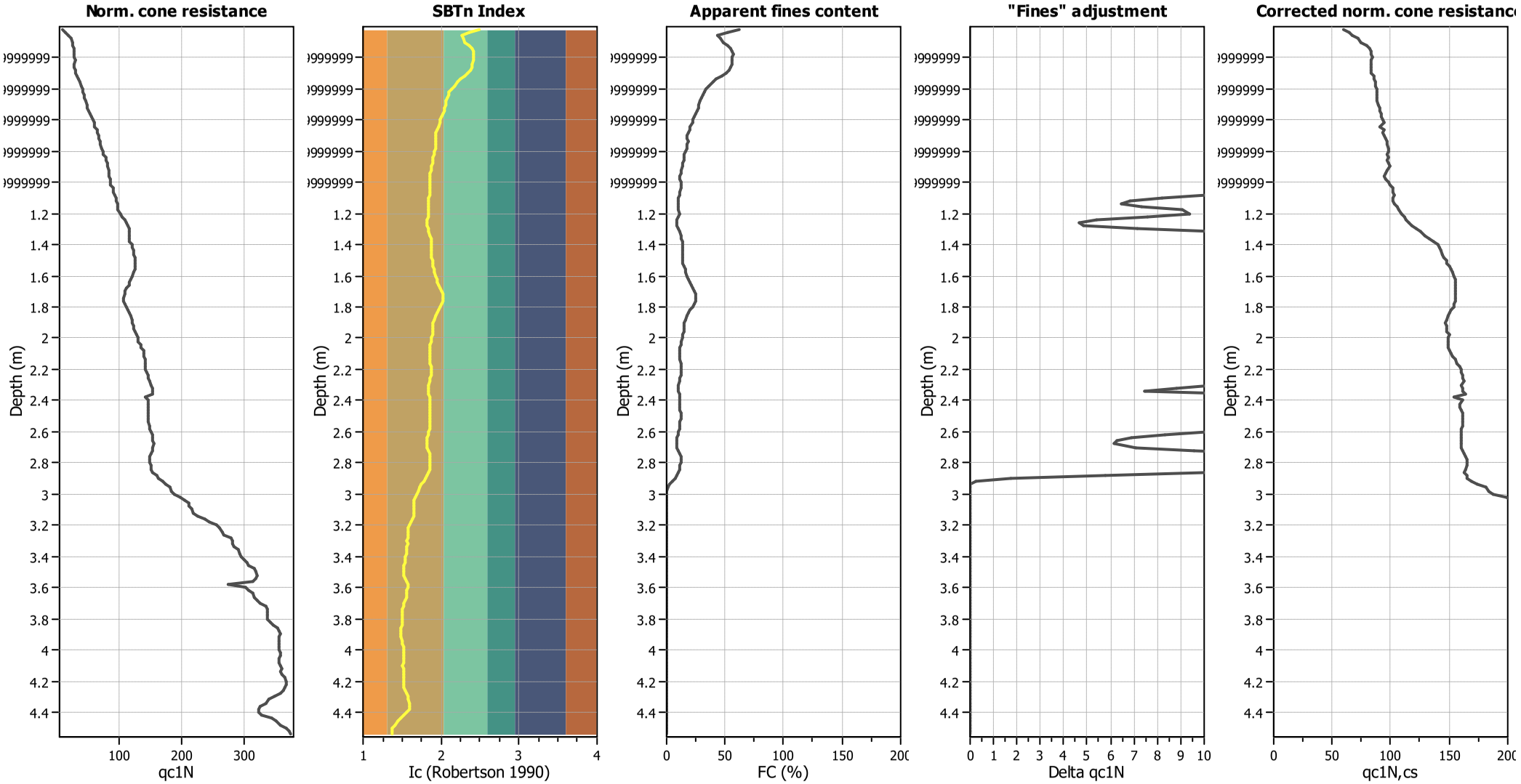
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

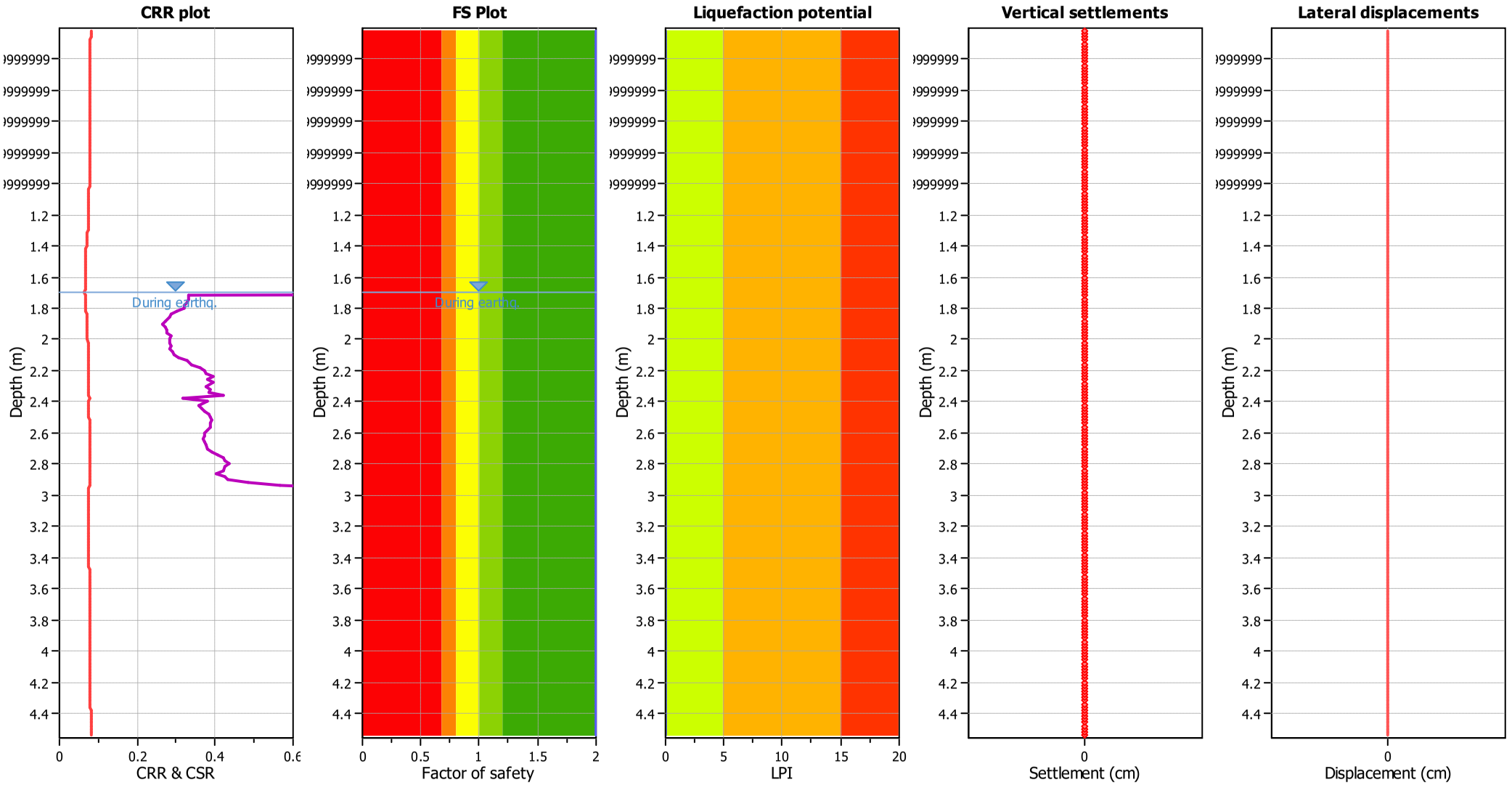
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

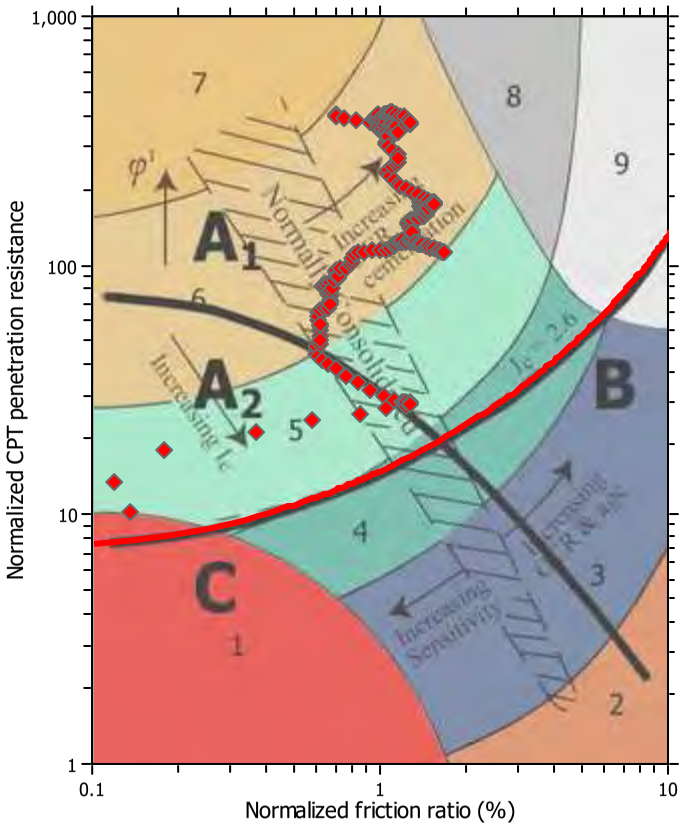
F.S. color scheme

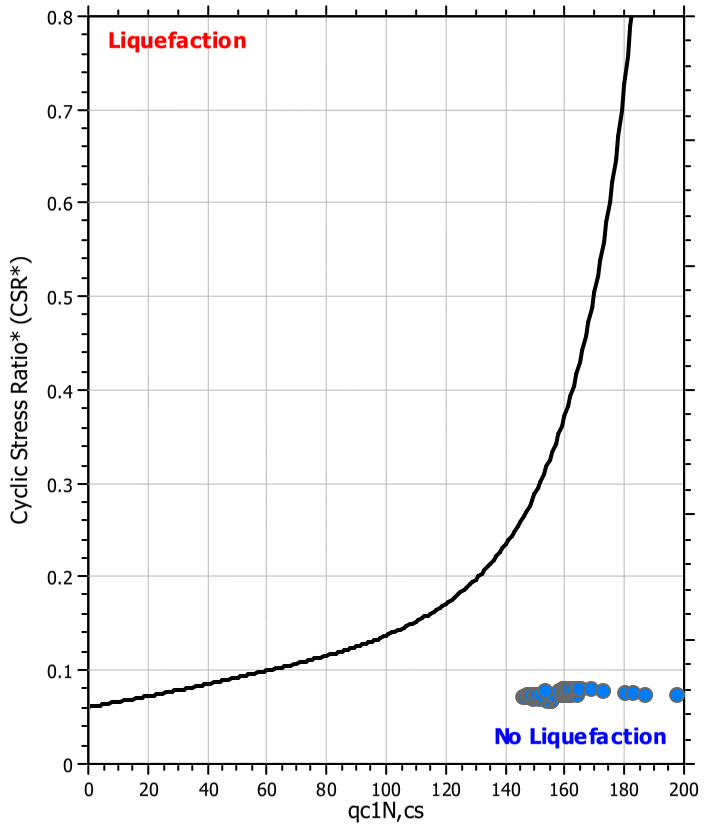
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

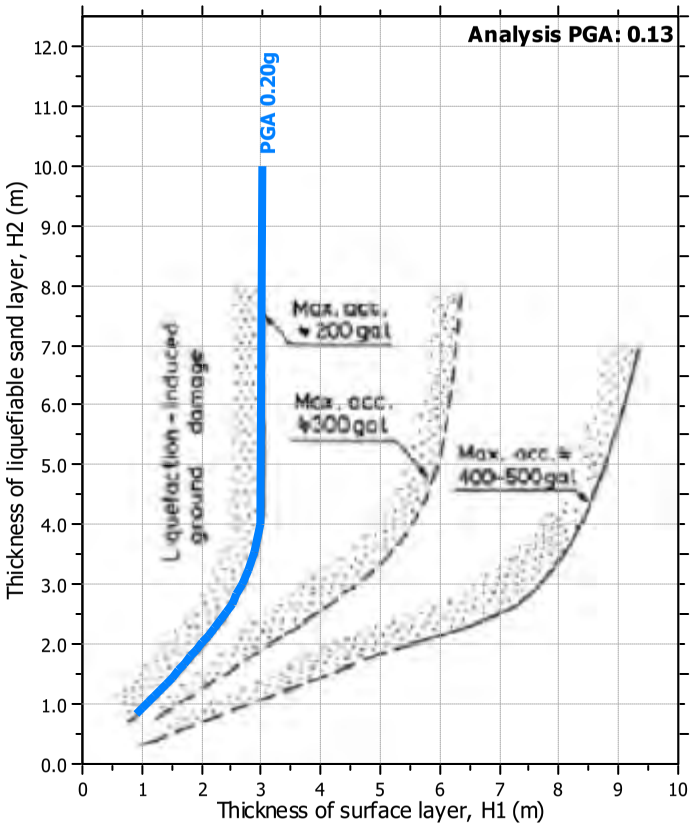
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



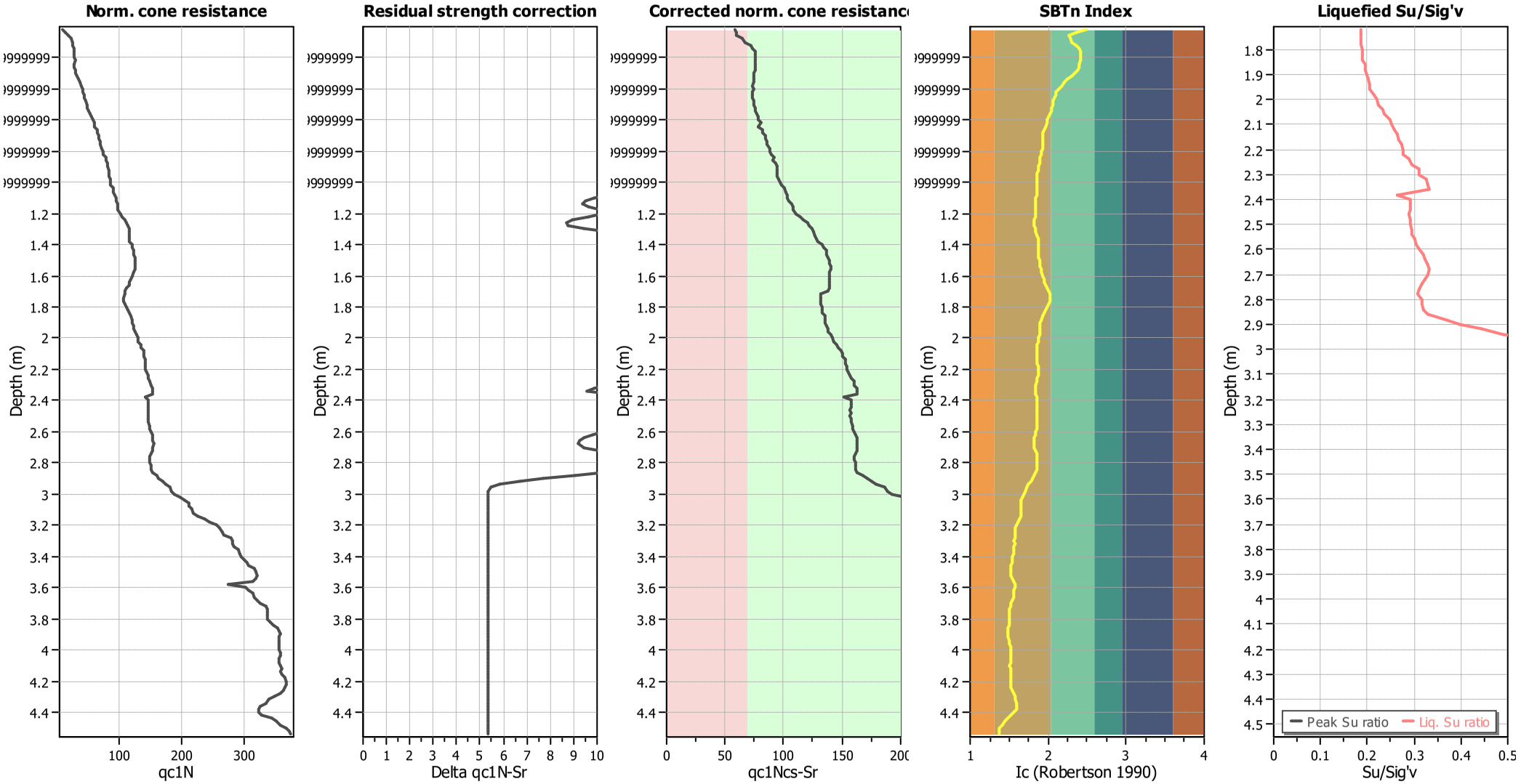




Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

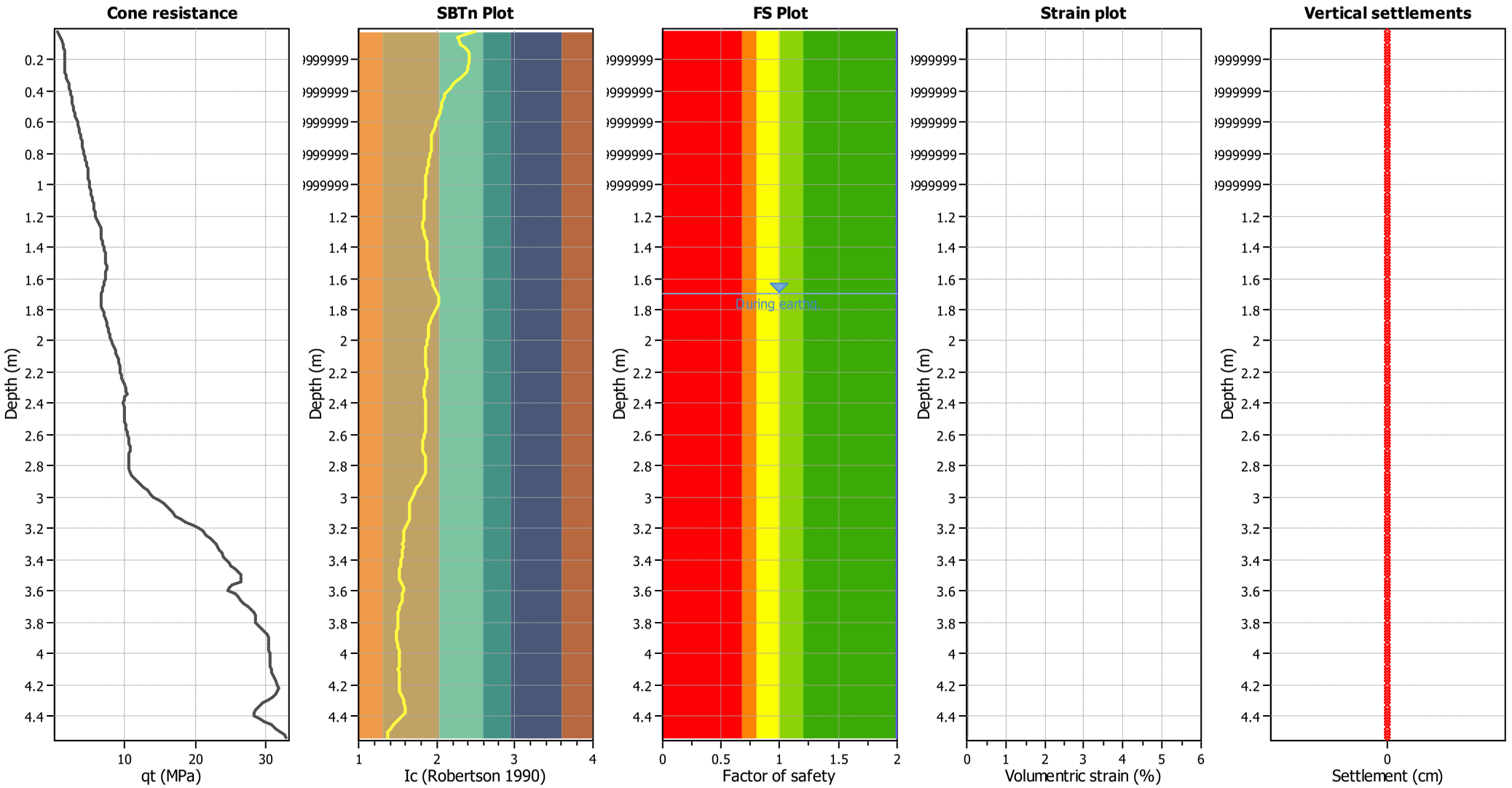
Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

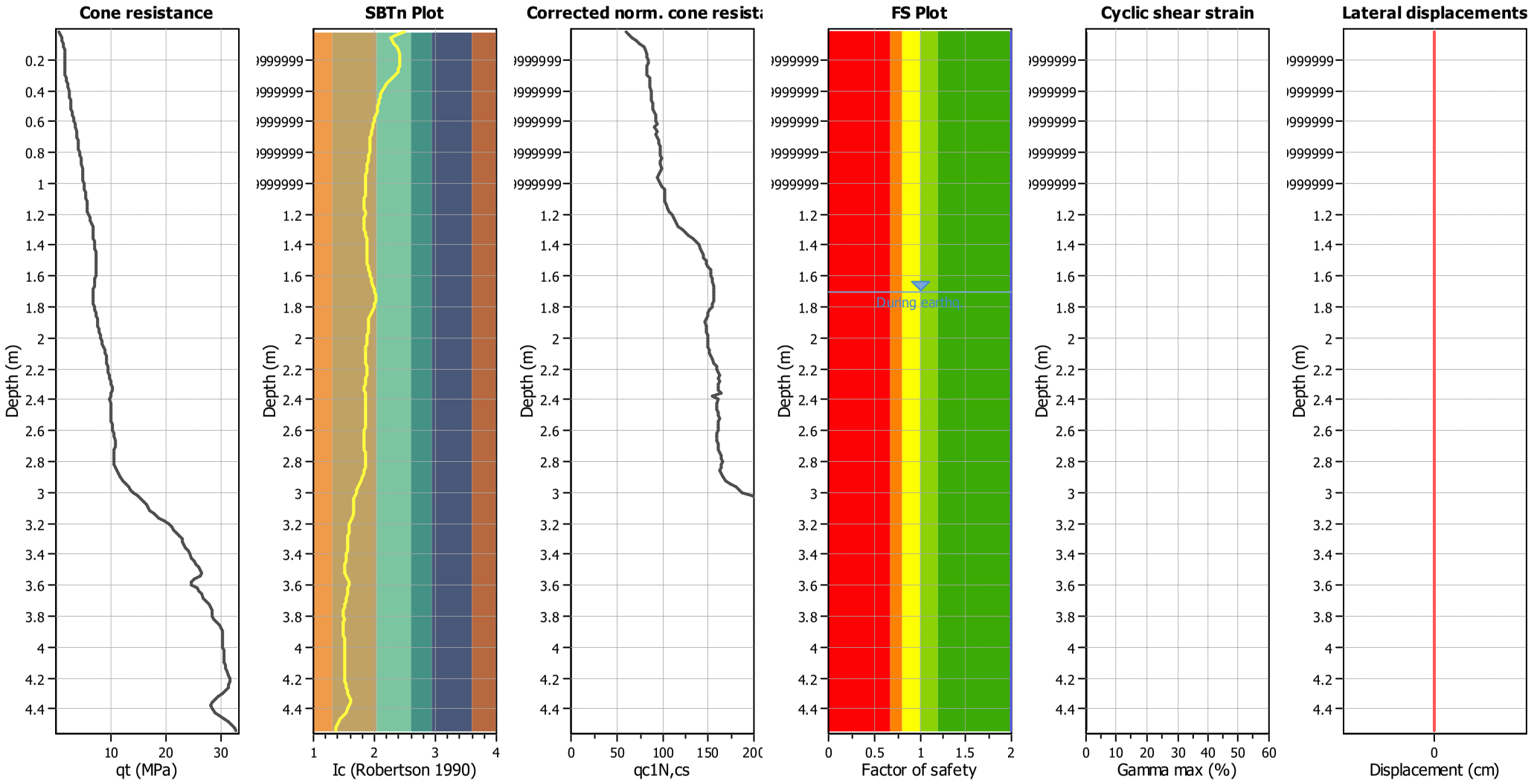
Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

Estimation of post-earthquake lateral Displacements



Abbreviations

q_t: Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c: Soil Behaviour Type Index
$q_{c1N,cs}$: Equivalent clean sand normalized CPT total cone resistance
F.S.: Factor of safety
γ_{max}: Maximum cyclic shear strain
LDI: Lateral displacement index

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2/182 Main Rd Tawa
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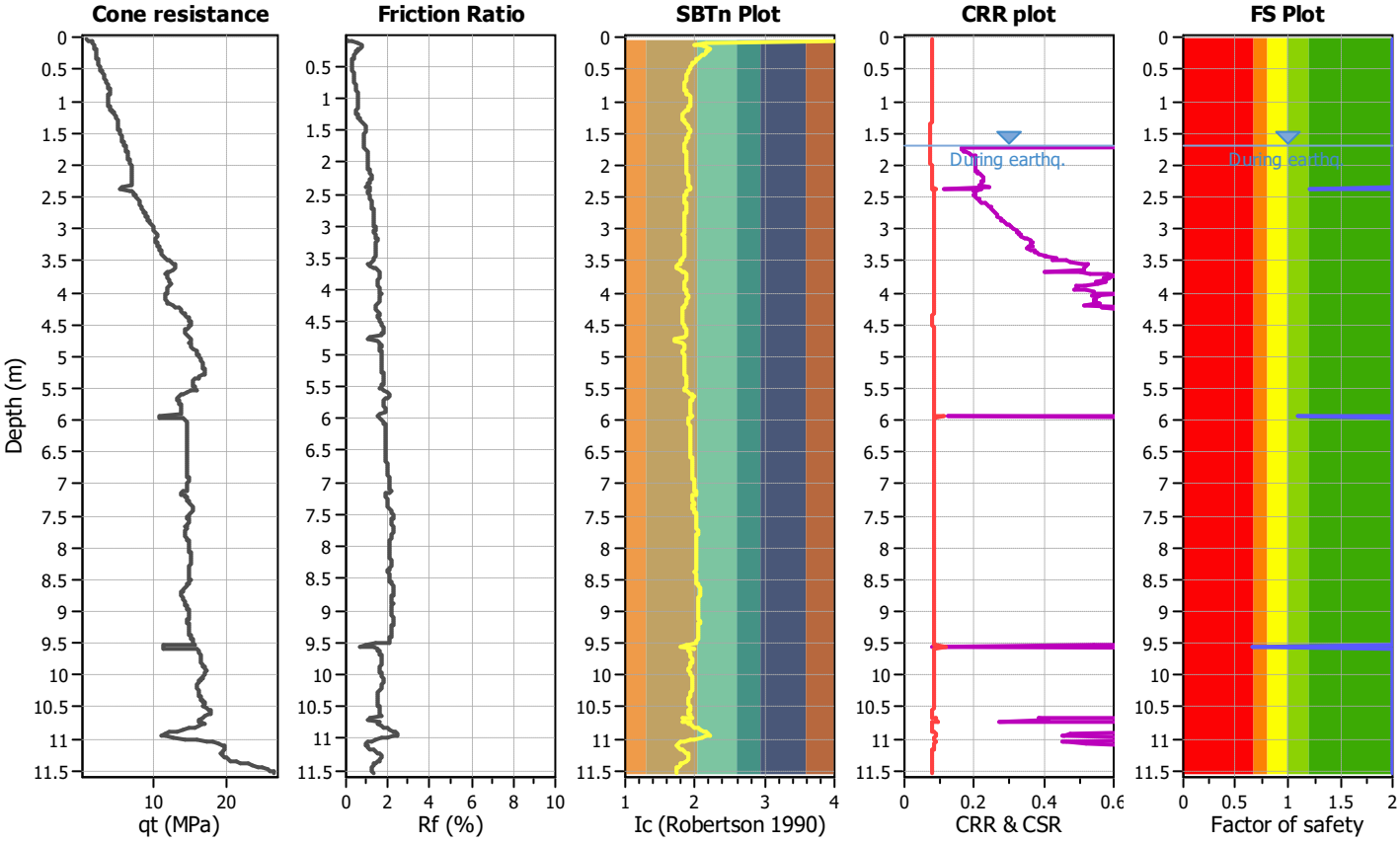
LIQUEFACTION ANALYSIS REPORT

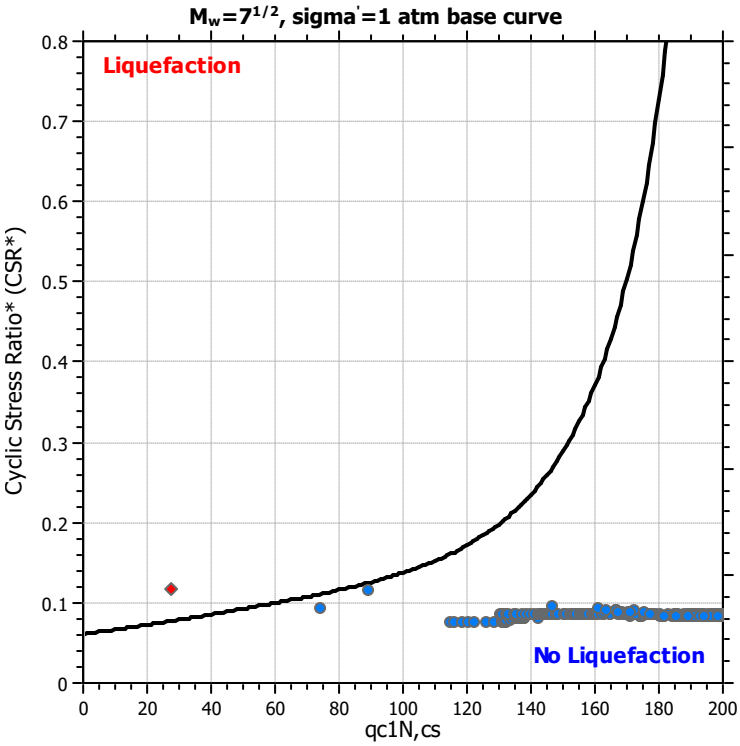
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

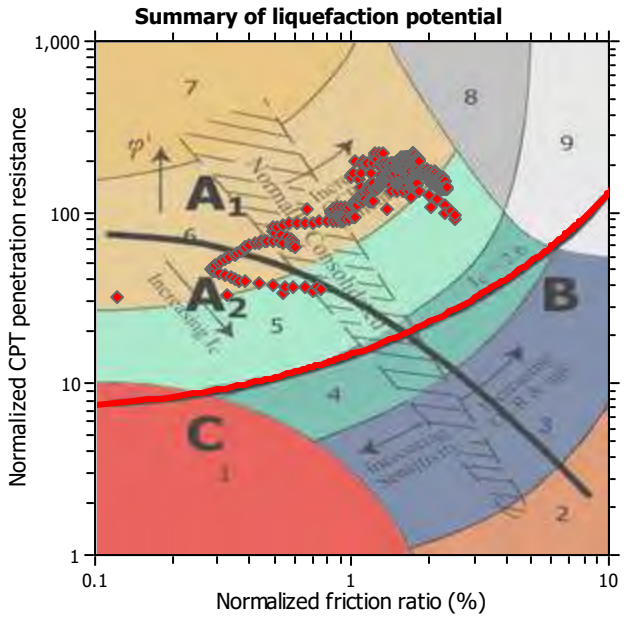
CPT file : CPT11_SLS

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.70 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	6.50	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:	No		

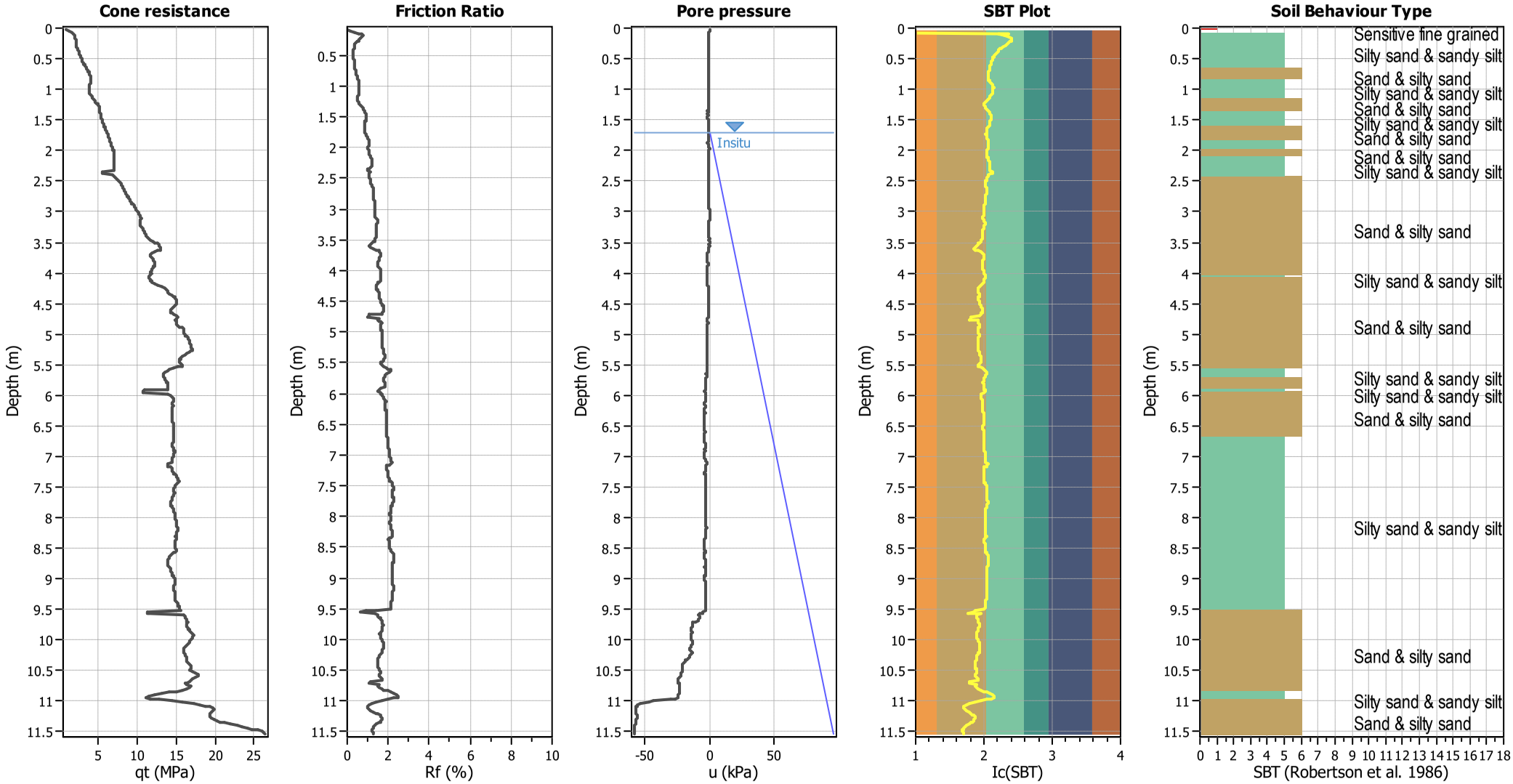






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



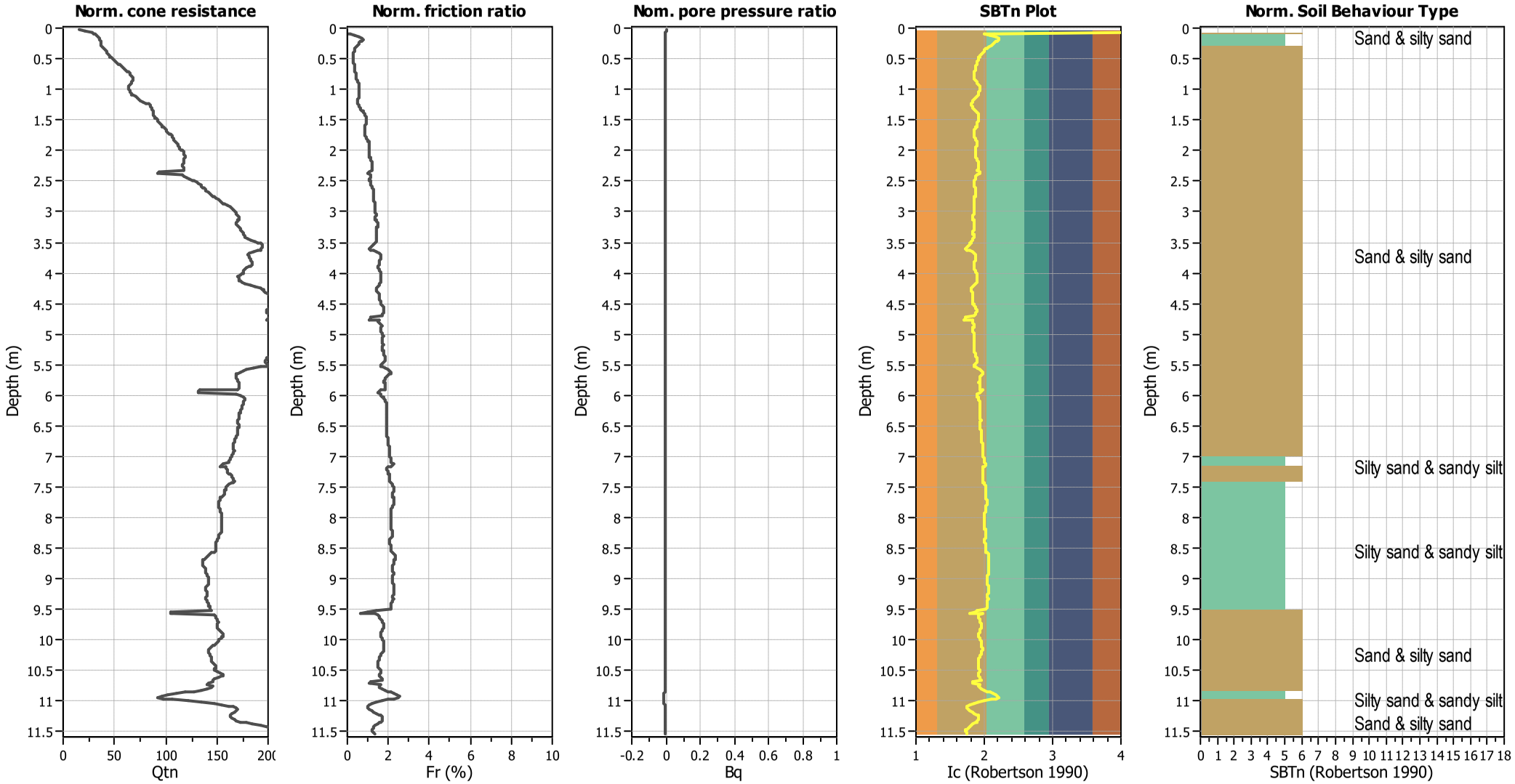
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

CPT basic interpretation plots (normalized)



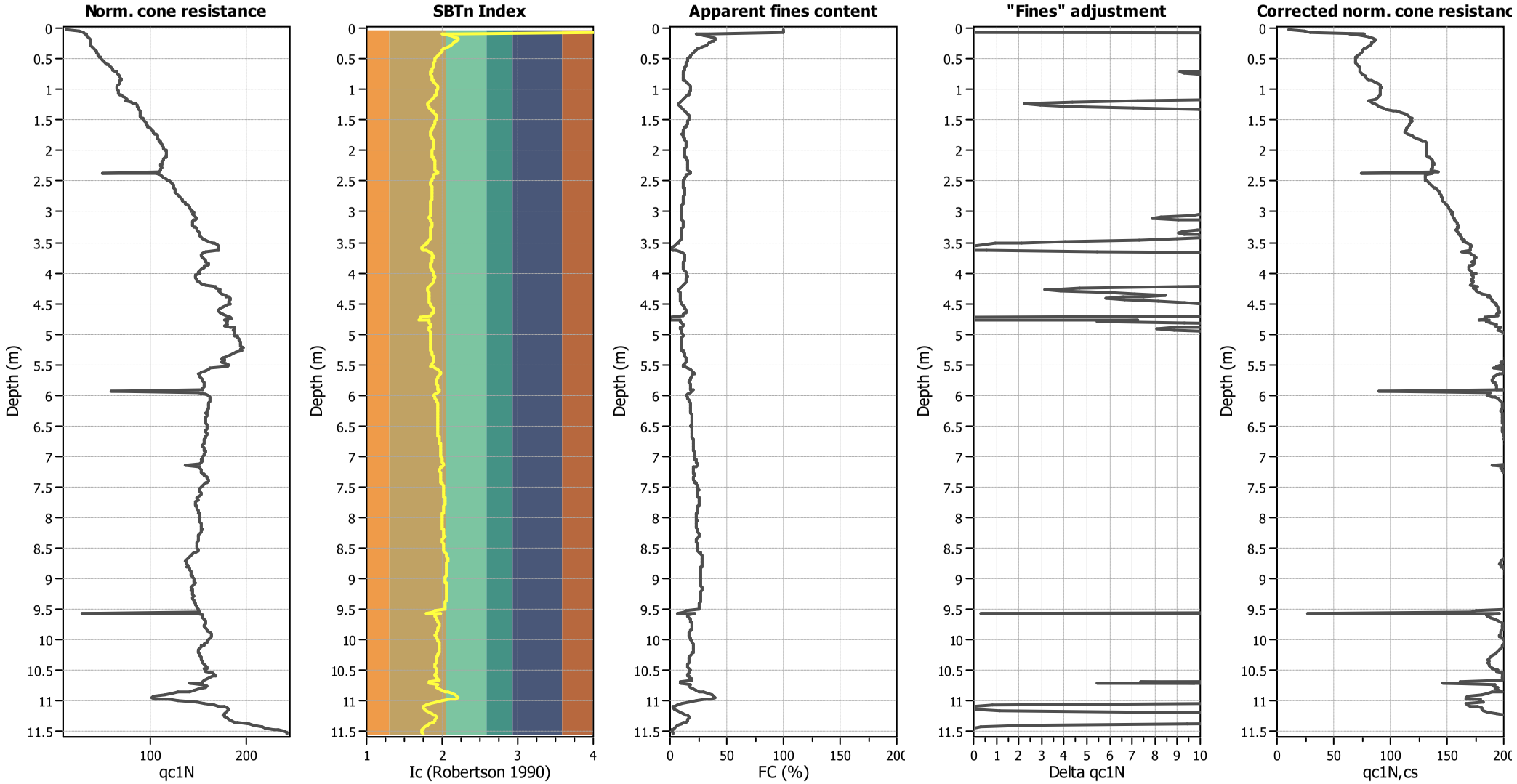
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

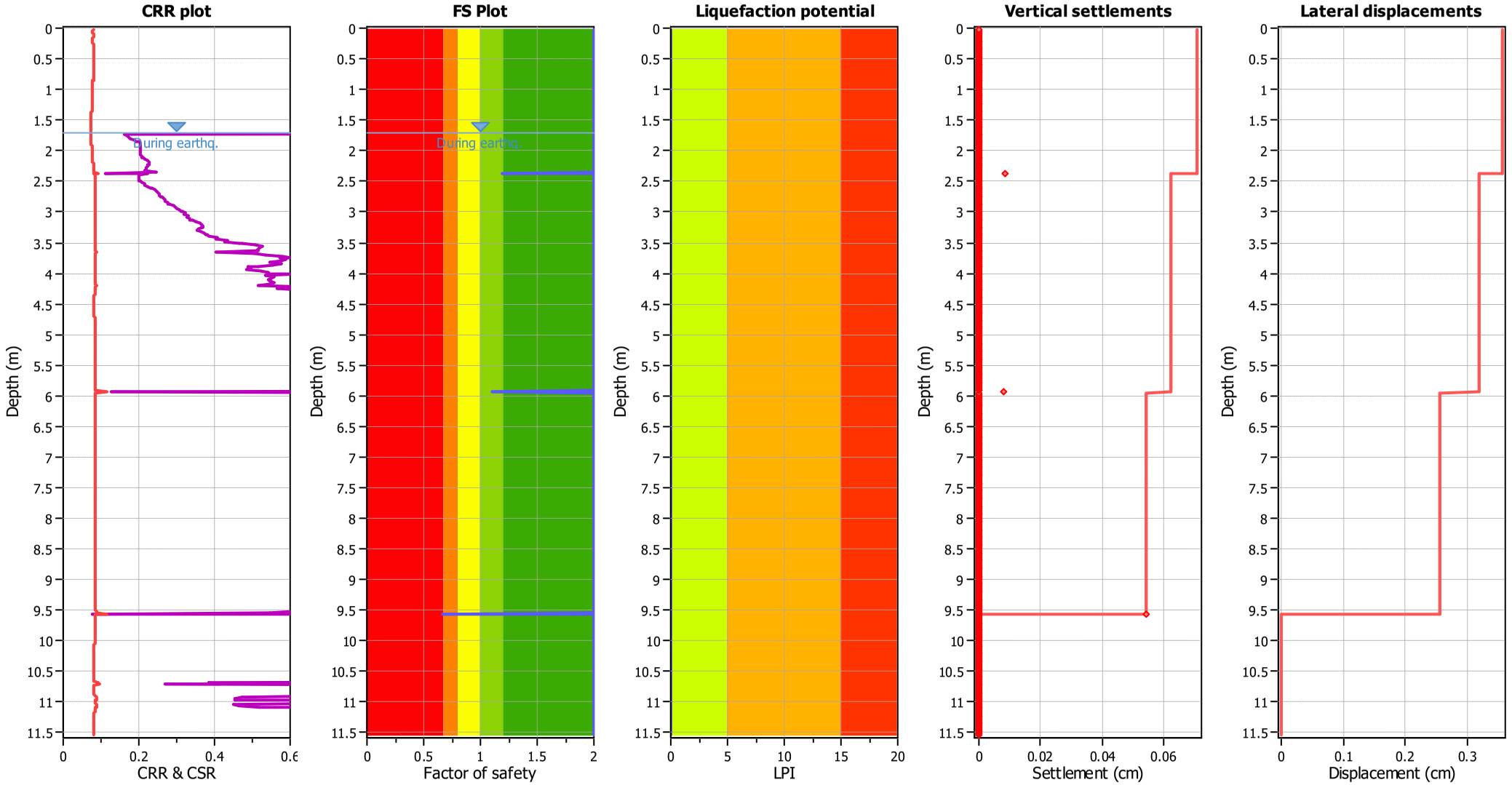
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

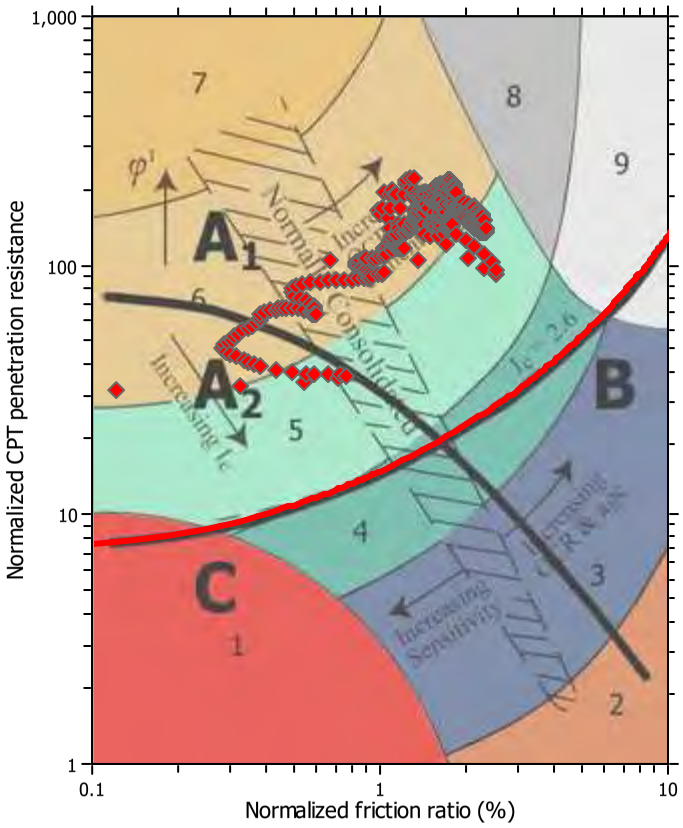
F.S. color scheme

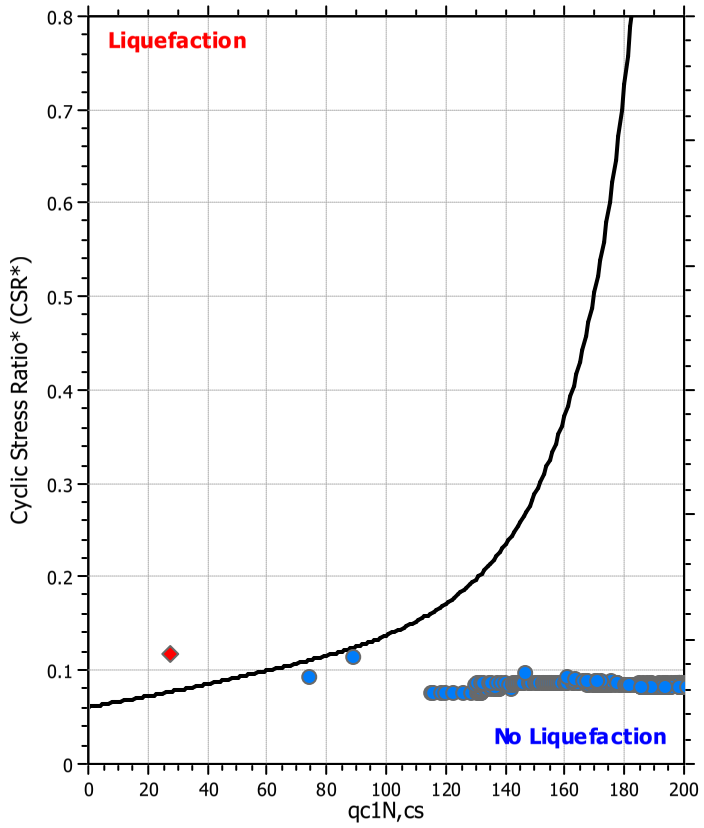
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

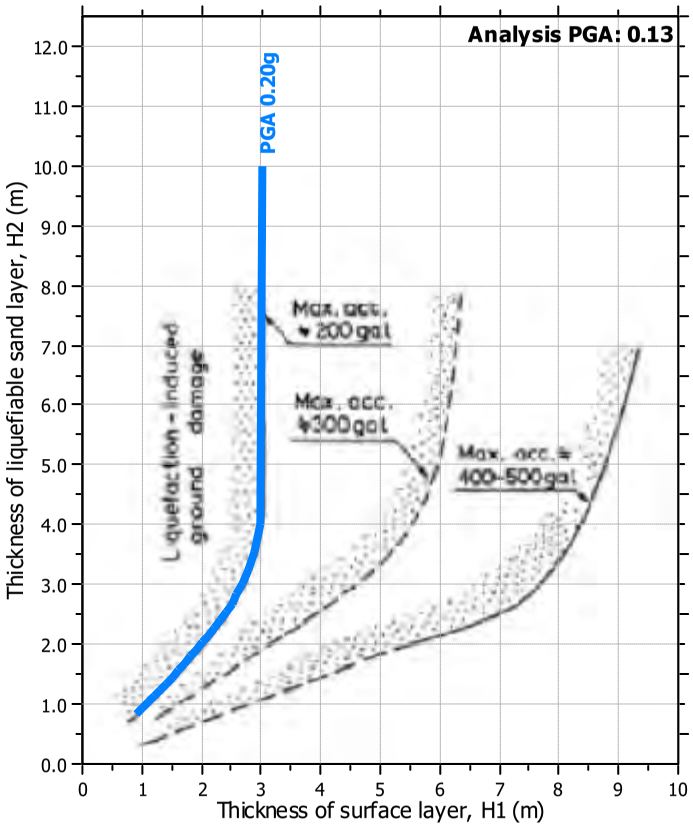
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



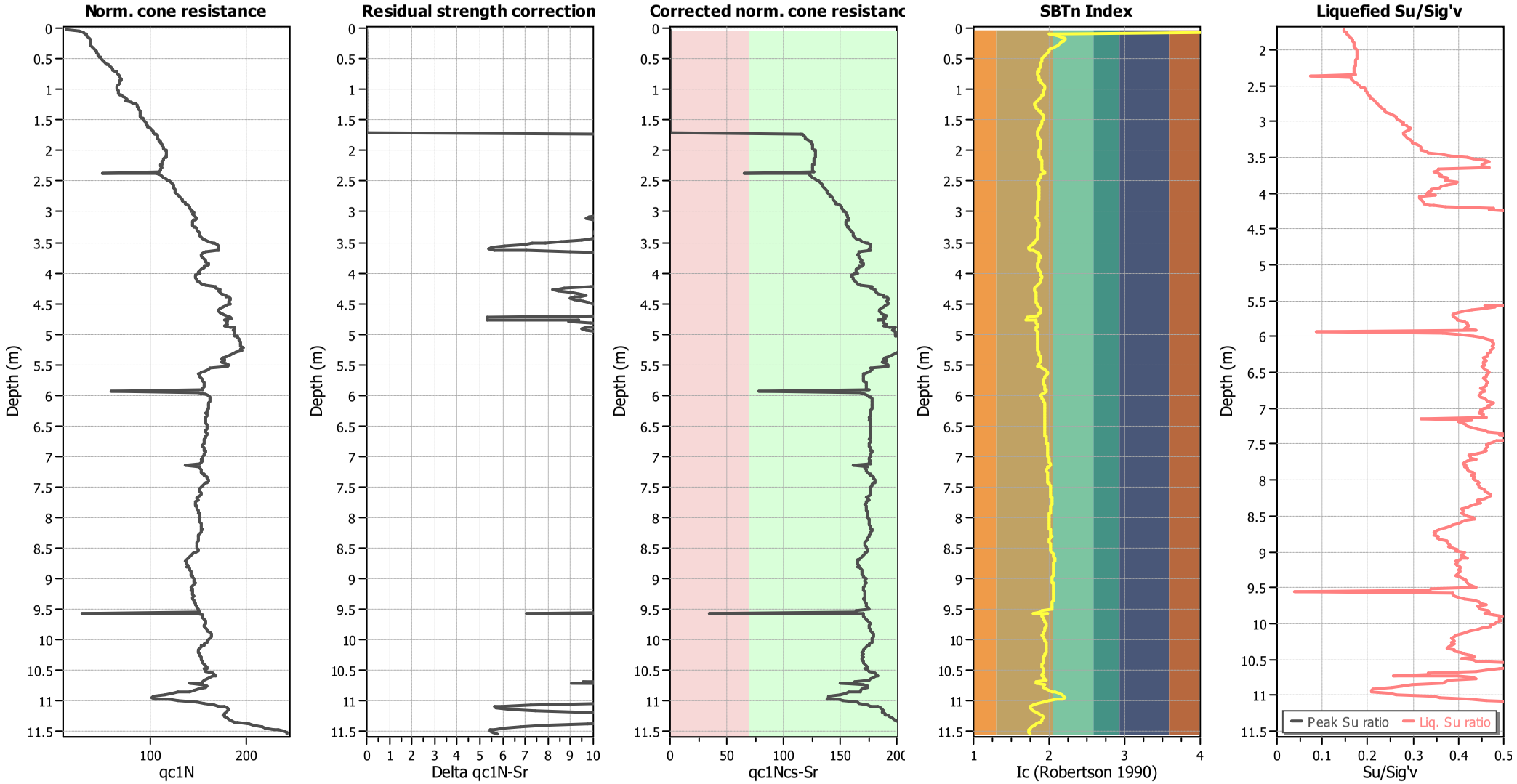




Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

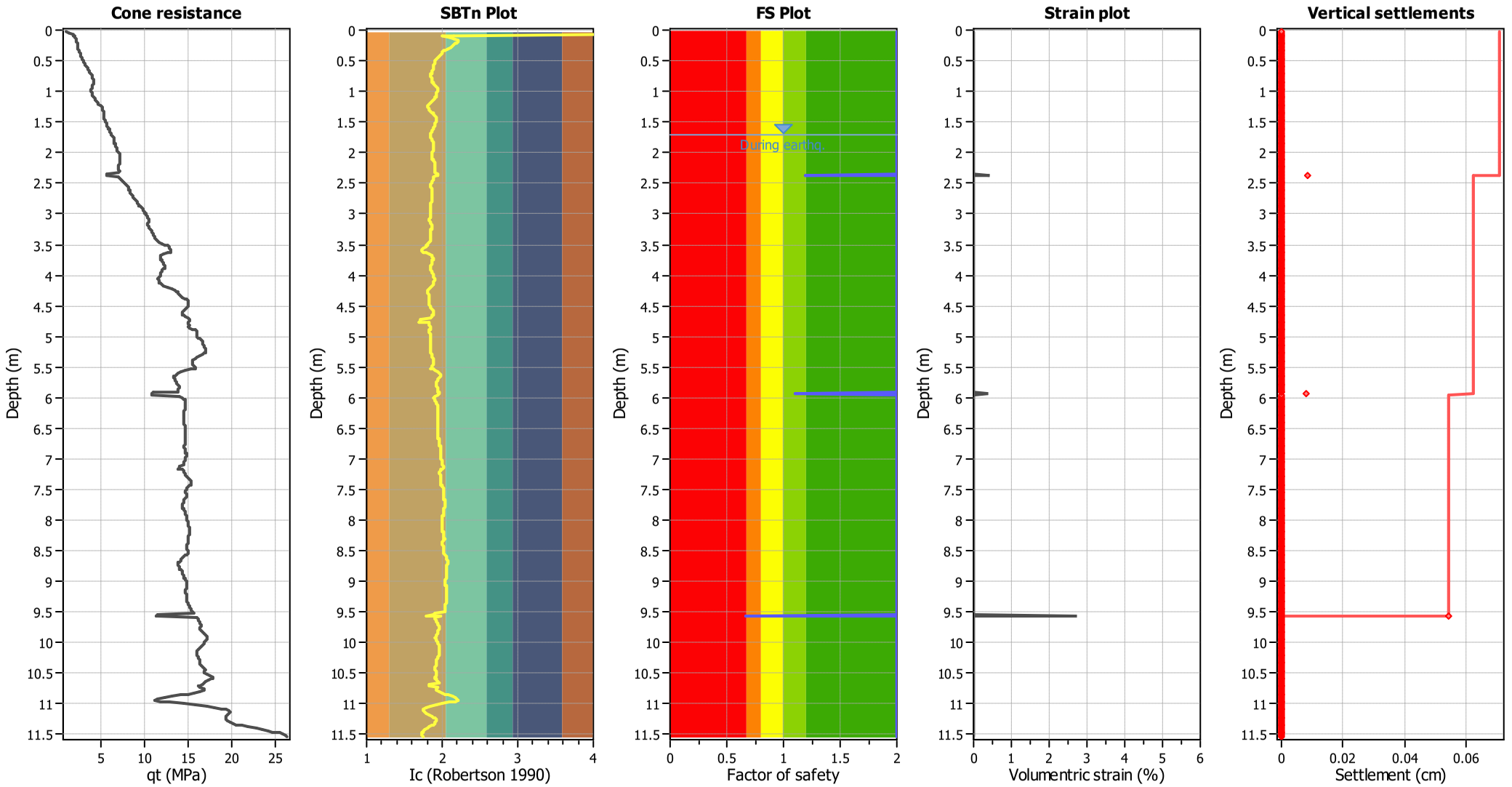
Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	6.50	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.13	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

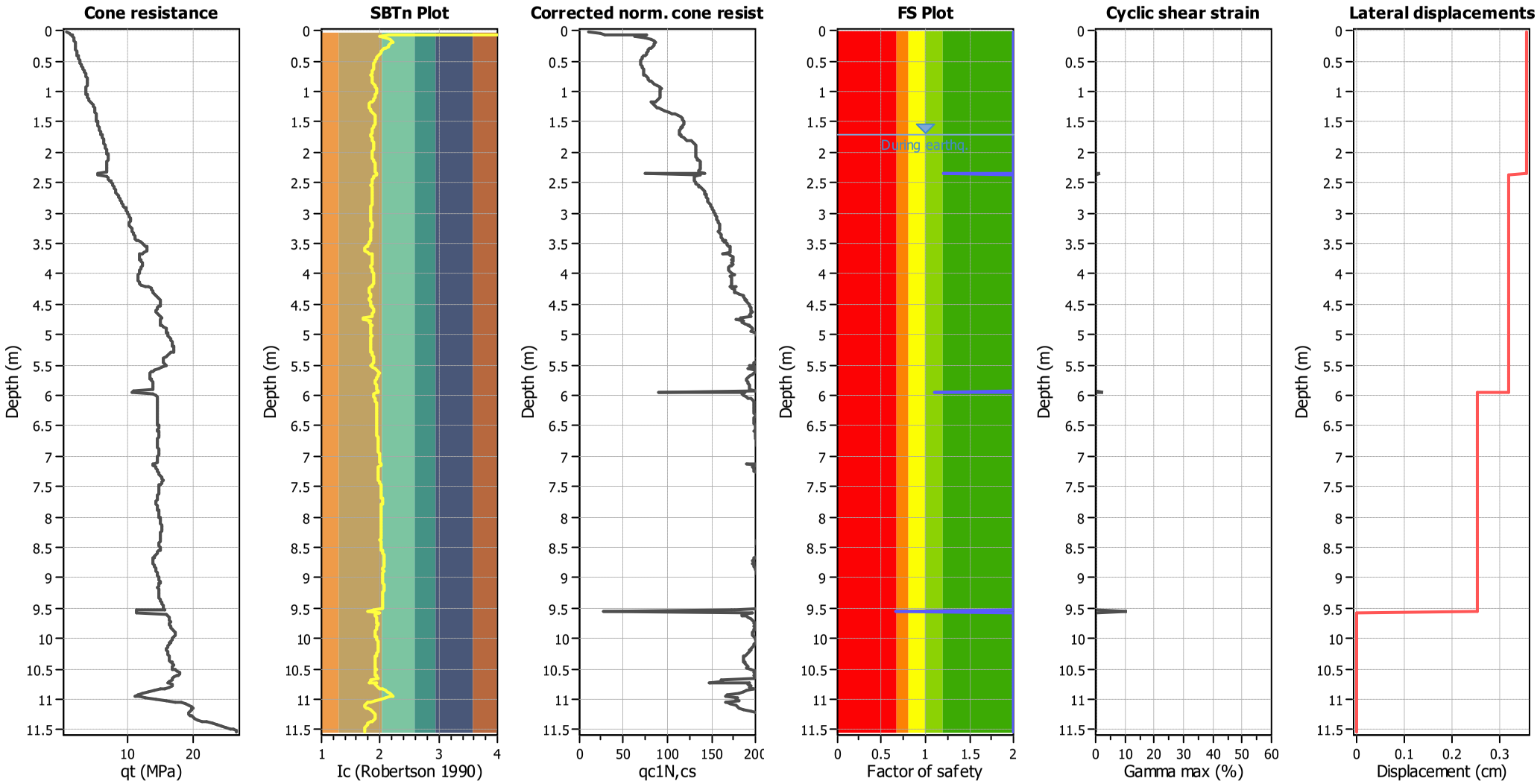
Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

Estimation of post-earthquake lateral Displacements



Abbreviations

q_t: Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c: Soil Behaviour Type Index
$q_{c1N,cs}$: Equivalent clean sand normalized CPT total cone resistance
F.S.: Factor of safety
γ_{max}: Maximum cyclic shear strain
LDI: Lateral displacement index

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2/182 Main Rd Tawa
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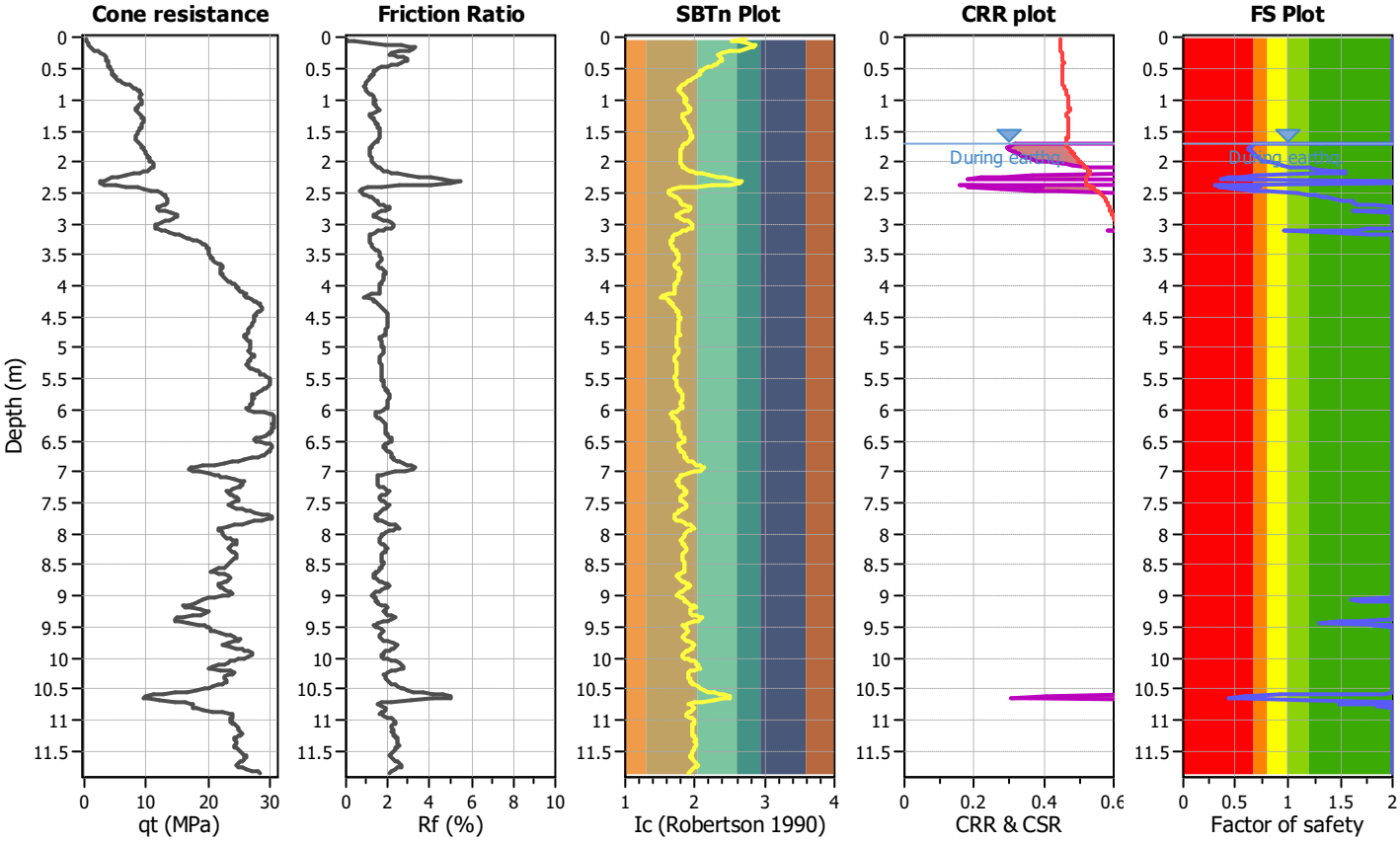
LIQUEFACTION ANALYSIS REPORT

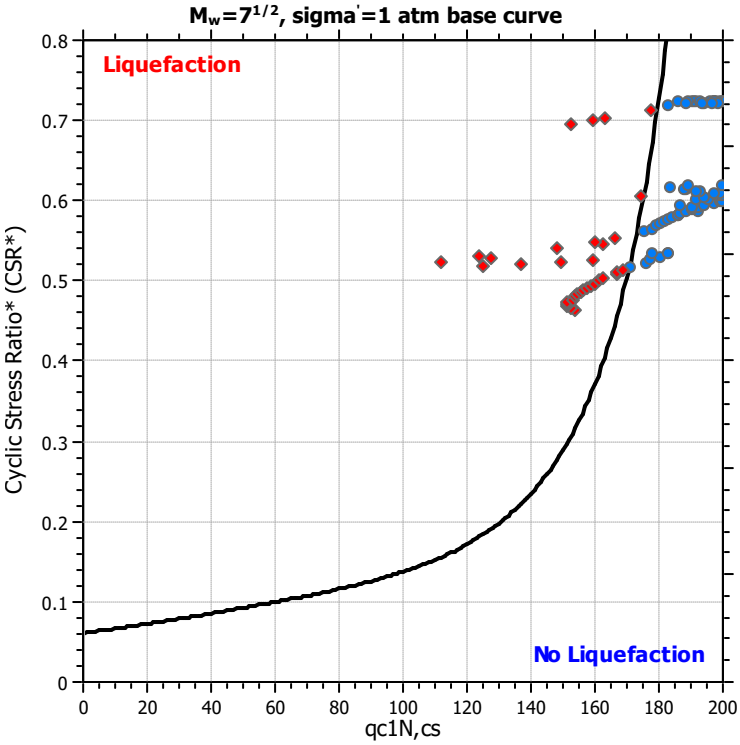
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

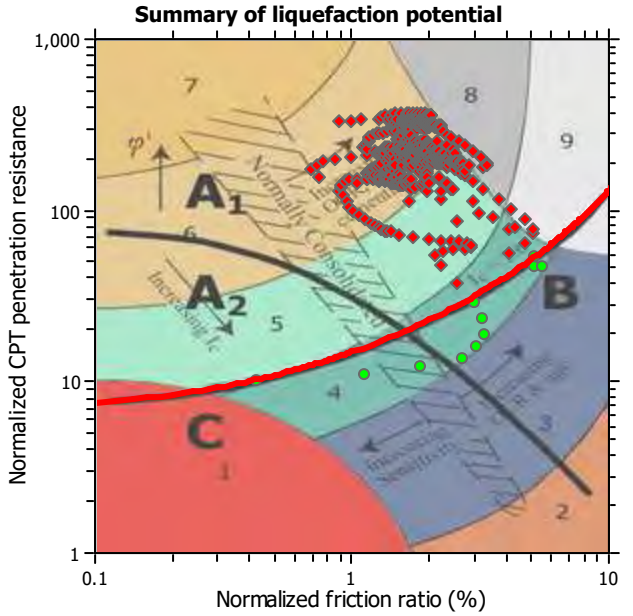
CPT file : CPT01_ULS

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.70 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	No		

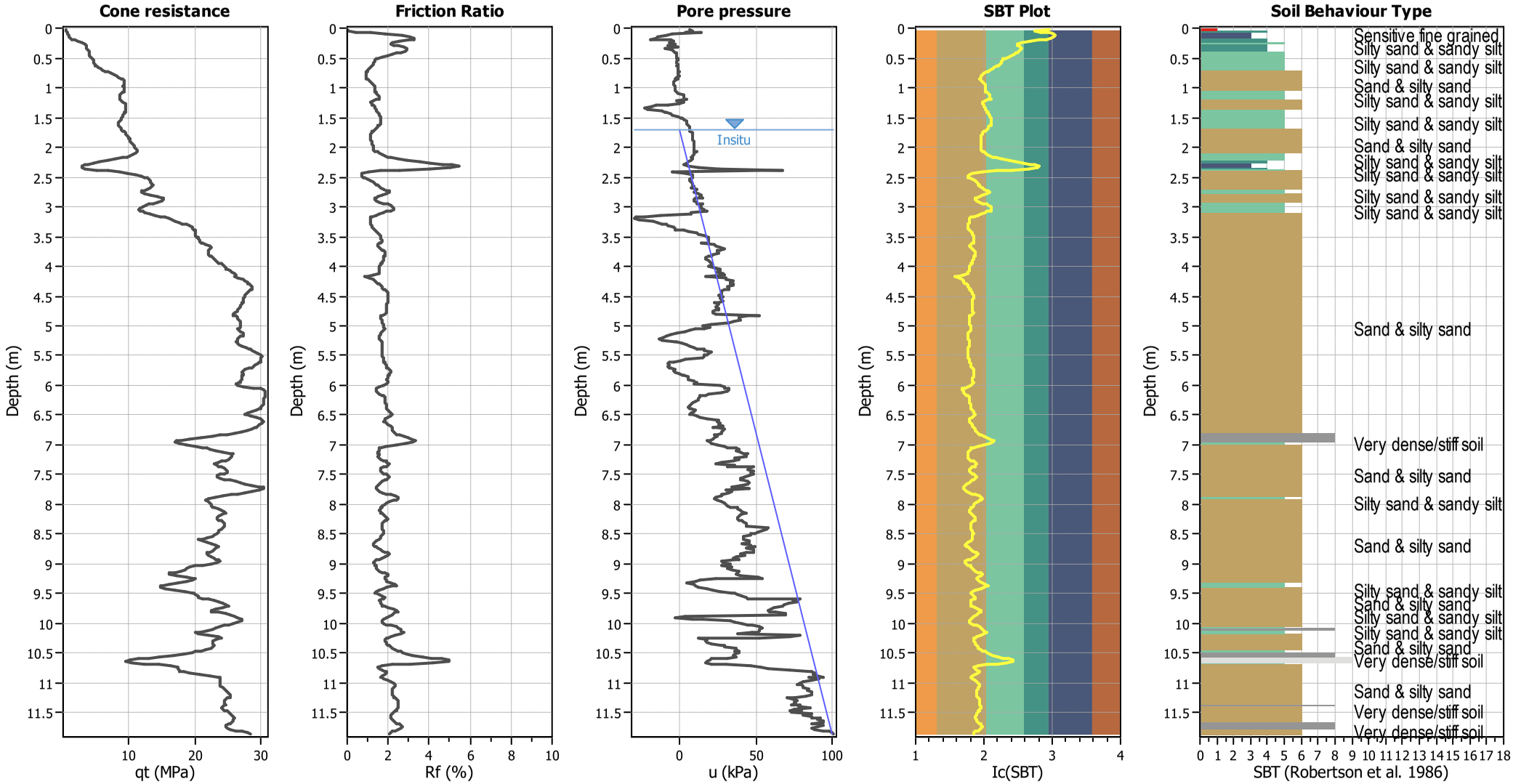






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



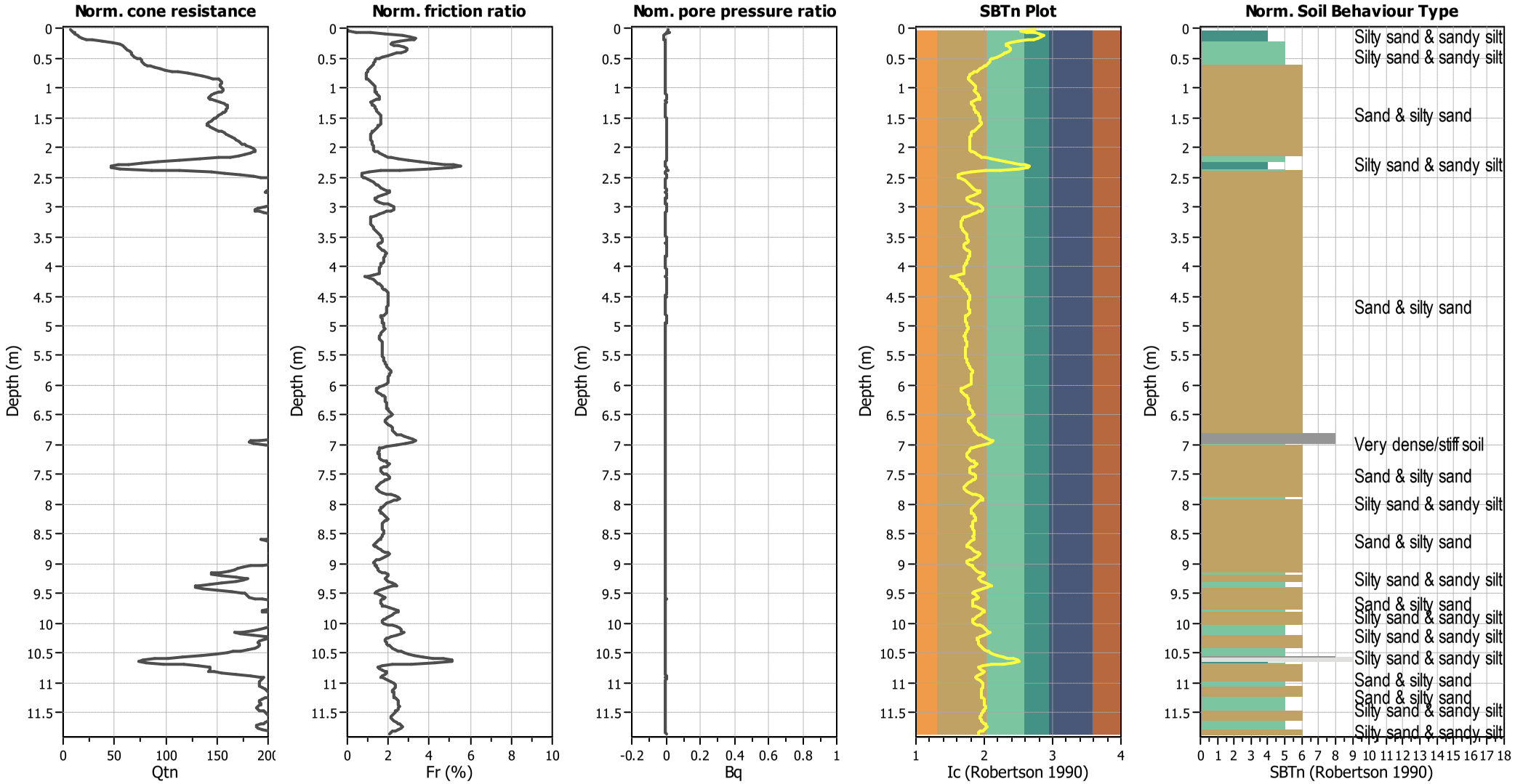
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

CPT basic interpretation plots (normalized)



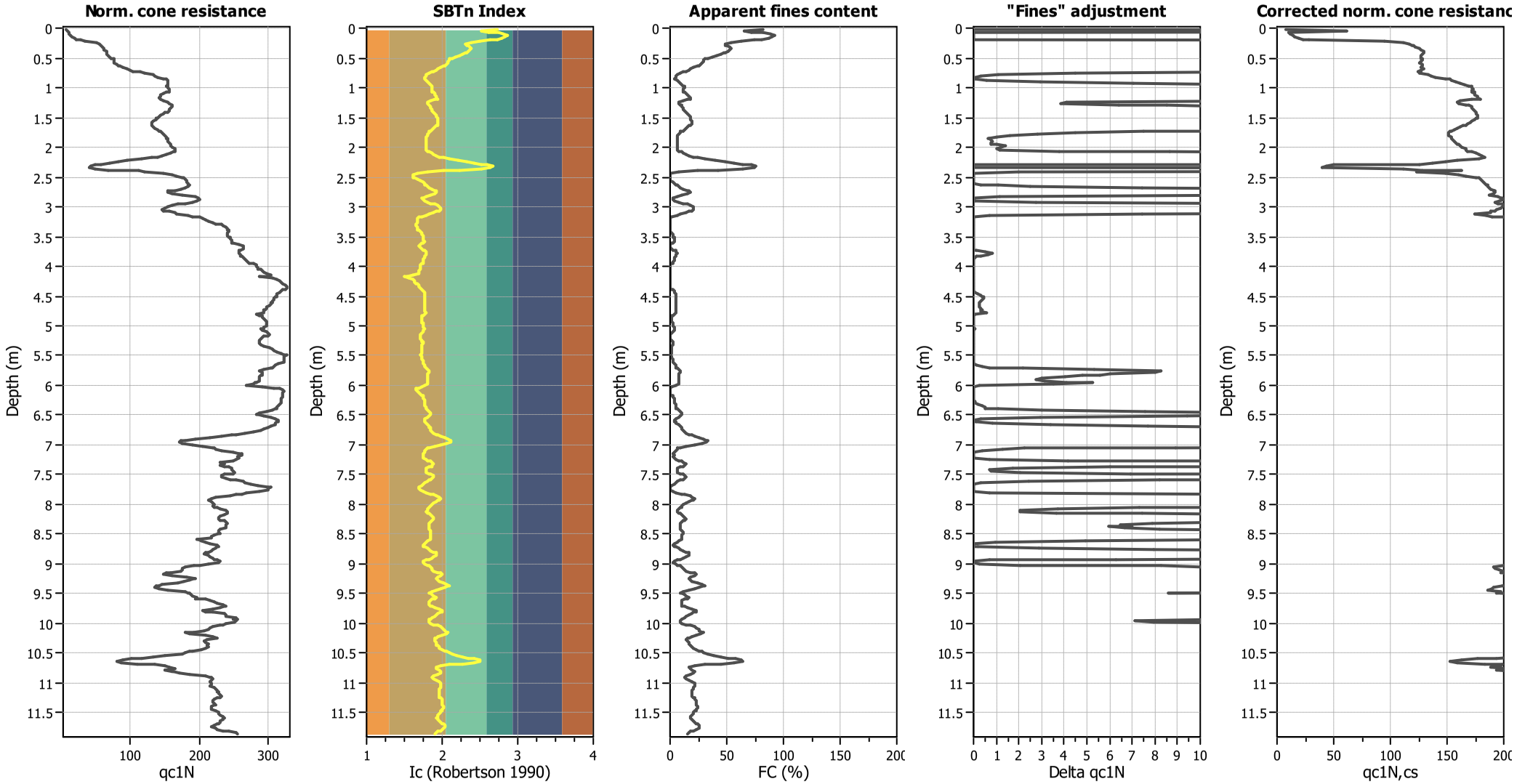
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

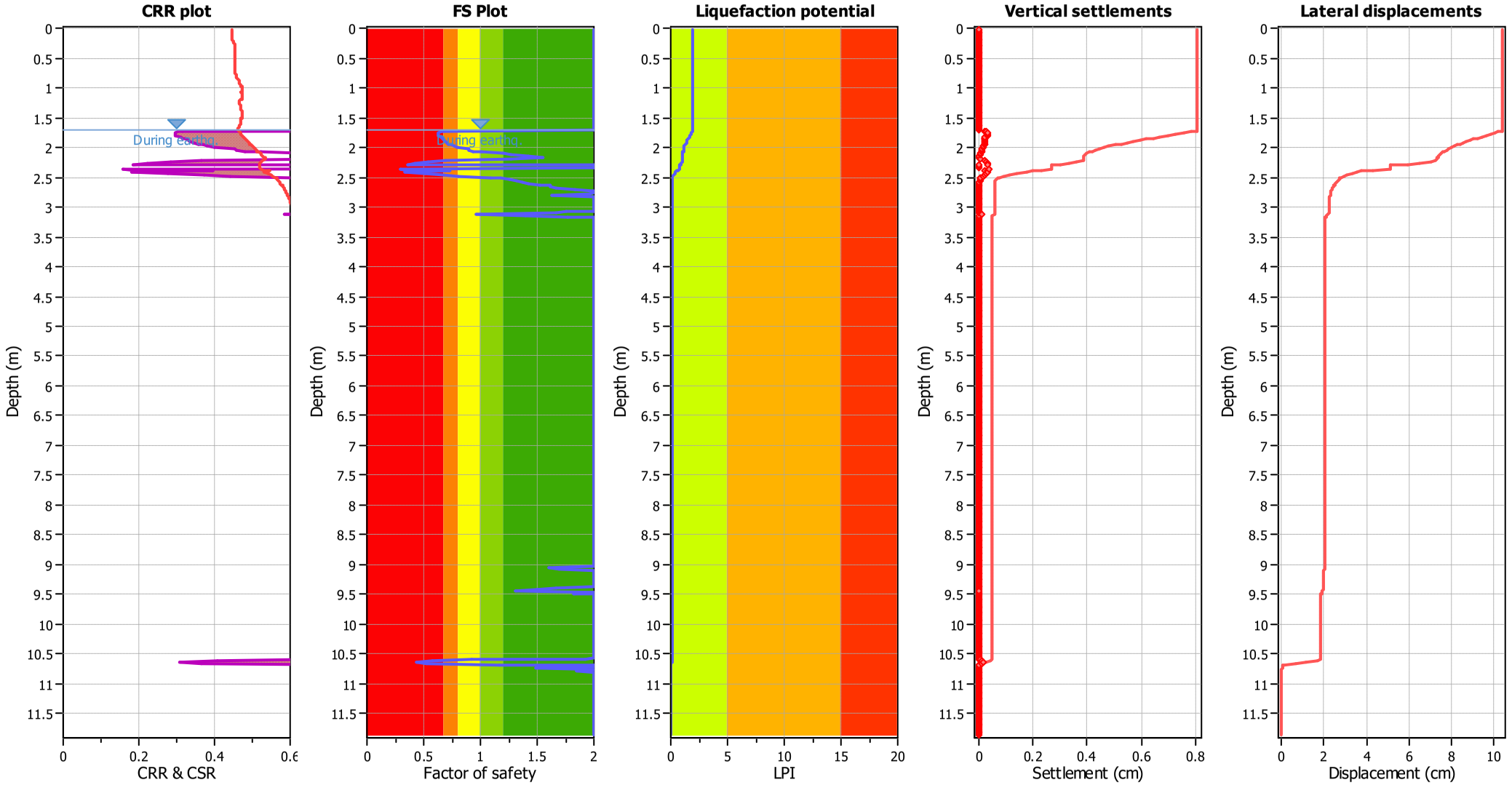
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

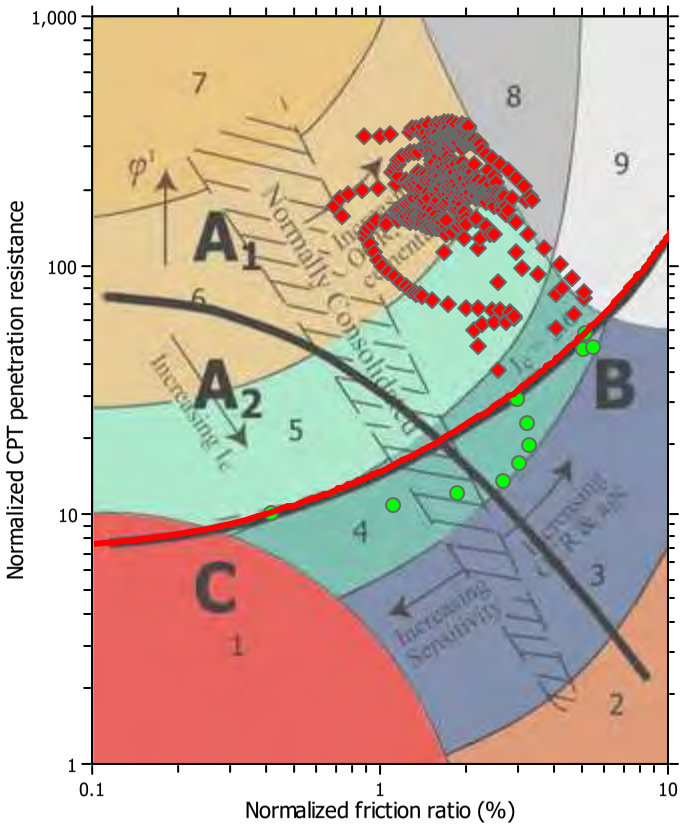
F.S. color scheme

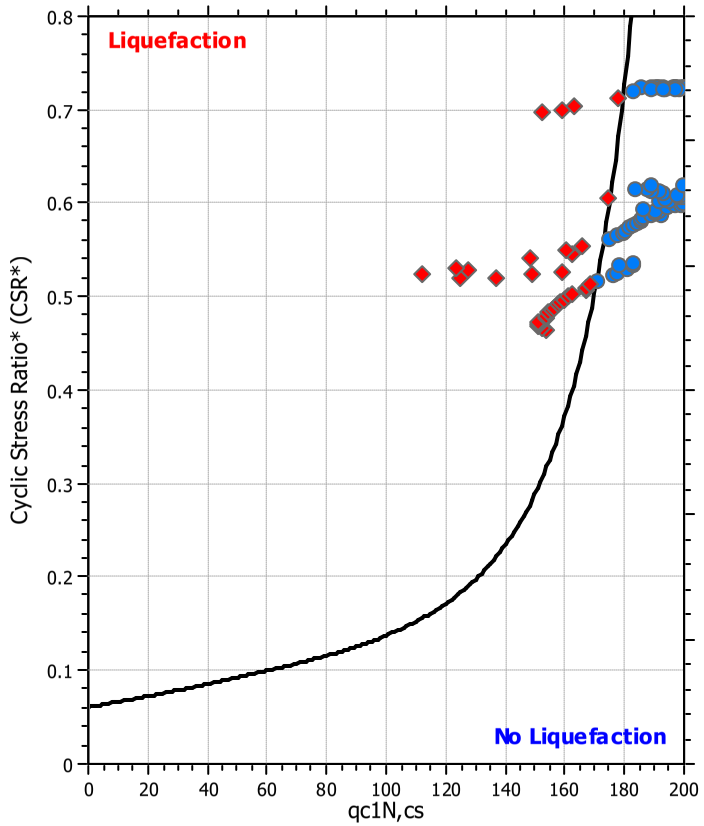
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

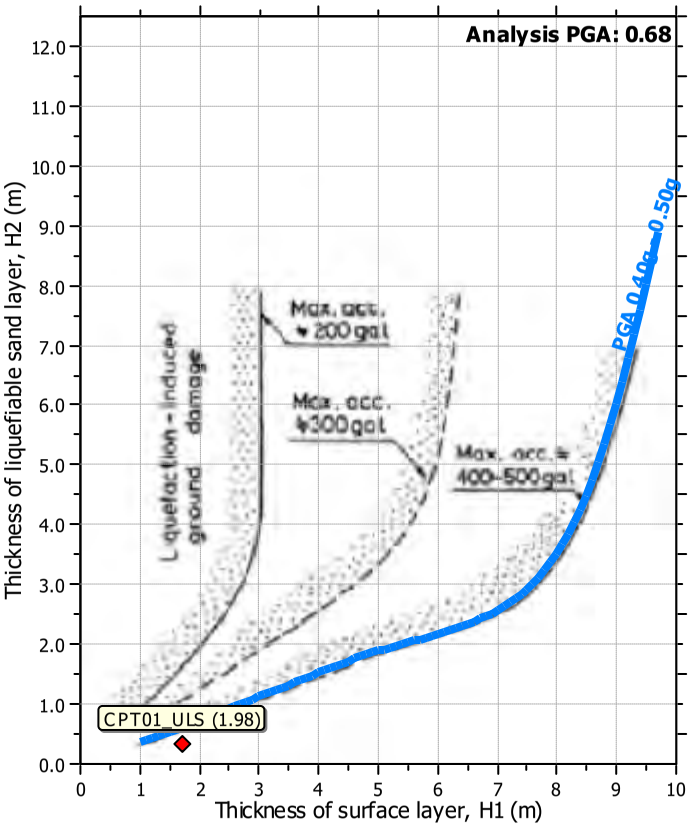
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



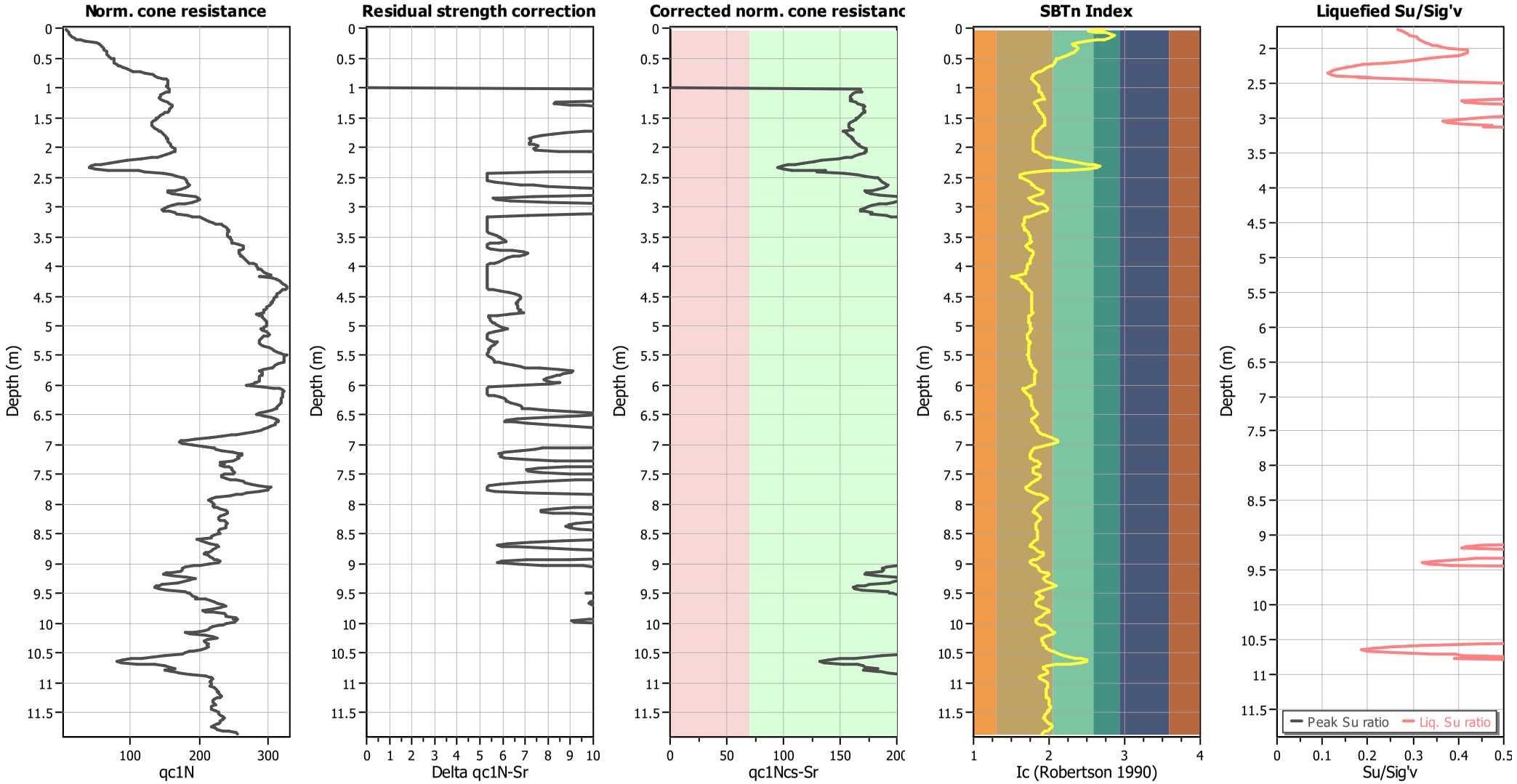




Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

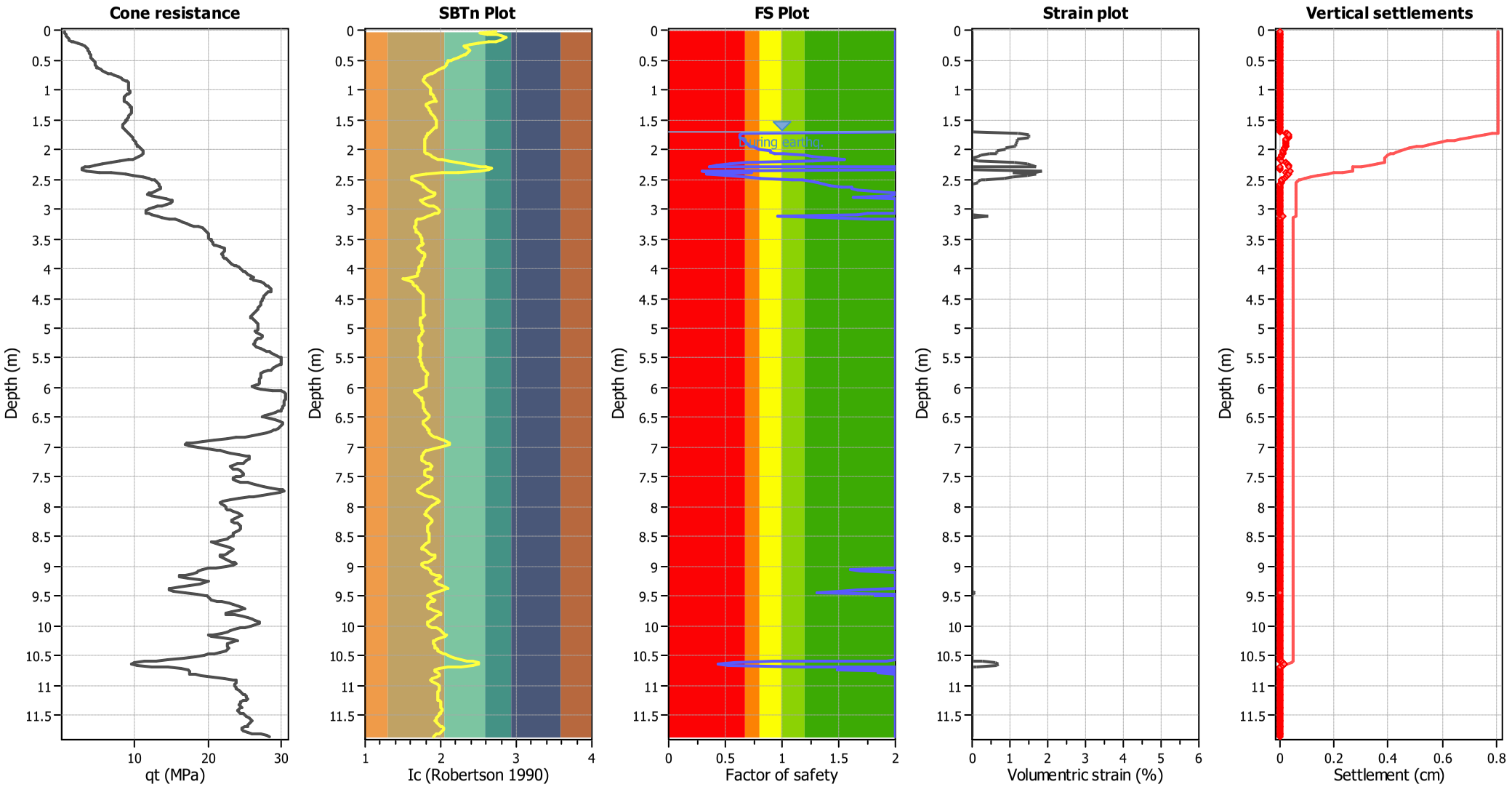
Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

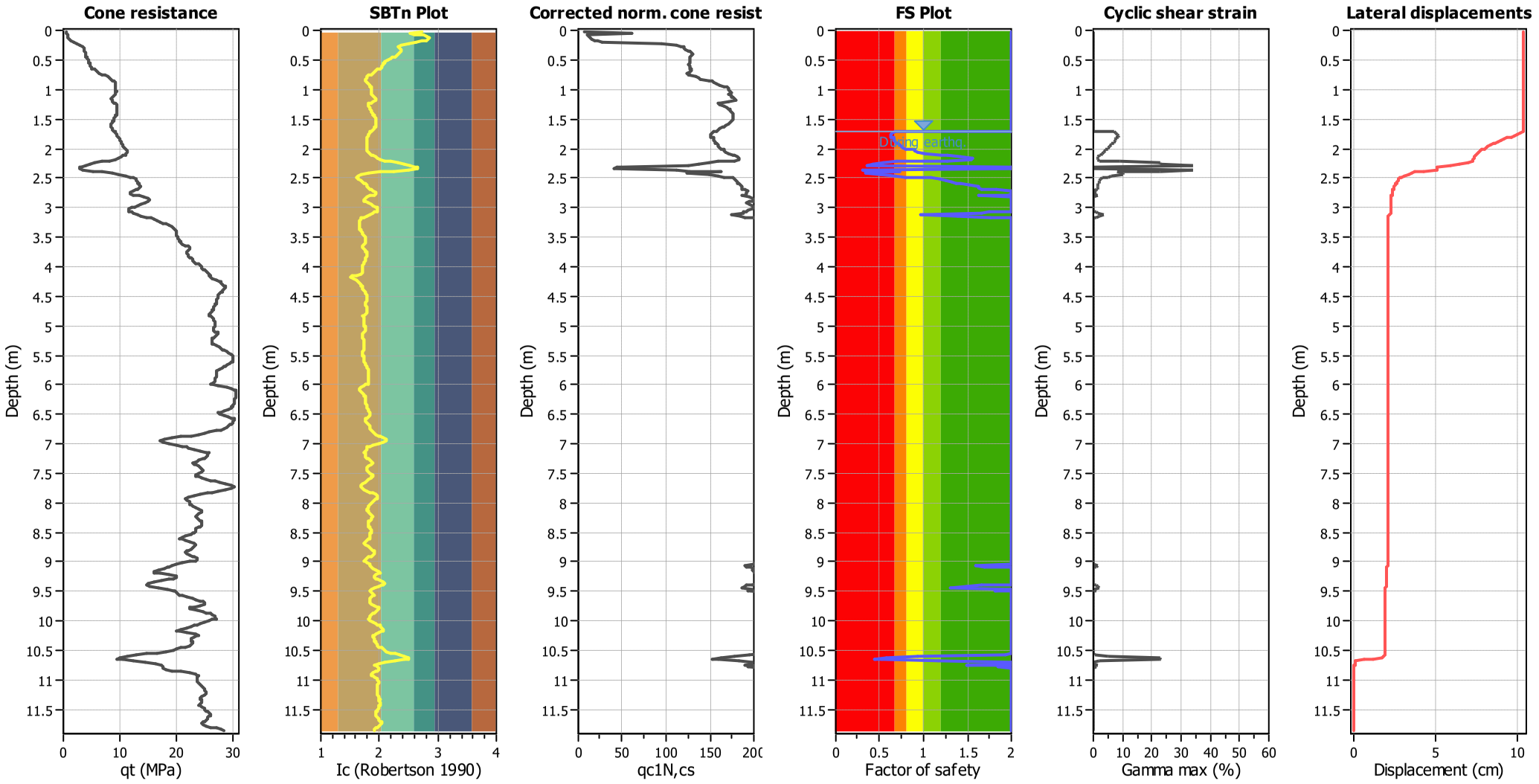
Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

Estimation of post-earthquake lateral Displacements



Abbreviations

q_t: Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c: Soil Behaviour Type Index
$q_{c1N,cs}$: Equivalent clean sand normalized CPT total cone resistance
F.S.: Factor of safety
γ_{max}: Maximum cyclic shear strain
LDI: Lateral displacement index

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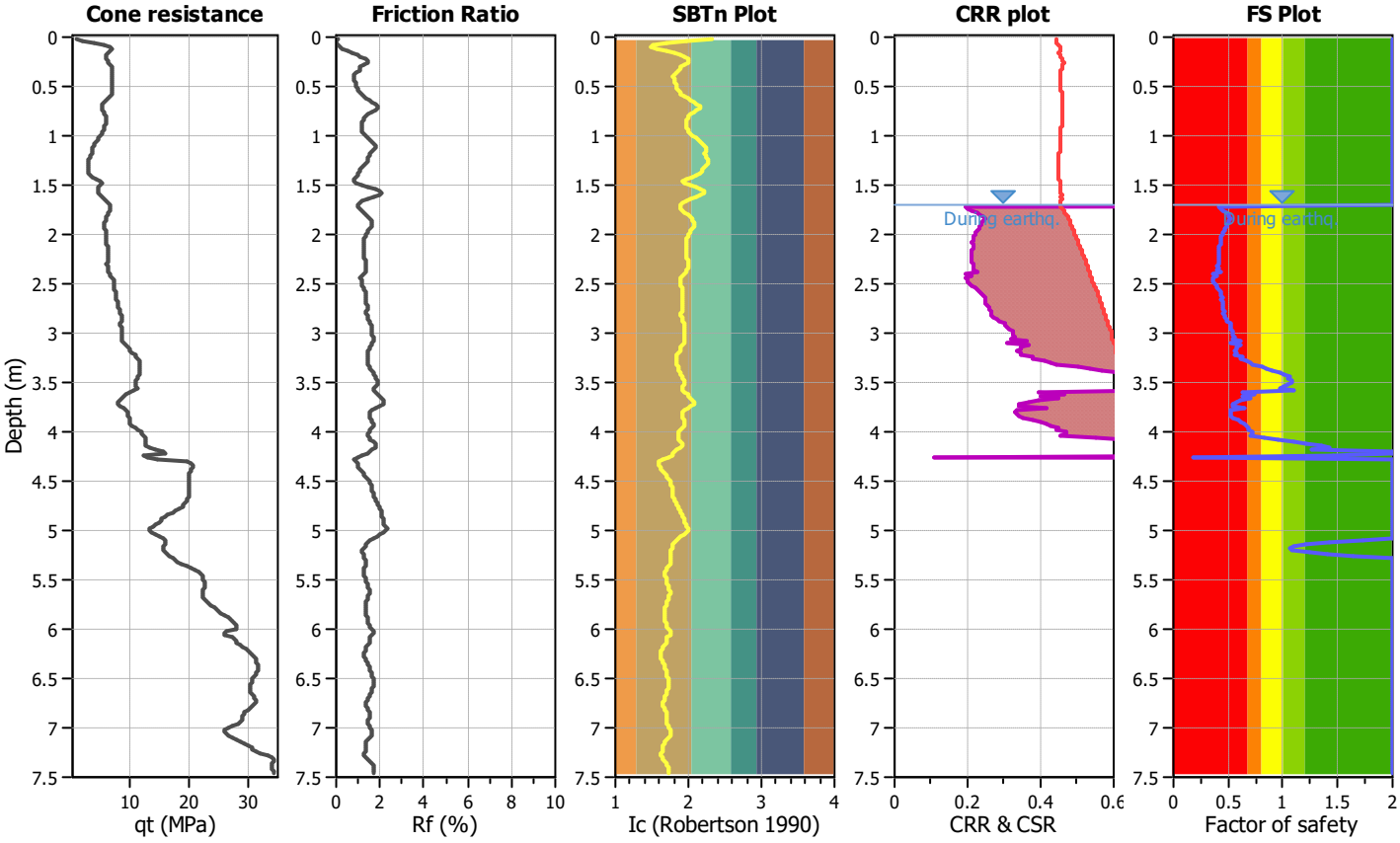
LIQUEFACTION ANALYSIS REPORT

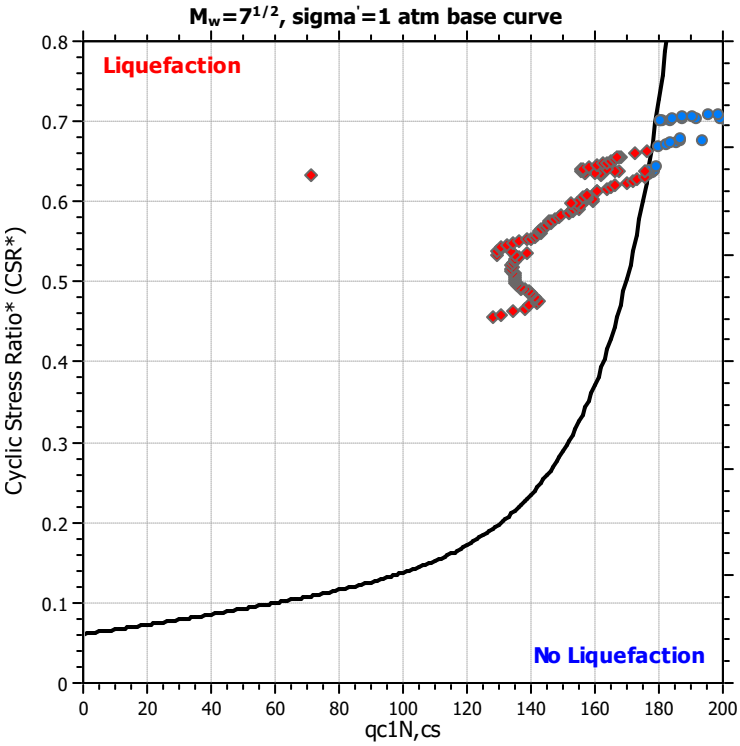
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

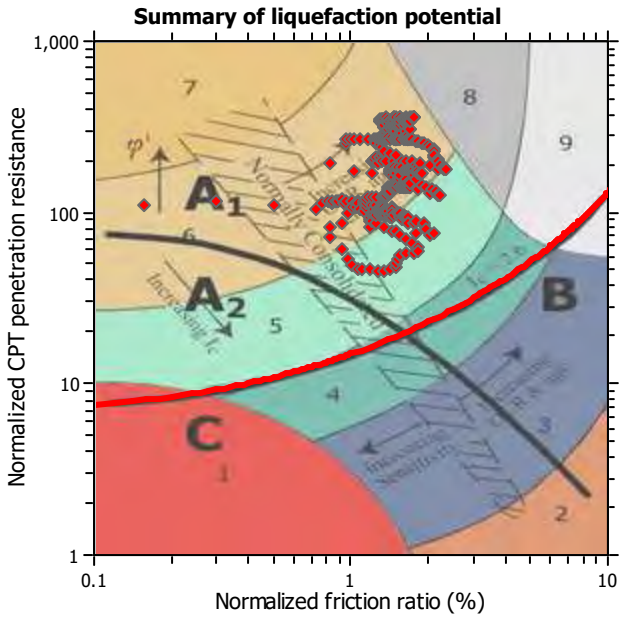
CPT file : CPT02_ULS

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.70 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	No		

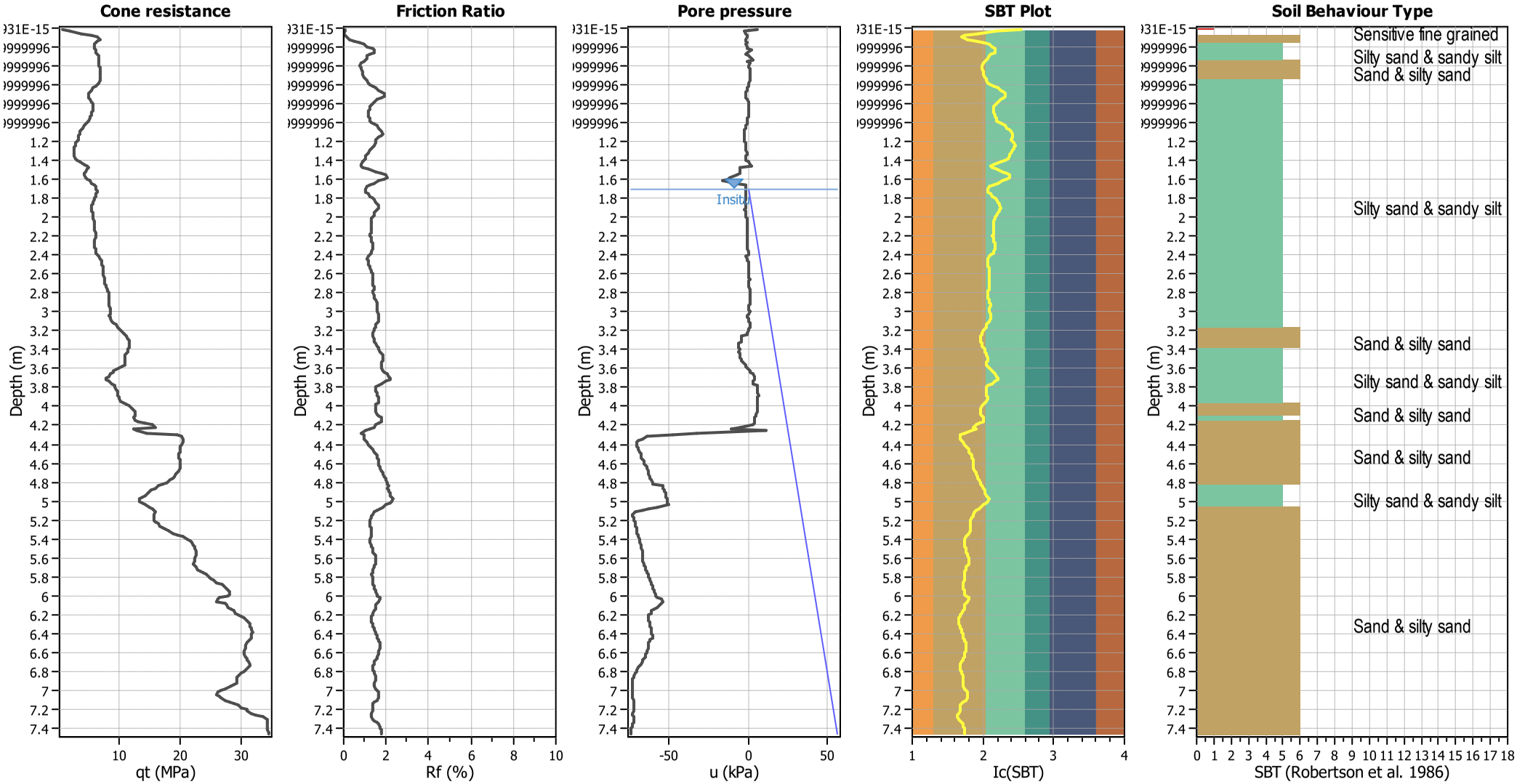






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



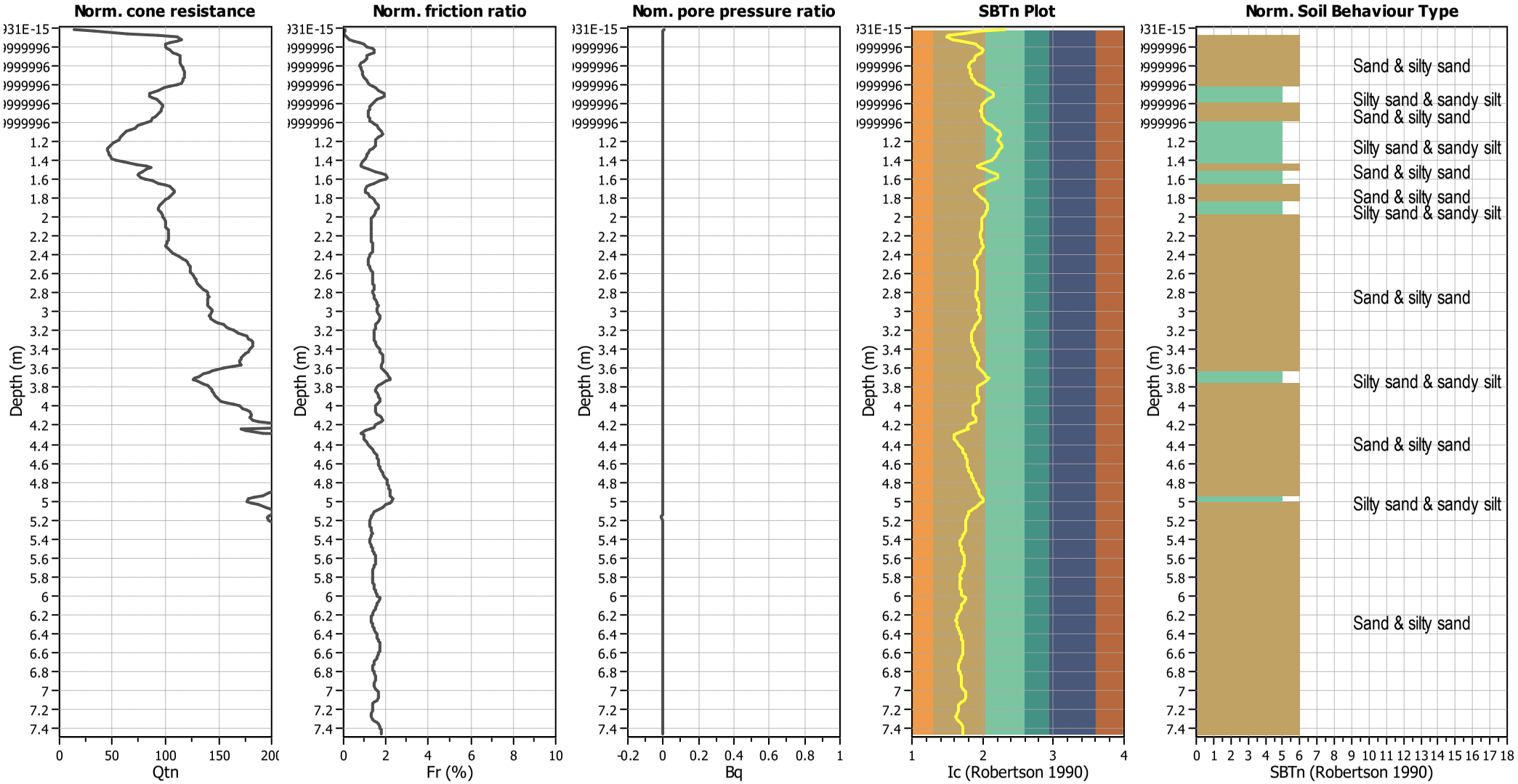
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

CPT basic interpretation plots (normalized)



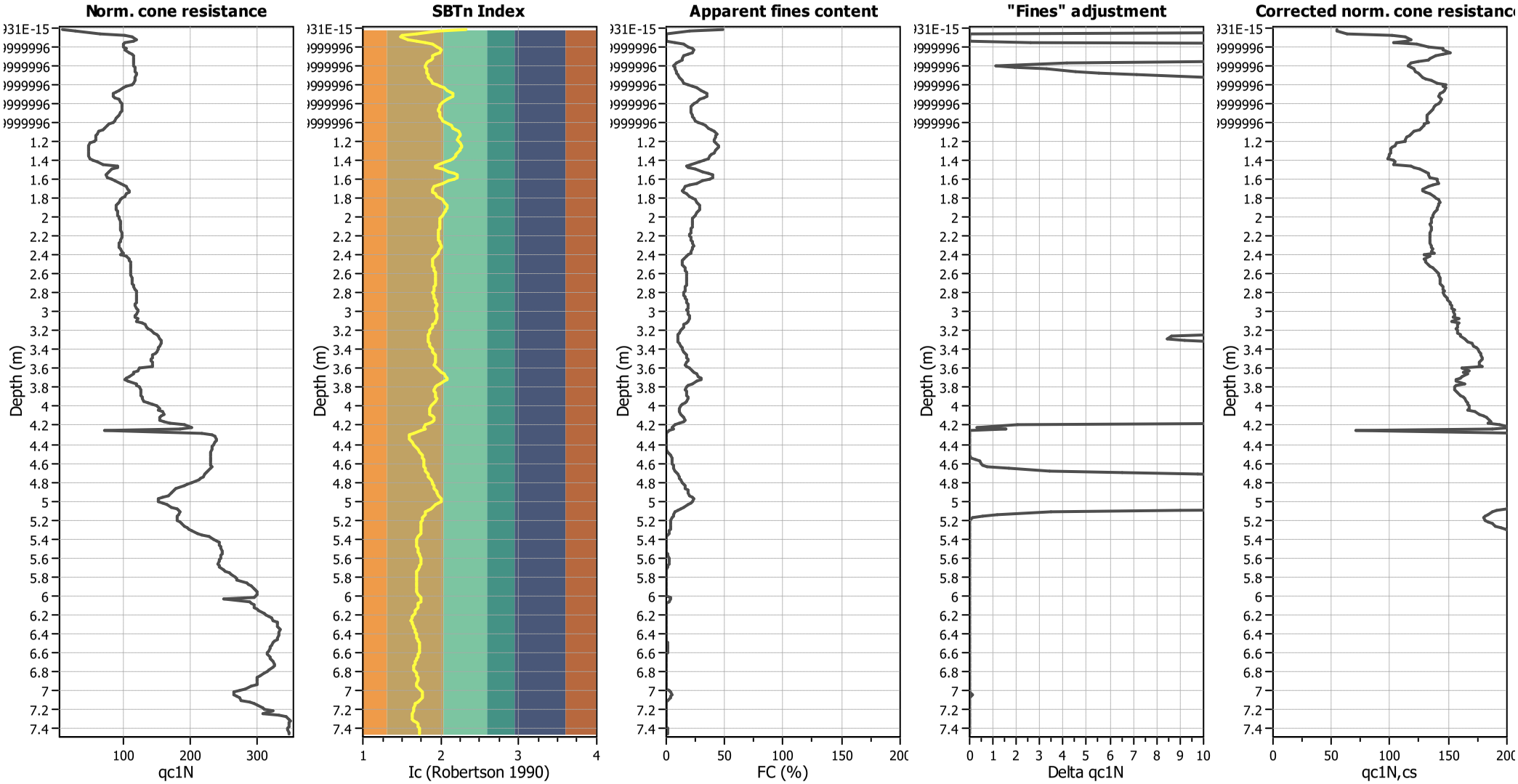
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

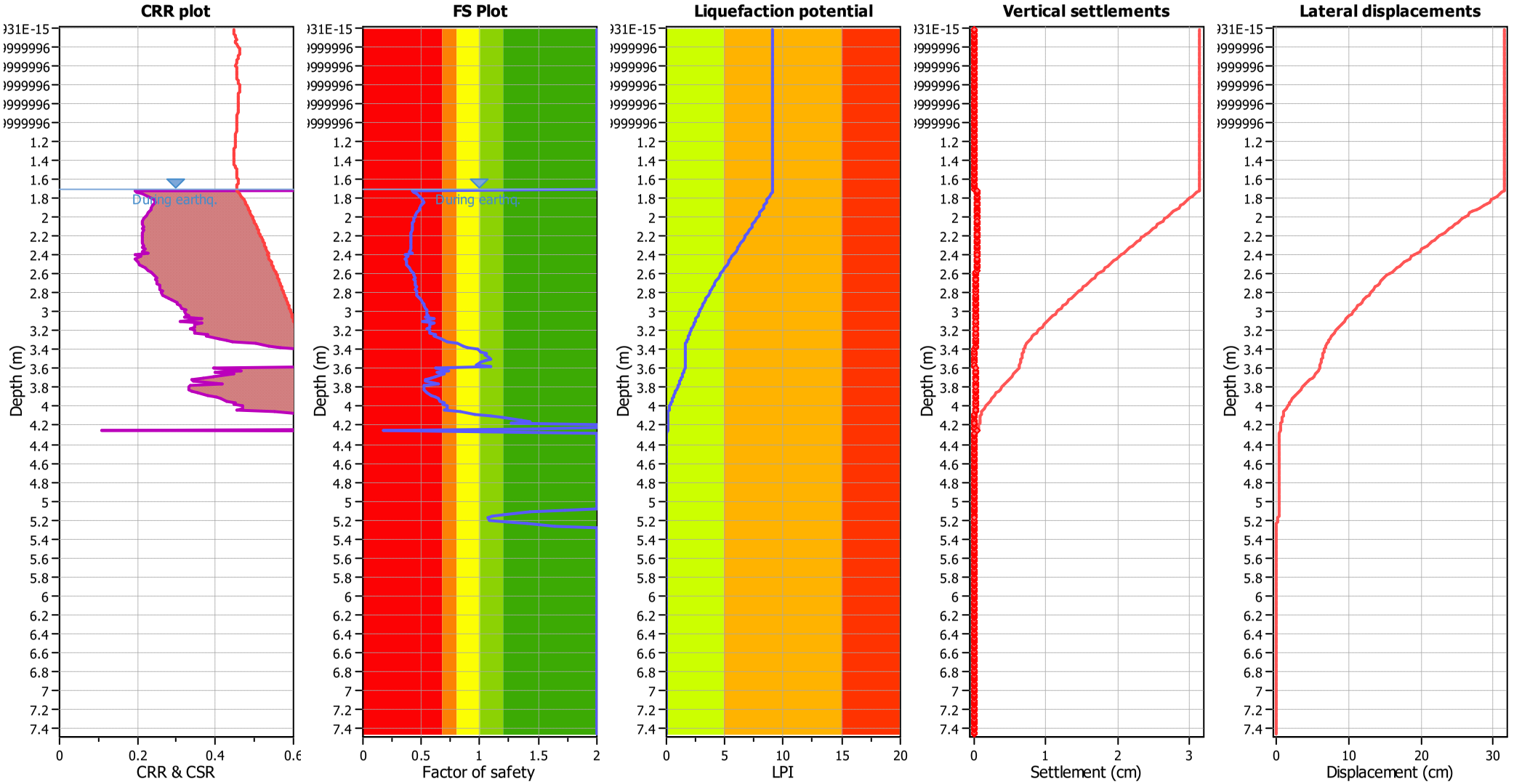
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

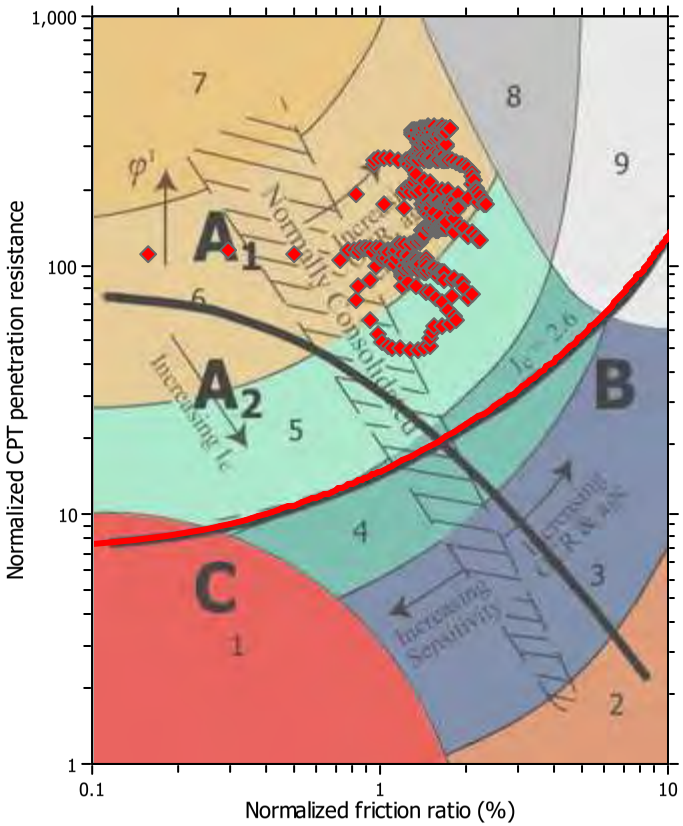
F.S. color scheme

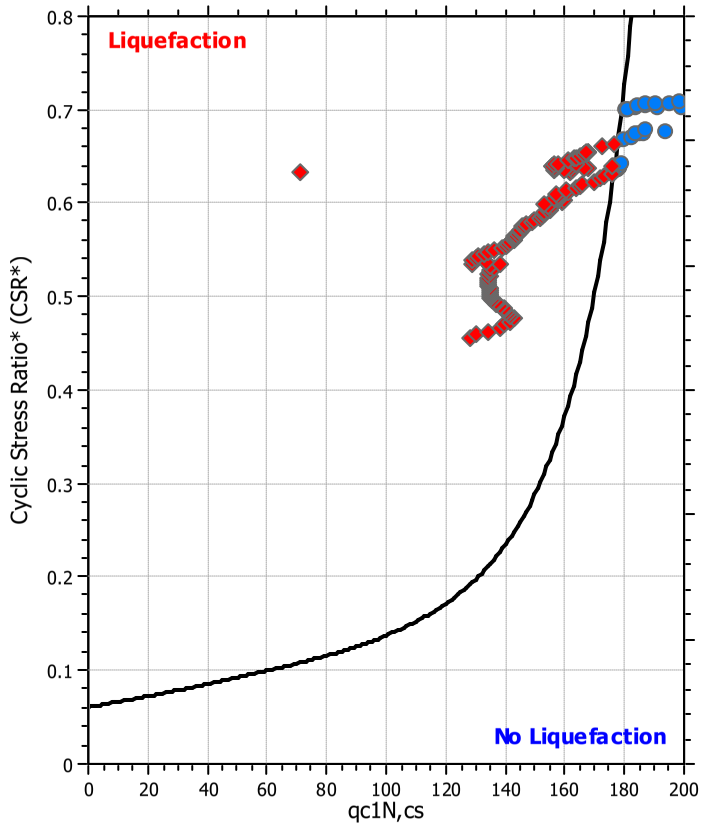
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

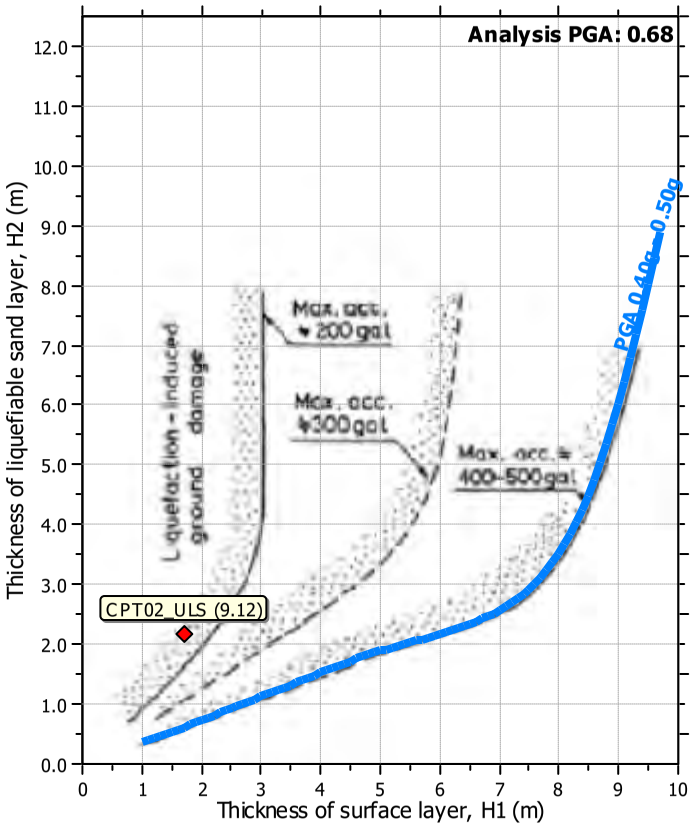
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



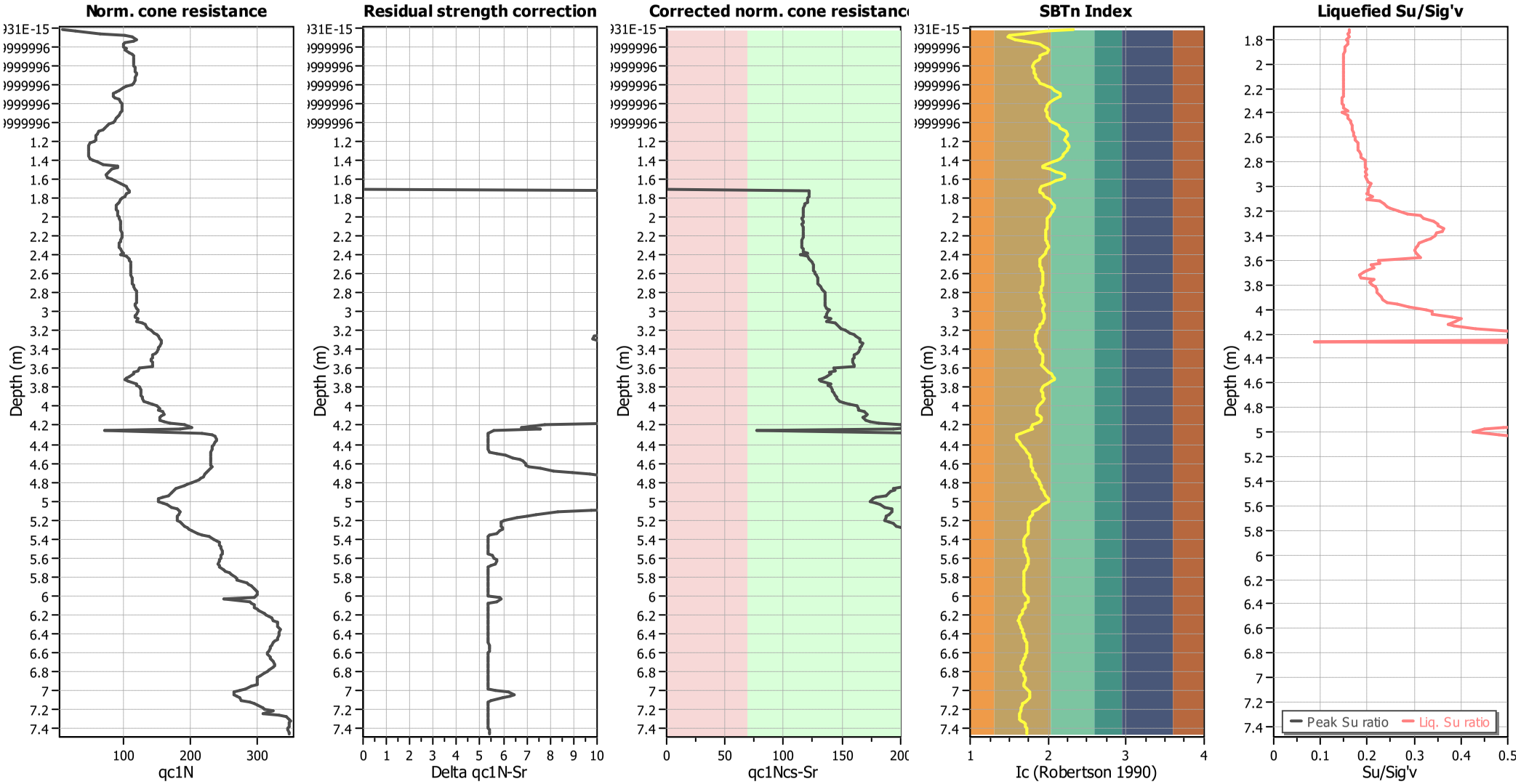




Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

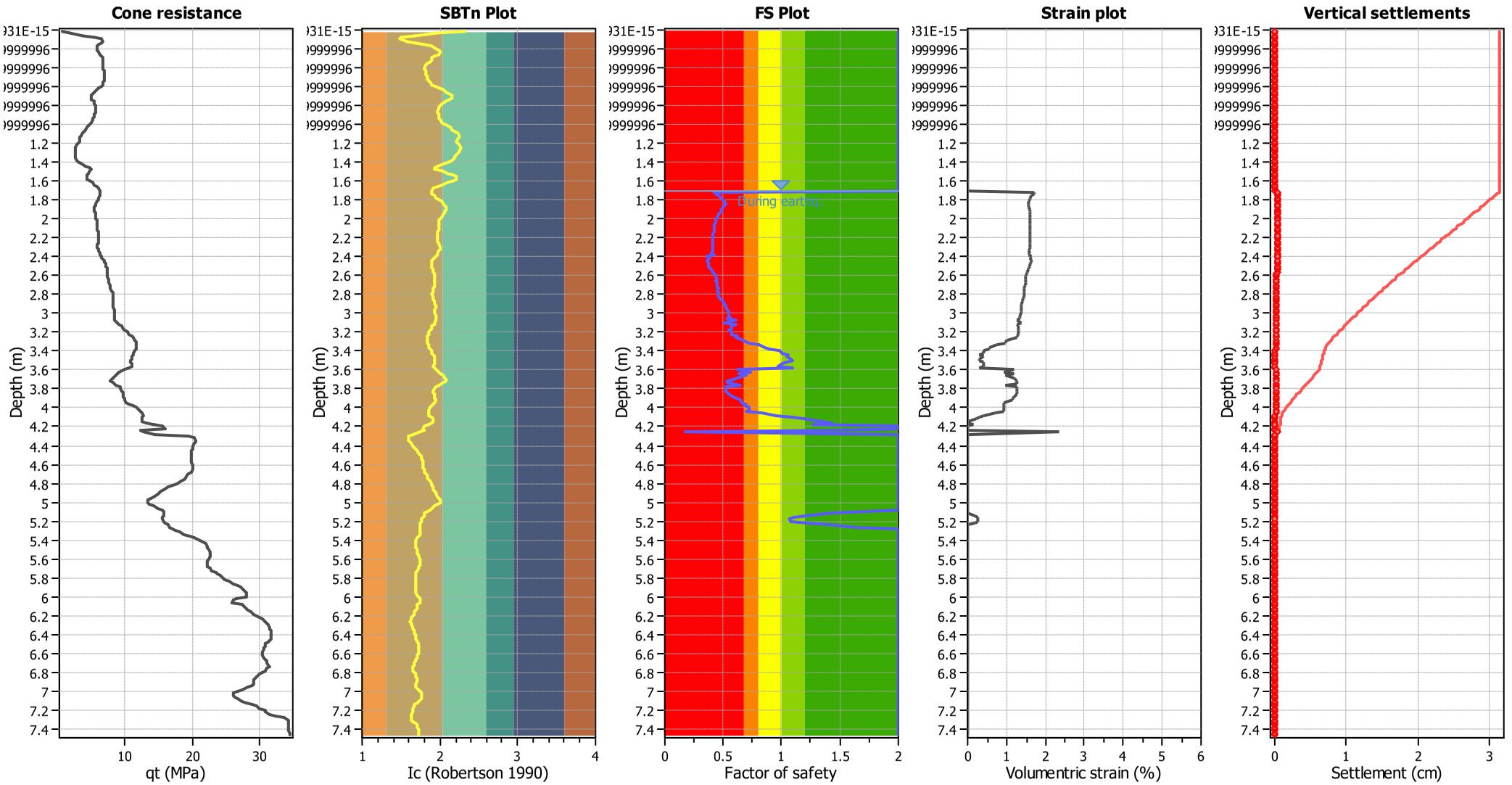
Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

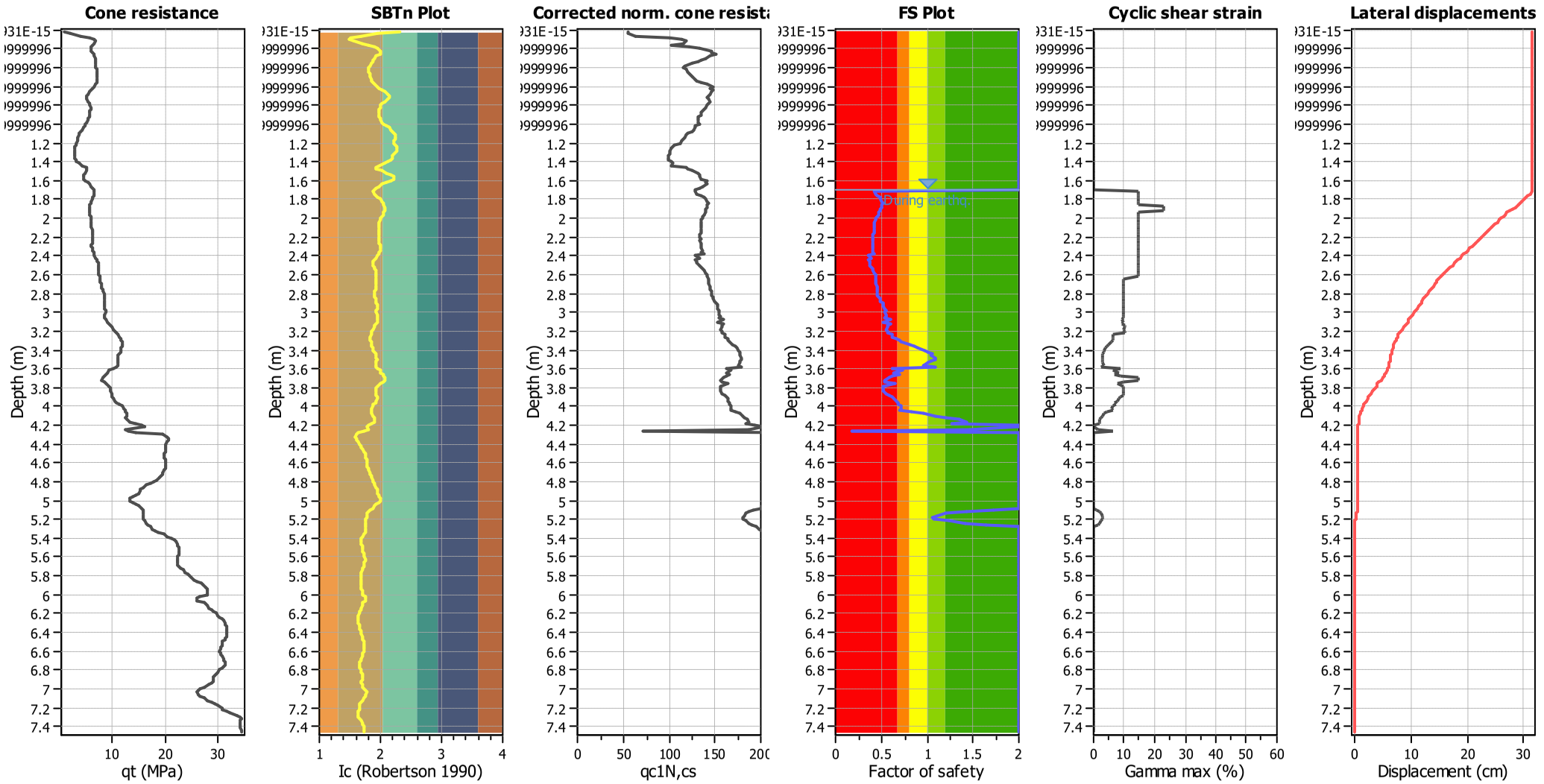
Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

Estimation of post-earthquake lateral Displacements



Abbreviations

q_t: Total cone resistance (cone resistance q_c corrected for pore water effects)
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$q_{c1N,cs}$: Equivalent clean sand normalized CPT total cone resistance
F.S.: Factor of safety
γ_{max}: Maximum cyclic shear strain
LDI: Lateral displacement index

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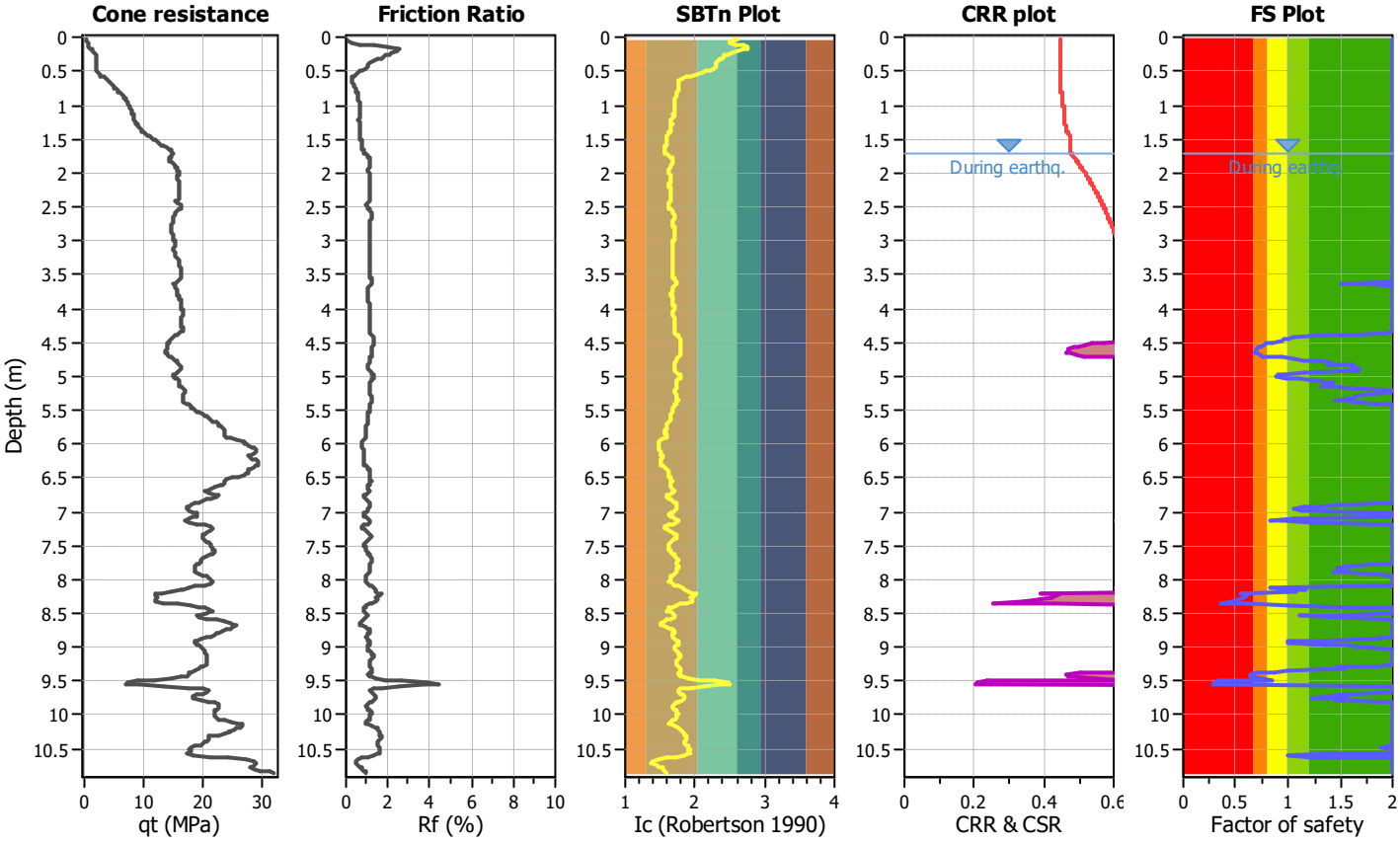
LIQUEFACTION ANALYSIS REPORT

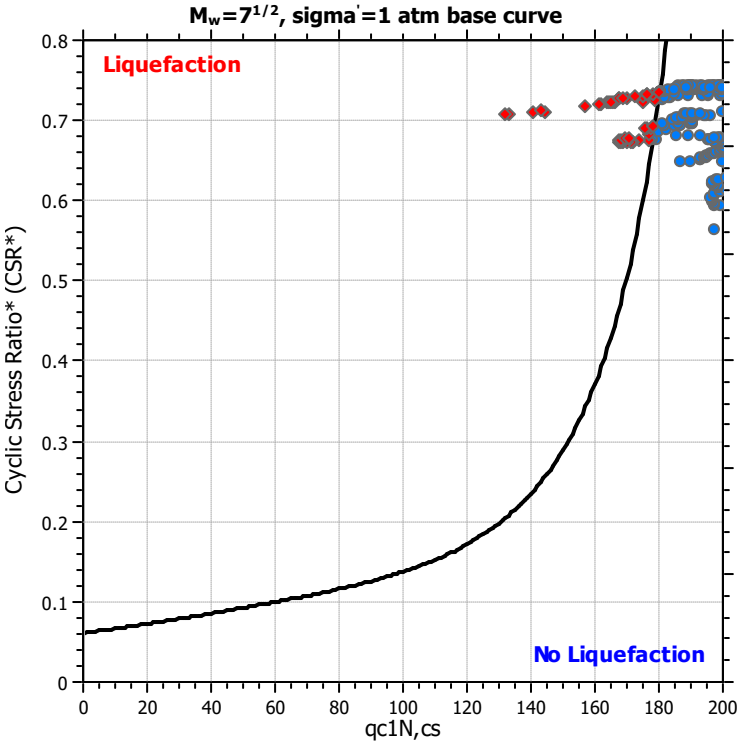
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

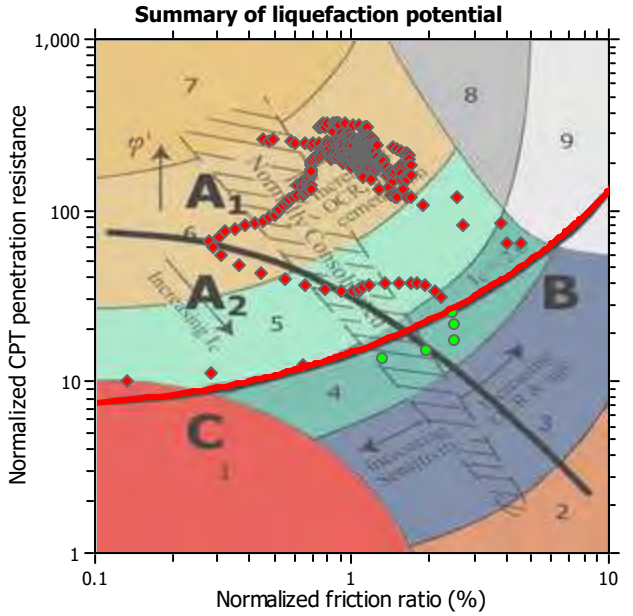
CPT file : CPT03_ULS

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.70 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	No		

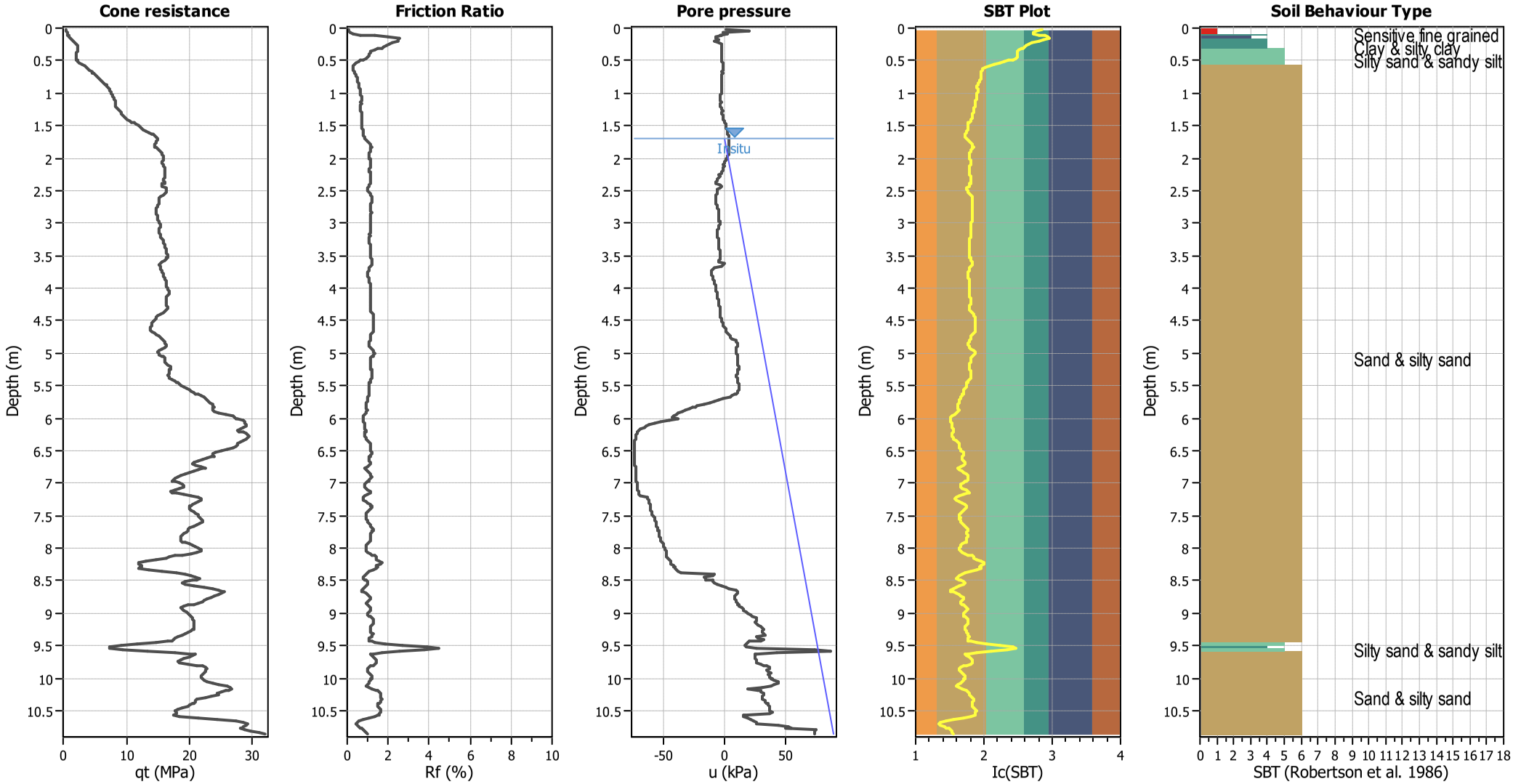






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



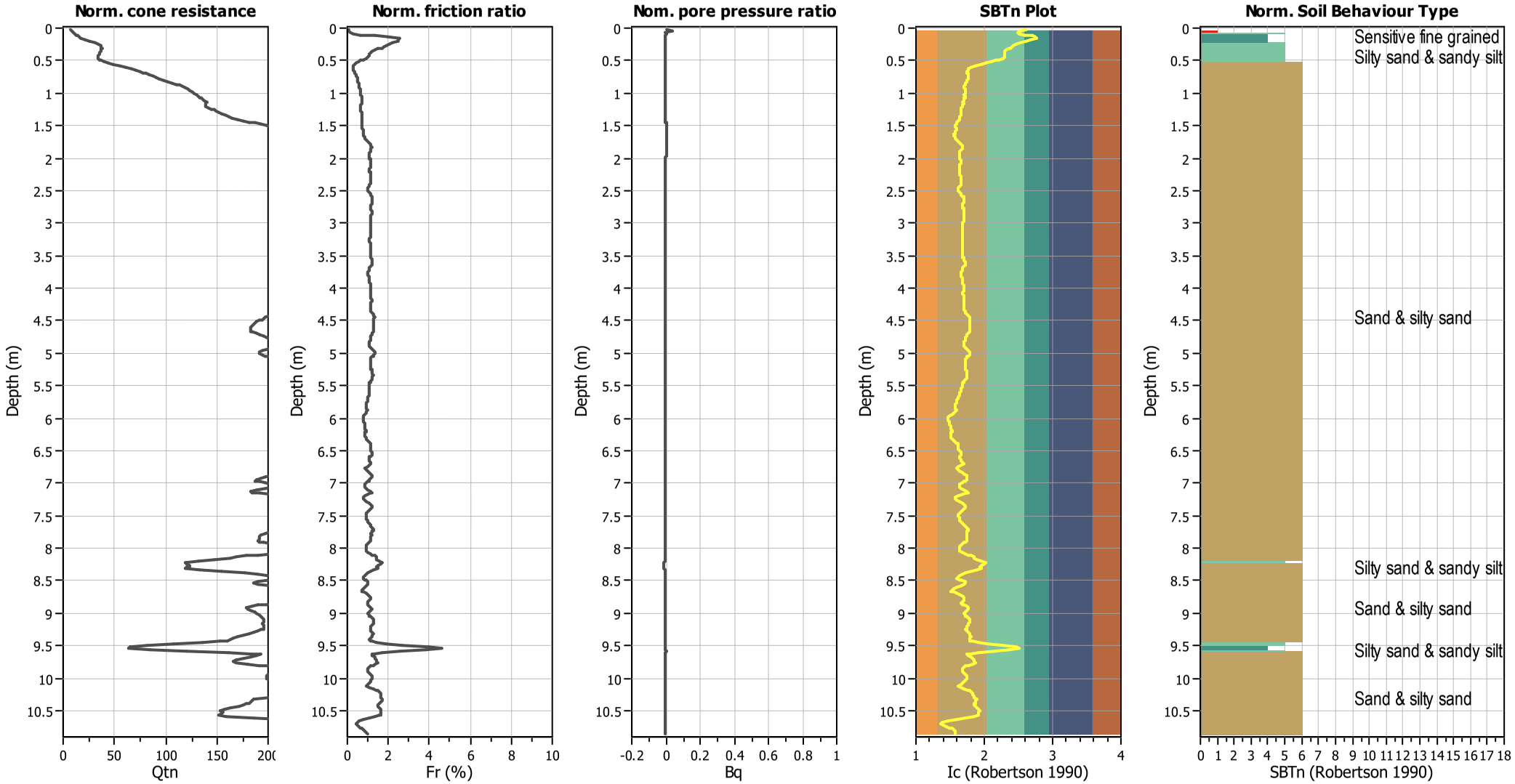
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

CPT basic interpretation plots (normalized)



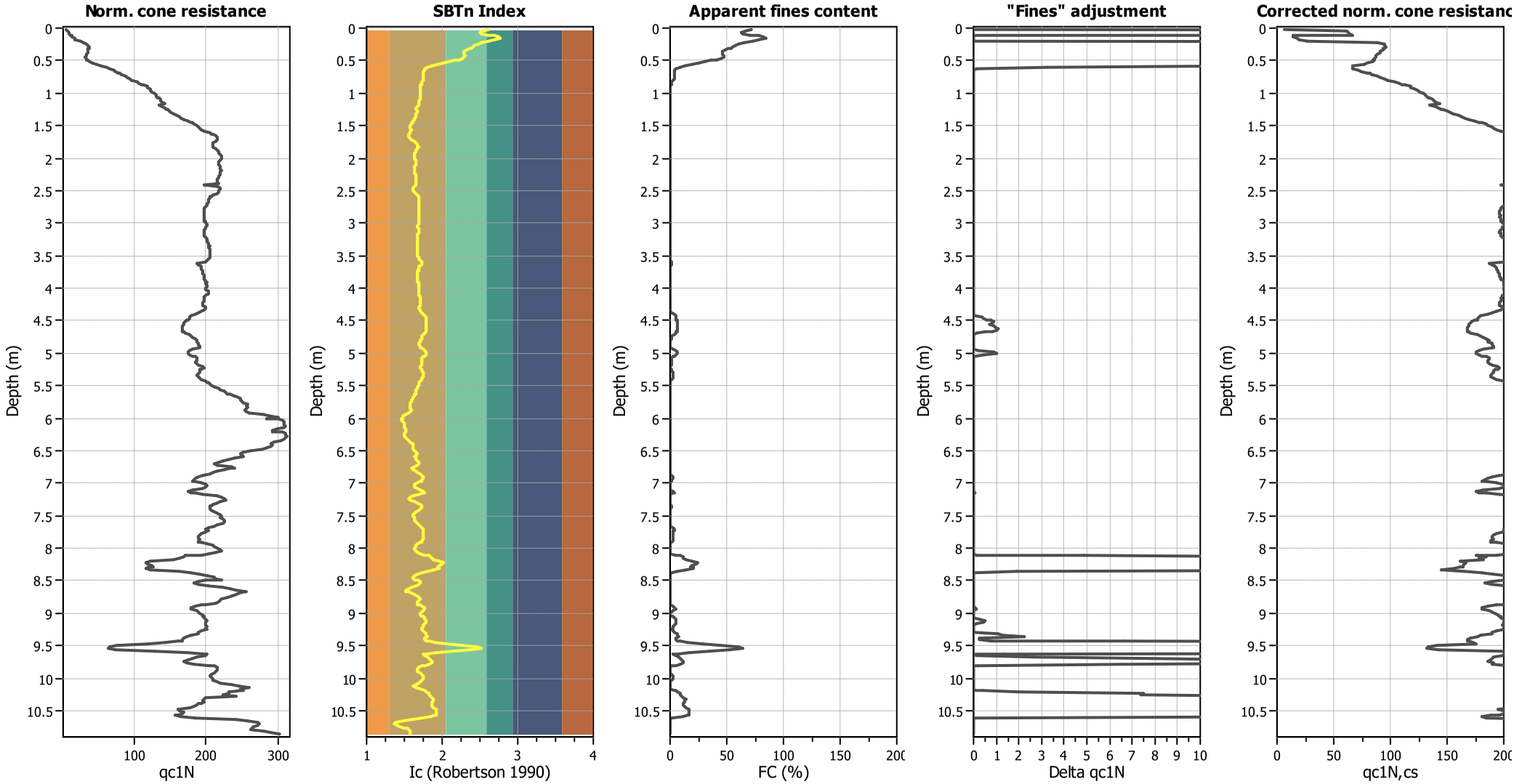
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

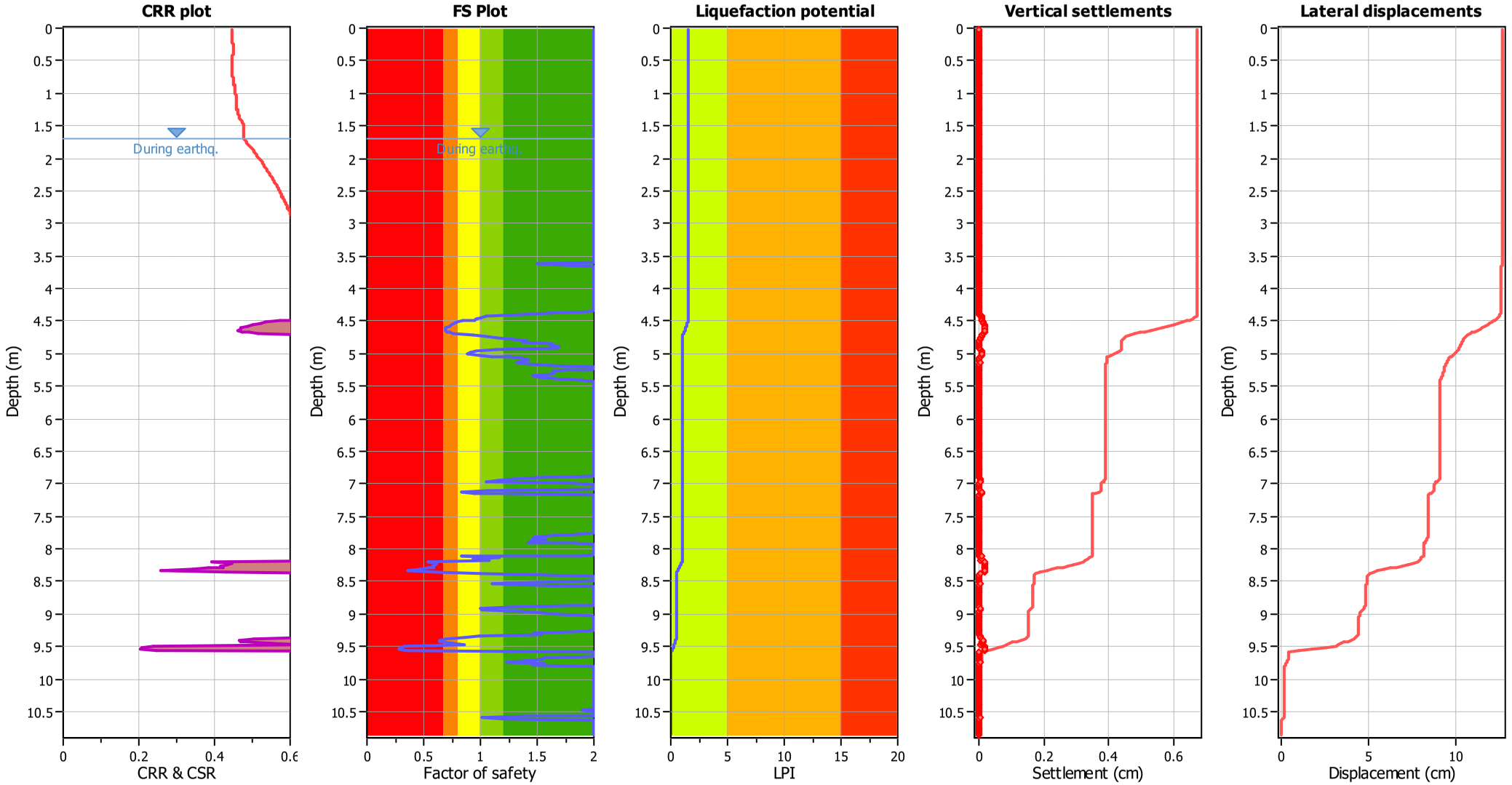
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

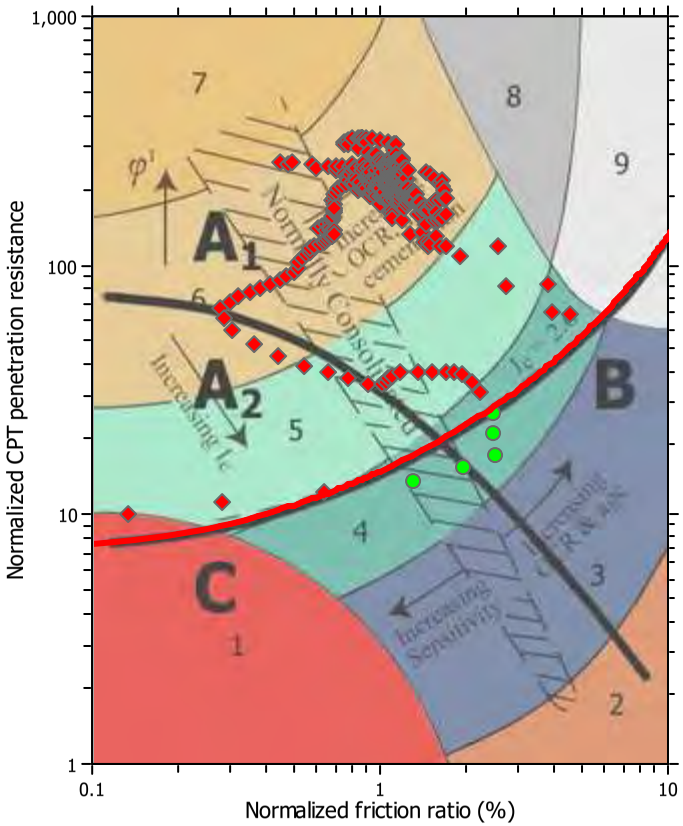
F.S. color scheme

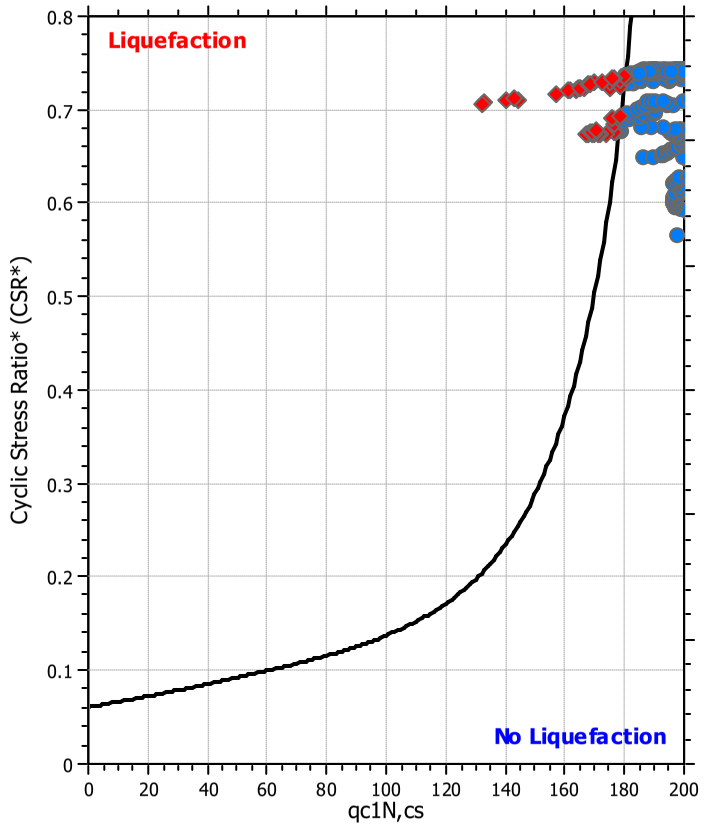
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

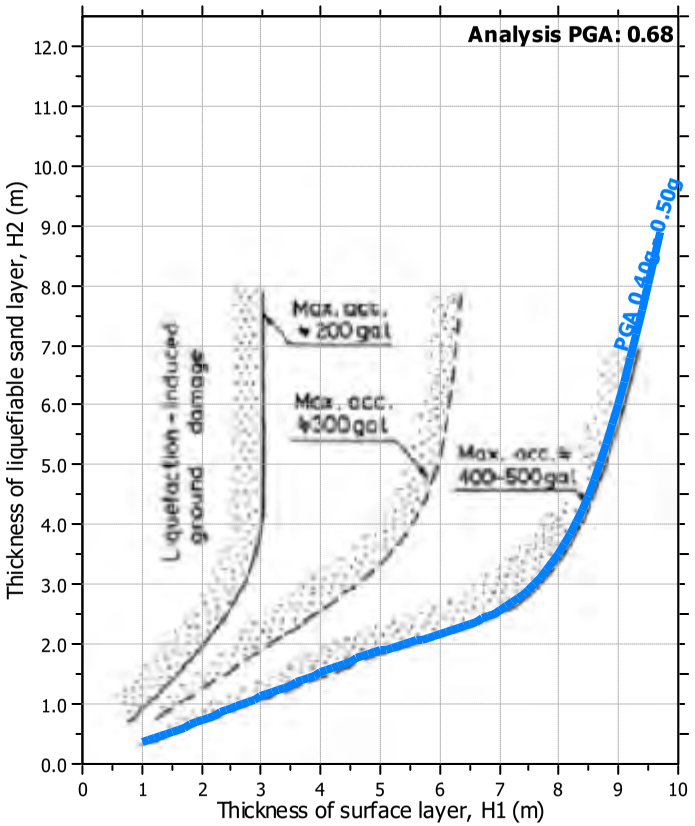
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



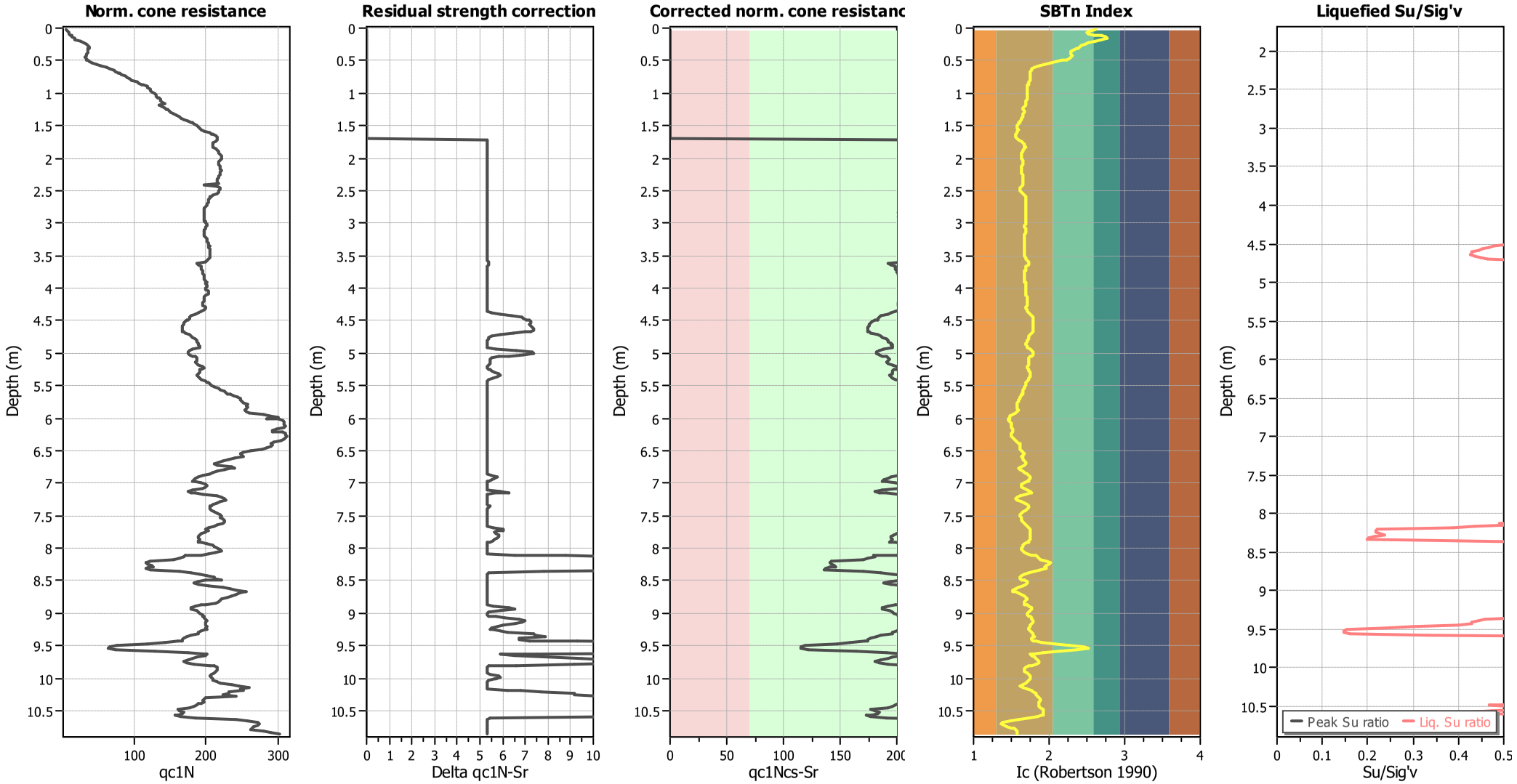




Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

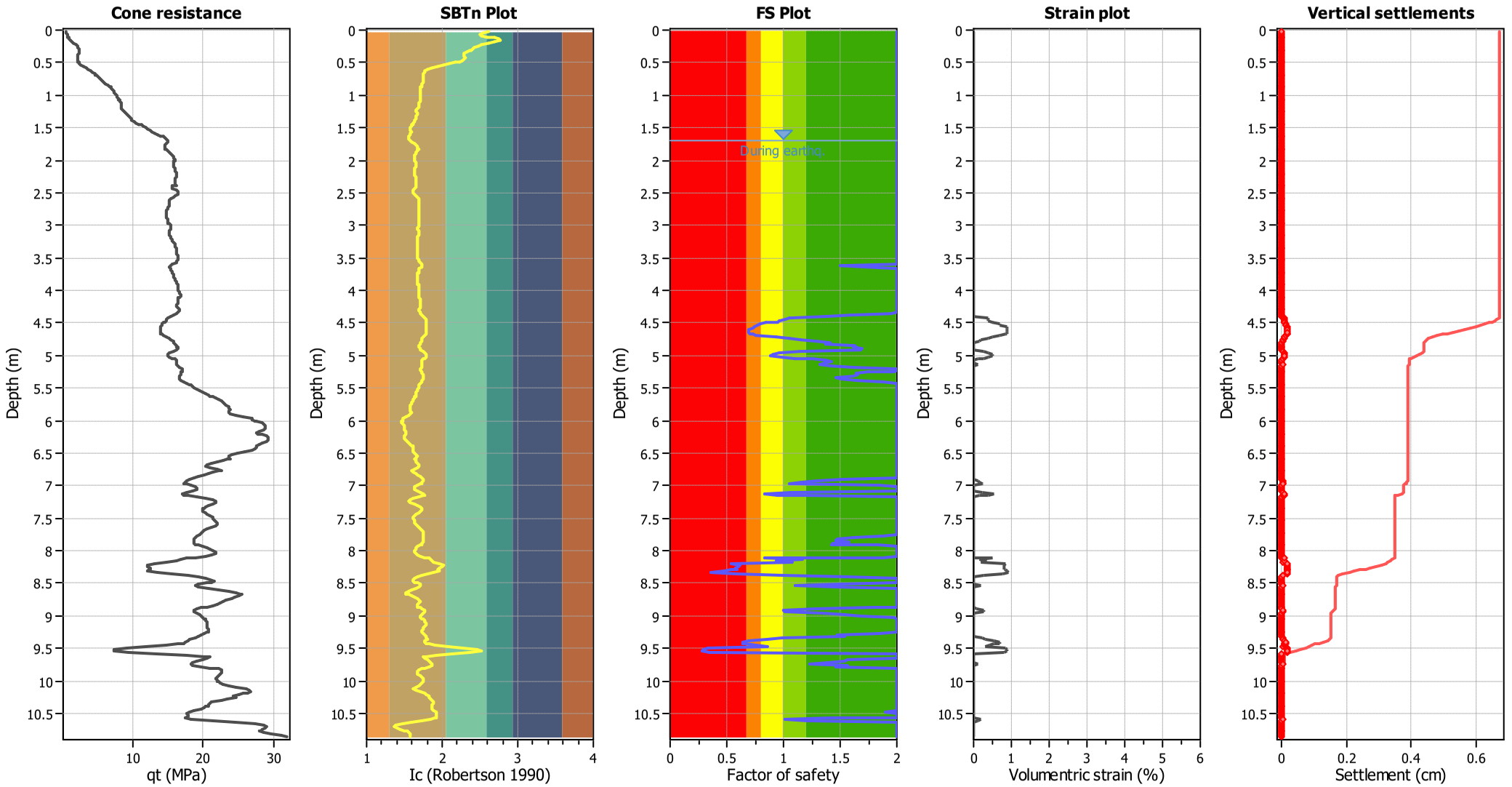
Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

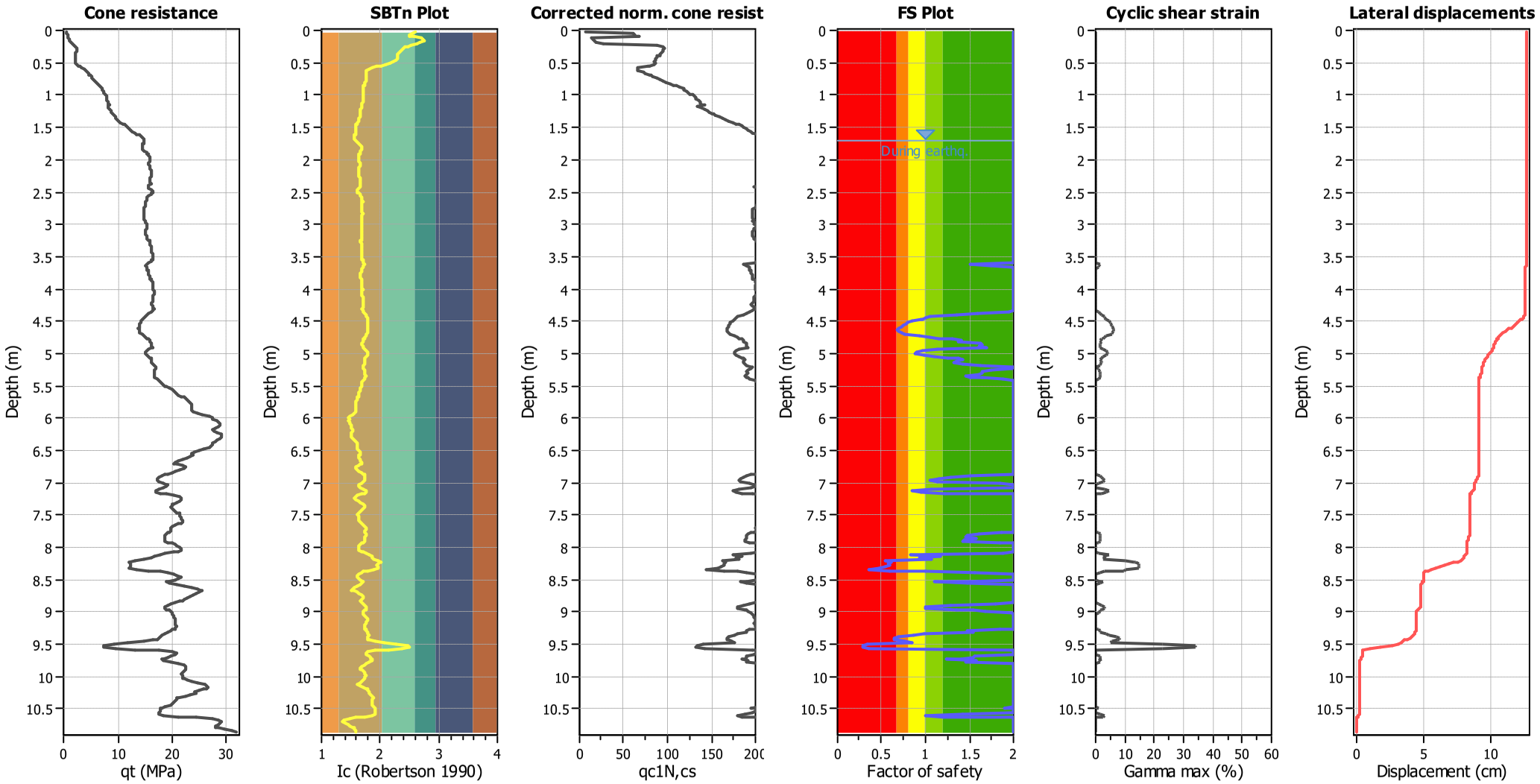
Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

Estimation of post-earthquake lateral Displacements



Abbreviations

q_t: Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c: Soil Behaviour Type Index
$q_{c1N,cs}$: Equivalent clean sand normalized CPT total cone resistance
F.S.: Factor of safety
γ_{max}: Maximum cyclic shear strain
LDI: Lateral displacement index

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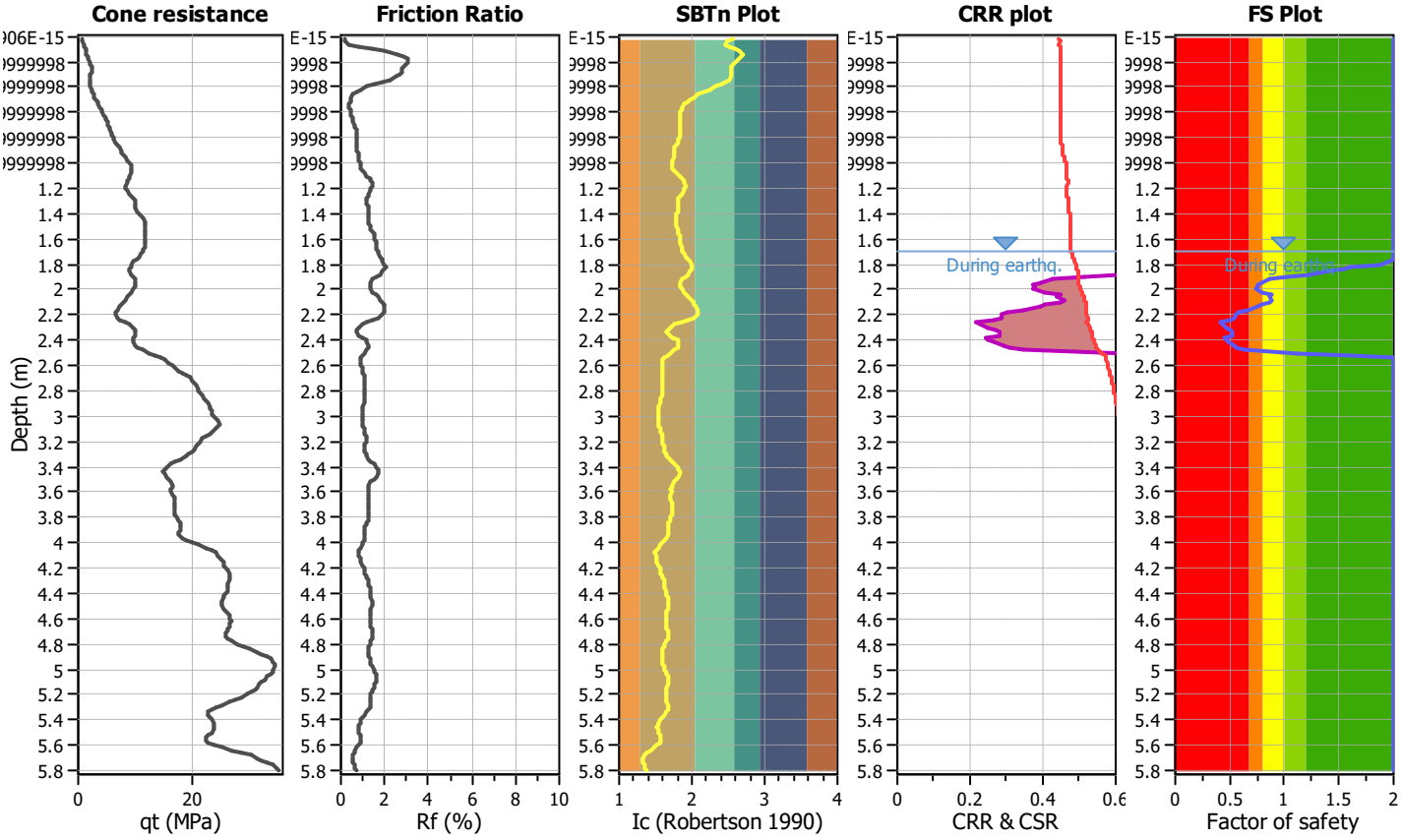
LIQUEFACTION ANALYSIS REPORT

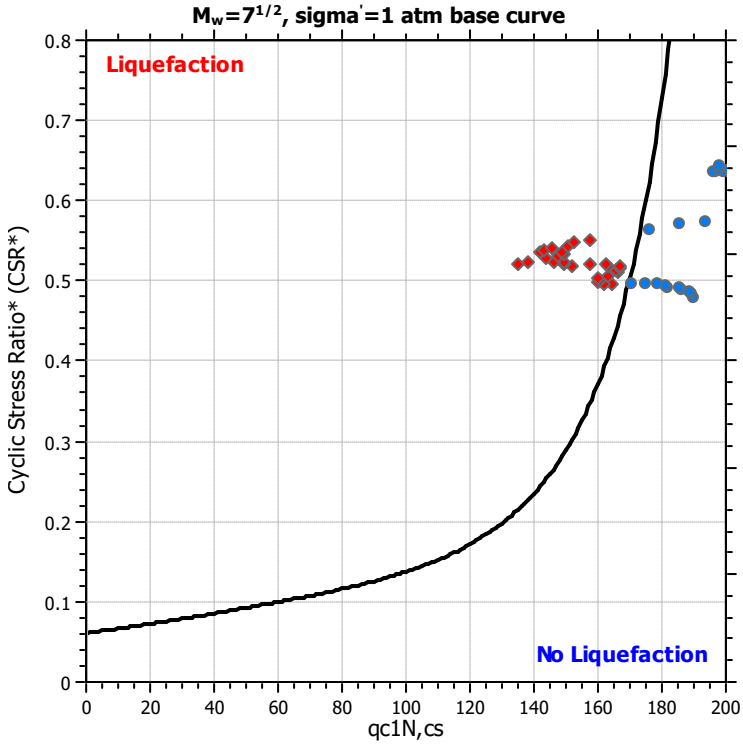
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

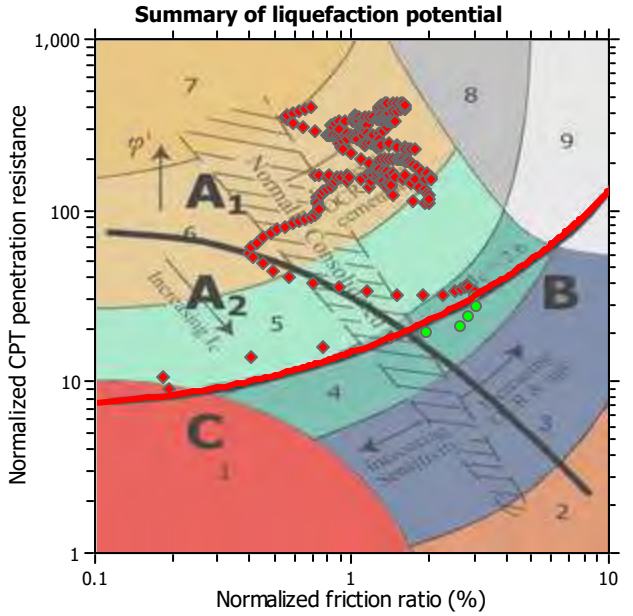
CPT file : CPT04_ULS

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.70 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	No		

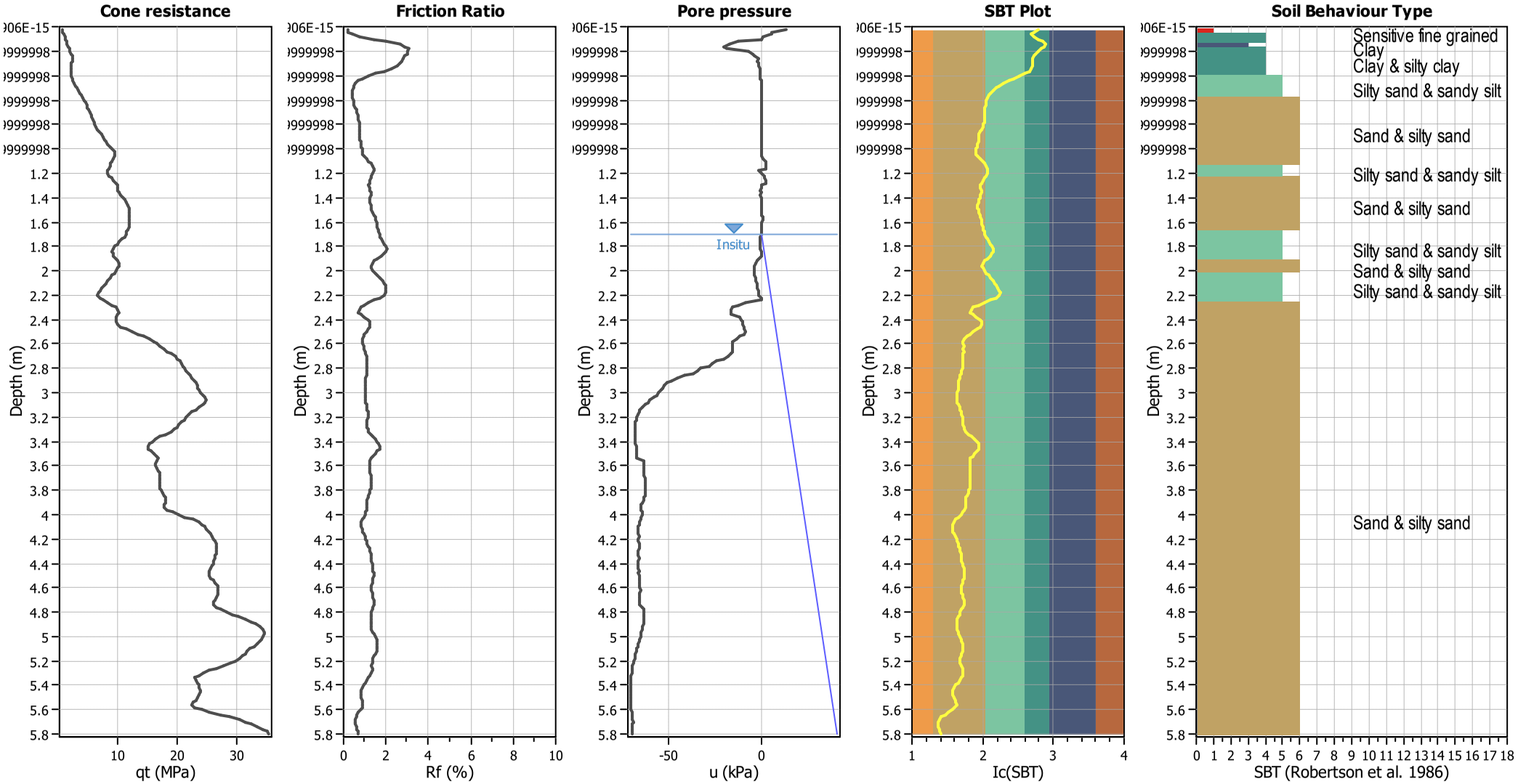






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



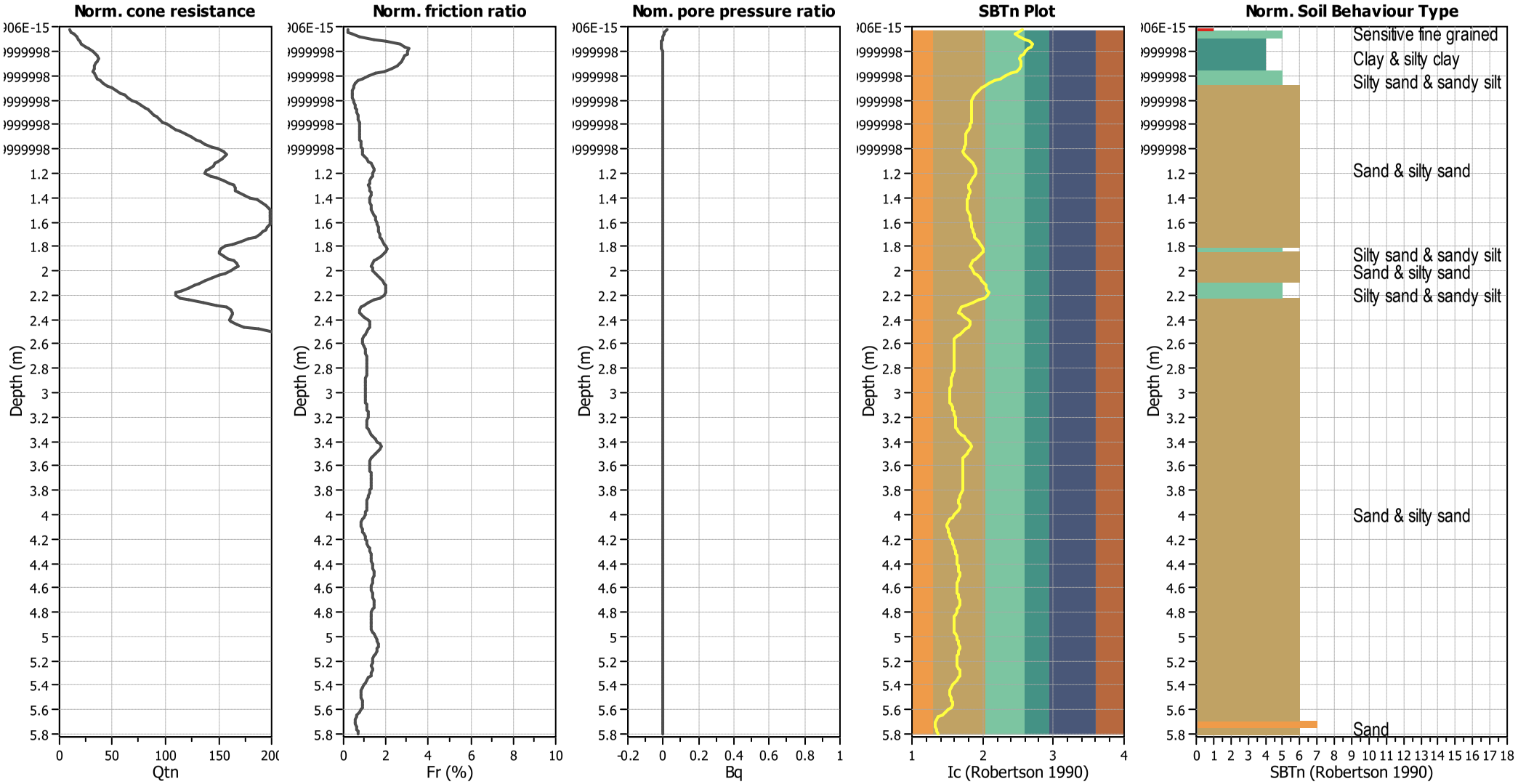
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

CPT basic interpretation plots (normalized)



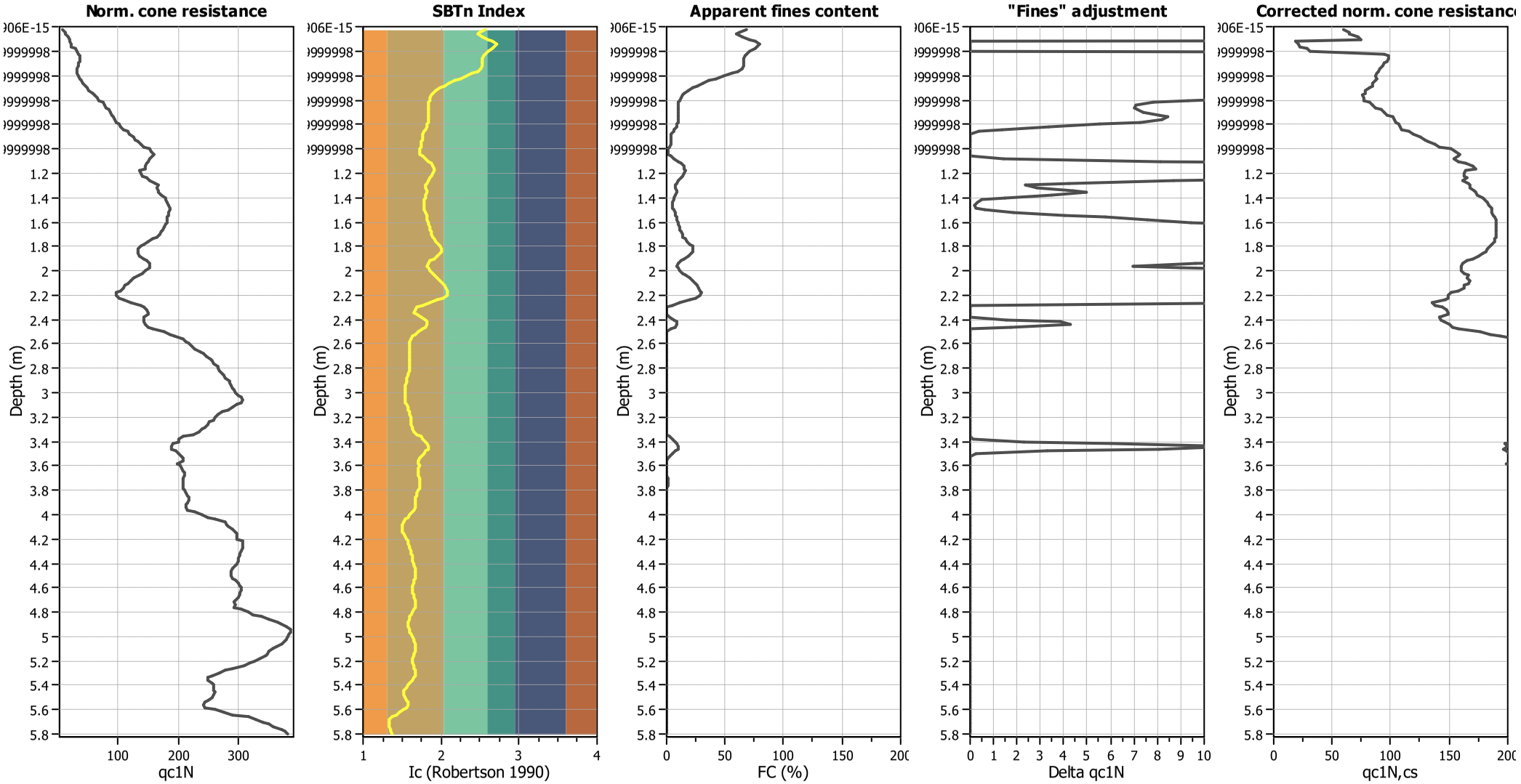
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

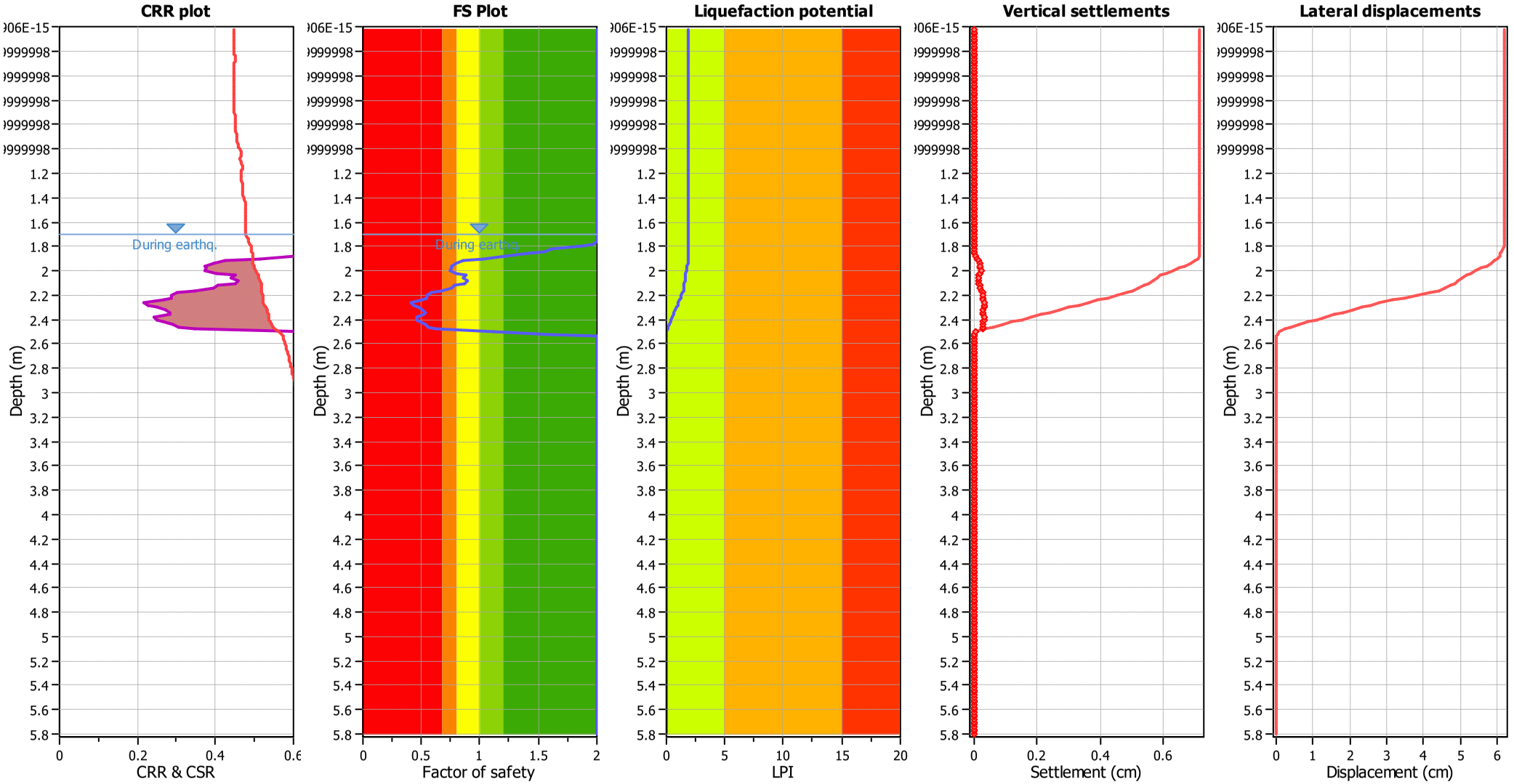
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

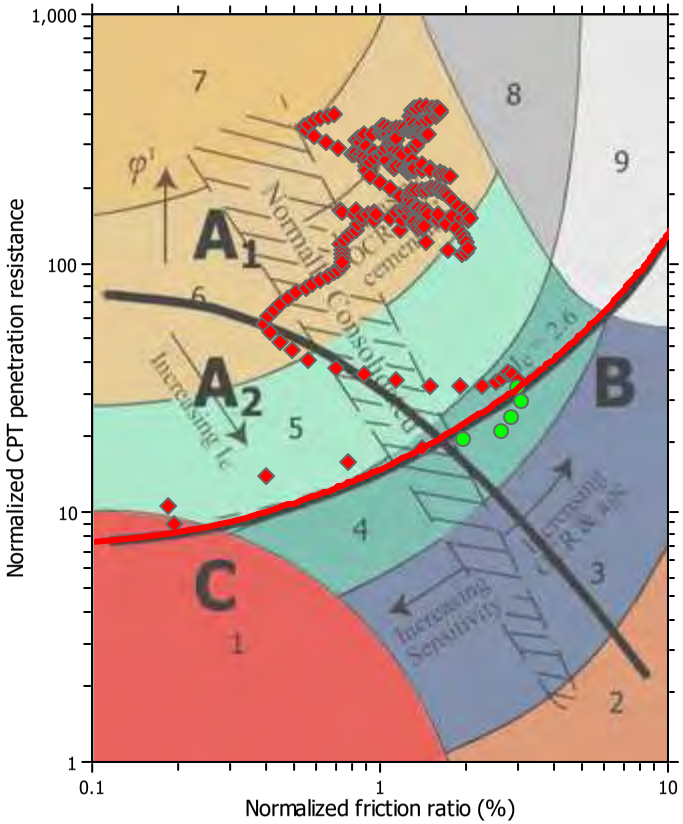
F.S. color scheme

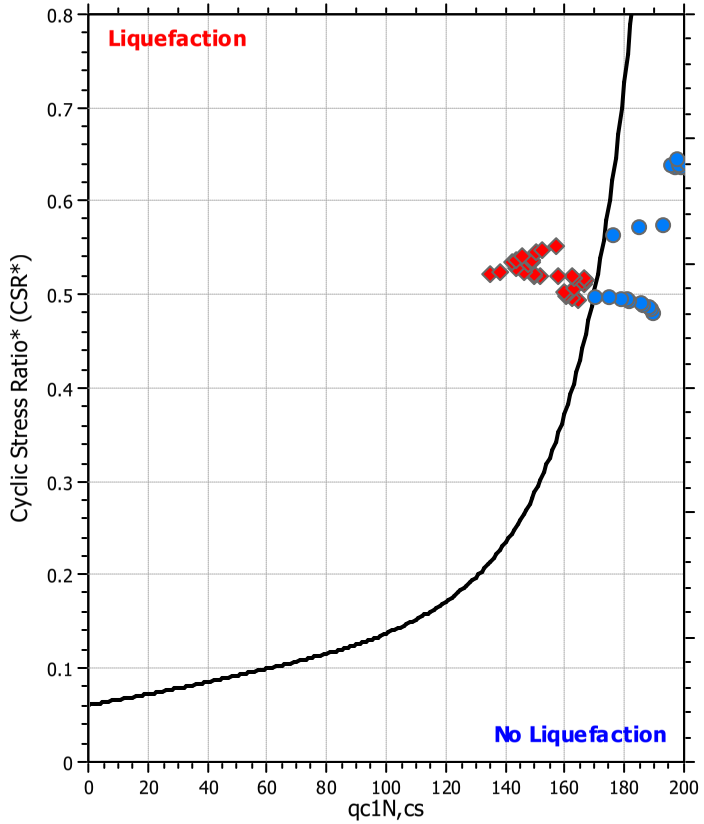
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

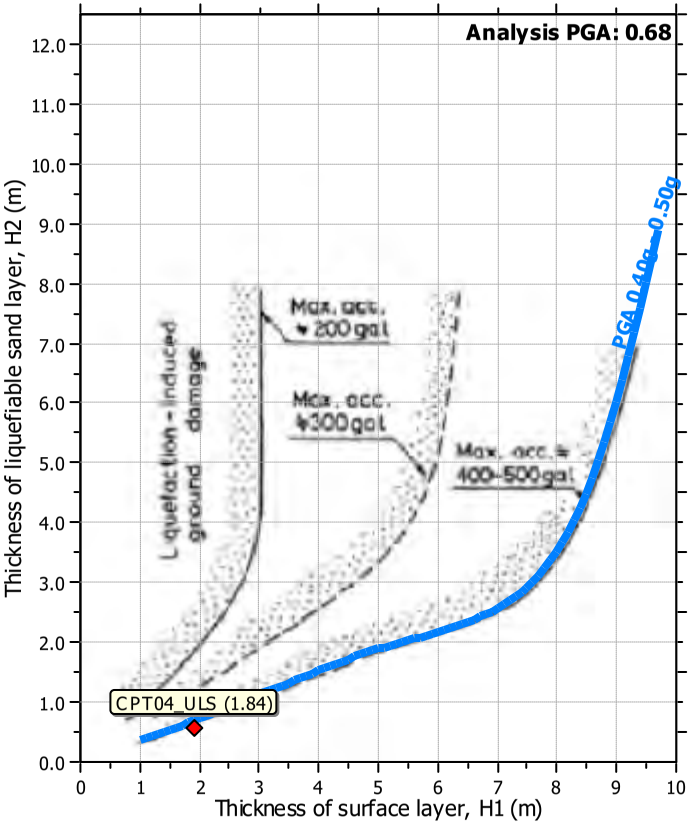
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



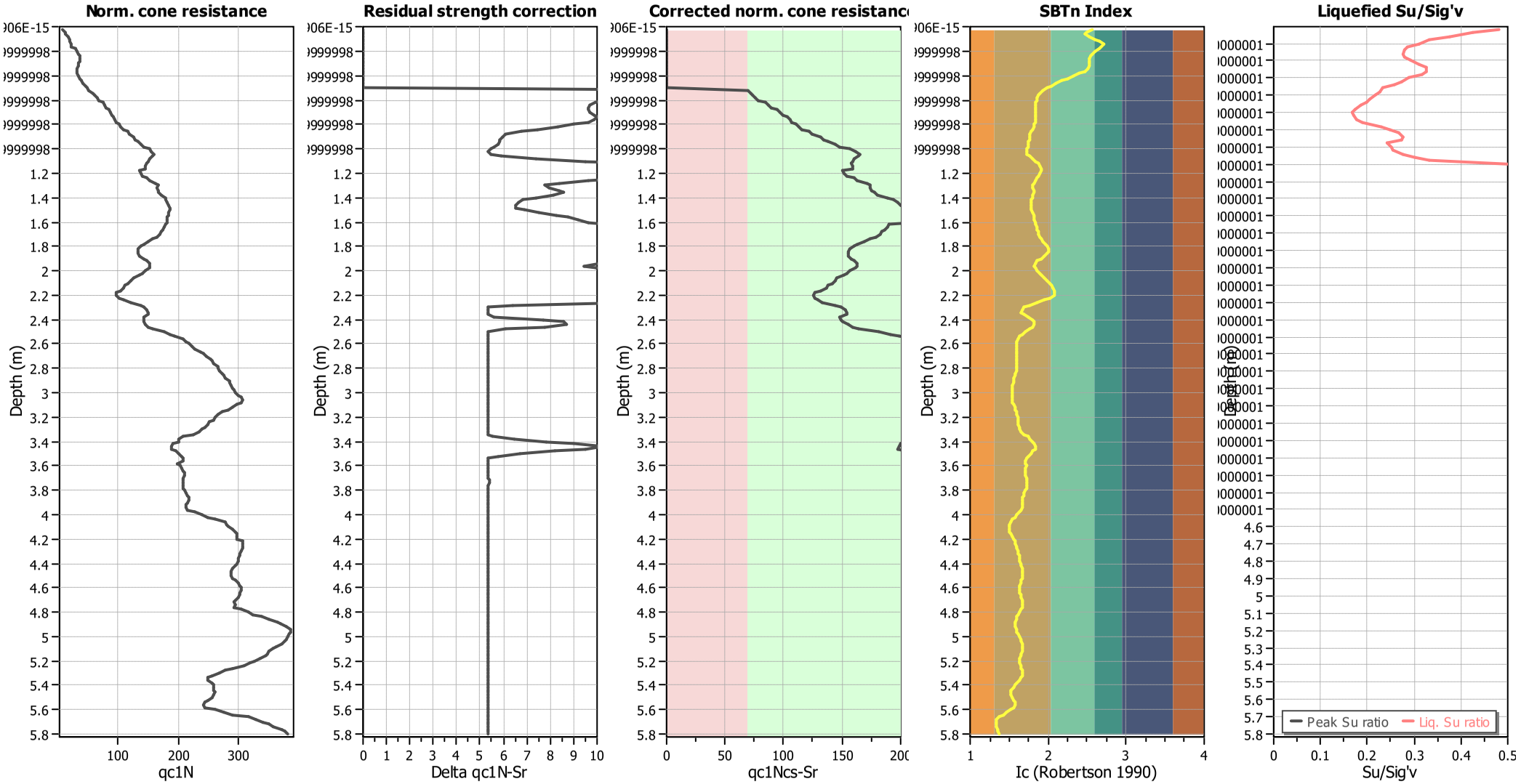




Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

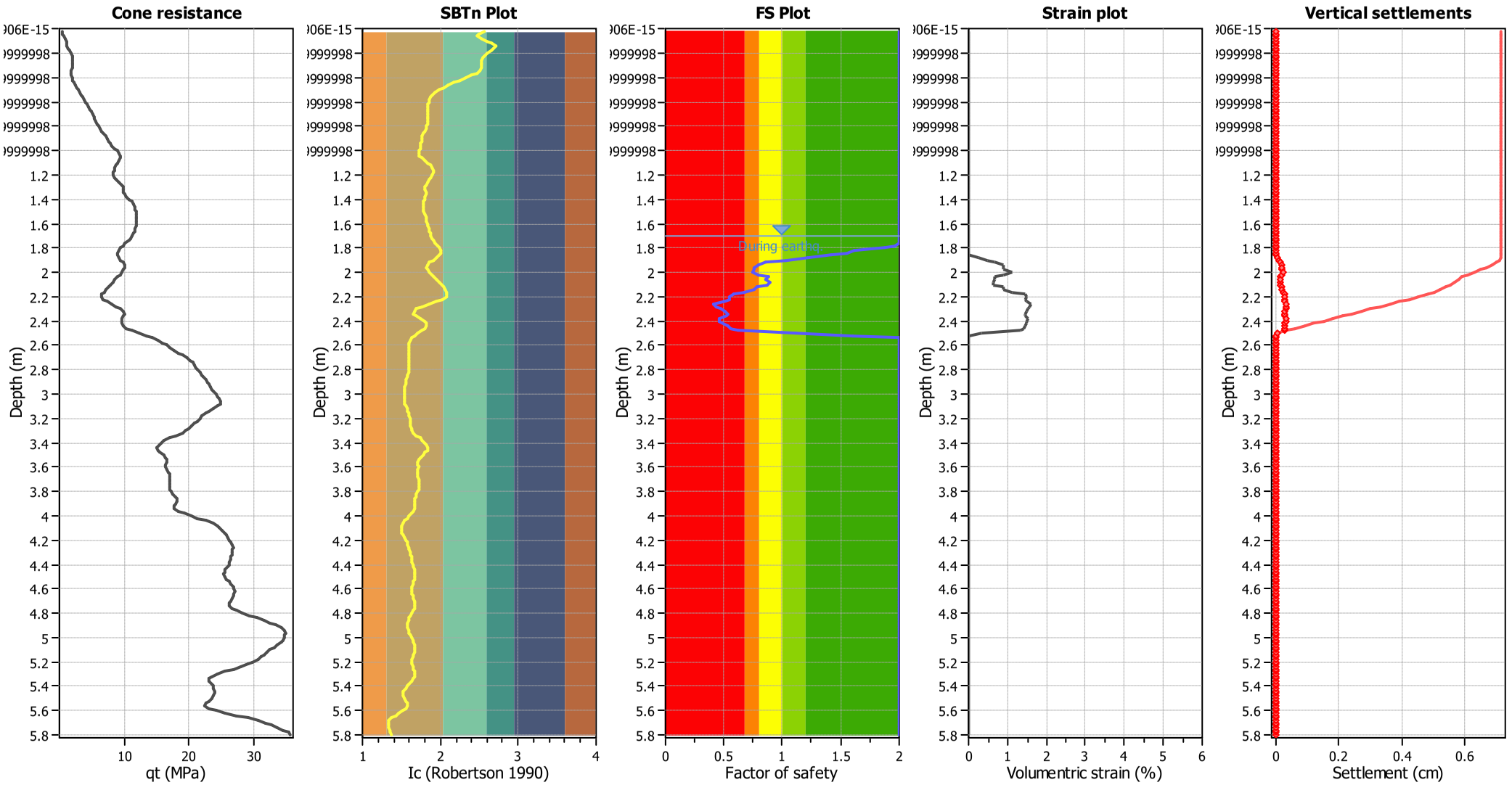
Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

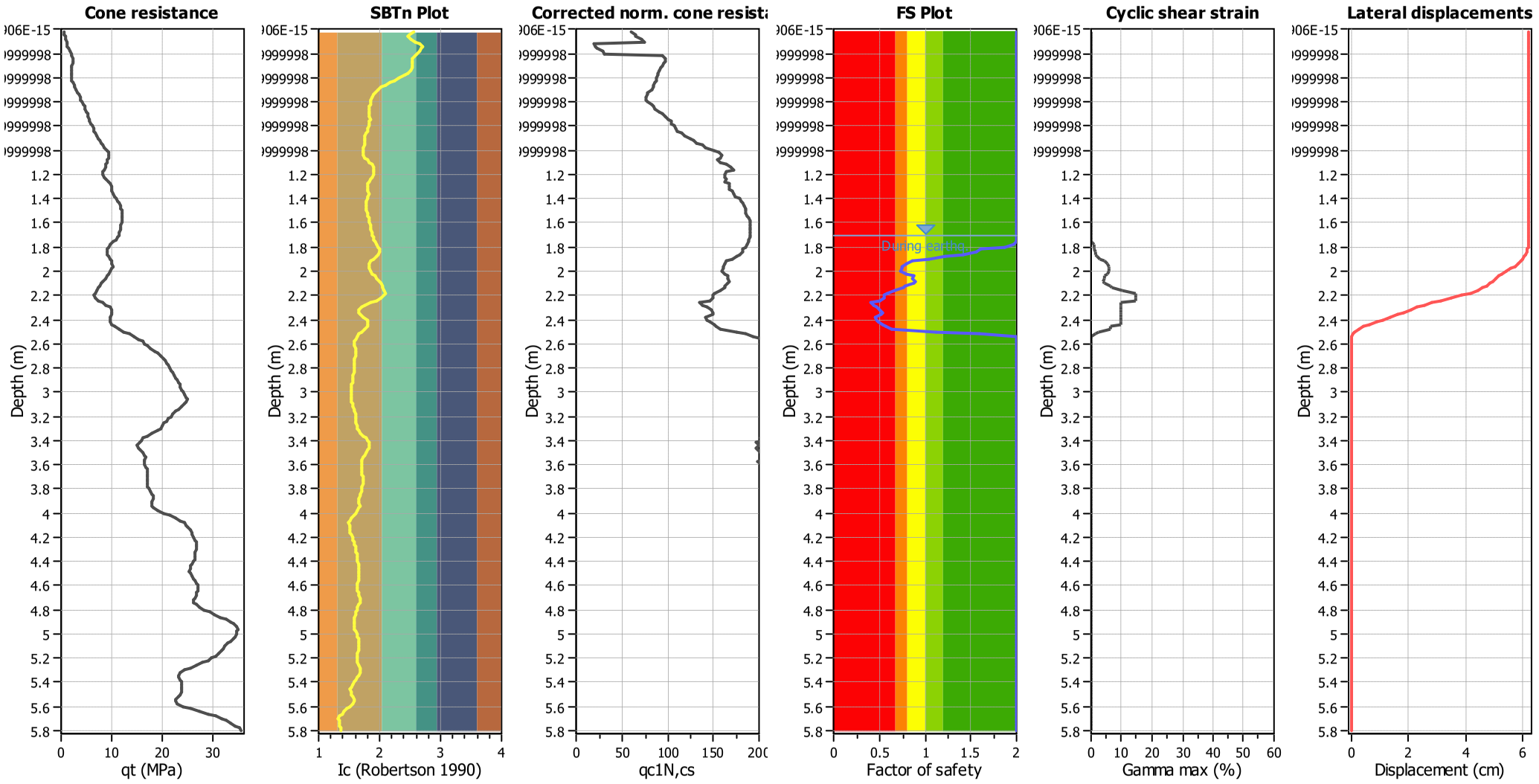
Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

Estimation of post-earthquake lateral Displacements



Abbreviations

q_t: Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c: Soil Behaviour Type Index
$q_{c1N,cs}$: Equivalent clean sand normalized CPT total cone resistance
F.S.: Factor of safety
γ_{max}: Maximum cyclic shear strain
LDI: Lateral displacement index

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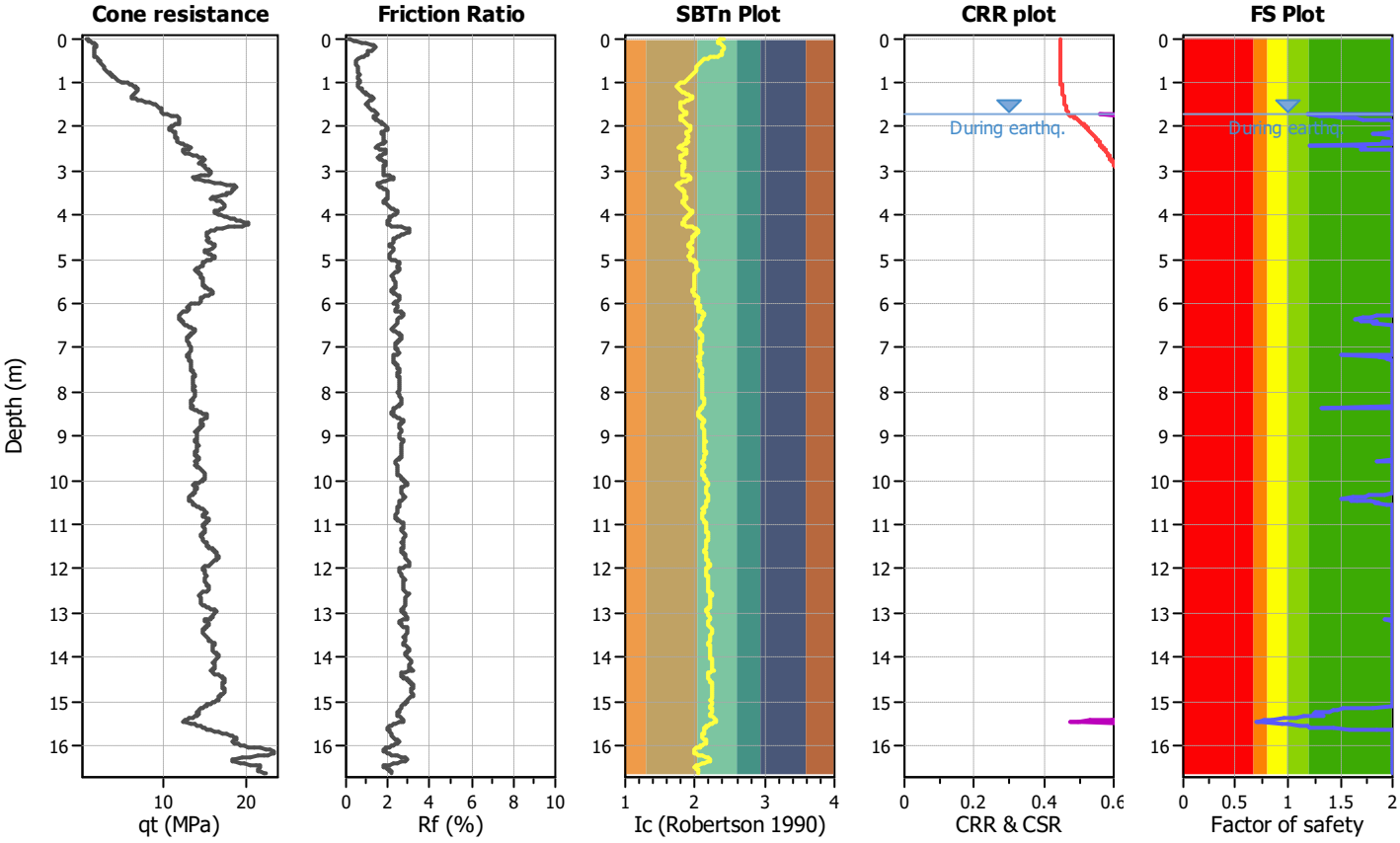
LIQUEFACTION ANALYSIS REPORT

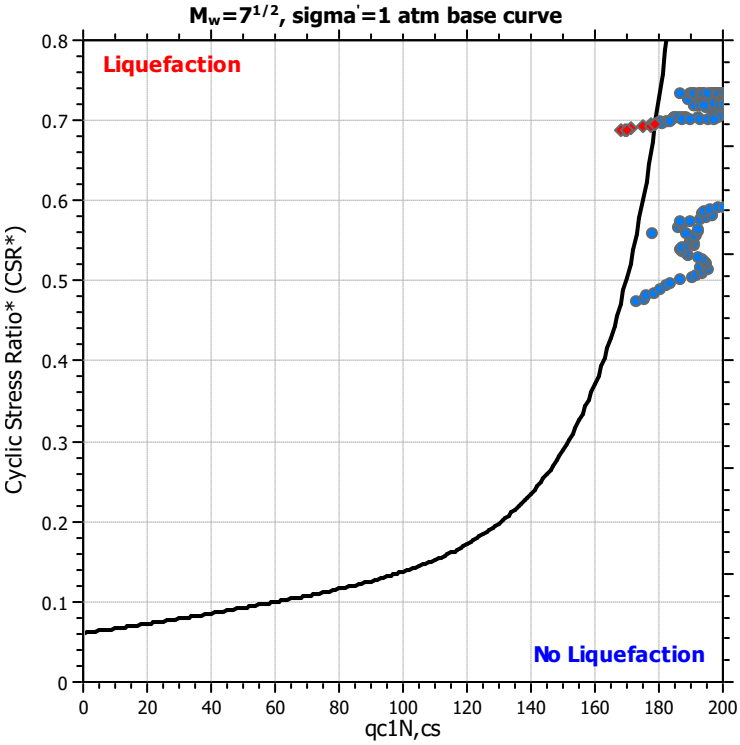
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

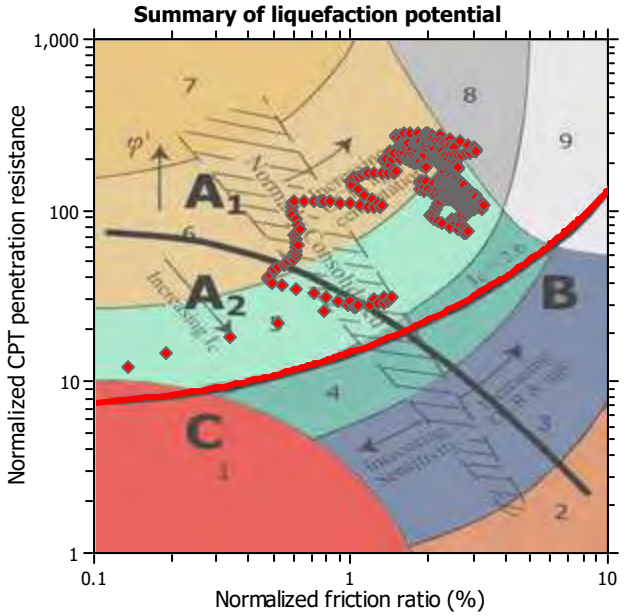
CPT file : CPT05_ULS

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.70 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	No		

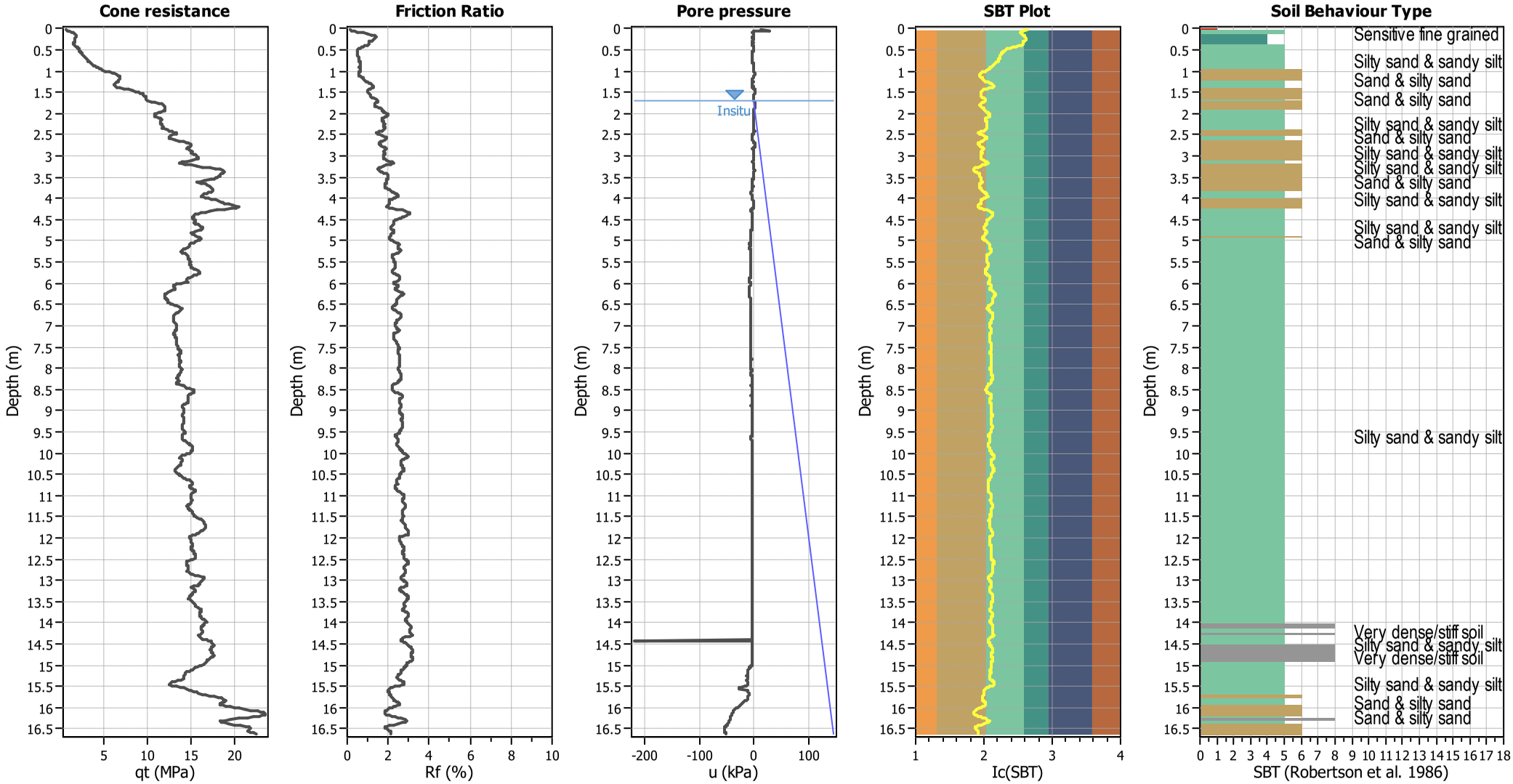






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



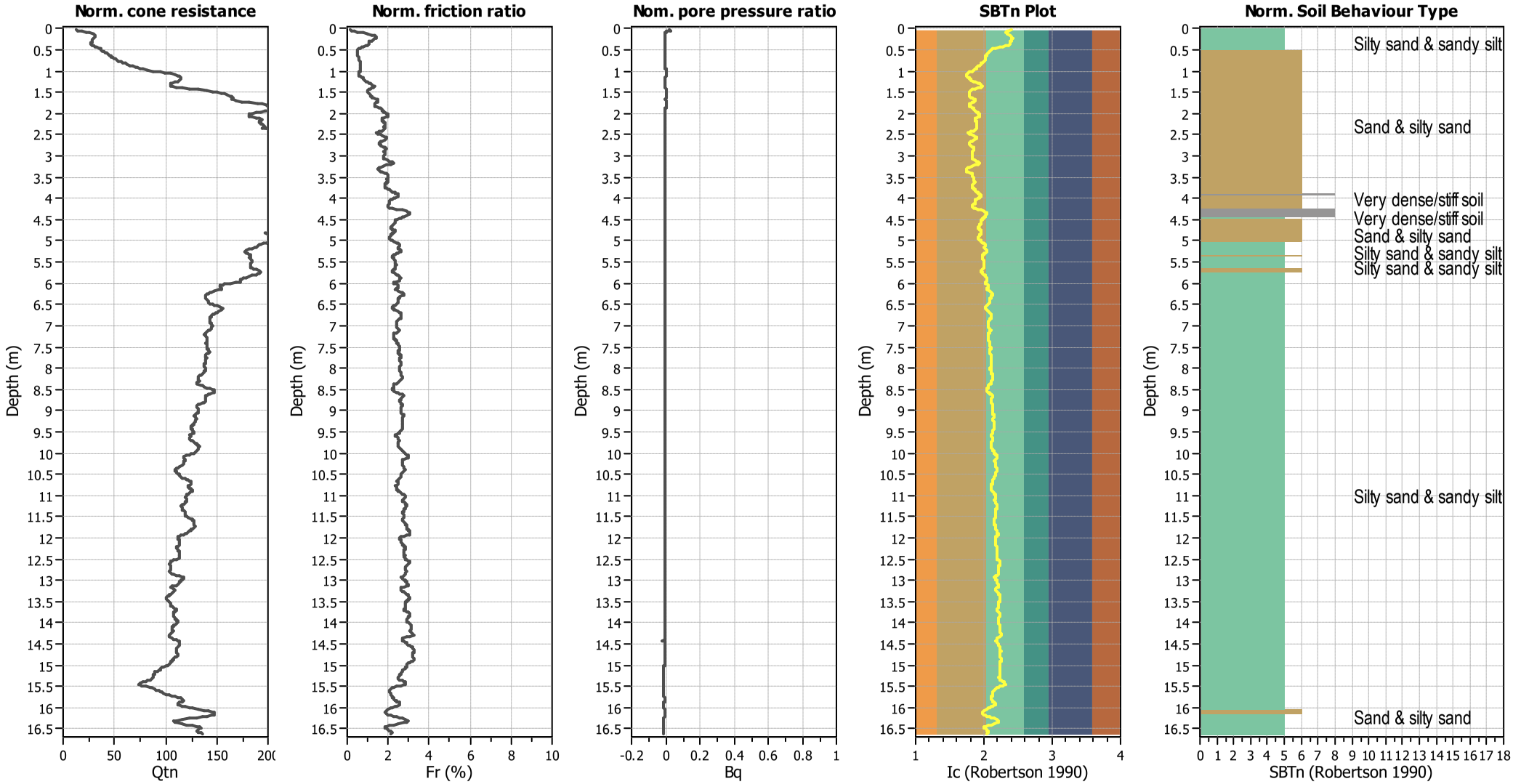
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

CPT basic interpretation plots (normalized)



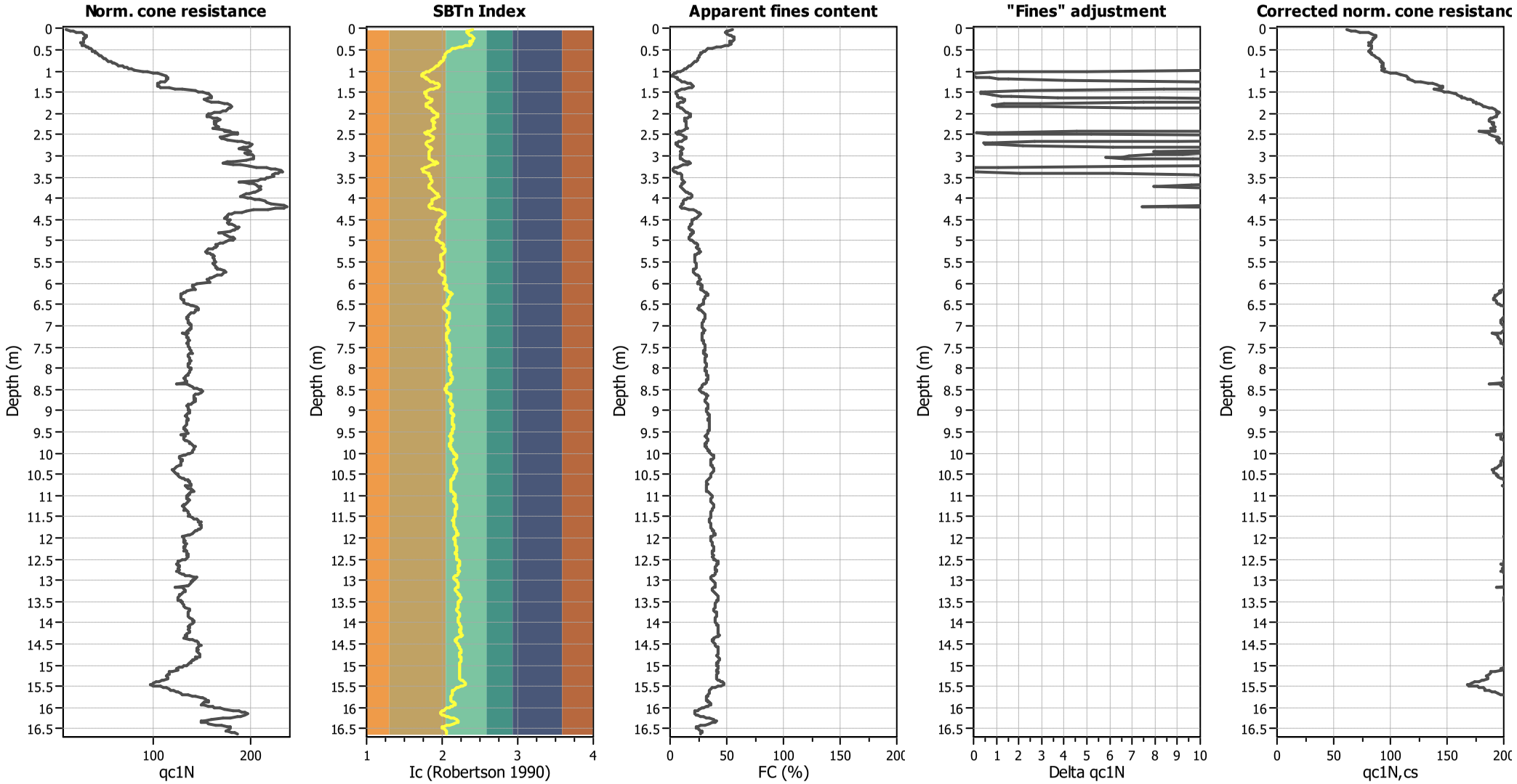
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

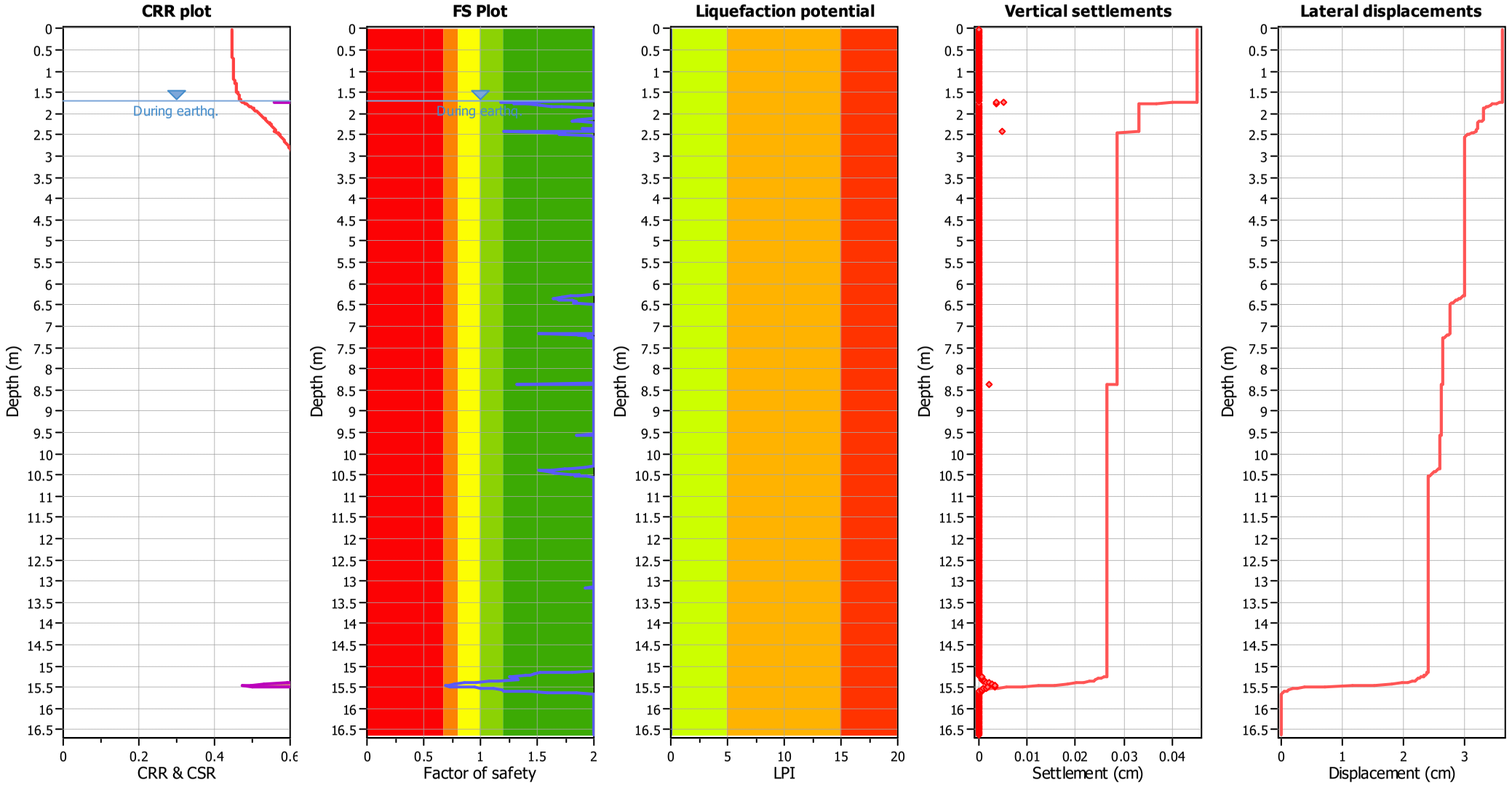
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

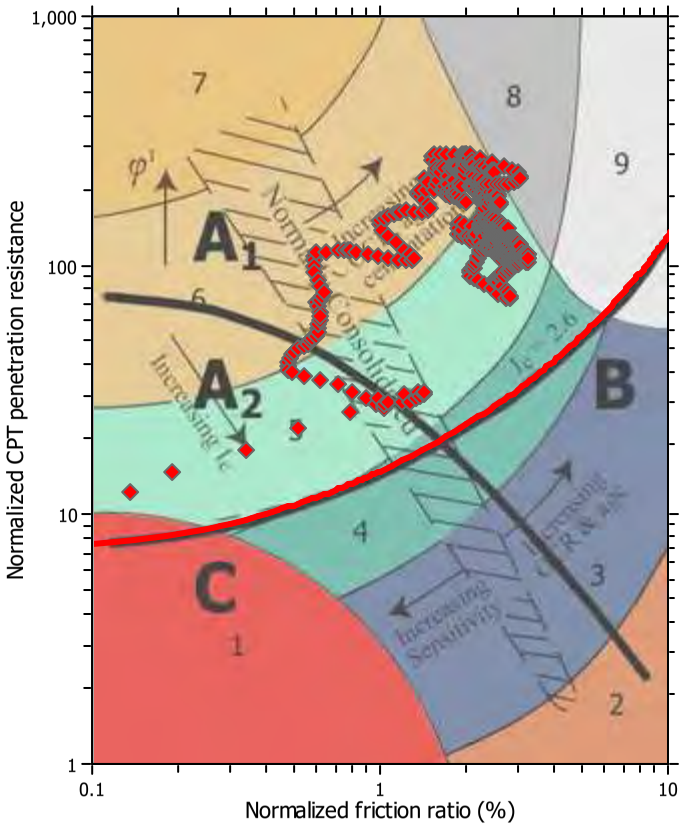
F.S. color scheme

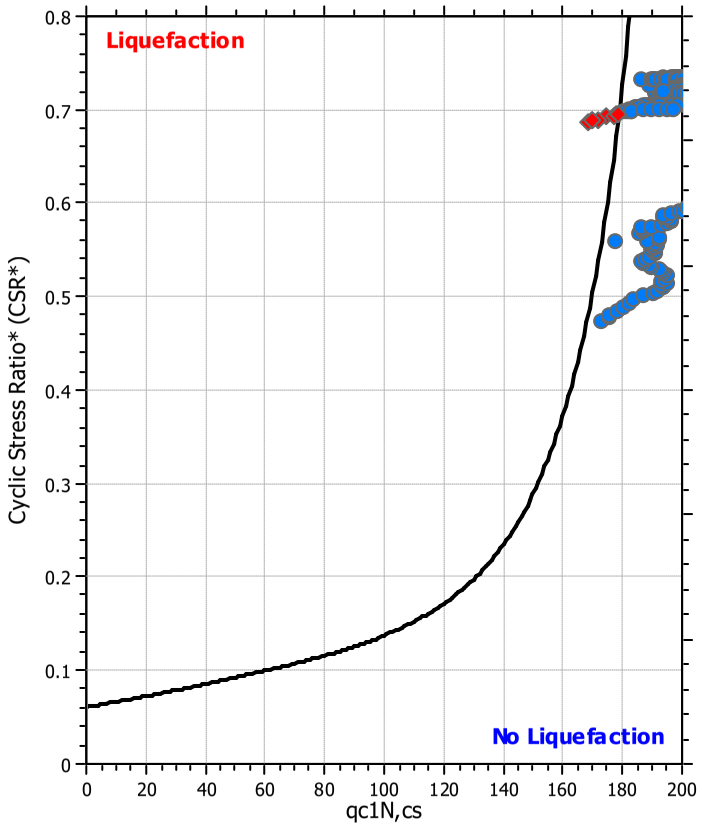
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

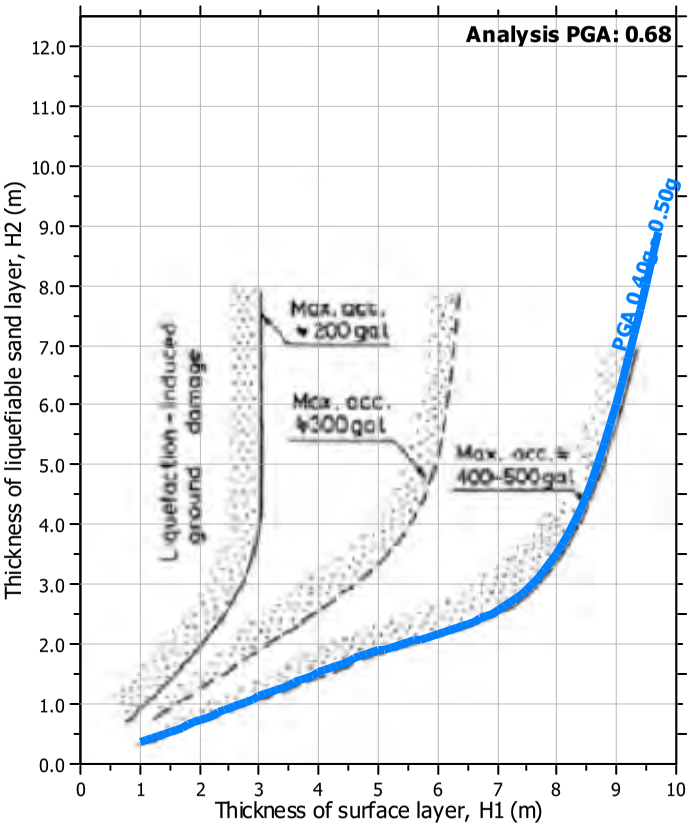
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



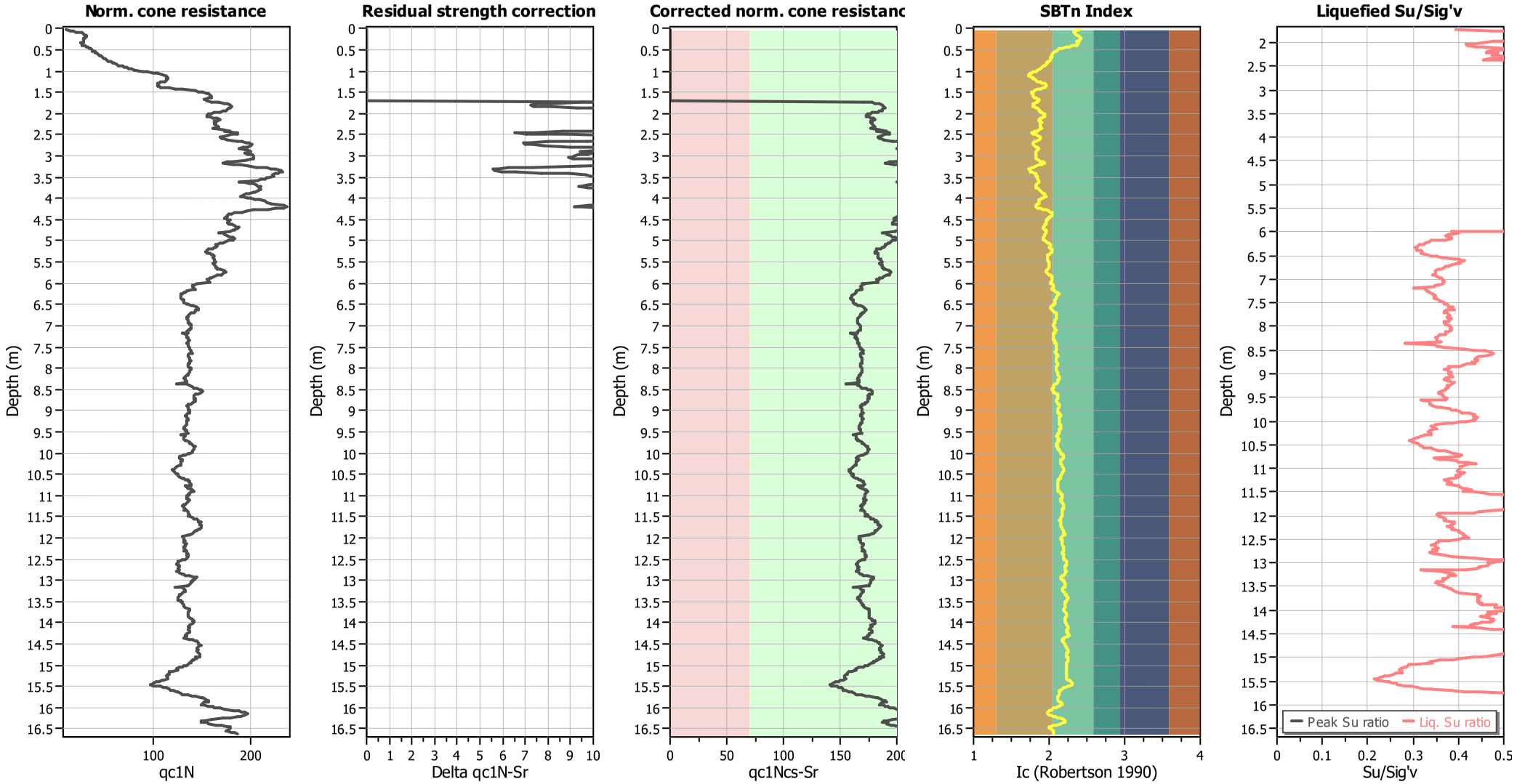




Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

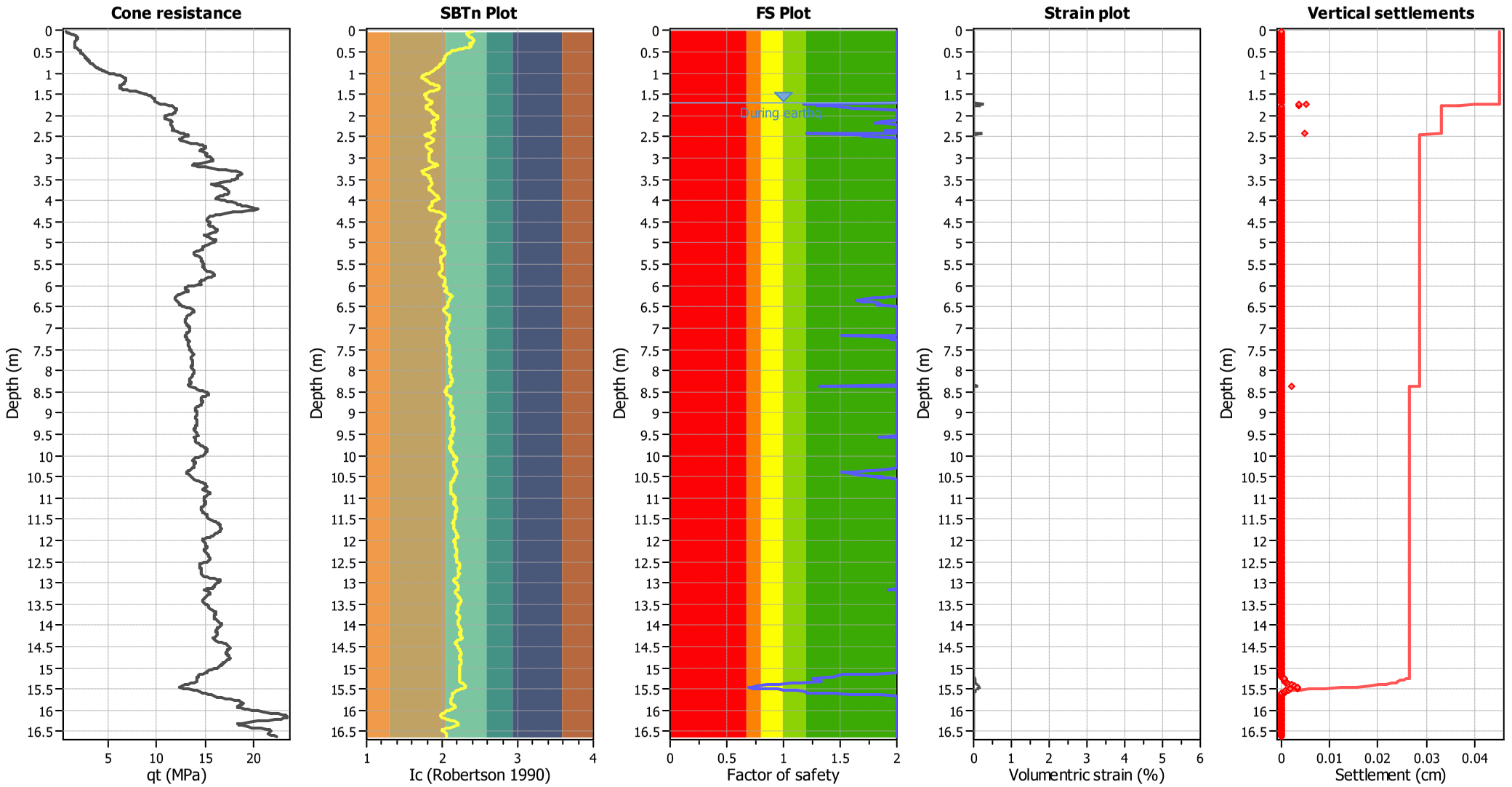
Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

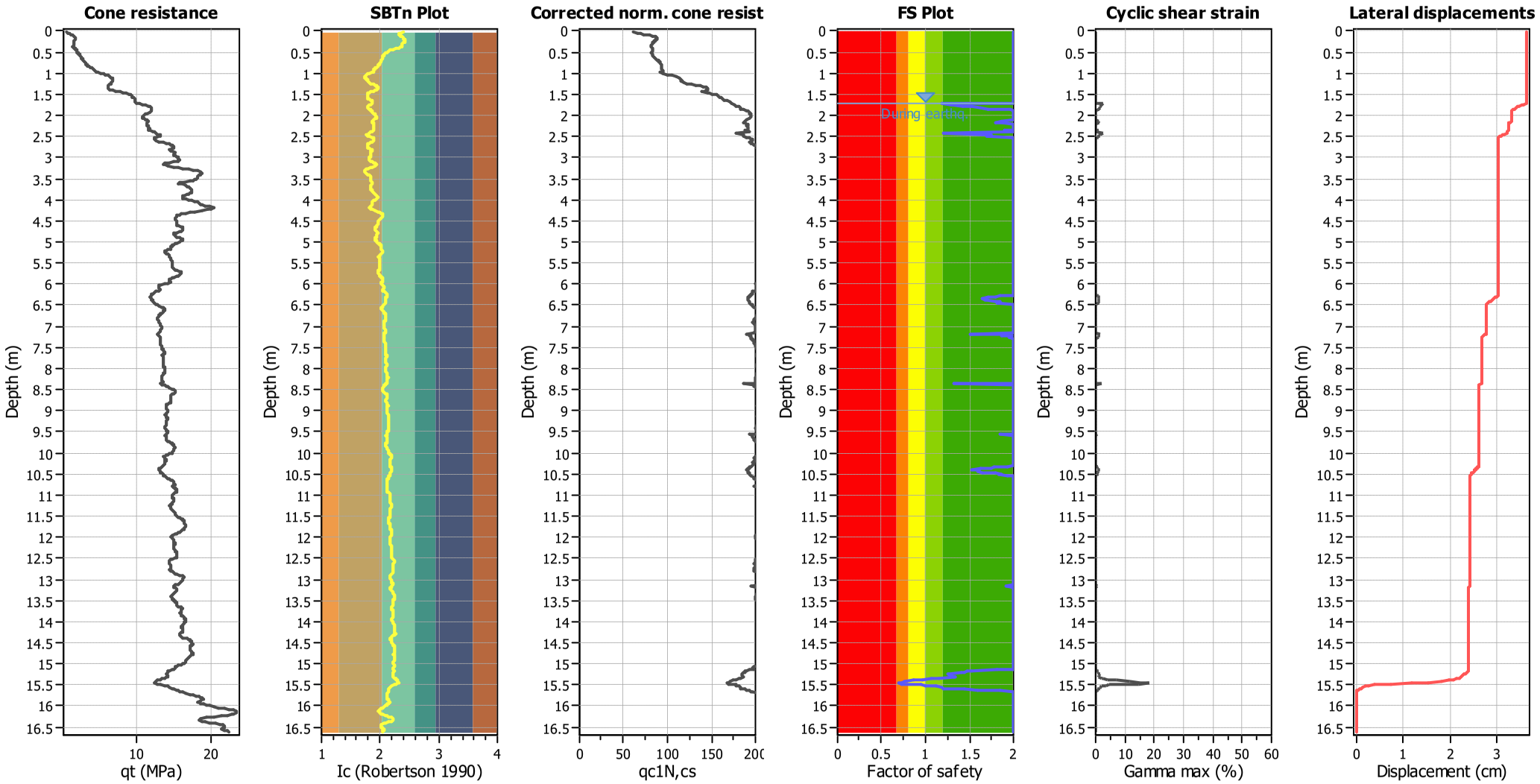
Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

Estimation of post-earthquake lateral Displacements



Abbreviations

q_t: Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c: Soil Behaviour Type Index
$q_{c1N,cs}$: Equivalent clean sand normalized CPT total cone resistance
F.S.: Factor of safety
γ_{max}: Maximum cyclic shear strain
LDI: Lateral displacement index

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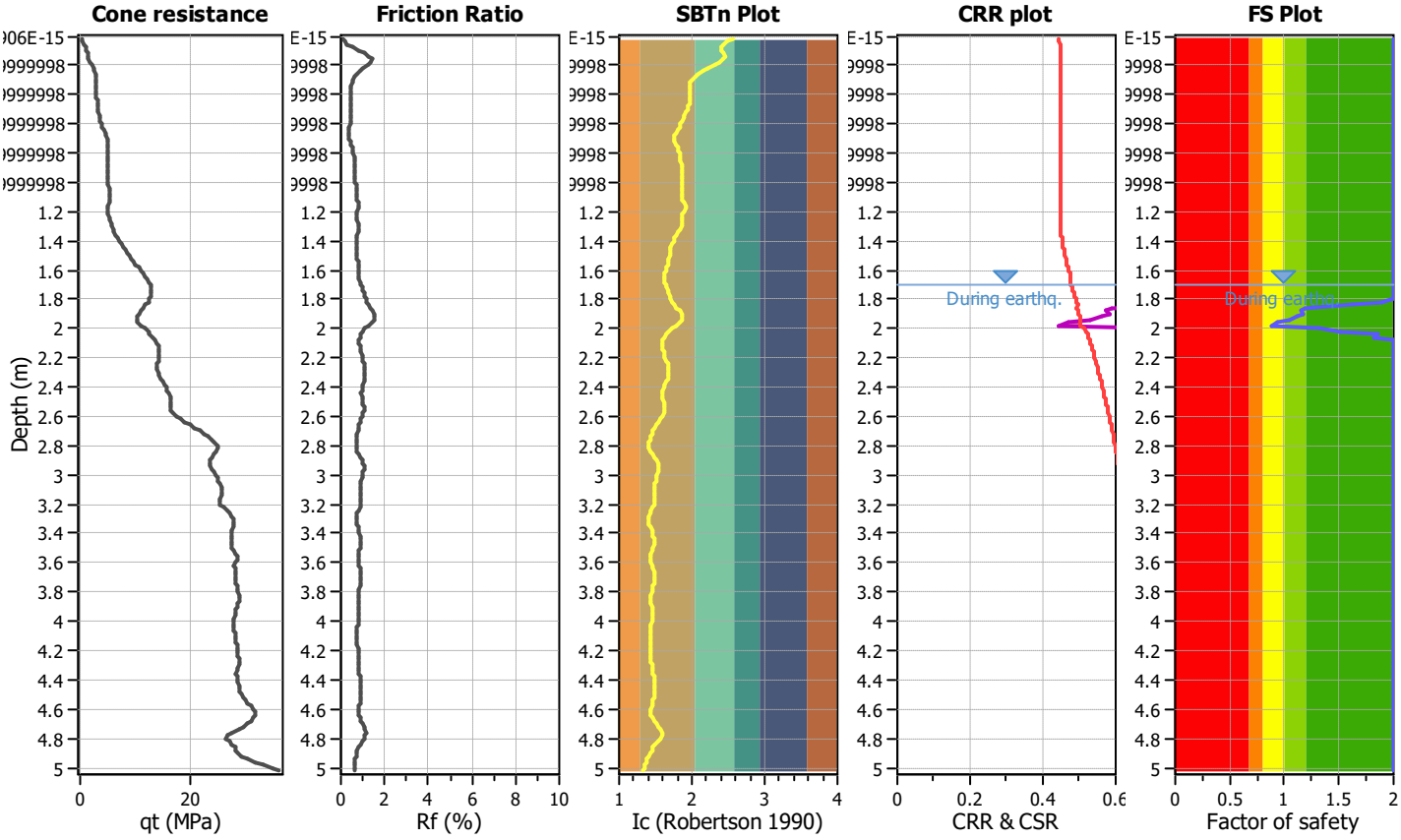
LIQUEFACTION ANALYSIS REPORT

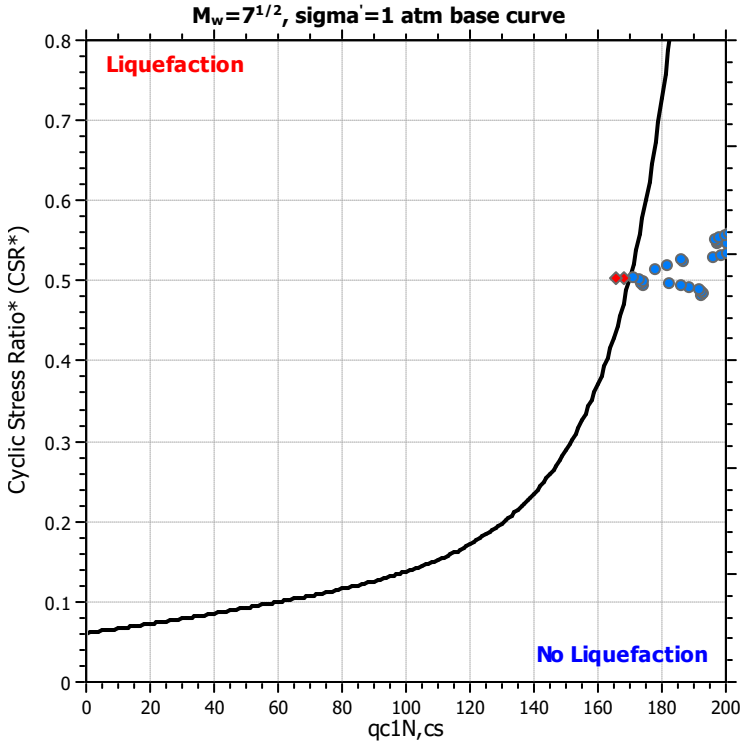
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

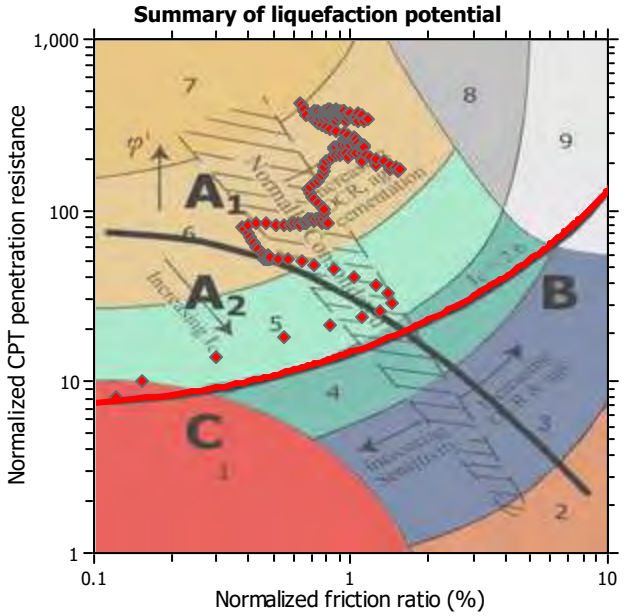
CPT file : CPT06_ULS

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.70 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	No		

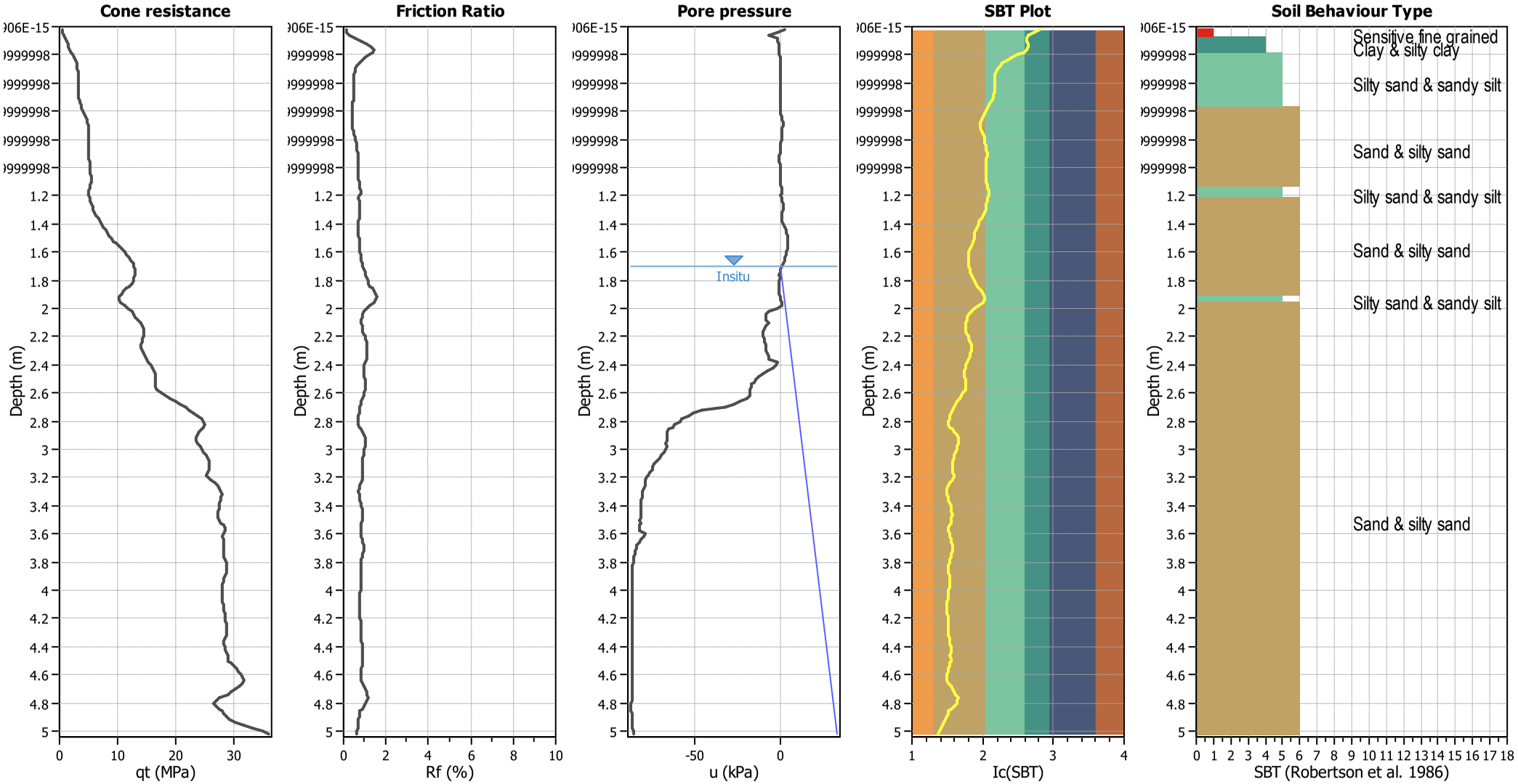






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



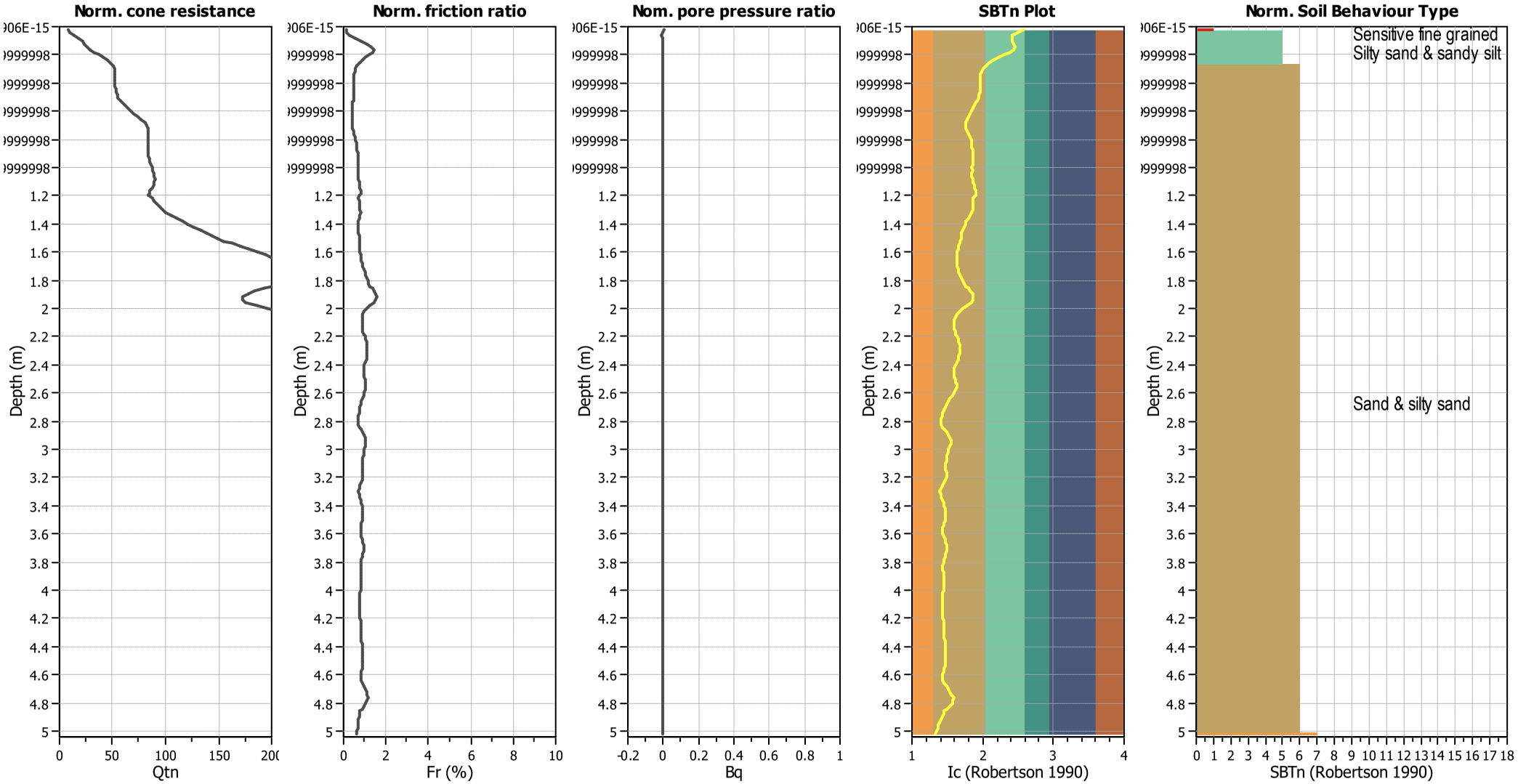
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

CPT basic interpretation plots (normalized)



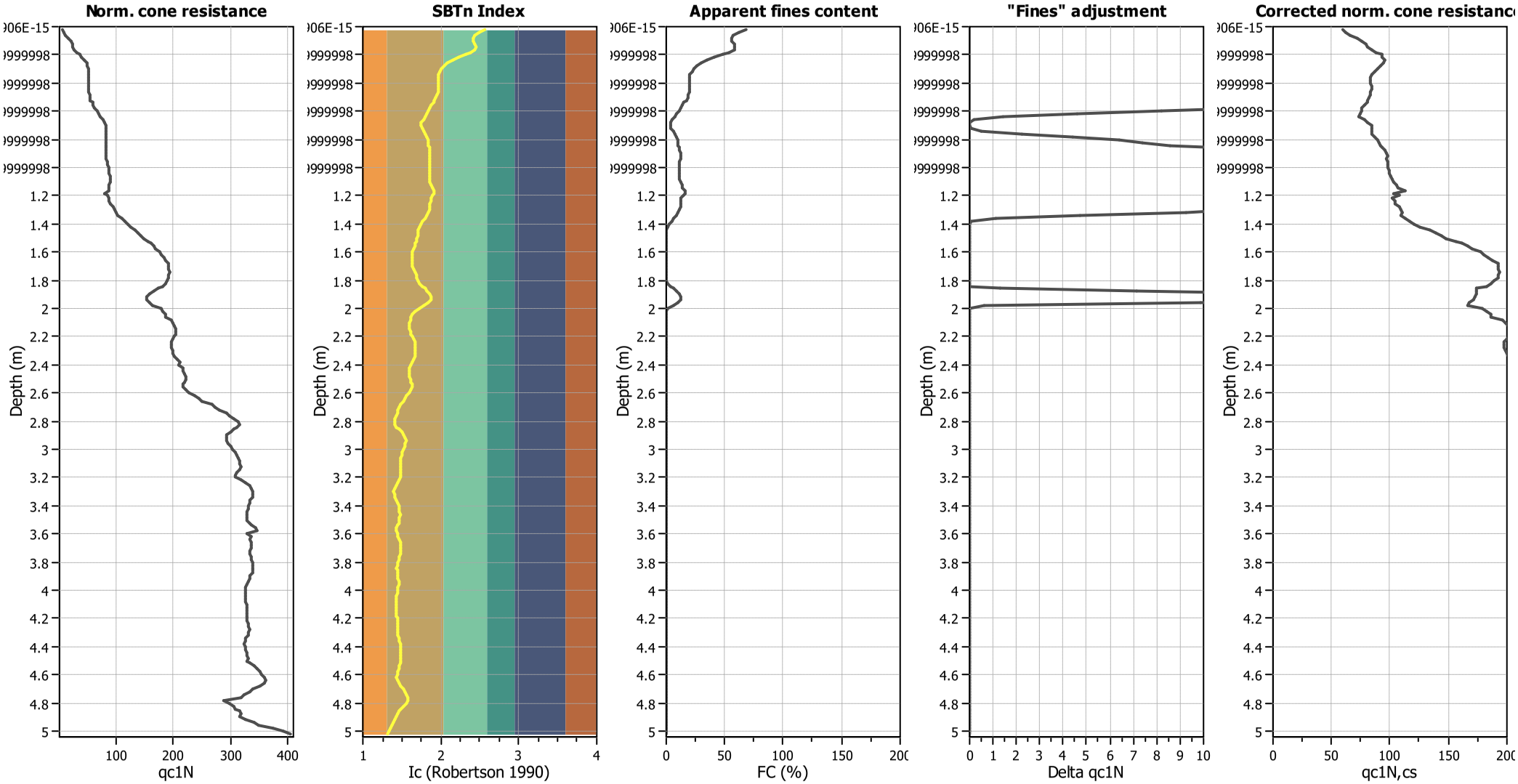
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

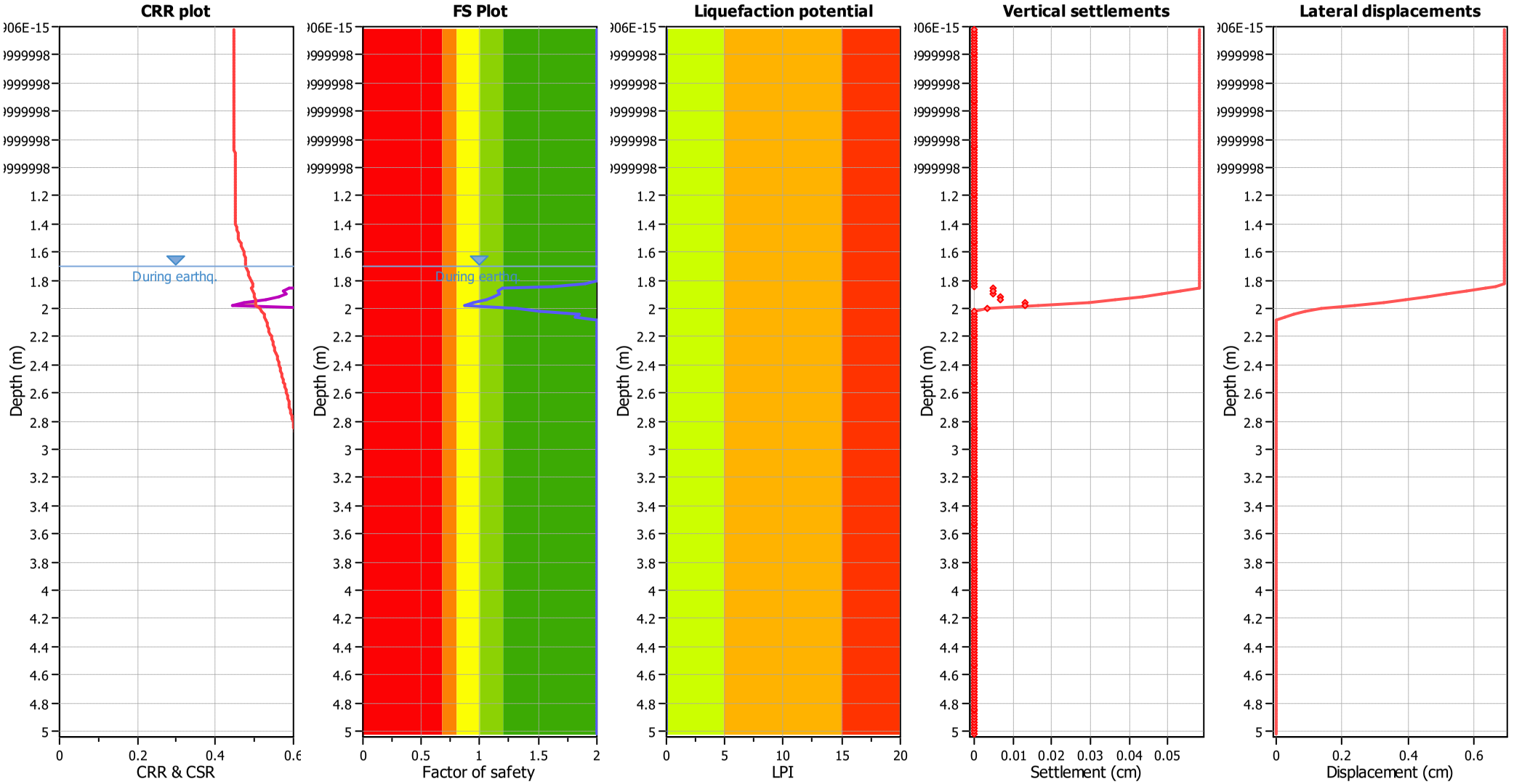
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

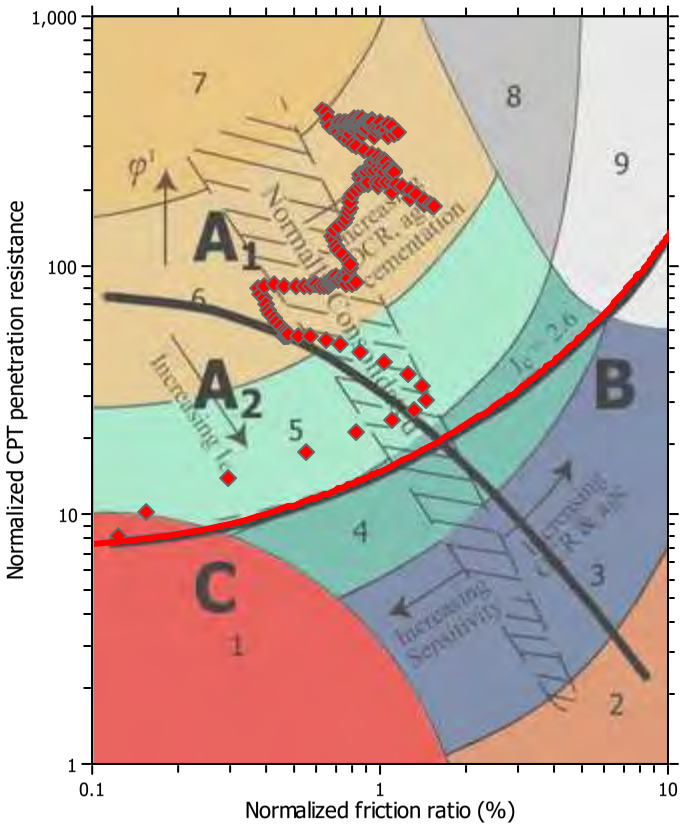
F.S. color scheme

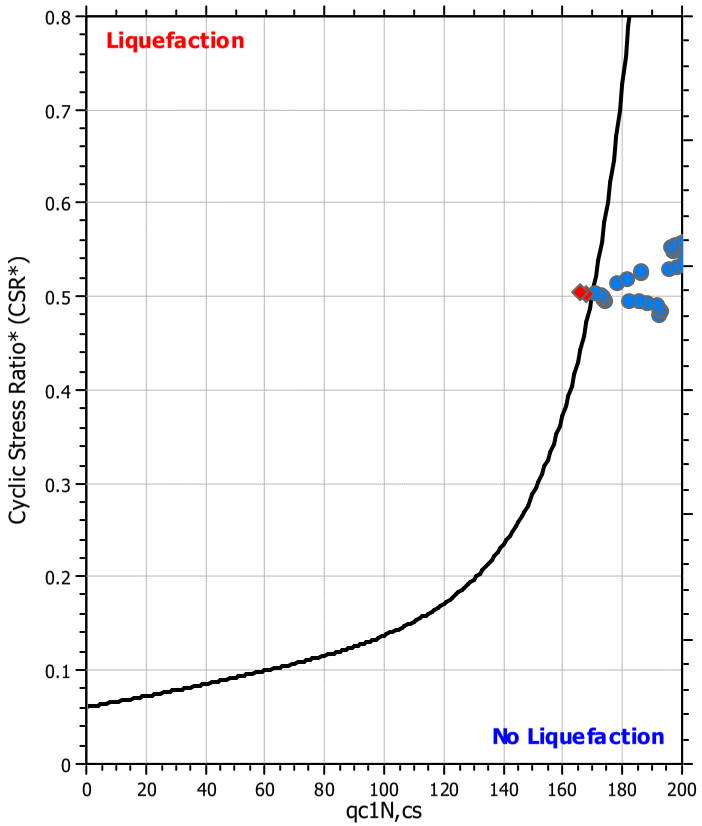
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

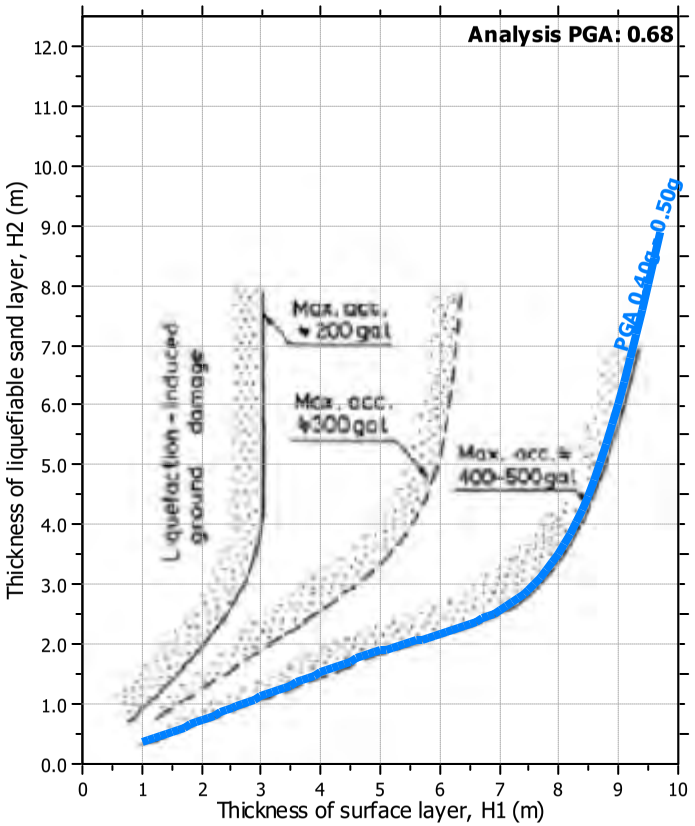
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



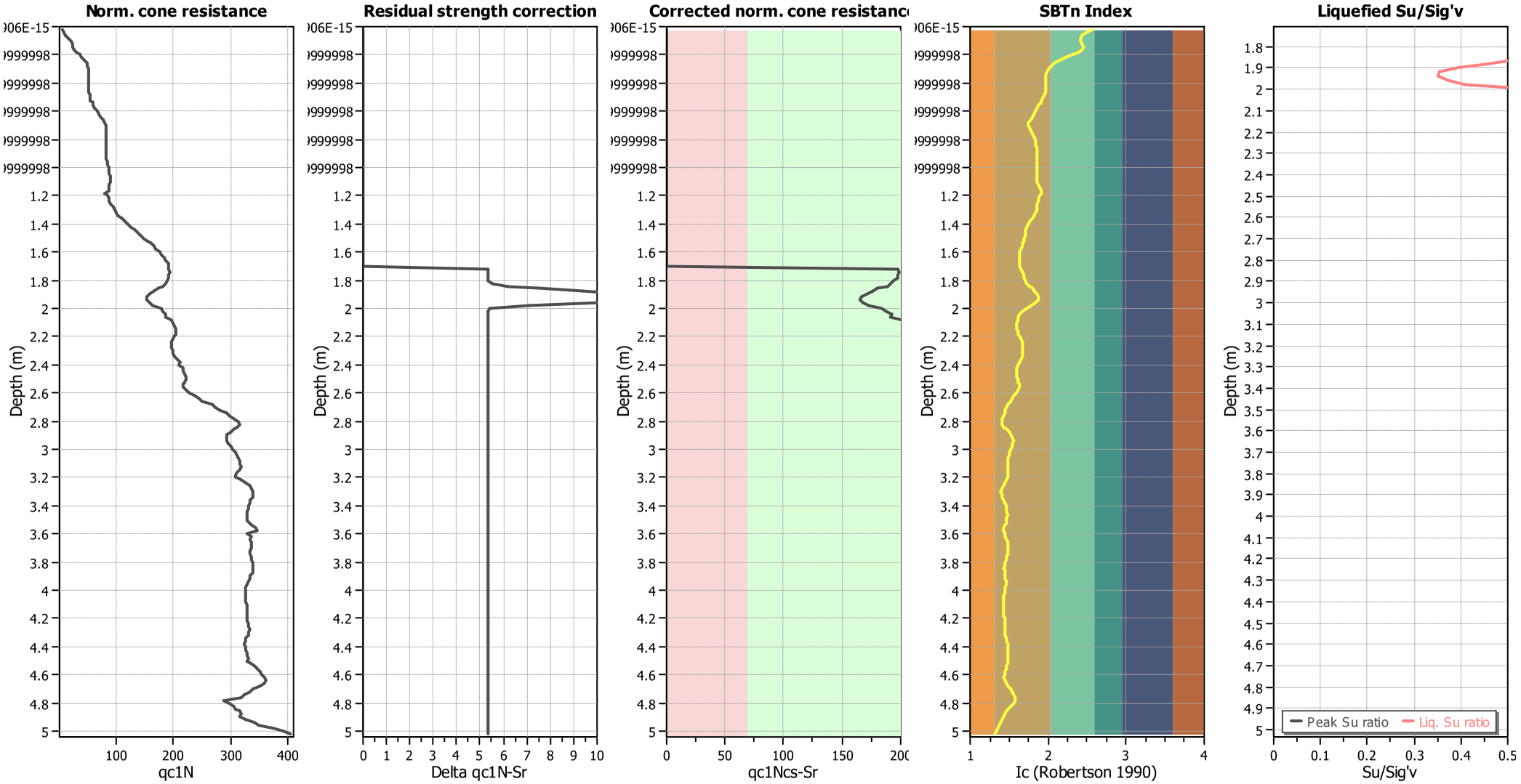




Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

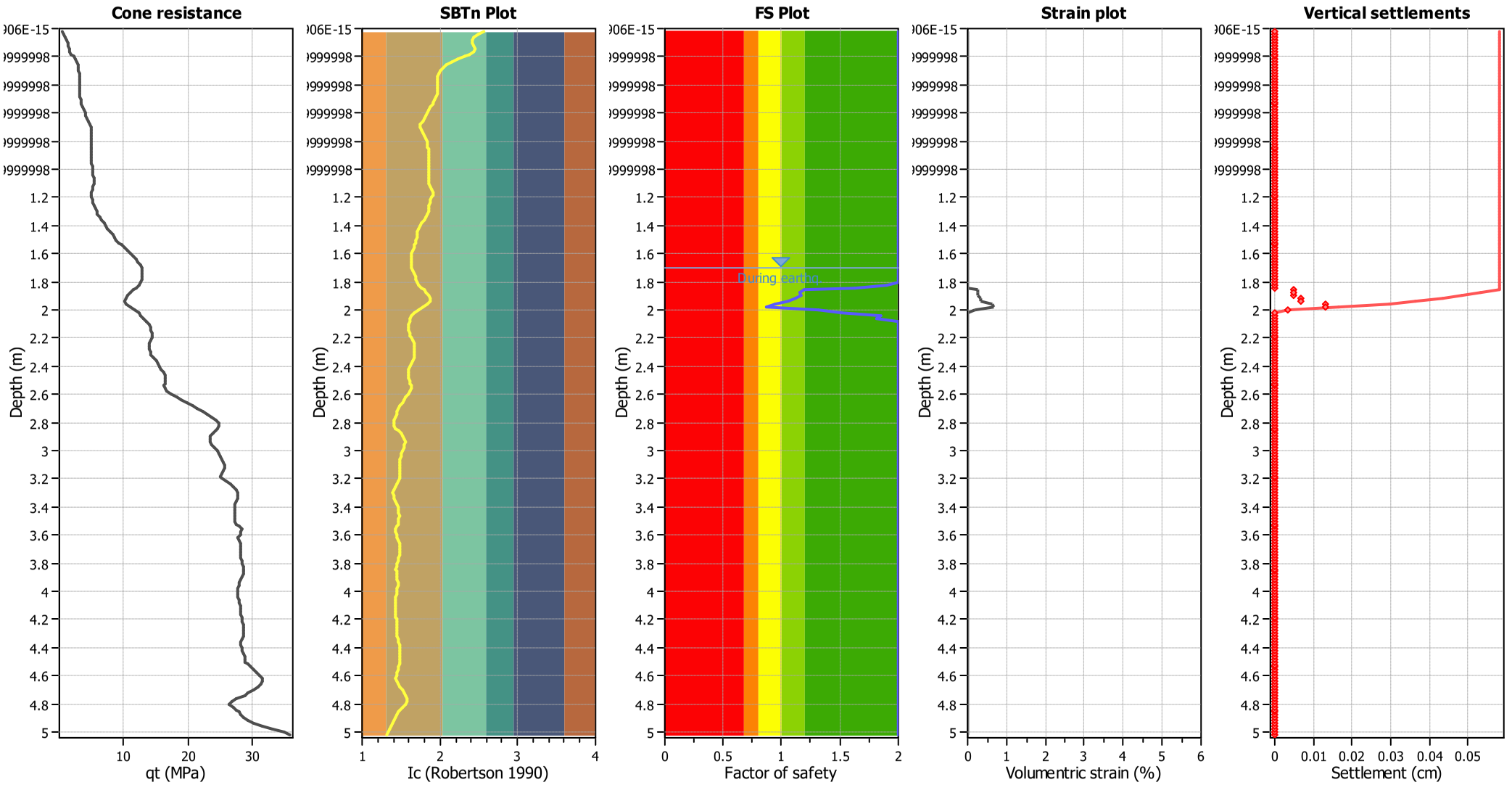
Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

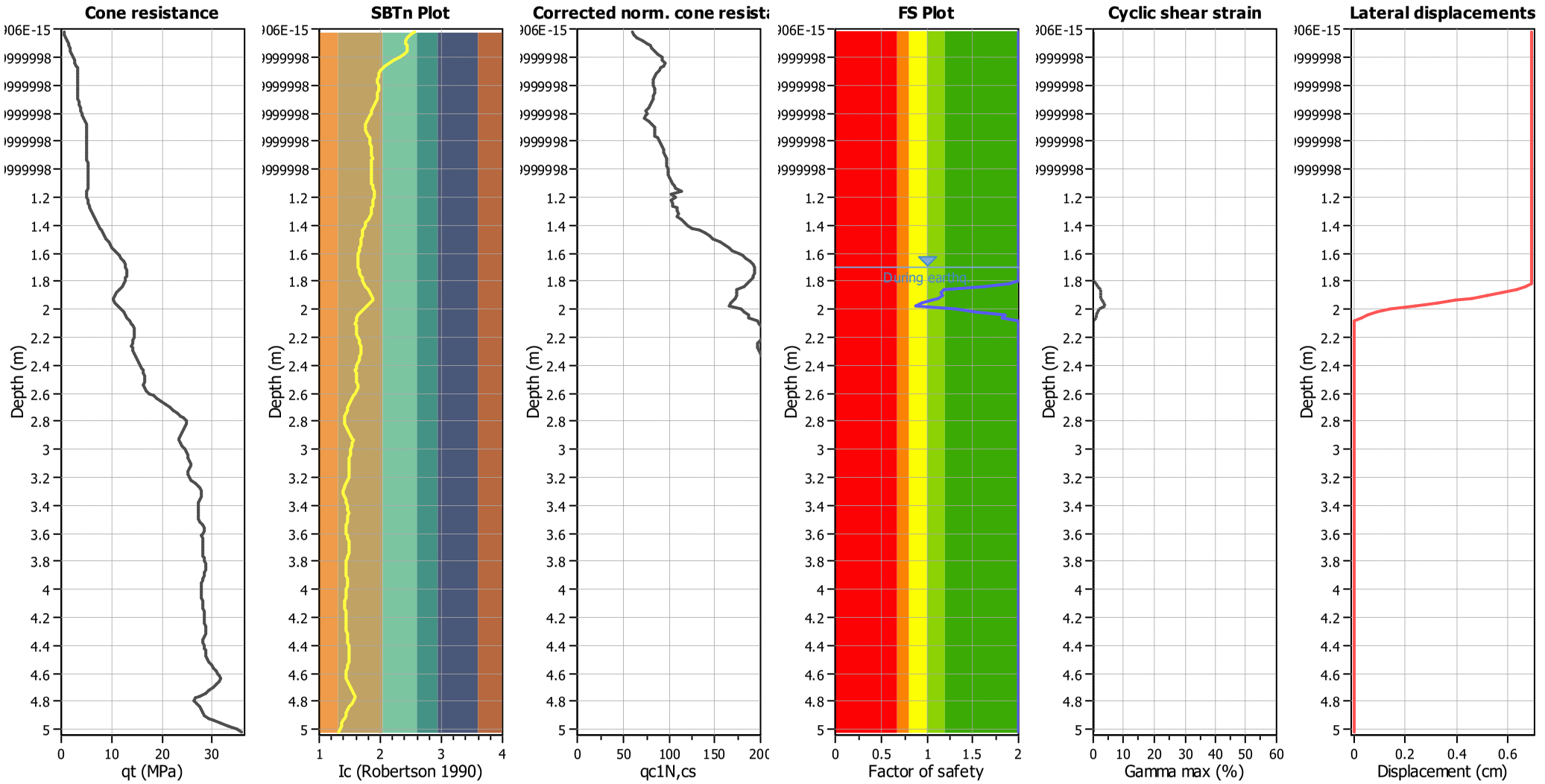
Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

Estimation of post-earthquake lateral Displacements



Abbreviations

q_t: Total cone resistance (cone resistance q_c corrected for pore water effects)
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$q_{c1N,cs}$: Equivalent clean sand normalized CPT total cone resistance
F.S.: Factor of safety
γ_{max}: Maximum cyclic shear strain
LDI: Lateral displacement index

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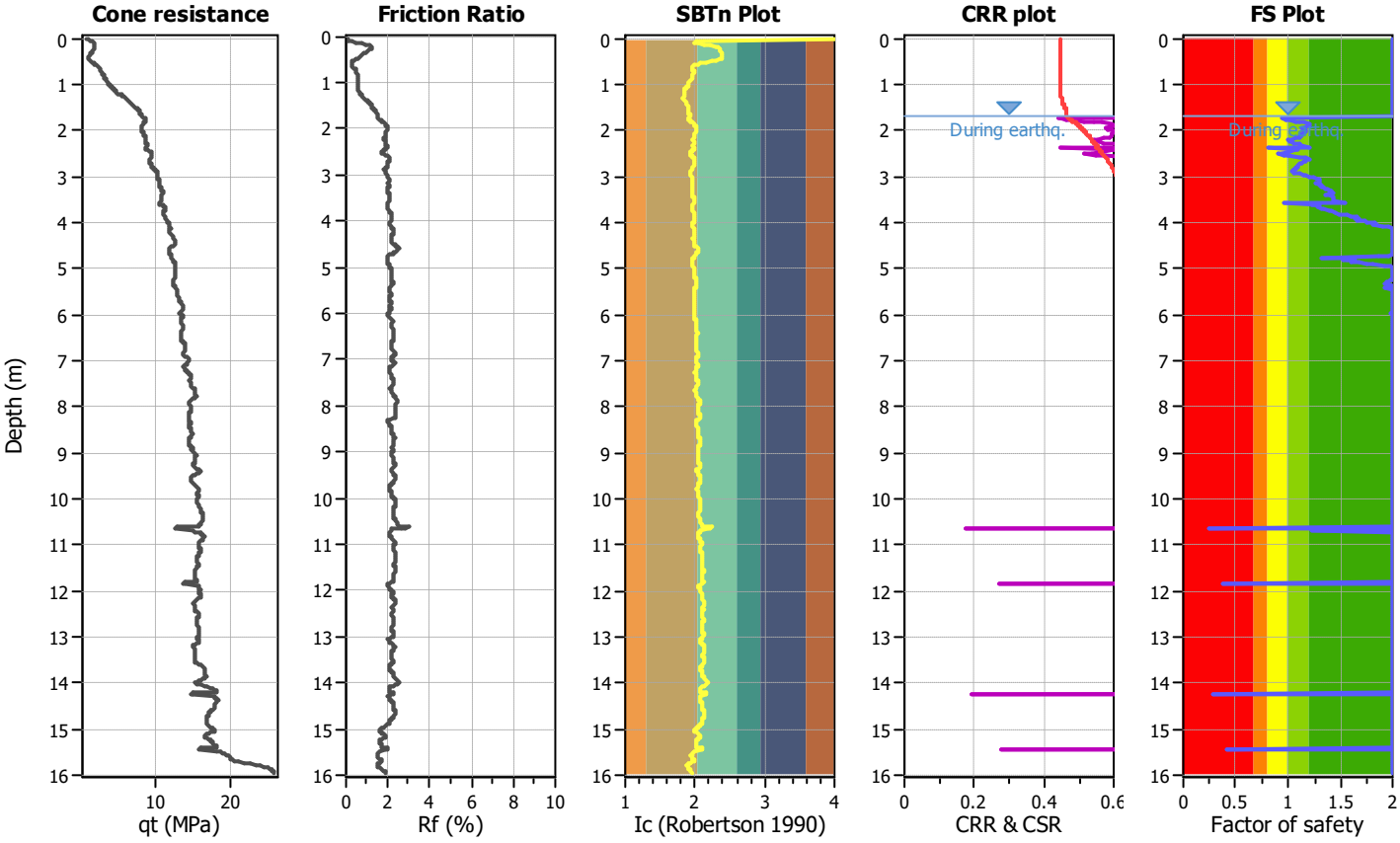
LIQUEFACTION ANALYSIS REPORT

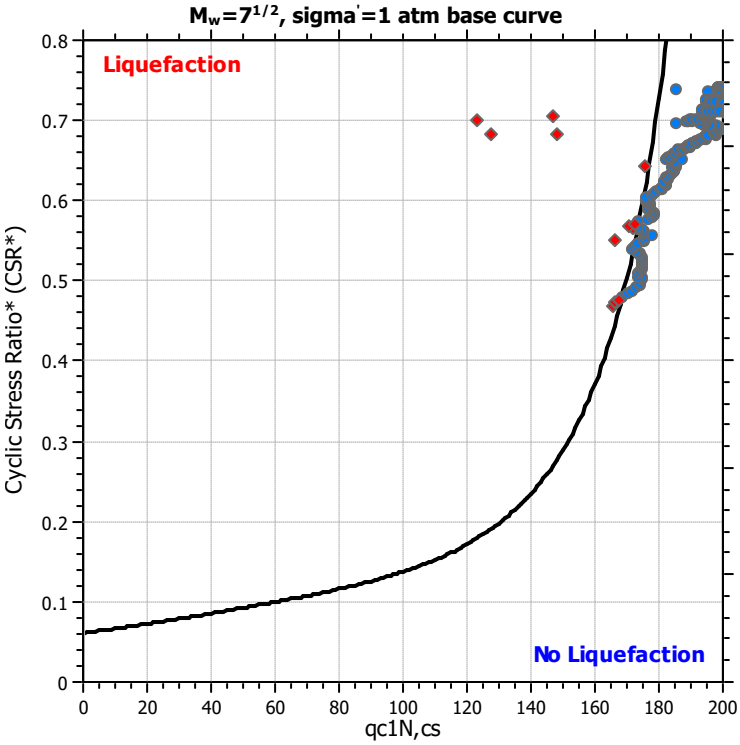
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

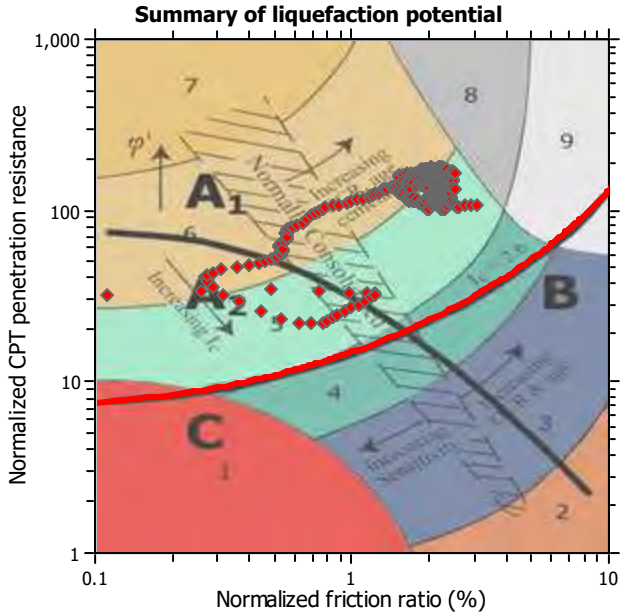
CPT file : CPT07_ULS

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.70 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	No		

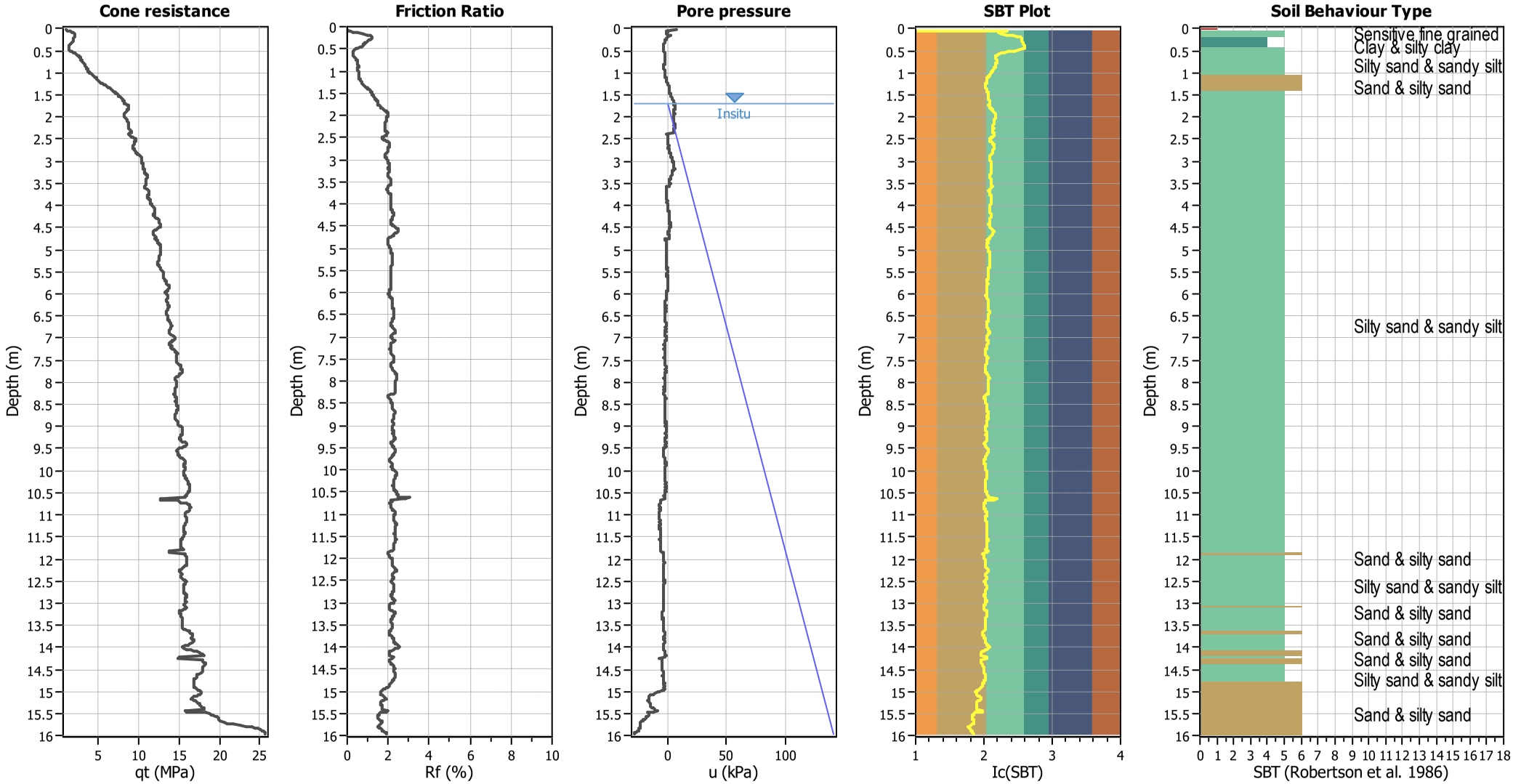






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



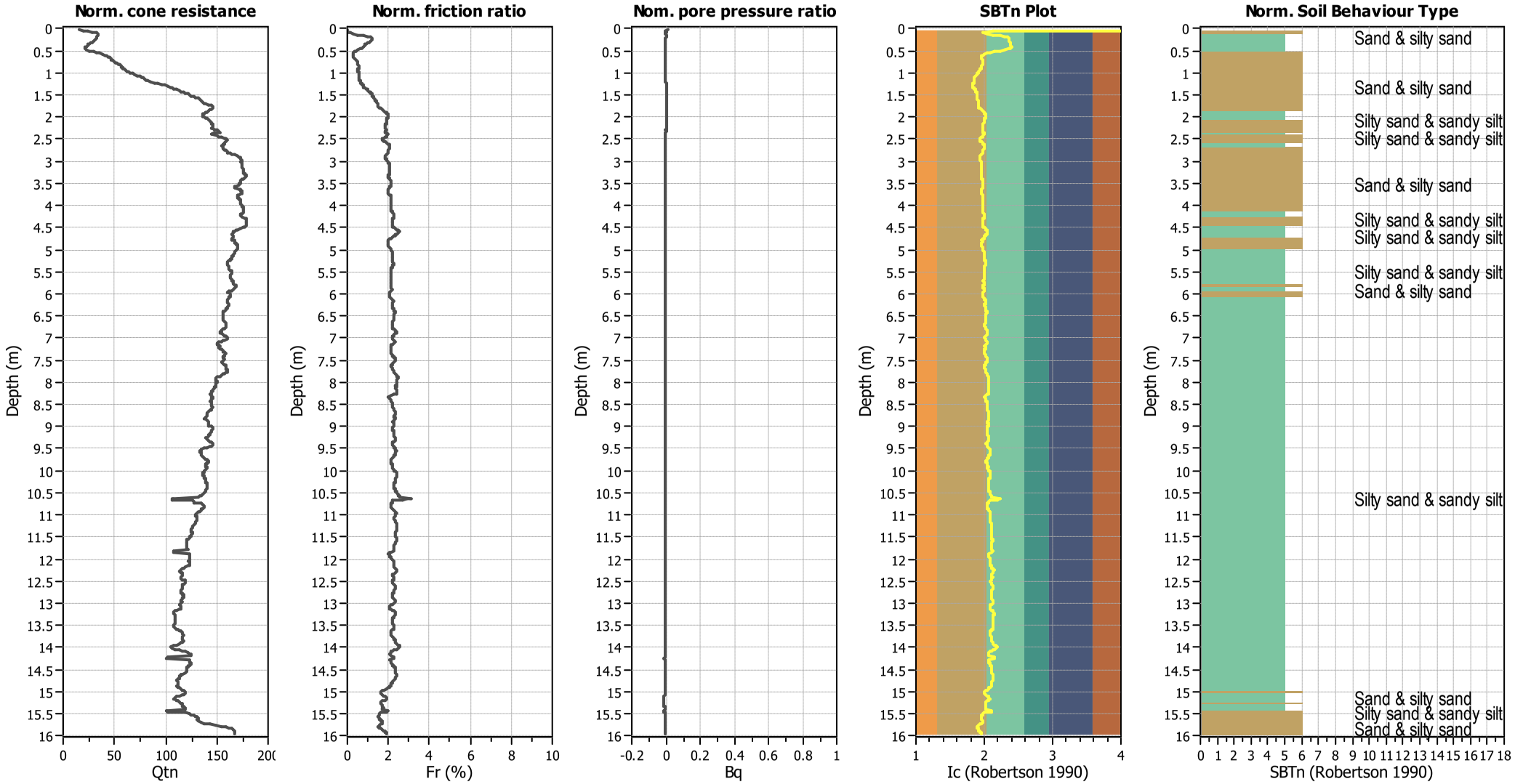
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

CPT basic interpretation plots (normalized)



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
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Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

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4. Clayey silt to silty
5. Silty sand to sandy silt
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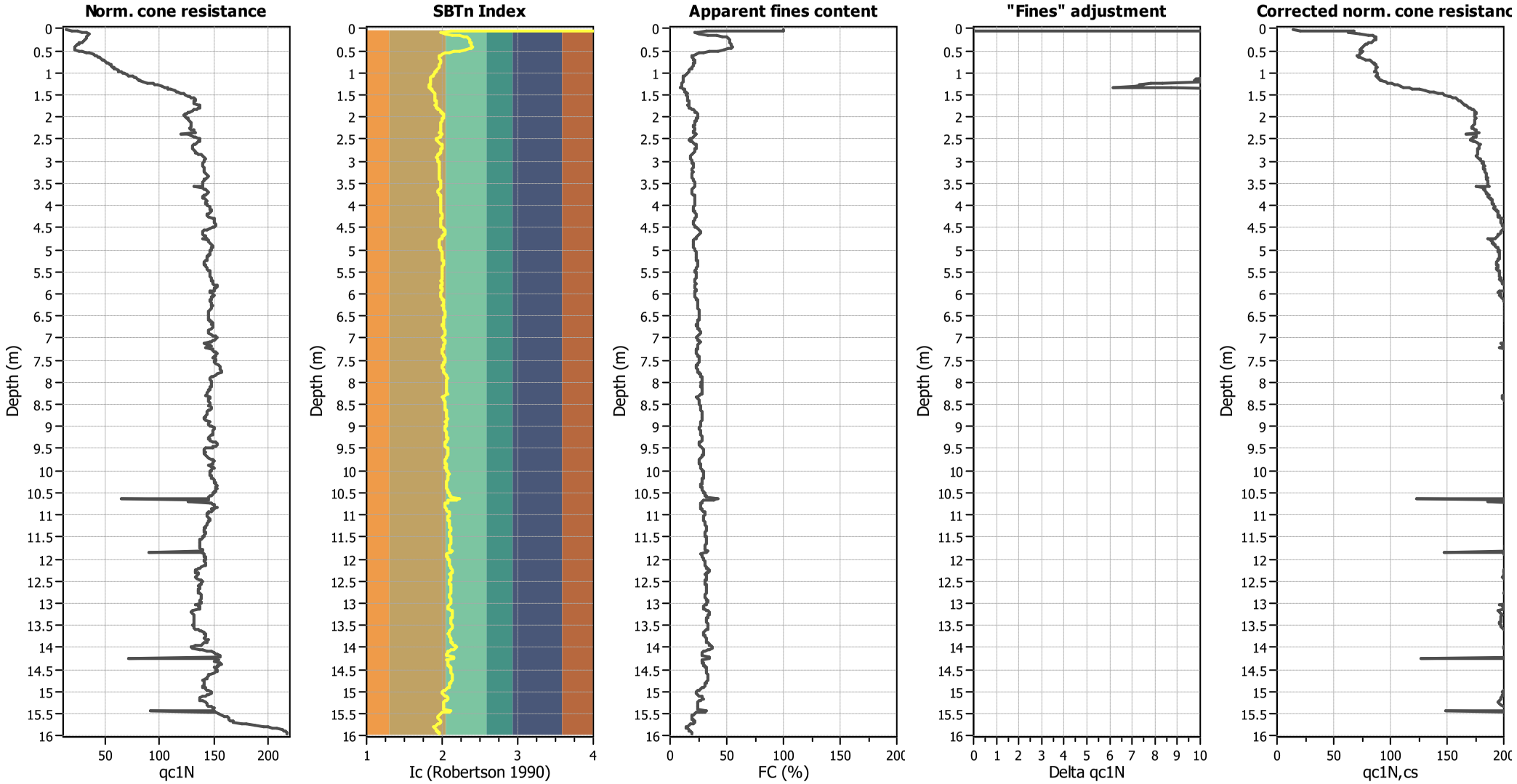
8. Very stiff sand to
9. Very stiff fine grained

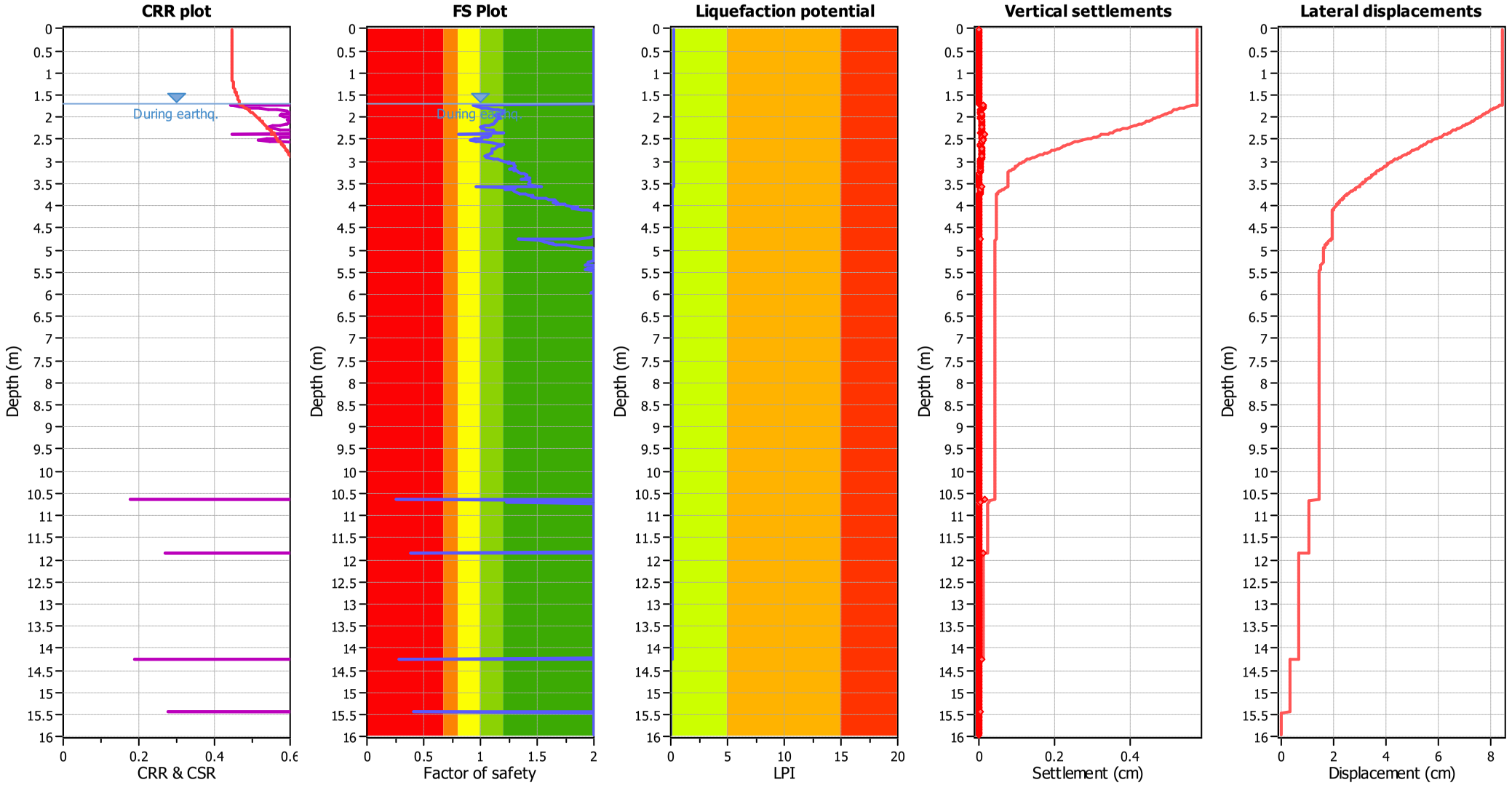
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

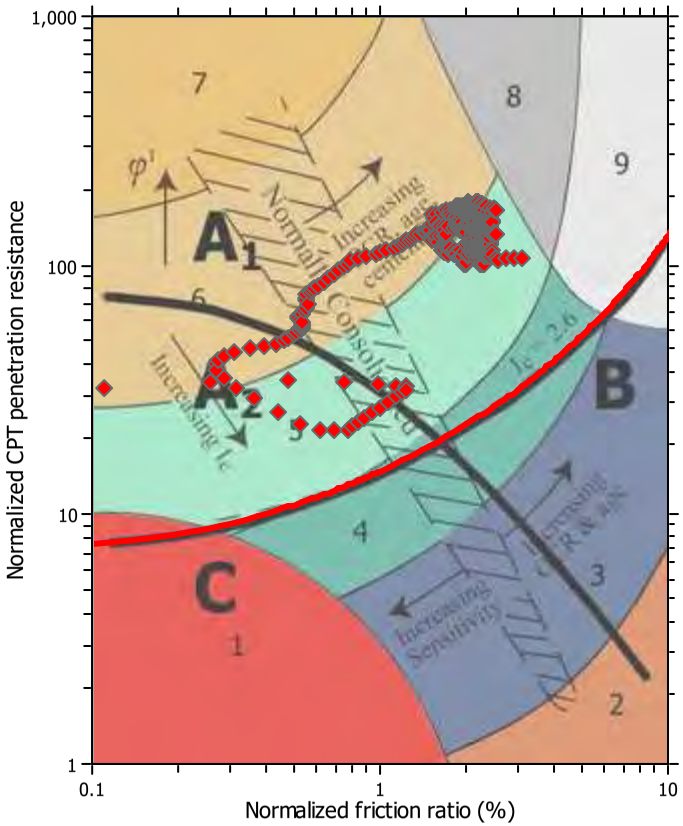
F.S. color scheme

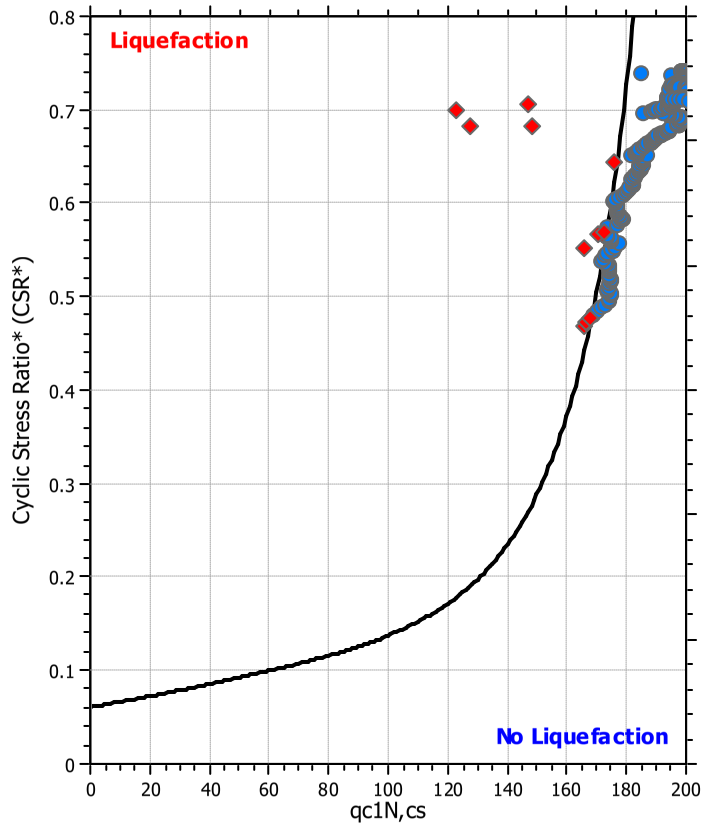
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

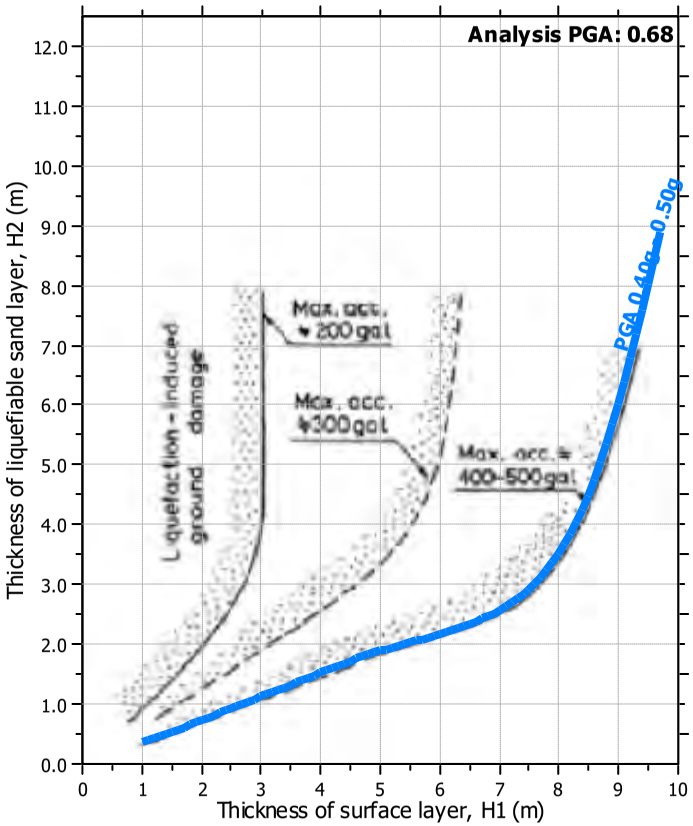
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



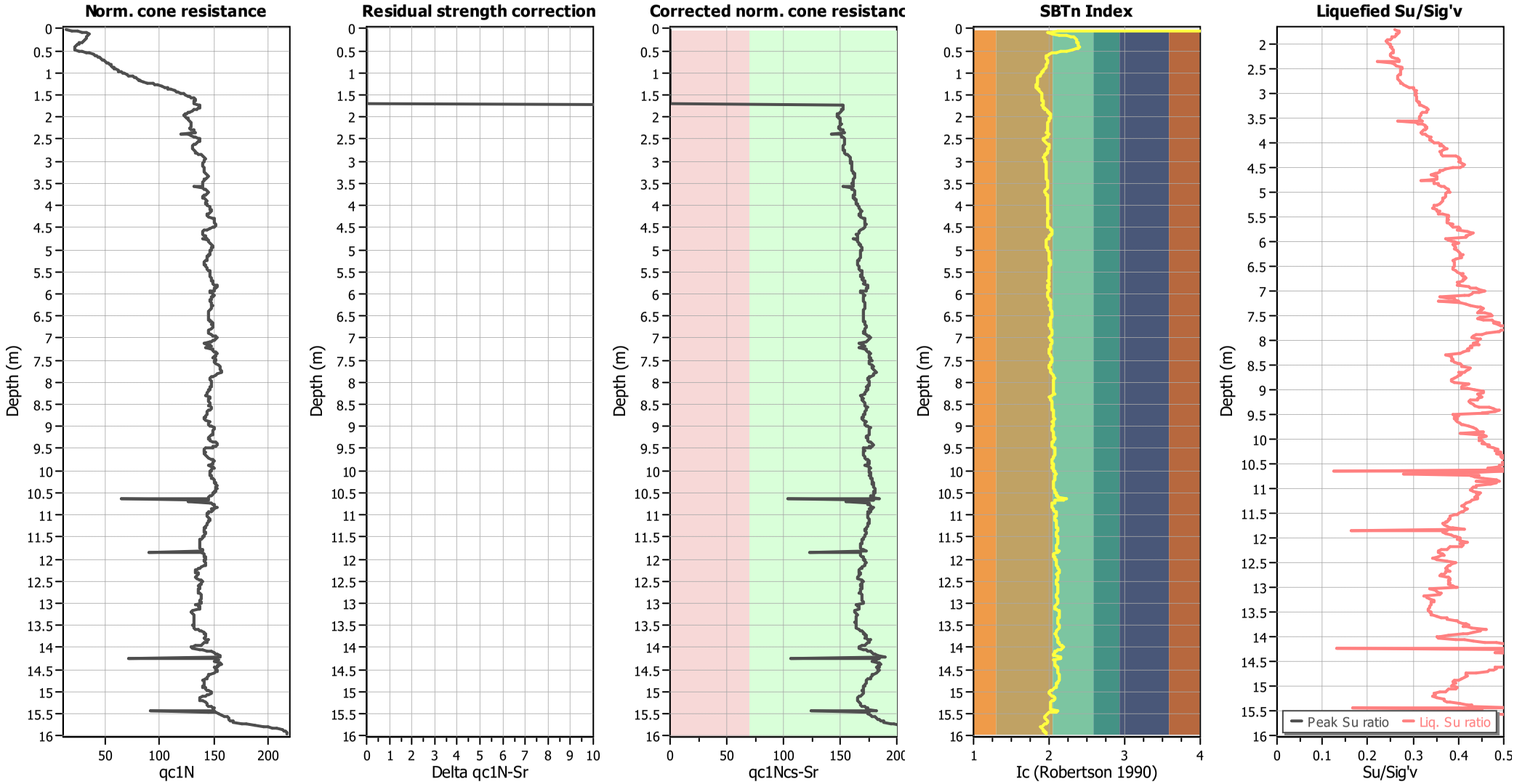




Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

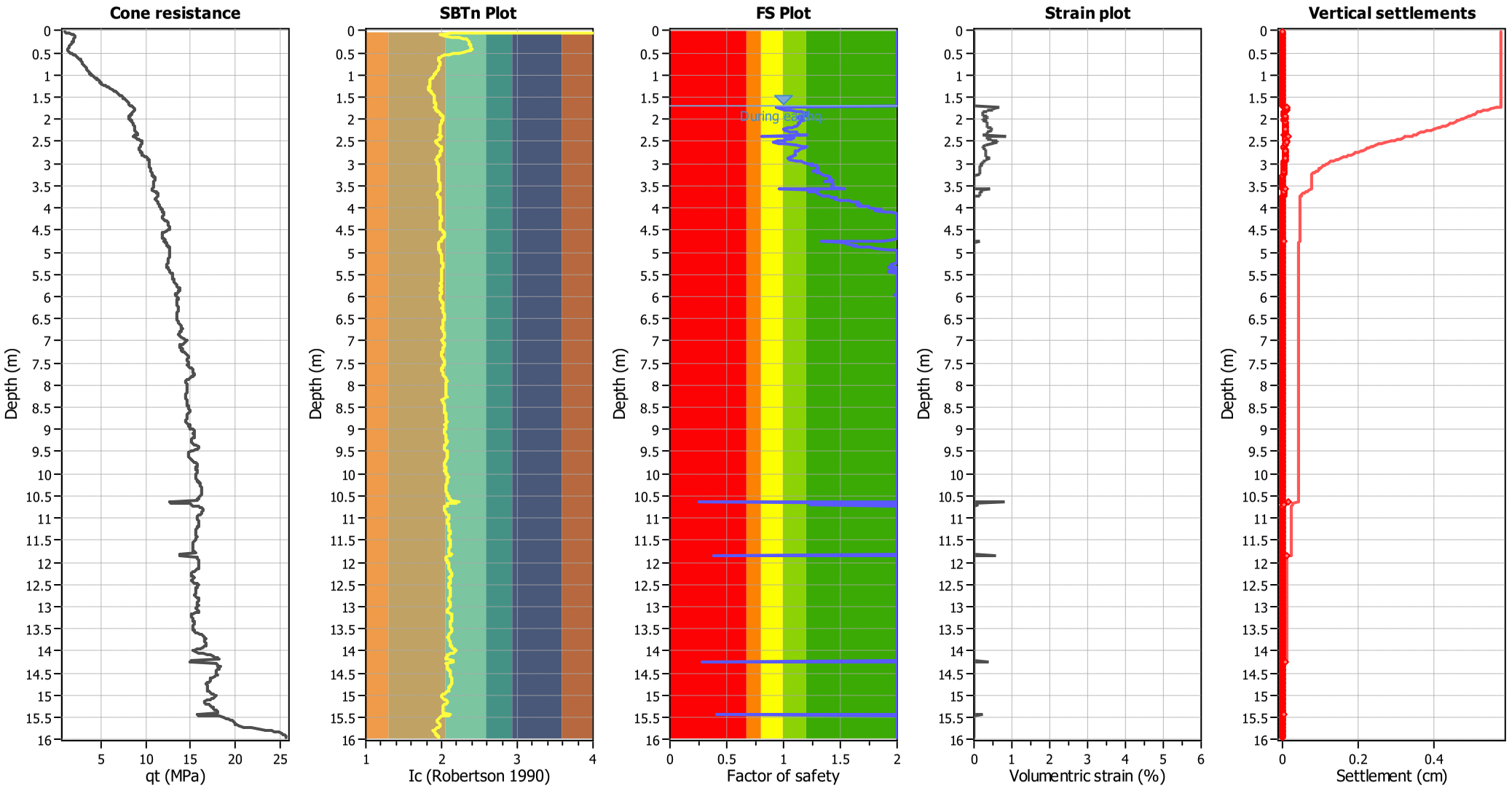
Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

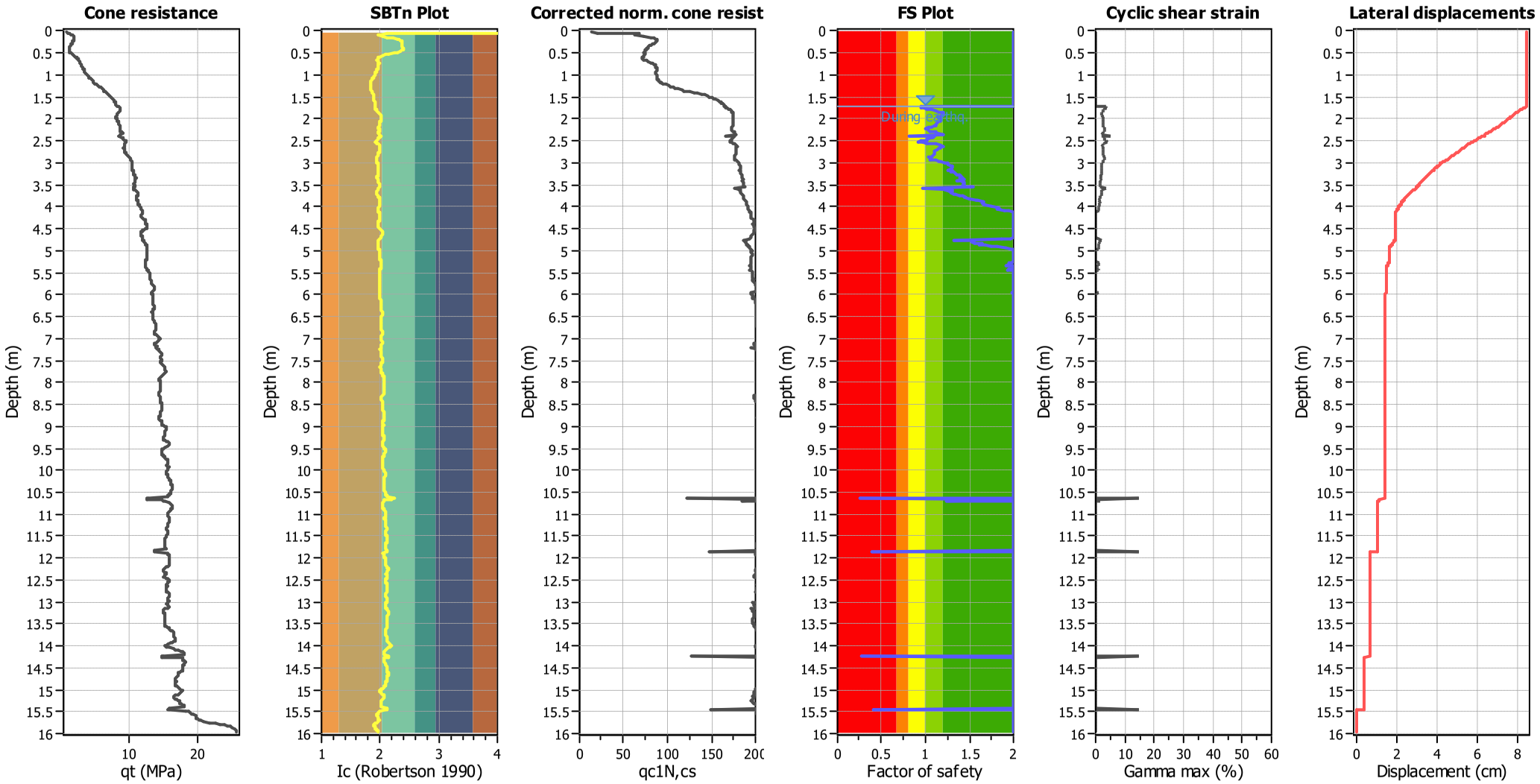
Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

Estimation of post-earthquake lateral Displacements



Abbreviations

q_t: Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c: Soil Behaviour Type Index
$q_{c1N,cs}$: Equivalent clean sand normalized CPT total cone resistance
F.S.: Factor of safety
γ_{max}: Maximum cyclic shear strain
LDI: Lateral displacement index

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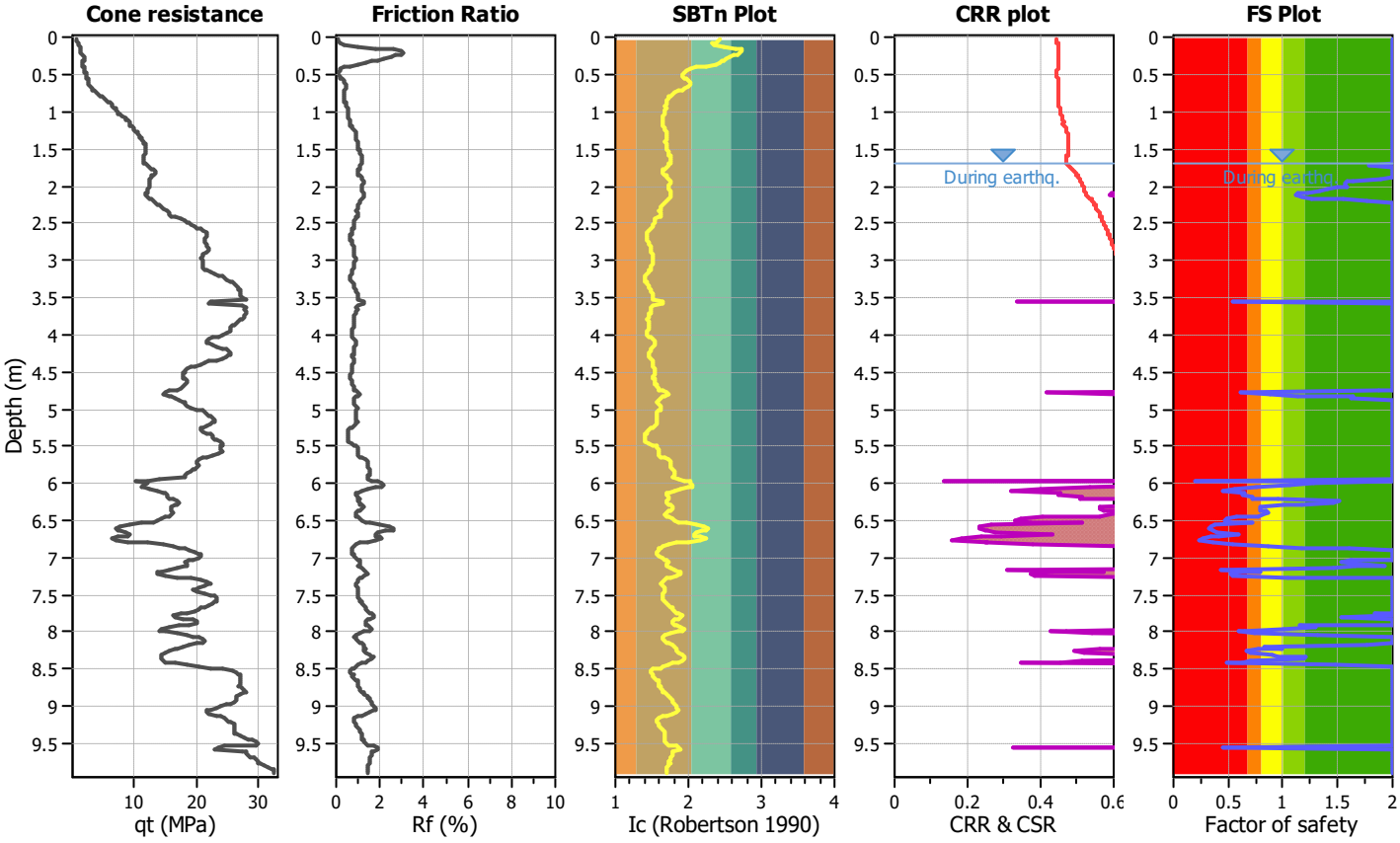
LIQUEFACTION ANALYSIS REPORT

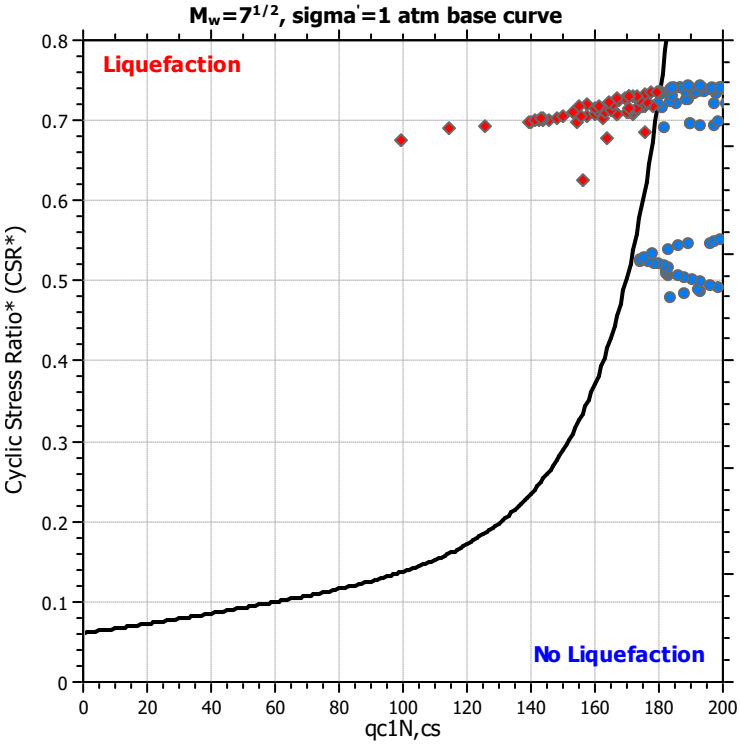
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

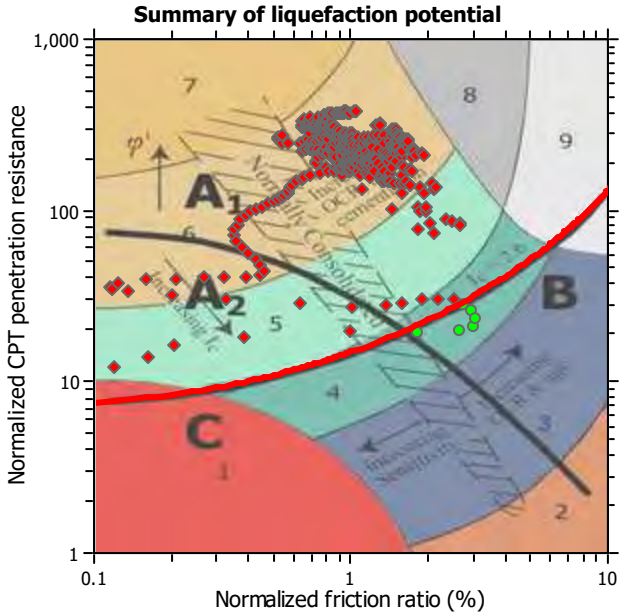
CPT file : CPT08_ULS

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.70 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	No		

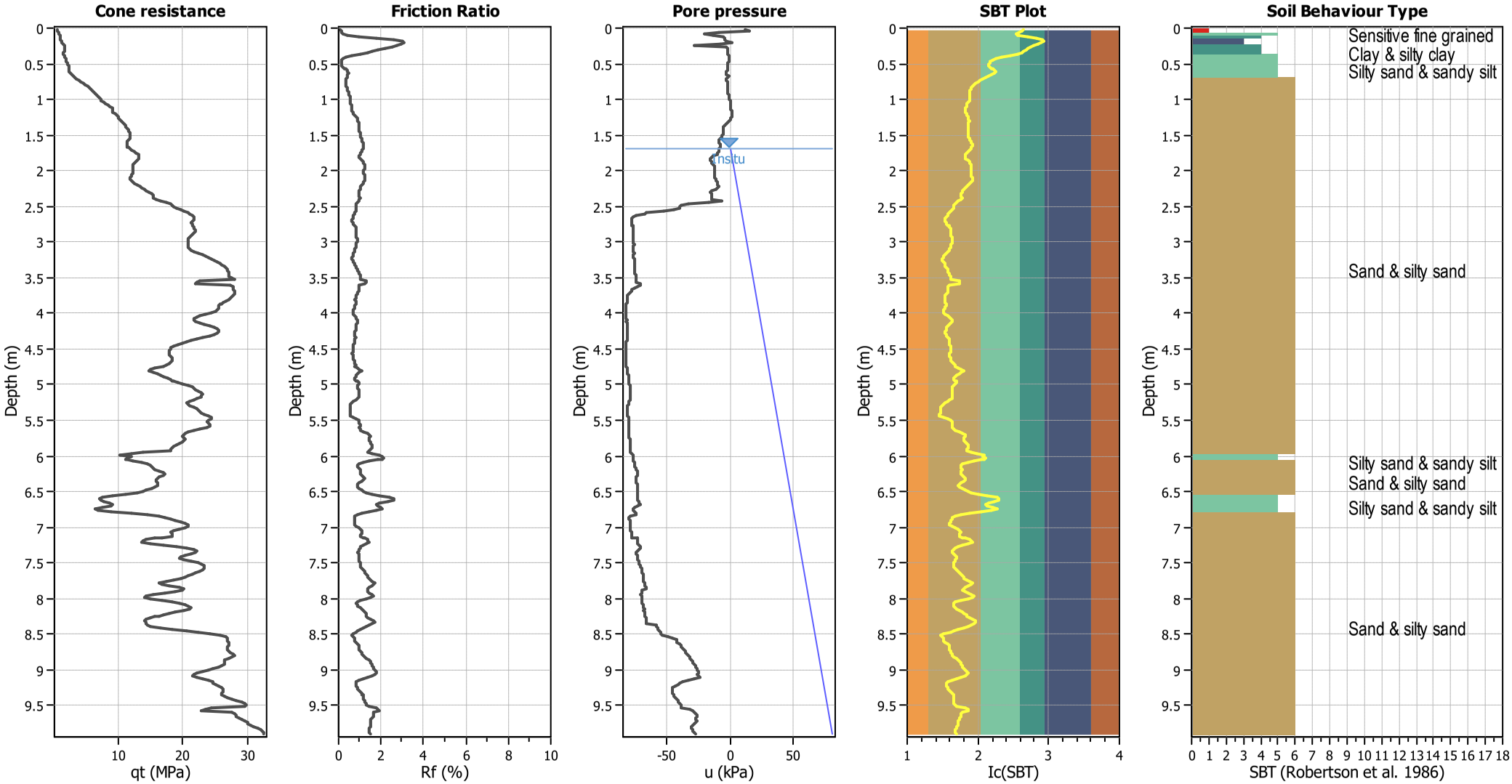






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



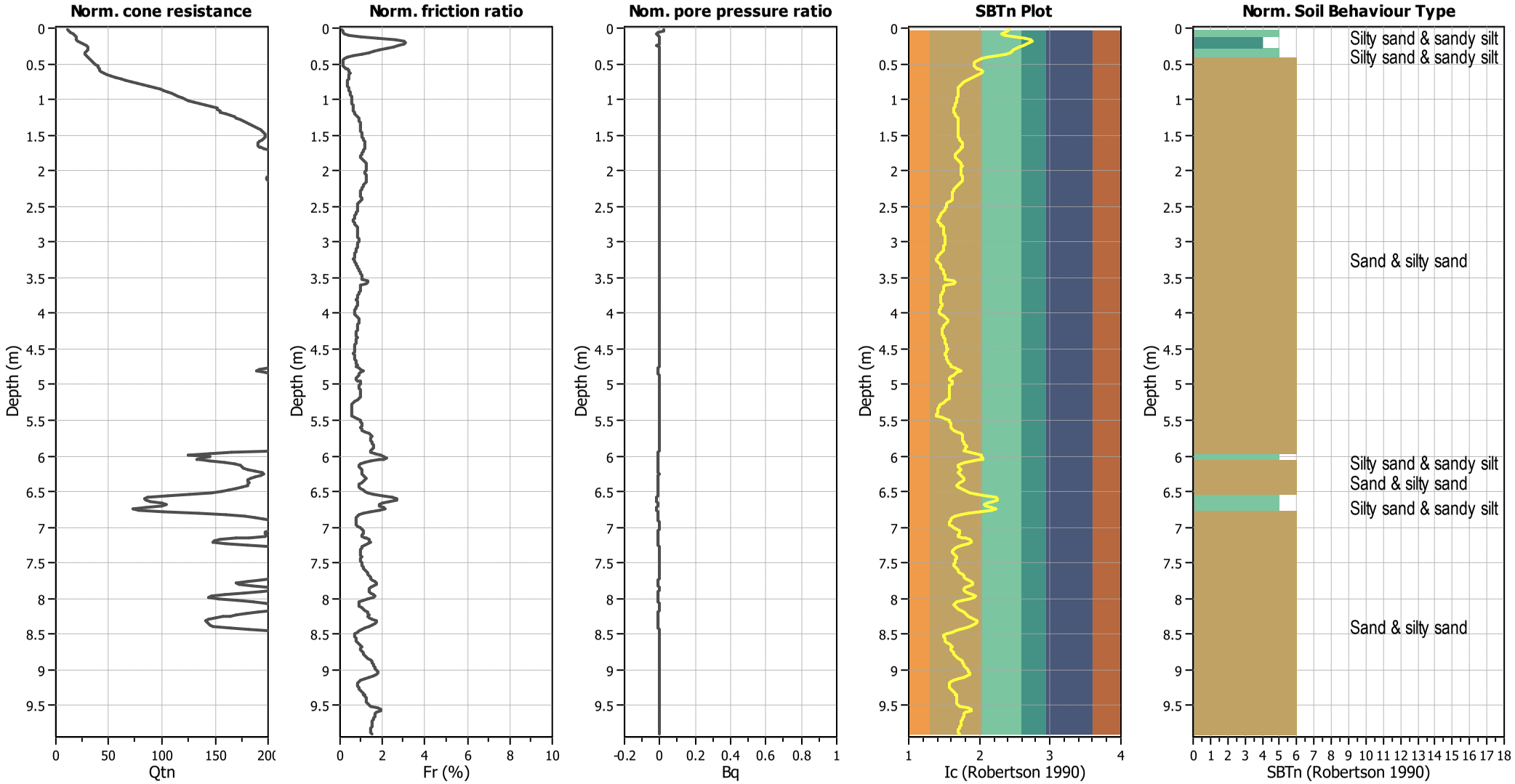
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

CPT basic interpretation plots (normalized)



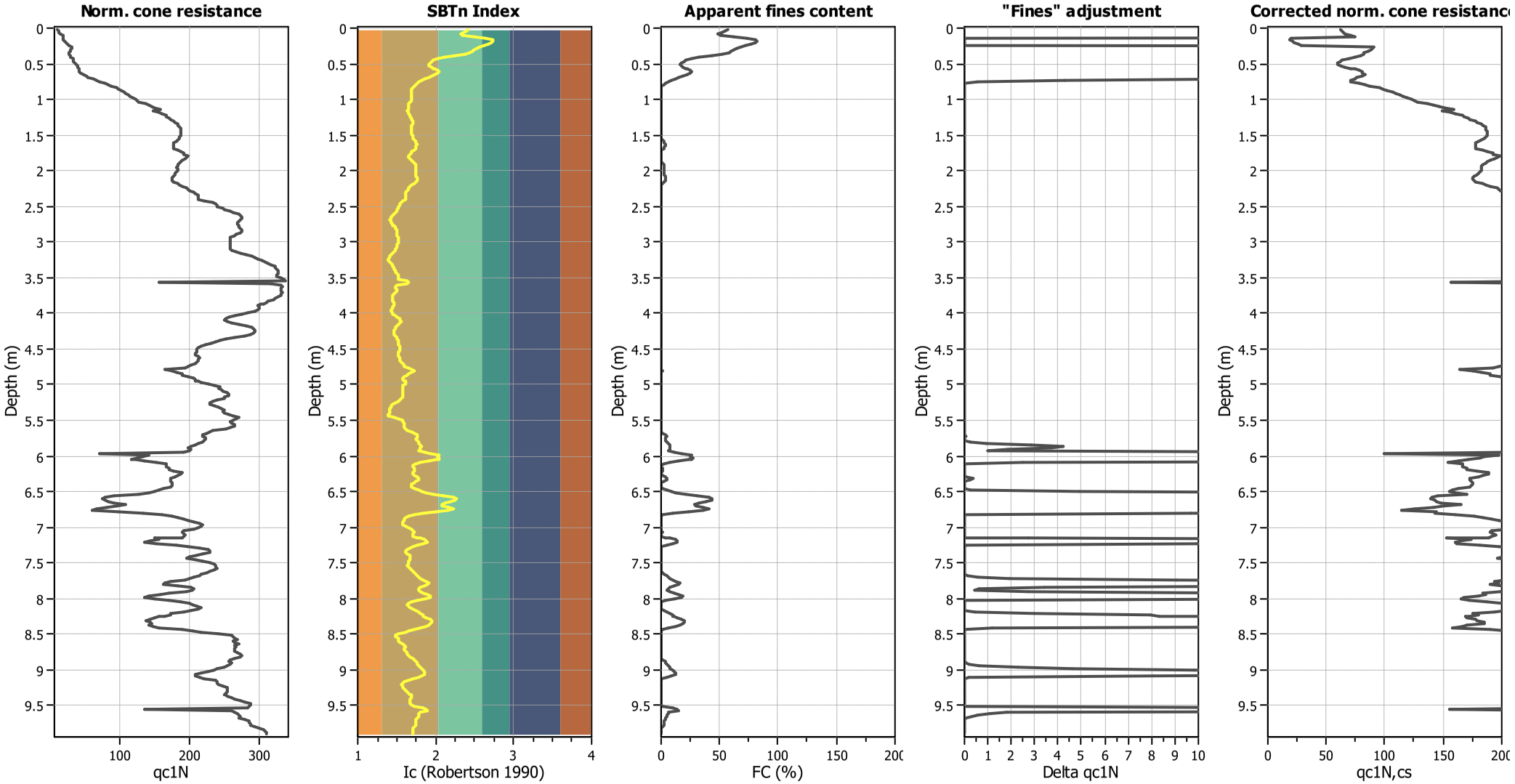
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

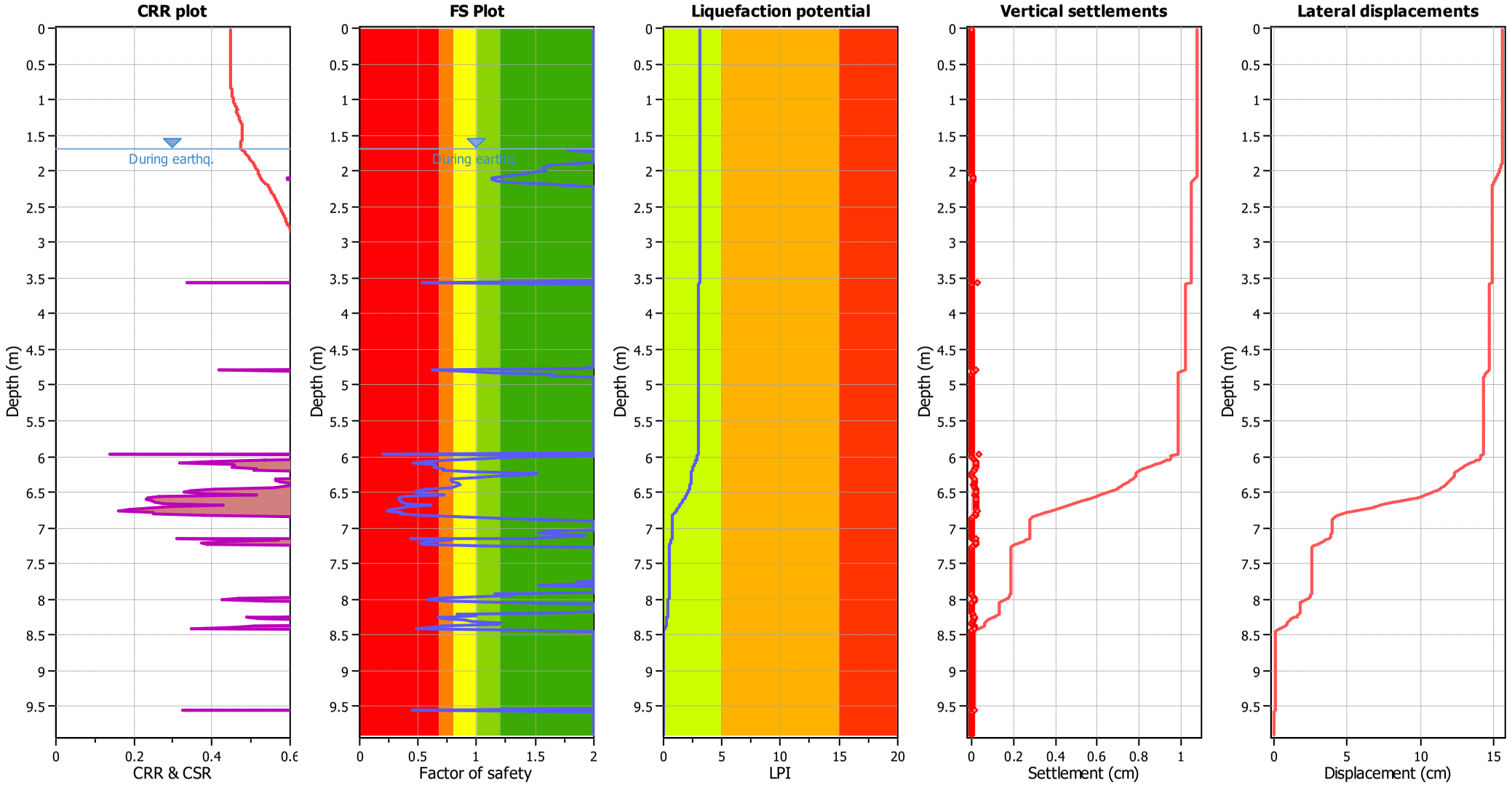
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

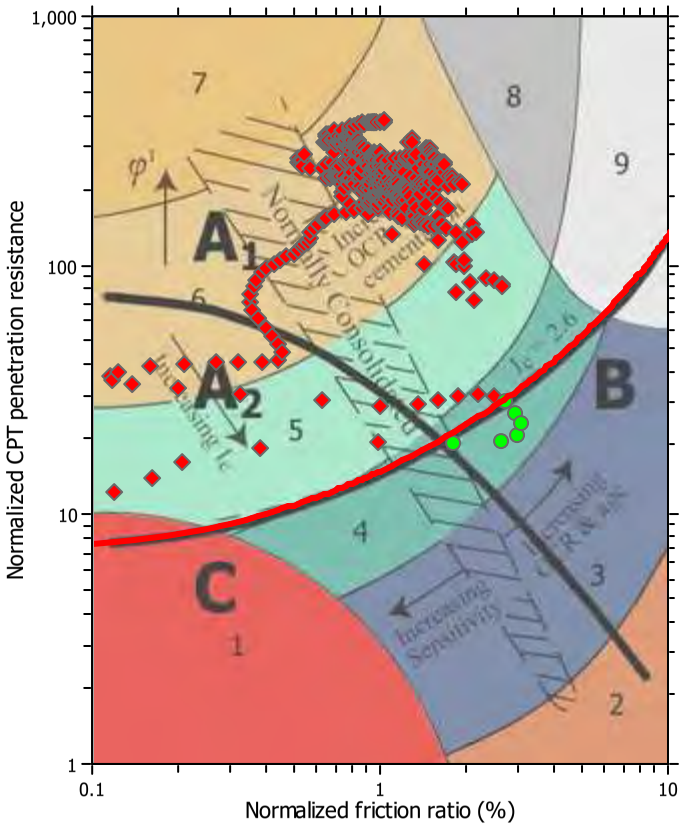
F.S. color scheme

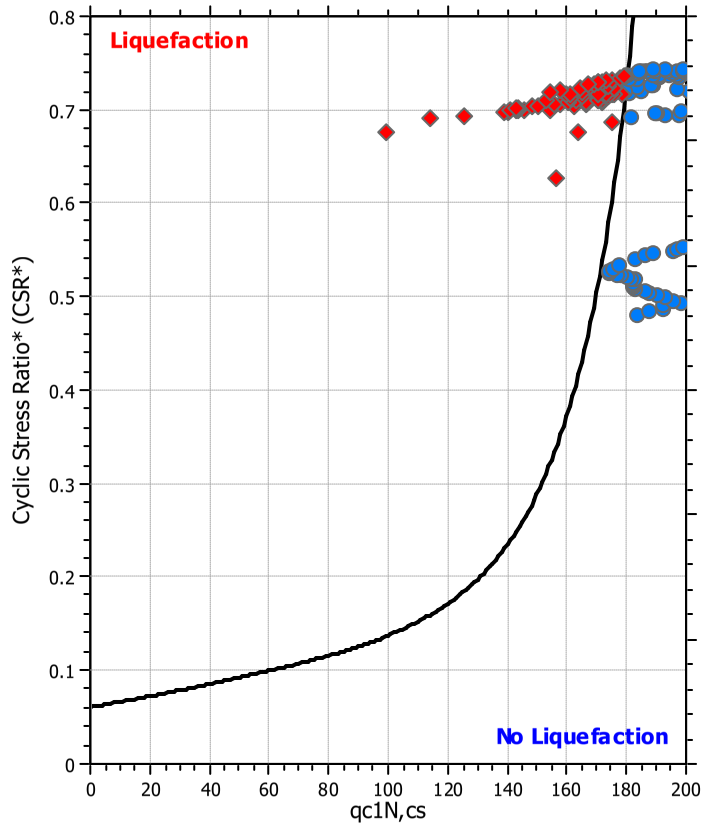
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

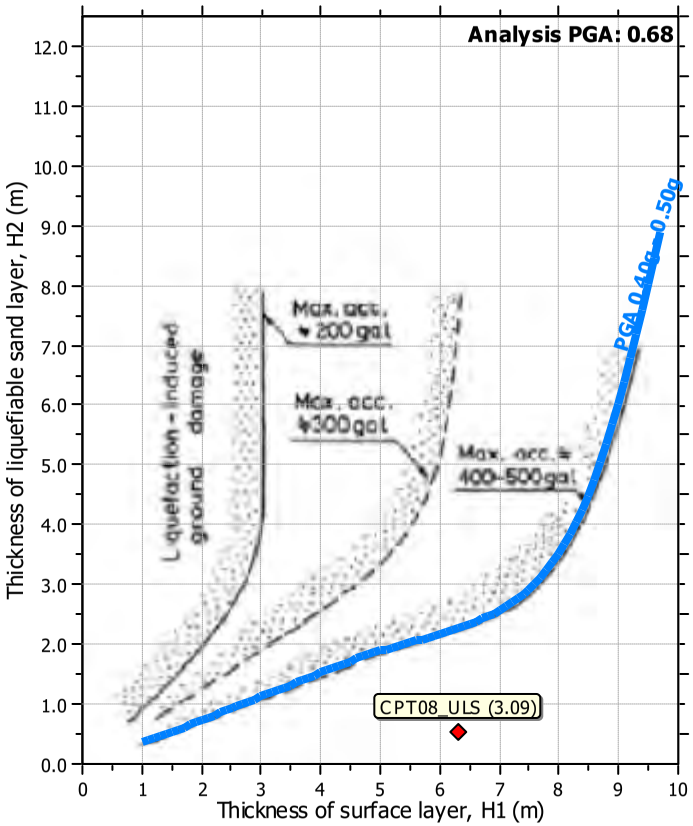
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



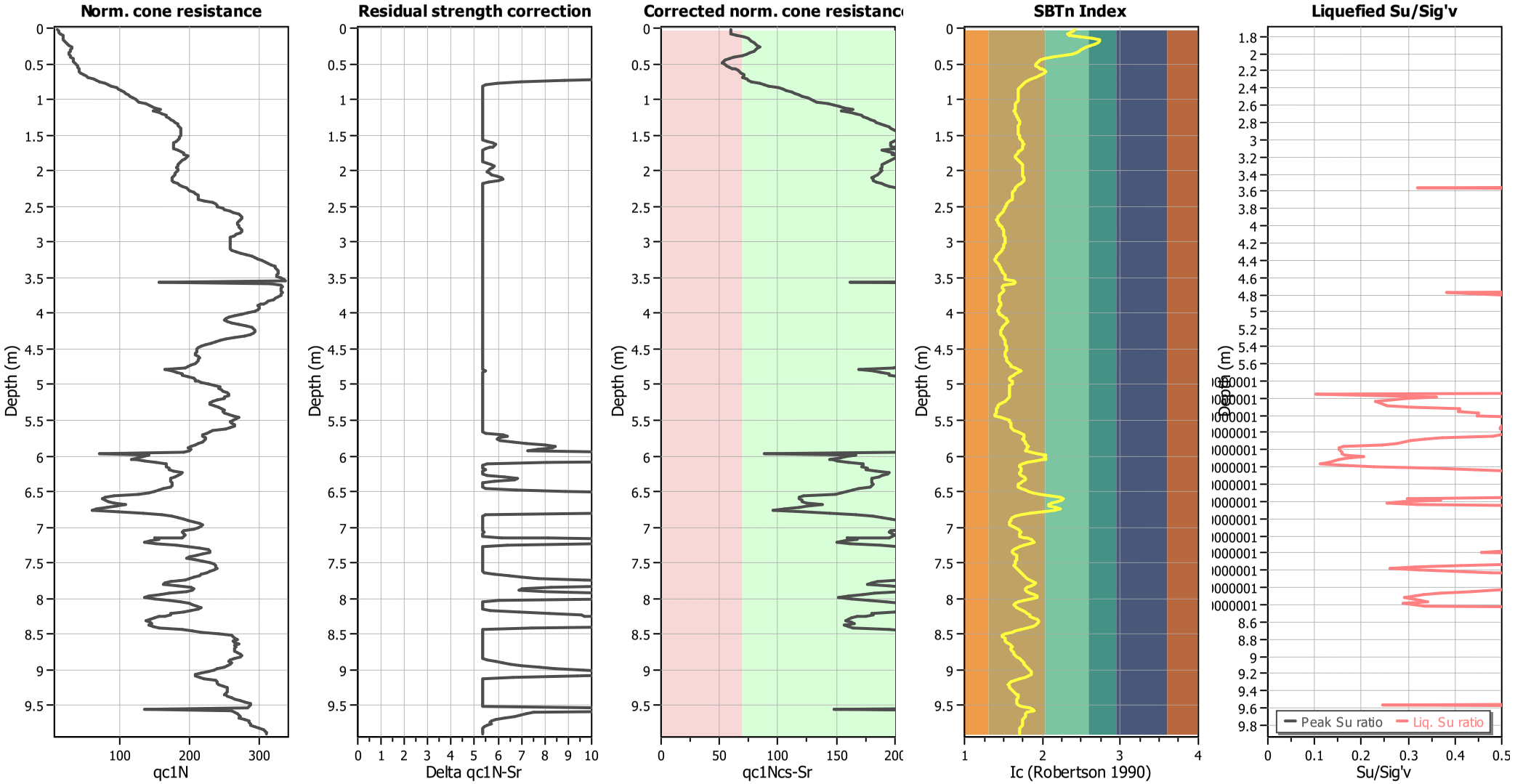




Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

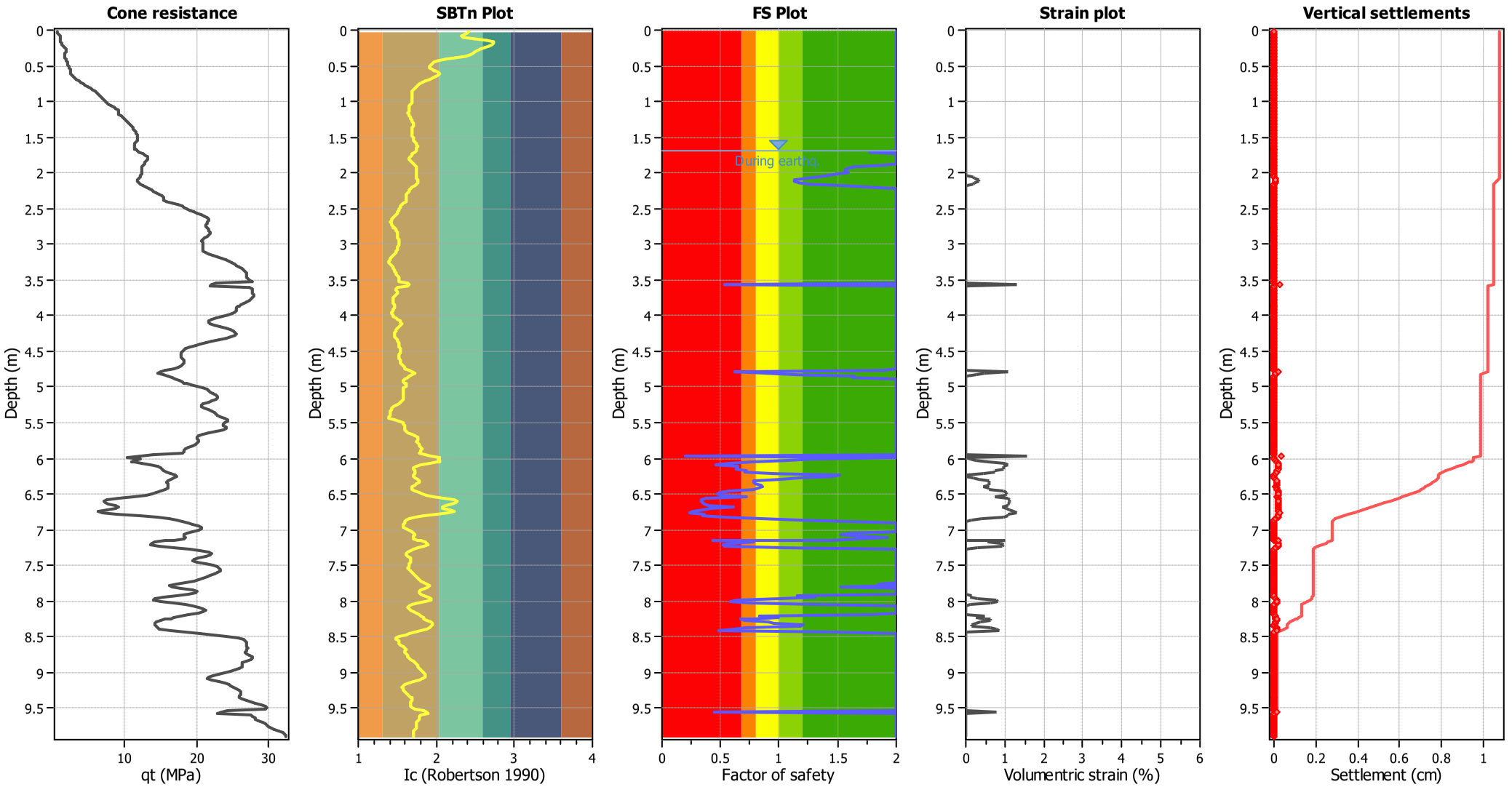
Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

Estimation of post-earthquake settlements



Abbreviations

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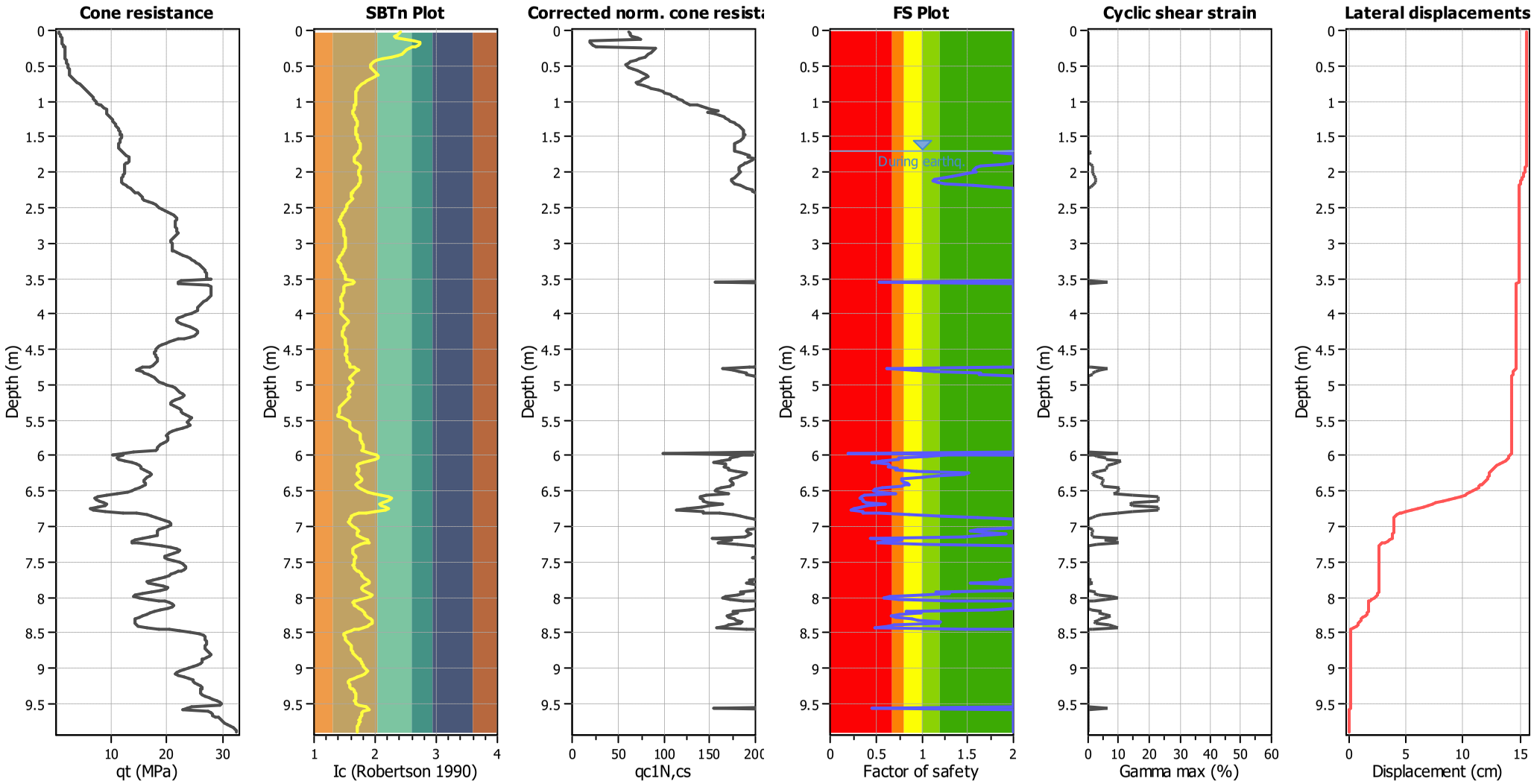
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

Estimation of post-earthquake lateral Displacements



Abbreviations

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$q_{c1N,cs}$: Equivalent clean sand normalized CPT total cone resistance
F.S.: Factor of safety
γ_{max}: Maximum cyclic shear strain
LDI: Lateral displacement index

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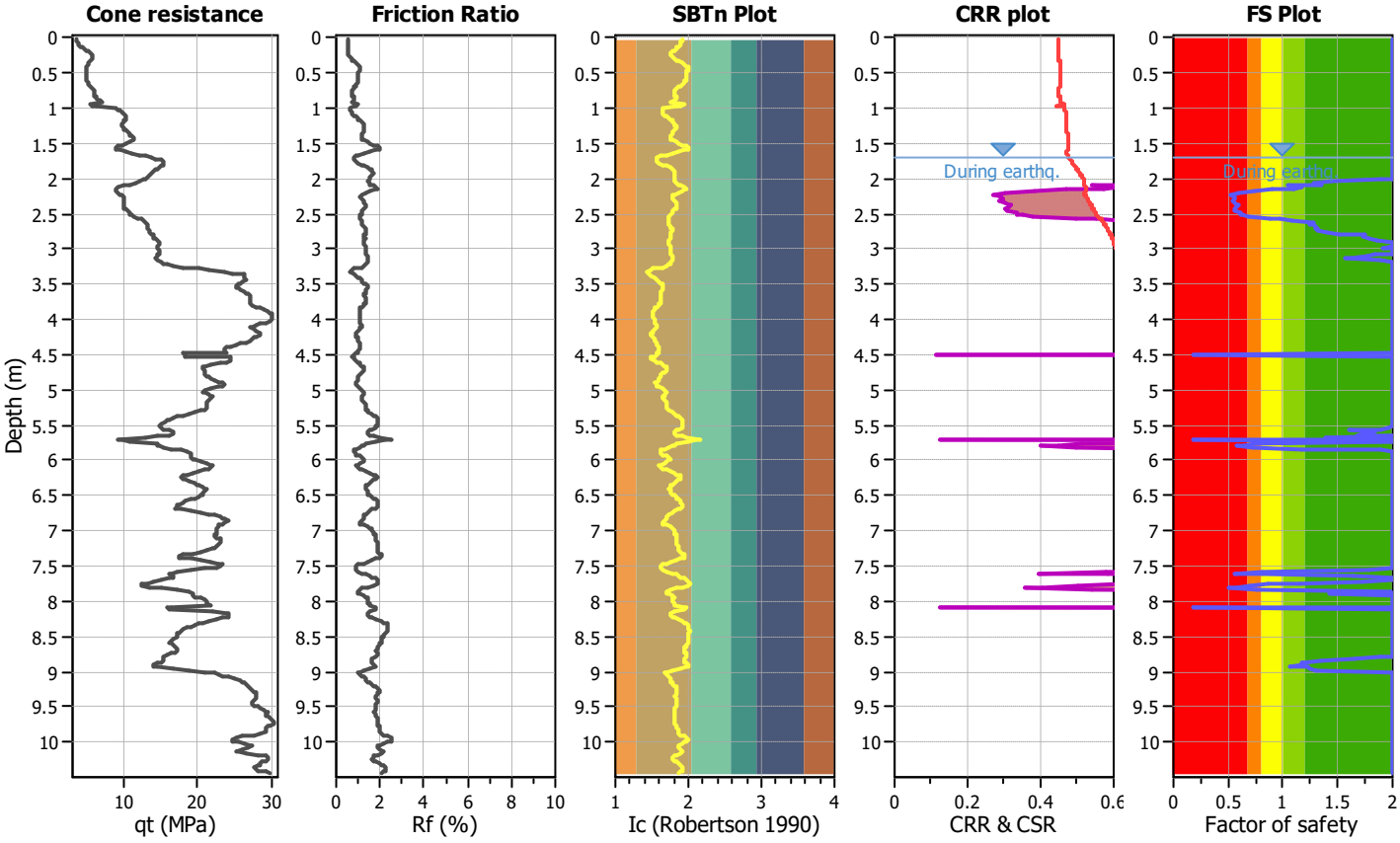
LIQUEFACTION ANALYSIS REPORT

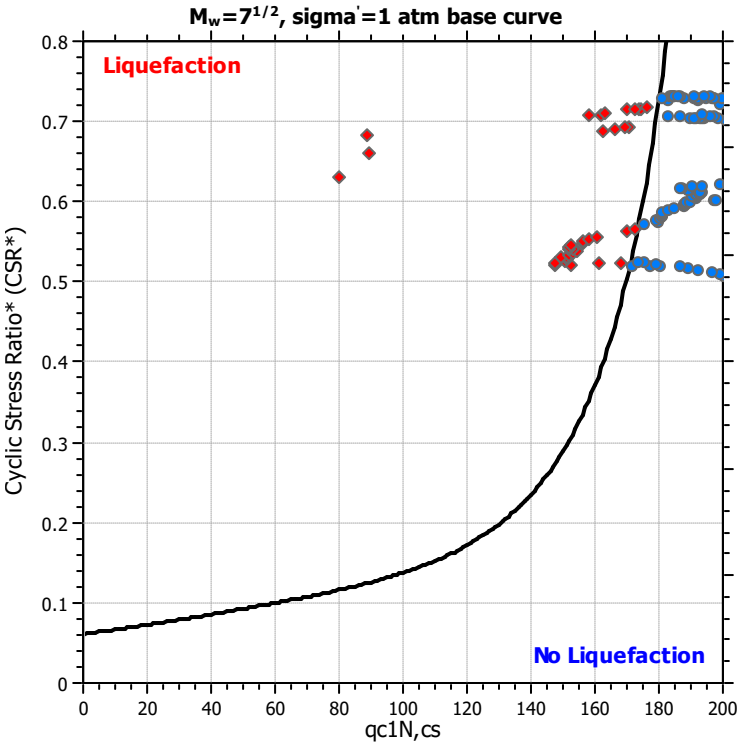
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

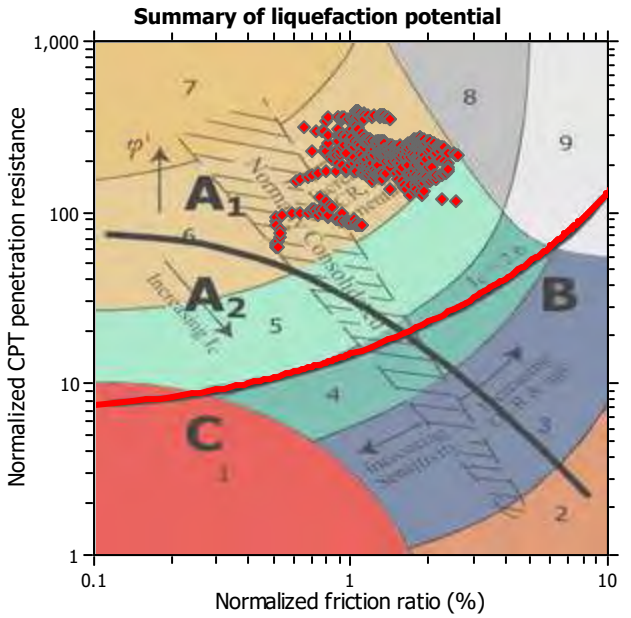
CPT file : CPT09_ULS

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.70 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	No		

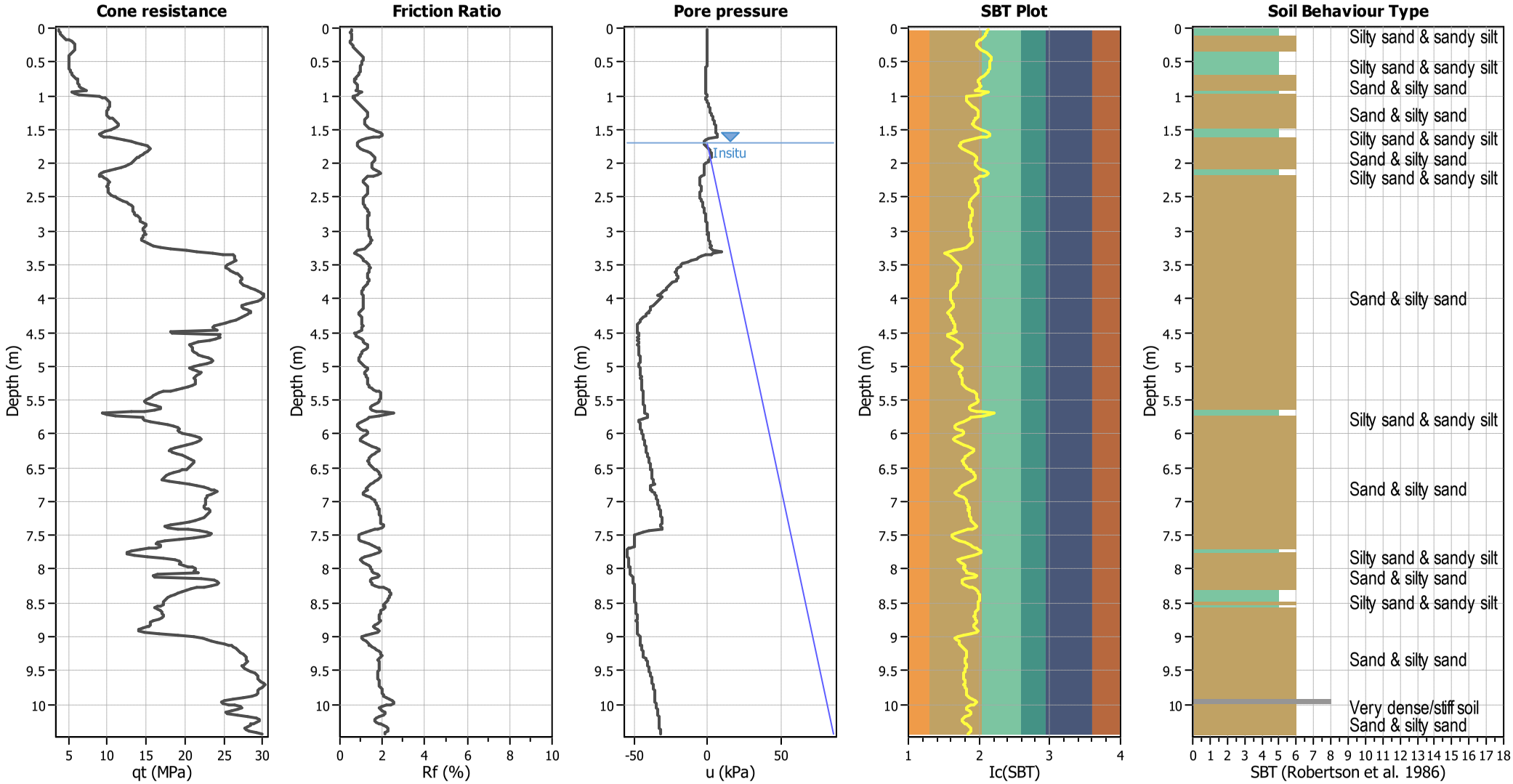






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



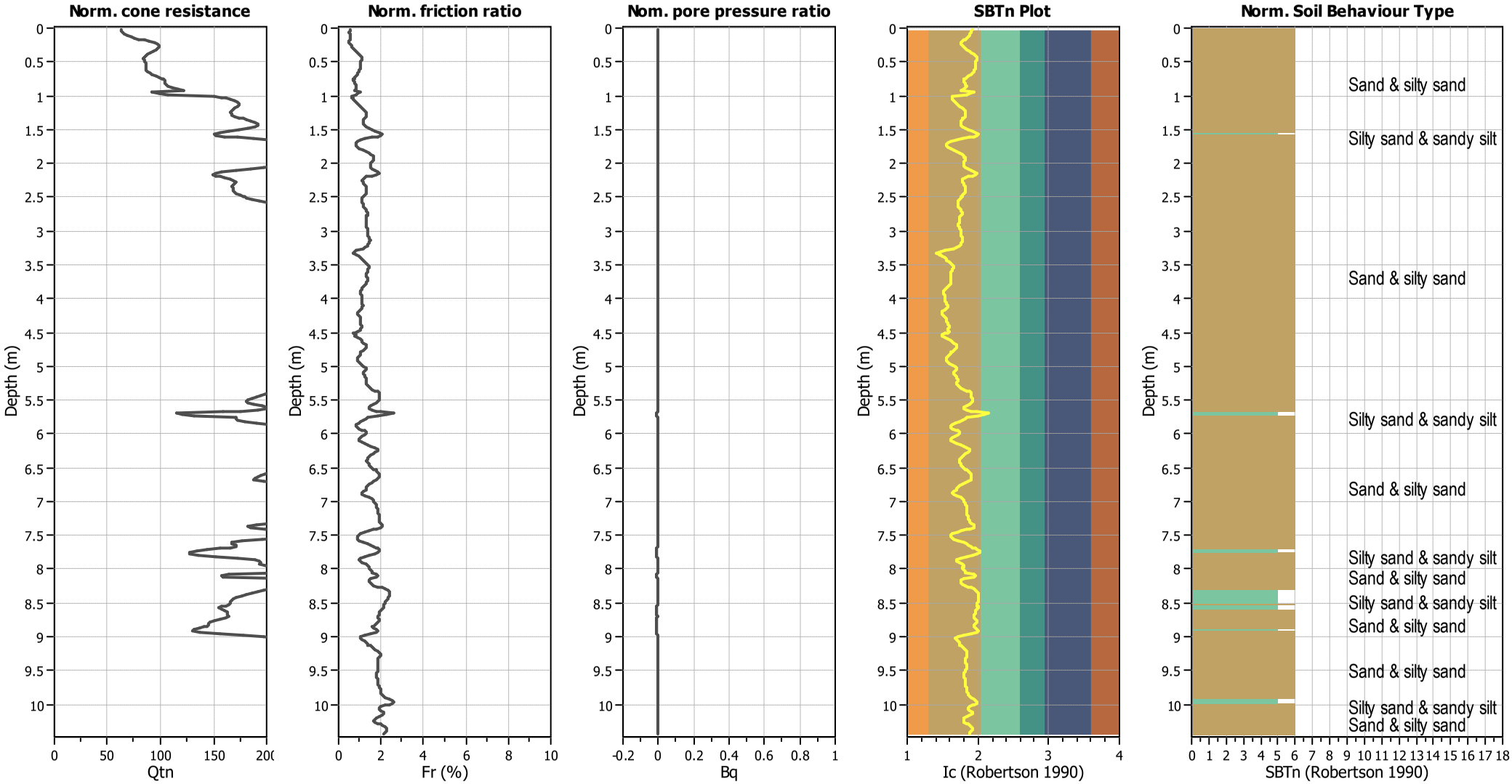
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

CPT basic interpretation plots (normalized)



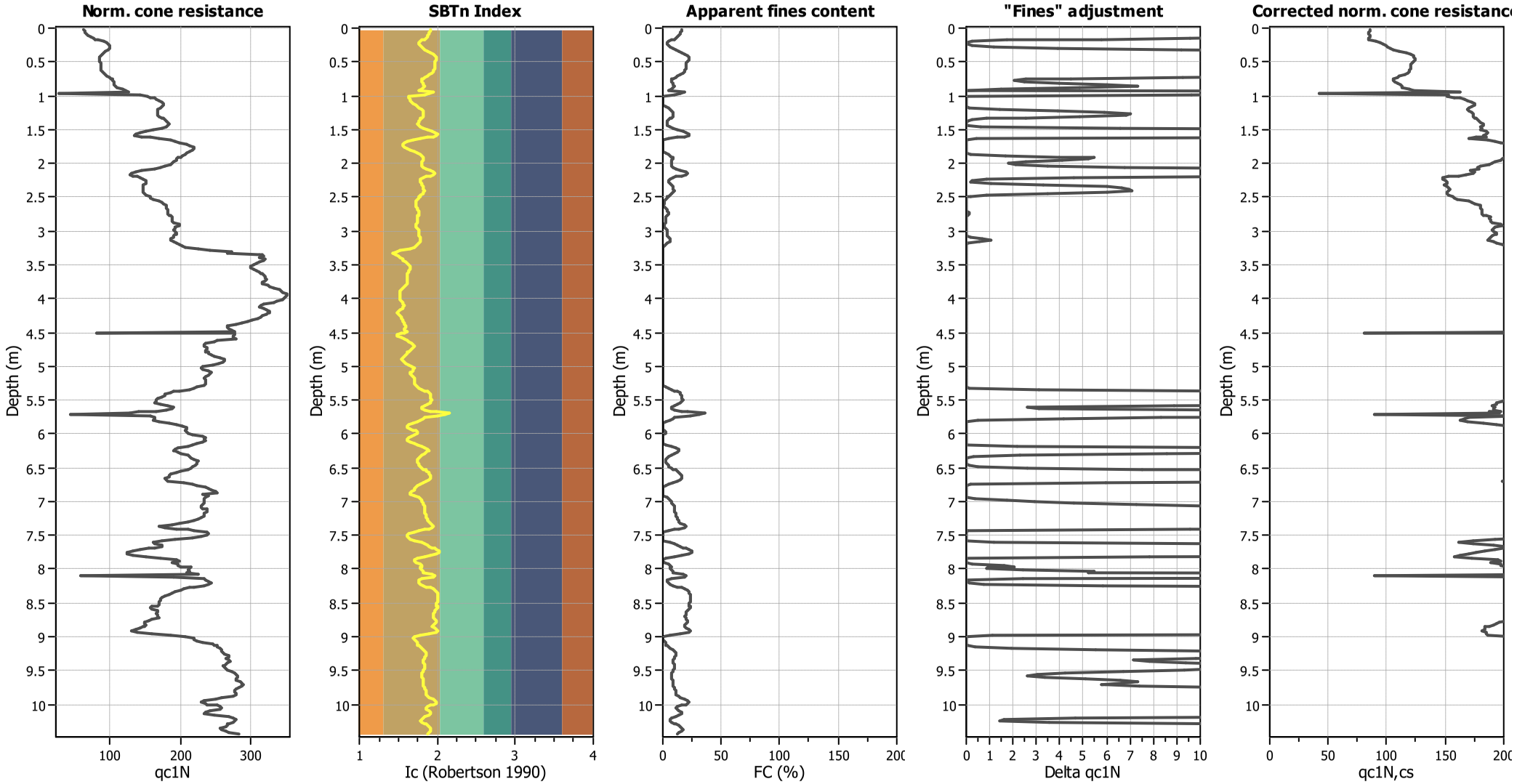
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

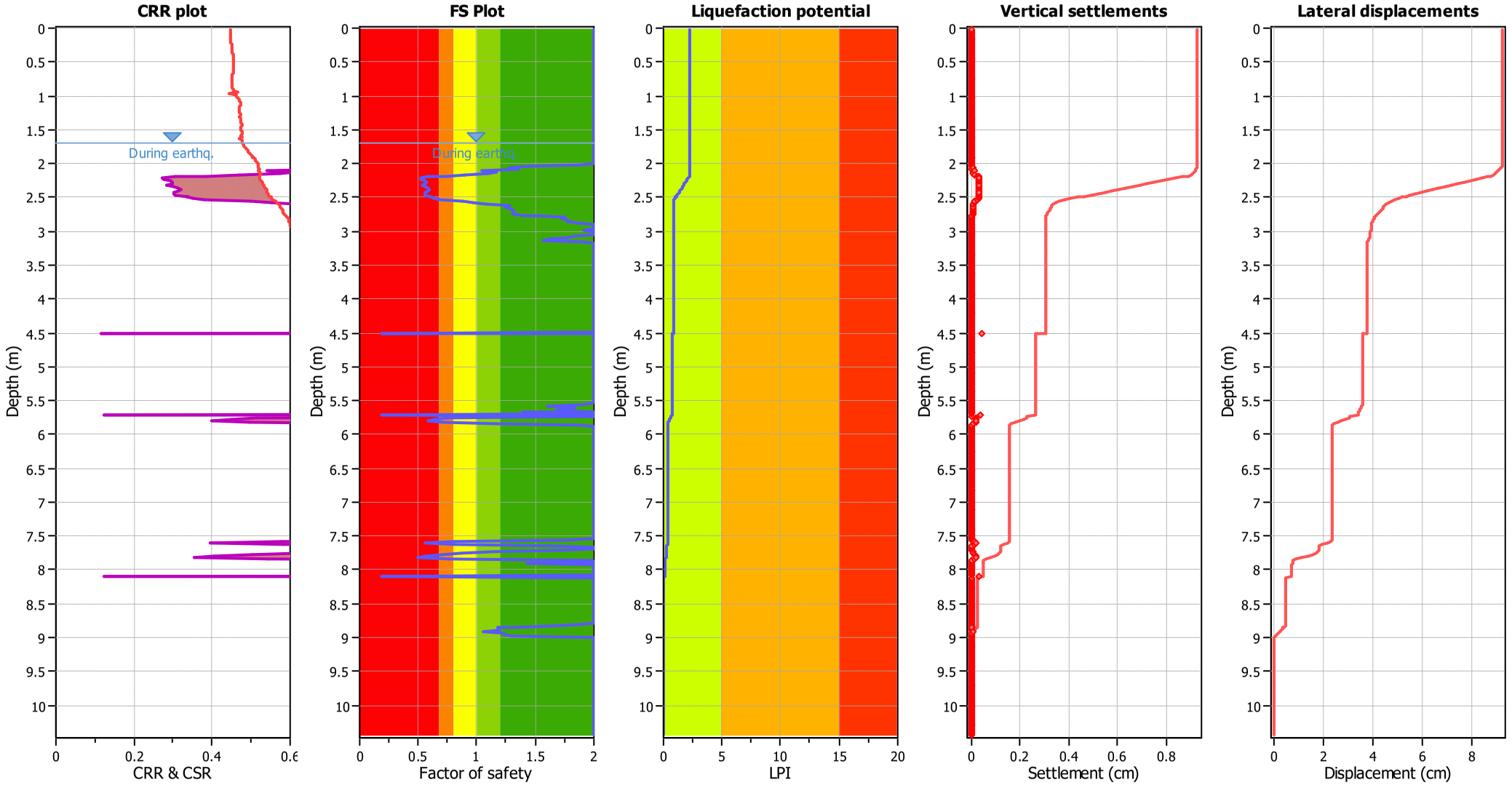
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

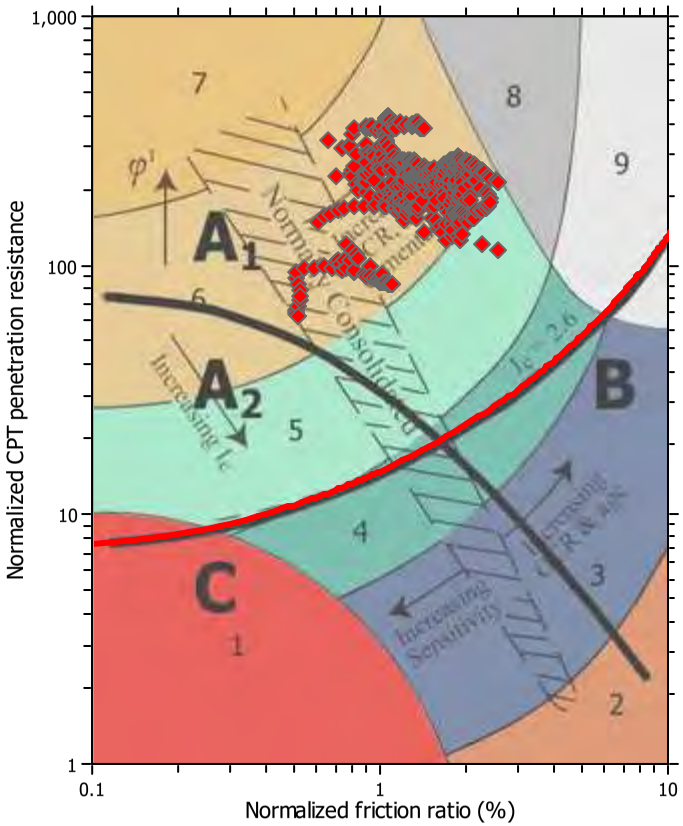
F.S. color scheme

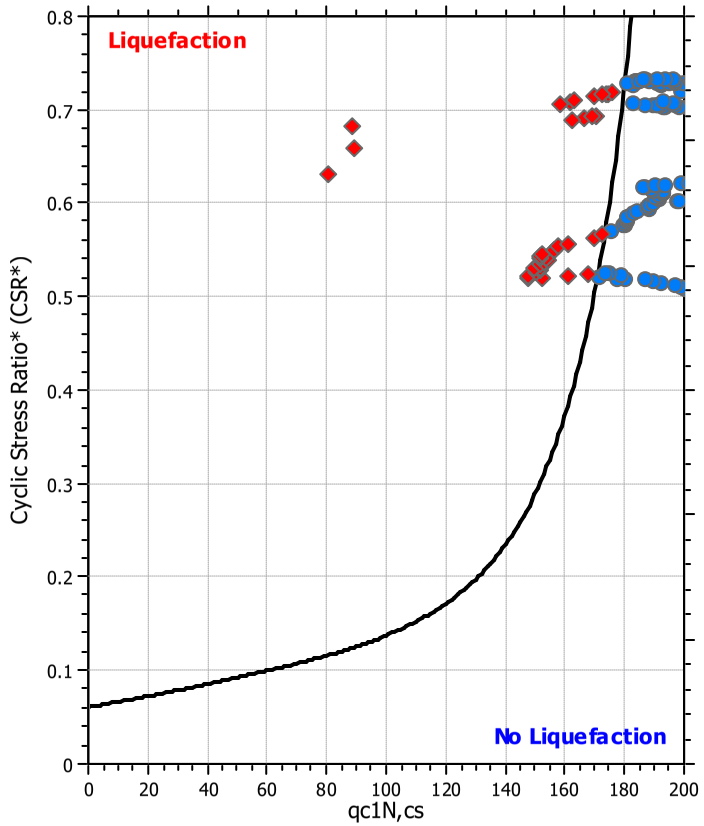
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

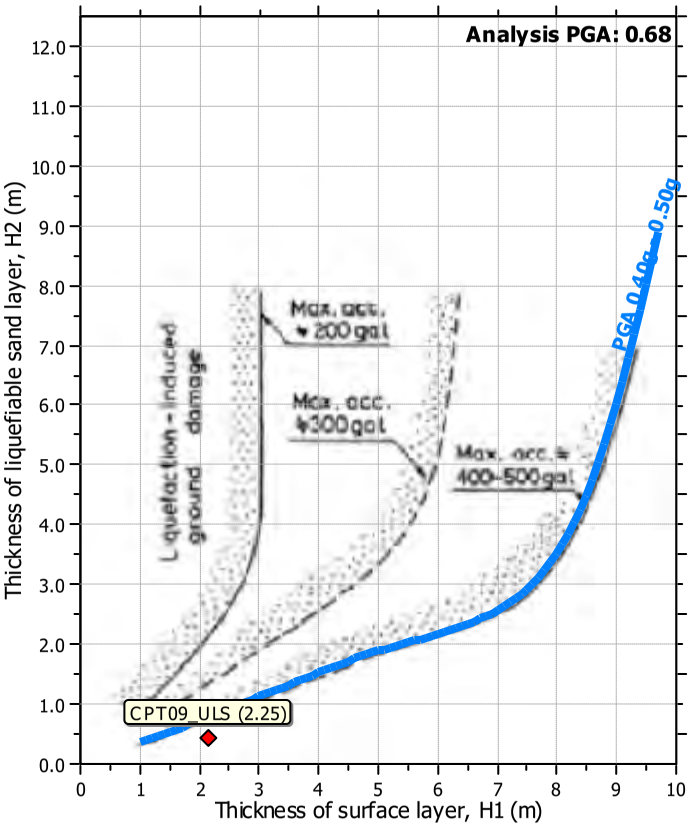
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



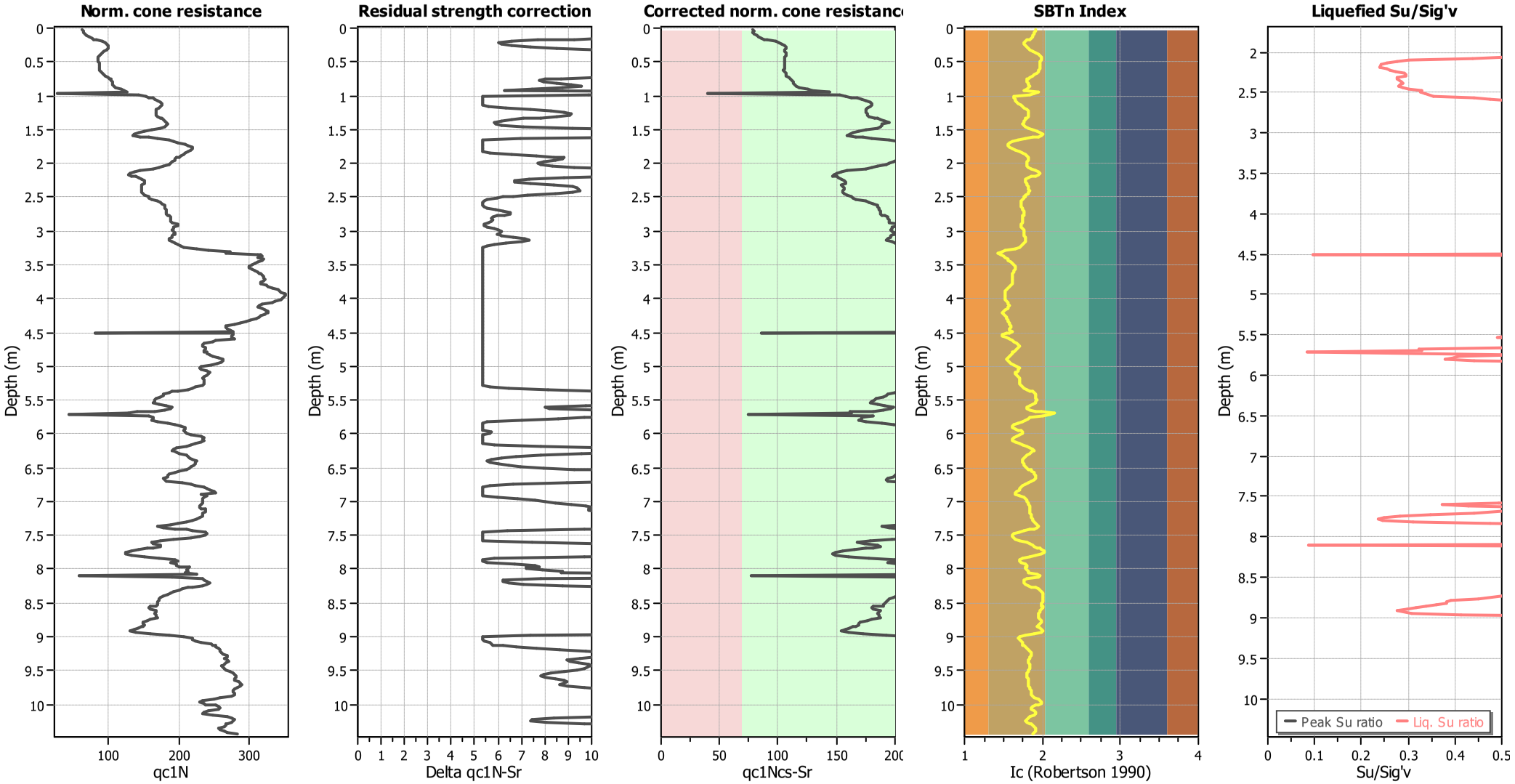




Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

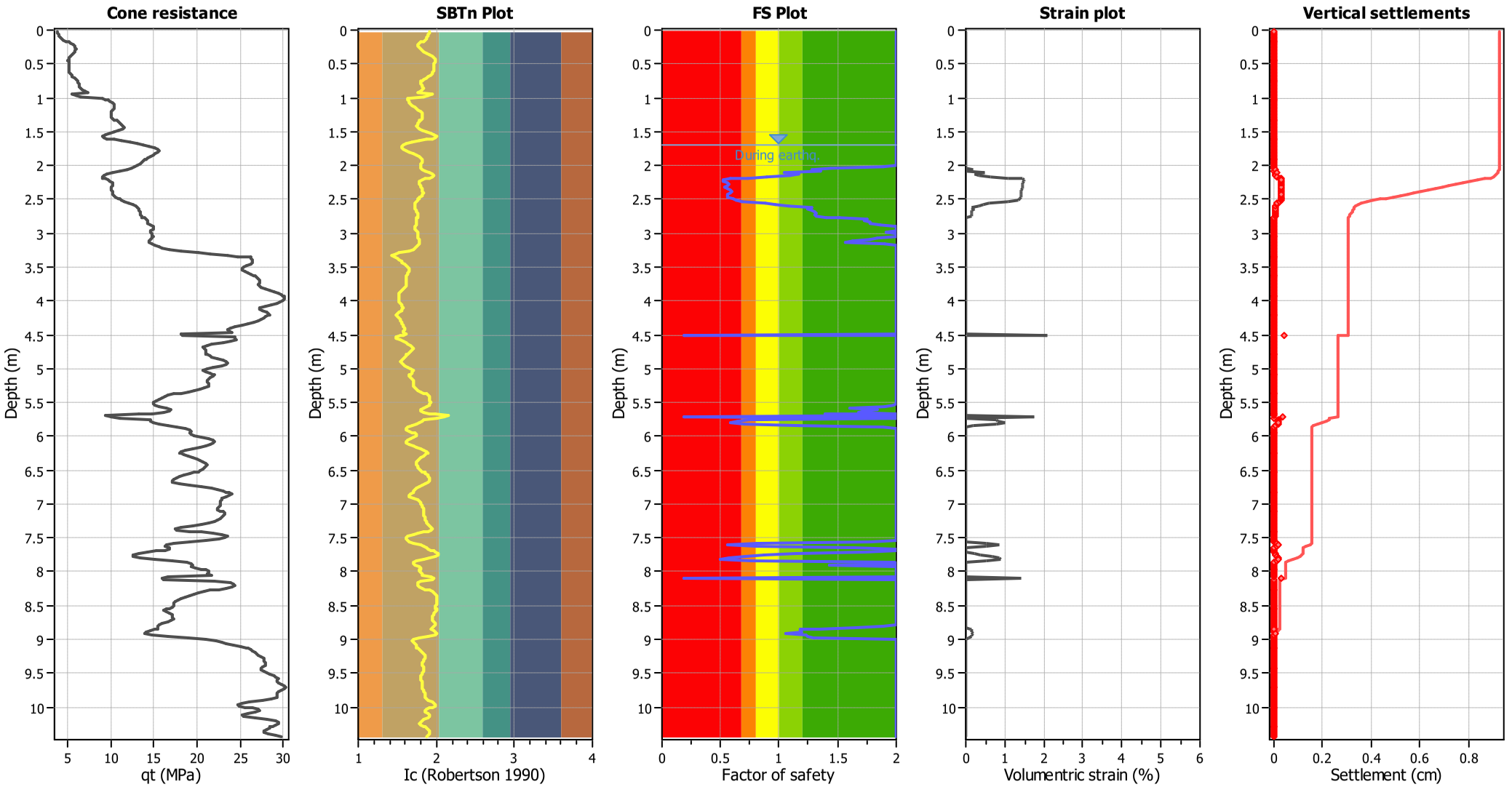
Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

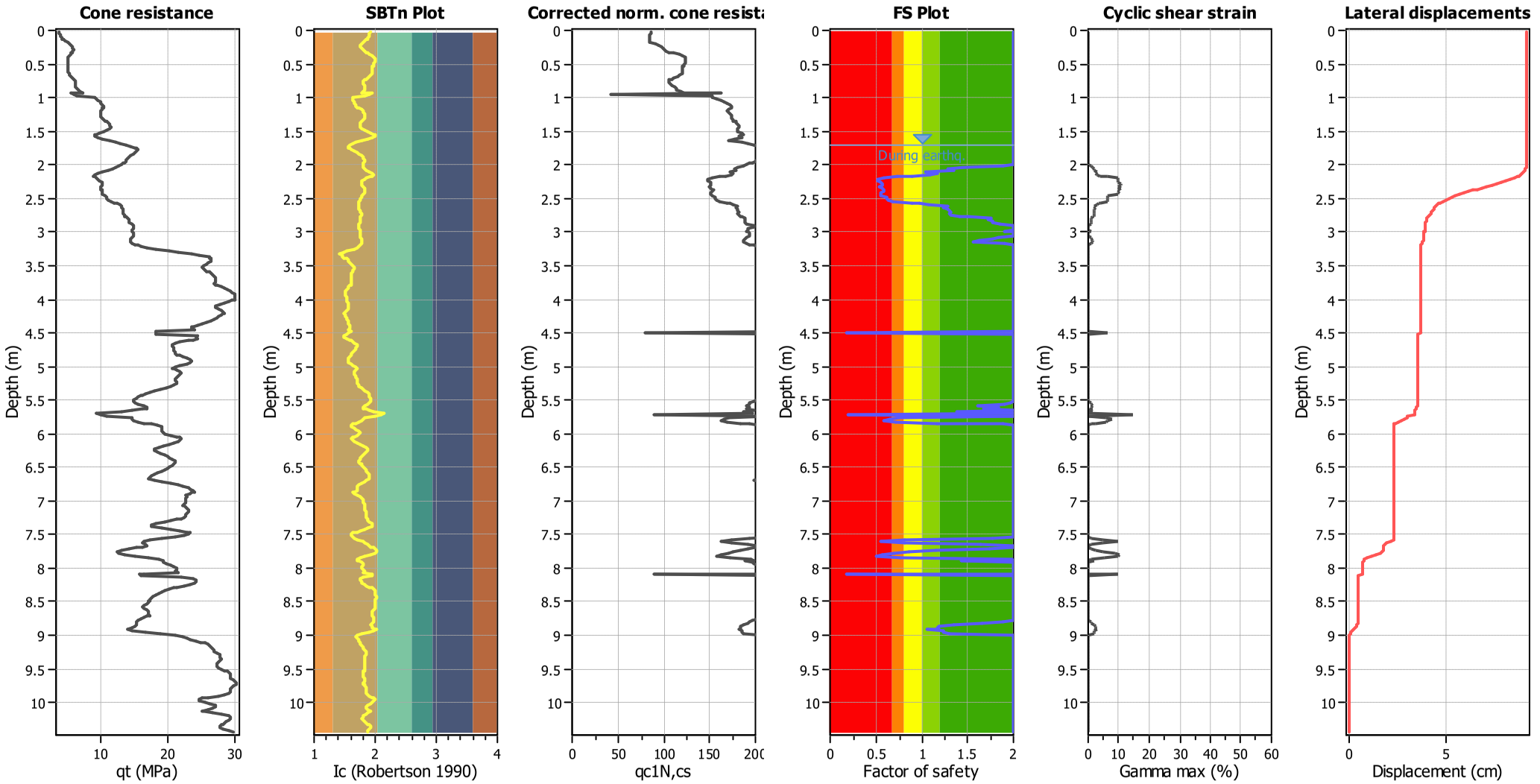
Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

Estimation of post-earthquake lateral Displacements



Abbreviations

q_t: Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c: Soil Behaviour Type Index
$q_{c1N,cs}$: Equivalent clean sand normalized CPT total cone resistance
F.S.: Factor of safety
γ_{max}: Maximum cyclic shear strain
LDI: Lateral displacement index

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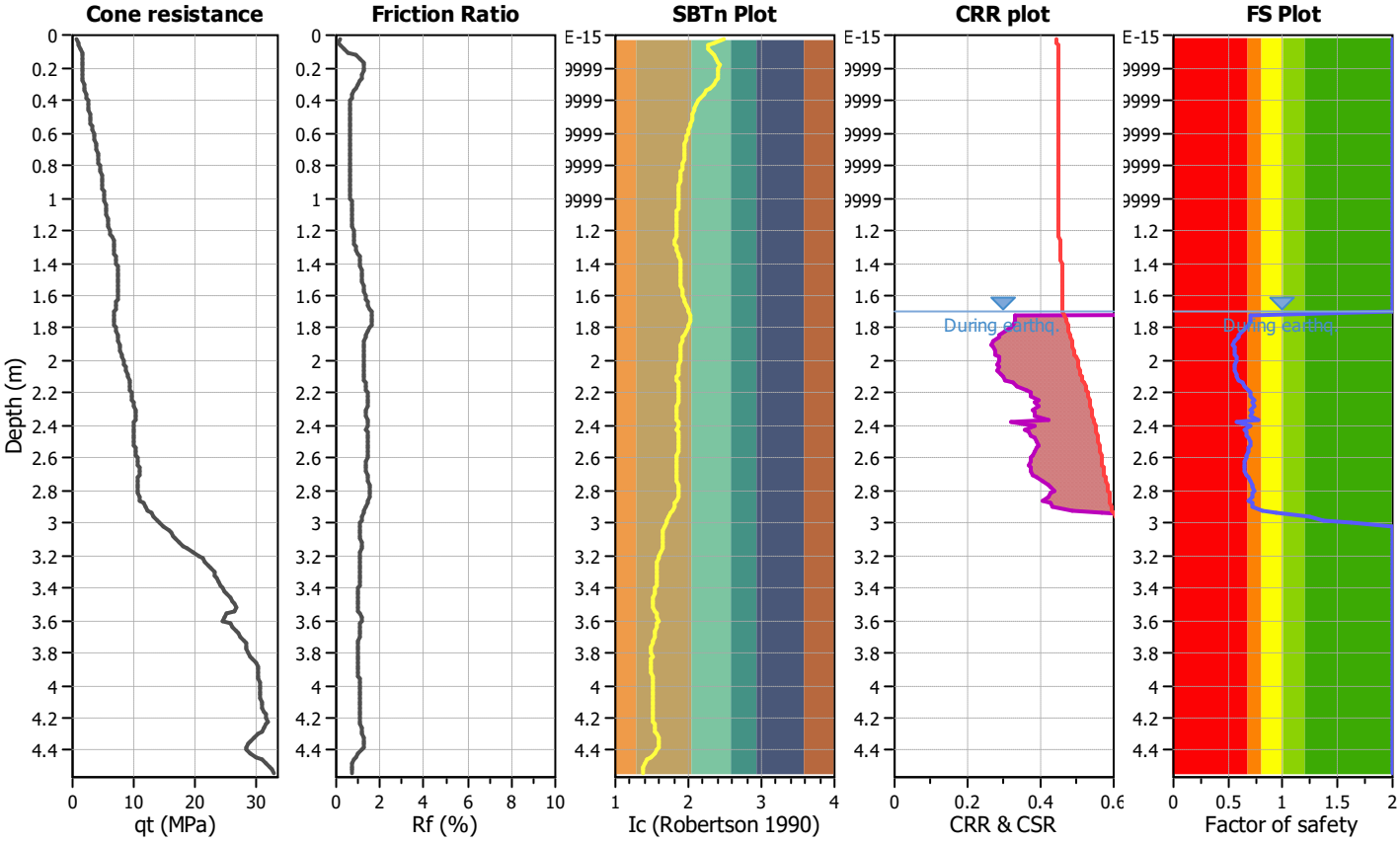
LIQUEFACTION ANALYSIS REPORT

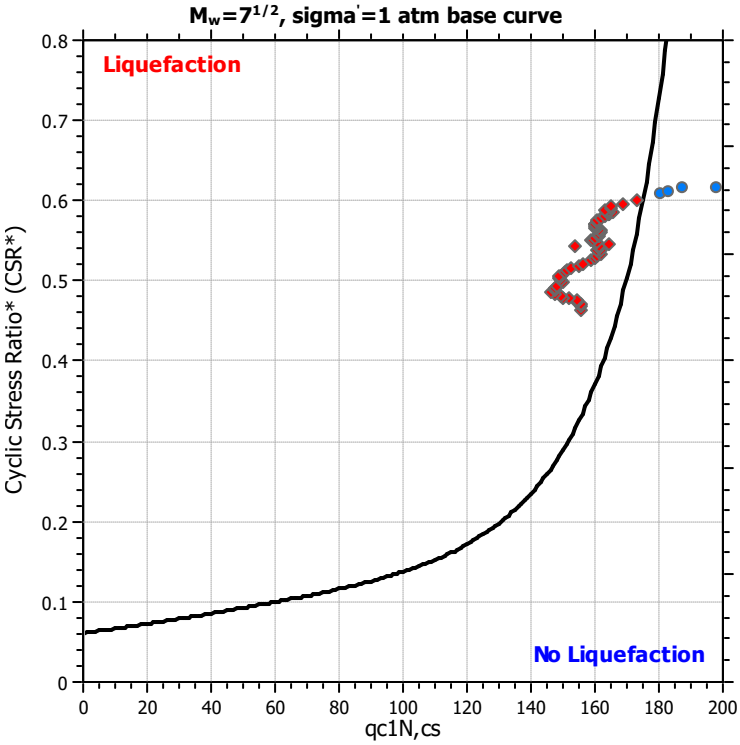
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

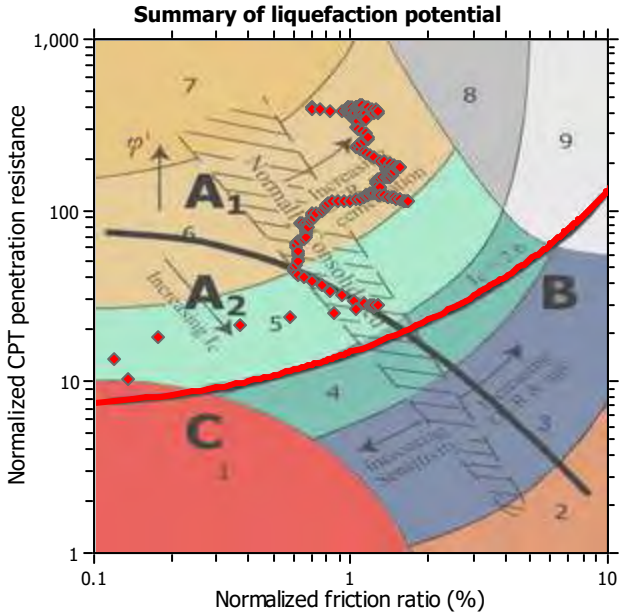
CPT file : CPT10_ULS

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.70 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	No		

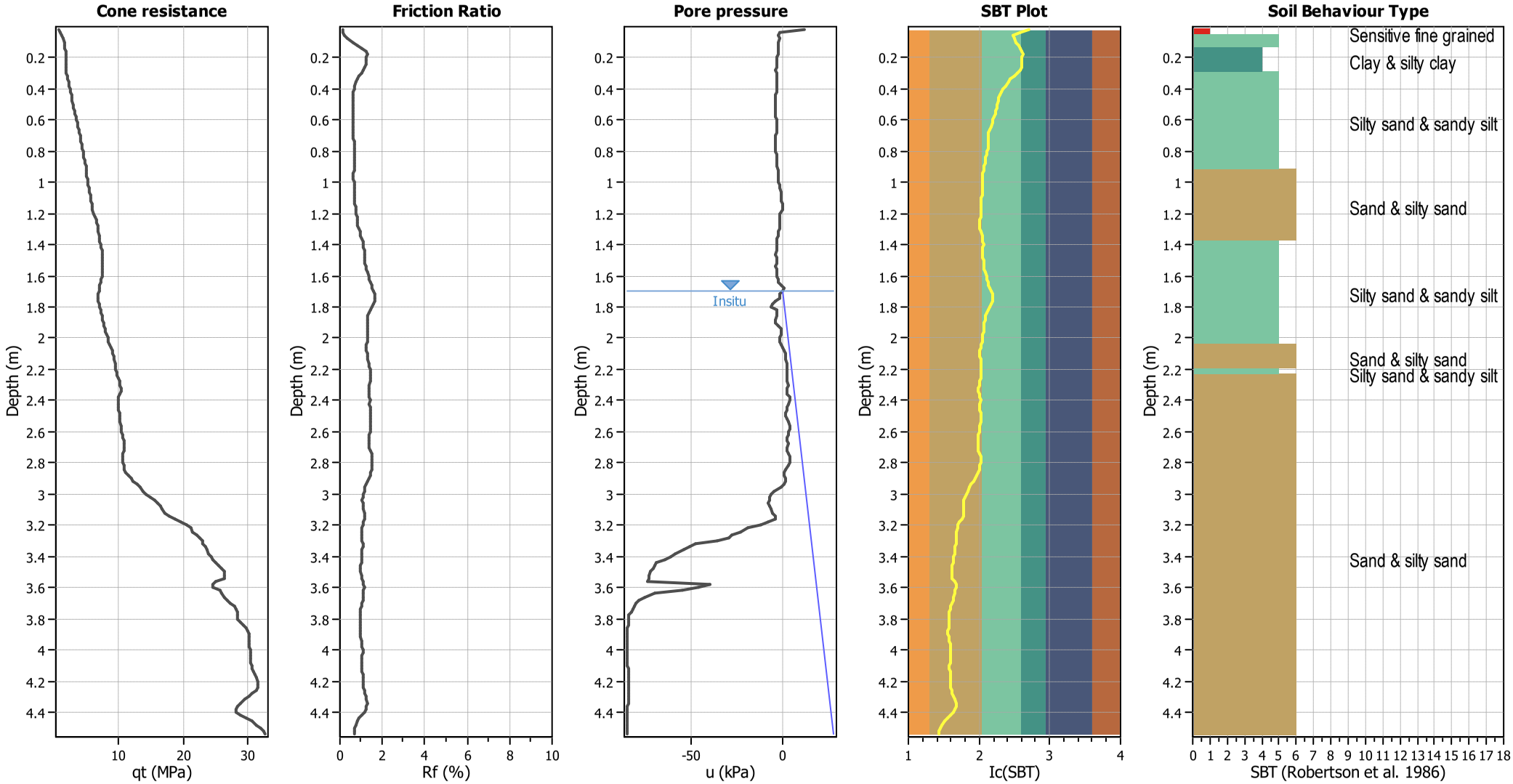






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



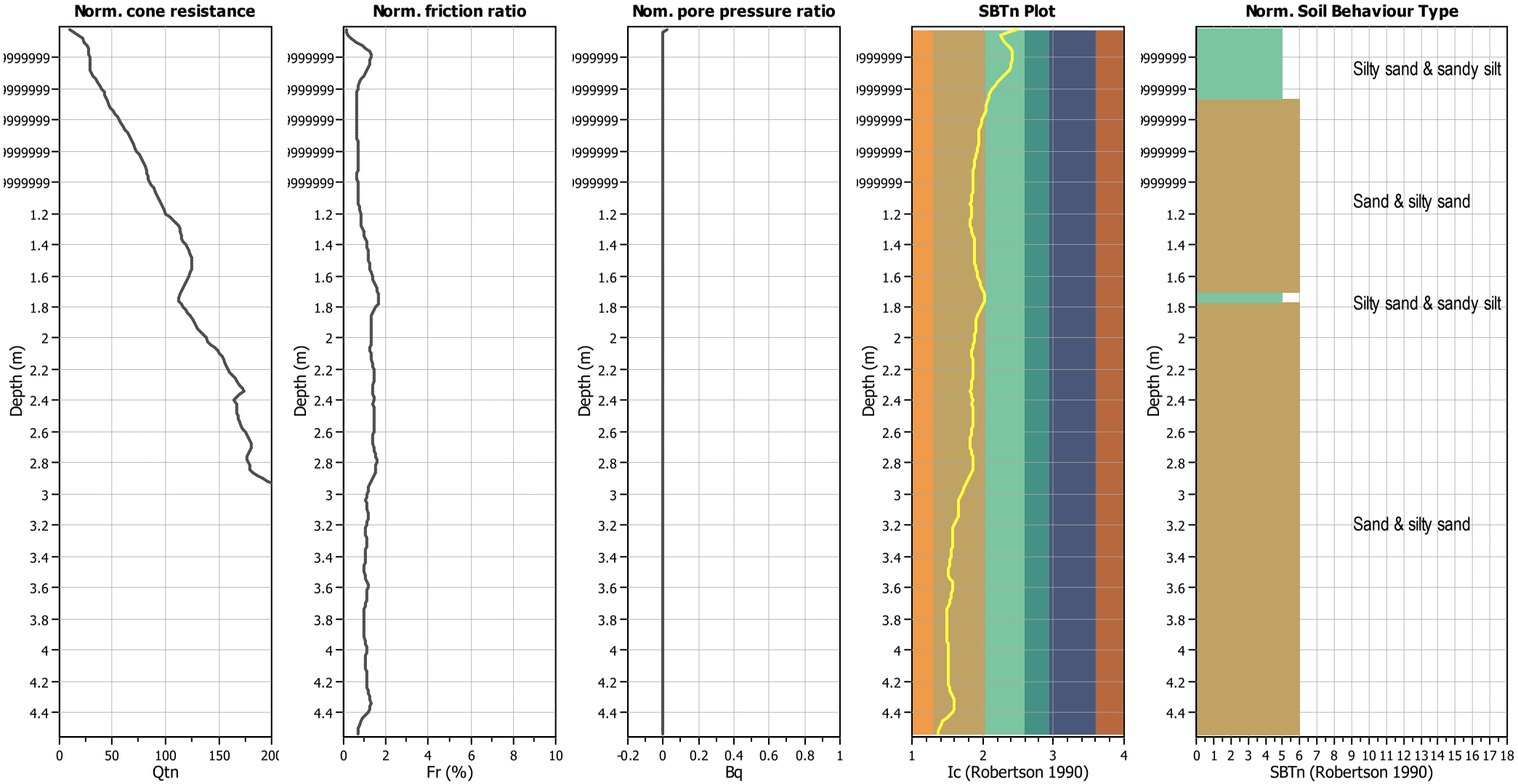
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

CPT basic interpretation plots (normalized)



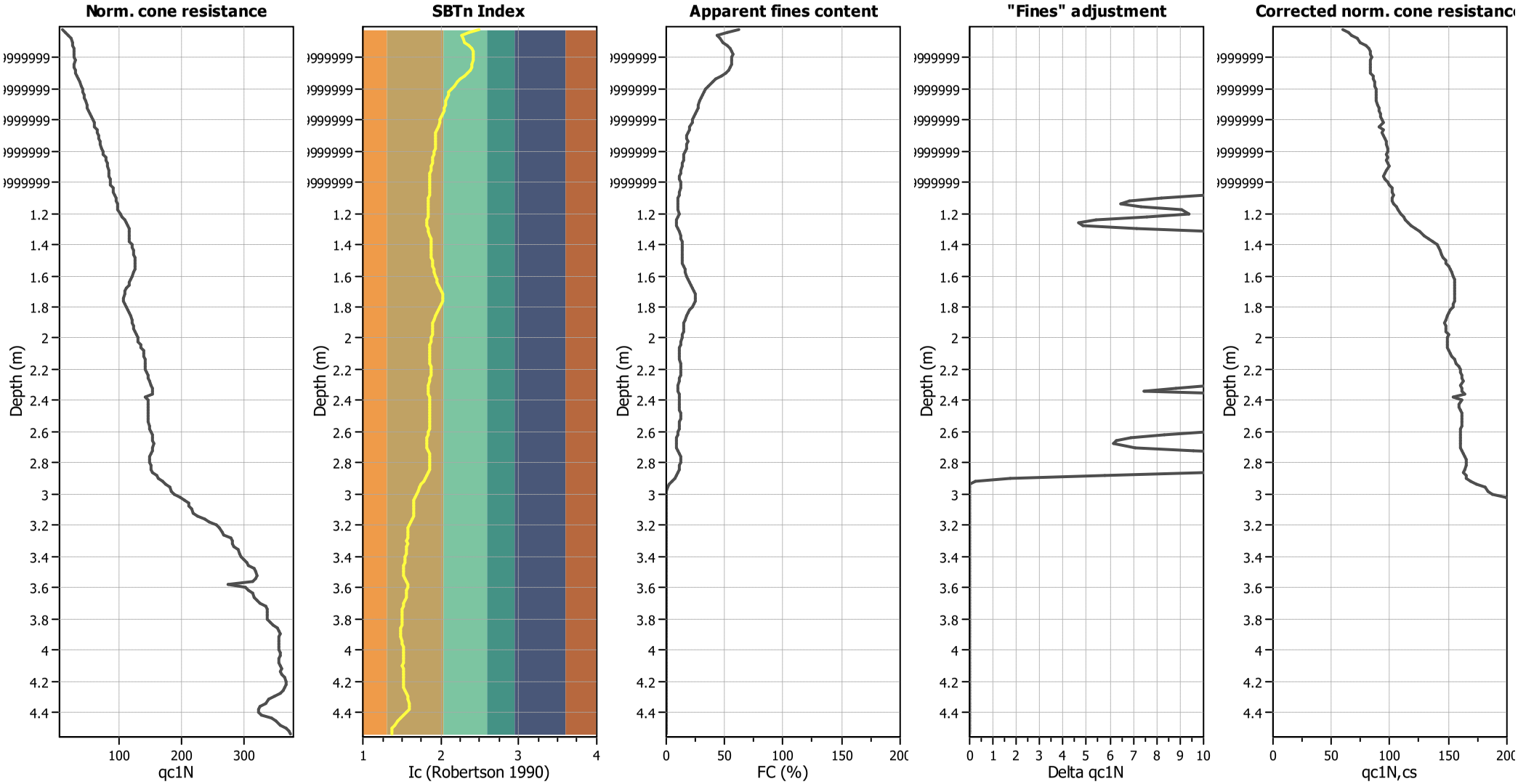
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

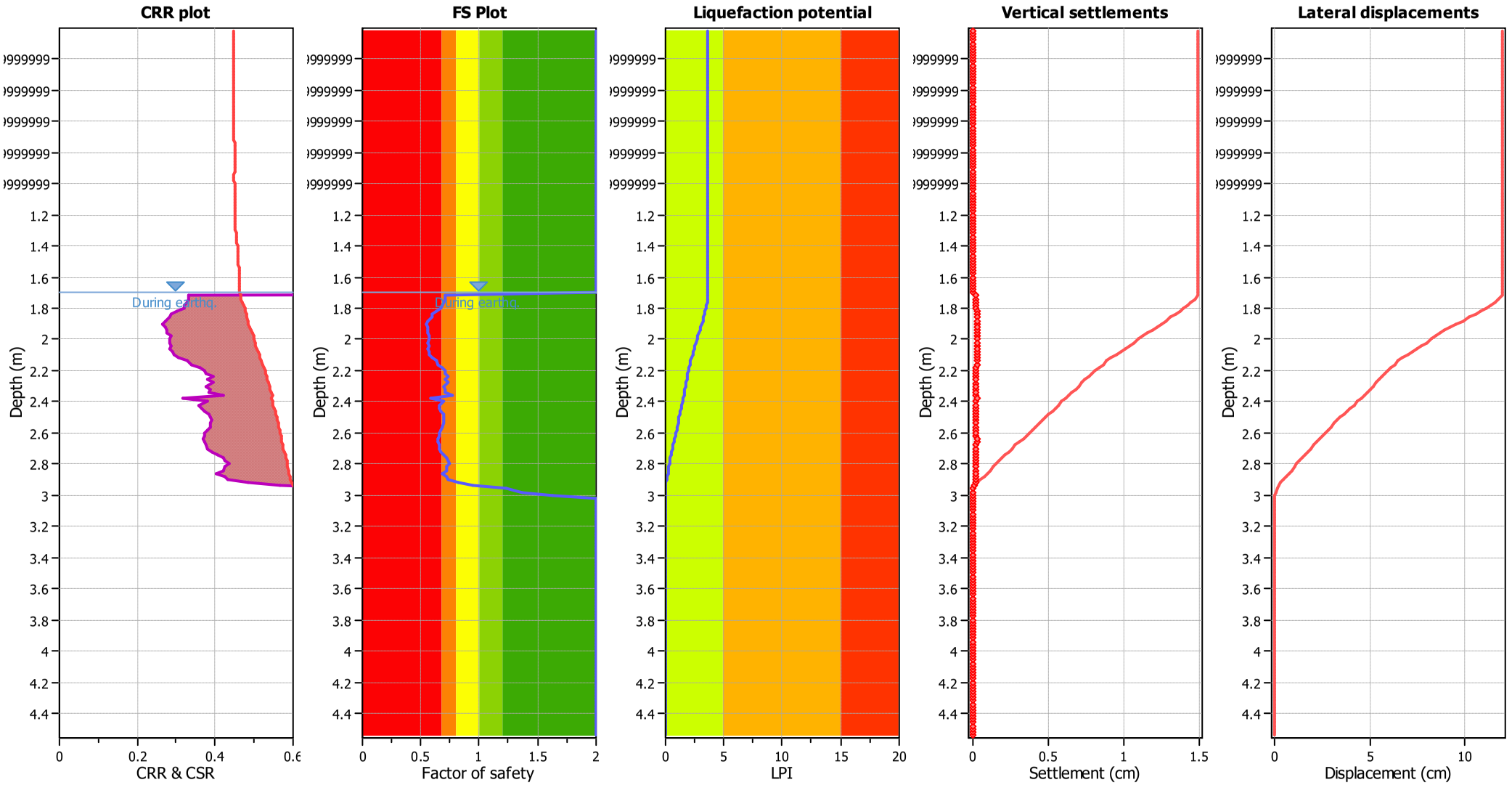
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

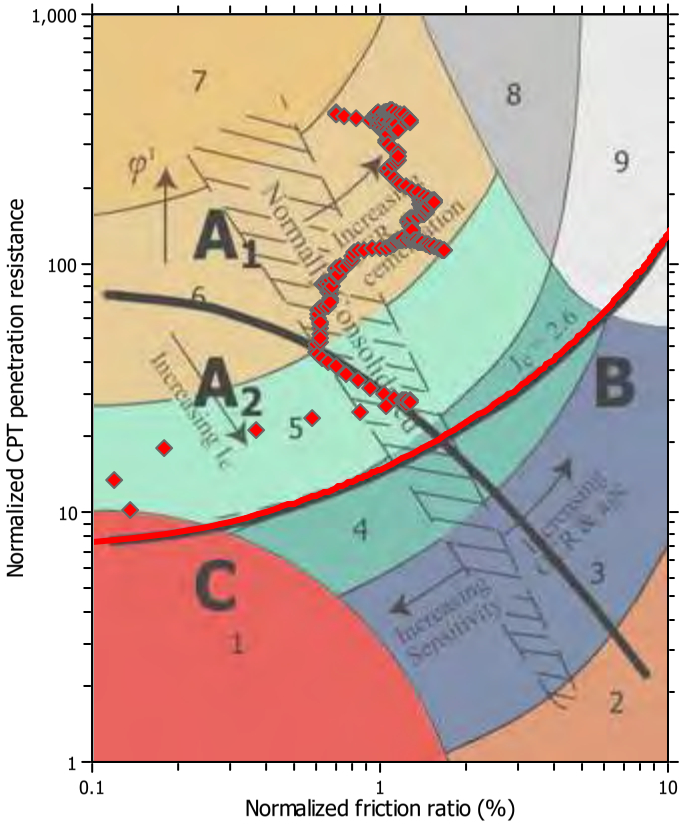
F.S. color scheme

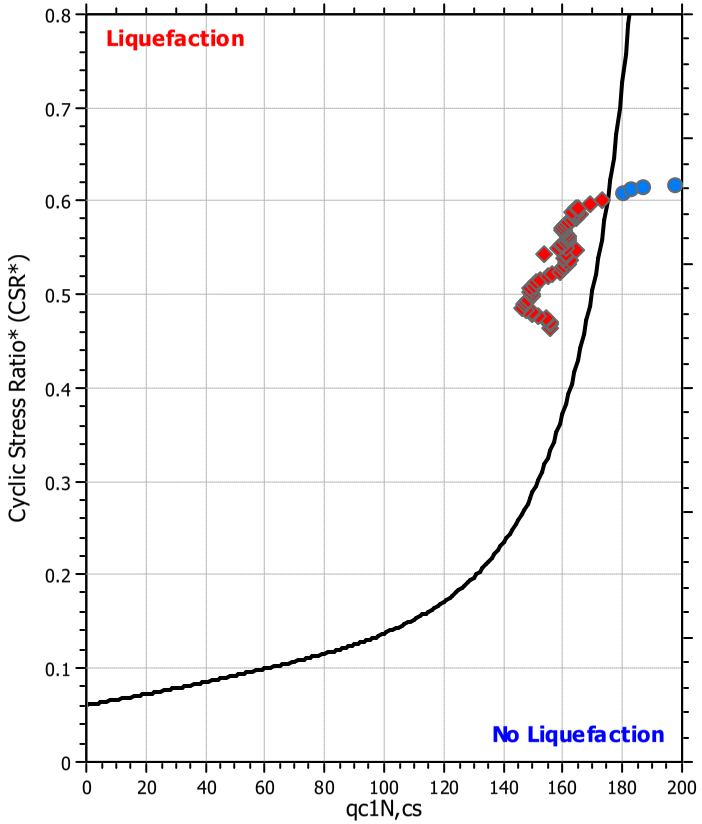
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

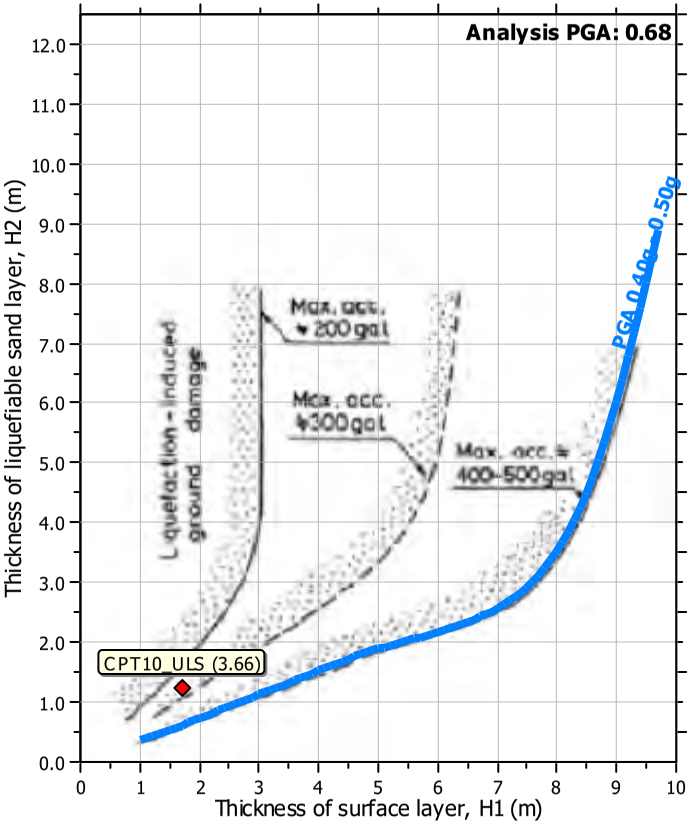
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



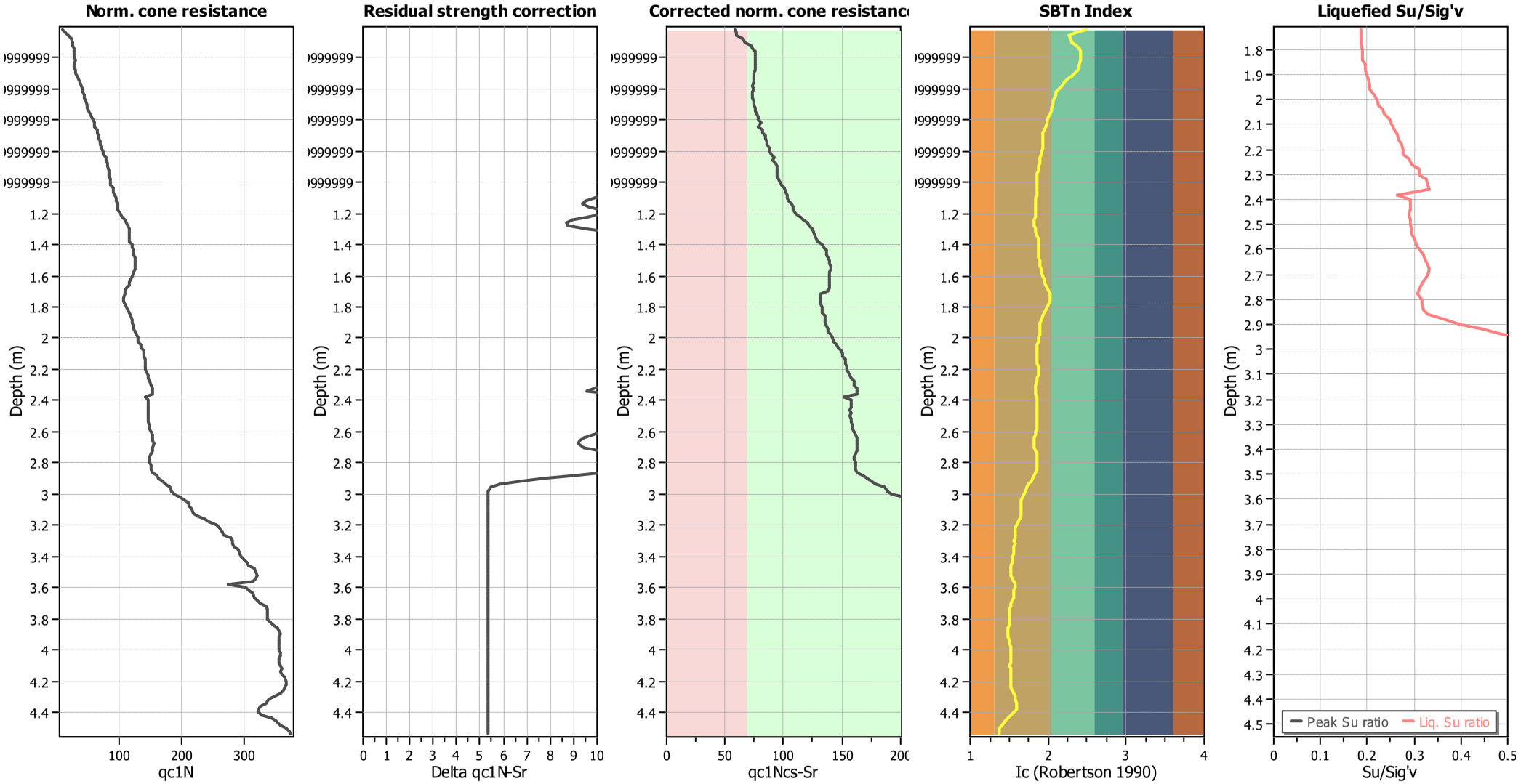




Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

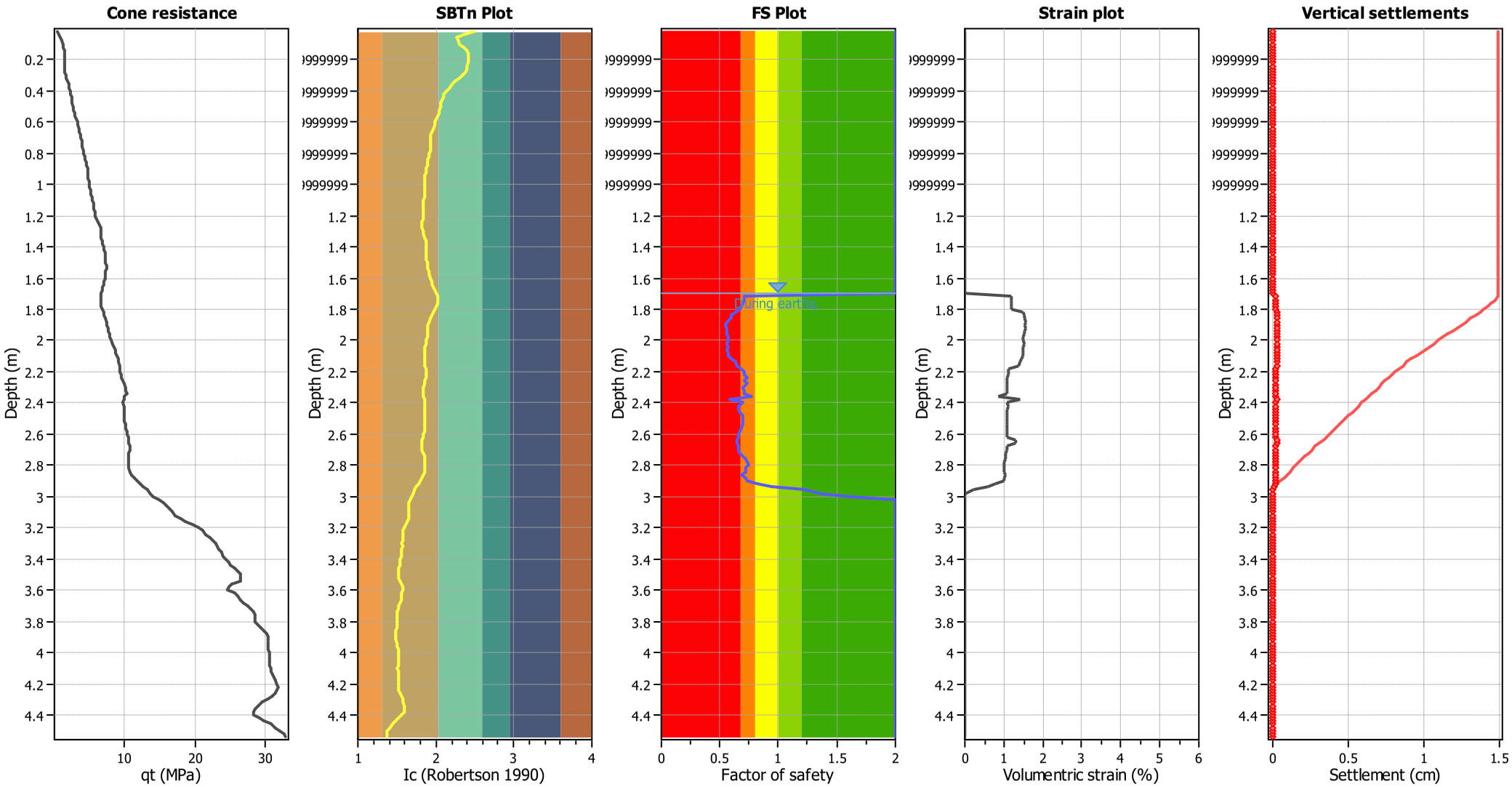
Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

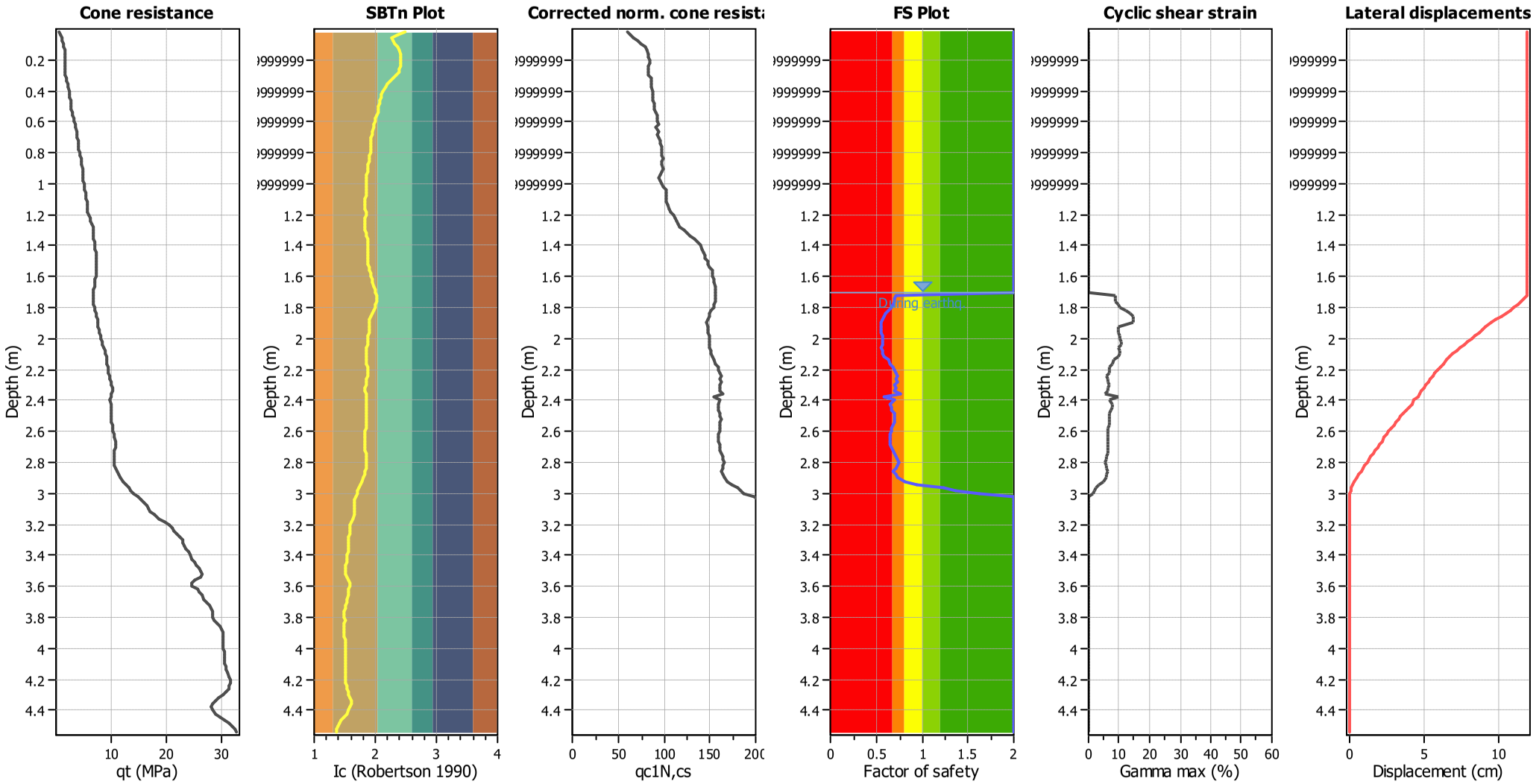
Estimation of post-earthquake settlements



Abbreviations

q_t:	Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

Estimation of post-earthquake lateral Displacements



Abbreviations

q_t: Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c: Soil Behaviour Type Index
$q_{c1N,cs}$: Equivalent clean sand normalized CPT total cone resistance
F.S.: Factor of safety
γ_{max}: Maximum cyclic shear strain
LDI: Lateral displacement index

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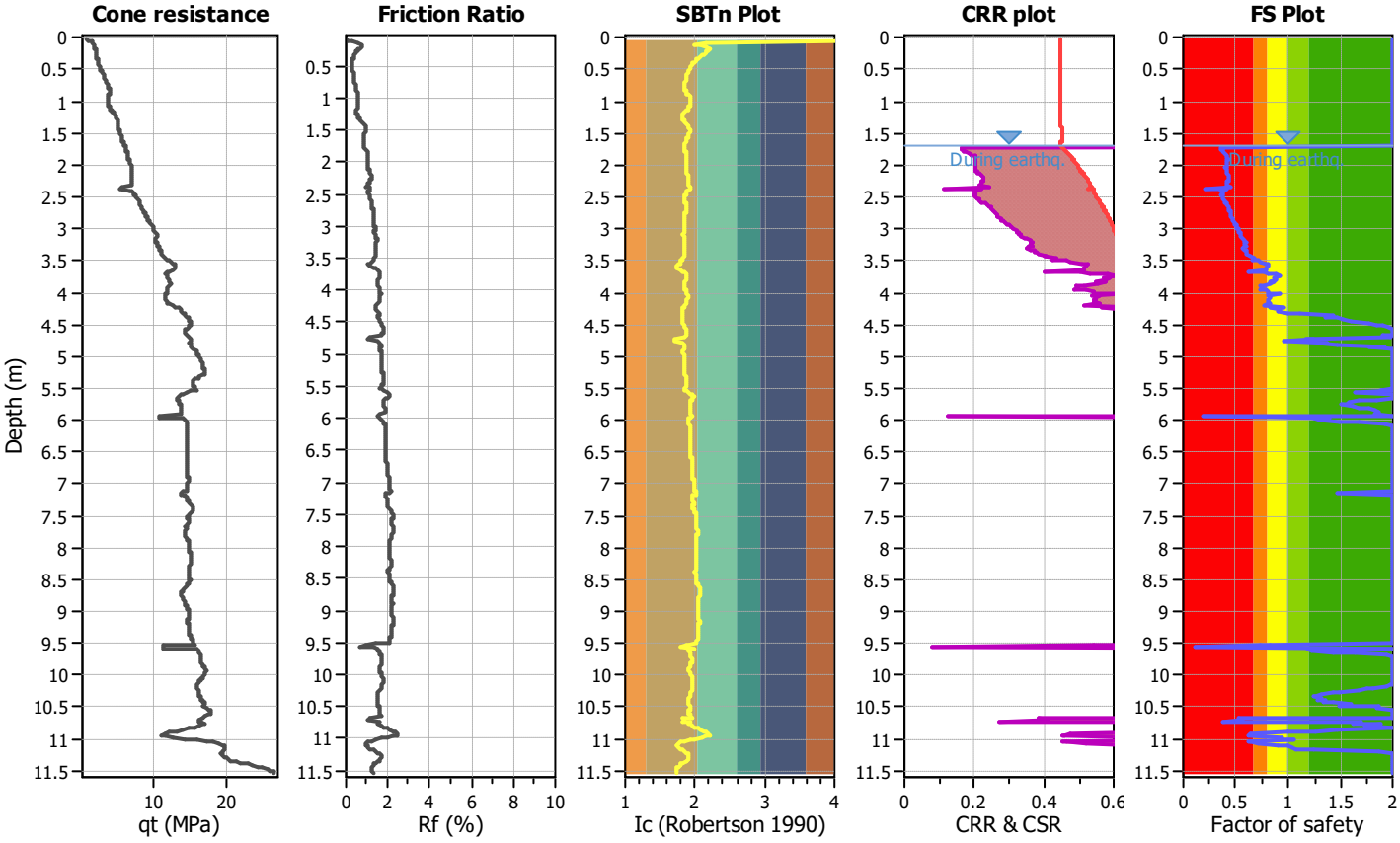
LIQUEFACTION ANALYSIS REPORT

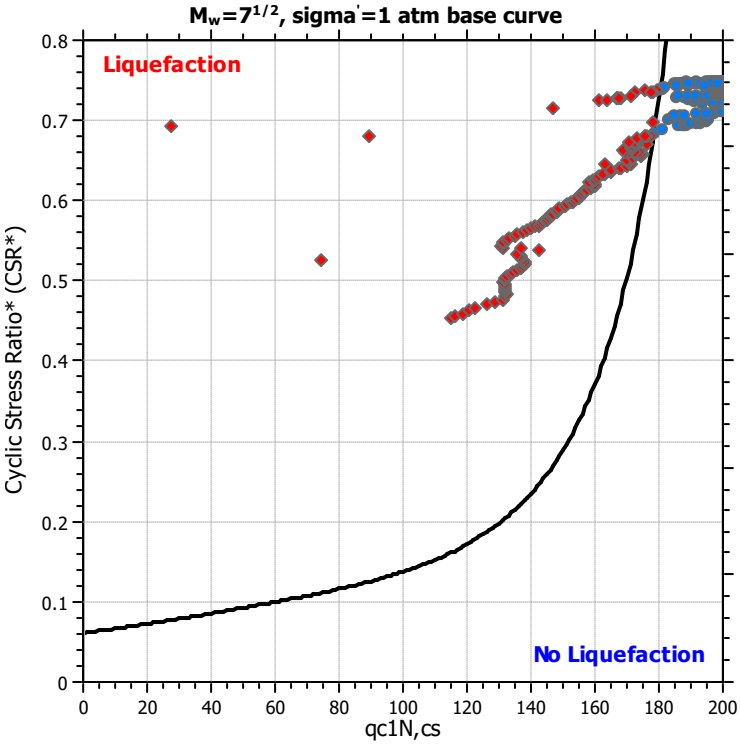
Project title : 195340402 **Location : 131 Otaihanga Rd, Paraparaumu**

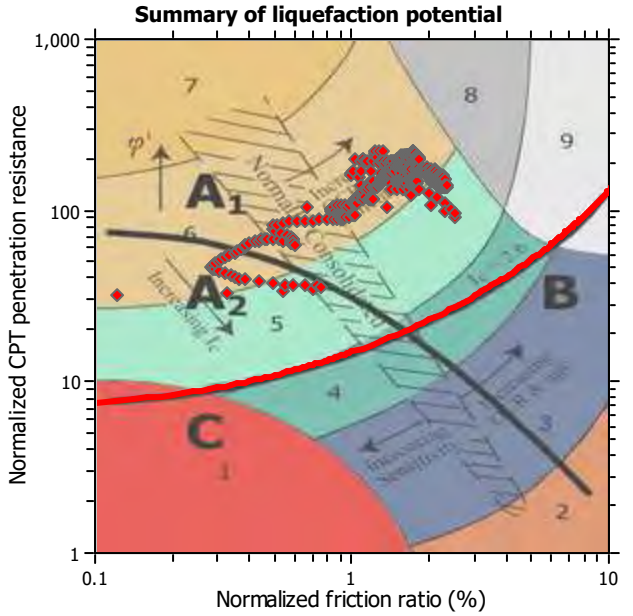
CPT file : CPT11_ULS

Input parameters and analysis data

Analysis method:	B&I (2014)	G.W.T. (in-situ):	1.70 m	Use fill:	No	Clay like behavior applied:	Sands only
Fines correction method:	B&I (2014)	G.W.T. (earthq.):	1.70 m	Fill height:	N/A	Limit depth applied:	Yes
Points to test:	Based on Ic value	Average results interval:	3	Fill weight:	N/A	Limit depth:	20.00 m
Earthquake magnitude M_w:	7.70	Ic cut-off value:	2.60	Trans. detect. applied:	No	MSF method:	Method
Peak ground acceleration:	0.68	Unit weight calculation:	Based on SBT	K_σ applied:	No		

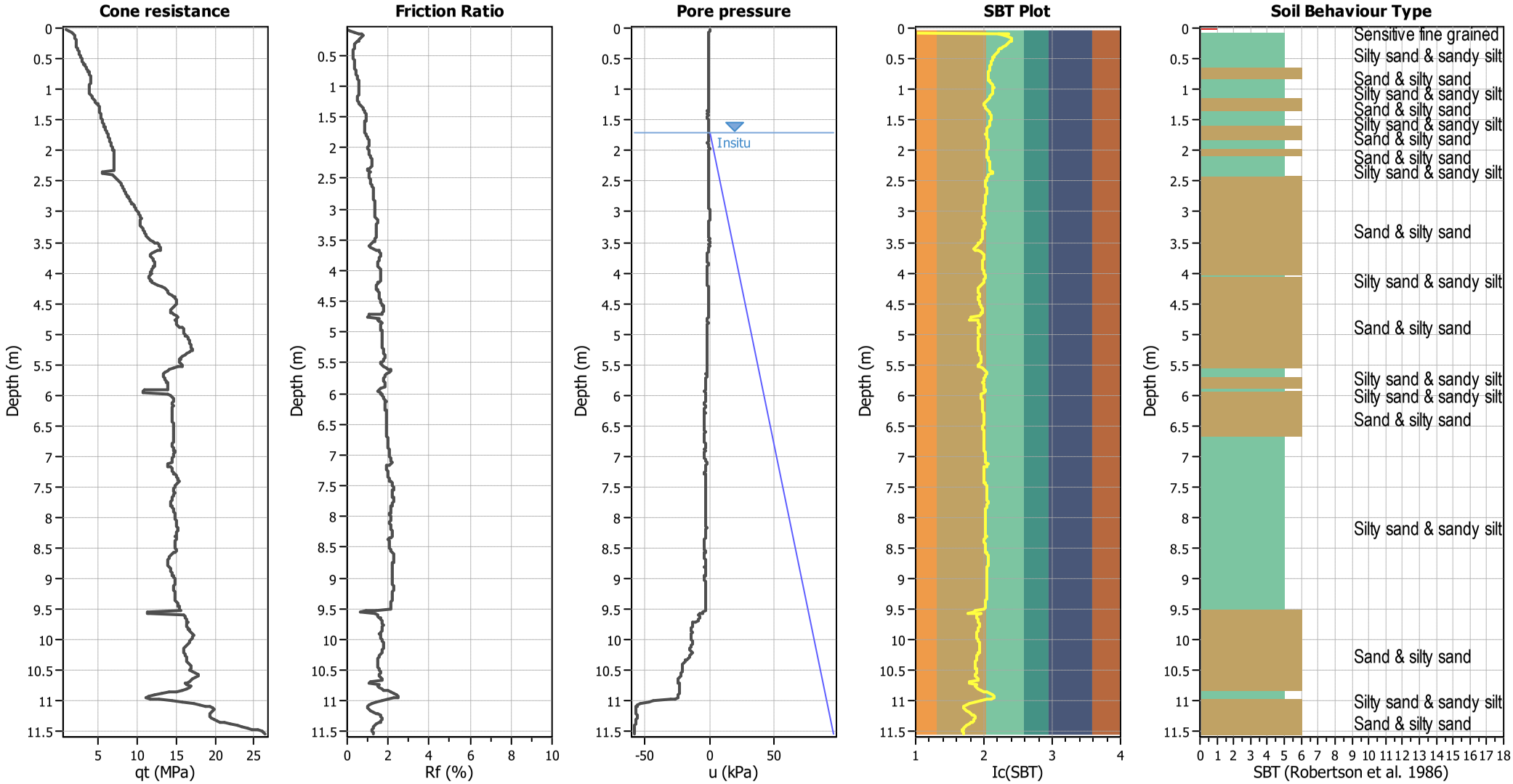






Zone A_1: Cyclic liquefaction likely depending on size and duration of cyclic loading
Zone A_2: Cyclic liquefaction and strength loss likely depending on loading and ground geometry
Zone B: Liquefaction and post-earthquake strength loss unlikely, check cyclic softening
Zone C: Cyclic liquefaction and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

CPT basic interpretation plots



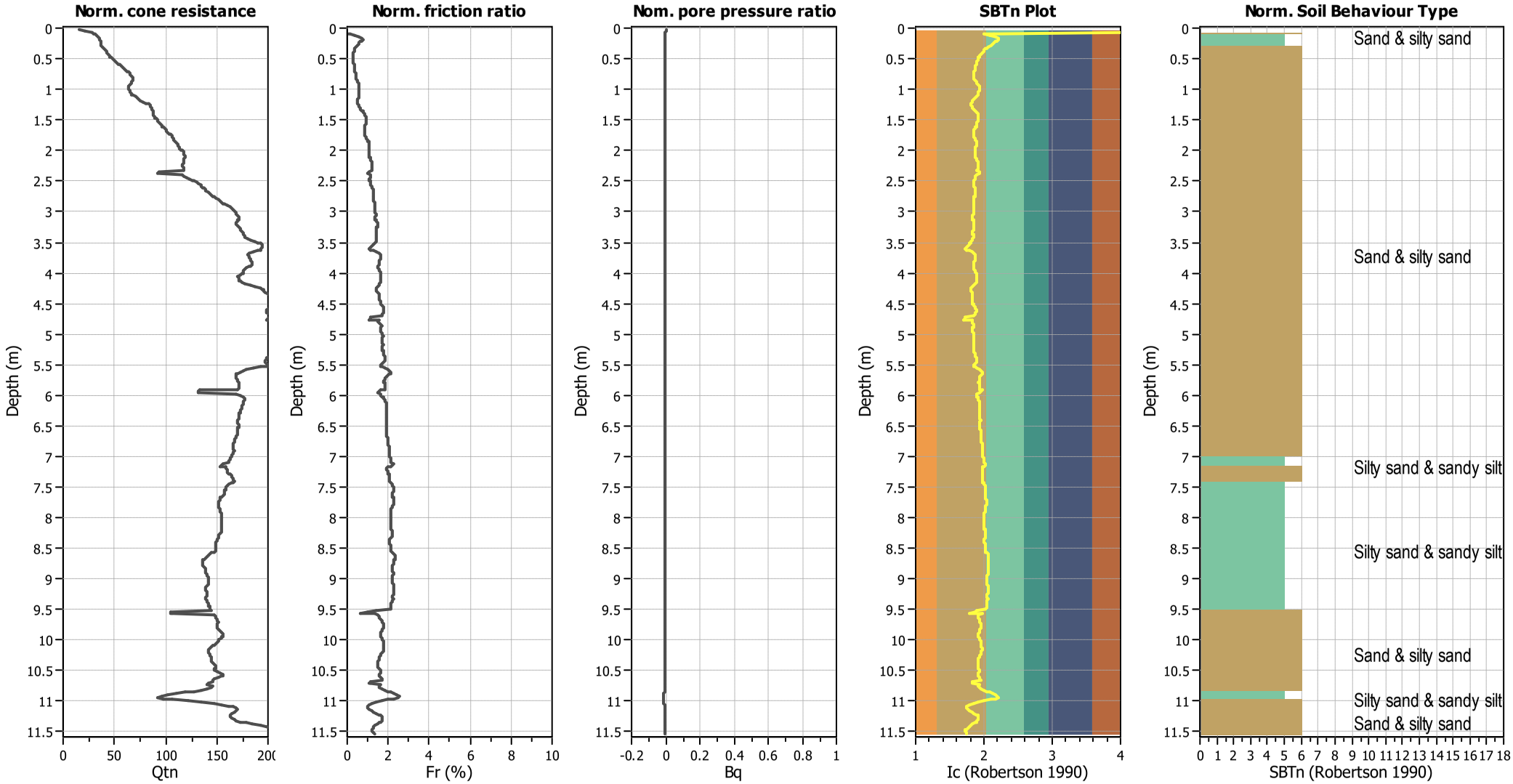
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBT legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

CPT basic interpretation plots (normalized)



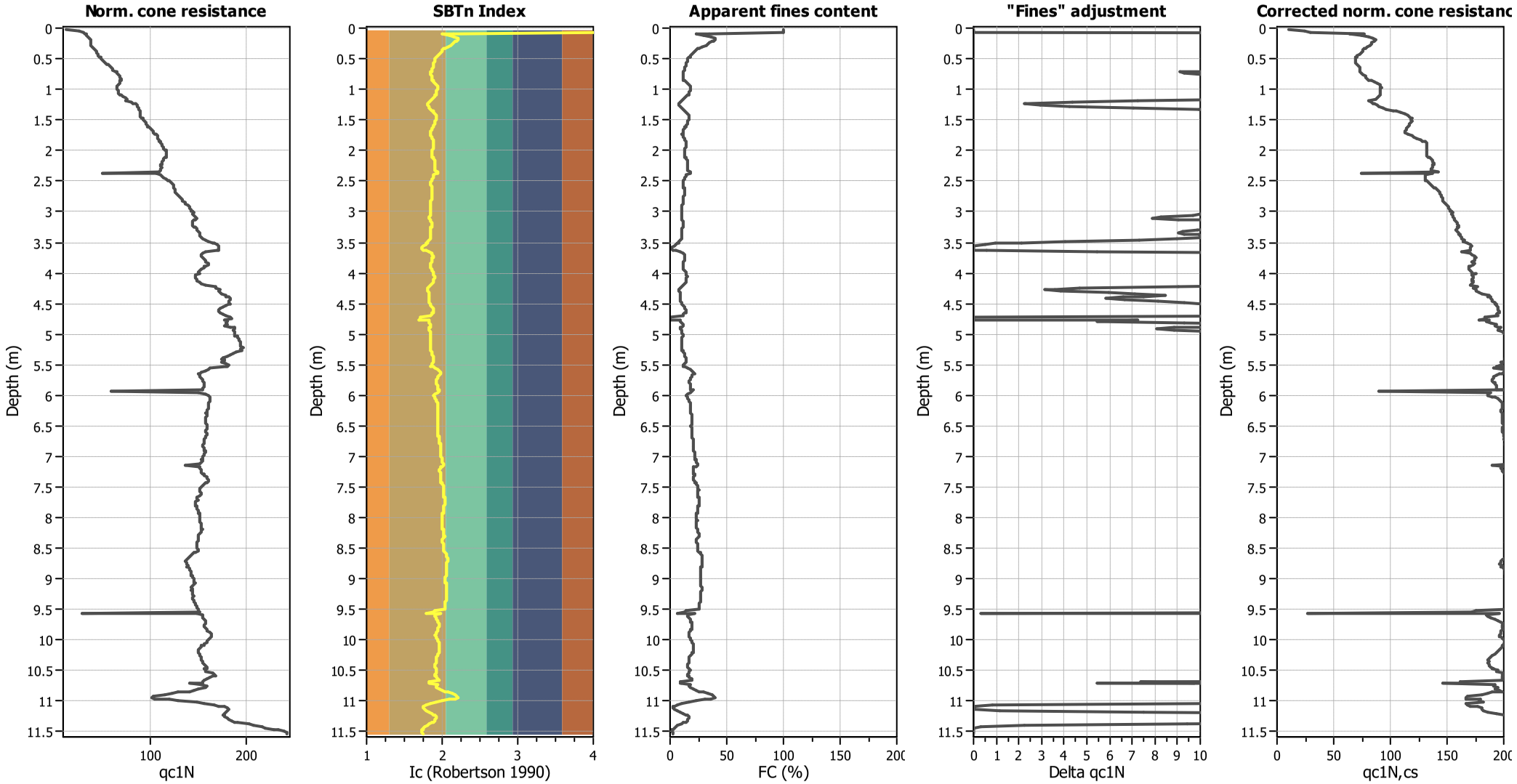
Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

SBTn legend

1. Sensitive fine grained
2. Organic material
3. Clay to silty clay
4. Clayey silt to silty
5. Silty sand to sandy silt
6. Clean sand to silty sand
7. Gravely sand to sand
8. Very stiff sand to
9. Very stiff fine grained

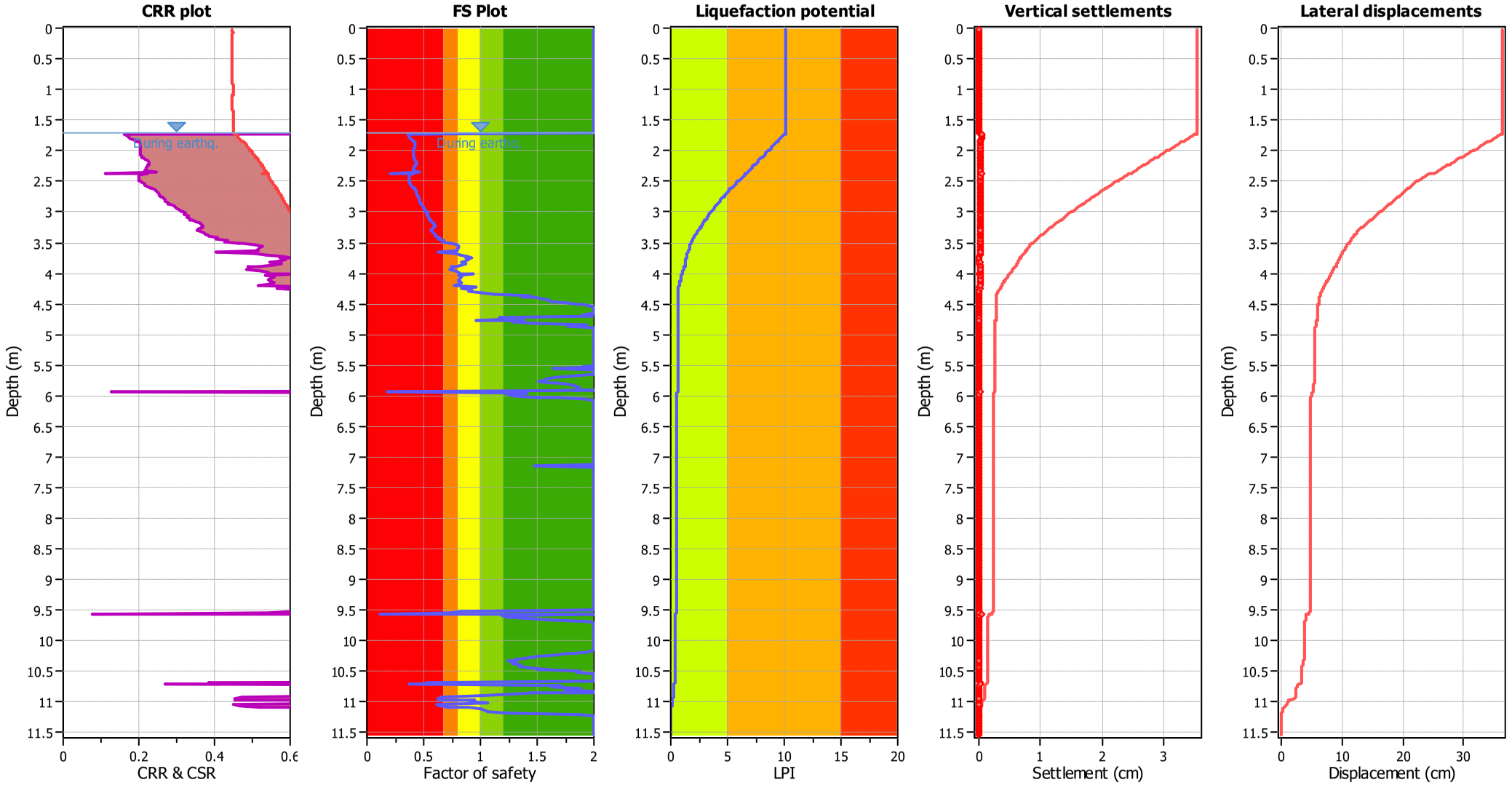
Liquefaction analysis overall plots (intermediate results)



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

Liquefaction analysis overall plots



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

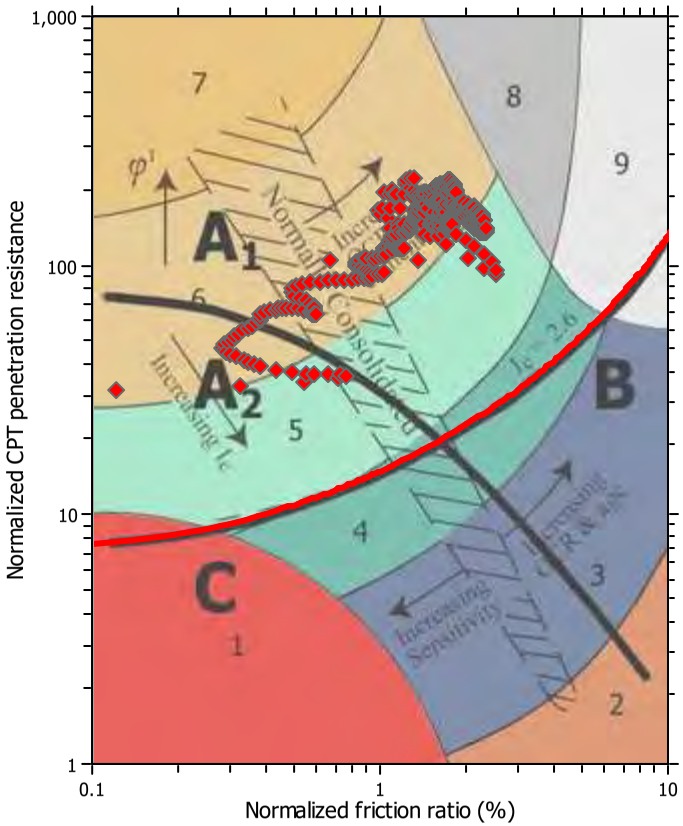
F.S. color scheme

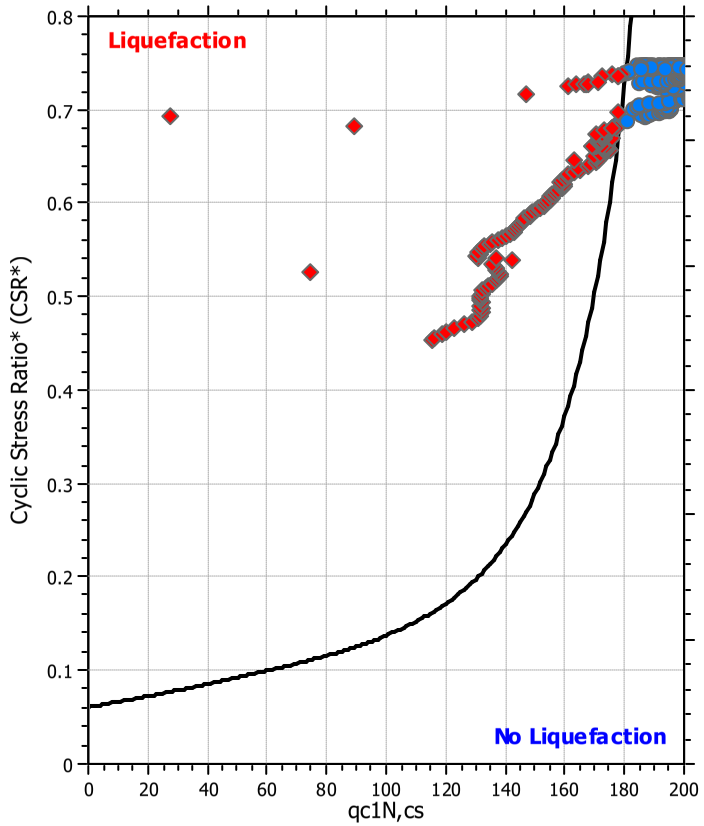
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

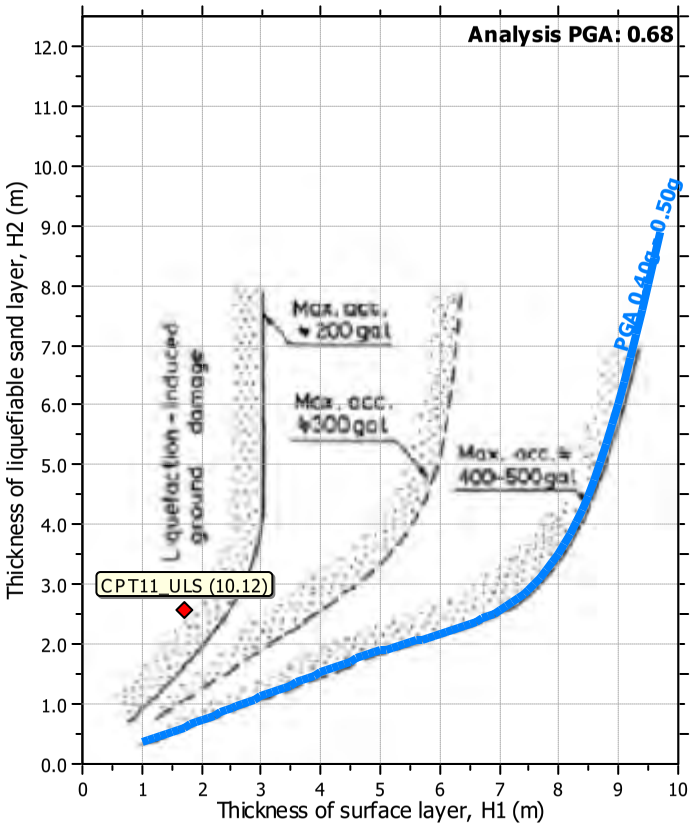
LPI color scheme

- Very high risk
- High risk
- Low risk

Liquefaction analysis summary plots



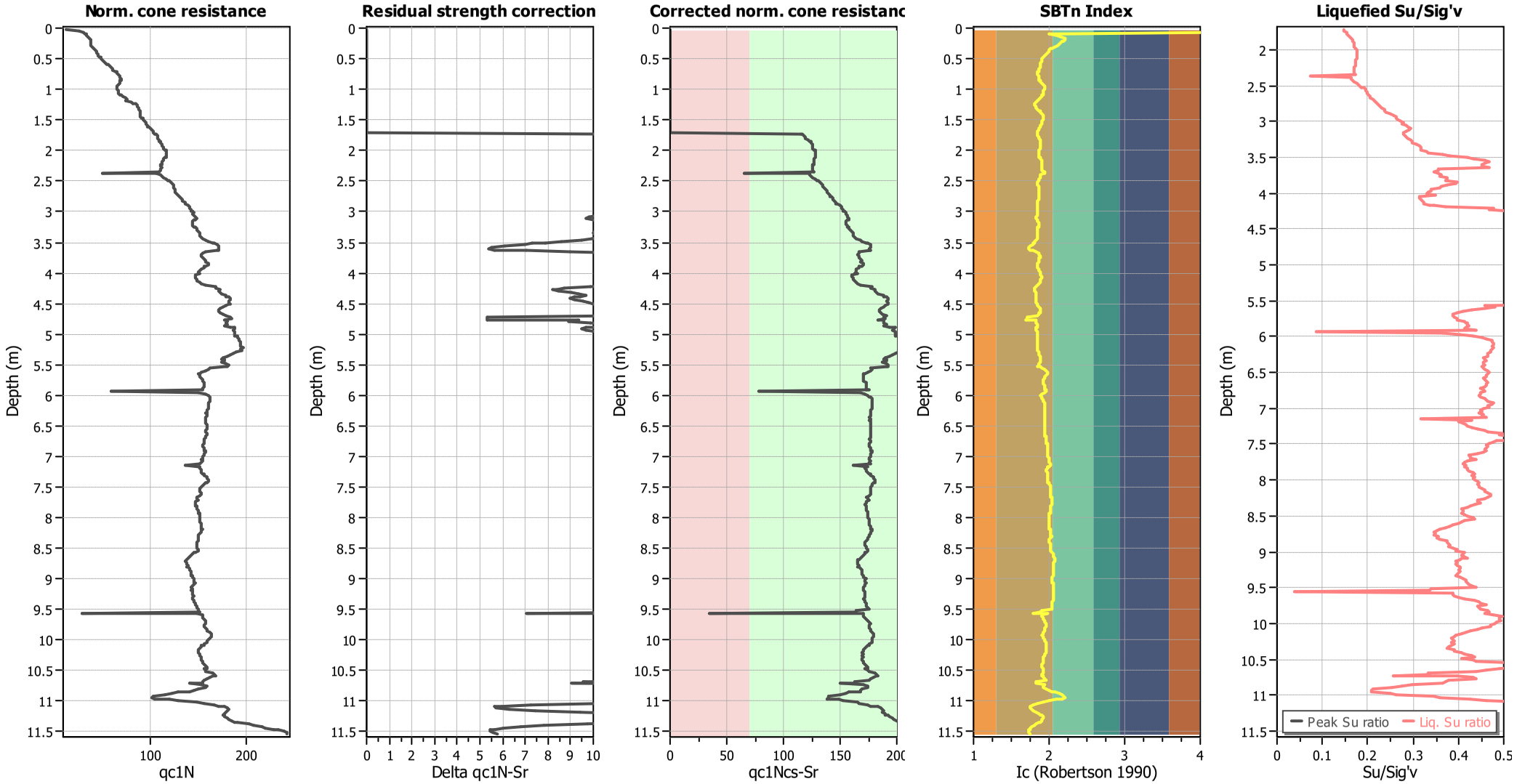




Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

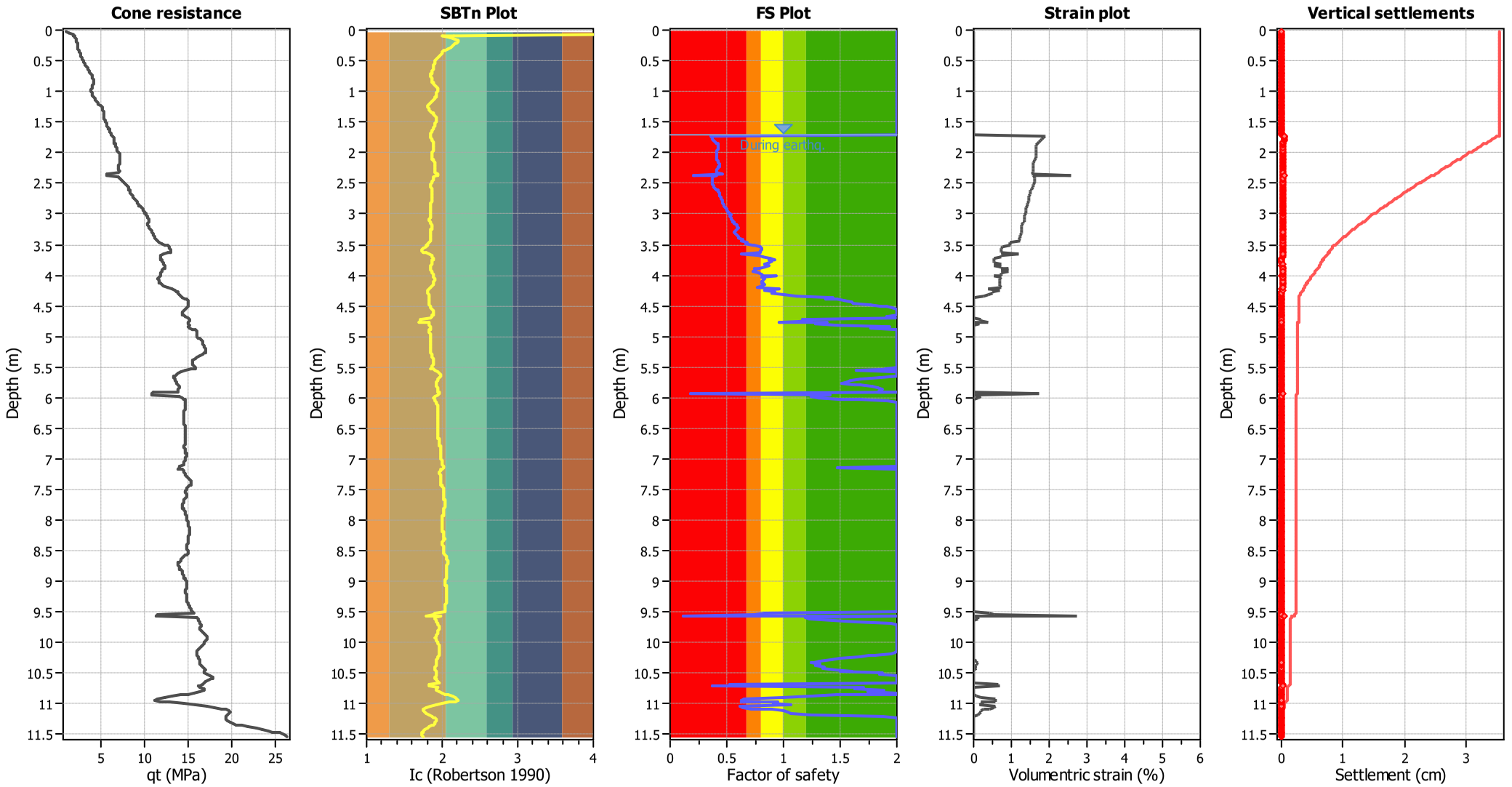
Check for strength loss plots (Idriss & Boulanger (2008))



Input parameters and analysis data

Analysis method:	B&I (2014)	Depth to GWT (erthq.):	1.70 m	Fill weight:	N/A
Fines correction method:	B&I (2014)	Average results interval:	3	Transition detect. applied:	No
Points to test:	Based on Ic value	Ic cut-off value:	2.60	K_σ applied:	No
Earthquake magnitude M_w:	7.70	Unit weight calculation:	Based on SBT	Clay like behavior applied:	Sands only
Peak ground acceleration:	0.68	Use fill:	No	Limit depth applied:	Yes
Depth to water table (insitu):	1.70 m	Fill height:	N/A	Limit depth:	20.00 m

Estimation of post-earthquake settlements



Abbreviations

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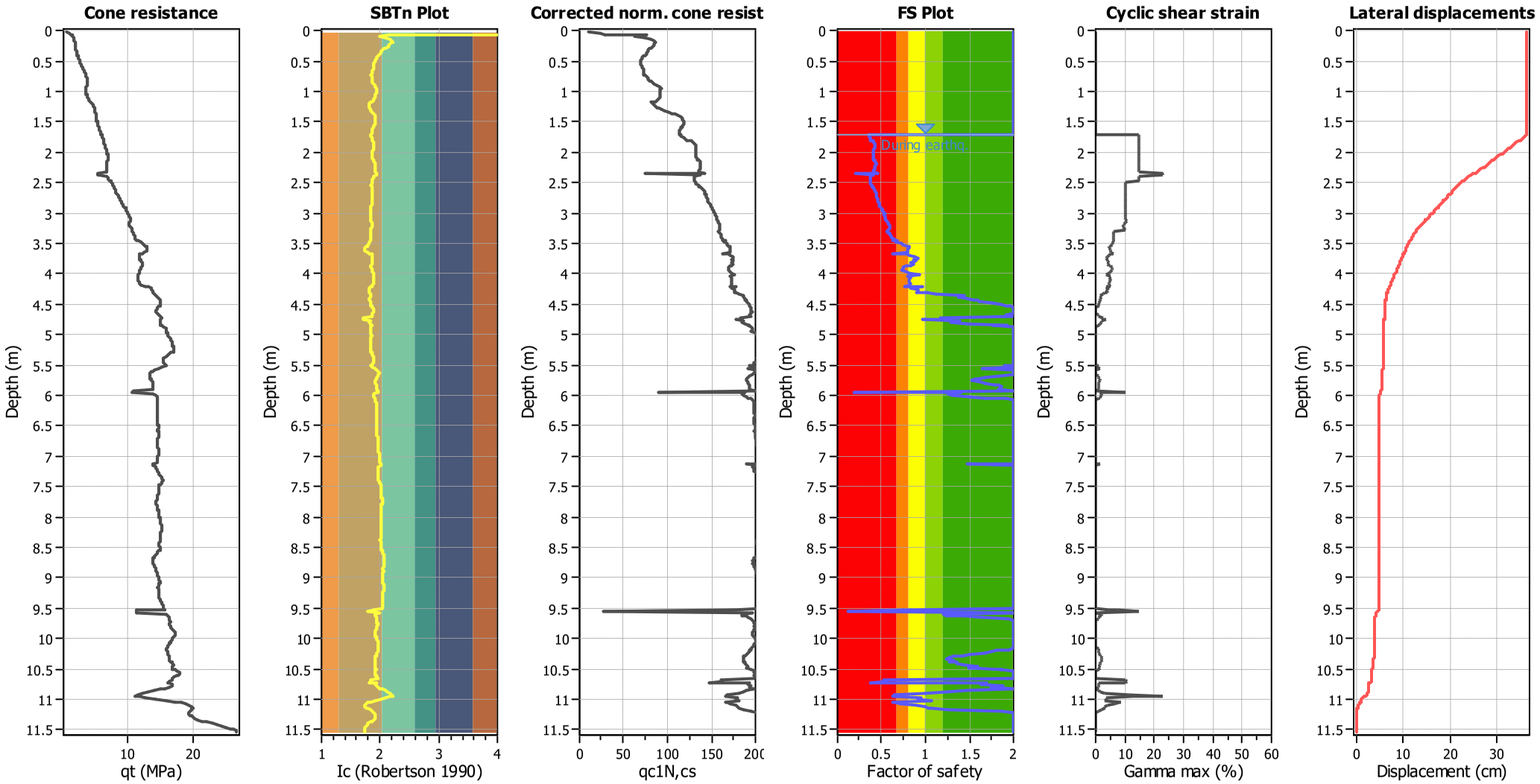
I_c:	Soil Behaviour Type Index
FS:	Calculated Factor of Safety against liquefaction
Volumentric strain:	Post-liquefaction volumentric strain

Estimation of post-earthquake lateral Displacements



Abbreviations

q_t: Total cone resistance (cone resistance q_c corrected for pore water effects)
I_c: Soil Behaviour Type Index
$q_{c1N,cs}$: Equivalent clean sand normalized CPT total cone resistance
F.S.: Factor of safety
γ_{max}: Maximum cyclic shear strain
LDI: Lateral displacement index

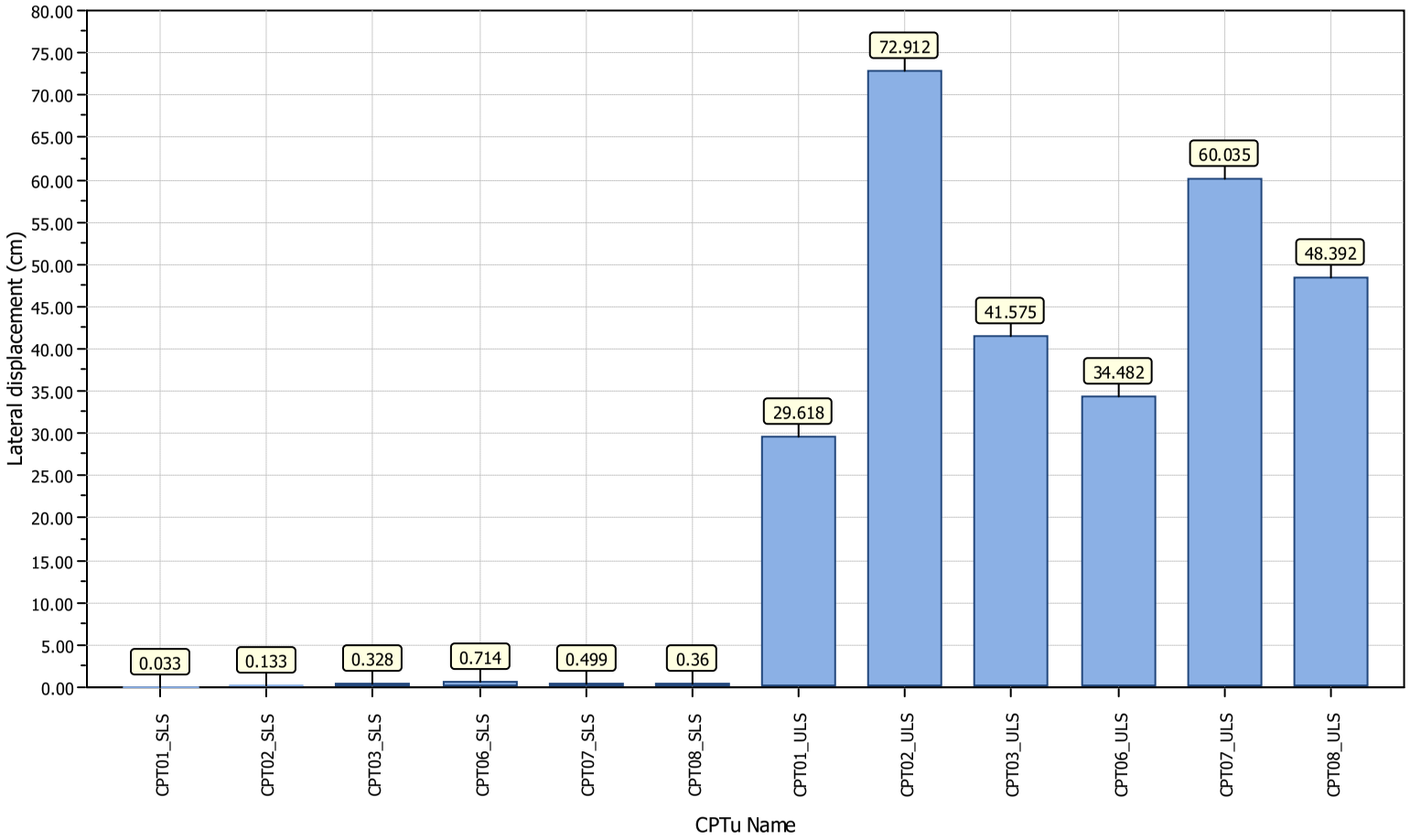
EARTHWORKED LATERAL SPREAD ASSESSMENT

RDCL
Geotechnical Engineers
2/182 Main Rd Tawa
www.rdcl.co.nz

Project title : 195340402 - Earthworked Topography

Location : 131 Otaihanga Rd, Paraparaumu

Overall lateral displacements report

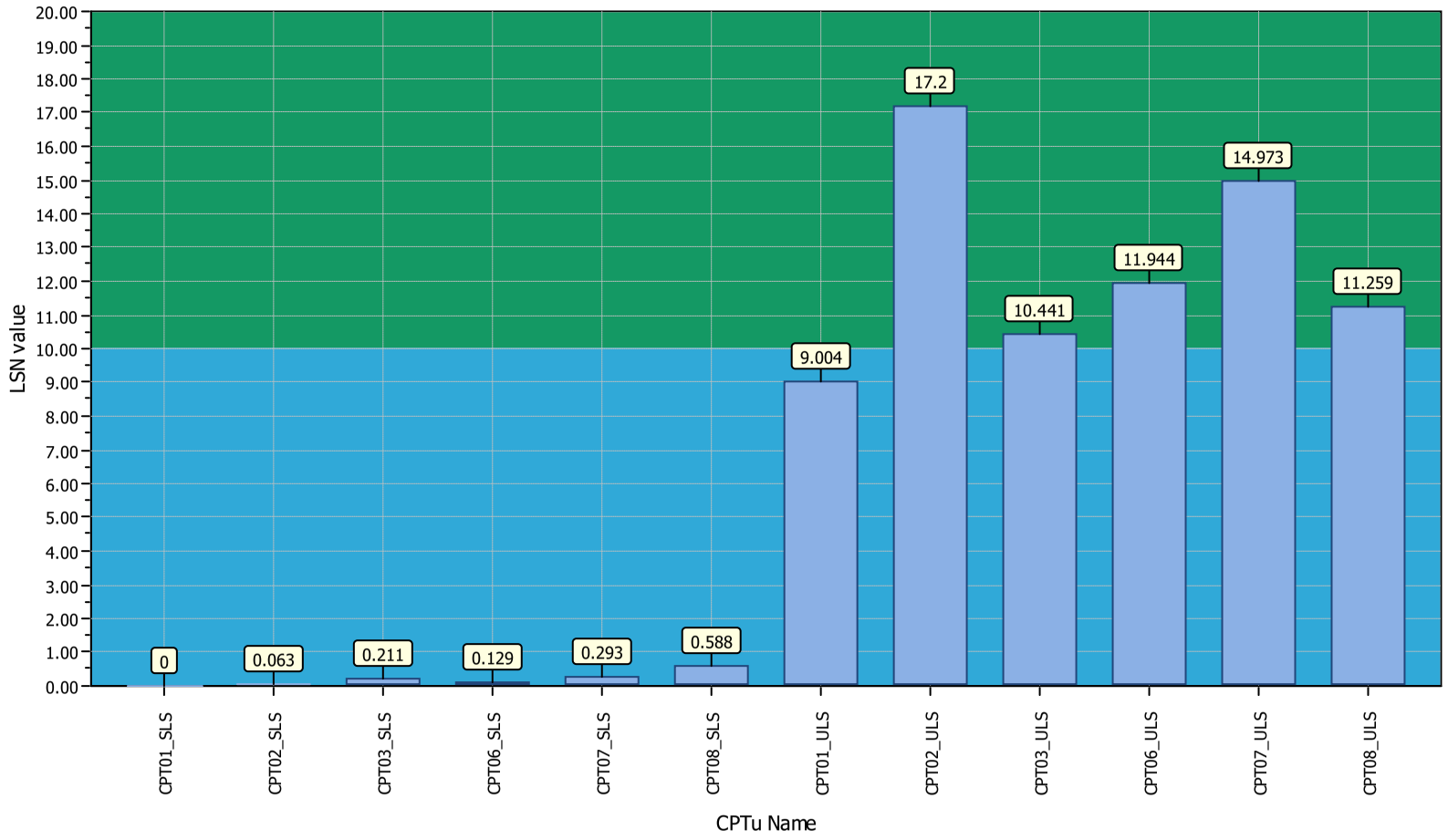


RDCL
Geotechnical Engineers
2/182 Main Rd Tawa
www.rdcl.co.nz

Project title : 195340402 - Earthworked Topography

Location : 131 Otaihanga Rd, Paraparaumu

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: 12

58% little liquefaction

42% minor liquefaction

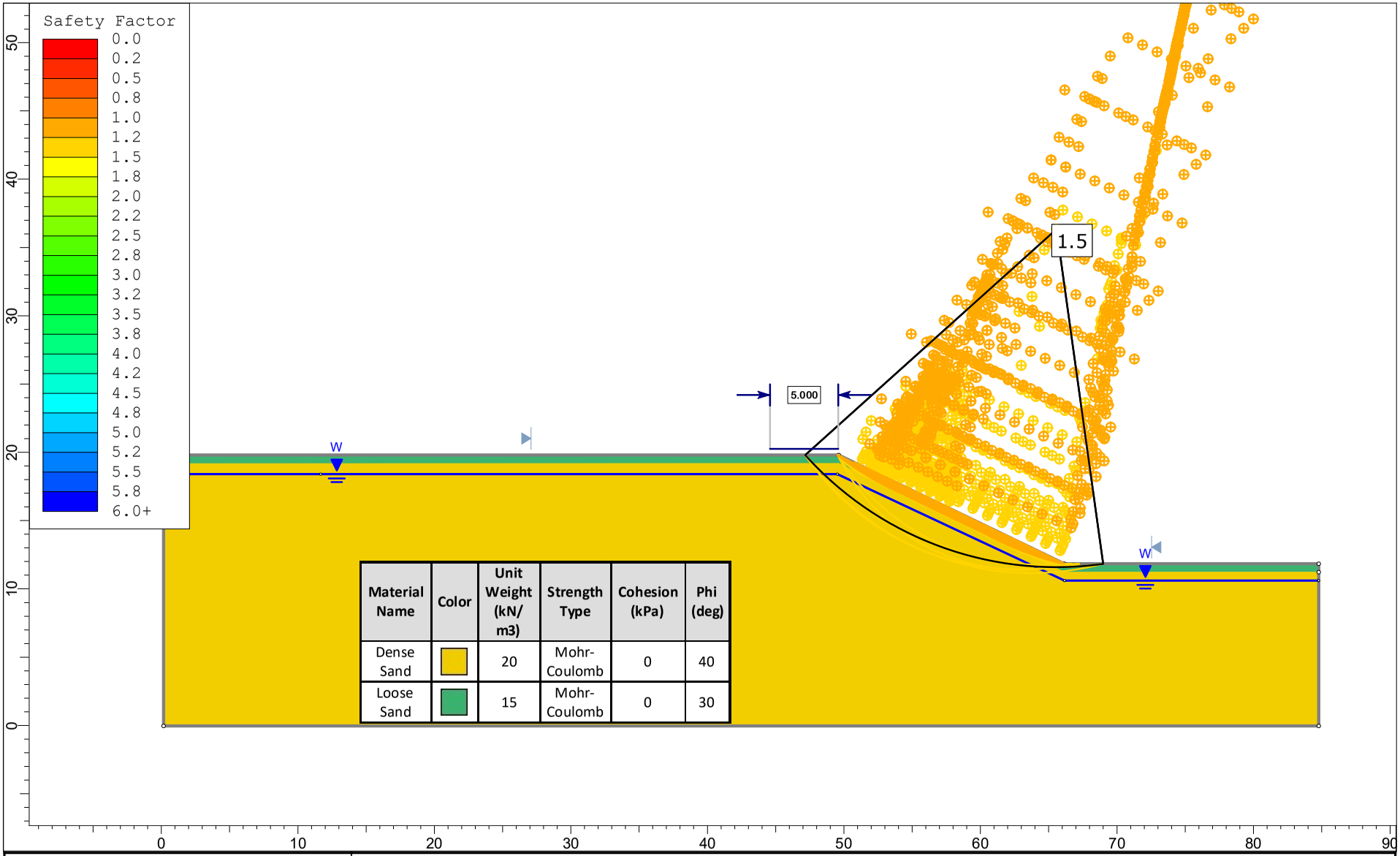
0% moderate liquefaction

0% moderate to major liquefaction

0% major liquefaction

0% severe liquefaction

APPENDIX C: SLOPE STABILITY OUTPUTS

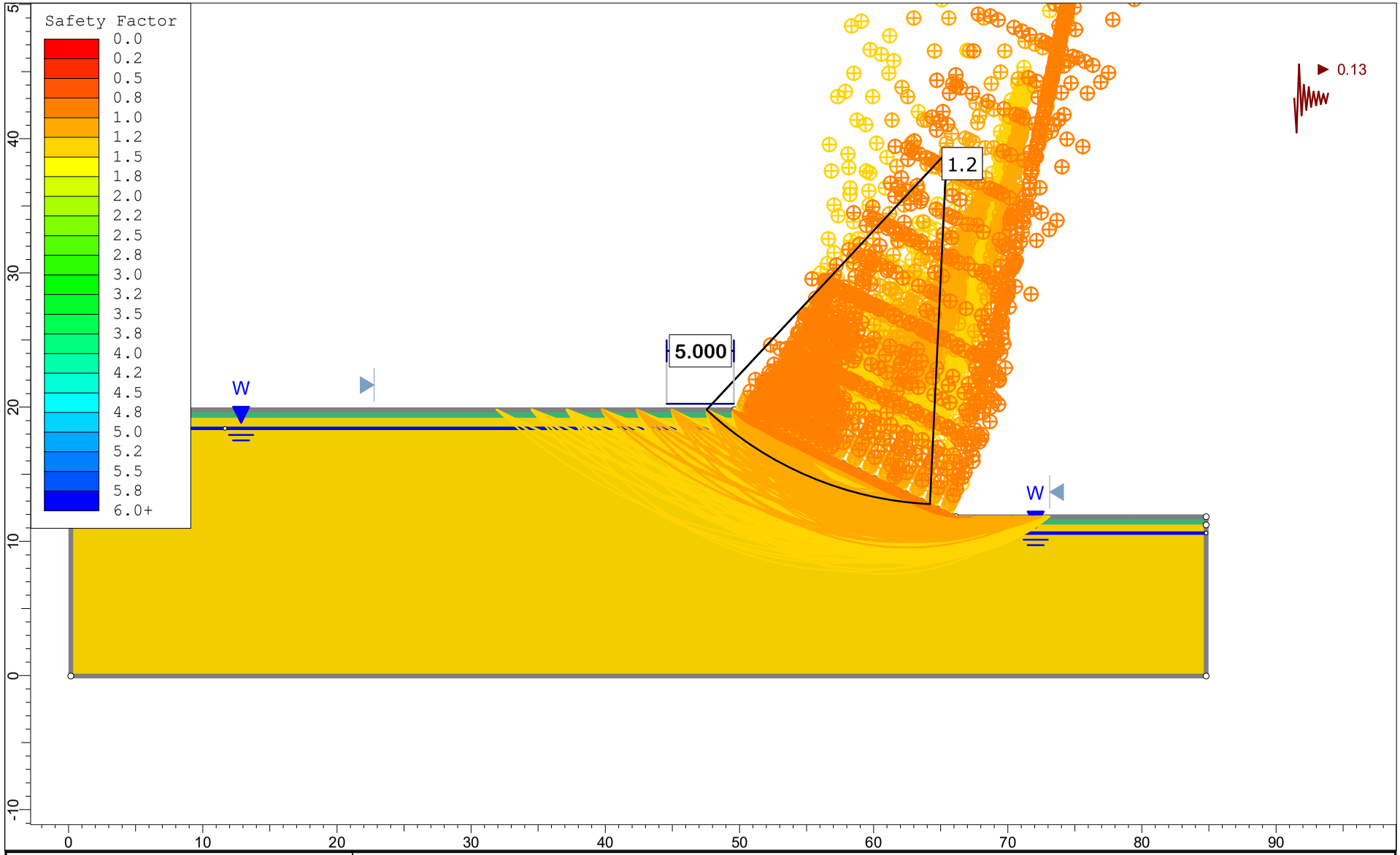


Material Name	Color	Unit Weight (kN/m3)	Strength Type	Cohesion (kPa)	Phi (deg)
Dense Sand		20	Mohr-Coulomb	0	40
Loose Sand		15	Mohr-Coulomb	0	30

RDCL

SLIDEINTERPRET 9.009

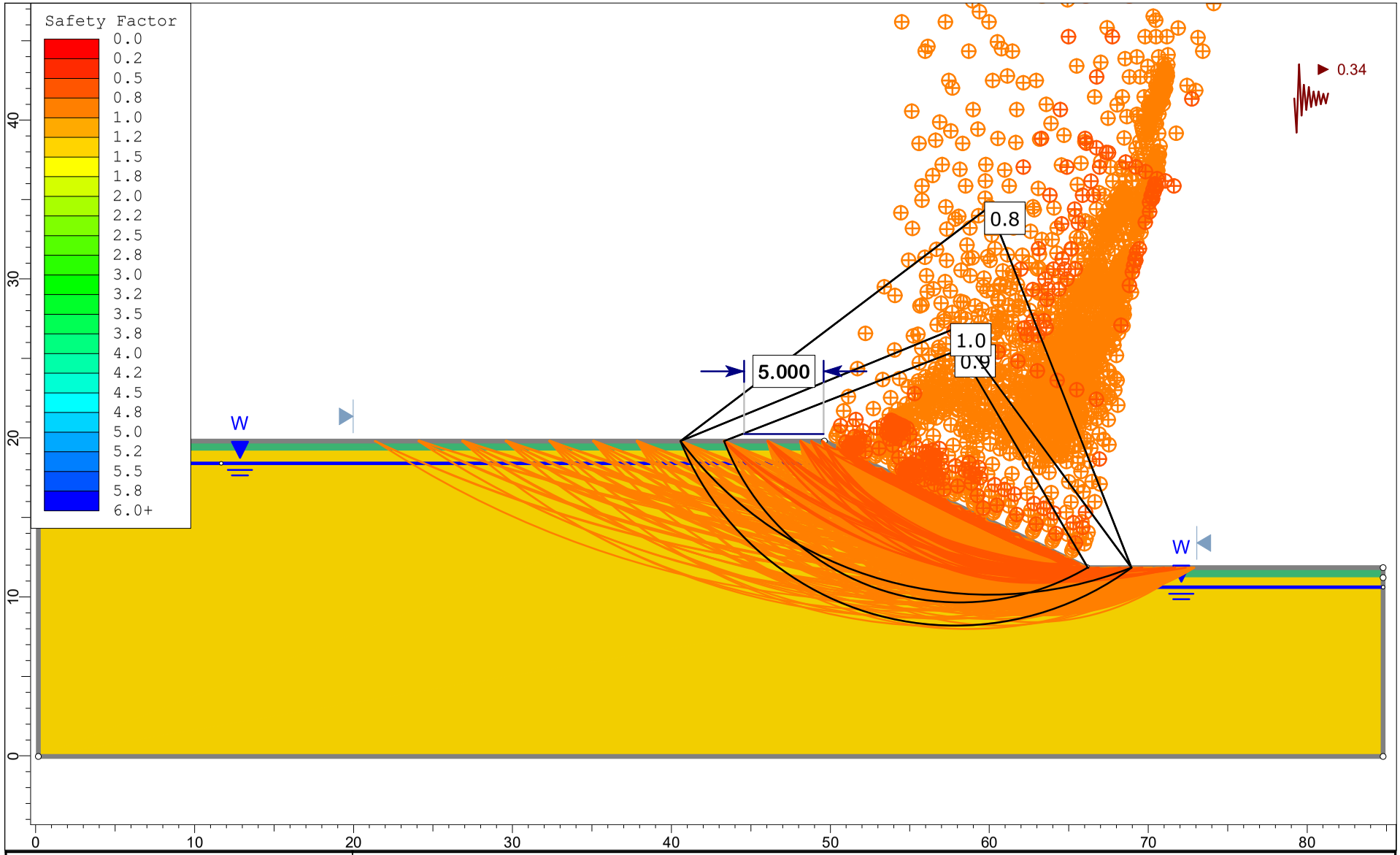
Project	Otainhanga Rd		
	Natural Slope_Static		
Drawn By	CAW	*Company*	Mr Mansell
Date	10/03/2022	*File Name*	Cross sections_Natural.slmd



RDCL

SLIDEINTERPRET 9.009

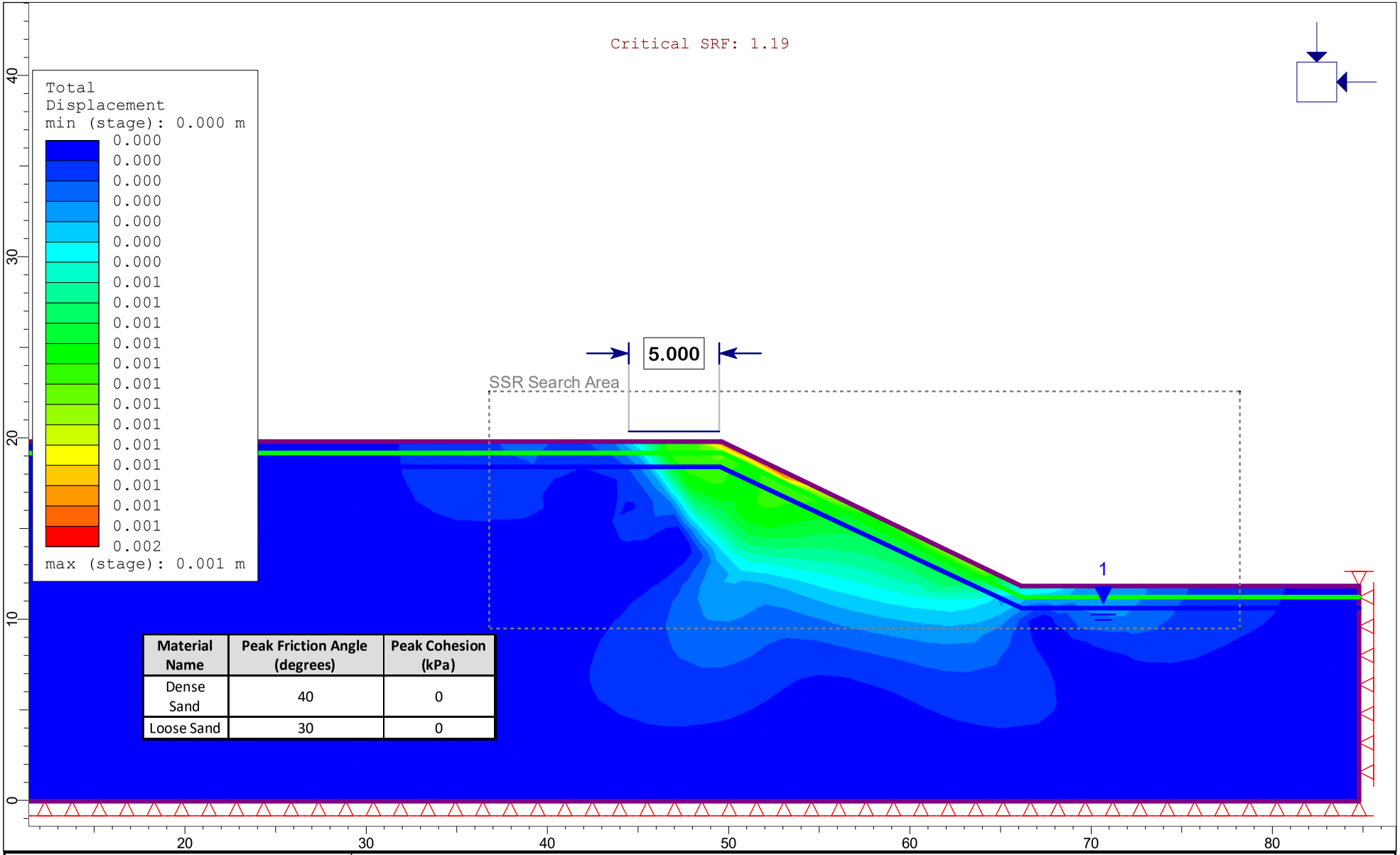
Project	Otainhanga Rd		
	Natural Slope_SLS		
Drawn By	CAW	*Company*	Mr Mansell
Date	10/03/2022	*File Name*	Cross sections_Natural.slmd



RDCL

SLIDEINTERPRET 9.009

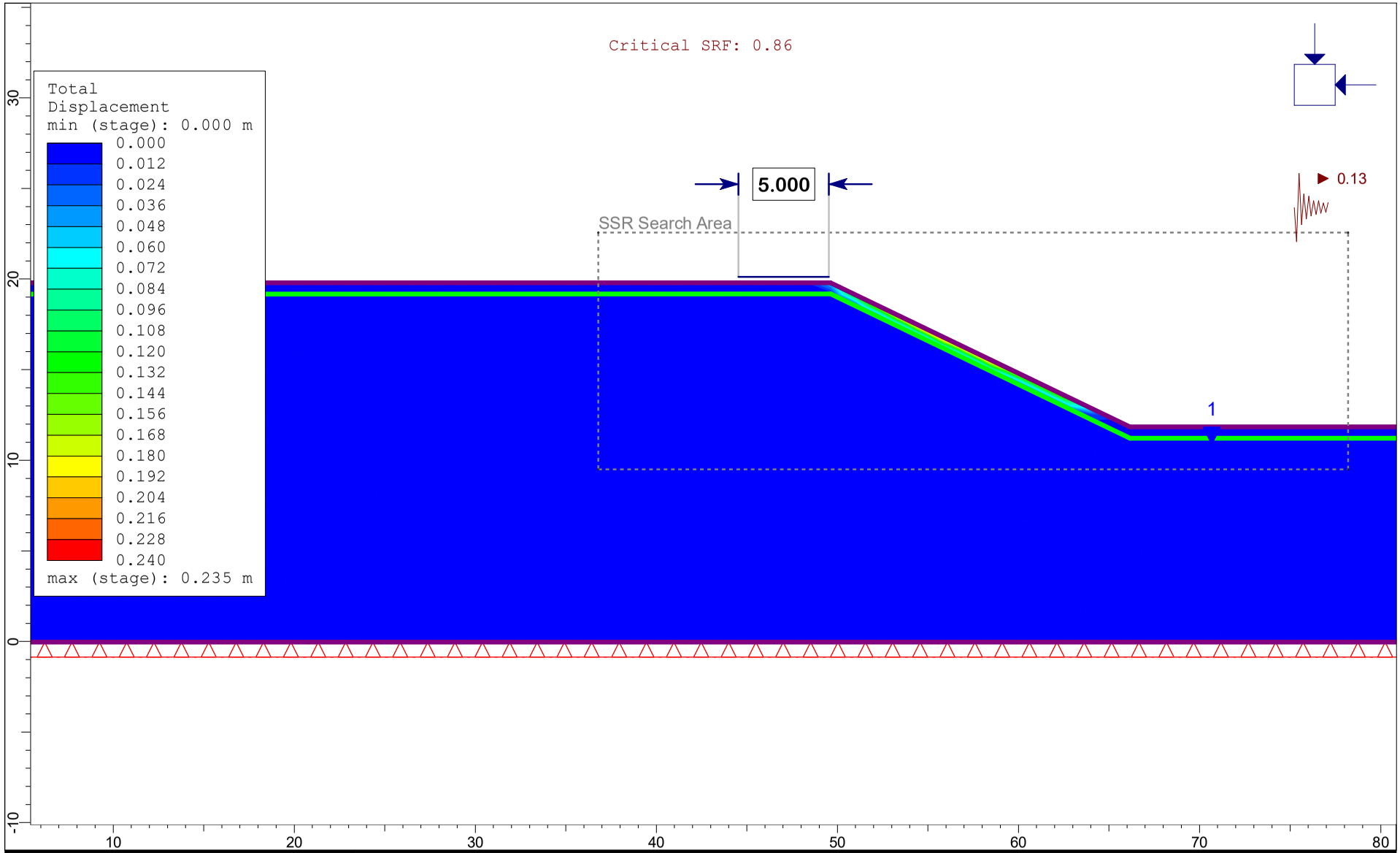
Project	Otainhanga Rd		
	Natural Slope_ULS		
Drawn By	CAW	*Company*	Mr Mansell
Date	10/03/2022	*File Name*	Cross sections_Natural.slmd



Material Name	Peak Friction Angle (degrees)	Peak Cohesion (kPa)
Dense Sand	40	0
Loose Sand	30	0

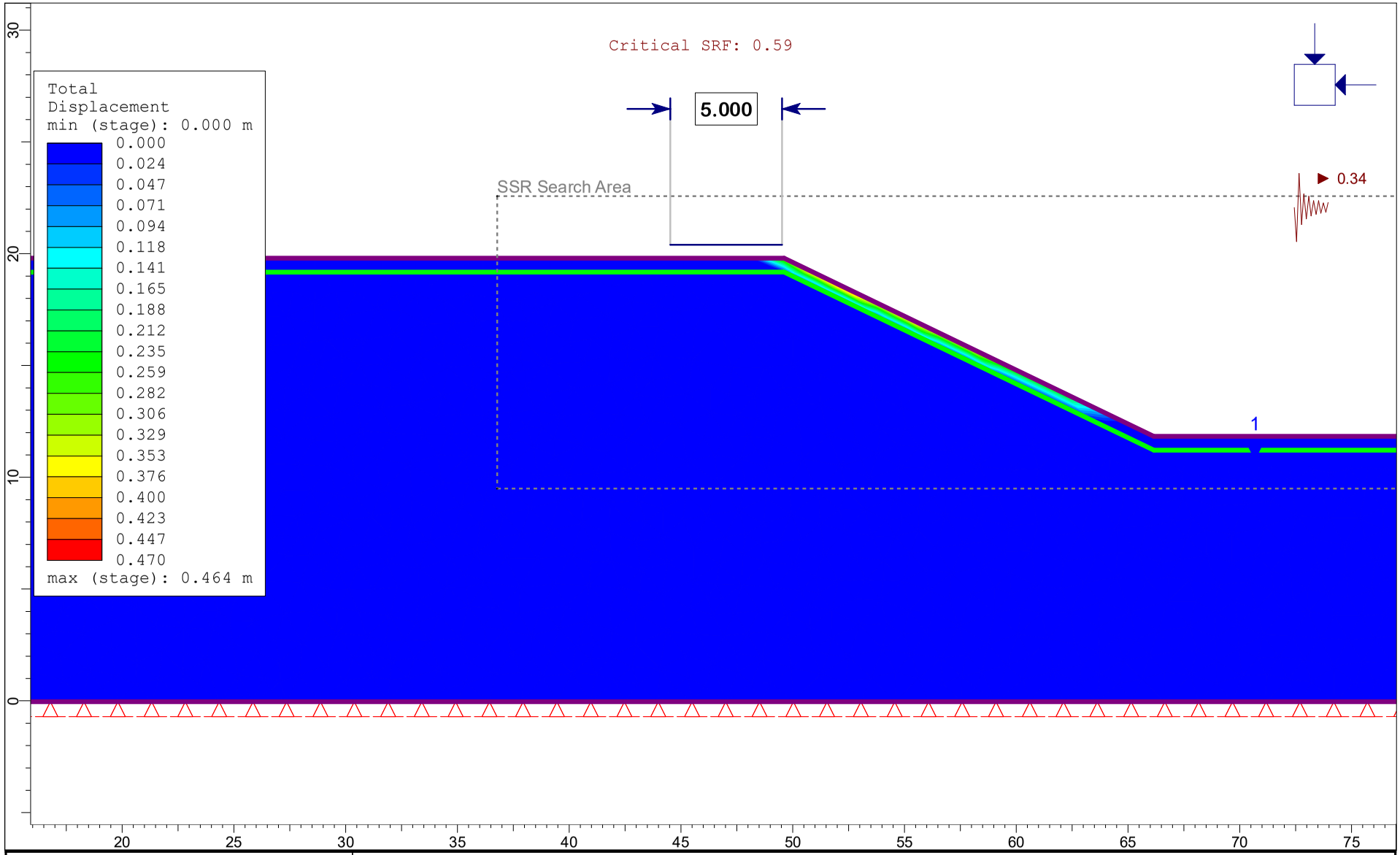
RDCL

Project	131 Otaihanga Rd				
Analysis Discription	Natural_Displacement_Static				
Drawn By	BB	Scale	1:288	Company	RDCL
Date	Converted 04-Mar-22, 4:09:25 PM			File Name	Converted from Slide v9.009 with RS2 11.007



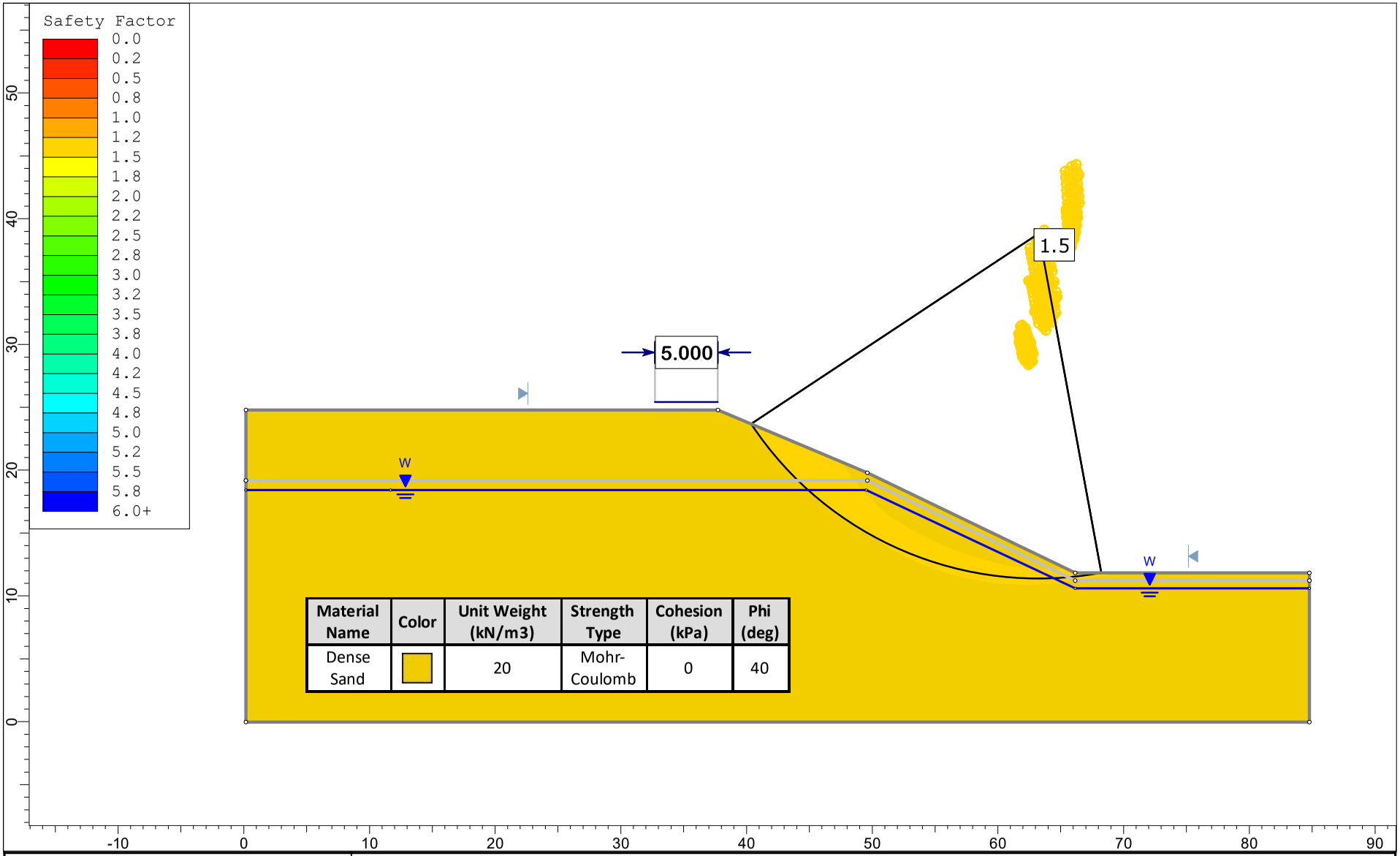
RDCL	*Project*	131 Otaihnaga Rd		
	Analysis Description	Natural Slope_SLS.fez		
	Drawn By	CAWylie	*Scale* 1:296	*Company* Resource Development Consultants Ltd
	Date	10/03/2022		*File Name* Natural Slope_SLS.fez

INTERPRET 11.007



RDCL	*Project*	131 Otaihnaga Rd		
	Analysis Description	Natural Slope_ULS.fez		
	Drawn By	CAWylie	*Scale* 1:240	*Company* Resource Development Consultants Ltd
	Date	10/03/2022		*File Name* Natural Slope_ULS.fez

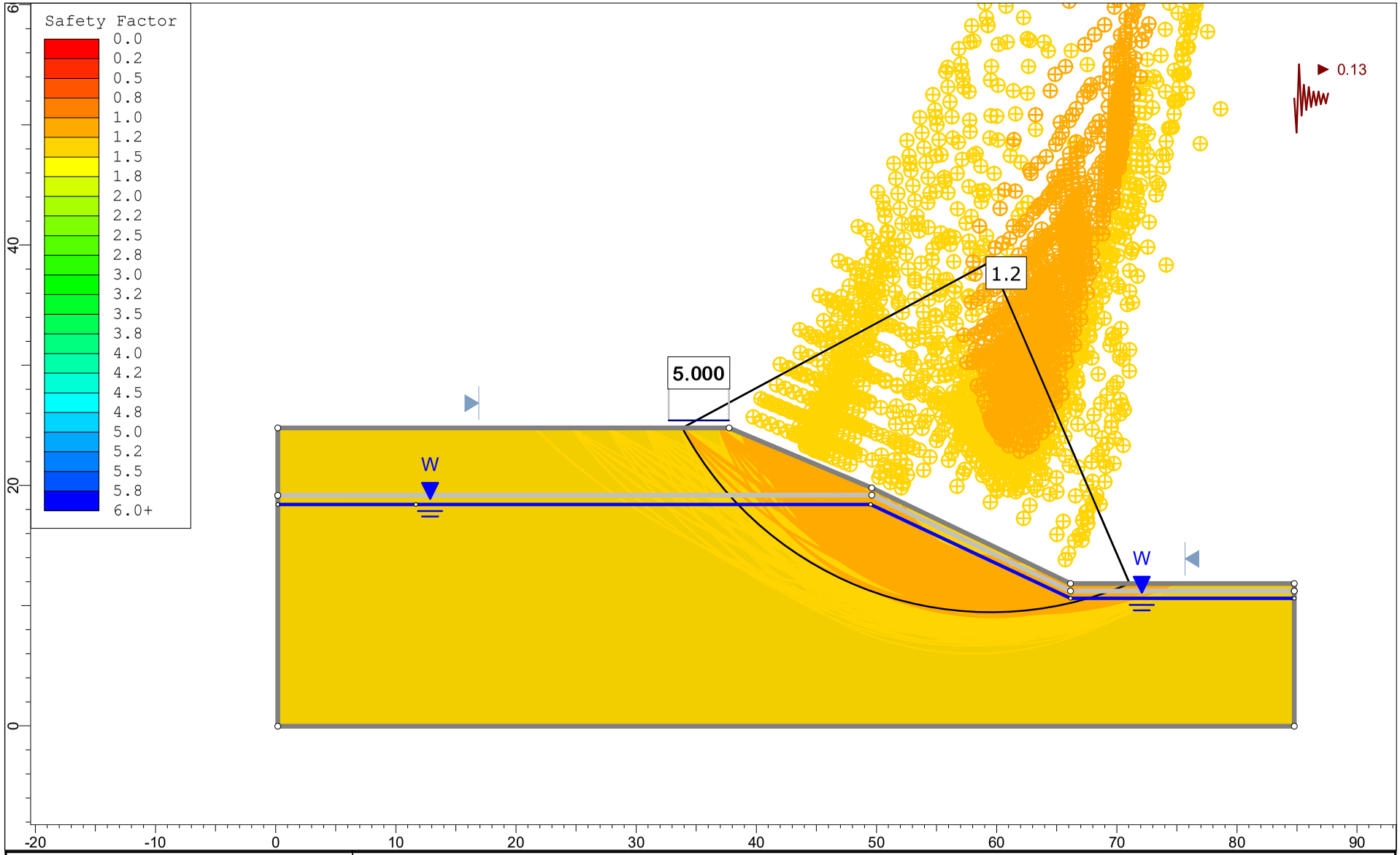
INTERPRET 11.007



RDCL

SLIDEINTERPRET 9.009

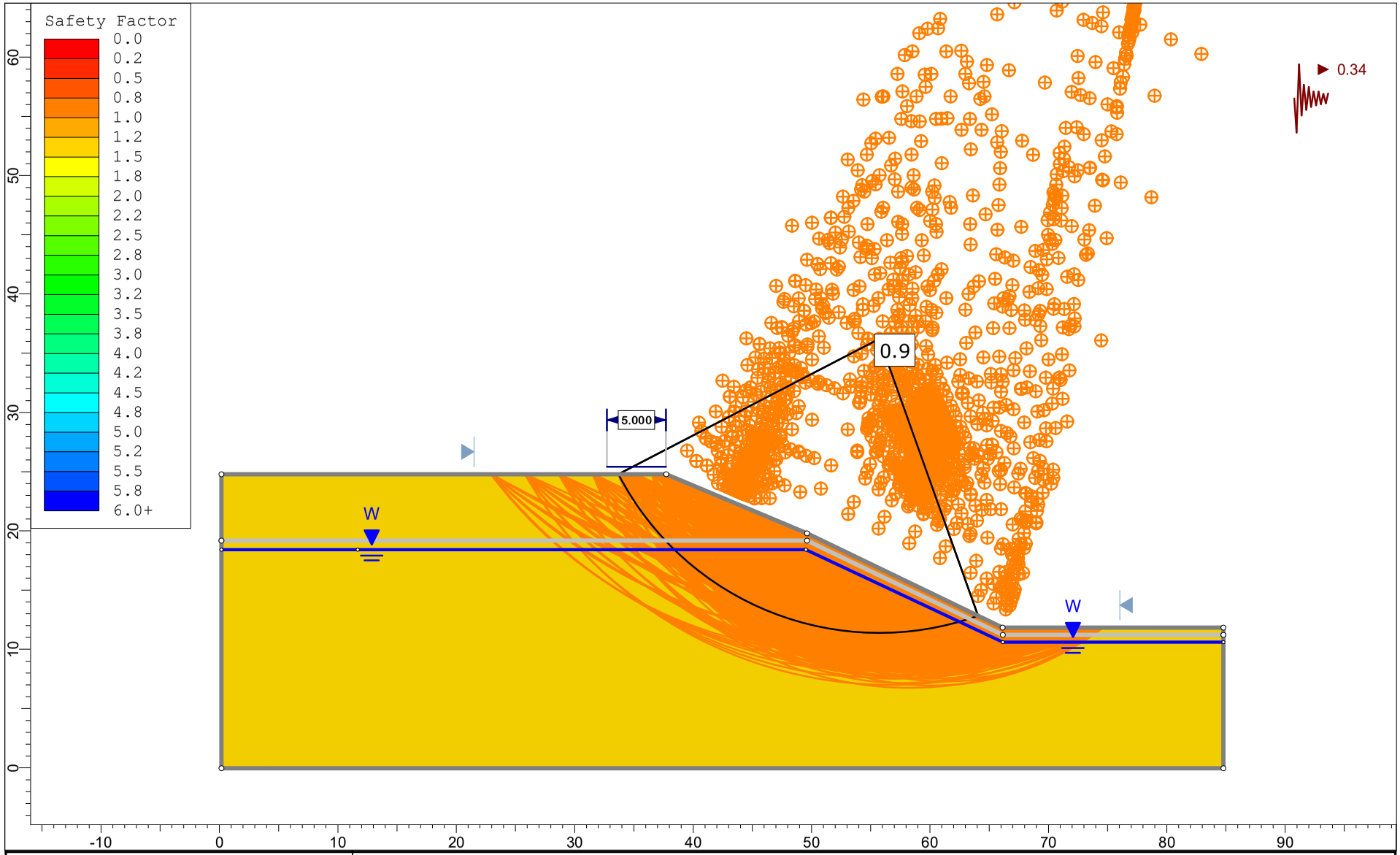
Project	Otainhanga Rd		
	Fill Slope_Static		
Drawn By	CAW	*Company*	Mr Mansell
Date	9/03/2022	*File Name*	Cross sections_Natural_Fill.slmd



RDCL

SLIDEINTERPRET 9.009

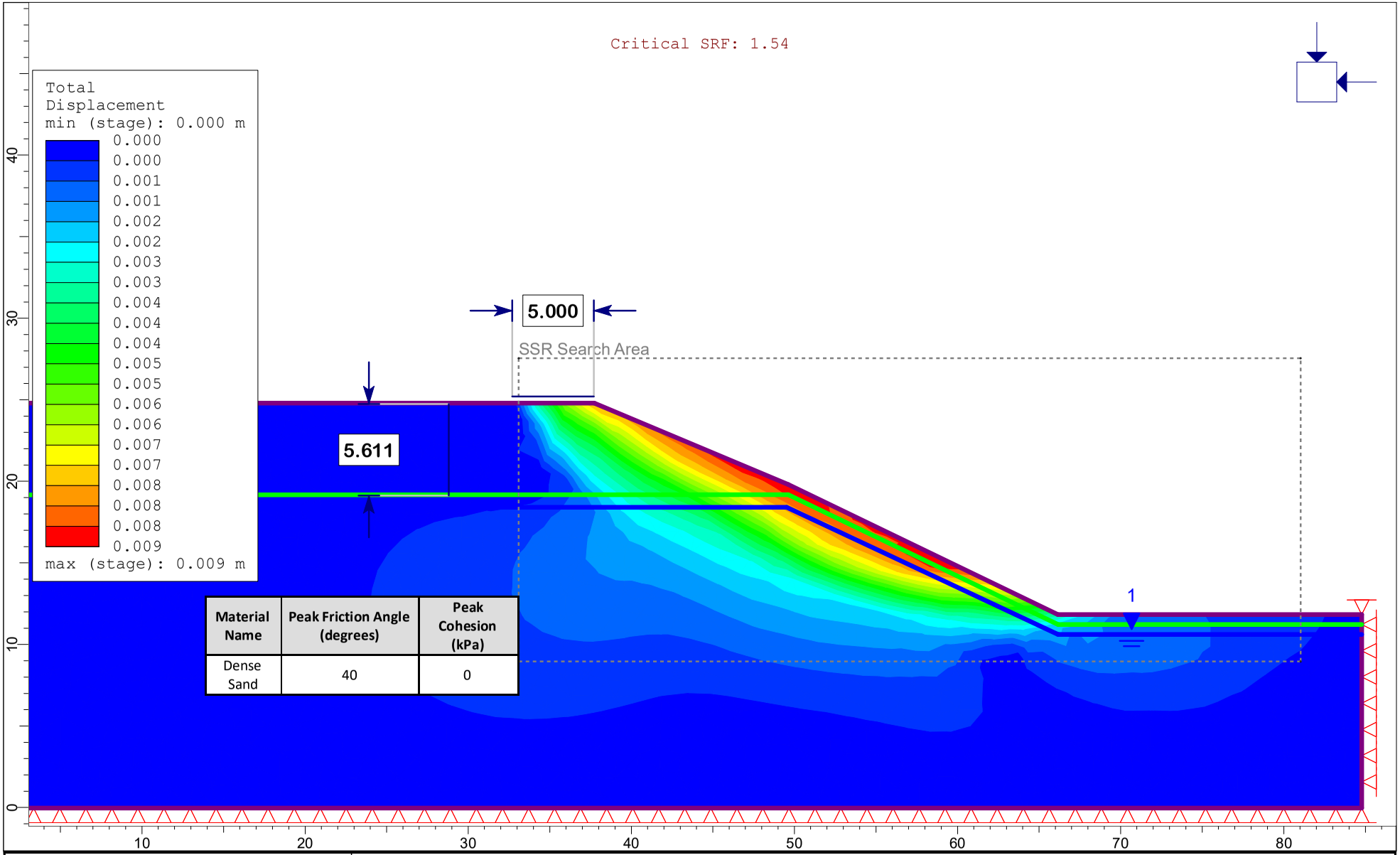
Project	Otainhanga Rd		
	Fill Slope_SLS		
Drawn By	CAW	*Company*	Mr Mansell
Date	9/03/2022	*File Name*	Cross sections_Natural_Fill.slmd



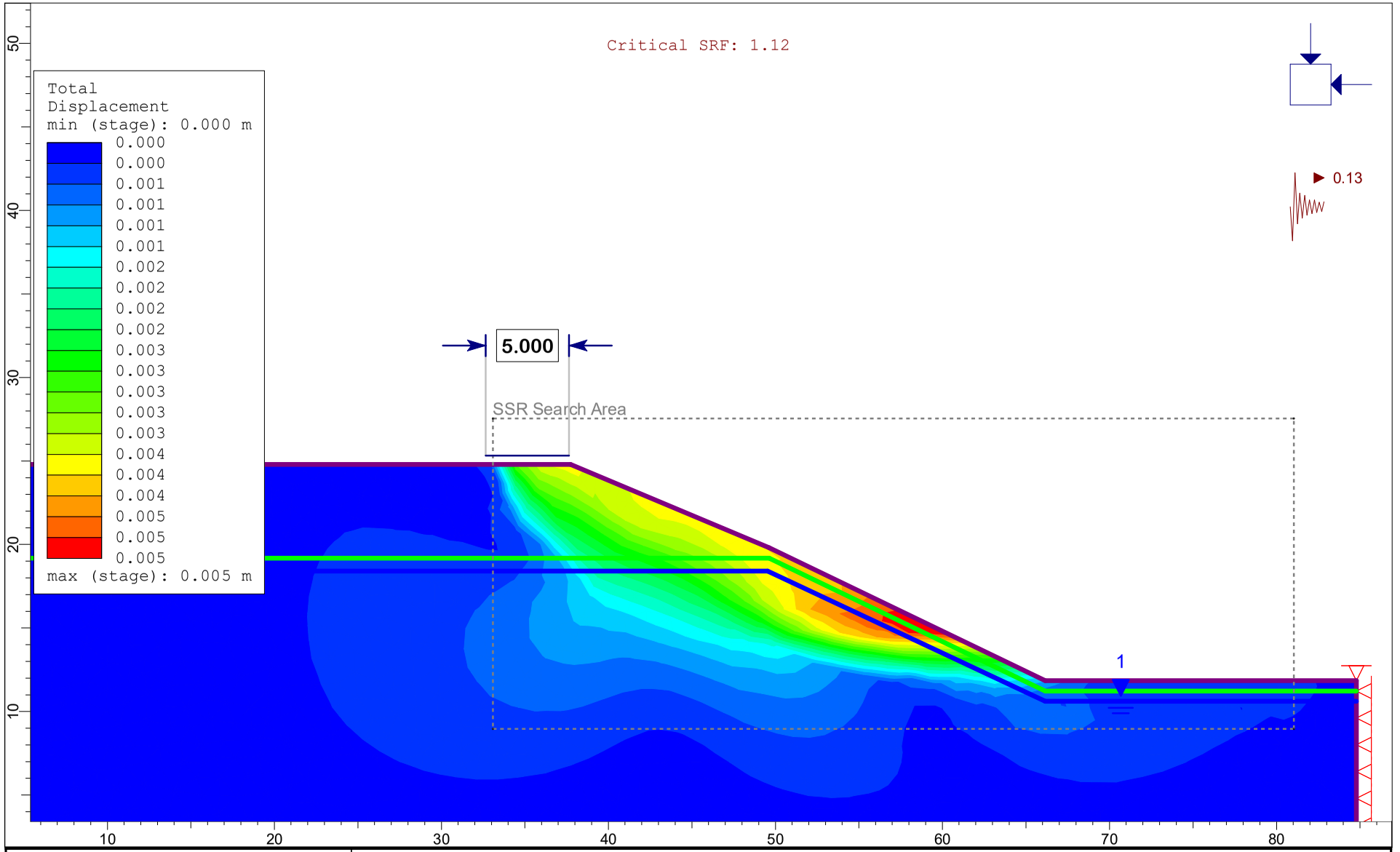
RDCL

SLIDEINTERPRET 9.009

Project	Otainhanga Rd		
	Fill Slope_ULS		
Drawn By	CAW	*Company*	Mr Mansell
Date	9/03/2022	*File Name*	Cross sections_Natural_Fill.slmd

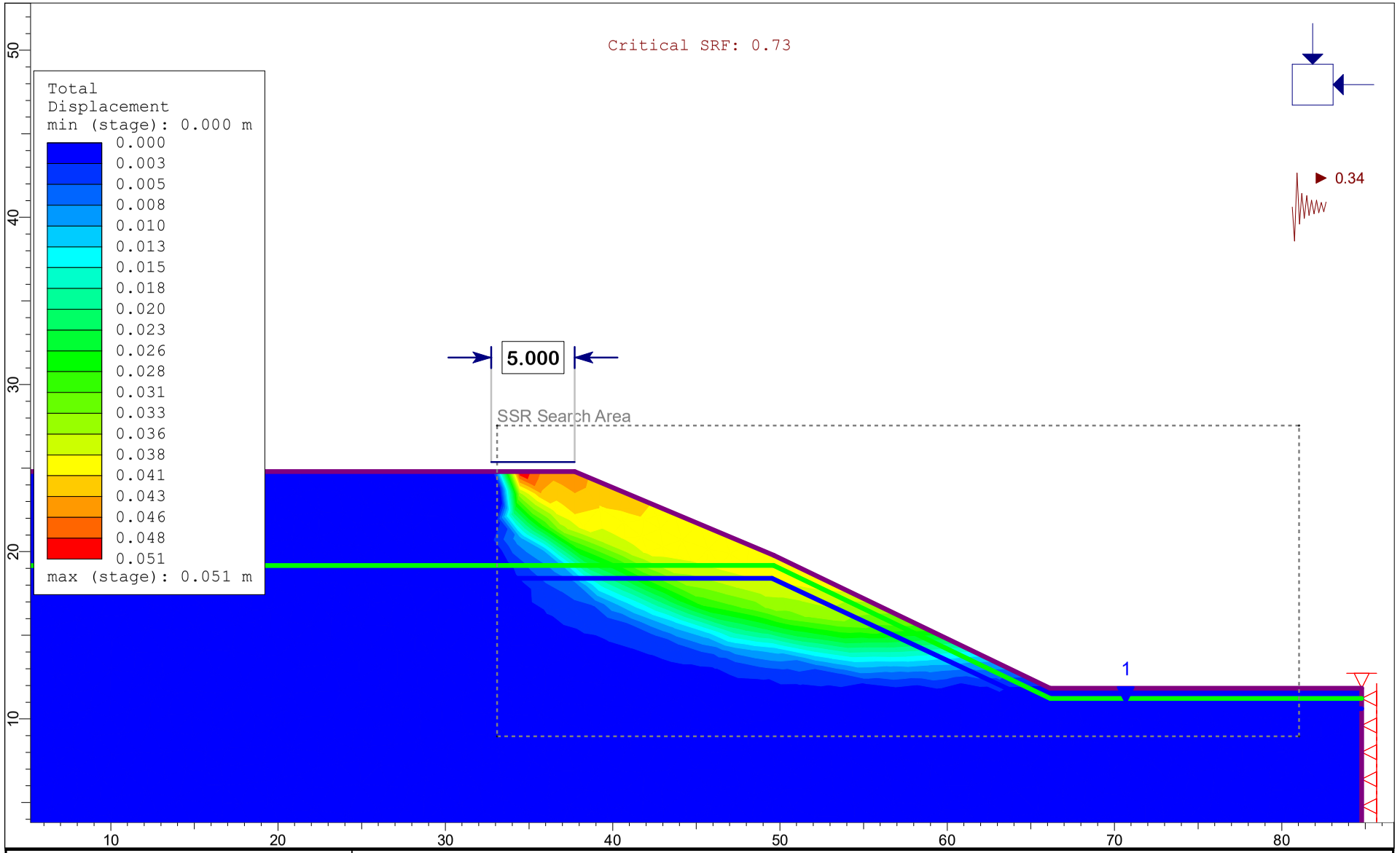


RDCL	Project: 131 Otaihanga Rd		
	Analysis Discription: Fill_Displacement_Static		
	Drawn By: BB	Scale: 1:320	Company: RDCL
	Date: Converted 07-Mar-22, 4:37:55 PM		File Name: Converted from Slide v9.009 with RS2 11.007



RDCL	*Project*	131 Otaihnaga Rd		
	Analysis Description	Fill Slope_SLS.fez		
	Drawn By	CAWylie	*Scale* 1:320	*Company* Resource Development Consultants Ltd
	Date	10/03/2022		*File Name* Fill Slope_SLS.fez

INTERPRET 11.007



RDCL	*Project*	131 Otaihnaga Rd		
	Analysis Description	Fill Slope_ULS.fez		
	Drawn By	CAWylie	*Scale* 1:320	*Company* Resource Development Consultants Ltd
	Date	10/03/2022		*File Name* Fill Slope_ULS.fez

INTERPRET 11.007

Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled*. No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

This Report May Not Be Reliable

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be*, and, in general, *if you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying it. A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed*. The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation*.

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

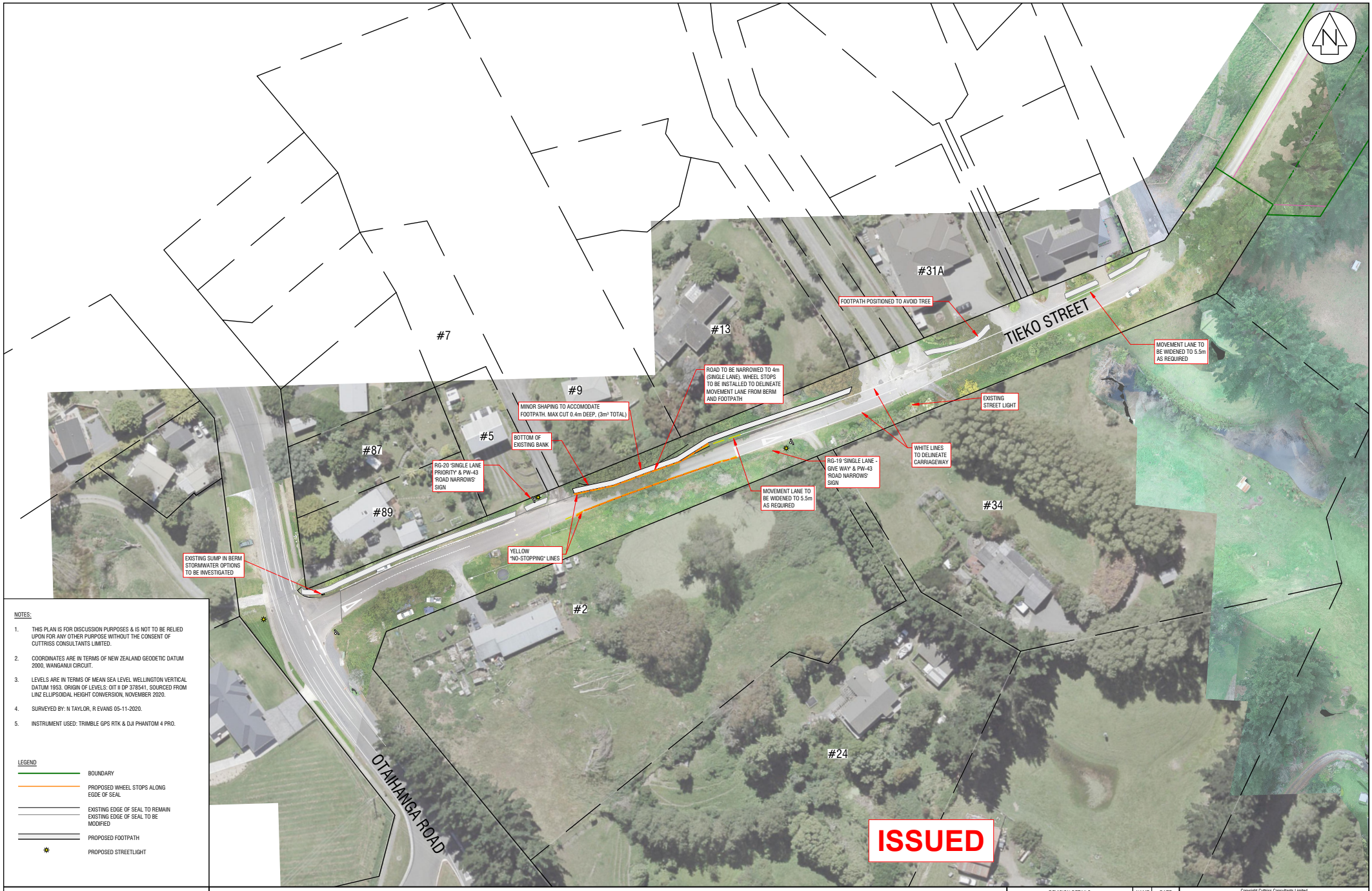
The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old.*

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration.*** Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

Telephone: 301/565-2733
e-mail: info@geoprofessional.org www.geoprofessional.org



NOTES:

1. THIS PLAN IS FOR DISCUSSION PURPOSES & IS NOT TO BE RELIED UPON FOR ANY OTHER PURPOSE WITHOUT THE CONSENT OF CUTTRISS CONSULTANTS LIMITED.
2. COORDINATES ARE IN TERMS OF NEW ZEALAND GEODETIC DATUM 2000, WANGANUI CIRCUIT.
3. LEVELS ARE IN TERMS OF MEAN SEA LEVEL WELLINGTON VERTICAL DATUM 1953. ORIGIN OF LEVELS: OIT II DP 378541, SOURCED FROM LINZ ELLIPSOIDAL HEIGHT CONVERSION, NOVEMBER 2020.
4. SURVEYED BY: N TAYLOR, R EVANS 05-11-2020.
5. INSTRUMENT USED: TRIMBLE GPS RTK & DJI PHANTOM 4 PRO.

LEGEND

- BOUNDARY
- PROPOSED WHEEL STOPS ALONG EGDE OF SEAL
- EXISTING EDGE OF SEAL TO REMAIN / EXISTING EDGE OF SEAL TO BE MODIFIED
- PROPOSED FOOTPATH
- PROPOSED STREETLIGHT

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PROJECT

TIEKO STREET UPGRADE

OVERVIEW

CLIENT

MANSELL

REVISION DETAILS		NAME	DATE
A	CROSS SECTION ADDED	NHT	06-21
B	ROAD MARKING DETAIL ADDED	NHT	08-21

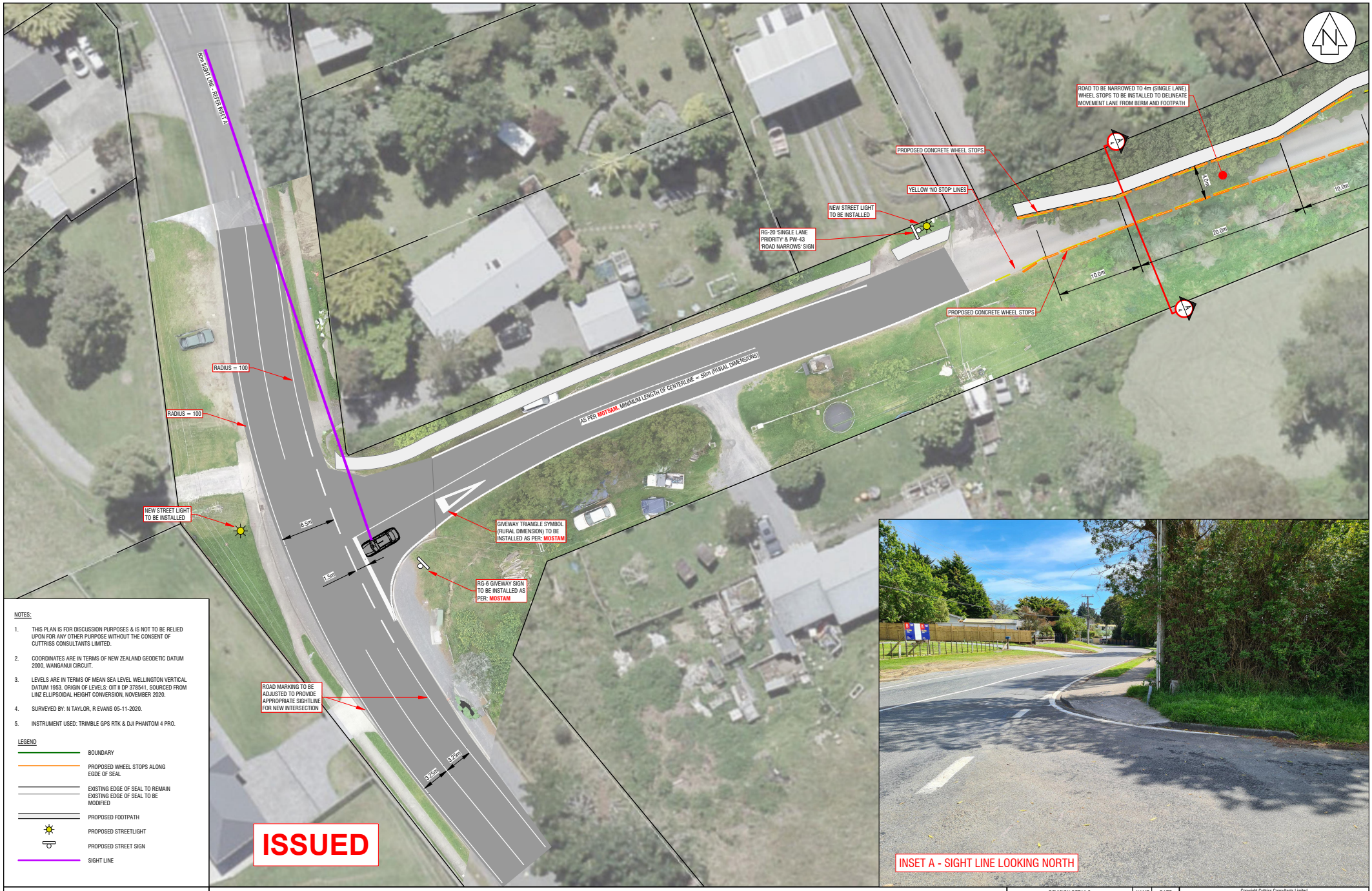
SCALE A1 1:500 | REDUCED SCALE A3 - 1:1000

	NAME	DATE
FIELDWORK	NKT	08/20
DESIGNED	TWC	11/20
DRAWN	TWC	11/20
CHECKED	NKT	11/20

DRAWING NUMBER 22208 SK3

SHEET 1 OF 4 SHEETS

REVISION B



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4. SURVEYED BY: N TAYLOR, R EVANS 05-11-2020.
5. INSTRUMENT USED: TRIMBLE GPS RTK & DJI PHANTOM 4 PRO.

LEGEND

- BOUNDARY
- PROPOSED WHEEL STOPS ALONG EGDE OF SEAL
- EXISTING EDGE OF SEAL TO REMAIN / EXISTING EDGE OF SEAL TO BE MODIFIED
- PROPOSED FOOTPATH
- PROPOSED STREETLIGHT
- PROPOSED STREET SIGN
- SIGHT LINE

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PROJECT

TIEKO STREET UPGRADE

ENGINEERING DETAIL - INTERSECTION ROAD MARKING AND SIGHT LINE

CLIENT

MANSELL

REVISION DETAILS		NAME	DATE
A	CROSS SECTION ADDED	NHT	06-21
B	ROAD MARKING DETAIL ADDED	NHT	08-21

SCALE A1 1:500 | REDUCED SCALE A3 - 1:1000

	NAME	DATE
FIELDWORK	NKT	08/20
DESIGNED	TWC	11/20
DRAWN	TWC	11/20
CHECKED	NKT	11/20

DRAWING NUMBER 22208 SK3

SHEET 2 OF 4 SHEETS

REVISION B

NOTES:

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4. SURVEYED BY: N TAYLOR, R EVANS 05-11-2020.
5. INSTRUMENT USED: TRIMBLE GPS RTK & DJI PHANTOM 4 PRO.

LEGEND

- BOUNDARY
- PROPOSED WHEEL STOPS ALONG EGDE OF SEAL
- EXISTING EDGE OF SEAL TO REMAIN
  EXISTING EDGE OF SEAL TO BE MODIFIED
- PROPOSED FOOTPATH
- PROPOSED STREETLIGHT
- PROPOSED STREET SIGN

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PROJECT

TIEKO STREET UPGRADE

ENGINEERING DETAIL - SINGLE LANE DELINEATION

CLIENT

MANSELL

REVISION DETAILS		NAME	DATE
A	CROSS SECTION ADDED	NHT	06-21
B	ROAD MARKING DETAIL ADDED	NHT	08-21

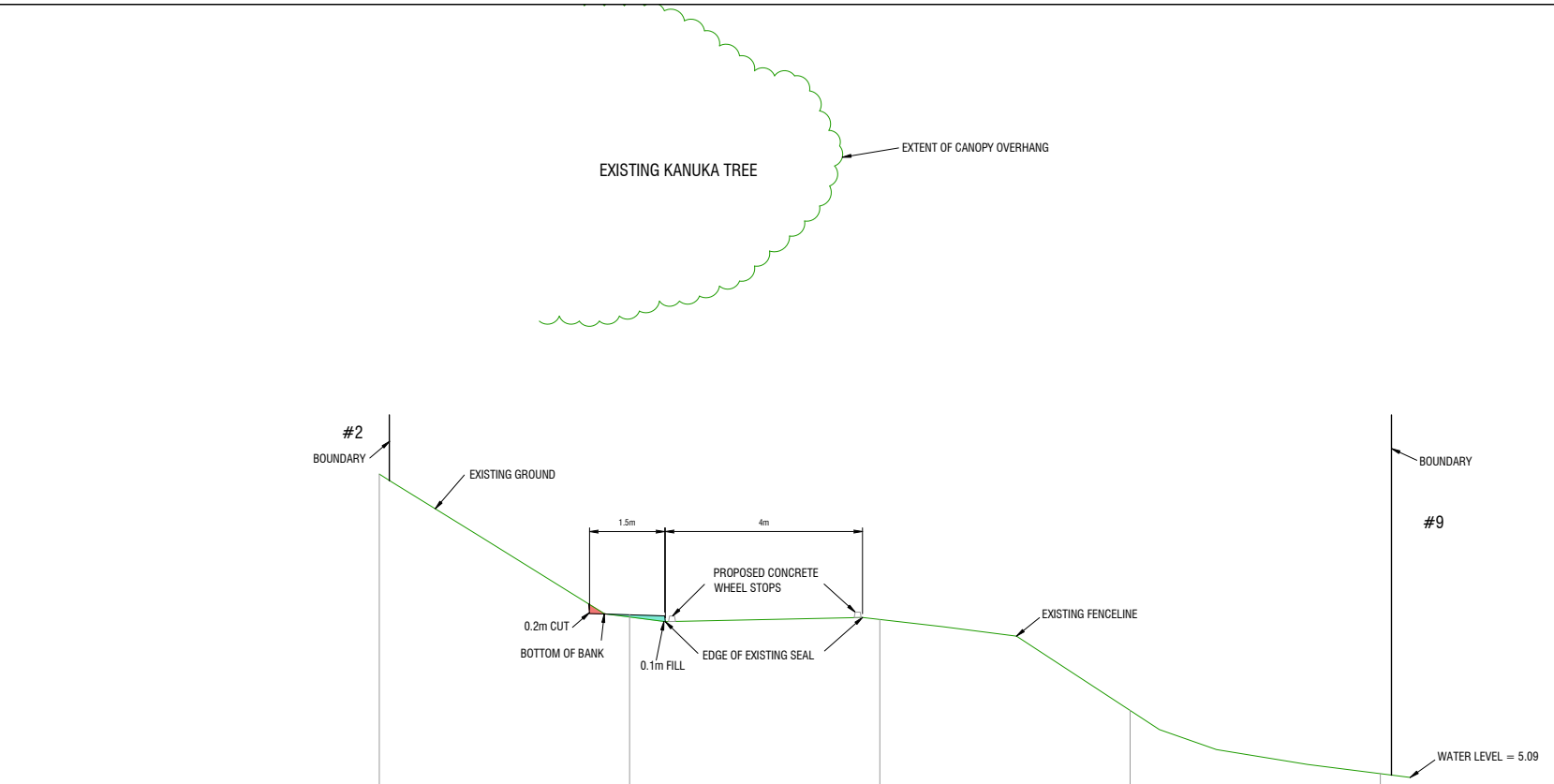
SCALE A1 1:100 | REDUCED SCALE A3 - 1:200

	NAME	DATE
FIELDWORK	NKT	08/20
DESIGNED	TWC	11/20
DRAWN	TWC	11/20
CHECKED	NKT	11/20

DRAWING NUMBER 22208 SK3

SHEET 3 OF 4 SHEETS

REVISION B



A/2 CROSS SECTION AA DATUM = 4

DESIGN LEVEL		8.34			
GROUND LEVEL	11.15	8.3	8.25	6.43	5.17
CHAINAGE	0	5	10	15	20

NOTES:

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4. SURVEYED BY: N TAYLOR, R EVANS 05-11-2020.
5. INSTRUMENT USED: TRIMBLE GPS RTK & DJI PHANTOM 4 PRO.

ISSUED

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PROJECT
TIEKO STREET UPGRADE
CROSS SECTION

CLIENT
MANSELL

REVISION DETAILS		NAME	DATE
A	CROSS SECTION ADDED	NHT	06-21
B	ROAD MARKING DETAIL ADDED	NHT	08-21

SCALE A1 1:50 | REDUCED SCALE A3 - 1:100

	NAME	DATE
FIELDWORK	NKT	08/20
DESIGNED	TWC	11/20
DRAWN	TWC	11/20
CHECKED	NKT	11/20

DRAWING NUMBER 22208 SK3

SHEET 4 OF 4 SHEETS

REVISION B

Otaihanga Estates

Suggested REVISED Draft Conditions for KCDC Consents

08 April 2022

Introduction

The following REVISED suggested draft conditions for [RM210147] build on the suggested draft conditions provided to Council in September 2021 as part of the response to request for further information under s.92 of the RMA, and include responses to further meetings held with Council's Roading and 3-Waters Teams in November 2021, the Peer Review of the Landscape & Visual and Geotechnical Technical Reports, and the post notification further information request received on 21 January 2022.

These draft conditions are offered on a '**WITHOUT PREJUDICE**' basis.

Earthworks

Condition #	Suggested Condition (or similar)
E1	All construction shall proceed in general accordance with the Construction Management Plan (CMP) to be prepared by a suitably qualified person and certified by Council's Development Engineer under [RM210147] prior to any construction activity being undertaken. The Development Engineer is to confirm certification within 20 working days of receipt of the CMP. The CMP shall include how the following construction effects will be managed through the construction period and how the construction related conditions of consent shall be complied with: a) Construction Traffic (refer to Condition R3) b) Earth-worked material tracking onto the road c) Dust d) Noise and hours of operation e) Stormwater runoff (as per conditions ST1 - 8 below) f) Animal pest control prior to and during construction The approved CMP shall be implemented and maintained throughout the entire earthworks and construction period, any proposed amendments to the plan shall be submitted to the Council's Development Engineer for consideration and approval.
E2	All earthworks staging, stabilisation and monitoring are to be undertaken in accordance with the Preliminary Erosion & Sediment Control Plan (ESCP) provided with [RM210147] in Appendix C of the Infrastructure Engineering Report prepared by Cuttriss dated 29 June 2021, further information provided in the s92 response, or any subsequent updated version agreed with Council. ***Note***: *A Consent Notice under Section 221 of the Resource Management Act 1991 (RMA) will be issued to facilitate the recording of requirements recommended in the Geotechnical Completion Report, which is to be complied with on an on-going basis*.
E3	The consent holder shall undertake earthworks in accordance with Part 3C & Part 4 Schedule 2 of the Subdivision and Development Principles and Requirements 2012 (SDPR:2012) and Section 2 of NZS4404:2010 unless otherwise agreed with the

	Council's Development Engineer in writing. Upon completion of the earthworks the consent holder shall provide a certificate in the form of Schedule 2A of NZS4404:2010 by the geo-professional to the Council's Development Engineer. Prior to the issue of a Section 224(c) certificate the consent holder shall supply to the satisfaction of the Council's Development Engineer a report by a suitably qualified person detailing site investigation work and findings together with recommendations for foundation design for Lots 1 - 47. ***Note:*** *A Consent Notice under Section 221 of the RMA will be issued to facilitate the recording of this condition which is to be complied with on an on-going basis.*
E4	The consent holder shall ensure: a) A minimum batter slope of 1V:2H for permanent batters in loose material and 1V:1.5H in dense material b) A minimum batter slope of 1V:1.5H for temporary batters in loose material and 1V:1H in dense material c) A nominal building restriction zone of 3m is established from natural slopes exceeding 15° (from the top and base of slopes); d) Building within these zones must take into consideration the potential for slope instability; e) NZS3604:2011 setbacks are met for fill batters.
E5	The consent holder shall ensure all silt fences shall be installed and maintained in accordance with the GWRC ESC Guidelines.
E6	The consent holder shall ensure the location of topsoil stockpile sites shall be identified using criteria included in the Preliminary ESCP provided with [RM210147] prior to commencement of construction activities; the management of the topsoil stockpile sites shall be undertaken in accordance with the measures included in the Preliminary ESCP provided with [RM210147].
E7	The consent holder shall ensure the disposal of unsuitable material shall only be to the sites identified on Sheet 3 of the Scheme Plans provided with [RM210147], unless otherwise agreed in writing with Council; management of these sites shall be undertaken in accordance with the measures included in the Preliminary ESCP provided with [RM210147].
E8	All earthworks are subject to the Archaeology Management Plan (AMP) prepared under Archaeology Authority #2020/378 and the roles and responsibilities and discovery protocols included in the AMP should any archaeological remains be found; monitoring of all earthworks shall be consistent with the AMP and with Appendix A of the Te Ātiawa Kaitiakitanga Plan.

Subdivision

Condition #	Suggested Condition (or similar)
SUB1	The e-survey dataset shall be in general conformity with the scheme plans included in Appendix C of the application as Drawing Number 22208 SCH1, or the FINAL version of those approved plans provided by the Applicant should amendments be made during the consenting process.
SUB2	A benchmark level reference point, with respect to Mean Sea Level (Wellington) shall be provided within close vicinity of the subdivision.

SUB3	Easements are required over any rights of ways and communal, private and public services where these pass through the lots in the subdivision; easement documents shall be prepared by solicitors at the consent holder's expense. ***Note**: The applicant has a separate resource consent granted by Council [RM210172] to undertake a boundary adjustment to separate the access lots with easements and rights of way to the eastern side of the property severed by the Kapiti Expressway. A certificate has been issued under S243(e) of the RMA to remove the redundant easements (including rights of way).*

Buildings

Condition #	Suggested Condition (or similar)
B1	Following the completion of earthworks, if any areas of unsuitable material placed during the works are identified by a suitably qualified and experienced geo-professional, these areas shall be shown on the land transfer title plan. Any buildings within these areas must take into account the recommendations of the Site Investigation Report, required by Condition E3. ***Note**: If required, a Consent Notice under Section 221 of the RMA will be issued to facilitate the recording of this condition which is to be complied with on an on-going basis.*
B2	The consent holder shall ensure a Consent Notice pursuant to section 221 of the RMA is registered against the titles of proposed Lots 23 - 47. This must state: The construction of any new buildings within Lots 23 - 47 shall be subject to a reduced yard setback requirement of 4.5m from the road boundary, 3m rear yard, and 3m for one side and 1.5m for all other sides. If the relevant permitted standards of the District plan are less restrictive than these specified reduced setbacks at the time of construction, the District Plan standards will apply. ***Note**: The condition above must be the subject of a Consent Notice under section 221 of the RMA and registered against the new Record of Title for Lots 23 - 47. The section 221 Consent Notice shall be prepared by Council at the cost of the consent holder. The section 221 Consent Notice shall be issued with the section 224(c) certificate to facilitate the recording of this condition which is to be complied with on an on-going basis.*
B3	The minimum floor level to the underside of the floor joist or under side of the slab of any new habitable dwelling constructed on Lots 6 and 7 shall be above the recommended building level set by Council at the time of application for building consent. ***Note:** A Consent Notice under Section 221 of the RMA will be issued for Lots 6 and 7 to facilitate the recording of this condition, which is to be complied with on an ongoing basis.*
B4	No buildings within Lots 1-22 shall be constructed with zinc or copper roofing materials, or use lead paints. ***Note:** A Consent Notice under Section 221 of the RMA will be issued for Lots 1-22 to facilitate the recording of this condition, which is to be complied with on an ongoing basis.*

Stormwater

Condition #	Suggested Condition (or similar)
ST1	Prior to works commencing, the consent holder shall submit copies of the plans and specifications for the engineering development to the Council's Development Engineer for approval. The Development Engineer is to confirm approval within 20 working days of receipt of the plans and specifications. The engineering development must be in accordance with Paragraphs 1 to 5 of Schedule 1 contained in Part 4 of Council's SDPR: 2012 and the technical reports prepared by Awa and Cuttriss as part of the resource consent application, including information provided by the applicant in part of the S92 response. ***Note:*** *Engineering drawings shall contain sufficient detail to clearly illustrate the proposal to enable assessment of compliance with Council's SDPR: 2012 and to enable accurate construction.* ***Note:*** *The consent holder shall provide hydraulic modelling of the detail design of the stormwater devices to demonstrate they will achieve the outcomes intended in the Awa Technical Report.* ***Note:*** *The consent holder shall undertake the detailed design in consultation with GWRC and provide evidence to the Council's Development Engineer of the consultation undertaken and GWRC's agreement to the final design.*
ST2	In the northern area, the consent holder shall ensure: 1. The discharge of stormwater within Lot 101 from the access road into swales, through an under-drain bio-filtration device prior to discharge to land as per the Awa preliminary design included in the Awa Technical Report accompanying the application. 2. The discharge of stormwater within Lots 1 – 22 the consent holder shall ensure the discharge of stormwater from roofs into an appropriately designed and sized on-site soakage pit and the discharge of stormwater from access roads into swales, through an under-drain bio-filtration device prior to discharge to land as per the Awa preliminary design included in the Awa Flood Hazard Report (Appendix H dated 29/6/2021) which accompanied the consent application. 3. The consent holder may propose alternatives that would need to be accepted by the Council's Development Engineer. An updated report must be provided for an alternative solution. ***Note****: In the event that the certified stormwater disposal design is not installed prior to the issue of the 224(c) certificate, a Consent Notice under Section 221 of the RMA will be issued to facilitate the recording of this condition, which is to be complied with on an on-going basis. The Consent Notice shall include reference to the following:* - *The certified stormwater disposal design as an option for compliance;* - *The owners' responsibility to construct a system to meet the above performance standard;* - *The owners' responsibility to maintain the system on an on-going basis to meet the above performance standard as it applied at the time of approval.* ***Note****: The consent holder shall undertake the detailed design required for the discharge of stormwater from roofs in consultation with GWRC and provide evidence to the Council's Development Engineer of the consultation undertaken and GWRC's agreement to the final design.*
ST3	In the southern area, the consent holder shall ensure:

	a) discharge of stormwater from roofs, driveways and access road to be collected and conveyed using traditional curb and channel into the proposed controlled compensatory storage area (constructed wetland) located in Lot 200; b) the open channel adjacent to Otaihanga Road is modified as part of the formalisation of the compensatory storage area; c) a non-return value is installed as per the Awa preliminary design included in the Awa Technical Report accompanying the application.
ST4	The consent holder shall provide appropriate planting of constructed wetland area in Lot 200 to filter out potential contaminants from stormwater discharge in accordance with the Planting Plan provided in the Landscape & Visual Assessment Technical Report accompanying the application, or an amended Planting Plan that will achieve the same or better outcomes, prior to the vesting of Lot 200 with Council. ***Note:*** *The consent holder shall prepare the Planting Plan in consultation with GWRC and provide evidence to the Council's Development Engineer of the consultation undertaken and GWRC's agreement to the Planting Plan.*
ST5	The consent holder shall install of an overflow pipe in the Otaihanga Road reserve adjacent to the Waka Kotahi (NZ Transport Agency) property immediately east of the southern area of the site to allow discharge from that site of ponding caused in a 100-year flood event as shown in the Awa Technical Report accompanying the application.
ST6	The consent holder shall provide Council with a comprehensive Maintenance and Operations Manual for the stormwater disposal systems prior to vesting with Council. The Operations and Management Plan shall include details of the operation and maintenance of the Constructed Wetlands Swales, including a programme for inspection and maintenance of vegetation associated with the stormwater devices including the replacement of plants and the control of pest plants and animals to be undertaken by the consent holder for a minimum of 5 years after vesting with Council. ***Note:*** *The consent holder shall prepare the Maintenance and Operations Manual for the stormwater disposal system in consultation with GWRC and provide evidence to the Council's Development Engineer of the consultation undertaken and GWRC's agreement to the final manual.*
ST7	Lot 200 shall be vested in Council as Local Purpose Reserve (stormwater). ***Note****: The consent holder must meet any requirements of GWRC consent [WGN210352] conditions relevant to Lot 200 prior to vesting in Council.*
ST8	Completion documentation shall be submitted in support of an application for Section 224(c) certification in accordance with Part 1 of NZS 4404:2010 and Part 4, Schedule 1 of Council's SDPR:2012. The consent holder shall provide Council with an itemised schedule of quantities and costs, and the CCTV inspection reports, for those stormwater services and assets which are to be vest in Council.

Wastewater

Condition #	Suggested Condition (or similar)
WW1	The subdivision shall be serviced by a Pressure Sewer System designed in accordance with the Council's SDPR:2012, as well as any other relevant Council policy relating to the design and construction of Pressure Sewer Systems.
WW2	Engineering drawings supported by hydraulic calculations shall be sent to the Development Engineer for Engineering acceptance prior to the commencement of

	any physical work. The Development Engineer is to confirm acceptance within 20 working days of receipt of the engineering drawings and hydraulic calculations.
WW3	The Approved Sanitary Sewer outfall for the common Council pressure sewer main shall be the manhole KWWN004946.
WW4	Each lot shall have a Boundary Kit located within the legal Road, or Right of Way outside the boundary of the lot. The pressure lateral from the Boundary Kit is to extend at least 600mm into the lot. The Boundary Kit and lateral shall be installed for all properties in a pressure zone prior to section 224(c) certification.
WW5	Installation of the common pressure sewer main and boundary kits in roads to vest shall be carried out by a Council Authorised Drainlayer.
WW6	Transfer of ownership (vesting) of reticulated pressure system to the Council will occur at the time of section 224(c) certification.
WW7	The consent holder shall provide Council with a comprehensive Maintenance and Operations Manual for the wastewater disposal systems that includes specifying the responsibilities of the property owner for their respective part of the system (including the Boundary Kit and lateral infrastructure) prior to vesting with Council.
WW8	The following conditions shall be recorded pursuant to Section 221 of the RMA in a Consent Notice registered on the titles of each residential lot: a) Each residential lot shall be served by a local pressure sewer unit comprising a pump and storage chamber which can accommodate at least 24 hours average dry weather flow to be supplied by Aquatec, EcoFlow or another Council approved supplier. b) The property owner shall retain ownership of the local pressure sewer unit complete with pump, chamber and control equipment. The property owner will be responsible for the operation and maintenance of the complete system, including the lateral, up to the boundary kit, in accordance with the Maintenance and Operations Manual prepared by the consent holder as required by Condition WW7. c) The electricity supply for the local pressure sewer unit shall be from the dwelling and metered to the dwelling serviced by the pump unit. The property owner shall be responsible for paying the power costs of operating the unit. d) Installation of the pressure sewer unit must be carried out by a Registered Drainlayer. e) The registered proprietor of the Lot agrees, in relation to the Pressure Sewer System to be bound by and comply with Council's standards, policies and requirements in relation to Pressure Sewer Systems. f) If the registered proprietor of a Lot leases the Lot or enters into a tenancy agreement in relation to the Lot or otherwise gives occupation of the Lot to a party other than the registered proprietor then the registered proprietor shall ensure the occupier is aware of the obligations contained herein. ***Note**: This is an on-going condition and a Consent Notice will be issued under section 221 of the RMA at the time of section 224(c) certificate. The Council is responsible for the infrastructure in the road, up to and including the boundary kit.*

Water

Condition #	Suggested Condition (or similar)
W1	Prior to works commencing, the consent holder shall submit copies of the plans and specifications for the water infrastructure for approval to the satisfaction of the Council's Development Engineer. The water infrastructure must be in accordance with Paragraphs 1 to 5 of Schedule 1 contained in Part 4 of Council's SDPR:2012

	and the technical reports prepared by Awa and Cuttriss as part of the resource consent application, including information provided by the applicant in part of the S92 response. No works shall commence until the plans are approved by the Council's Development Engineer. The Development Engineer is to confirm approval within 20 working days of receipt of the plans and specification for the water infrastructure. ***Note:*** *Engineering drawings shall contain sufficient detail to clearly illustrate the proposal to enable assessment of compliance with Council's SDPR:2012 and to enable accurate construction.*
W2	Fire-fighting requirements shall comply with the New Zealand Fire Service Fire-fighting Water Supplies Code of Practice SNL 4509:2008.
W3	Completion documentation, including operation and maintenance manuals, shall be submitted in support of an application for Section 224(c) certification in accordance with Part 1 of NZS 4404:2010 and Part 4, Schedule 1 of Council's SDPR:2012. The consent holder shall provide Council with an itemised schedule of quantities and costs for those water services and assets which are to be vest in Council.

Roading/Transport

Condition #	Suggested Condition (or similar)
R1	The consent holder shall ensure the access roads, layout and corridor design, and shared use path network is established in general accordance with the plans included in Appendix C of the application as Drawing Number 22208 SCH1. The final details of road design and construction shall be submitted to the Council's Development Engineer for certification in writing prior to the commencement of any construction. The Development Engineer is to confirm certification within 20 working days of receipt of the final details of road design and construction plans.
R2	The consent holder shall provide a new intersection on Otaihanga Rd with a right turn bay providing access to southern area to comply with Austroads standards as shown in the scheme plans included in Appendix C of the application as Drawing Number 22208 SCH1. The final design of the new intersection is to be provided to the Council's Development Engineer for certification in writing prior to the commencement of any construction. The Development Engineer is to confirm certification within 20 working days of receipt of the final design of the new intersection.
R3	The consent holder shall prepare a Construction Traffic Management Plan (CTMP) to cover such matters as: a) Methods to minimise the use of Tieko Street by construction traffic; inclusion of forecasts of vehicle types and daily volumes (typical & peak) using each site access point during the various stages of construction b) Ensuring additional damage by construction traffic to the road pavement on Tieko Street is avoided; a baseline pavement condition inspection will be undertaken prior to construction and the CTMP would provide a mechanism for the repair of the road pavement back to baseline standard c) Ensuring the safe interaction between all road users (including pedestrians) on Tieko Street and construction traffic, with particular consideration of pedestrians and cyclists d) Ensuring the safe crossing of the site accesses on Otaihanga Road with particular regard to the existing frontage shared path e) Ensuring the safe turning of construction traffic to and from Otaihanga Road and any site access points; consideration should be included of the early formation of the proposed new Otaihanga Road intersection f) Construction traffic movements on Tieko Street during daylight hours only given the lack of lighting

	g) Avoid construction traffic activity on weekends and public holidays when recreational use of the existing Otaihanga Road shared path can be expected to be busier h) Methods to minimise debris being carried onto local roads i) All construction traffic to park within the site; and j) Description of how construction traffic activity will be communicated to local residents along with an incident reporting process. The CTMP is to be provided to the Council's Development Engineer for certification in writing prior to the commencement of any construction. The Development Engineer is to confirm certification within 20 working days of receipt of the CMTP.
R4	The consent holder will facilitate, in collaboration with Council's Roading Engineer, the trimming/removal of planting along Otaihanga Road at the Tieko Street intersection to meet Austroads sight line standards, prior to the completion of the subdivision and development.
R5	The consent holder shall ensure the provision and design of the shared use path meet the relevant CPTED standards for intended purpose and use of the facility where practicable.
R6	Lots 100 – 104 shall be vested in Council or be dedicated as road.
R7	The consent holder is required to submit to Council's Roading Engineer a post construction safety audit undertaken by a suitably qualified person confirming the intersection providing new access to the southern part of the site, and the Tieko Street intersection, is meeting Austroads safety standards. If Austroads safety standards are not being met, the consent holder shall submit to Council's Roading Engineer an amended design that would meet these standards.

Environmental

Condition #	Suggested Condition (or similar)
EN1	The consent holder shall provide an on-site 1ha northern grass skink habitat area to be fenced and planted around northern most wetland (Lot 5) as shown in the scheme plans included in Appendix C of the application as Drawing Number 22208 SCH1. The consent holder shall prepare a Lizard Management Plan to meet any requirements of the Wildlife Act to establish the skink habitat area, and provide a copy to Council for information purposes. ***Note:*** *The consent holder will need a Wildlife Act permit for the handling and translocation of northern grass skink, and the Lizard Management Plan will be required by that permit issued by the Department of Conservation. Refer to the Advice Note below that requires a covenant be placed on the Certificate of Title of Lot 5 that contains the proposed skink habitat.*
EN2	The consent holder shall ensure natural wetlands are fenced to provide a 10m buffer (except where already fenced or the wetland and/or buffer area would exceed the site boundary); undertake weed pest control; undertake planting with appropriate wetland species (as per the Wildlands Report and Landscape Concept Plan accompanying the application), prior to the Certificate of Title being issued for a lot that includes a natural wetland. ***Note****: A Consent Notice under Section 221 of the RMA will be issued for any lot that include natural wetlands to ensure the long term management of the 10m buffer by the new lot owner. Where practicable, the edges of wetlands are to be retained as natural as possible.*

EN3	The consent holder shall ensure the kānuka stands identified in the Wildlands Report (Appendix G accompanying the application) has pest plant management and underplanting within the groves undertaken prior to the Certificate of Title being issued for a lot that include kānuka stands. ***Note**: A Consent Notice under Section 221 of the RMA will be issued for any lot that include kānuka stands to ensure the long term management of the stands by the new lot owner.*
EN4	The consent holder shall ensure all woody vegetation to be removed during construction is undertaken outside of the bird breeding season (September – March (if possible)) ***Note**: If removal of woody material occurs within the bird breeding season, a suitably qualified ecologist should undertake a visual survey for active bird nesting within 48 hours from the commencement of the works. If active nests are observed these should be taped off and clearing should not occur until such time as fledglings have left the nest.*
EN5	The consent holder shall implement the Planting Plan included in the Landscape & Visual Assessment Technical Report accompanying the application, prior to the Certificate of Title being issued for lots identified as having amenity planting.
EN6	The consent holder shall implement the Landscape Concept Plan included in the Landscape & Visual Assessment Technical Report accompanying the application, prior to the Certificate of Title being issued for the subdivision.
EN7	The existing Kānuka stands identified within Lots 1, 2, 5 and 20 on sheet 3 of the Cuttriss Consultants plan number 22208 SCH1 Rev K shall not be modified or removed, other than for the removal of pest species or for the control of fire or other hazard. ***Note:** A Consent Notice under Section 221 of the RMA will be issued for Lots 1, 2, 5 and 20 to facilitate the recording of this condition, which is to be complied with on an ongoing basis.*
EN8	The following activities are prohibited within the 10m fenced wetland buffer identified within Lots 1, 5, 14-18 and 20 on sheet 3 of the Cuttriss Consultants plan number 22208 SCH1 Rev K: • The placement of rubbish or green waste; • The construction of any building or structure; • The removal of any indigenous vegetation and/or planting of any exotic vegetation. ***Note:** A Consent Notice under Section 221 of the RMA will be issued for Lots 1, 5, 14-18 and 20 to facilitate the recording of this condition, which is to be complied with on an ongoing basis.*

Term of Consent

Under Section 125 of the Resource Management Act 1991, this resource consent lapses 10 years after the date of commencement of consent.

Advice Note

- Under Section 125 of the Resource Management Act 1991, this resource consent will lapse in ten years, unless it is given effect to within that time.

- The consent holder is required to place a Consent Notice on the Certificate of Titles to control the following matters:
    - No build areas/no land disturbance areas/geotechnical setback requirements – to restrict any buildings/land disturbance on dunes and ridgelines in Lots 6 – 11; 18; 21 – 22; 25 – 30; and 47 - 49 shown on Sheet 3 of the Scheme Plans 22208 SCH1 included in Appendix C of the AEE are adhered to.
    - Proposed Fill Area (unsuitable material) – to restrict any buildings/land disturbance within the areas identified on Lots 11, 12 and 30 shown in Sheet 3 of the Scheme Plans 22208 SCH1 included in Appendix C of the AEE.

- The consent holder is required to place a covenant on the Certificate of Titles to control the following matters:

    - Proposed Lizard Habitat – to require the on-going protection of the 1ha area for the northern grass skink around the northern most natural wetland area (Lot 5).
    - Fencing – to require fencing types within identified areas to meet the specifications in accordance with Landscape Concept Plan included in Appendix D of the AEE to ensure open space character is retained. No front fences along properties adjoining the access road to the southern area.

Dray Report

29th Jan 2022

Morena Chris

The Dray Track would have been formed by Manawhenua of Otaihanga as they trekked between hapu settlements within the Kenakena, Paraparaumu and Waikanae lands

Early Certificate of Titles (C.T.s) identify maori occupation within the Mansell Development, in fact settlement was established throughout the whole of Otaihanga and close to the Waikanae awa. Wetlands are still present and cultivation grounds have been identified within the development. Known hapu of Otaraoa, Puketapu and Ngati Kuri resided here and it would have been these hapu who would have laid out the original Dray track prior to European settlement.

Transporting and exchanging produce between hapu was common. Depending on what soils produced crops, exchanging produce was an important way of life for hapu
Current Wetlands, eel weirs, harakeke would have provided additional kai and uses

The Dray track was a very important means of transport and link to other hapu settlements including the Waikanae awa.

Horses, buggies were required to transport goods between hapu and the Dray Track would have provided hapu with 'horse drawn plows' to travel between cultivation sites. No doubt there would have been 'protocols' established along the track as kai was transported between settlements and that protocol if broken was taken as being very serious with no doubt consequences for those that broke it

Another important factor was the establishment of a railway station close to where the rail crossing is situated at Otaihanga. Produce could be railed from there into southern communities for sale or just to be exchanged with southern hapu / whanau

I would go so far as to say that our tupuna Wi Parata had some say in insisting that a railway station be established close to the present Otaihanga rail crossing, for the good of the hapu keeping in mind the benefits that would come with the opening of the rail line between Manawatu and Wellington Land that was gifted by Wi Parata on behalf of the Atiawa iwi to the Rail Company in 1884 to complete the railway line between Pekapeka and Otaihanga. History Plaque just inside Southwards Museum gates
The rail station is close to the Mansell Development

So the importance of the Dray Track remaining is important to our iwi history. All steps need to be taken to restore it in some way. It binds the Track to our tupuna and those that whakapapa to them. We need to retain as much early local history as we can when the opportunity arises.

This is such an example. Let's not lose it by having it 'buried' by a road !!

My suggestion is to retain the Dray Track as a Walkway / Pathway / cycleway / horseway for all the community to enjoy. It would be a 'shared' pathway

It would complement the surrounding lands with Wetlands (and noisy frogs) Ngahere, history board / photos explaining yesteryear as it meanders through the sandhills and dune ridges.

We would be following in the footsteps of our tupuna and this opportunity shouldn't be lost or discarded

On behalf of Te Atiawa Iwi I would strongly support the Dray Track being retained as a Walkway / Pathway for all the community to use

The Dray Track must be kept as natural as possible and formed to its original track with possible 'Horse railing stops' along the walkway?
The Track must not impose on the wetlands and must keep away from the northern pa sit Kaiwarehou

We would not like to see any lighting installed as this would take away its importance as an olde Dray Track

A name for the Track will be later given by Ra Higgott, the author of this report. Possible naming for the wetlands is also possible along with History Boards. This would give the community a 'glimpse' of early history in the 1800s.

What a great opportunity to have our history recorded by establishing the Dray Track and look forward to working alongside the development of this Project

Ra Higgott

For Te Atiawa ki Whakarongotai Charitable Trust Taiao Unit

DCM URBAN DESIGN LIMITED
10/245 St Asaph St
Christchurch 8011
www.dcmurban.com

Ref: 2020_142 Mansell Otaihanga Subdivision CPTED_C

Thursday, 17 February 2022

CHRIS HANSEN CONSULTANTS LIMITED
220 Ross Road, RD7
Whakamarama, Tauranga 3179

Email: chris@rmaexpert.co.nz,
phernne.tancock@legalchambers.co.nz
rmansell@coastlands.co.nz

CPTED ASSESSMENT – RURAL RESIDENTIAL SUBDIVISION

OTAIHANGA ESTATES SUBDIVISION

Dear Chris,

The following letter is a CPTED assessment of the subdivision and amended scheme plans 8 and 9 prepared by Cuttriss Consultants dated September 2021, Revision M.

MY BACKGROUND

I am a Principal Landscape Architect at DCM Urban Design Limited, having started work here in April 2021 following 13 years at Christchurch City Council. During this time I attended a course on Advanced Training In CPTED in September 2018. The course was organised by the International Security Management and Crime Prevention Institute (ISMCPI). I have also undertaken several CPTED audits of projects with particular emphasis on public open spaces and residential developments.

THE PROPOSAL BACKGROUND

The resource consent application for the proposed Otaihanga Estates subdivision (including earthworks and infrastructure) proposes a shared use path (SUP) labelled Lot 104 between the northern area (rural-residential lifestyle lots) and the southern area (residential lots). Parts of the proposed SUP more or less follows a Dray Track identified by the Project archaeologist. Local iwi have prepared a Report[1] which highlights the importance of the Dray Track to the local iwi and states a preference for the SUP to be "as natural as possible" without lighting. After lodgement of the resource consent application, the applicant received a s.92 request for further information, which included a request for the SUP (Lot 104) be subject to a CPTED assessment. A response to this request is outlined further below.

The intention of the SUP (Lot 104) was that it would be vested in Council's Parks & Recreation Team as a recreational asset (local purpose reserve (walkway/cycleway/bridleway)) and the maintenance of the walkway would be with Council. However, at a recent meeting with Council's Transport Planners, it was stated that the Parks & Recreation Team did not want the SUP (Lot 104) vested in Council as a local purpose reserve, and instead it would be vested in the

[1] Action Points Attachment 3 - Report from Ra Higgott on behalf of Te Atiawa ki Whakarongotai Charitable Trust 030222

Transport Team (presumably as a road) and would be a strategic accessway linking up two no-exit streets. The Transport Planners have a different view of what standard the SUP (Lot 104) needs to be constructed to, and what lighting it needs (i.e. the strategic access way needs to meet NZS4404:2010). Whether the SUP (Lot 104) is a recreational asset or roading asset is yet to be resolved with Council, but the resource consent application stated it is to be a local purpose reserve managed by the Parks & Recreation Team.

CPTED ASSESSMENT

The s.92 further information request sought the following:

"Applicant to address the CPTED issues in NZS 4404:2010 with regard to path connections, points a), b), c), e) and f) to be addressed (see below) – lighting is required for the entire length especially given the length of the shared path and the potential use by cyclists and pedestrians and motor vehicles:

NZS4404:2010 - 3.3.11.1 FOOTPATHS AND ACCESSWAYS

Footpaths shall be a minimum of 1.5m wide surfaced over their full width. The crossfall should be no greater than 2%. Wider footpaths or areas or local widening will often be required by the TA where higher use or other needs dictate such widening.

Accessways should be provided at no-exit roads or where necessary to improve connectivity. They shall be designed for user safety using crime prevention through environmental design (CPTED) principles and should:

a) ***Be direct and no greater than two properties long;***

Response:

It is considered the SUP is more rural in nature than urban and this CPTED design principle is more appropriate in the urban context. It is noted existing shared paths within the rural parts of Kapiti would not meet this design standard. The proposed SUP is also more open than a typical subdivision accessway with a different character.

b) ***Have good sight lines for passive surveillance with fences a maximum height of 1.2m for 10m from the road frontage, or no fencing;***

The nature and size of the adjacent rural-residential lots may limit the opportunity for passive surveillance from the properties. However, it is noted that the Landscape Concept Plan included in the Landscape and Visual Assessment (Appendix D accompanying the AEE) proposes open style fences, a maximum of 1.2m in height, on either side of the extent of the SUP. This type of fence will retain the openness sought by principle (b).

c) ***Be sited to ensure high levels of community use;***

The proposed SUP is located so that it connects the proposed community park (Lot 105) and access road to the southern area (Lots 23 – 49) to the access road to the northern area (Lots 1 – 22). This will provide a shared path network that loops back to Tieko Street and Otaihanga Road. The location of the SUP is designed to service the entire proposed subdivision, and connect to existing walking/cycling facilities along Otaihanga Road and the Kapiti Expressway.

The SUP is most likely to be used by local residents of the development as opposed to being a through route to other parts of Otaihanga given the existing layout of the area and other available routes.

d) ***Be amenity landscaped without compromising safety;***

Planting is typically restricted to the individual specimen trees with no under planting allowing open sightlines throughout the development. As outlined above, open style fencing will also positively contribute to an open character environment.

e) ***Have provision for the disposal of stormwater;***

The SUP (Lot 104) is not proposed to be sealed, but will be a topped with a fine compacted crusher dust (and permeable) similar to the current path along Otaihanga Road and paths adjoining the Wharemauku Stream in Paraparaumu. This will allow stormwater to go straight to ground as it currently does. Should this part of the SUP be sealed in the future, stormwater disposal could be addressed using a combination of swales and soakage devices within the Lot 104 boundary easement.

f) ***Be provided with pedestrian level lighting; and***

In an environment such as this proposal, pedestrian level lighting is not considered necessary or desired. The SUP is not the only 'link' between areas with alternative routes possible during hours of darkness. The SUP is located in a rural-residential environment where path lighting is not anticipated. I also note that the existing shared path on Otaihanga Road has an unsealed surface and is not lit apart from at intersections.

The SUP is intended to be a daytime recreational facility and the use of the path during the hours of darkness will not be encouraged. Therefore, as discussed with the Council's roading team at a meeting on 24 February, no lighting is proposed. The provision of lighting fittings also reduces the natural character of the northern area which is rural-residential. A number of submitters have responded with concern over the increased 'light pollution' resulting from the development, which street/ pedestrian level lighting is a notable contributor to. The Dray Report[2] also sates a preference for the path to not be lit.

Though these are genuine concerns, they are not an influence on the CPTED assessment of whether the track should be lit or not, as they don not relate to the safe use of the track. It is noted that CPTED in relation to lighting states that it is crucial that lighting sends the right messages to the public about the safe and appropriate use of space at different times of day and night. Lighting should not be provided in areas not intended for night- time use, therefore avoiding a false impression of safety.

g) ***Have a legal width not less than 5.5m.***

Typically shared paths in rural-residential areas are 2.5-3.0m in width maximum. Greater than this, the path takes on the appearance of a road. The legal with of Lot 104 (which the SUP is located) is 5.5m with the formed width being 2.5m – this is consistent with other developments. The surface is proposed to be topped with a fine compacted crusher dust giving the track a lesser hierarchy than surrounding paths while providing an accessible,

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[2] Action Points Attachment 3 - Report from Ra Higgott on behalf of Te Atiawa ki Whakarongotai Charitable Trust 030222

more ‘natural’ and cultural appropriate response. The track width and materiality, in turn elevates submitter concerns over the track being sealed and (potentially) enabling the use of motorised vehicles (motocross and quad bikes) which (could) pose a safety issue for others. Threshold treatments (to be investigated at detail design), at the entrances to the track and selected points along the track can be implemented to deter most motorised vehicles, though not entirely, without compromising accessibility.

CONCLUSIONS

Having reviewed the scheme plan and landscape plan for this project, I consider that the proposal is appropriate for its setting in a rural-residential environment and meets good CPTED Principles for the following reasons:

(a) The environment is safe and secure with long, open views possible resulting in good visibility with clear sightlines;
(b) Passive surveillance is provided from adjoining dwellings with open style fencing proposed along boundaries;
(c) No dense planting is proposed along the edges of the SUP or within the corridor;
(d) There is a clear demarcation of public and private space with the use of farm style fences;
(e) Although no lighting is proposed, I consider this an appropriate design response for this environment and the nature of the SUP.
(f) The use of an unsealed surface on the SUP provides an appropriate compromise between the rural-residential context for this portion of the proposed development, natural character, and cultural sensitivity, balanced with accessibility and intended user groups.

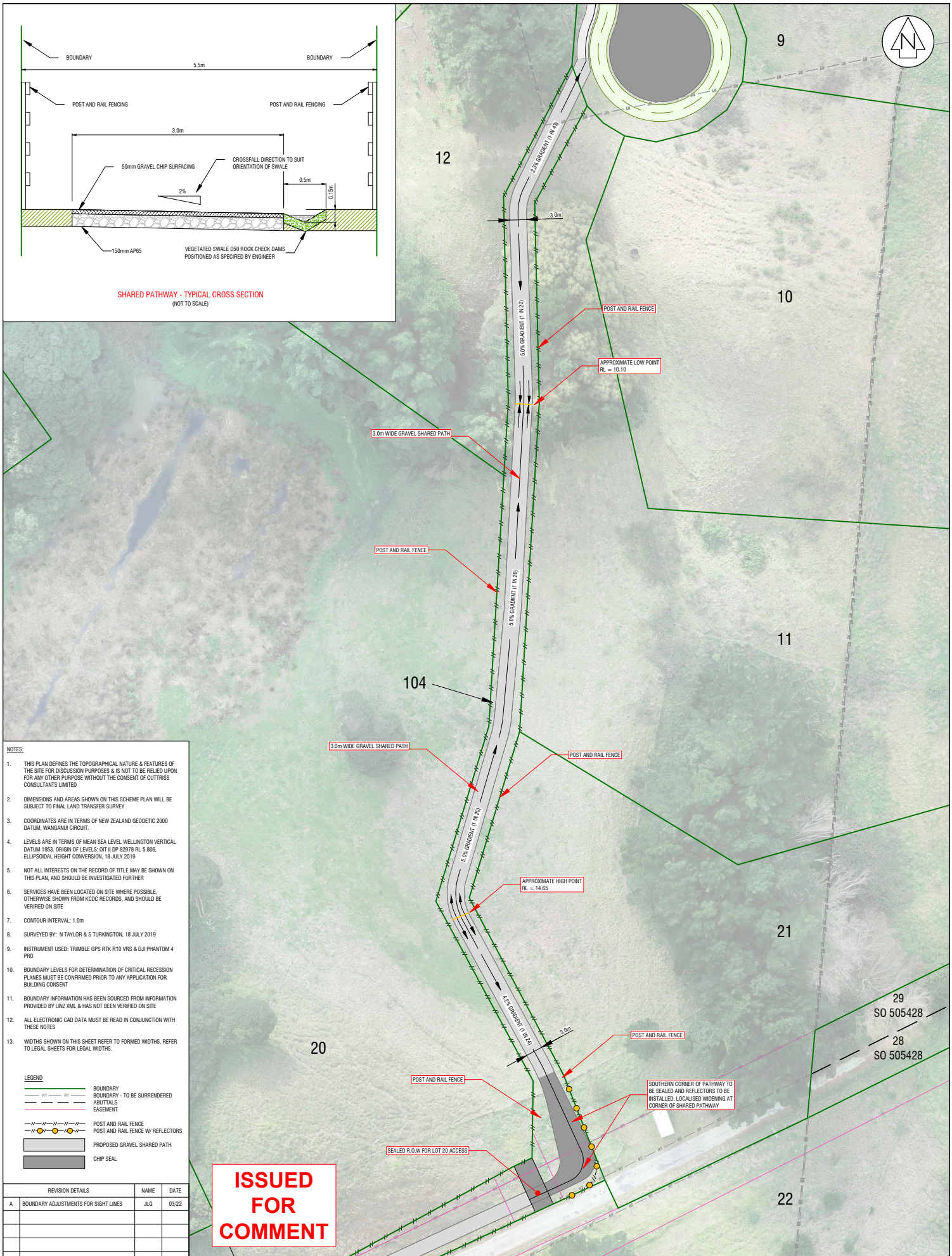
Yours sincerely

Chris Greenshields,

Principal Landscape Architect

DCM URBAN DESIGN LIMITED

SHARED PATHWAY - TYPICAL CROSS SECTION
(NOT TO SCALE)



NOTES:

1. THIS PLAN DEFINES THE TOPOGRAPHICAL NATURE & FEATURES OF THE SITE FOR DISCUSSION PURPOSES & IS NOT TO BE RELIED UPON FOR ANY OTHER PURPOSE WITHOUT THE CONSENT OF CUTTRISS CONSULTANTS LIMITED
2. DIMENSIONS AND AREAS SHOWN ON THIS SCHEME PLAN WILL BE SUBJECT TO FINAL LAND TRANSFER SURVEY
3. COORDINATES ARE IN TERMS OF NEW ZEALAND GEODETIC 2000 DATUM, WANGANUI CIRCUIT.
4. LEVELS ARE IN TERMS OF MEAN SEA LEVEL WELLINGTON VERTICAL DATUM 1953. ORIGIN OF LEVELS: OIT II DP 82978 RL 5.806, ELLIPSOIDAL HEIGHT CONVERSION, 18 JULY 2019
5. NOT ALL INTERESTS ON THE RECORD OF TITLE MAY BE SHOWN ON THIS PLAN, AND SHOULD BE INVESTIGATED FURTHER
6. SERVICES HAVE BEEN LOCATED ON SITE WHERE POSSIBLE, OTHERWISE SHOWN FROM KCDC RECORDS, AND SHOULD BE VERIFIED ON SITE
7. CONTOUR INTERVAL: 1.0m
8. SURVEYED BY: N TAYLOR & S TURKINGTON, 18 JULY 2019
9. INSTRUMENT USED: TRIMBLE GPS RTK R10 VRS & DJI PHANTOM 4 PRO
10. BOUNDARY LEVELS FOR DETERMINATION OF CRITICAL RECESSION PLANES MUST BE CONFIRMED PRIOR TO ANY APPLICATION FOR BUILDING CONSENT
11. BOUNDARY INFORMATION HAS BEEN SOURCED FROM INFORMATION PROVIDED BY LINZ XML & HAS NOT BEEN VERIFIED ON SITE
12. ALL ELECTRONIC CAD DATA MUST BE READ IN CONJUNCTION WITH THESE NOTES
13. WIDTHS SHOWN ON THIS SHEET REFER TO FORMED WIDTHS, REFER TO LEGAL SHEETS FOR LEGAL WIDTHS.

LEGEND

- BOUNDARY
- BOUNDARY - TO BE SURRENDERED
- ABUTTALS
- EASEMENT
- POST AND RAIL FENCE
- POST AND RAIL FENCE W/ REFLECTORS
- PROPOSED GRAVEL SHARED PATH
- CHIP SEAL

	REVISION DETAILS	NAME	DATE
A	BOUNDARY ADJUSTMENTS FOR SIGHT LINES	JLG	03/22

ISSUED FOR COMMENT

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PROJECT
PROPOSED SUBDIVISION
PT LOT 6 DP 53191, LOTS 2-4 & PT LOT 5 DP 84524, PT LOTS 1 & 2 DP 303764, SECS 5, 7 & 12 SO 404971, SECS 25, 27 & 31 SO 505428, 131-155 OTAIHANGA RD & 48-58 TIEKO ST, OTAIHANGA
SHARED PATH DETAIL

CLIENT
MANSELL

SCALE A1 - 1:300
REDUCED SCALE A3 - 1:600

	NAME	DATE
FIELDWORK	-	-
DESIGNED	NHT	04/21
DRAWN	JLG	03/22
CHECKED	NHT	03/22

DRAWING NUMBER 22208 SK11
SHEET 1 OF 3 SHEETS
REVISION A

NOTES:

1. THIS PLAN DEFINES THE TOPOGRAPHICAL NATURE & FEATURES OF THE SITE FOR DISCUSSION PURPOSES & IS NOT TO BE RELIED UPON FOR ANY OTHER PURPOSE WITHOUT THE CONSENT OF CUTTRISS CONSULTANTS LIMITED
2. DIMENSIONS AND AREAS SHOWN ON THIS SCHEME PLAN WILL BE SUBJECT TO FINAL LAND TRANSFER SURVEY
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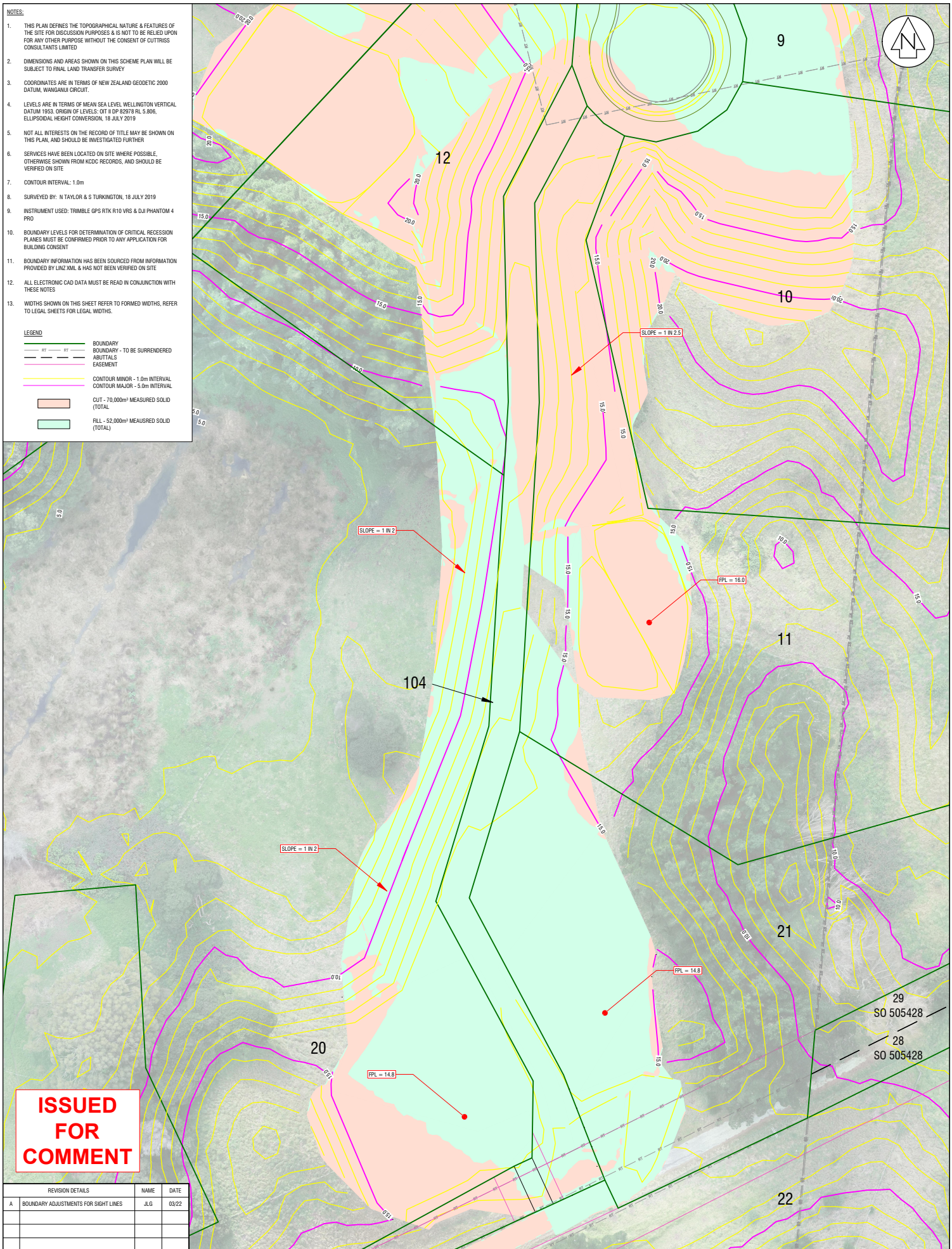
LEGEND

- BOUNDARY
- BOUNDARY - TO BE SURRENDERED
- ABUTTALS
- EASEMENT
- CONTOUR MINOR - 1.0m INTERVAL
- CONTOUR MAJOR - 5.0m INTERVAL
- CUT - 70,000m³ MEASURED SOLID (TOTAL
- FILL - 52,000m³ MEAUSRED SOLID (TOTAL)



ISSUED FOR COMMENT

REVISION DETAILS		NAME	DATE
A	BOUNDARY ADJUSTMENTS FOR SIGHT LINES	JLG	03/22

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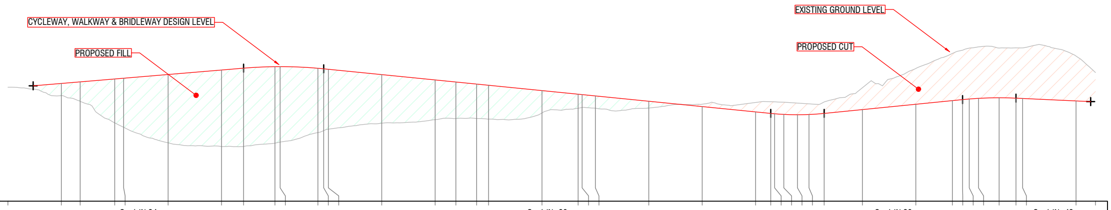
PROJECT
PROPOSED SUBDIVISION
PT LOT 6 DP 53191, LOTS 2-4 & PT LOT 5 DP 84524, PT LOTS 1 & 2 DP 303764, SECS 5, 7 & 12 SO 404971, SECS 25, 27 & 31 SO 505428, 131-155 OTAIHANGA RD & 48-58 TIEKO ST, OTAIHANGA
SHARED PATH - EARTHWORKS

CLIENT
MANSELL

SCALE A1 - 1:300 | REDUCED SCALE A3 - 1:600

	NAME	DATE
FIELDWORK	-	-
DESIGNED	NHT	04/21
DRAWN	JLG	03/22
CHECKED	NHT	03/22

DRAWING NUMBER 22208 SK11
SHEET 2 OF 3 SHEETS
REVISION A



DATUM RL= 2.0

VERTICAL GEOMETRY: G=1 IN 24 · K=1.6 L=15.0m · G=1 IN -20 · K=1.0 L=10.0m · G=1 IN 20 · K=1.4 L=10.0m · G=1 IN -43

HORIZONTAL GEOMETRY: L=13.5m · R=-30m · L=28.5m · R=10m · L=25.8m · R=-20m · L=19m · R=-20m · L=36m · R=-20m · L=31.6m · R=10m · L=21.9m

CHAINAGES (DESIGN CENTRELINE)	EXISTING GROUND LEVELS	CUT OR FILL DEPTHS	DESIGN CENTRELINE LEVELS
0.00	12.69		
10.00	11.91	1.14	13.05
13.53	11.37	1.83	13.20
20.00	9.35	4.12	13.47
21.67	8.94	4.60	13.54
30.00	7.48	6.41	13.89
40.00	7.13	7.18	14.31
44.13	7.14	7.35	14.48
50.00	7.45	7.18	14.63
50.98	7.54	7.09	14.63
58.04	8.44	6.04	14.48
59.13	8.62	5.80	14.43
60.00	8.76	5.62	14.38
70.00	9.33	4.56	13.88
80.00	9.65	3.73	13.38
83.88	9.76	3.42	13.19
87.77	9.76	3.23	12.99
90.00	9.70	3.18	12.88
100.00	10.28	2.10	12.38
106.77	10.72	1.32	12.04
107.52	10.79	1.21	12.01
110.00	10.73	1.16	11.88
120.00	10.74	0.64	11.38
130.00	11.10	-0.22	10.88
140.00	11.27	-0.89	10.38
142.84	11.34	-1.10	10.24
143.56	11.33	-1.12	10.21
145.28	11.29	-1.14	10.15
147.84	11.21	-1.09	10.11
150.00	11.13	-1.00	10.14
152.84	11.31	-1.07	10.24
160.00	12.65	-2.05	10.60
170.00	14.46	-3.36	11.10
176.84	15.87	-4.43	11.44
178.75	16.20	-4.66	11.54
180.00	16.37	-4.78	11.59
181.74	16.49	-4.83	11.65
185.60	16.37	-4.67	11.71
188.75	16.39	-4.72	11.67
190.00	16.39	-4.75	11.64
200.00	15.62	-4.21	11.41
203.64	14.07		

SHARED PATHWAY LONGSECTON

HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:250

NOTES:

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8. SURVEYED BY: N TAYLOR & S TURKINGTON, 18 JULY 2019
9. INSTRUMENT USED: TRIMBLE GPS RTK R10 VRS & DJI PHANTOM 4 PRO
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11. BOUNDARY INFORMATION HAS BEEN SOURCED FROM INFORMATION PROVIDED BY LINZ XML & HAS NOT BEEN VERIFIED ON SITE
12. ALL ELECTRONIC CAD DATA MUST BE READ IN CONJUNCTION WITH THESE NOTES
13. WETLAND EXTENT & KĀNUKA EXTENT TAKEN FROM INFORMATION SUPPLIED BY WILDLANDS ECOLOGY, RECEIVED 22-09-2020.
14. WIDTHS SHOWN ON THIS SHEET REFER TO FORMED WIDTHS, REFER TO LEGAL SHEETS FOR LEGAL WIDTHS.

ISSUED FOR COMMENT

	REVISION DETAILS	NAME	DATE
A	BOUNDARY ADJUSTMENTS FOR SIGHT LINES	JLG	03/22

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PROJECT
PROPOSED SUBDIVISION
PT LOT 6 DP 53191, LOTS 2-4 & PT LOT 5 DP 84524, PT LOTS 1 & 2 DP 303764, SECS 5, 7 & 12 SO 404971,
SECS 25, 27 & 31 SO 505428, 131-155 OTAIHANGA RD & 48-58 TIEKO ST, OTAIHANGA
SHARED PATH - LONGSECTION

CLIENT
MANSELL

SCALE A1 - AS SHOWN
REDUCED SCALE A3 - AS SHOWN

	NAME	DATE
FIELDWORK	-	-
DESIGNED	NHT	04/21
DRAWN	JLG	03/22
CHECKED	NHT	03/22

DRAWING NUMBER 22208 SK11
SHEET 3 OF 3 SHEETS
REVISION A

ADDENDUM - LANDSCAPE AND VISUAL IMPACT ASSESSMENT FIGURES

RFI RESPONSE - LANDSCAPE CONCEPT
FOR MANSELL

ADDENDUM 1 TO LVIA REPORT
5 MARCH 2022

dcm URBAN

OTAIHANGA SUBDIVISION PROPOSAL

Project no: 2020_142
Document title: RFI RESPONSE - LANDSCAPE CONCEPT
Revision: ADDENDUM 1 TO LVIA
Date: 5 MARCH 2022
Client name: Mansell

Author: David Compton-Moen
File name: 2020_142 Mansell Otaihanga Subdivision LVIA RFI Response

DCM URBAN DESIGN LIMITED

10/ 245 ST ASAPH ST
Christchurch 8011

CONTENTS

LEGEND

A A 5m wide landscape strip is proposed along the northern edge of the constructed wetland. Two rows of planting are proposed consisting of species: Titoki, kanuka, pittosporum eugenioides and flax (see palette)

B Existing kanuka trees along Otaihanga Road will be retained and supplemented with additional kanuka plantings at 3m centres. Totara trees are also proposed along this frontage.

C Existing topography and vegetation will be protected to screen views into the site.

D Fencing is limited to open style treatments to retain an open character characterised by landscape planting.

- - - Post and raill fence + hedge

- - - Post and wire fence

E Vegetated pinch points to slow traffic and provide amenity

A. LANDSCAPE CONCEPT PLAN (1:750 @ A3)

client / project name:	MANSELL / OTAIHANGA ESTATES
drawing name:	**LANDSCAPE CONCEPT PLAN**
designed by:	Dave Compton Moen
Drawn by:	Jeremy Ross
original issue date:	5 APRIL 2022
scales:	1:750

revision no:	amendment:	approved	date
A	COUNCIL RFI - ADDENDUM	DCM	05/04/2022

REGISTERED LANDSCAPE ARCHITECT

DCM URBAN DESIGN LIMITED
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CHRISTCHURCH 8011
WWW.DCMURBAN.COM

project no / drawing no: **2020_142/LA/001** revision: **A**

LEGEND

A VIEWS INTO THE SITE FROM OTAIHANGA ROAD WILL BE SCREENED/SOFTEN BY EXISTING KANUKA PLANTINGS COMBINED WITH ADDITIONAL PLANTINGS ON THE ROAD EDGE AND ON THE NORTHERN EDGE OF THE CONSTRUCTED WETLAND

B THE RETENTION OF THE EXISTING LANDFORM AND VEGETATIONON THE CORNER OF THE RESERVE AND LOT 47 WILL SCREEN THE MAJORITY OF VIEWS FROM THE WEST INTO THE SITE

C THE EXISTING TOPOGRAPHY AT THE REAR OF LOTS 23-28 (WITHIN LOT 29) WILL BE RETAINED TO ENSURE THE EXISTING DUNE-CHARACTER IS MAINTAINED, PROVIDING A BREAK BETWEEN THE PROPOSAL AND THE EXPRESSWAY. NO ADDITIONAL PLANTING IS PROPOSED IN THIS LOCATION.

D LOT 33 CONTAINS AN EXISTING HOUSE AND VEGETATION WHICH WILL BE RETAINED

E PINCH POINTS AND NATIVE CLUMP PLANTINGS HAVE BEEN INCORPORATED INTO THE ROAD RESERVE AS TRAFFIC CALMING MEASURES AND TO PROVIDE AMENITY.

F FENCING IS RESTRICTED TO OPEN STYLE FENCES NO HIGHER THAN 1200MM WITH HEDGE PLANTING BETWEEN PROPERTIES. NO FENCING IS PROPOSED IN FRONT YARDS TO CREATE AN OPEN, SPACIOUS FEEL TO THE DEVELOPMENT.

A. ELEVATED PERSPECTIVE (NTS)

client / project name: MANSELL / OTAIHANGA ESTATES
drawing name: **ELEVATED PERSPECTIVE**
designed by: Dave Compton Moen
Drawn by: Jeremy Ross
original issue date: 5 APRIL 2022
scales: NTS

revision no:	amendment:	approved	date
A	COUNCIL RFI - ADDENDUM	DCM	05/04/2022

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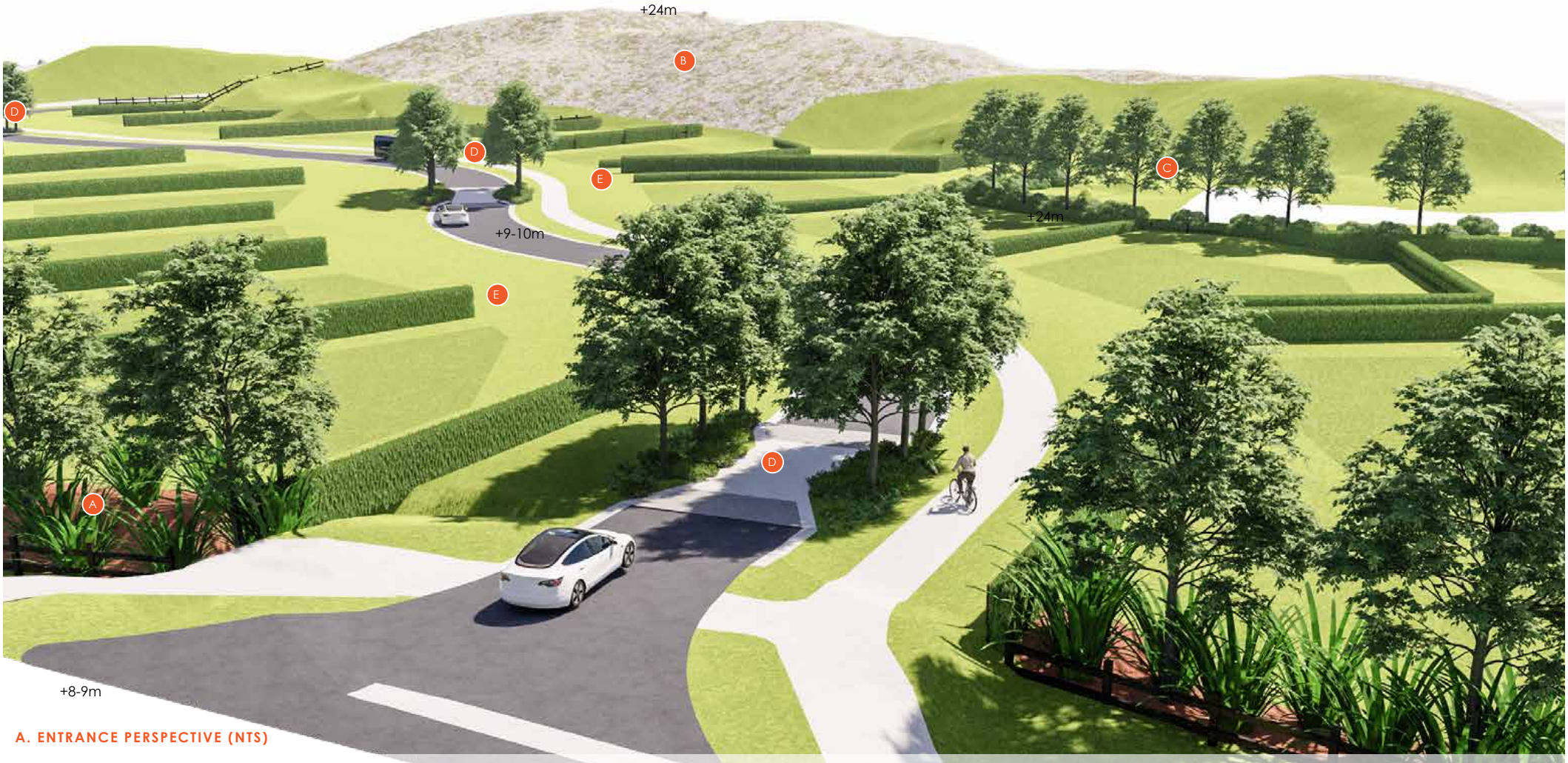
CHRISTCHURCH 8011
WWW.DCMURBAN.COM

project no / drawing no: **2020_142/LA/002** revision: **A**



A. ENTRANCE PERSPECTIVE (NTS)

LEGEND

A VIEWS INTO THE SITE FROM OTAIHANGA ROAD WILL BE SCREENED/SOFTEN BY EXISTING KANUKA PLANTINGS COMBINED WITH ADDITIONAL PLANTINGS ON THE ROAD EDGE AND ON THE NORTHERN EDGE OF THE CONSTRUCTED WETLAND, SEE PALETTE ON FIGURE 7)

B THE EXISTING TOPOGRAPHY AT THE REAR OF LOTS 23-28 (WITHIN LOT 29) WILL BE RETAINED TO ENSURE THE EXISTING DUNE-CHARACTER IS MAINTAINED, PROVIDING A BREAK BETWEEN THE PROPOSAL AND THE EXPRESSWAY. NO ADDITIONAL PLANTING IS PROPOSED IN THIS LOCATION.

C LOT 33 CONTAINS AN EXISTING HOUSE AND VEGETATION WHICH WILL BE RETAINED

D PINCH POINTS AND NATIVE CLUMP PLANTINGS HAVE BEEN INCORPORATED INTO THE ROAD RESERVE AS TRAFFIC CALMING MEASURES AND TO PROVIDE AMENITY (REFER TO FIGURE 6)

E FENCING IS RESTRICTED TO OPEN STYLE FENCES NO HIGHER THAN 1200MM WITH HEDGE PLANTING BETWEEN PROPERTIES. NO FENCING IS PROPOSED IN FRONT YARDS TO CREATE AN OPEN, SPACIOUS FEEL TO THE DEVELOPMENT.

client / project name:	MANSELL / OTAIHANGA ESTATES	**revision no:**	**amendment:**	**approved**	**date**	
drawing name:	**ENTRANCE PERSPECTIVE**	A	COUNCIL RFI - ADDENDUM	DCM	05/04/2022	
designed by:	Dave Compton Moen					
Drawn by:	Jeremy Ross					
original issue date:	5 APRIL 2022					
scales:	NTS					

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CHRISTCHURCH 8011
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project no / drawing no: **2020_142/LA/003** revision: **A**

A. EXISTING VIEW

B. ILLUSTRATION GENERATED FROM SKETCHUP MODEL USING ENSCAPE

LEGEND

A VIEWS INTO THE SITE FROM OTAIHANGA ROAD WILL BE SCREENED/SOFTEN BY EXISTING KANUKA PLANTINGS COMBINED WITH ADDITIONAL PLANTINGS ON THE ROAD EDGE AND ON THE NORTHERN EDGE OF THE CONSTRUCTED WETLAND

B THE RETENTION OF THE EXISTING LANDFORM AND VEGETATIONON THE CORNER OF THE RESERVE AND LOT 47 WILL SCREEN THE MAJORITY OF VIEWS FROM THE WEST INTO THE SITE

C THE EXISTING TOPOGRAPHY AT THE REAR OF LOTS 23-28 (WITHIN LOT 29) WILL BE RETAINED TO ENSURE THE EXISTING DUNE-CHARACTER IS MAINTAINED, PROVIDING A BREAK BETWEEN THE PROPOSAL AND THE EXPRESSWAY. NO ADDITIONAL PLANTING IS PROPOSED IN THIS LOCATION.

D FENCING IS RESTRICTED TO OPEN STYLE FENCES NO HIGHER THAN 1200MM TO CREATE AN OPEN, SPACIOUS FEEL TO THE DEVELOPMENT.

E 5.5M HIGH BUILDING ENVELOPES

C. PHOTO-ILLUSTRATION DEVELOPED FROM MODEL AND PHOTOSHOP COMBINING (A) AND (B) ABOVE

PHOTO SIMULATION 1 FROM OTAIHANGA ROAD LOOKING EAST

client / project name:	MANSELL / OTAIHANGA ESTATES
drawing name:	**PHOTO SIMULATION 1**
designed by:	Dave Compton Moen
Drawn by:	Jeremy Ross
original issue date:	5 APRIL 2022
scales:	NTS

revision no:	amendment:	approved	date
A	COUNCIL RFI - ADDENDUM	DCM	05/04/2022

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CHRISTCHURCH 8011
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project no / drawing no: **2020_142/LA/004** revision: **A**

A. EXISTING VIEW

B. ILLUSTRATION GENERATED FROM SKETCHUP MODEL USING ENSCAPE

LEGEND

A VIEWS INTO THE SITE FROM OTAIHANGA ROAD WILL BE SCREENED/SOFTEN BY EXISTING KANUKA PLANTINGS COMBINED WITH ADDITIONAL PLANTINGS ON THE ROAD EDGE AND ON THE NORTHERN EDGE OF THE CONSTRUCTED WETLAND

B THE EXISTING TOPOGRAPHY AT THE REAR OF LOTS 23-28 (WITHIN LOT 29) WILL BE RETAINED TO ENSURE THE EXISTING DUNE-CHARACTER IS MAINTAINED, PROVIDING A BREAK BETWEEN THE PROPOSAL AND THE EXPRESSWAY. NO ADDITIONAL PLANTING IS PROPOSED IN THIS LOCATION.

C FENCING IS RESTRICTED TO OPEN STYLE FENCES NO HIGHER THAN 1200MM WITH HEDGE PLANTING BETWEEN PROPERTIES. NO FENCING IS PROPOSED IN FRONT YARDS TO CREATE AN OPEN, SPACIOUS FEEL TO THE DEVELOPMENT.

D 5.5M HIGH BUILDING ENVELOPES

E THE CONSTRUCTED WETLAND PROVIDES A HIGH AMENITY BUFFER BETWEEN THE DEVELOPMENT AND OTAIHANGA ROAD

C. PHOTO-ILLUSTRATION DEVELOPED FROM MODEL AND PHOTOSHOP COMBINING (A) AND (B) ABOVE

PHOTO SIMULATION 2 FROM OTAIHANGA ROAD LOOKING NORTH

client / project name:	MANSELL / OTAIHANGA ESTATES
drawing name:	**PHOTO SIMULATION 2**
designed by:	Dave Compton Moen
Drawn by:	Jeremy Ross
original issue date:	5 APRIL 2022
scales:	NTS

revision no:	amendment:	approved	date
A	COUNCIL RFI - ADDENDUM	DCM	05/04/2022

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CHRISTCHURCH 8011
WWW.DCMURBAN.COM

project no / drawing no: **2020_142/LA/005** revision: **A**

LEGEND

A THE 4M WIDE PINCH POINTS RESTRICT VEHICLE ACCESS TO ONE VEHICLE AT A TIME

B PLANTING IS A MIX OF LOW GROWING NATIVE GROUNDCOVERS AND KANUKA TREES WITH A 'CLEAN' STEM UP TO 2.0M IN HEIGHT. THIS IS TO ENSURE VISIBILITY IS MAINTAINED.

A. STREET 'PINCH POINT' / TRAFFIC CALMING

client / project name: MANSELL / OTAIHANGA ESTATES
drawing name: **STREET PINCH POINT**
designed by: Dave Compton Moen
Drawn by: Jeremy Ross
original issue date: 5 APRIL 2022
scales: 1:750

revision no:	amendment:	approved	date
A	COUNCIL RFI - ADDENDUM	DCM	05/04/2022

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CHRISTCHURCH 8011
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project no / drawing no: **2020_142/LA/006** revision: **A**

A. SPECIMEN TREES (STREET AND RESERVE)


Kunzea robusta
Kanuka


Podocarpus totara
TOTARA


Plagianthus regius
Ribbonwood


Sophora microphylla
Kowhai

B. WETLAND BUFFER MIX A


Carex geminata
Rautahi


Coprosma propinqua
Mingimingi


Coprosma robusta
Karamu


Cordyline australis
Cabbage Tree, ti kouka


Juncus usitatus
Juncus


Kunzea robusta
Kanuka


Coprosma rugosa
NZ Coprosma


Muehlenbeckia complexa
Pohuehue


Phormium tenax
NZ flax


Ficinia nodosa
Knobby club rush

C. CONSTRUCTED WETLAND MIX


Carex geminata
Rautahi


Apodasmia similis
Oioi, Jointed Rush


Muehlenbeckia complexa
Pohuehue


Phormium tenax
NZ flax


Ficinia nodosa
Knobby club rush

D. SCREEN PLANTING ADJACENT TO OTAIHANGA ROAD AND ALONG NORTHERN EDGE OF THE CONSTRUCTED WETLAND


Kunzea robusta
Kanuka


Cordyline australis
Cabbage Tree, ti kouka


Phormium tenax
NZ flax


Hebe salicifolia
Koromiko


Austroderia richardii
South Island Toetoe


Pittosporum eugenioides
Lemonwood


Pittosporum tenufolium
Black mapou

E. STREET - PINCH POINT SPECIES


Kunzea robusta
Kanuka (clean stem to 2.0m)


Libertia peregrinans
NZ Iris


Muehlenbeckia axillaris
Creeping wire vine


Ficinia nodosa
Knobby club rush


Pratia angulata
Pratia

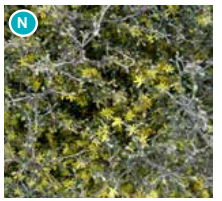

Pimelia prostrata
Pimelia


Coprosma acerosa 'Hawera'
Groundcover coprosma


Carex testacea
New Zealand Sedge

F. HEDGING - PROPERTY BOUNDARY TREATMENT


Griselinia littoralis
Kapuka, Broadleaf


Corokia cotoneaster
Corokoia


Open style post and rail fence

client / project name:	MANSELL / OTAIHANGA ESTATES	**revision no:**	**amendment:**	**approved**	**date**
drawing name:	**MATERIAL / PLANT PALETTE**	A	COUNCIL RFI - ADDENDUM	DCM	05/04/2022
designed by:	Dave Compton Moen				
Drawn by:					
original issue date:	14 MARCH 2022				
scales:	1:1250				

REGISTERED LANDSCAPE ARCHITECT

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10/245 ST ASAPH ST
CHRISTCHURCH 8011
WWW.DCMURBAN.COM

E = Exotic
N = Native

project no / drawing no: **2020_142/LA/007** revision: **A**