

**BEFORE THE GREATER CHRISTCHURCH PARTNERSHIP**

**IN THE MATTER** of the Local Government Act 2002

**AND**

**IN THE MATTER** of a submission by Ernst Frei on the Greater Christchurch Settlement Update – Our Space 2018-2048

**EVIDENCE – FIONA ASTON**

**1.0 Introduction**

- 1.1 My name is Fiona Aston (MA Cambridge University, England, M.Phil Town Planning, University College London, MNZPI, MRMLA). I have 34 years resource management and planning experience. I am Principal and Director of Aston Consultants Resource Management and Planning (Aston), and have operated my own consultancy practice, based in Christchurch, since 1995.
- 1.2 I work extensively in the Greater Christchurch area, with numerous clients with interests in subdivision, land development and land use planning matters. I am very familiar with the Urban Development Strategy (UDS), Christchurch District Plan (CDP), Chapter 6 (C6) of the Canterbury Regional Policy Statement (CRPS) and the planning history relating to these documents. This includes Plan Change 1 (PC1) and Chapter 12A of the RPS (C12A), the Land Use Recovery Plan (LURP) and Christchurch Replacement District Plan (CRDP). I have advised and prepared evidence and submissions on behalf of clients on all of these documents.

1.3 Ernst Frei has asked me to provide planning evidence in relation to his submission on the Greater Christchurch Settlement Update 2018 -2048 (hereafter referred to as 'Our Space').

1.4 I summarise the relief sought by Mr Frei, and outline the principal reasons for the relief. In addition, I discuss and assess the proposal against the overall policy and statutory context for Our Space which will 'inform' any subsequent changes to the Canterbury Regional Policy Statement (CRPS).

## **2.0 Reason for Submission – Consequences of Fixed, Uncontestable, Cadastrally based Rural/Urban Boundary Line**

2.1 Our Space has been prepared in order to satisfy the requirement of the National Policy Statement on Urban Development Capacity (NPS-UDC). It outlines the GCP's proposed settlement pattern and strategic planning framework to meet GC's land use and infrastructure needs over the medium (next 10 years) and long term (10-30 years) periods.<sup>1</sup>

2.2 Whilst Our Space is intended as a 'high level' strategic planning document, it has site specific implications for landowners. This is because it proposes to continue the approach of the current Greater Christchurch Urban Development Strategy ('UDS') and CRPS C6 of setting a fixed, cadastrally based urban/rural boundary line combined with a objective and policy framework which requires 'avoidance' of urban activities outside that line (C6 Objective 6.2.1, Policy 6.3.1).

2.3 Affected landowners have no choice but to participate in reviews of the 'higher order' planning documents as well as subsequent District Plan change processes in order to progress their site specific development proposals. They are beholden to councils' timeframes as private plan changes are not permissible to 'higher order' documents such as regional plans or policy statements. The process is extremely costly, slow and uncertain and can take many years. Many landowners simply do not have the resources, or 'give up'. Whilst economics is not my area of expertise, it logically follows that inevitably the cost of the process is reflected in land values, development costs and ultimately the cost of housing.

2.4 The CRPS fixed rural/urban boundary line approach means there is no flexibility to respond to minor anomalies, or meritorious boundary changes which do affect or

<sup>1</sup> Our Space i

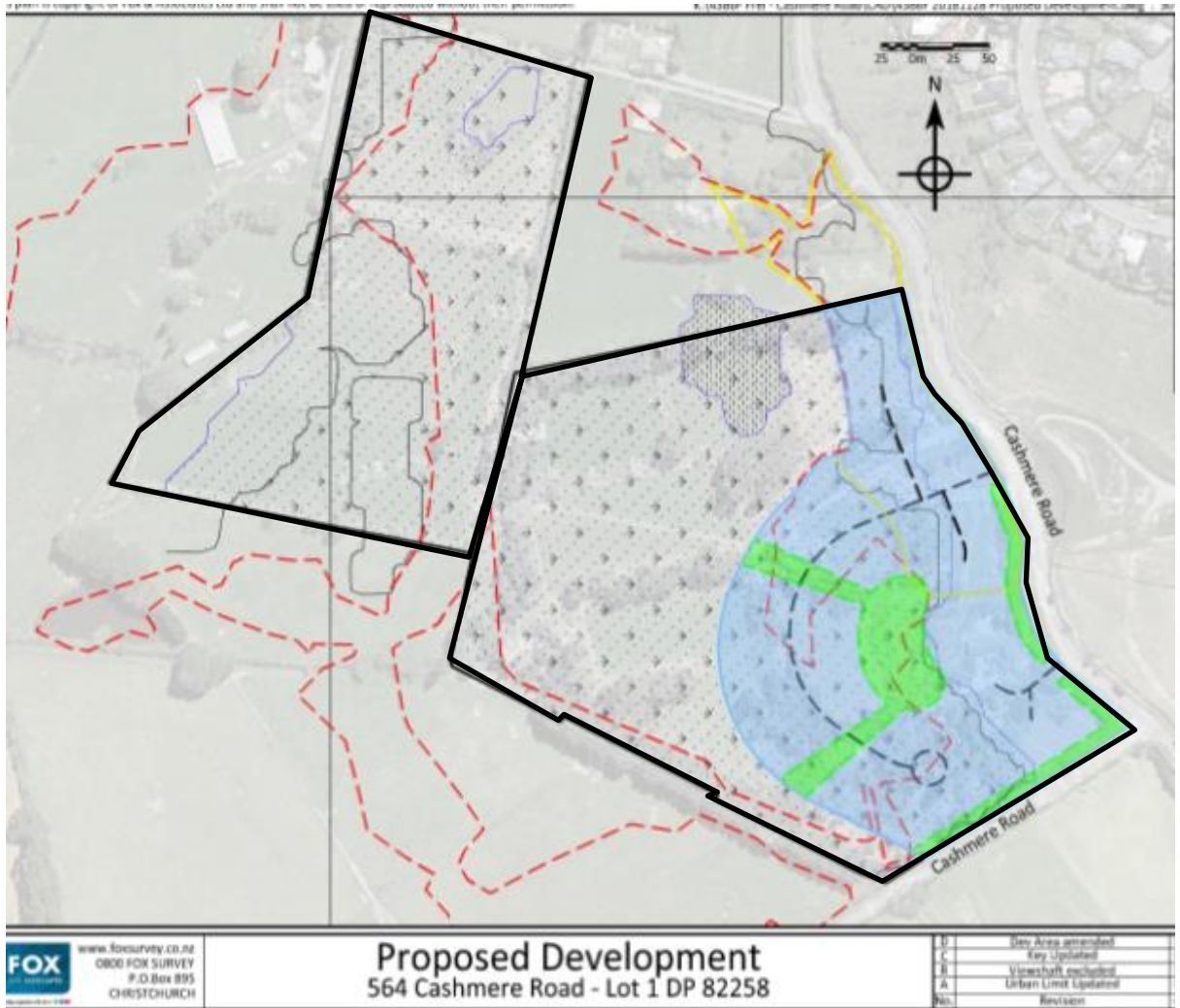
compromise the Our Space overall urban management approach - such as Mr Frei's development proposal for 564 Cashmere Road.



- 2.5 **Our Space** and CRPS C6 are 'high level' documents which cannot realistically respond to local circumstances, land use patterns and needs which importantly inform land use planning at the local level. It needs to retain flexibility to enable appropriate response at the district level to local circumstances.
- 2.6 I have outlined the site specific details of Mr Frei's proposal below. In summary, Mr Frei proposes a high amenity mixed density development of 6 ha of his 18.1 ha property, including 1 ha of covenanted amenity areas. This is less than the area 8.1 ha identified as Greenfield Priority Area (GPA) in the C6. The boundaries of the proposed development area are largely based on natural topography and include 2 ha which is not GPA – hence the development is precluded by the 'avoidance' policies of the C6.
- 2.7 The Our Space urban growth management approach is intended to provide certainty as to where development will take place to enable planning for and development of infrastructure required for projected urban growth; to protect key strategic infrastructure such as strategic transport networks; to protect the function, viability and public investment in the Central City and Key Activity Centres; and to ensure development is appropriately located in terms of potential environmental effects.
- 2.8 Mr Frei's development proposal will have no effect whatsoever on the any of the above intended planning outcomes – yet, it still cannot proceed.

### **3.0 Background, Site and Development Proposal**

3.1 I refer to Mr Frei's submission. In summary: \_

- Mr Frei's land is 18.5ha in area. It is located within CDP Hendersons Outline Development Plan area (Appendix 8.10.18) in south west Christchurch. The ODP covers land suitable for residential development around the periphery of Hendersons Ponding Basin and so the rural/urban boundary here has an irregular shape, as illustrated on the figure below which shows these areas as they relate to Mr Frei's land (outlined in black).



-  Submitters Site
-  Proposed Development Area
-  Residential New Neighbourhood Zone
-  Existing Urban Limit and LURP Greenfield area boundary

- Mr Frei has owned the Site for 40 years and has developed it as a very high amenity area with substantial areas of native planting and pond area (to be retained as part of the proposed development).
- Approximately 1.5ha of the Site is zoned Residential New Neighbourhood (RNNZ), with the balance (16.5ha) zoned Rural Urban Fringe as shown on the map below.



Fig 1: Zoning

Light brown – Rural/Urban Fringe

Yellow – Residential New Neighbourhood (RNN)

564 Cashmere Road (the Site) boundaries marked with black line

- A total of 8.1ha of the Site is located within the Map A – Greenfield Priority Area.
- Mr Frei proposes a high amenity mixed density residential development of approximately 5 ha of the Site (see copy of development concept plan attached as **Appendix A**). The development area is approximately 5ha (excluding the amenity area – 1ha) and has been defined largely by the natural topography of the land. 3.9 ha (including covenanted amenity areas) is within a Greenfield Priority Area on Map A. The balance (2 ha) is outside and zoned Rural Urban Fringe (refer to **Appendix A**).
- The proposed development yield is approximately 50 mixed density household units. This number of lots is necessary for the subdivision to be commercially viable and meet the NPS-UDC definition of commercially viable development (see **Appendix B**).
- Based on a preliminary look at the existing zoned RNN area of the Mr Frei's land (1.5 ha) it has a realistic yield of 25 lots. The required yield is a minimum of 23 lots with a maximum of 28 lots.

#### **4.0 Environmental Effects of Proposal**

4.1 The development proposal is not anticipated as having any adverse environmental effects<sup>2</sup> and will result in an overall more favourable planning outcome, with positive environmental features, compared with that enabled under the current RNN zoning boundaries which apply to Mr Frei's land. Further, the reality is that development of the RNN zoned area will not occur as it simply is not commercially viable – and in this respect the current zoning and GPA boundary is contrary to the NPS-UDC.

4.2 In terms of environmental effects, I note:-

- there are no servicing constraints (see **Appendix C**)
- the Site is not identified on the Hazardous Activities and Industries List (HAIL)
- flood compensation can be provided by excavating existing flood prone land within Mr Frei's overall 18.1 ha site (see **Appendix D**)
- the site is generally suitable for use for residential purposes from a geotechnical perspective subject to further on site testing to support future development (see **Appendix E**)

4.3 The proposal will have a number of beneficial planning and environmental outcomes. In essence it will facilitate a high amenity subdivision which retains and builds on the existing site features and the attractive outlook onto the adjoining stormwater management areas. Positive environmental features include:-

- Two single entry points which avoid the high amenity native planting around the Cashmere Road frontage.
- Existing native planting and other amenity features (including pond area) are to be included in an 'amenity covenant' (1 ha) which prohibits their removal.

4.4 Mr Frei has owned this land for the last 40 years, and is passionate about ensuring that it is developed in an environmentally sensitive manner with the high amenity features to be retained as features of the subdivision.

#### **5.0 Hendersons Ponding Basin**

<sup>2</sup> detailed site investigations including geotech will be required at subdivision stage as noted in the pre-application meeting notes attached as **Appendix G**).

- 5.1 Hendersons Basin is located in south-western Christchurch, near the Port Hills in the upper catchment of the Heathcote River. It provides important flood storage capacity in times of significant rainfall which helps reduce downstream water (flood) levels.
- 5.2 PC1 set the boundary for future potential greenfield development (or the urban limit as it was known under this document) at the Hendersons Basin 19m contour which equated to (at the time) a 200 year flood event. The LURP largely carried through the urban limits set in PC1 with respect to Hendersons Basin. The RNN zoning for the Hendersons area (namely that area bounded by Sparks Road, Hendersons Road, Cashmere Road and Sutherlands Road) was based on the CRPS Chapter 6 GPA boundary extent (the 19m contour).<sup>3</sup>
- 5.3 Boundaries of most other Greenfield Priority Areas i.e. the rural/urban boundary are in my experience based around roads which are more definitive.
- 5.5 The appropriate urban development areas have been and are still being refined within the Henderson's Outline Development Plan area as a result of Christchurch City Council's ongoing hydrological investigations – including post the 2010/2011 earthquakes<sup>4</sup>.

## **6.0 Christchurch Replacement District Plan - Findings in relation to Hendersons Outline Development Plan**

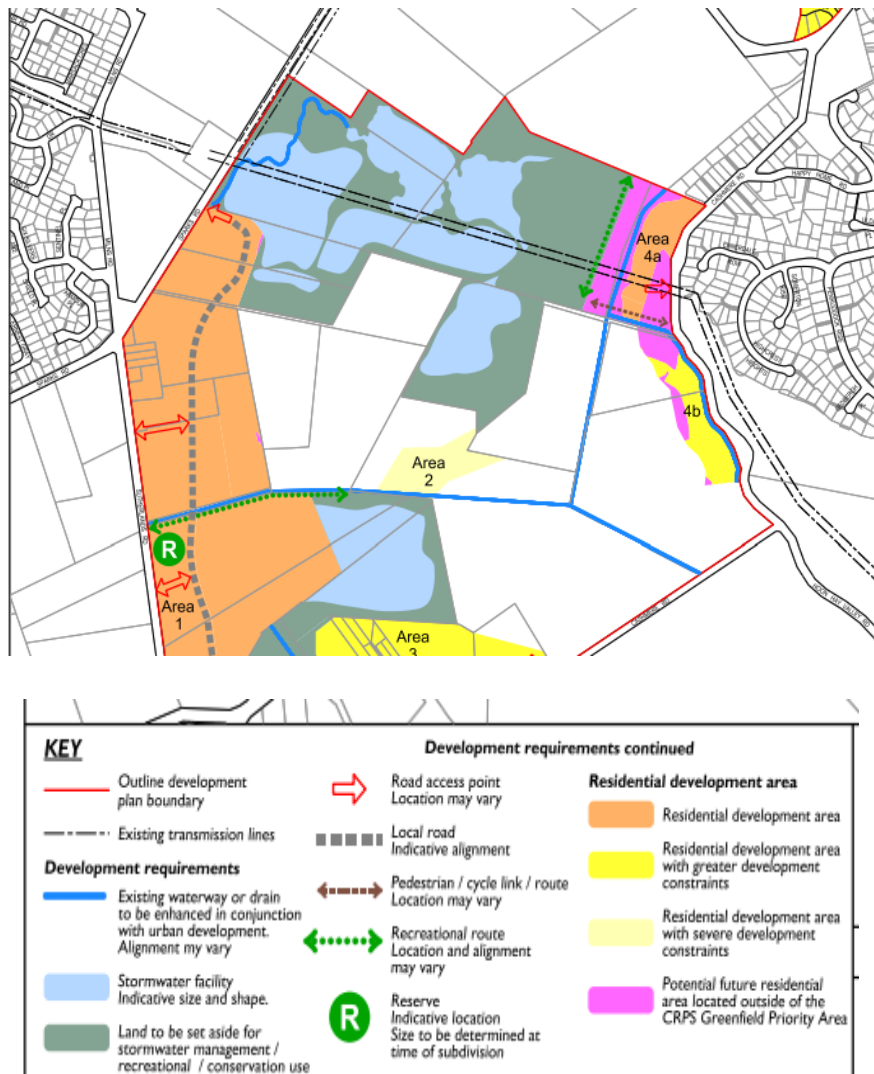
- 6.1 At the time of the Christchurch Replacement District Plan Review, Council officers recognised that some amendments to the notified RNNZ boundaries as requested by submitters were appropriate – but that the C6 rural/urban boundary line i.e. defined Greenfield Priority Areas precluded any changes relating to land outside the GPAs being made through the District Plan Review. Thus, paragraph 21.4 of Ms Oliver's Statement of Evidence – Residential New Neighbourhood 2015, stated that (<http://www.chchplan.ihp.govt.nz/wp-content/uploads/2015/08/3723-CCC-Evidence-of-Sarah-Oliver-Part-1-7-12-2015.pdf>) :

<sup>3</sup> Paragraph 21.2 Statement of evidence of Sarah Oliver – Residential New Neighborhood Zone Planning – Outline Development Plans and Rezoning requests, 7<sup>th</sup> December 2015, Paragraph 21.2.5

<sup>4</sup> personal communication Sarah Oliver, Principal Planner Christchurch City Council

The boundary of the CRPS GPA and the updated Hendersons ODP included in the RNN Revised Proposal 7 December 2015, will not in my opinion achieve the most appropriate urban development form. Nor will it facilitate the creation of a unique and high quality residential environment that takes full advantage of the unique environmental conditions. In my opinion Option 1 Hendersons Outline Development Plan as contained in Attachment G of my evidence, is a more preferred and appropriate option for this area. Option 1 would also achieve much of the relief sort by submitters. However I accept that Option 1 cannot be given effect to in this DPR due to the higher order policy restrictions in CRPS Chapter 6. Therefore Option 2 Hendersons ODP has been included in the RNN Revised Proposal 7 December 2015 (refer to Attachment A of my evidence).

6.2 Option 1 of Ms Oliver’s Statement of Evidence is attached below:



6.3 Option 1 was not progressed any further given it would not give effect to the higher order policy restrictions in CRPS Chapter 6.



6.4 Ms Oliver clearly shares my concerns that the existing rural/urban boundary i.e. Greenfield Priority Area boundary, at least as it applies to Hendersons Ponding Basin, is rigid and does not necessarily result in good planning and urban design outcomes.

## **7.0 Relief Sought – A More Flexible, Responsive Approach**

7.1 *“With many of the primary drivers and influencers of urban development in Greater Christchurch being in a state of change...”* Our Space considers a responsive approach to planning is necessary.<sup>5</sup> However, the Our Space approach, including the continued use of a fixed, non-contestable CRPS rural/urban boundary is the opposite of responsive planning. Mr Frei is aware of, and supports other submissions which seek that the fixed rural/urban boundary line be removed from the CRPS, to be replaced with a more flexible ‘directions for growth’ approach, to implemented at District Plan level.

7.2 If the Panel is of a mind to retain the fixed rural/urban boundary, then at the very least there should be a more flexible policy framework; and the rural/urban boundary line should be amended to include all of the 564 Cashmere Road proposed development area as a Greenfield Priority Area.

7.3 As set out in the submission, I suggest an additional policy (or similar) and consequential amendments to the CRPS C6 objective and policy framework. I have further refined this as follows:-

### **Policy 6.3.1 A**

**(a) Enable urban development or urban zoning outside the Greenfield Priority, Special Housing Areas and Existing Urban Areas shown on Map A where:-**

**(i) The urban development or extension will have beneficial planning outcomes; or**

**(ii) The additional land is required to enable commercially viable development, taking into account the current likely costs, revenue and yield of developing; or**

<sup>5</sup> Our Space page 54

**(iii) The additional land is required because land identified for urban development on Map A is subject to physical development constraints which limits its ability to meet the CRPS density requirements;**

**and all of the following conditions are met:-**

- (i) Any additional land is contiguous with a Greenfield Priority Area, Special Housing area, or Existing Urban Area; and**
- (ii) Any additional land will integrate with the provision of infrastructure; and**
- (iii) Any additional land is a logical addition to the urban area and will contribute to a consolidated urban form; and**
- (iv) All of the criteria in Policy 6.3.11 (5)(a) to (g) inclusive are met.**

**Explanation:**

**This policy confirms the requirement for urban development to be contained within Greenfield Priority, Special Housing and Existing Urban Areas but provides some flexibility to accommodate meritorious proposals, to ensure zoned land is commercially viable to develop, including taking into account potential geotechnical constraints and other development costs, and to facilitate a responsive planning approach given the uncertainties associated with the housing and business land capacity assessments which have informed Map A, and with the primary drivers and influencers of urban development in Greater Christchurch.**

**6.2.1 Recovery framework**

Recovery, rebuilding and development are enabled within Greater Christchurch through a land use and infrastructure framework that:....

- 3. avoids urban development outside of existing urban areas or greenfield priority areas for development, unless expressly provided for in the CRPS **or which will not compromise the overall CRPS urban growth management approach;**

**6.3.1 Development within the Greater Christchurch area**

In relation to recovery and rebuilding for Greater Christchurch:

4. ensure new urban activities only occur within existing urban areas or identified greenfield priority areas as shown on Map A, unless they are otherwise expressly provided for in the CRPS **or which will not compromise the overall CRPS urban growth management approach**;

#### 6.3.7 Residential location, yield and intensification

In relation to residential development opportunities in Greater Christchurch:...

Subject to Policy 5.3.4, residential greenfield priority area development shall occur **generally** in accordance with Map A. These areas are sufficient for both growth and residential relocation through to 2028.

- 7.4 Policy 6.3.1A, (a) (v) refers to Policy 6.3.11 Monitoring and Review ss5 (a) to (h). These are the list of circumstances under which changes or additions to GPAs may be made, if, as result of monitoring, there is found to be a shortfall in available development land or to the expected availability of sub-regional infrastructure. The policy is set out in full in **Appendix F**. Criteria (a) to (h) are, in effect, a helpful 'check list' of matters to be considered for a rezoning proposal, including environmental effects and availability of infrastructure.

## **8.0 Pre-Application Meeting with Christchurch City Council – CCC Support for Submission**

- 8.1 A pre-application meeting with Christchurch City Council (CCC) to discuss Ernst Frei's Our Space submission and development proposal. Both regulatory and policy staff attended. The meeting record is attached as **Appendix G**.
- 8.2 The meeting minutes confirm the approach of the territorial authorities towards resource consent for proposals (however small) outside the rural/urban boundary. There is essentially a blanket policy of rejecting such applications regardless of the specific circumstances, and even though their status is non complying not prohibited – on the basis of CRPS and CDP policies which seek to 'avoid' residential development on lots smaller than 4 ha i.e. the minimum permitted lot size for a rural dwelling. This interpretation in turn rests on case law which has determined that 'avoid' means to 'not allow' or 'prevent the occurrence of'.
- 8.3 The meeting minutes also record the policy planner's support for Mr Frei's proposal, including an urgent change to the RPS to enable it to proceed:-

*The inability to alter the lines (i.e. the current rural/urban boundary) makes undertaking good planning impractical for this site. Obtaining the high level support to do something different is important.*

*ECAN are not planning on making a change until 2022. The review of the CRPS is extensive and will take years possibly to finalise. The applicant needs to make it clear to ECAN the adverse impact of the timing of this process and preventing the applicant from developing their land in a more appropriate manner.*

*ECAN could be minded (if convinced) to give the review of Chapter 6 priority and may get decisions sooner. The applicant needs to state the timeframe and show ECAN practically how this would work. Policy changes are needed upfront and they are needed urgently to allow for these developments to take place.*

*Our Space submission process provides the applicant with an opportunity for convincing ECAN to be more open to resolving the procedural constraints that currently exist and have been in place for some time now. It will however be up to the Our Space Panel to decide whether this should result in any changes to Our Space, at best an action that signalled ECAN investigating an earlier change to the CRPS prior to 2020, including the possibility of this occurring through a streamlined planning process.*

*The administrative barriers to ECAN changing Chapter 6 ahead of the 2020 review (it is in fact scheduled for 2022 in Our Space) appear to be more administrative in nature.*

8.4 I understand that administrative concerns include the lack of funding for an earlier CRPS review in relation to Greater Christchurch urban growth; and the fact that Selwyn and Waimakariri District Councils do not want such a review to slow down or complicate their respective District Plan Review processes.<sup>6</sup>

8.5 I accept that a move away from the current CRPS focussed allocative approach to future urban growth could widen the scope of the current District Plan Reviews to include consideration of urban growth needs at a township level (currently this is not possible as the location and extent of urban growth is 'fixed' by C6 Map A). However, I consider this

<sup>6</sup> Reflected in comments made in OR – Appendix F Assessment of key matters with different partner views

is essential in any case to meet the requirements of the NPS-UDC, in particular PB1 which requires 3 yearly assessment of housing and business development capacity for different types, locations and price points. My understanding is that Our Space has only assessed housing land needs at a District wide level and in the case of Selwyn District, proposes to allocate any shortage of supply in the medium term to Rolleston only. I am aware that there will be a shortage of land supply within the next year at Prebbleton (see evidence for GF Rhodes Estate & Larson Group, submitter 60).

8.6 In my opinion, proposed Policy 6.3.1A will not widen the scope of the current District Plan Reviews.

8.7 I consider below possible mechanisms for facilitating the necessary changes to policy documents.

## **9.0 National Policy Statement on Urban Development Capacity**

9.1 In my opinion, the Panel in fact must accept Mr Frei's submission (or potentially other amendments to Our Space and C6 of the CRPS which achieve the intent of the submission) - because not to do so would be contrary to the NPS-UDC.

9.2 The NPS-UDC focuses on sufficient commercially viable development capacity and 'development ready' land rather than simply rezoning land that is required for future urban growth. Local Authorities are required to:-

- carry out housing (and business) development capacity assessments at least 3 yearly (Policy PB1);
- set minimum targets for sufficient feasible development capacity (PB5-11);
- produce a future development strategy that demonstrates there will be sufficient, feasible development capacity in the medium and long term and that the minimum targets will be met (PC12-14);
- consider all practicable options for providing sufficient, feasible development capacity and enabling development to meet demand (PC4).

9.3 The evidence establishes that there is a need for amendments to the CRPS rural/urban boundary line at Hendersons Basin now to enable commercially viable development of Mr Frei's land so that the existing minimum targets for housing land as reflected on the current C6 Map A and Fig 16 of Our Space can be met (see Carl Fox's evidence for

assessment of feasible development in accordance with the NPS-UDC requirements). This is just one of potentially numerous cases where the fixed urban/rural boundary line in the C6 does not reflect the reality of what is feasible development 'on the ground' – and therefore the minimum targets for feasible development on which they are based cannot be met. This is reflected in Ms Oliver's comments recorded in the preapplication meeting minutes:-

*Overall the total household greenfield yield for some greenfield primary areas has been less than first expected, due to removal of stormwater management, geotechnically constrained and ecological areas (in accordance with the definition of 'net density' under the CRPS). Therefore the additional houses that are proposed to be yielded could be presented as beneficial or better meeting the strategic intent of GPA's to meet projected household demands (noting also that this area has been planned for development for many years through SWAP – South West Area Plan - CCC Infrastructure Strategy and the UDS).*

- 9.4 The fact that the current Map A GPAs cannot in some cases deliver the minimum housing targets on which they are based is particularly problematic because my understanding is that the GCP have adopted the minimum targets as maximum targets, particularly in Waimakariri and Selwyn Districts – i.e. there is no 'spare' capacity. I do acknowledge the Housing and Business Capacity Assessment findings that 75% of greenfield capacity is in Christchurch City; and that overall, even in the long term Christchurch City has "*sufficiency of assumed feasible development capacity*" - + 13 539 dwellings by 2048.<sup>7</sup> However, that capacity includes brownfield and intensification targets as well as greenfield land.
- 9.5 I conclude that the minimum targets set for Hendersons Ponding Basin in Open Space (which are the same as the current C6) cannot be met; and that the Greater Christchurch Partnership (GCP) has not considered all practical options for meeting minimum targets and therefore providing sufficient development capacity. In this respect Our Space is contrary to and does not give effect to the NPS-UDC.
- 9.6 Objective OA1 on the NPS-UDS is '*Effective and efficient urban environments that enable people and communities and future generations to provide for their social,*

<sup>7</sup> Housing and Business Capacity Assessment March 2018, Table 6 page 21

*economic, cultural and environmental wellbeing*' and PA4<sup>8</sup> requires decision makers to take into account the benefits and costs of urban development when considering the effects of urban development.

- 9.7 I consider retaining a fixed rural/urban boundary line in the C6 with no policy framework for considering circumstances where variations can be considered is contrary to OA1 and PA4. As illustrated by Mr Frei's case, it has adverse planning consequences. It precludes the ability to deliver an efficient and effective urban environment as the current planning framework results in uneconomic development; and it precludes the ability to create a high amenity urban environment with beneficial environmental features. I have assessed (at a preliminary and 'high level') the costs and benefits of 'waiting' for the 2022 CRPS review and subsequent district planning processes to resolve this matter in section 12 (Section 32 Assessment). There are no benefits and substantial costs compared with my recommendation of enabling development to proceed now.

## **10.0 Need for Action Now**

- 10.1 Our Space Schedule of Future Work item 8 is a change to C6 of the CRPS to address any need for additional housing development over the medium term. This scope is limited and may not cover all of the CRPS changes I consider are necessary, as set out above. In my opinion it does include addition of Policy 6.3.1A and amendments to the rural/urban (GPA) boundary and RNN zone at Hendersons Ponding Basin by the addition of all of Mr Frei's proposed development area – because the current RNN zoned area is not commercially viable so additional developable land is required to meet both the short and medium term targets set for this area.
- 10.2 Notwithstanding, the Officers Report recommends rejecting the submission, noting that *"this land is best considered as part of subsequent RMA planning processes, including changes to the CRPS and district plans, and relevant LGA process, including spatial planning"*. The general officer comments on submissions seeking additional greenfield areas and any wider policy changes to C6 that the appropriate process for addressing the submissions *"is likely to the full review of the CRS scheduled for 2022."* It is not clear whether the review will be commenced in 2022 or notified in 2022.

<sup>8</sup> When considering the effects of urban development, decision-makers shall take into account:  
a) The benefits that urban development will provide with respect to the ability for people and communities and future generations to provide for their social, economic, cultural and environmental wellbeing; and b) The benefits and costs of urban development at a national, inter-regional, regional and district scale, as well as the local effects.

- 10.3 In my opinion it is not reasonable to expect Mr Frei to wait until the outcome of the full 2022 RPS review<sup>9</sup> and any subsequent required District Plan changes to pursue his development proposal for his land – simply because the current RNN zone and GPAs boundaries do not reflect the reality of development on the ground. His proposal has significant planning merit, and will not offend or compromise the overall Our Space approach to management of urban growth in any way.
- 10.4 Mr Frei is 68 years old and does not have time on his side if he is to remain as custodian to oversee a sensitive development of this land. Realistically, the CRP review process will take 2-4 years (once notified) and the subsequent District Plan change process a further 1-3 years (depending on whether it is a private or Council initiated plan change and whether it relates to just Mr Frei's land or other land as well). It will be at least 2025 – 2027 before zoning is in place, or 2027 – 2029 if the CRPS review process only commences in 2022. It is also a hugely costly process for one landowner to participate in.
- 10.5 In any case, in my opinion C6 (or at least some parts as outlined below) are overdue for review now. C6 was adopted in December 2013 as part of the LURP. Its history is complex but essentially it replaced the decisions version of PC1, issued in December 2009 and notified in 2007. It provides for urban growth up to 2028, whereas the planning framework for PC1 was up to 2041. The planning framework for Our Space is up to 2048. The focus of C6 was earthquake recovery, in particular providing sufficient greenfield housing and business land to facilitate large scale greenfield development necessary to meet the urgent housing needs resulting from the 'red zoning' of substantial areas of existing housing.
- 10.6 C6 was implemented under streamlined procedures. Appeals were restricted to points of law and appeals on its predecessor PC1 were extinguished. C6 did not consider consequences of smaller anomalous situations where individual landowners were not given the opportunity to put their case (there were no hearings on LURP 'comments') and appeal rights were extinguished – or landowners were not even aware of the process. The overall allocative approach and fixed uncontested rural/urban boundary line was not tested, as for example it has been through the Auckland Unitary Plan

<sup>9</sup> Our Space Schedule of Future Work Item 11



process – and found to be ‘lacking’ (see evidence for GR Rhodes Estate & Mark Larson submission 60).

10.7 I further note that Christchurch City Council publicly expressed the view in its submission on the Draft LURP (Land Use Recovery Plan) in 2015 – four years ago now - that *"there are some relatively minor changes to the existing urban boundary that are considered to have merit at a local level and would not in fact compromise any higher order policy direction."*<sup>10</sup> (see **Appendix H**).

10.8 The Comment notes that C6's predecessor, PC1, did contain some flexibility but this was not carried through to C6. This was Policy 12:-

*Policy 12: Resolution of Urban Limits (a) During the process of completing district plans and Outline Development Plans, territorial authorities may make minor amendments to provide for urban zoning outside the Urban Limits shown on Map 1 provided all the following conditions are met: (i) Any proposed extension or reduction will not change the Outline Development Plan area by more than 5%; and (ii) Any additional land is contiguous with the Outline Development Plan Area; and (iii) Economies of Scale or other efficiencies of infrastructure would arise; and (iv) All other provisions of Policy 8 are met.*

10.9 In my opinion the 5% limit to extensions or reductions to ODPs is somewhat arbitrary – a more flexible approach is required which responds to the local circumstances in each case. With respect to the Hendersons ODP area, it may be the changes to the Hendersons ODP area shown on Sarah Oliver's Option 1 plan (as produced above) and changes sought by Ernst Frei, and other potential beneficial changes amount to more than 5%. Also – Policy 12 does not cover changes to the rural/urban boundary line which are not GPAs i.e. the Existing Urban Area, Housing Accord Areas or Future Development Areas. My proposed Policy 6.3.1A is preferred as it 'all encompassing' in this respect and provides the required flexibility.

<sup>10</sup> CRDP Exhibit B, Letter from CCC dated 29-5-15, page 2, section 2.3

## 11.0 Implementation Including Streamlined Planning Process

11.1 Our Space notes that the GCP may consider streamlined processes for making the Our Space proposed targeted change to the CRPS<sup>11</sup>. Section 80C of the Resource Management Act 1991 states that if a local authority determines that, in the circumstances, it would be appropriate to use the streamlined planning process to prepare a planning instrument, it may apply in writing to the responsible Minister for a direction to proceed under this subpart. Subsection 2 lists a number of criteria, at least one of which must be met, in order for such a direction to be made (see **Appendix I**). I presume the GCP are relying on s2a) *“the proposed planning instrument will implement a national direction”*.

11.2 I consider that Section (2) (a), (b), (d) and (f)<sup>12</sup> apply in this particular case. I therefore consider that the Panel should consider the appropriateness of a streamlined process to facilitate my recommended changes to the CRPS and CDP which will enable Mr Frei to proceed with development now, rather than 2026 at the very earliest. With respect to (d), an unintended consequence of a fixed rural/urban boundary line in C6 of the CRPS, particularly as it applies to Hendersons Ponding Basin, is that the minimum targets for sufficient, feasible development capacity cannot be achieved – and, as recognised by the Council planner at the preapplication meeting *“the inability to alter the lines, makes undertaking good planning for this site impractical”*. This is contrary to NPS-UDC PA4 for the reasons outlined above.

## 12.0 Section 32 Assessment

12.1 There is no s32 assessment accompanying Our Space despite its defining role in ‘dictating’ the urban growth approach for Greater Christchurch for the next 30 years. I

<sup>11</sup> Reference note 22, Our Space Section 5.7

<sup>12</sup> (2)However, a local authority may apply for a direction only if the local authority is satisfied that the application satisfies at least 1 of the following criteria:

(a)the proposed planning instrument will implement a national direction:

(b)as a matter of public policy, the preparation of a planning instrument is urgent:

(d)a plan or policy statement raises an issue that has resulted in unintended consequences

(f) the expeditious preparation of a planning instrument is required in any circumstance comparable to, or relevant to, those set out in paragraphs (a) to (e).

note that under s80C streamlined procedures, s32/32AA evaluation reports are to be submitted with the proposed planning instrument.

12.2 In my opinion, the relief sought in Ernst Frei's submission, including using streamlined procedures to amend C6 and the CDP, is the most efficient and effective option in terms of s32 (see **Appendix J**) to give effect to the NPS-UDC. To wait until the 2022 full RPS review to even consider the matter would have nil benefits and substantial costs - it would not give effect to the NPS-UDC; would most likely be cost prohibitive for the submitter as it would require input into multiple future planning processes with no certainty of outcome; and result in a lost opportunity for a high amenity subdivision to be realised in the short/medium term – and involving less development land than existing identified Greenfield Priority Areas within Mr Frei's site.

### **13.0 Officers Report**

13.1 The OR appears not to have considered the particular circumstances of any of the submissions seeking further greenfield areas. In Mr Frei's case, it is more a matter of seeking a more appropriate greenfield area within an existing ODP area, rather than seeking significant additional greenfield land. The OR does not recognise this distinction.

13.2 The OR has a standard response with respect to all submissions seeking further greenfield land i.e. they "*do not consider the additional land proposed by the submitters is preferable to that identified in Our Space or necessary to demonstrate sufficient, feasible development capacity in the medium or long term for Greater Christchurch.*" The evidence is that this is clearly not the case for Mr Frei's land.

13.3 I have set out above (under section 10) why I strongly disagree with the OR that the relief sought by Mr Frei is best left to consideration at the time of the full CRPS Review in 2022 – and subsequent District Plan processes.

### **14.0 Conclusion**

14.1 Mr Frei's land is 18.5ha in area. It is located within CDP Hendersons Outline Development Plan area (Appendix 8.10.18) in south west Christchurch. Approximately 1.5ha of the Site is zoned Residential New Neighbourhood (RNNZ), with the balance (16.5ha) zoned Rural Urban Fringe. A total of 8.1ha of the Site is located within the Map A – Greenfield Priority area but only 3.9 ha (including proposed covenanted amenity areas) of the proposed development area is within the GPA. Mr Frei proposes a high amenity mixed density residential development of approximately 5 ha of the Site (excluding amenity covenant areas). The proposed development yield is approximately

50 mixed density household units. This number of lots is necessary for the subdivision to be commercially viable and meet the NPS-UDC definition of feasible development.

- 14.2 The development proposal is not anticipated as having any adverse environmental effects<sup>13</sup> and will result in an overall more favourable planning outcome, with positive environmental features, compared with that enabled under the current RNN zoning which applies to Mr Frei's land. Development of the current RNN zoned part of Mr Frei's land is highly unlikely to proceed in any case because it is not commercially viable.
- 14.3 Mr Frei's case illustrates why a fixed, rigid, uncontestable urban/rural boundary set in a regional policy statement does not work when applied at the local level – and can result in undesirable and unintended adverse planning outcomes.
- 14.4 **Our Space** and CRPS C6 are 'high level' documents which cannot realistically respond to local circumstances, land use patterns and needs which importantly inform land use planning at the local level. It needs to retain flexibility to enable appropriate response at the district level to local circumstances.
- 14.4 Mr Frei is aware of, and supports other submissions which seek that the fixed rural/urban boundary line be removed from the CRPS, to be replaced with a more flexible 'directions for growth' approach, to implemented at District Plan level.
- 14.5 If the Panel is of a mind to retain the fixed rural/urban boundary, then at the very least there should be a more flexible policy framework (my suggested Policy 6.3.1A or similar); and the rural/urban boundary line should be amended to include all of the 564 Cashmere Road proposed development area as a Greenfield Priority Area, and zoned RNN.
- 14.6 Christchurch City Council itself support a more flexible policy framework – as reflected in their submission on the LURP and their advice at the recent preapplication meeting for 564 Cashmere Road.
- 14.7 It is not possible or reasonable for the matters raised in Mr Frei's submission to be deferred until the 2022 CRPS full review and subsequent district plan rezoning processes. This is because Our Space and the limited scope of the recommended CRPS 2019 change do not give effect to the NPS-UDC or meet the requirements of s32 of the RMA (noting that whether streamlined or standard RMA processes are adopted, a 32 assessment will be required).

<sup>13</sup> detailed site investigations including geotech will be required at subdivision stage as noted in the pre-application meeting notes attached as **Appendix F**).

14.8 Our Space is, in particular contrary to NPS-UDC OA1 and PA4 and will not enable development necessary to meet Our Space minimum targets for short or medium term housing.

14.9 I consider that subsections 2a), b), d) and f) of s80C 2) of the RMA (streamlined provisions) apply in this case and, accordingly, I request that the Panel consider a streamlined process to facilitate my recommended changes to the CRPS and CDP.

## **Appendices**

**Appendix A** Development Concept Plan

**Appendix B** NPS-UDC Definition of Feasible

**Appendix C** Servicing letter – Fox Associates

**Appendix D** Letter from E2 regarding compensatory flood storage

**Appendix E** Report from LandTech Consulting regarding Geotechnical Overview of Site.

**Appendix F** Policy 6.3.11 Monitoring and Review – Canterbury Regional Policy Statement

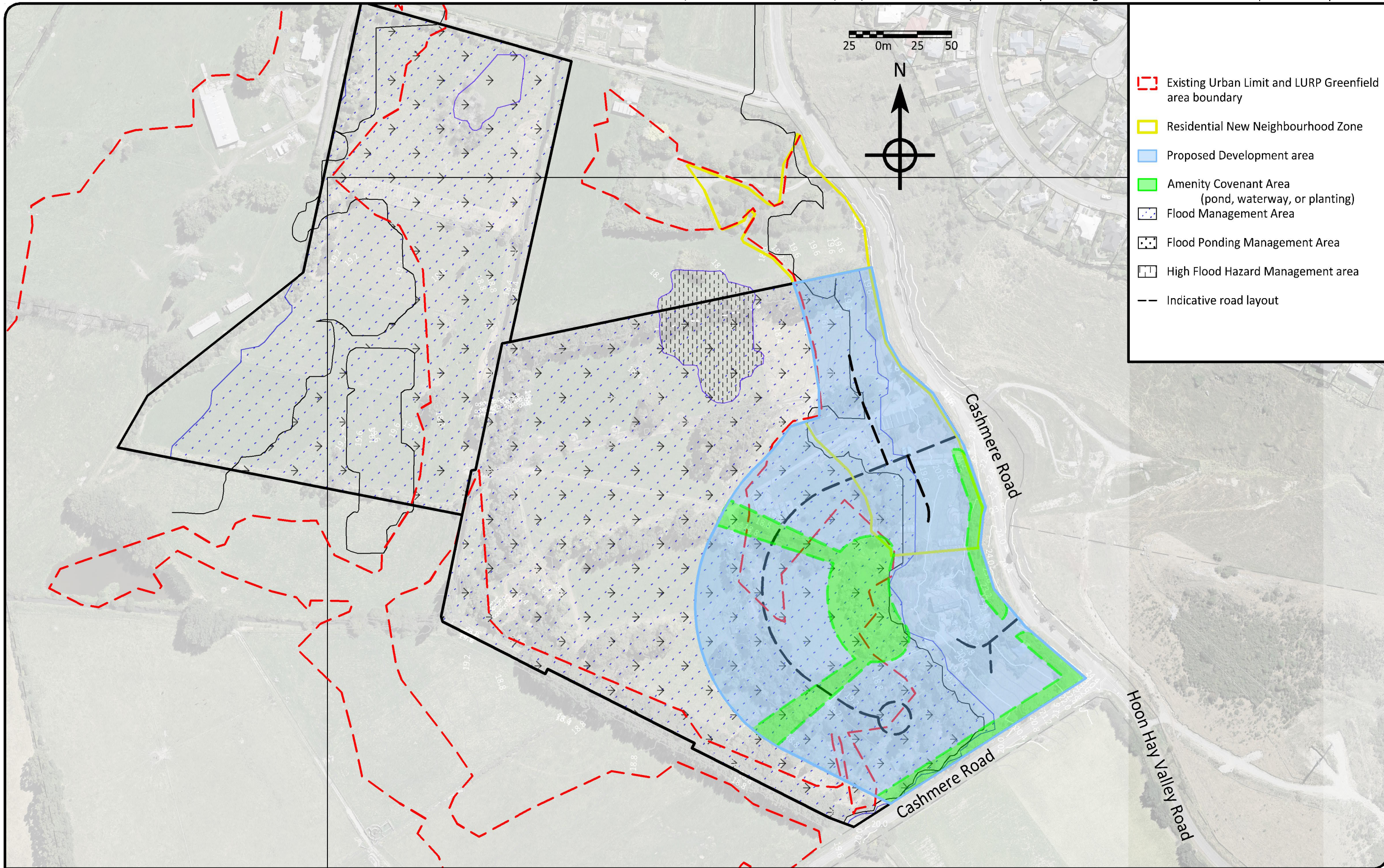
**Appendix G** Pre application meeting minutes – Christchurch City Council

**Appendix H** Christchurch City Council Submission on Draft Land Use Recovery Plan - 2015

**Appendix I** Section 80C Resource Management Act 1991

**Appendix J** Section 32 Resource Management Act

**Appendix A**  
**Development concept plan**



# Proposed Development

## 564 Cashmere Road - Lot 1 DP 82258

|     |                     |       |          |                 |               |
|-----|---------------------|-------|----------|-----------------|---------------|
| D   | Dev Area amended    | MJM   | 30/11/18 | Scale 1:2500    | Job No. 4386F |
| C   | Key Updated         | MJM   | 29/11/18 |                 |               |
| B   | Viewshaft excluded  | MJM   | 28/11/18 | Designed        | Rev. D        |
| A   | Urban Limit Updated | MJM   | 28/11/18 | Drawn MJM       |               |
| No. | Revision            | Appr. | Date     | Date 28/11/2018 |               |

## **Appendix B**

### **NPS-UDC Definition of Feasible**

**Feasible:** means the development is commercially viable development, taking into account the current likely costs, revenue and yield of developing; and feasibility has a corresponding meaning.



**Appendix C**  
**Servicing letter – Fox Associates**

**Date**  
28 November 2018

**Job Number**  
4386F.01



195 Peterborough St, Christchurch 8013  
PO Box 895, Christchurch 8140

0800 FOX SURVEY  
0800 369 787

info@foxsurvey.co.nz  
www.foxsurvey.co.nz

**SUBMISSION ON  
GREATER CHRISTCHURCH SETTLEMENT UPDATE  
– OUR SPACE 2018-2048**

**CONCEPTUAL DESIGN AND SERVICING  
OF RESIDENTIAL DEVELOPMENT AREA**

**At:** 564 Cashmere Rd

**For:** Ernst & Renate Frei

**Date:** 28<sup>th</sup> Nov 2018

**Prepared by:** Michael Martin - Surveyor and Land Development Consultant

**Introduction**

Our clients have owned the property at 564 Cashmere Rd for some decades, operating an organic farm from the site in the early years. Over the years they have planted significant areas of the proposed development area with native planting, and the proposed development is sympathetic to these existing plantings.

The majority of the land is flat and rises to the edge of Cashmere Rd on the northeast boundary.

A portion of the land in the northeast corner is zoned RNN (Residential New Neighbourhood). The Urban Limit / LURP line passes through the site in a very irregular path. The Proposed Development is more sympathetic to site topography and vegetation than these existing zone lines.

Our client proposes to protect existing vegetation, waterways and a pond with covenants and/or consent notices to restrict development in these areas thus providing amenity to neighbouring dwellings.

We estimate that 40-50 mixed residential dwellings could be developed on this site, and we consider that this number of dwellings is required to fund the necessary infrastructure (sewer, roading and stormwater). Without a greater number of allotments than what is currently zoned for development, this development would likely become unviable.

**Services**

A Low Pressure Sewer main could be extended along Cashmere Rd to the gravity outfall.

Stormwater: On-site stormwater treatment and retention could be achieved on the lower parts of the site. The adjacent property to the west is being developed by Council for large scale stormwater treatment and retention.

Water Supply: An existing water supply main is laid along Cashmere Rd and could be used to supply this site.

Power reticulation can be extended from the existing overhead HV along Cashmere Rd. Phone and fibre broadband reticulation could be extended from the existing network along Cashmere Rd.

### Constraints

The proposed development area is similar to the area that is already zoned RNN. A detailed geotechnical assessment is not available, but the landform and levels are similar to the currently RNN zoned area. Neighbouring properties typically border on Technical Classification 2 and 3. Development of this type of land is achievable with appropriate engineering solutions.

Detailed requirements regarding floor levels were not available at short notice. While some of the proposed development area is at a lower level than the existing RNN area, filling could be used to raise the site to meet required minimum floor levels. This filling might reduce flood storage volumes and require compensatory storage. It is possible that this storage might be provided on the land that our client owns to the west. These requirements and appropriate engineering solutions could be worked out as the proposed development progresses through the planning phase.

Yours faithfully



Michael Martin | Registered Professional Surveyor

**Fox & Associates Ltd**

\\FOXDC01\Projects\4386F Frei - Cashmere Road\Correspondence\4386F.01 20181130 Urban Limit.docx

## **Appendix D**

**Report from E2 regarding compensatory flood storage**

# Flood Compensation for 564 Cashmere Road

Feasibility Assessment Report

Ernst and Renate Frei

13 February 2019

## Quality Control

|                   |                              |              |                       |
|-------------------|------------------------------|--------------|-----------------------|
| Author            | Daryll Pinfeld               | Client       | Ernst and Renate Frei |
| Reviewed by       | Andrew Tisch                 | Date Issued  | 13 February 2019      |
| Approved by       | Andrew Tisch                 | Revision No. | 2                     |
| Doc Name/Location | rpt 190212 564Cashmere 18063 |              |                       |

### Disclaimer

This report has been prepared solely for the benefit of Ernst and Renate Frei. No liability is accepted by e2Environmental Ltd or Ernst and Renate Frei if information contained in this report is used by any third party.

© Copyright e2Environmental Ltd

All rights are reserved. This publication may not be copied or reproduced in any form without the permission of Ernst and Renate Frei. Permission will only be given within the terms and conditions of the contract with e2Environmental Ltd and Ernst and Renate Frei. This copyright extends to all forms of storage including any sort of storage retrieval system.

e2environmental Ltd.  
46 Acheron Drive  
PO Box 31159  
Christchurch NZ

Project No. 18063

## TABLE OF CONTENTS

|  |   |
|--|---|
| Table of Contents .....                                      | i |
| 1 PURPOSE .....  | 2 |
| 2 SUMMARY .....  | 2 |
| 3 SITE CONDITIONS .....                                      | 3 |
| 2.1 200-year Flood levels .....                              | 3 |
| 2.2 Groundwater .....  | 3 |
| 4 FLOOD COMPENSATION METHODOLOGY .....                       | 4 |
| 5 POST DEVELOPMENT STORMWATER ATTENUATION.....               | 4 |
| 6 LIMITATIONS ON COMPENSATION VOLUME .....                   | 4 |
| APPENDICES .....   | 5 |
| APPENDIX A – Flood Compensation Drawings by e2               |   |
| APPENDIX B – Christchurch City Council 200-year flood levels |   |
| APPENDIX C – Groundwater Monitoring Wells                    |   |

## 1 PURPOSE

A submission to the Christchurch City Council (CCC) is being prepared for Ernst and Renate Frei, the Submitter and land owner, to increase the Residential New Neighbourhood (RNN) Zone for their property at 564 Cashmere Road, Christchurch. This report needs to be read in conjunction with the submission<sup>1</sup> described above.

The existing RNN extent is confined to higher ground in the east overlooking lower-lying flood prone land to the west.

To be suitable for residential development, the submission proposes that flood prone land within the proposed

RNN Zone will be filled above the 200-year flood level. The proposed RNN Zone is shown in Figure 1 below.

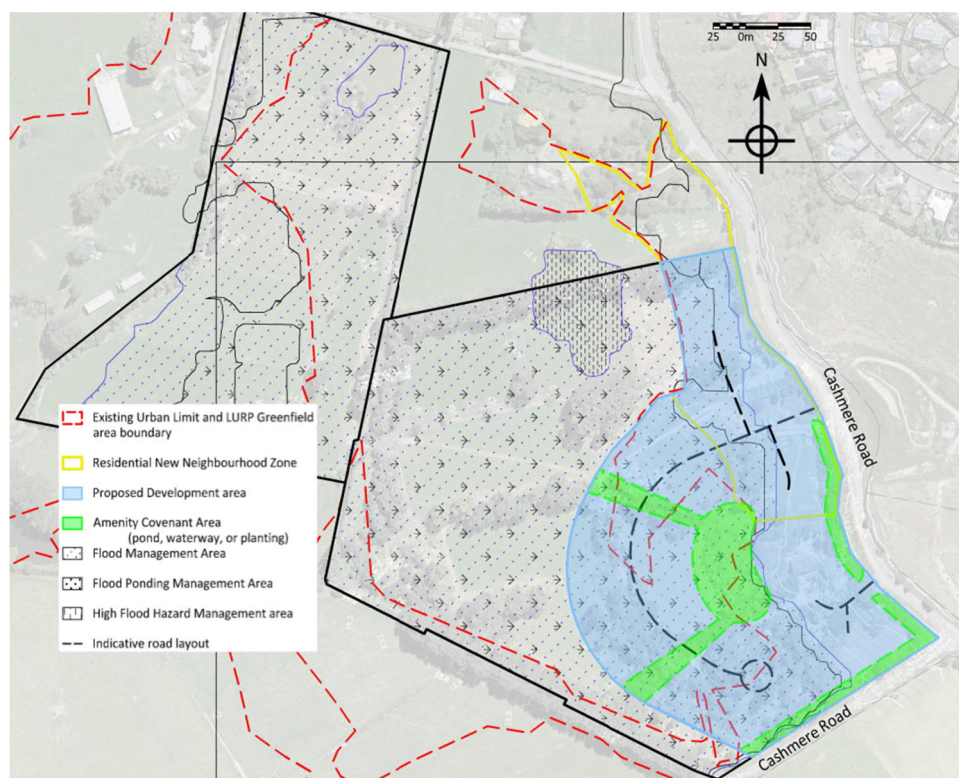
As a consequence of filling over flood prone land, flood storage will be lost in the catchment, therefore flood compensation will be required elsewhere on the property. e2Environmental Ltd (e2) have assessed and confirmed that flood compensation is technically feasible.

## 2 SUMMARY

Flood compensation can be provided on the land owned by Ernst and Renate Frei by excavating existing flood prone land as shown in the plan in Appendix A.

The depth of excavation is limited by shallow groundwater levels because

Figure 1. Site at 564 Cashmere Road owned by Ernst and Renate Frei showing District Plan areas and proposed RNN boundary



<sup>1</sup> Aston Consultants (November 2018). Submission on Greater Christchurch, Settlement Update – Our Space 2018-2048.



compensation storage is only possible between the groundwater surface and the flood level surface. Note that we have shown a compensation excavation to demonstrate feasibility but there may be other places on site or elsewhere in the catchment where this compensation can be achieved. This can be confirmed at the detailed design stage.

The calculated volume of displaced flood storage by filling is approximately 15,000m<sup>3</sup>. The volume is based on the residential zone extent shown on the plan in Figure 1 and the 200-year flood levels provided by Council.

### 3 SITE CONDITIONS

#### 2.1 200-year Flood levels

To prepare land that is suitable for residential development in a Flood Management Zone it must not be at risk

of flooding in up to a 200-year flood event.

200-year flood levels for the site were provided by Council from their Heathcote Model. These levels are shown in Figure 2 below and Appendix B.

The flood levels vary across the site from 19.29m up to 19.33m, based on the Christchurch City Datum (Jan 2014).

#### 2.2 Groundwater

Excavations for flood compensation storage is limited to the highest groundwater level because storage is only available above the groundwater surface.

Groundwater levels from two nearby monitoring wells were sourced from the Canterbury Regional Council (ECan) online well database.

A summary of groundwater levels are shown in Table 1. Well locations and groundwater levels over time are provided in Appendix C.

Figure 2. Spot height 200-year flood levels (Shown as the larger red numbers) provided by Council, Heathcote Model at 564 Cashmere Road, Christchurch



Table 1. Groundwater level summary for lower-lying flood prone land

| Well number | RL of Minimum elevation (m) | RL of Maximum elevation (m) |
|-------------|-----------------------------|-----------------------------|
| BX24 /1626  | 14.75                       | 18.39                       |
| BX26 /1629  | 14.60                       | 18.28                       |

A groundwater level of 18.4m was selected for the compensation assessment.

The ground elevation for the lower-lying land is generally at 18.8 to 19.5m and therefore excavations would be up to 0.8m deep i.e 19.3m (flood level) – 18.5m (max groundwater + 100mm freeboard).

#### 4 FLOOD COMPENSATION METHODOLOGY

To calculate the volume for flood compensation, the fill volume inside the proposed residential zone up to the flood level was assessed.

12d software was used to develop the 200-year flood surface which was overlaid with the existing ground contours giving a flood compensation volume of 15,000m<sup>3</sup>.

Flood compensation can be provided in the lower-lying land further to the west of the proposed residential area.

See the plan in Appendix A

#### 5 POST DEVELOPMENT STORMWATER ATTENUATION

Any development of greenfield land that will increase the impervious surface area,

or increase runoff from the site will require some form of stormwater attenuation. This could either be provided on site or via the proposed Sutherlands Basins system adjacent to the site. Feasibility of connection to the Sutherland's system and CCC approval is outside the scope of this report.

Note also that Land Use consents from both CCC and Ecan for earthworks, work near a waterway and ground water matters are also likely to be required prior to any earthworks described in this report.

#### 6 LIMITATIONS FOR CALCULATED COMPENSATION VOLUME

The calculated flood compensation volume of 15,000m<sup>3</sup> is not necessarily the final fill volume to complete the proposed development. The actual fill volume will include:

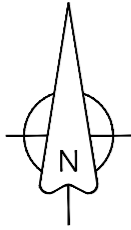
- raising the ground surface to achieve minimum freeboard requirements above the 200-year flood level;
- additional filling to top up ground areas that settle overtime under the applied fill loads.
- reductions where features such as existing ponds and trees are maintained at their current ground levels

## APPENDICES

APPENDIX A – Flood Compensation Drawings by e2

APPENDIX B – Christchurch City Council 200-year flood levels

APPENDIX C – Groundwater Monitoring Wells



20 10 0 10 20 30 40 50 60 70 80 90 100  
Scale 1:1250



| LEGEND |                               |
|--------|-------------------------------|
|        | MAJOR CONTOUR (0.5m INTERVAL) |
|        | PROPOSED RNN BOUNDARY         |

THIS DESIGN AND DRAWING IS COPYRIGHT OF E2ENVIRONMENTAL LTD AND SHALL NOT BE USED OR REPRODUCED WITHOUT WRITTEN AUTHORITY



Unit 1/46 Acheron Drive PO Box 31159 Christchurch  
P 64 3 358 4955 www.e2environmental.com

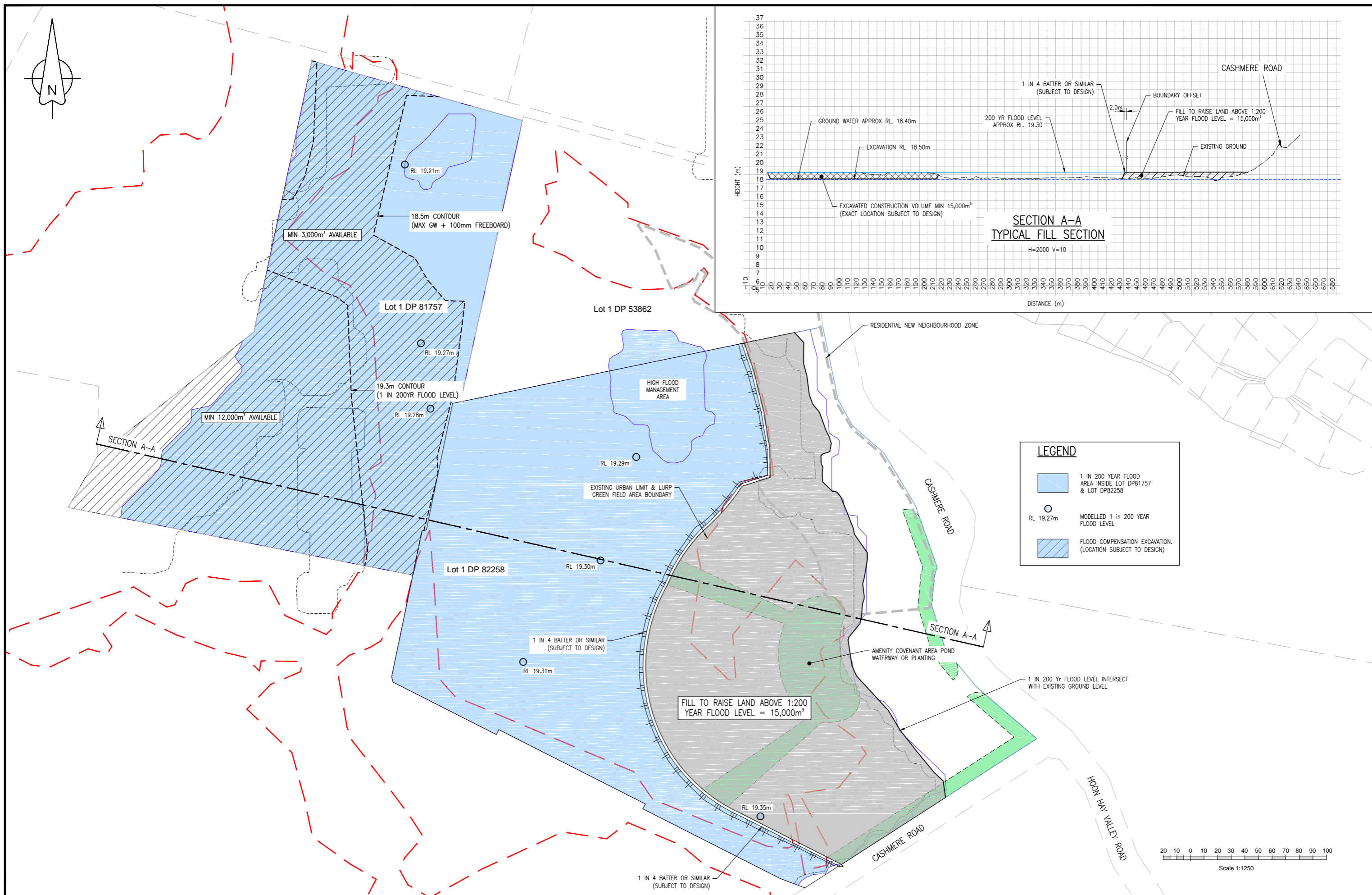
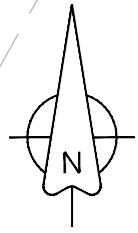
| Rev | Comments     | Approved | Date     |
|-----|--------------|----------|----------|
| A   | FOR APPROVAL | AJT      | 12.02.19 |
|     |              |          |          |
|     |              |          |          |
|     |              |          |          |

Client ERNST FREI

Project 564 CASHMERE ROAD  
CHRISTCHURCH

Title PROPOSED RNN BOUNDARY

|                               |                |                   |                    |                           |
|-------------------------------|----------------|-------------------|--------------------|---------------------------|
| Designed by<br>MP             | Drawn by<br>MP | Checked by<br>AJT | Approved by<br>AJT | Approved Date<br>12.02.19 |
| Status<br><b>FOR APPROVAL</b> |                |                   |                    | Scale<br>1:1250 (A1)      |
| Project No<br>18063-01        |                | Drawing No<br>211 |                    | Revision<br>A             |



THIS DESIGN AND DRAWING IS COPYRIGHT OF E2ENVIRONMENTAL LTD AND SHALL NOT BE USED OR REPRODUCED WITHOUT WRITTEN AUTHORITY

**e2 environmental**  
CONSULTING ENGINEERS

Unit 1/46 Acheron Drive PO Box 31159 Christchurch  
P 64 3 358 4955 www.e2environmental.com

| Rev | Comments     | Approved | Date     |
|-----|--------------|----------|----------|
| A   | FOR APPROVAL | AJT      | 11.02.19 |
|     |              |          |          |
|     |              |          |          |
|     |              |          |          |

Client **ERNST FREI**

Project **564 CASHMERE ROAD CHRISTCHURCH**

Title **COMPENSATION FEASIBILITY FOR FILLING WITHIN THE MODELLED 1:200 YEAR FLOOD ZONE**

|                            |                |                       |                    |                             |
|----------------------------|----------------|-----------------------|--------------------|-----------------------------|
| Designed by<br>MP          | Drawn by<br>MP | Checked by<br>AJT     | Approved by<br>AJT | Approved by Date<br>8.02.19 |
| Status <b>FOR APPROVAL</b> |                |                       |                    | Scale 1:1250 (A1)           |
| Project No <b>18063-01</b> |                | Drawing No <b>210</b> |                    | Revision <b>A</b>           |

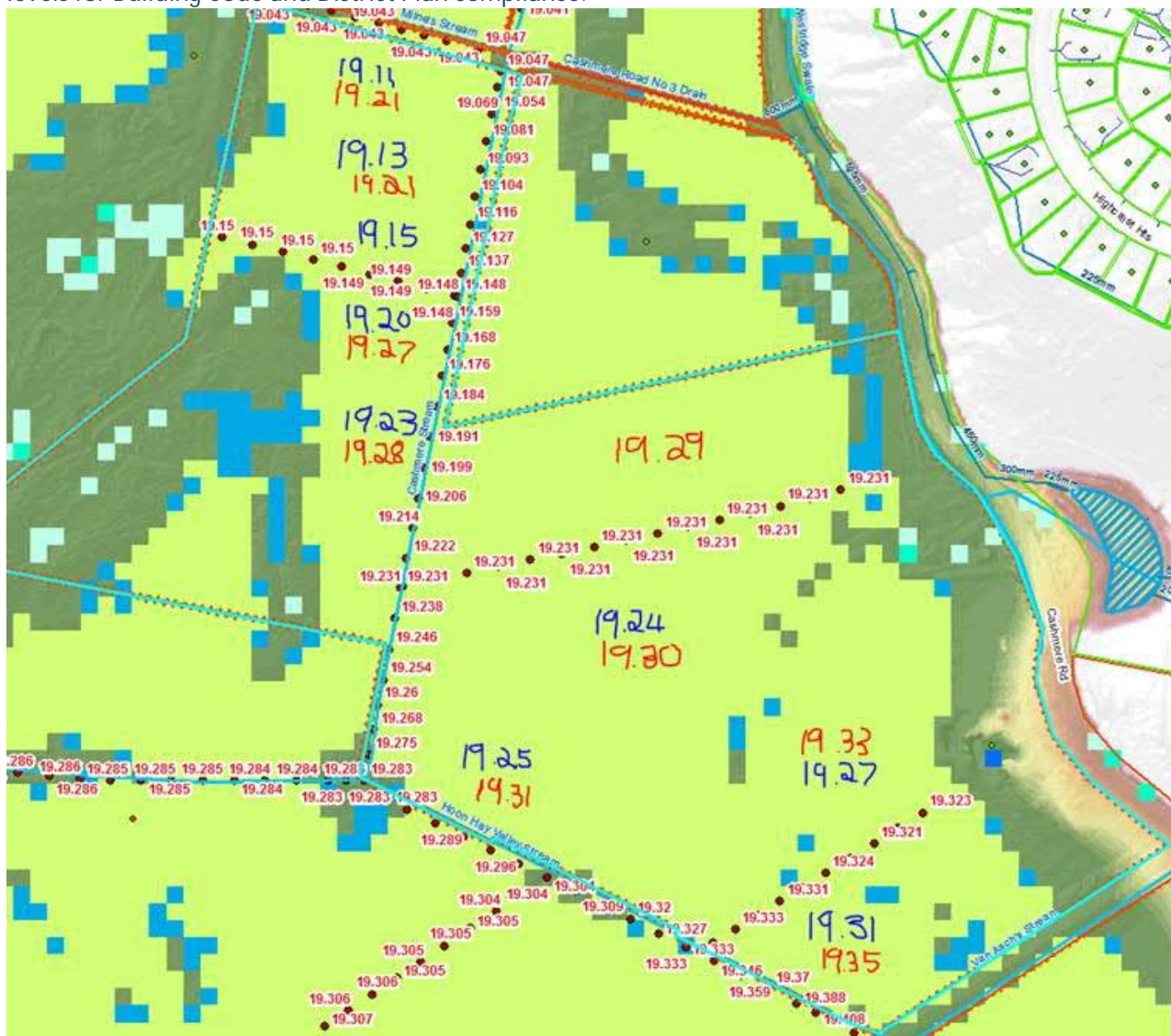
Daryll Pinfold

Subject: FW: 564 Cashmere Road - Water Levels - 30/01/2019

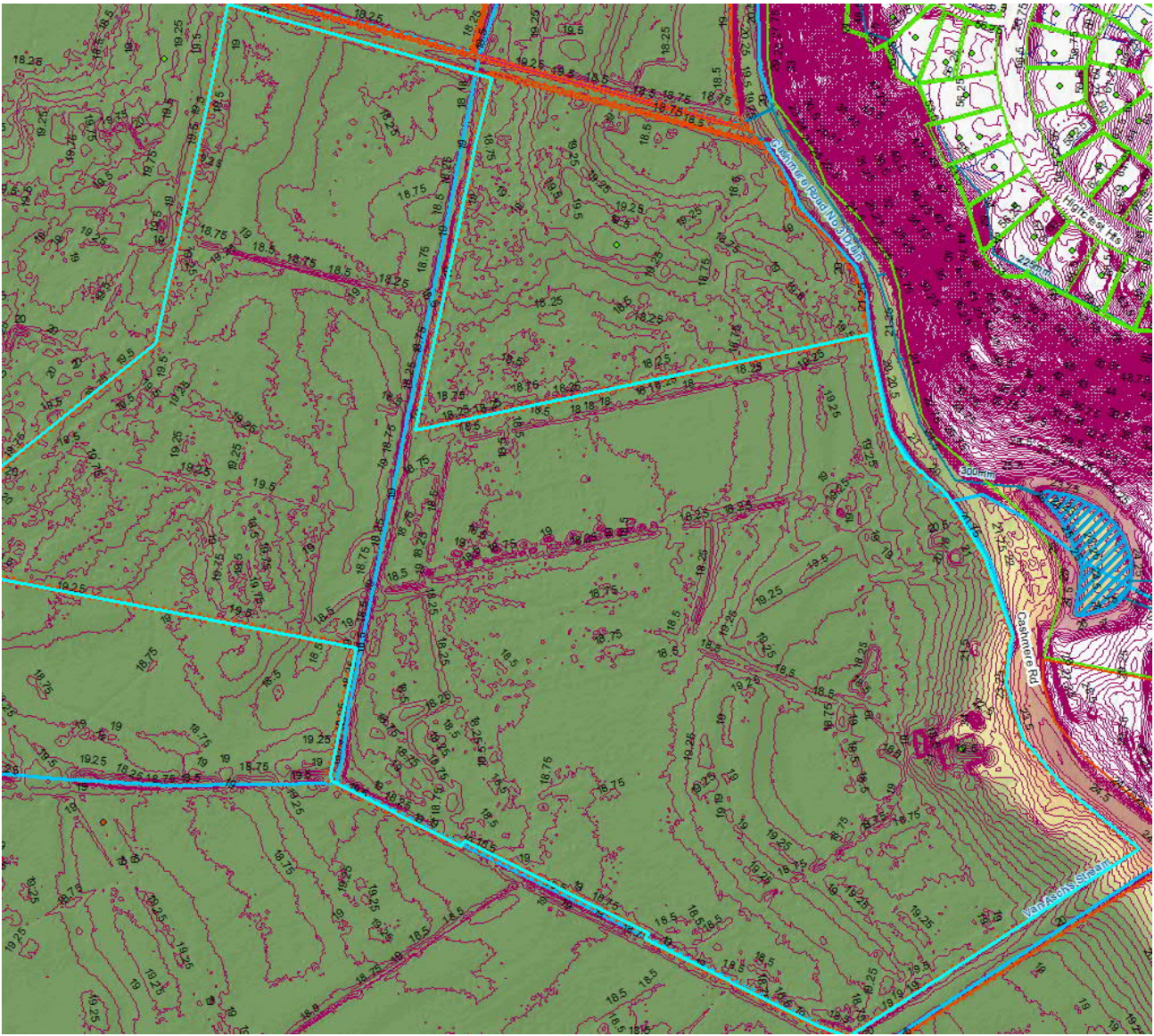
From: Van Voorthuysen, Nick [mailto:Nick.vanVoorthuysen@ccc.govt.nz] On Behalf Of FloorLevels  
Sent: Wednesday, 30 January 2019 10:11 a.m.  
To: Daryll Pinfold <daryll.pinfold@e2environmental.com>  
Subject: 564 Cashmere Road - Water Levels - 30/01/2019

Hi Daryll,

I have taken some spot heights of water levels for the Heathcote model. Blue is the 1-in-50 year levels (green extent) and red is the 1-in-200 water levels. A freeboard of 400 mm would be added to these respective water levels for Building Code and District Plan compliance.



Below is a 250 mm contour to give an idea of the lay of the land. It's pretty hectic but you may be able to ascertain the general layout.



Thanks,

Nick van Voorthuysen  
 Consultant Engineer  
 Network Planning City Water and Waste  
 Email: [FloorLevels@ccc.govt.nz](mailto:FloorLevels@ccc.govt.nz)  
 Phone: +64 3 941 8699  
 Web: [www.ccc.govt.nz](http://www.ccc.govt.nz)  
 Christchurch City Council  
 Civic Offices, 53 Hereford Street, Christchurch  
 PO Box 73014, Christchurch, 8154

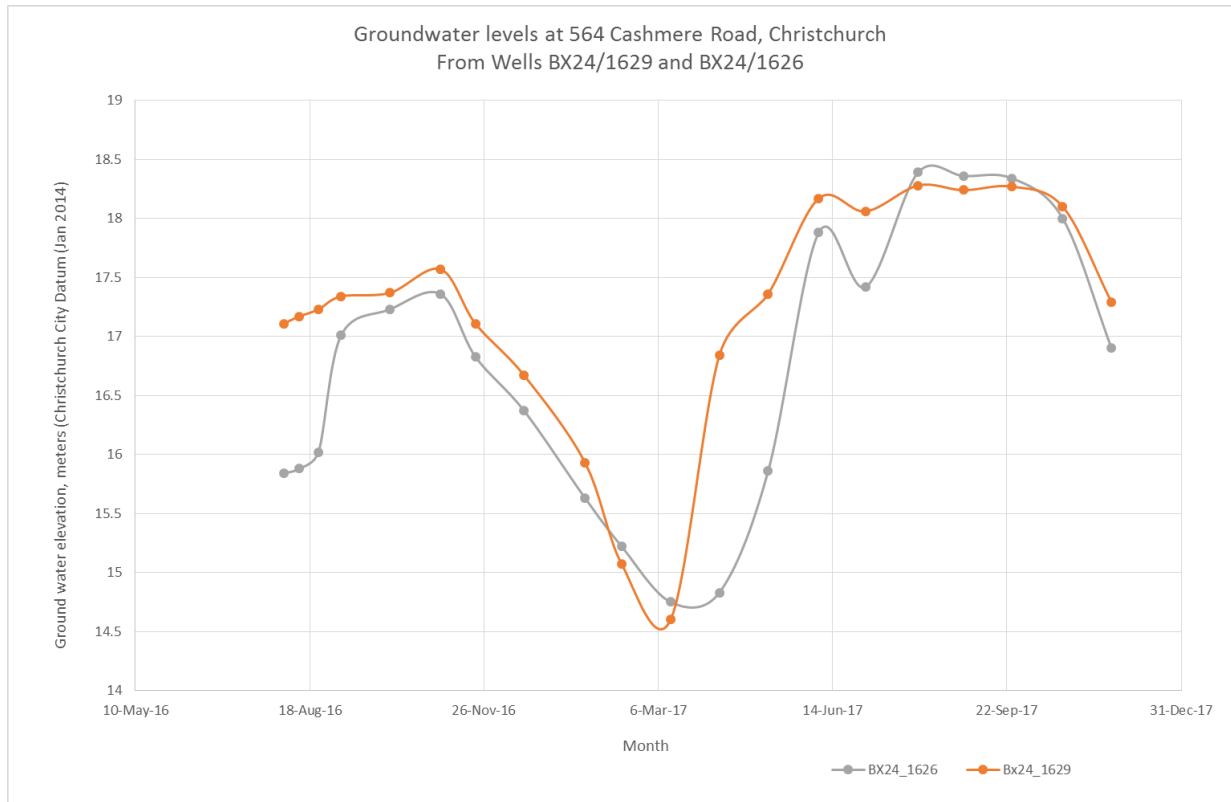
Please consider the environment before printing this email

\*\*\*\*\*  
 This electronic email and any files transmitted with it are intended  
 solely for the use of the individual or entity to whom they are addressed.

The views expressed in this message are those of the individual sender  
 and may not necessarily reflect the views of the Christchurch City Council.  
 If you are not the correct recipient of this email please advise the  
 sender and delete.

Christchurch City Council  
<http://www.ccc.govt.nz>

\*\*\*\*\*



Groundwater monitoring well locations for 564 Cashmere Road, Christchurch





e2environmental Ltd.

46 Acheron Drive

PO Box 31159

Christchurch NZ

<http://www.e2environmental.com>

## **Appendix E**

**Report from LandTech Consulting regarding Geotechnical overview of Site.**



## **GEOTECHNICAL OVERVIEW REPORT**

### **FOR PROPOSED PLANNING CHANGE**

564 Cashmere Road, Westmorland, Christchurch

Client: Ernst Frei

Project Reference: LTC19020

Revision: A

Date: 7 February 2019

## Documentation Control:

LandTech Consulting Ltd



### Postal Address:

PO Box 119  
Christchurch 8013

### Christchurch Address:



Unit 6, 31 Carlyle Street  
Sydenham  
Christchurch 8023  
P. 03 390 1371

### Auckland Address:

127A Plunket Avenue  
Manukau  
Auckland 2241  
P. 09 930 9334

E. [info@landtech.nz](mailto:info@landtech.nz)

[www.landtech.nz](http://www.landtech.nz)

|                                   |   |   |
|-----------------------------------|---|---|
| <b>Document Title:</b>            | <b>Geotechnical Report for Proposed Planning Change</b>                             |   |
| <b>Address:</b>                   | 564 Cashmere Road, Westmorland, Christchurch  |   |
| <b>Revision:</b>                  | A   |   |
| <b>Client:</b>                    | Ernst Frei  |   |
| <b>Project Reference:</b>         | LTC19020  |   |
| <b>Author:</b>                    |  | Ben Ellis, Engineering Geologist<br>BSc (Geology), MEngNZ   |
| <b>Reviewed &amp; Authorised:</b> |  | Dwayne Wilson, Senior Geotechnical Engineer<br>BEngTech (Civil), MEngSt (Geotechnical),<br>CMEngNZ, CPEng, Director |

| REPORT DISTRIBUTION: |                 |               |
|----------------------|-----------------|---------------|
| Recipient            | Release Date    | Document Type |
| Ernst Frei           | 7 February 2019 | PDF           |
| Aston Consultants    | 7 February 2019 | PDF           |

### COPYRIGHT:

The information presented in this geotechnical report/document is the property of LandTech Consulting Limited. Use or copying of this document in whole or in part without the previous permission of LandTech Consulting Limited implies a breach of copyright.

## Executive Summary:

|   |  |
|---|--|
| MBIE Technical Category (NZGD)  | N/A – Rural & Unmapped   |
| Geological Setting  | Alluvial Plain for the majority of the site, with Alluvial Fan deposits located in the south eastern corner where the land is slightly sloping up toward the Port Hills  |
| Performance through the Canterbury Earthquake Sequence                                  | No observed liquefaction ejecta, even given the high levels of peak ground accelerations experienced. Some lateral ground movement observed in the southeast within the slightly sloping alluvial fan.   |
| Site Specific and Nearby Testing  | On-site hand augers within the alluvial plain area west of the existing farm sheds indicate firm silts for the upper 1.0m or so, underlain by soft silt and loose sand with occasional organic materials at depth. Boreholes around the existing dwellings within the alluvial fan encountered 1.0m to 2.0m of fill, overlying loess colluvium (alluvial fan materials) to 3.0m depths. Alluvial plain deposits are encountered below 3.0m to the base of testing at 12.0m, predominantly comprising silts and sandy silts. This indicates the alluvial fan is younger in geologic age compared to the surrounding alluvial plain. |
| Probable Technical Category for site, as assessed via our area wide geotechnical review | <b>TC2 or TC3</b>  |

**Figure 1: Aerial photograph of investigation site**



(Source: Land Information New Zealand (LINZ) image captured 5 February 2019)

## Table of Contents:

|      |                                       |    |
|------|---------------------------------------|----|
| 1.0  | Introduction & Scope of Work .....    | 2  |
| 2.0  | Site & Dwelling Description .....     | 2  |
| 3.0  | Damage Review .....                   | 2  |
| 4.0  | Received Report Review .....          | 3  |
| 5.0  | Area Geology .....                    | 4  |
| 6.0  | Geological Data Review .....          | 4  |
| 7.0  | Subsurface Conditions .....           | 6  |
| 8.0  | Past Earthquake Performance .....     | 7  |
| 9.0  | Liquefaction Analysis .....           | 8  |
| 9.1  | Past Earthquake Events .....          | 8  |
| 9.2  | Model Earthquake Events .....         | 10 |
| 10.0 | Geotechnical Hazard Evaluation .....  | 12 |
| 11.0 | Conclusion .....                      | 13 |
| 12.0 | Future Geotechnical Involvement ..... | 13 |
| 13.0 | Limitations .....                     | 14 |

## Appendices:

|             |  |
|-------------|--|
| APPENDIX A: | NZGD Borehole Logs   |
| APPENDIX B: | NZGD CPT Reports   |
| APPENDIX C: | MBIE Past Event Liquefaction Analysis Outputs                                |
| APPENDIX D: | Past Event Liquefaction Analysis Outputs with Soil Specific Correction       |
| APPENDIX E: | MBIE Model Earthquake Liquefaction Analysis Outputs                          |
| APPENDIX F: | Model Earthquake Liquefaction Analysis Outputs with Soil Specific Correction |

## 1.0 Introduction & Scope of Work

LandTech Consulting Ltd. (LandTech) were engaged by Ernst Frei (the Client) to carry out a geotechnical desktop review of the property at 564 Cashmere Road, Westmorland, Christchurch. The review is in relation to the proposal to change the zoning of the site to enable residential development.

The geotechnical investigation for the site included the following:

- Desktop study, including review and analysis of NZGD;
- Site Walkover;
- Liquefaction assessment; and
- Provision of this geotechnical report.

## 2.0 Site & Dwelling Description

The site is located at 564 Cashmere Road, Westmorland and is legally described as Lot 1 DP 82258 with an area of 184,752m<sup>2</sup> (according to Land Information New Zealand, weblink; <https://data.linz.govt.nz/>, accessed 5 February 2019).

The site gently slopes from the Port Hills to the east toward gently undulating ground to the west. A pond is located at the centre of the proposed development, with a slight ridge to the west. The site is bounded by Cashmere Road to the east, and south, and farmland to the north and west. The proposed development is located largely within the southwestern corner of the property, which is currently occupied by the landowners dwelling, some farm sheds and grassed paddocks. The Cashmere Stream runs near the western and northern proposed development boundary.

The dwelling on site was repaired following the Canterbury Earthquake Sequence (CES) but is generally constructed with heavy weight cladding on a slab on grade foundation. This is classed as Type C2 under the MBIE Guidelines (December 2012).

## 3.0 Damage Review

During our walkover inspection on 4<sup>th</sup> February 2019 and in conversation with the landowner who was present during the CES we understand the property experienced no liquefaction ejecta. The dwelling on site was repaired following damage during the CES where up to 100mm of lateral stretch occurred. Due to the elapse of time between the CES and our inspection, any potential ground damage that may have taken place has likely been masked due to the passage of time. Therefore, our report herein has made reference to damaged mapped during the CES, recorded on the New Zealand Geotechnical Database (NZGD), and anecdotal evidence by the landowner. This will aid our assessment in the likely level of damage following future significant earthquakes.

#### 4.0 Received Report Review

We have been supplied with three reports relating to the site. These will be summarised here and referred to in our geotechnical assessment of the site.

Lewis & Barrow Ltd, Shallow Geotechnical Investigation – We are in receipt of a geotechnical report relating to the proposed construction of two new farm sheds on the property. The investigation consisted of three hand augers with associated Scala penetrometer testing. The report indicates that historic Google Earth imagery indicates liquefaction on neighbouring properties, but no visible liquefaction on the area under investigation. Additionally, it mentions that tests on similar sites in the area are shown to border between TC2 and TC3.

Aston Consultants, Submission on Greater Christchurch Settlement Update – We have also been provided with a submission by Aston Consultants on behalf of Ernst Frei in regards to a proposed high amenity residential development of approximately 5 hectares on the site. The submission indicates that the site is located partially within the Residential New Neighbourhood Zone and partially within the Rural / Urban Fringe. It indicates a plan change is required in order to proceed with the proposed development. An attached LiDAR plan of the area indicates the ground ranges from RL 18.4m to RL 23.6m. There is also an attached letter from ECan confirming the site is verified non-HAIL.

Christchurch City Council Meeting Record – dated 24 January 2019, this document summarises the pre-application meeting within the council. The minutes note that the most significant barriers to the development are likely the disposal of floodwaters and the requirement for a zoning change. A minimum finished floor level of RL 19.60m is mentioned.



## 5.0 Area Geology

The area geology has been reviewed and reference has been made to the GNS Geological Unit QMAP (accessed 5 February 2019). The reviewed sources indicate that the south eastern portion of the site is located on young alluvial fan deposits, while the north west of the site is underlain by young terrace or plain alluvium of Holocene river deposits.

The characteristics of the Alluvial Deposits can vary widely over small distances. These variations include both vertical and horizontal differences in both soil and particle size distribution and consolidation. These materials generally comprise interbedded horizons of fine to coarse sand, silt, clay, and peat however layers of rounded to sub-rounded greywacke gravel to cobble size particles can also exist.

The geotechnical properties of Alluvial Deposits depend on a number of factors including composition, level of consolidation, groundwater, particle size distribution, and potential organic content. For this reason, alluvium can be prone to differential settlement. It can exhibit potential for liquefaction during seismic events and lateral spreading near river systems.

## 6.0 Geological Data Review

Reference has been made to sources including the New Zealand Geotechnical Database (NZGD): <http://www.nzgd.org.nz/>, Environment Canterbury (ECan): <http://canterburymaps.govt.nz/>. The following text summaries the findings of our data review:

- The MBIE Residential Foundation Technical Category Map indicates the site is located within an area designated as N/A – Rural and Unmapped. This indicates that normal building consent procedures apply.
- The *EQC Liquefaction Interpreted from Aerial Photography* indicates no observed liquefaction following the February 2011 event. The site was not mapped following any other event.
- The *EQC Observed Ground Crack Locations* indicates no cracks were mapped near the site during the CES.
- The *Property Summary Report* for the site indicates a median design groundwater level of 8.82m above the LVD37 datum. The LiDAR and digital elevation model indicates a ground height of approximately 11m above the LVD37 datum. Therefore a conservative design groundwater level of 2.0m is assumed.

- The *GNS Science Post 4 Sept 2010 Observations* and *GNS Science Post 22 February 2011 Observations* indicates liquefaction to the north and west of the site following the September 2010 event. Liquefaction is recorded to the north following the February 2011 event. No liquefaction was observed on the subject site for either of these events.
- The NZGD has two bore hole logs (BH\_40382 BH01 & BH\_40382 BH02) mapped as being performed on site, referred to as BH01 and BH02 respectively. We have accessed these logs and will refer to them in order to assess the subsurface conditions. The logs are attached in Appendix A. The location of the boreholes are indicated on Figure 2, below.
- The NZGD also maps two CPT's being performed near the site, CPT\_76306 to the north and CPT\_88430 to the west, in adjacent properties. These CPT's have been accessed and analysed in order to estimate the liquefaction hazard in the area. CPT\_76306 was performed without a U2 filter, so we have assumed a hydrostatic line for the purposes of liquefaction analysis. The logs are attached in Appendix B. The location of the two CPT's is indicated on Figure 2, below.



Figure 2: NZGD Test locations.

## 7.0 Subsurface Conditions

The subsurface conditions on site are referred to via two bore holes logged on site by Coffey Geotechnical Ltd on April 2014, and the hand augers performed by Lewis & Barrow Ltd on the 30<sup>th</sup> of March 2015. Additionally, Two CPT reports and the bore hole logs were accessed via the NZGD on the 5 February 2019 and are attached in Appendix A and B respectively. Detailed descriptions are given on the attached log, while a summary of the main soil units encountered is given below. It should be noted that the borehole logs are classified according to the Unified Classification System and not the New Zealand Geotechnical Society's Field Description of Rock and Soil guidelines.

- **Topsoil and Fill.** Topsoil and Fill were encountered from the existing ground surface to depths between 0.3m and 0.5m, within the hand auger logs. Additional peaty organics were logged below 2.0m. The Borehole logs indicate fill to between 1.4m to 1.9m depths. Due to the nature of the fill and organic content of the topsoil, these materials may be unsuitable for permanent support of foundations due to the potential for differential settlement.
- **Alluvial Fan.** Below the topsoil and fill the boreholes record a Loess Colluvium deposit between 1.4m and 3.2m depth. These deposits are recorded as silt and sandy silt. They are likely deposited by the alluvial fan noted within Section 5.0. These deposits are also encountered within the CPT to the north (CPT\_76306), with higher densities recorded between 2.2m to 5.0m depth. These denser alluvial fan deposits are not encountered within the CPT to the west (CPT\_88430).
- **Alluvial Planes.** Underlying the Alluvial Fan deposits, soft to firm silts and sandy silts are encountered to the termination of the boreholes at 6.45m and 12.45m, and 8.6m to 15.0m within the CPT's. The CPT's encountered a dense sand and gravel layer between 8.0m and 9.0m depths, which were not encountered within the borehole logs.
- **Groundwater.** Groundwater was logged as 2.2m and 2.4m within the boreholes on the day of testing, with the casing removed. The water table was not struck in the Lewis and Barrow Ltd logs, which terminated between 1.8m and 2.7m depth. Groundwater levels were not recorded within the CPT results.
- **Site Seismicity.** For the purpose of applying requirements of NZS 1170.5:2004 the site subsoil is considered likely to be either Class D – Deep or Soft soils or, Class E – Very Soft Soils. Additional site specific testing is required to correctly determine the site subsoil class.

## 8.0 Past Earthquake Performance

Table 1 below shows mapped peak ground accelerations (PGA's) during the CES and corresponding extent of liquefaction ejecta, from the NZGD and based on LandTech aerial photographic interpretation. The magnitude of the June and December 2011 events have been adjusted to take into account the foreshocks before the main events.

**Table 1: Past earthquake performance**

|                                   | September<br>2010<br>(Mw 7.1) | February<br>2011<br>(Mw 6.2) | June<br>2011<br>(Mw 6.2) | December<br>2011<br>(Mw 6.1) |
|-----------------------------------|-------------------------------|------------------------------|--------------------------|------------------------------|
| PGA (g)                           | 0.27                          | 0.44                         | 0.17                     | 0.14                         |
| Scaled PGA <sub>7.5</sub><br>(g)  | <b>0.24<br/>(tested)</b>      | <b>0.31<br/>(tested)</b>     | 0.12<br>(not tested)     | 0.10<br>(not tested)         |
| Scaled PGA <sub>10th</sub><br>(g) | <b>0.15<br/>(tested)</b>      | <b>0.19<br/>(tested)</b>     | 0.07<br>(not tested)     | 0.06<br>(not tested)         |
| Reviewed Ejecta                   | Not mapped                    | None observed                | Not mapped               | Not mapped                   |

With reference to the NZGD data the site can be considered well tested to SLSA levels of strong ground motion (Mw 7.5 PGA=0.13g) during the September 2010 and February 2011 earthquakes. The September 2010 most closely represents the demand of a SLSA level event. Therefore, future SLSA earthquakes are qualitatively expected to undergo a similar degree of land damage to that experienced during the September events (assume little to none liquefaction ejecta).

The February 2011 event also equals the requirements for a ULS level event in terms of intensity, but not duration (i.e. Mw = 7.5, PGA = 0.35g) during which no ground damage was assessed. Therefore, we can expect a slightly greater level of ground damage during future ULS level events (i.e. minor liquefaction ejecta).

## 9.0 Liquefaction Analysis

### 9.1 Past Earthquake Events

We have analysed the CPT's acquired from the NZGD for liquefaction in Past Earthquake Events. The analysis has been carried out using Geologismiki CLiq Version 2.0. Liquefaction settlement and land damage potential has been calculated for the four main past earthquake events, with methodology adapted for our analysis is based on the MBIE Guidelines (December 2012) and recent clarifications (October 2014). Analysis was carried out using groundwater set to 2.0m.

The model past event conditions are given below:

- September 2010; where  $M_w = 7.1$ , and  $PGA = 0.27g$ ;
- February 2011; where  $M_w = 6.2$ , and  $PGA = 0.44g$ ;
- June 2011; where  $M_w = 6.2$ , and  $PGA = 0.17g$ ; and
- December 2011; where  $M_w = 6.1$ , and  $PGA = 0.14g$

Table 2 below shows the results of these analyses, with outputs attached in Appendix C.

**Table 2: MBIE Liquefaction Analysis Results**

| Test ID   | Result                       | Sep      | Feb      | Jun            | Dec            |
|-----------|------------------------------|----------|----------|----------------|----------------|
| CPT_76306 | Index Settlement (10m)       | 118mm    | 118mm    | 78mm           | 37mm           |
|           | Liquefaction Severity Number | 27       | 27       | 15             | 6              |
|           | Ground Damage Category       | Moderate | Moderate | Minor          | Little to none |
| CPT_88430 | Settlement (0m to 8.68m)     | 79mm     | 83mm     | 51mm           | 19mm           |
|           | Liquefaction Severity Number | 15       | 17       | 9              | 3              |
|           | Ground Damage Category       | Minor    | Minor    | Little to none | Little to none |

The modelled past events appear to poorly predict the surface expression of liquefaction on site, seriously overpredicting the results. We have analysed the results again, with a PL of 84% and a C(FC) of 0.2 to try to better match the predicted results with the liquefaction observed at the locations where the CPT's were conducted. These analysis adjustments are the maximum soil specific correlation values that can be used within the software.

Table 3 below shows the results of these analyses, with outputs attached in Appendix D.

**Table 3: Soil Specific Corrected Liquefaction Analysis Results**

| Test ID   | Result                       | Sep            | Feb      | Jun            | Dec            |
|-----------|------------------------------|----------------|----------|----------------|----------------|
| CPT_76306 | Index Settlement (10m)       | 63mm           | 96mm     | 6mm            | 0mm            |
|           | Liquefaction Severity Number | 11             | 20       | 1              | 0              |
|           | Ground Damage Category       | Minor          | Moderate | Little to none | Little to none |
| CPT_88430 | Settlement (0m to 8.68m)     | 49mm           | 63mm     | 1mm            | 0mm            |
|           | Liquefaction Severity Number | 9              | 12       | 0              | 0              |
|           | Ground Damage Category       | Little to none | Minor    | Little to none | Little to none |

The adjusted software settings better reflect the ground damage in the locations where the CPT's were carried out, where minor degrees of liquefaction ejecta were observed following the September 2010 and February 2011 earthquakes.

It can therefore be concluded that initial estimates of the subject development sites Technical Category, utilising the CPT's from neighbouring properties will yield initial conservative estimates of the liquefaction potential. This is because the CPT's analysed were conducted in areas that experienced liquefaction ejecta, whereas our reviewed evidence suggests the subject site did not. Conservative estimates of liquefaction potential are considered suitable given the desk top nature of our herein assessments in support of the proposed land use plan change. However, it is likely that site-specific geotechnical investigations and analysis will return more realistic estimates of liquefaction performance for the site of the development proposal.

## 9.2 Model Earthquake Events

We have analysed the CPT's for liquefaction in Model Earthquake Events. Liquefaction settlement and land damage potential has been calculated for the three model earthquake events in accordance with MBIE criteria, using the same programs as described in Section 11.1: Past Earthquake Events.

The model conditions are given below:

- *Service Limit State A (SLSA)*; where  $M_w = 7.5$  and  $PGA = 0.13g$ ;
- *Service Limit State B (SLSB)*; where  $M_w = 6.0$  and  $PGA = 0.19g$ ; and
- *Ultimate Limit State (ULS)*; where  $M_w = 7.5$  and  $PGA = 0.35g$ .
- Groundwater Level during all modelled events are set at 2.0m.

Table 4 below shows the results of these analyses, with outputs attached in Appendix E.

**Table 4: MBIE Liquefaction Analysis Results**

| Test ID   | Result                       | SLSA           | SLSB  | ULS      |
|-----------|------------------------------|----------------|-------|----------|
| CPT_76306 | Index Settlement (10m)       | 53mm           | 91mm  | 118mm    |
|           | Liquefaction Severity Number | 9              | 18    | 26       |
|           | Ground Damage Category       | Little to None | Minor | Moderate |
| CPT_88430 | Settlement (0m to 8.68m)     | 29mm           | 62mm  | 83mm     |
|           | Liquefaction Severity Number | 5              | 11    | 17       |
|           | Ground Damage Category       | Little to none | Minor | Minor    |

However, as noted above the default MBIE Guideline parameters appear to overestimate predicted liquefaction when compared to liquefaction observed on site. As such we have analysed the model earthquakes with the same assumed soil specific calibration parameters used in the past earthquakes above.

Table 5 below shows the results of these analyses, with outputs attached in Appendix F.

**Table 5: Soil Specific Corrected Liquefaction Analysis Results**

| Test ID   | Result                       | SLSA           | SLSB           | ULS   |
|-----------|------------------------------|----------------|----------------|-------|
| CPT_76306 | Index Settlement (10m)       | 3mm            | 10mm           | 93mm  |
|           | Liquefaction Severity Number | 0              | 1              | 19    |
|           | Ground Damage Category       | Little to None | Little to none | Minor |
| CPT_88430 | Settlement (0m to 8.68m)     | 0mm            | 6mm            | 64mm  |
|           | Liquefaction Severity Number | 0              | 1              | 12    |
|           | Ground Damage Category       | Little to none | Little to none | Minor |

These outputs represent the two extremes of the liquefaction modelling software, with the subject site likely falling somewhere in the middle. It should be noted that the MBIE Guidelines analysis predicts TC3, while the analysis with soil specific correction applied indicates TC2 results. This again underlies the importance of site-specific geotechnical testing and analysis for the support of the proposed development. We would envisage this to comprise investigations utilising CPT's, Boreholes, groundwater measurements, and laboratory testing of selected samples, in order to accurately assess whether the site should be considered TC2 or TC3. However, such an investigation and assessment is best conducted at the subdivision consent application stage to inform the detailed design of the land development engineering. At this stage, as part of the plan change application, it is safe to assume the site falls somewhere between TC2 and TC3.

Given the performance through the CES, the slightly sloping alluvial fan area likely falls within the Minor to Moderate lateral ground movement categories (ie 0 to 300mm at ULS), while the more low-lying alluvial plain areas would potentially undergo Minor lateral ground movement (ie 0 to 100mm). Localised lateral movements towards free faces, drains, streams, and channels may also occur, which should be considered at the detailed design stage of the any future land development engineering.



## 10.0 Geotechnical Hazard Evaluation

Section 106 of the Resource Management Act 1991 outlines hazards that must be assessed when a territorial authority considers a Building Consent application. This section outlines our evaluation of possible geotechnical hazards associated with the site.

- Erosion. The site did not appear to be experiencing any significant erosion during our walkover inspection. Given stormwater is captured and disposed on in a controlled manner we do not envisage the proposed development will accelerate, worsen or result in adverse erosion on neighbouring properties or the site itself.
- Falling Debris. The Port Hills are located to the south east, and the site is located downslope from two areas mapped as Rockfall Management Zone Area 1 & 2. However, given the distance and slope between the mapped areas and the site we consider the risk to be minimal.
- Subsidence. The site may be prone to liquefaction-induced subsidence. Additional site specific testing is likely required for confirmation on whether the site should be considered TC2 or TC3, and the extent of any mitigation measures that may correspondingly be required.
- Slippage. Our qualitative assessment is that the low-lying alluvial plain areas of the site may have the potential for TC2 levels of lateral ground movement, while the slightly elevated alluvial fan area may be expected to undergo TC3 extents of lateral movement. Further site specific investigations are required to confirm the extents of such, and inform the detailed design of any sloping earthworks and permanent ponds, swales, and streams/channels.
- Inundation. According to the Christchurch City Council floor level website, <https://ccc.govt.nz/services/water-and-drainage/stormwater-and-drainage/flooding/floorlevelmap/>, the site is located within a flood management area. According to the Council Meeting Record and the Aston Consultants Submission referenced in Section 4.0, the RL of the site ranges from 18.4m to 23.6m, with a required minimum floor level of RL 19.60m. This indicates that some filling or other environmental engineering may be required to reach the required minimum floor level.

Whilst not a requirement of Section 71 of the New Zealand Building Act 2004, soil contamination is a potential geotechnical hazard that should be considered when making Building Consent applications to territorial authorities where ground disturbance works are proposed (i.e. foundation excavations etc). We have made reference to the ECan Listed Land Use Register (LLUR), that indicates the site has been verified as a non-HAIL site. This is confirmed by an attachment to the Aston Consultants Submission referenced in Section 4.0.

## 11.0 Conclusion

In summary, we consider the site generally suitable for use for residential purposes from a geotechnical perspective provided the following issues are addressed.

Given the analysis performed on the CPT's in the general area, we expect the site to fall within either the TC2 or TC3 category. It should be noted that the CPT that predicted the worst settlement and ground damage was also the CPT with the assumed porewater pressure profile, and more sophisticated on-site testing will be required to support the proposed development at the subdivision consent stage. The analysis that predicted lower levels of liquefaction had the highest levels of soil specific correction applied. Additional site-specific testing will provide a more accurate indication of appropriate Technical Category and expected ground damage following another significant earthquake. Based on the results of such, an informed decision can be made as to the requirement for any ground strengthening as part of the proposed development, or whether specifically design house foundations would suffice solely.

We understand the site may also be subject to flooding hazards. The Council Meeting Report mentions several methods for addressing the potential flood hazard on site, and these will need to be further developed.

## 12.0 Future Geotechnical Involvement

It should be understood that additional geotechnical investigations, analysis, design, and reporting will be required to support the subdivision consent and detailed land development engineering design stages of the proposed development.

Based on the over-prediction of liquefaction potential utilising default MBIE liquefaction analysis parameters, we strongly recommend that any additional geotechnical investigations of the site comprise machine drilled boreholes to collect soil specimens for laboratory testing, comprising particle size distribution, clay fraction, and plasticity indices. This will enable accurate estimation of the site performance during future large earthquakes.

### 13.0 Limitations

This geotechnical report has been prepared for our Client, Ernst Frei, for the purposes of supporting their proposed residential development. This report shall not be extrapolated for other nearby sites, or used for any other purposes without the express approval of LandTech and their Client.

This report has been based on the results of tests at point locations; therefore, subsurface conditions could vary away from the assumed geotechnical model. Should exposed soil conditions vary from those described herein we request to be informed to determine the continued applicability of our recommendations.

The geotechnical investigation was confined to geotechnical aspects of the site only and did not involve the assessment for environmental contaminants. In addition, our investigation and analyses have also not taken into account possible fault rupture that may cause deformations and displacements of the ground directly below the site. This type of assessment is outside of the scope of our geotechnical engagement.

END OF REPORT

## **APPENDIX A**

### **NZGD Borehole Logs**

# Engineering Log - Borehole

Borehole ID: **BH1**  
 sheet: 1 of 2  
 project no: **GENZCHRI15217ARR**  
 date started: **14 Apr 2014**  
 date completed: **14 Apr 2014**  
 logged by: **M. Houghton**  
 checked by: **H.MacMurray**

client: **IAG Insurance**  
 principal: -  
 project: **IAG Insurance Claims**  
 location: **564 Cashmere Rd, Westmorland, Christchurch**

position: See Location Plan      surface elevation : Not Specified      angle from horizontal: 90°  
 drill model: Comacchio MC-900      shear vane blade number:      Casing Diameter : 150 mm

| drilling information |               |   |   | material substance |                            |        |           |             |                       |  |                    |                                |                         |                    |                                       |
|----------------------|---------------|---|---|--------------------|----------------------------|--------|-----------|-------------|-----------------------|--|--------------------|--------------------------------|-------------------------|--------------------|---------------------------------------|
| method & support     | 1 penetration | 2 | 3 | water              | samples & field tests      | RL (m) | depth (m) | graphic log | classification symbol | material description   | moisture condition | consistency / relative density | hand penetrometer (kPa) | DCP (blows/100 mm) | structure and additional observations |
|                      |               |   |   |                    |                            |        | 0.2       |             | ML                    | FILL: SILT: low plasticity, dark brown, trace rootlets.<br>0.3m: rootlets absent | M                  |                                |                         |                    | FILL                                  |
|                      |               |   |   |                    |                            |        | 0.4       |             | ML                    | FILL: SILT: low plasticity, dark brown and orange.                               |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                            |        | 0.6       |             | ML                    | FILL: SILT: low plasticity, dark brown and orange.                               |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                            |        | 0.8       |             |                       |  |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                            |        | 1.0       |             |                       |  |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                            |        | 1.2       |             |                       |  |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                            |        | 1.4       |             |                       |  |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                            |        | 1.6       |             | ML                    | SILT: low plasticity, mottled orange and grey.                                   |                    | VS                             |                         |                    | LOESS COLLUVIUM                       |
|                      |               |   |   |                    | SPT HW/450mm               |        | 1.8       |             |                       | 1.8m: layer of dark grey silt, 50mm thick  |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                            |        | 2.0       |             |                       |  |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                            |        | 2.2       |             |                       |  |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                            |        | 2.4       |             |                       |  |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                            |        | 2.6       |             |                       |  |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                            |        | 2.8       |             |                       |  |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                            |        | 3.0       |             |                       |  |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    | SPT 1, 1, 1, 1, 1, 2 N*=5  |        | 3.2       |             | ML                    | Sandy SILT: low plasticity, orange.  | S                  | S / F                          |                         |                    | SPRINGSTON FORMATION                  |
|                      |               |   |   |                    |                            |        | 3.4       |             |                       | 3.4m: grey   |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                            |        | 3.6       |             |                       |  |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                            |        | 3.8       |             |                       |  |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                            |        | 4.0       |             |                       |  |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                            |        | 4.2       |             |                       |  |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                            |        | 4.4       |             |                       |  |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                            |        | 4.6       |             |                       |  |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    | SPT 1, 0, 0, 1, 0, 1 N*=2  |        | 4.8       |             |                       |  |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                            |        | 5.0       |             |                       |  |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                            |        | 5.2       |             |                       |  |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                            |        | 5.4       |             |                       |  |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                            |        | 5.6       |             |                       |  |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                            |        | 5.8       |             |                       |  |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                            |        | 6.0       |             |                       |  |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    | SPT 0, 0, 0, 1, 1, 1 N*=3  |        | 6.2       |             | ML                    | SILT: low plasticity, grey, some fine sand.                                      |                    | W                              |                         |                    |                                       |
|                      |               |   |   |                    |                            |        | 6.4       |             |                       |  |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                            |        | 6.6       |             |                       |  |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                            |        | 6.8       |             |                       |  |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                            |        | 7.0       |             |                       |  |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                            |        | 7.2       |             |                       | 7.0m: minor fine sand  |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                            |        | 7.4       |             |                       |  |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                            |        | 7.6       |             |                       |  |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    | SPT 0, 1, 1, 2, 4, 4 N*=11 |        | 7.8       |             |                       |  |                    |                                |                         |                    |                                       |

|  |  |   |  |  |
|--|--|---|--|--|
| <b>method</b><br>AD auger drilling*<br>AS auger screwing*<br>RR roller/tricone<br>W washbore<br>CT cable tool<br>HA hand auger<br>DT diatube<br>B blank bit<br>V V bit<br>T TC bit<br>* bit shown by suffix<br>e.g. AD/T | <b>support</b><br>M mud      N nil<br>C casing<br><br><b>penetration</b><br><br>no resistance ranging to refusal<br><br><b>water</b><br><br>10-Oct-12 water level on date shown<br>water inflow<br>water outflow | <b>samples &amp; field tests</b><br>U## undisturbed sample ##mm diameter<br>D disturbed sample<br>B bulk disturbed sample<br>E environmental sample<br>HP hand penetrometer (kPa)<br>N standard penetration test (SPT)<br>N* SPT - sample recovered<br>Nc SPT with solid cone<br>VS vane shearpeak/remoulded (uncorrected kPa)<br>R refusal | <b>classification symbol &amp; soil description</b><br>based on Unified Classification System<br><br><b>moisture</b><br>D dry<br>M moist<br>W wet<br>S saturated | <b>consistency / relative density</b><br>VS very soft<br>S soft<br>F firm<br>St stiff<br>VSt very stiff<br>H hard<br>Fb friable<br>VL very loose<br>L loose<br>MD medium dense<br>D dense<br>VD very dense |
|--|--|---|--|--|

CDF\_0\_9\_04AV.GLB Log COF BOREHOLE: NON CORED + DCP WITH SV IAG ARR GINT.GPJ <<DrawingFile>> 09/05/2014 15:30



# Engineering Log - Borehole

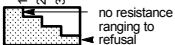
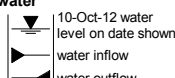
Borehole ID: **BH1**  
 sheet: 2 of 2  
 project no: **GENZCHRI15217ARR**  
 date started: **14 Apr 2014**  
 date completed: **14 Apr 2014**  
 logged by: **M. Houghton**  
 checked by: **H.MacMurray**

client: **IAG Insurance**  
 principal: -  
 project: **IAG Insurance Claims**  
 location: **564 Cashmere Rd, Westmorland, Christchurch**

position: See Location Plan surface elevation : Not Specified angle from horizontal: 90°  
 drill model: Comacchio MC-900 shear vane blade number: Casing Diameter : 150 mm

| drilling information |               |   |   | material substance |                                    |        |           |             |                       |   |                    |                                |                         |                    |                                       |
|----------------------|---------------|---|---|--------------------|------------------------------------|--------|-----------|-------------|-----------------------|---|--------------------|--------------------------------|-------------------------|--------------------|---------------------------------------|
| method & support     | 1 penetration | 2 | 3 | water              | samples & field tests              | RL (m) | depth (m) | graphic log | classification symbol | material description                                    | moisture condition | consistency / relative density | hand penetrometer (kPa) | DCP (blows/100 mm) | structure and additional observations |
|                      |               |   |   |                    |                                    |        | 8.2       |             | ML                    | SILT: low plasticity, grey, some fine sand. (continued) | W                  | F / St                         |                         |                    | SPRINGSTON FORMATION                  |
|                      |               |   |   |                    |                                    |        | 8.4       |             |                       |   |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                                    |        | 8.6       |             |                       |   |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                                    |        | 8.8       |             |                       |   |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    | SPT<br>1, 0, 1, 1,<br>2, 2<br>N*=6 |        | 9.0       |             |                       |   |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                                    |        | 9.2       |             |                       |   |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                                    |        | 9.4       |             |                       |   |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                                    |        | 9.6       |             |                       | 9.6 to 11.3m: with trace of fine gravel sized clasts    |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                                    |        | 9.8       |             |                       |   |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                                    |        | 10.0      |             |                       |   |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                                    |        | 10.2      |             |                       |   |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                                    |        | 10.4      |             |                       |   |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    | SPT<br>1, 1, 2, 2,<br>2, 2<br>N*=8 |        | 10.6      |             |                       |   |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                                    |        | 10.8      |             |                       |   |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                                    |        | 11.0      |             |                       |   | S                  |                                |                         |                    |                                       |
|                      |               |   |   |                    |                                    |        | 11.2      |             |                       |   |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                                    |        | 11.4      |             |                       |   |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                                    |        | 11.6      |             |                       |   |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                                    |        | 11.8      |             |                       |   |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    | SPT<br>1, 1, 1, 1,<br>2, 3<br>N*=7 |        | 12.0      |             |                       |   |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                                    |        | 12.2      |             |                       |   |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                                    |        | 12.4      |             |                       |   |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                                    |        | 12.6      |             |                       | Borehole BH1 terminated at 12.45 m<br>Target depth      |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                                    |        | 12.8      |             |                       |   |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                                    |        | 13.0      |             |                       |   |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                                    |        | 13.2      |             |                       |   |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                                    |        | 13.4      |             |                       |   |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                                    |        | 13.6      |             |                       |   |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                                    |        | 13.8      |             |                       |   |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                                    |        | 14.0      |             |                       |   |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                                    |        | 14.2      |             |                       |   |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                                    |        | 14.4      |             |                       |   |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                                    |        | 14.6      |             |                       |   |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                                    |        | 14.8      |             |                       |   |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                                    |        | 15.0      |             |                       |   |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                                    |        | 15.2      |             |                       |   |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                                    |        | 15.4      |             |                       |   |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                                    |        | 15.6      |             |                       |   |                    |                                |                         |                    |                                       |
|                      |               |   |   |                    |                                    |        | 15.8      |             |                       |   |                    |                                |                         |                    |                                       |

CDF\_0\_9\_04AV.GLB Log COF BOREHOLE: NON CORED + DCP WITH SV IAG ARR GINT.GPJ <<DrawingFile>> 09/05/2014 15:30

|  |  |   |  |  |
|--|--|---|--|--|
| <b>method</b><br>AD auger drilling*<br>AS auger screwing*<br>RR roller/tricone<br>W washbore<br>CT cable tool<br>HA hand auger<br>DT diatube<br>B blank bit<br>V V bit<br>T TC bit<br>* bit shown by suffix<br>e.g. AD/T | <b>support</b><br>M mud N nil<br>C casing<br><b>penetration</b><br><br>water<br> | <b>samples &amp; field tests</b><br>U## undisturbed sample ##mm diameter<br>D disturbed sample<br>B bulk disturbed sample<br>E environmental sample<br>HP hand penetrometer (kPa)<br>N standard penetration test (SPT)<br>N* SPT - sample recovered<br>Nc SPT with solid cone<br>VS vane shearpeak/remoulded (uncorrected kPa)<br>R refusal | <b>classification symbol &amp; soil description</b><br>based on Unified Classification System<br><b>moisture</b><br>D dry<br>M moist<br>W wet<br>S saturated | <b>consistency / relative density</b><br>VS very soft<br>S soft<br>F firm<br>St stiff<br>VSt very stiff<br>H hard<br>Fb friable<br>VL very loose<br>L loose<br>MD medium dense<br>D dense<br>VD very dense |
|--|--|---|--|--|

# Engineering Log - Borehole

Borehole ID: **BH2**  
 sheet: 1 of 1  
 project no: **GENZCHRI15217ARR**  
 date started: **14 Apr 2014**  
 date completed: **14 Apr 2014**  
 logged by: **M. Houghton**  
 checked by: **H.MacMurray**

client: **IAG Insurance**  
 principal: -  
 project: **IAG Insurance Claims**  
 location: **564 Cashmere Rd, Westmorland, Christchurch**

position: See Location Plan surface elevation : Not Specified angle from horizontal: 90°  
 drill model: Comacchio MC-900 shear vane blade number: Casing Diameter : 150 mm

| drilling information |               |   |   | material substance |                                    |        |           |             |                       |   |                    |                                |                         |                    |  |
|----------------------|---------------|---|---|--------------------|------------------------------------|--------|-----------|-------------|-----------------------|---|--------------------|--------------------------------|-------------------------|--------------------|--|
| method & support     | 1 penetration | 2 | 3 | water              | samples & field tests              | RL (m) | depth (m) | graphic log | classification symbol | material description  | moisture condition | consistency / relative density | hand penetrometer (kPa) | DCP (blows/100 mm) | structure and additional observations    |
|                      |               |   |   |                    |                                    |        | 0.2       |             | ML                    | FILL: SILT: low plasticity, dark brown, trace charcoal fragments, trace rootlets, trace angular gravel. | M                  |                                |                         |                    | FILL (TOPSOIL)                           |
|                      |               |   |   |                    |                                    |        | 0.4       |             | ML                    | FILL: SILT: low plasticity, orange and dark brown.  |                    |                                |                         |                    | derived from loess colluvium and topsoil |
|                      |               |   |   |                    |                                    |        | 0.6       |             |                       |   |                    |                                |                         |                    |  |
|                      |               |   |   |                    |                                    |        | 0.8       |             |                       |   |                    |                                |                         |                    |  |
|                      |               |   |   |                    |                                    |        | 1.0       |             |                       |   |                    |                                |                         |                    |  |
|                      |               |   |   |                    |                                    |        | 1.2       |             |                       |   |                    |                                |                         |                    |  |
|                      |               |   |   |                    |                                    |        | 1.4       |             |                       |   |                    |                                |                         |                    |  |
|                      |               |   |   |                    |                                    |        | 1.6       |             |                       |   |                    |                                |                         |                    |  |
|                      |               |   |   |                    | SPT HW/75mm, 0, 1, 1, 1, 2, 3 N*=7 |        | 1.8       |             |                       |   |                    |                                |                         |                    |  |
|                      |               |   |   |                    |                                    |        | 2.0       |             | ML                    | 1.8m: 50mm layer of dark grey silt<br>SILT: low plasticity, grey mottled orange.                        | F                  |                                |                         |                    | LOESS COLLUVIUM                          |
|                      |               |   |   |                    |                                    |        | 2.2       |             |                       |   |                    |                                |                         |                    |  |
|                      |               |   |   |                    |                                    |        | 2.4       |             |                       |   |                    |                                |                         |                    |  |
|                      |               |   |   |                    |                                    |        | 2.6       |             | ML                    | Sandy SILT: low plasticity, yellow-grey mottled orange and brown.                                       | S                  |                                |                         |                    | 2.5 to 3.2m: grading to colluvial soil   |
|                      |               |   |   |                    |                                    |        | 2.8       |             |                       |   |                    |                                |                         |                    |  |
|                      |               |   |   |                    |                                    |        | 3.0       |             |                       |   |                    |                                |                         |                    |  |
|                      |               |   |   |                    | SPT 1, 1, 1, 1, 0, 1 N*=3          |        | 3.2       |             | ML                    | Sandy SILT: low plasticity, grey.   | S                  |                                |                         |                    | SPRINGSTON FORMATION                     |
|                      |               |   |   |                    |                                    |        | 3.4       |             |                       |   |                    |                                |                         |                    |  |
|                      |               |   |   |                    |                                    |        | 3.6       |             |                       |   |                    |                                |                         |                    |  |
|                      |               |   |   |                    |                                    |        | 3.8       |             | ML                    | SILT: low plasticity, grey, some sand.  | S / F              |                                |                         |                    |  |
|                      |               |   |   |                    |                                    |        | 4.0       |             |                       |   |                    |                                |                         |                    |  |
|                      |               |   |   |                    |                                    |        | 4.2       |             |                       |   |                    |                                |                         |                    |  |
|                      |               |   |   |                    |                                    |        | 4.4       |             |                       |   |                    |                                |                         |                    |  |
|                      |               |   |   |                    |                                    |        | 4.6       |             |                       |   |                    |                                |                         |                    |  |
|                      |               |   |   |                    | SPT 1, 2, 1, 1, 1, 1 N*=4          |        | 4.8       |             | ML                    | Sandy SILT: low plasticity, grey.   |                    |                                |                         |                    |  |
|                      |               |   |   |                    |                                    |        | 5.0       |             |                       |   |                    |                                |                         |                    |  |
|                      |               |   |   |                    |                                    |        | 5.2       |             |                       |   |                    |                                |                         |                    |  |
|                      |               |   |   |                    |                                    |        | 5.4       |             |                       |   |                    |                                |                         |                    |  |
|                      |               |   |   |                    |                                    |        | 5.6       |             |                       |   |                    |                                |                         |                    |  |
|                      |               |   |   |                    |                                    |        | 5.8       |             |                       |   |                    |                                |                         |                    |  |
|                      |               |   |   |                    |                                    |        | 6.0       |             |                       |   |                    |                                |                         |                    |  |
|                      |               |   |   |                    | SPT 1, 0, 1, 1, 1, 2 N*=5          |        | 6.2       |             |                       |   |                    |                                |                         |                    |  |
|                      |               |   |   |                    |                                    |        | 6.4       |             |                       |   |                    |                                |                         |                    |  |
|                      |               |   |   |                    |                                    |        | 6.6       |             |                       | Borehole BH2 terminated at 6.45 m Target depth  |                    |                                |                         |                    |  |
|                      |               |   |   |                    |                                    |        | 6.8       |             |                       |   |                    |                                |                         |                    |  |
|                      |               |   |   |                    |                                    |        | 7.0       |             |                       |   |                    |                                |                         |                    |  |
|                      |               |   |   |                    |                                    |        | 7.2       |             |                       |   |                    |                                |                         |                    |  |
|                      |               |   |   |                    |                                    |        | 7.4       |             |                       |   |                    |                                |                         |                    |  |
|                      |               |   |   |                    |                                    |        | 7.6       |             |                       |   |                    |                                |                         |                    |  |
|                      |               |   |   |                    |                                    |        | 7.8       |             |                       |   |                    |                                |                         |                    |  |

CDF\_0\_9\_04AV.GLB Log COF BOREHOLE: NON CORED + DCP WITH SV IAG ARR GINT.GPJ <<DrawingFile>> 09/05/2014 15:30

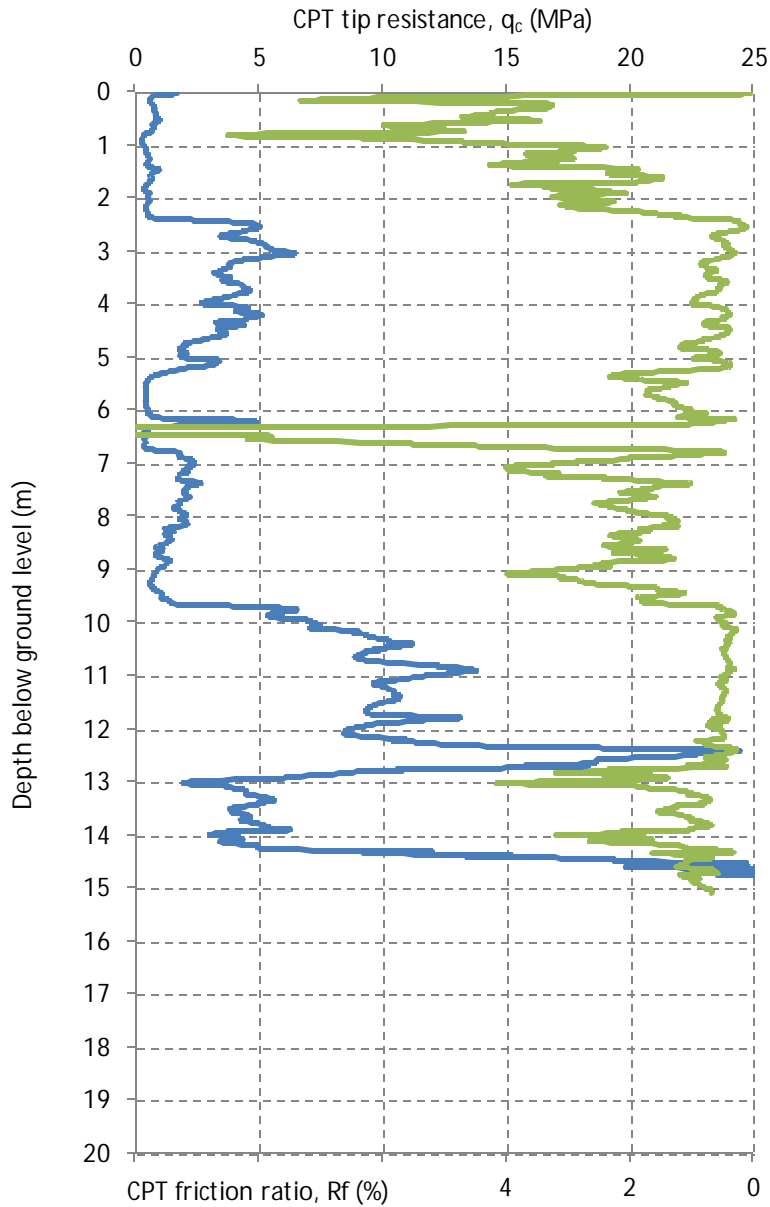
|  |   |   |  |  |
|--|---|---|--|--|
| <b>method</b><br>AD auger drilling*<br>AS auger screwing*<br>RR roller/tricone<br>W washbore<br>CT cable tool<br>HA hand auger<br>DT diatube<br>B blank bit<br>V V bit<br>T TC bit<br>* bit shown by suffix<br>e.g. AD/T | <b>support</b><br>M mud N nil<br>C casing<br><b>penetration</b><br><br>no resistance ranging to refusal<br><b>water</b><br><br>10-Oct-12 water level on date shown<br>water inflow<br>water outflow | <b>samples &amp; field tests</b><br>U## undisturbed sample ##mm diameter<br>D disturbed sample<br>B bulk disturbed sample<br>E environmental sample<br>HP hand penetrometer (kPa)<br>N standard penetration test (SPT)<br>N* SPT - sample recovered<br>Nc SPT with solid cone<br>VS vane shearpeak/remoulded (uncorrected kPa)<br>R refusal | <b>classification symbol &amp; soil description</b><br>based on Unified Classification System<br><b>moisture</b><br>D dry<br>M moist<br>W wet<br>S saturated | <b>consistency / relative density</b><br>VS very soft<br>S soft<br>F firm<br>St stiff<br>VSt very stiff<br>H hard<br>Fb friable<br>VL very loose<br>L loose<br>MD medium dense<br>D dense<br>VD very dense |
|--|---|---|--|--|

## **APPENDIX B**

### **NZGD CPT Reports**



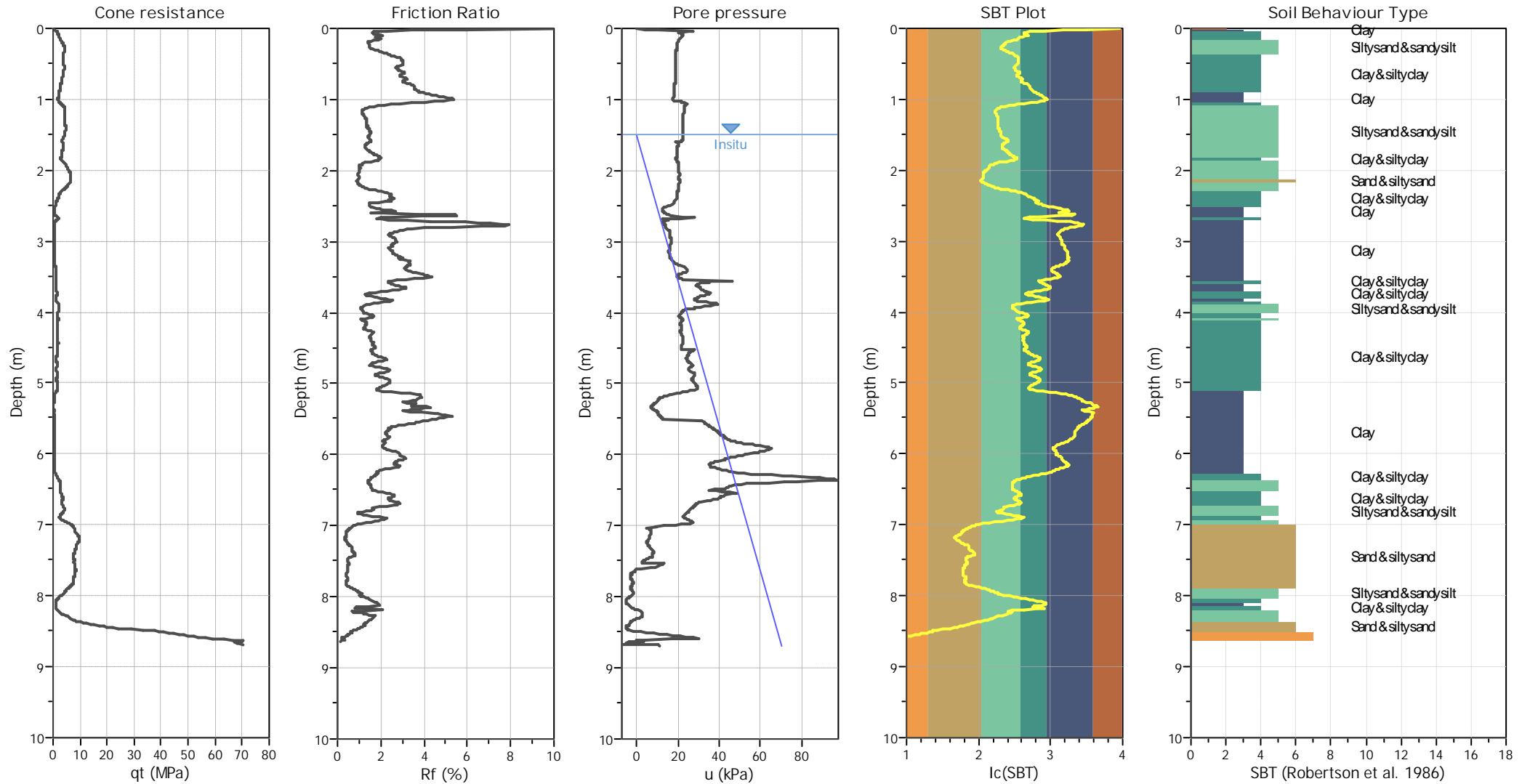
### HISTORICAL CPT DATA FROM ARCHIVE



|             |                                      |
|-------------|--------------------------------------|
| LOCATION    | Cashmere Lakes                       |
| JOB NUMBER  | 52133.001                            |
| Contractor  | Resource Development Contractors Ltd |
| Operator    | unknown                              |
| Date        | 10/09/2012                           |
| CLIENT      | Cashmere Lakes Ltd                   |
| PROJECT     | Cashmere Lakes                       |
| DESCRIPTION | Historical CPT data, CPT07           |

Note: The data presented above has been recovered from incomplete historical archives

### CPT basic interpretation plots



#### Input parameters and analysis data

|                                |                   |                           |              |                             |             |
|--------------------------------|-------------------|---------------------------|--------------|-----------------------------|-------------|
| Analysis method:               | B&I (2014)        | Depth to GWT (erthq.):    | 1.50 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         | $K_G$ applied:              | Yes         |
| Earthquake magnitude $M_w$ :   | 6.00              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sand & Clay |
| Peak ground acceleration:      | 0.19              | Use fill:                 | No           | Limit depth applied:        | Yes         |
| Depth to water table (insitu): | 1.50 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m     |

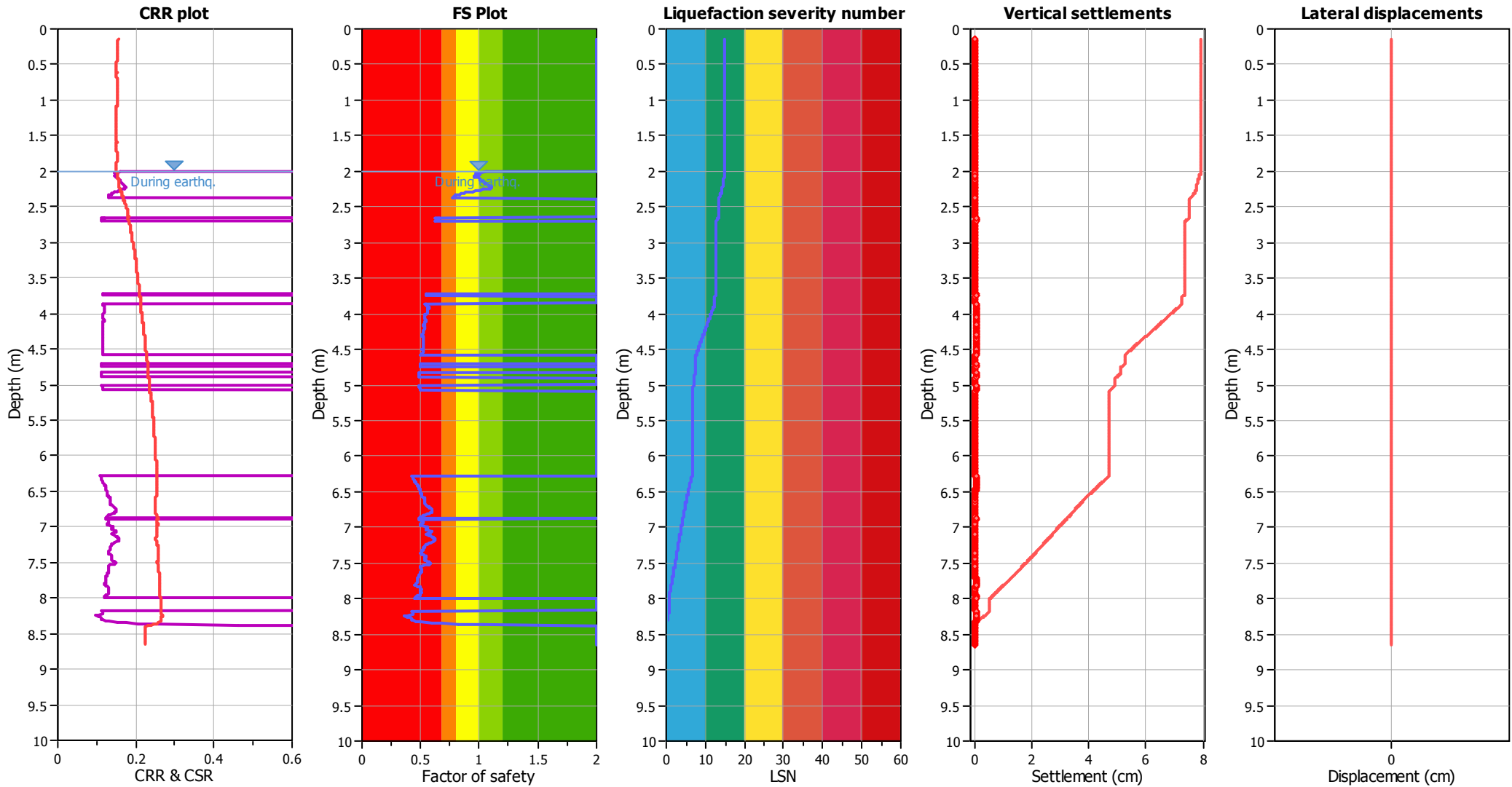
#### SBT legend

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

## **APPENDIX C**

### **MBIE Past Earthquake Liquefaction Analysis Outputs**

### Liquefaction analysis overall plots



**Input parameters and analysis data**

|                                |                   |                           |              |                             |            |
|--------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| Analysis method:               | B&I (2014)        | Depth to GWT (earthq.):   | 2.00 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         | $K_{\sigma}$ applied:       | Yes        |
| Earthquake magnitude $M_w$ :   | 7.10              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:      | 0.27              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu): | 2.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

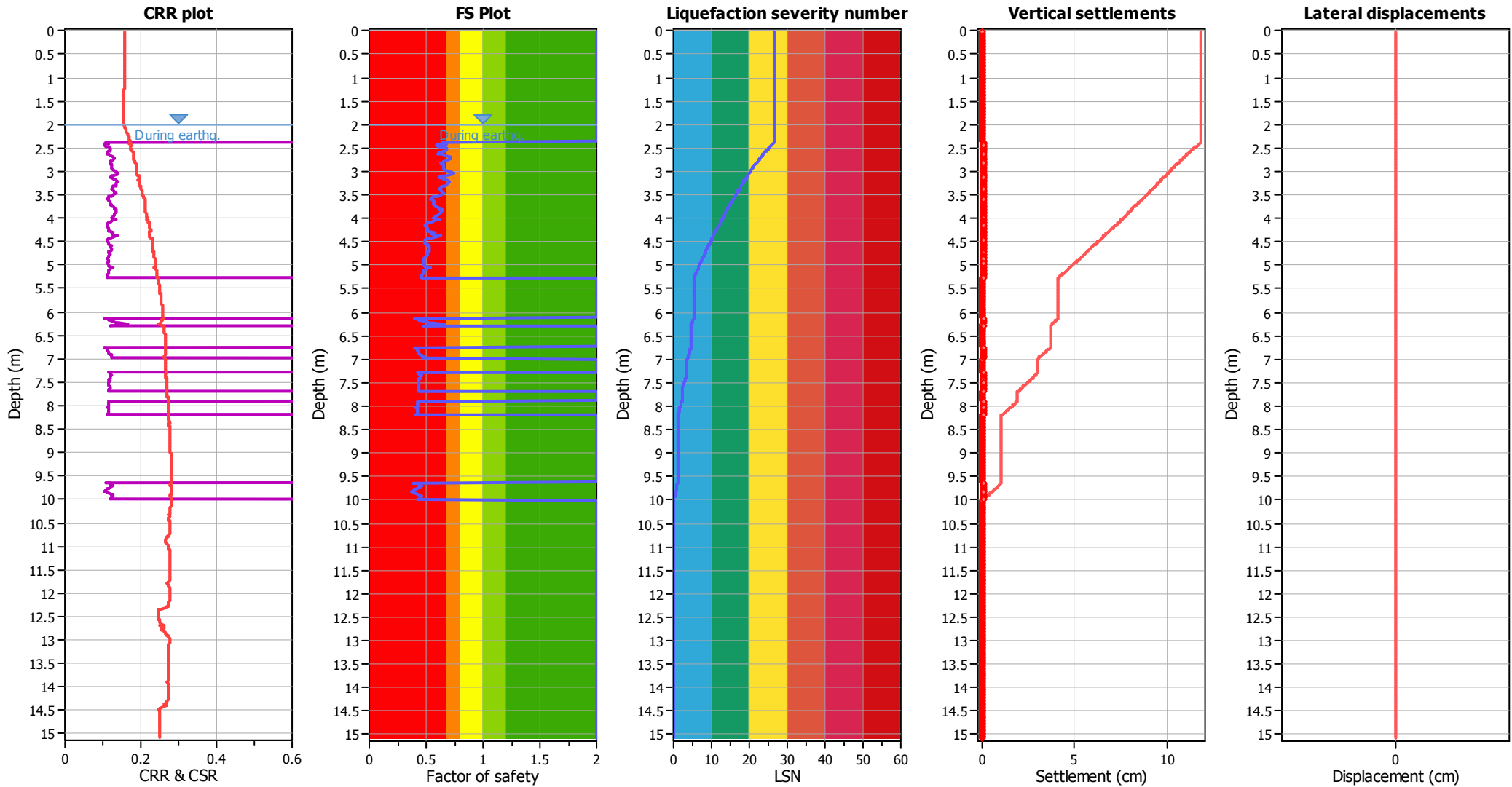
**F.S. color scheme**

- 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

**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

### Liquefaction analysis overall plots



**Input parameters and analysis data**

|                                |                   |                           |              |                             |            |
|--------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| Analysis method:               | B&I (2014)        | Depth to GWT (erthq.):    | 2.00 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         | $K_{\sigma}$ applied:       | Yes        |
| Earthquake magnitude $M_w$ :   | 7.10              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:      | 0.27              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu): | 2.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

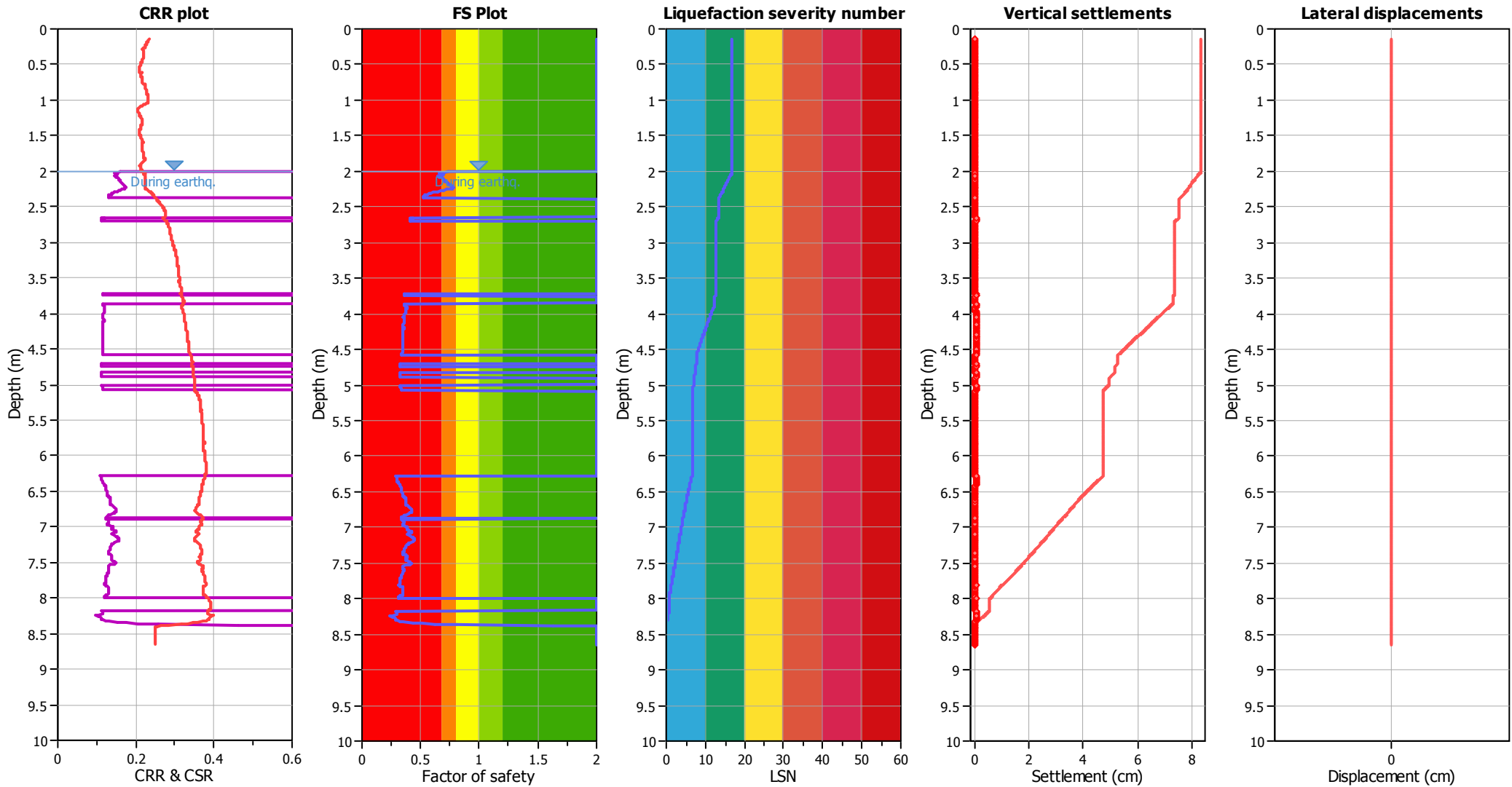
**F.S. color scheme**

- 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

**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

### Liquefaction analysis overall plots



**Input parameters and analysis data**

|                                |                   |                           |              |                             |            |
|--------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| Analysis method:               | B&I (2014)        | Depth to GWT (erthq.):    | 2.00 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         | $K_{\sigma}$ applied:       | Yes        |
| Earthquake magnitude $M_w$ :   | 6.20              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:      | 0.44              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu): | 2.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

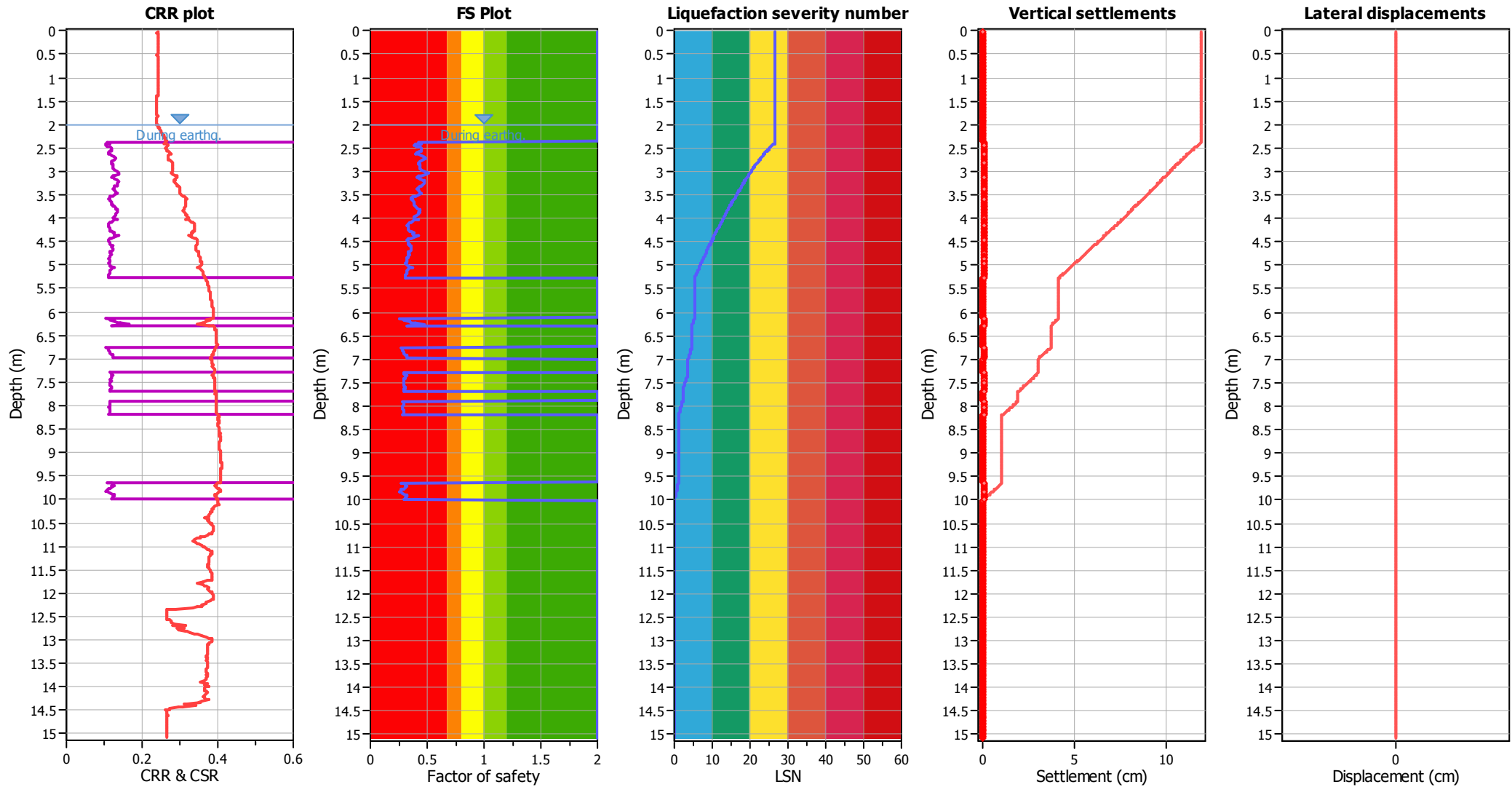
**F.S. color scheme**

- 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

**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

### Liquefaction analysis overall plots



**Input parameters and analysis data**

|                                |                   |                           |              |                             |            |
|--------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| Analysis method:               | B&I (2014)        | Depth to GWT (earthq.):   | 2.00 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         | $K_{\sigma}$ applied:       | Yes        |
| Earthquake magnitude $M_w$ :   | 6.20              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:      | 0.44              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu): | 2.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

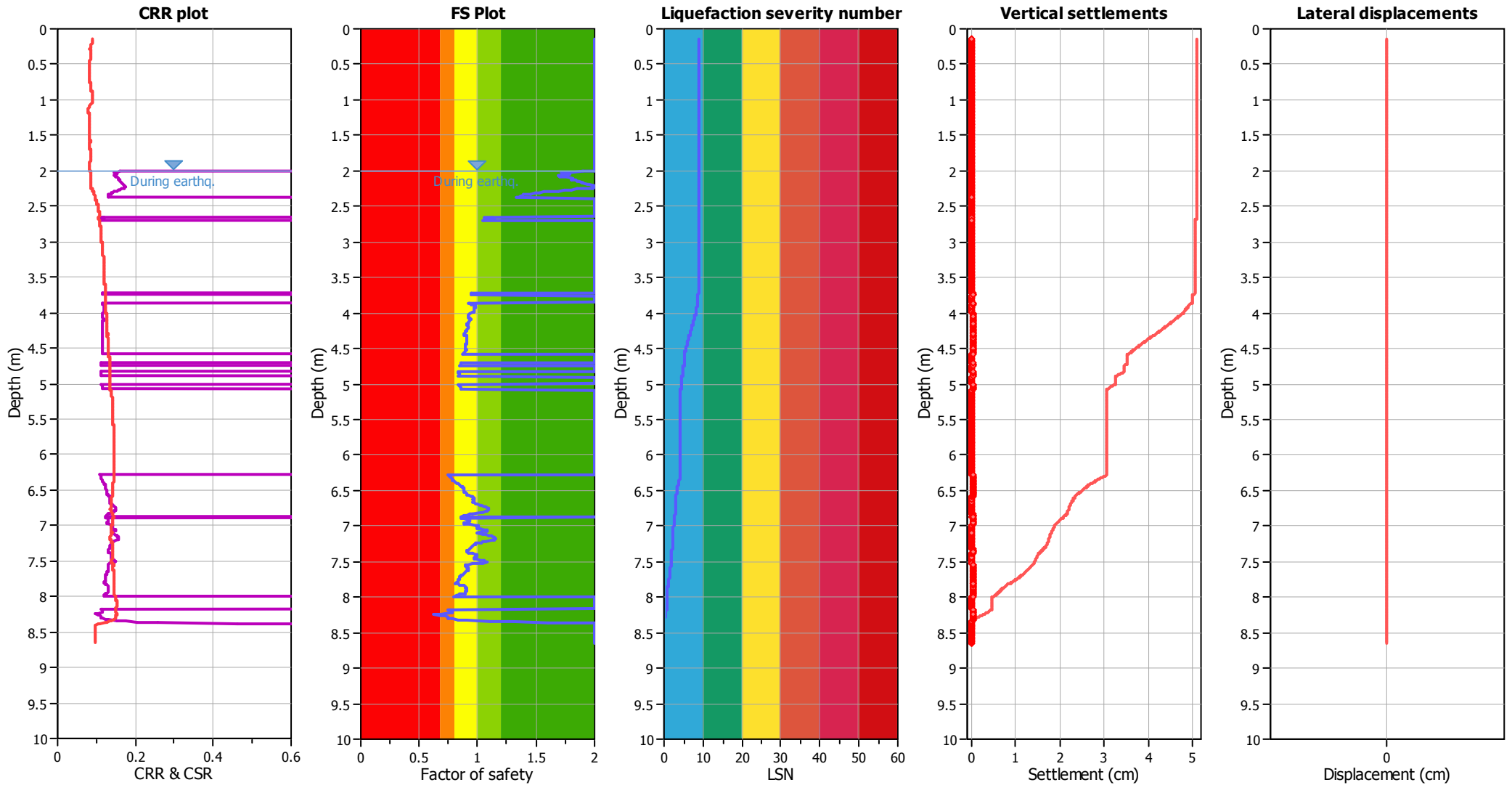
**F.S. color scheme**

- 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

**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

### Liquefaction analysis overall plots



**Input parameters and analysis data**

|                                       |                   |                           |              |                             |            |
|---------------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| Analysis method:                      | B&I (2014)        | Depth to GWT (earthq.):   | 2.00 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 <sub>σ</sub> applied:     | Yes        |
| Earthquake magnitude M <sub>w</sub> : | 6.20              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.17              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 2.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

**F.S. color scheme**

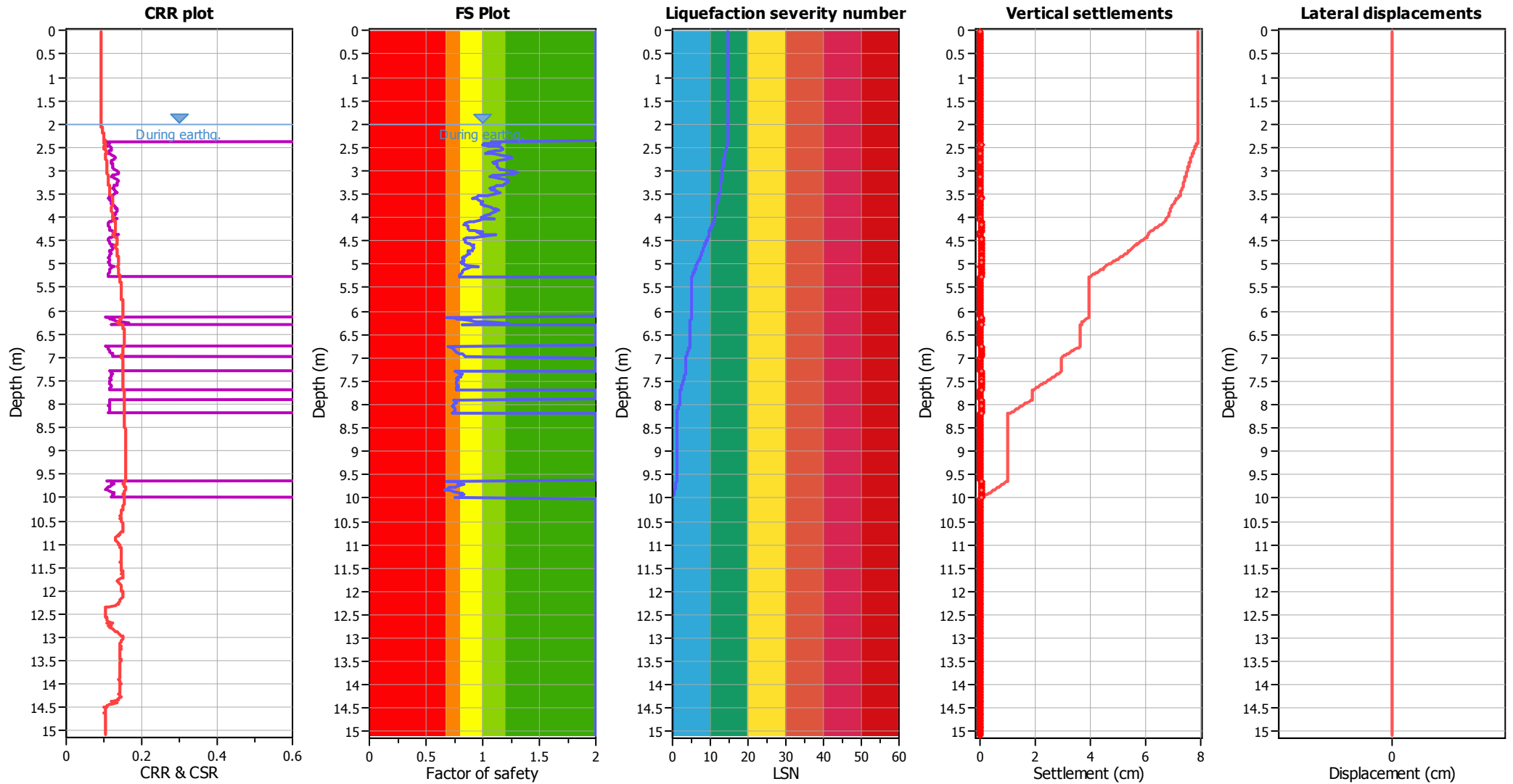
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**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



### Liquefaction analysis overall plots



**Input parameters and analysis data**

|                                |                   |                           |              |                             |            |
|--------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| Analysis method:               | B&I (2014)        | Depth to GWT (earthq.):   | 2.00 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         | $K_{\sigma}$ applied:       | Yes        |
| Earthquake magnitude $M_w$ :   | 6.20              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:      | 0.17              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu): | 2.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

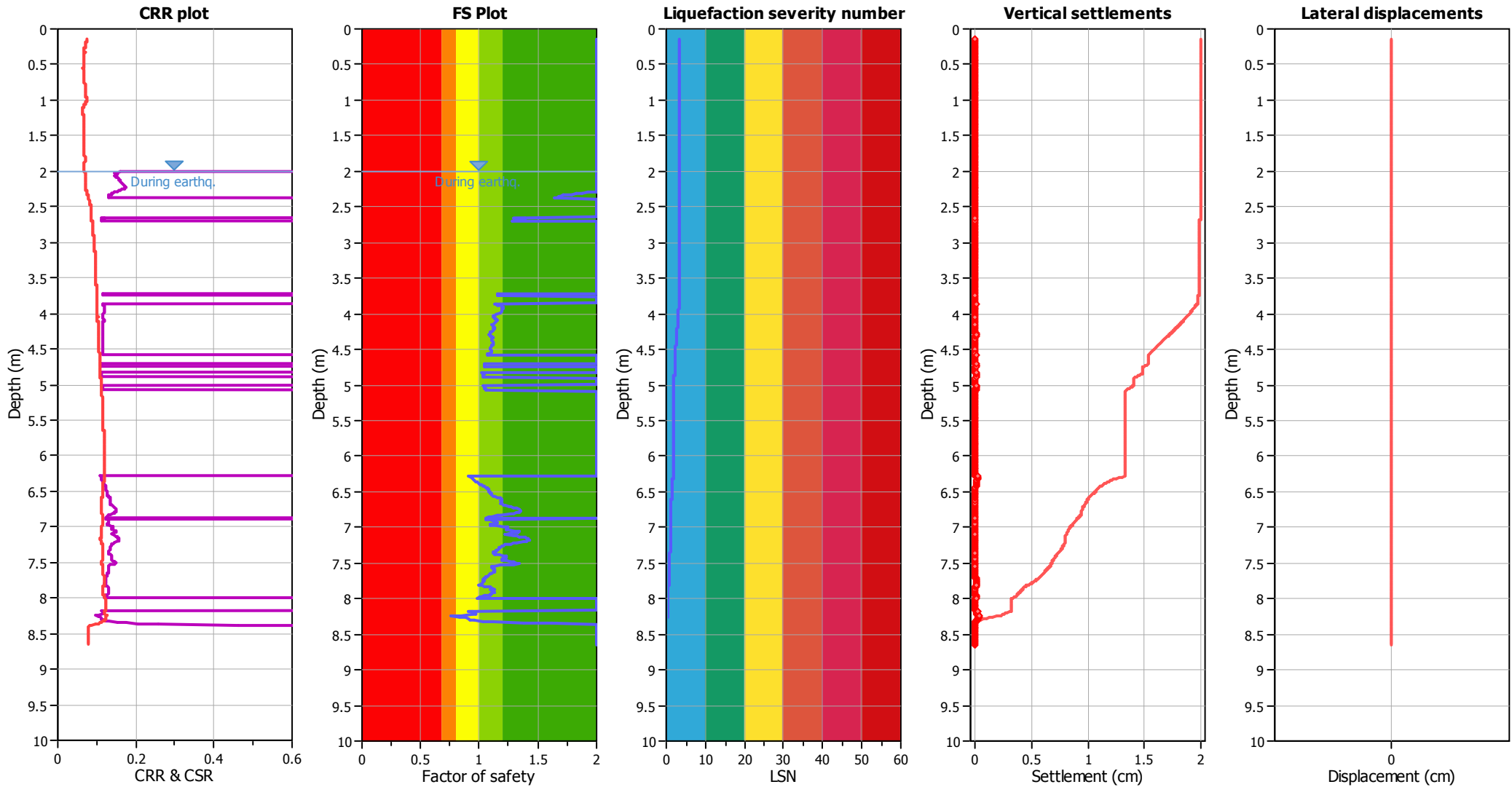
**F.S. color scheme**

- 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

**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

### Liquefaction analysis overall plots



**Input parameters and analysis data**

|                                       |                   |                           |              |                             |            |
|---------------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| Analysis method:                      | B&I (2014)        | Depth to GWT (erthq.):    | 2.00 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 <sub>σ</sub> applied:     | Yes        |
| Earthquake magnitude M <sub>w</sub> : | 6.10              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.14              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 2.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

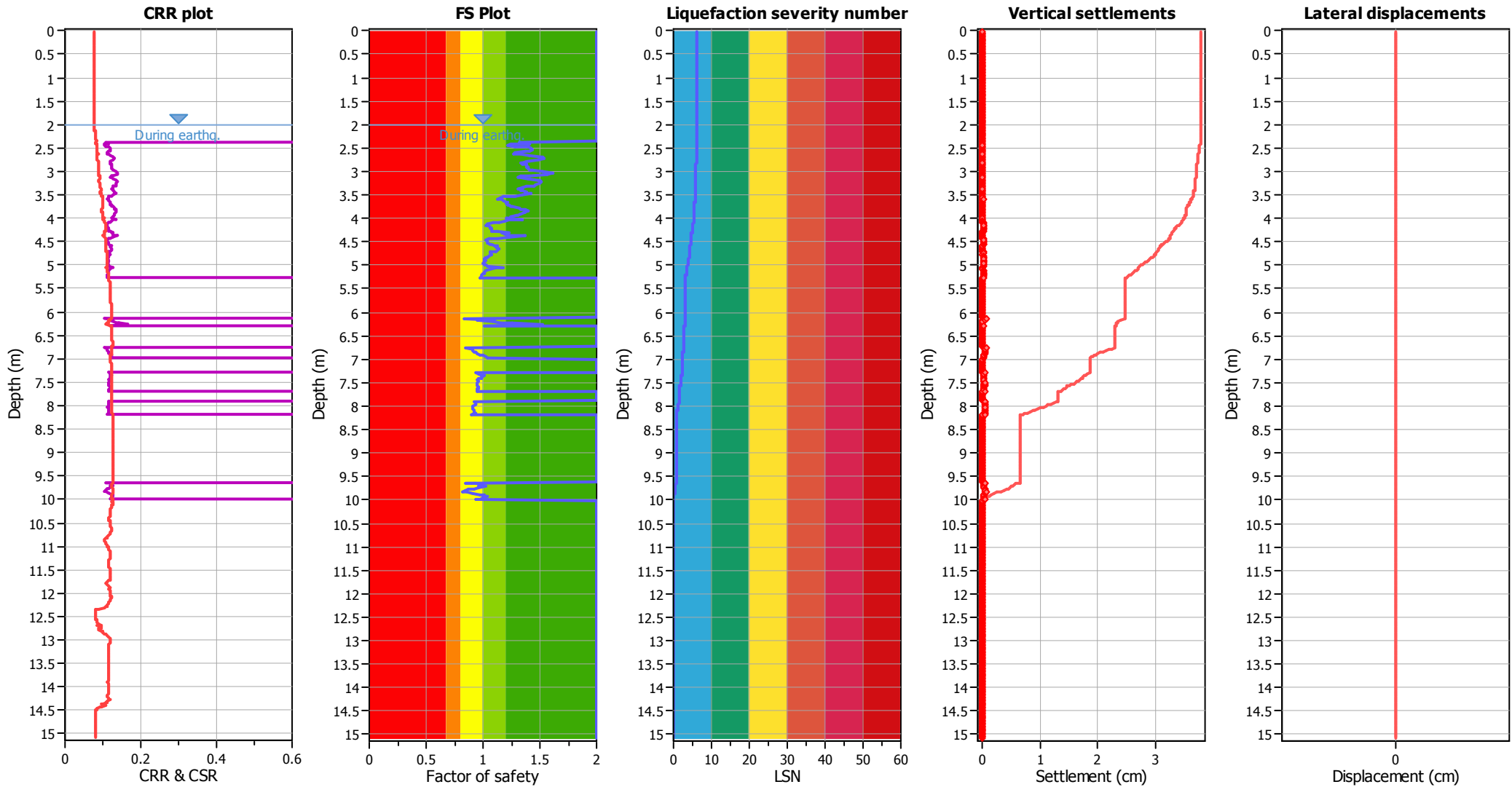
**F.S. color scheme**

- 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

**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

### Liquefaction analysis overall plots



**Input parameters and analysis data**

|                                |                   |                           |              |                             |            |
|--------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| Analysis method:               | B&I (2014)        | Depth to GWT (earthq.):   | 2.00 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         | $K_{\sigma}$ applied:       | Yes        |
| Earthquake magnitude $M_w$ :   | 6.10              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:      | 0.14              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu): | 2.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

**F.S. color scheme**

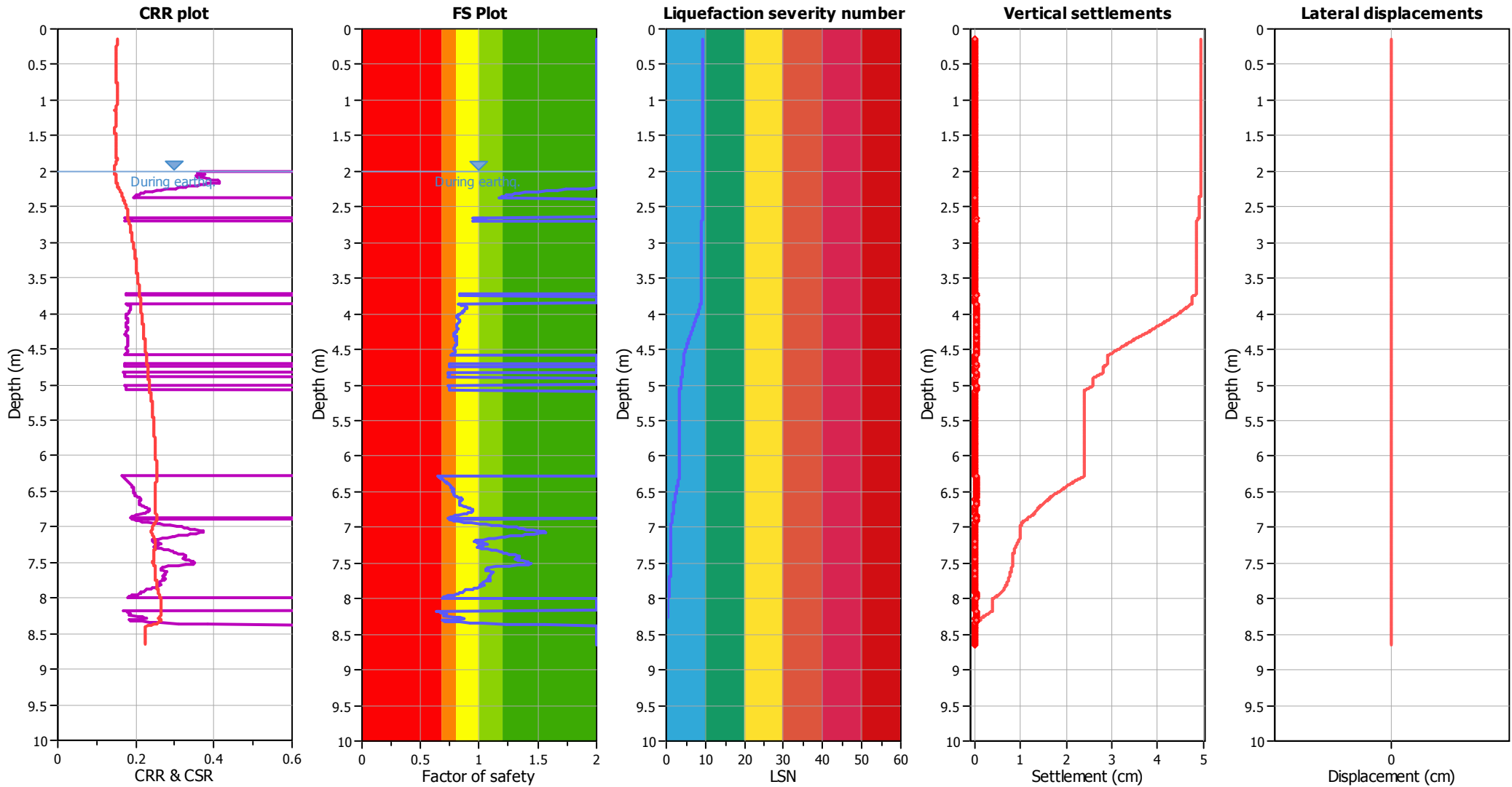
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**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

**APPENDIX D**  
**Past Earthquake Liquefaction Analysis Outputs with Soil Specific  
Correction**

### Liquefaction analysis overall plots



**Input parameters and analysis data**

|                                |                   |                           |              |                             |            |
|--------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| Analysis method:               | B&I (2014)        | Depth to GWT (earthq.):   | 2.00 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         | $K_{\sigma}$ applied:       | Yes        |
| Earthquake magnitude $M_w$ :   | 7.10              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:      | 0.27              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu): | 2.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

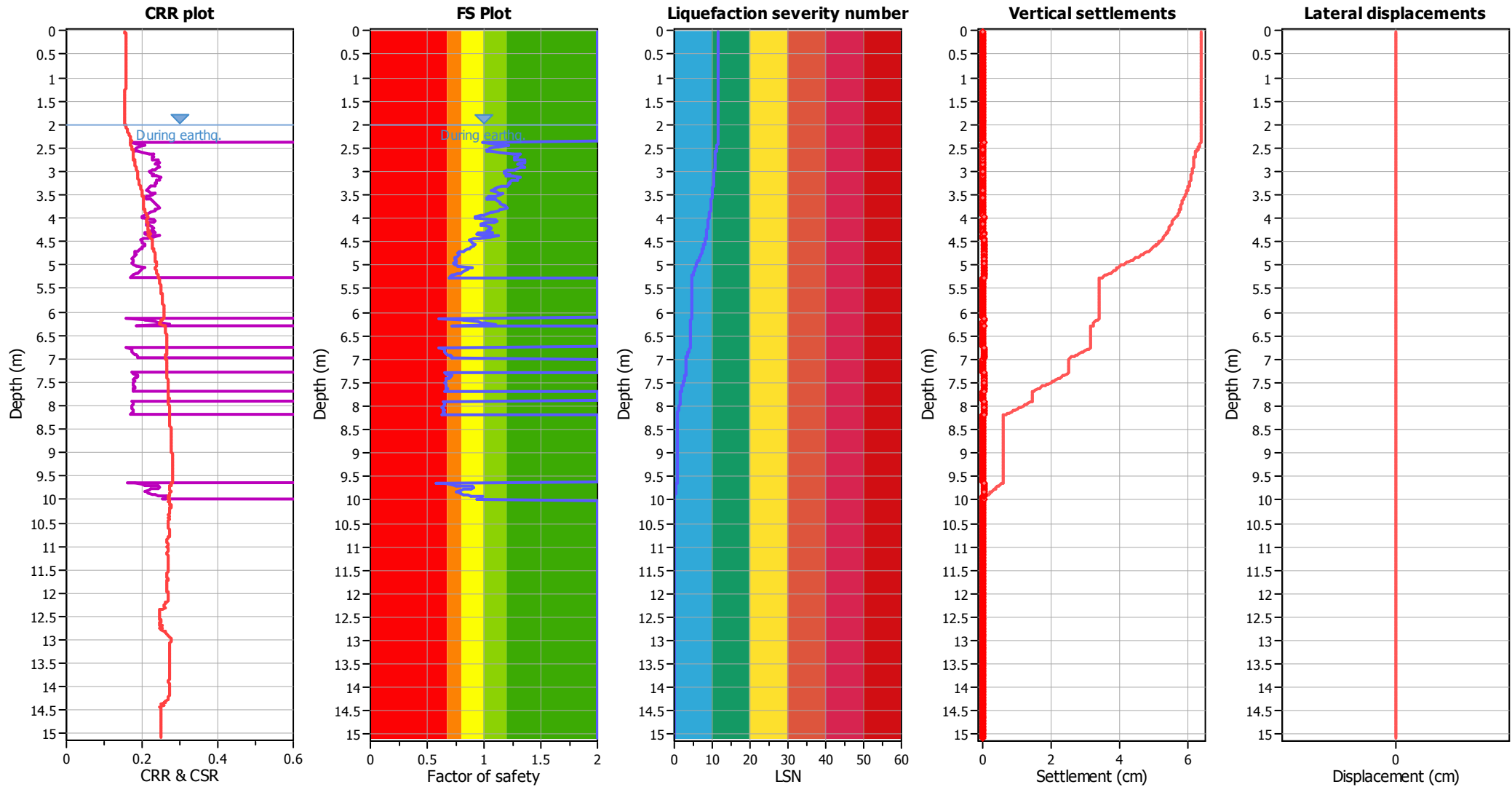
**F.S. color scheme**

- 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

**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

### Liquefaction analysis overall plots



**Input parameters and analysis data**

|                                |                   |                           |              |                             |            |
|--------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| Analysis method:               | B&I (2014)        | Depth to GWT (erthq.):    | 2.00 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         | $K_{\sigma}$ applied:       | Yes        |
| Earthquake magnitude $M_w$ :   | 7.10              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:      | 0.27              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu): | 2.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

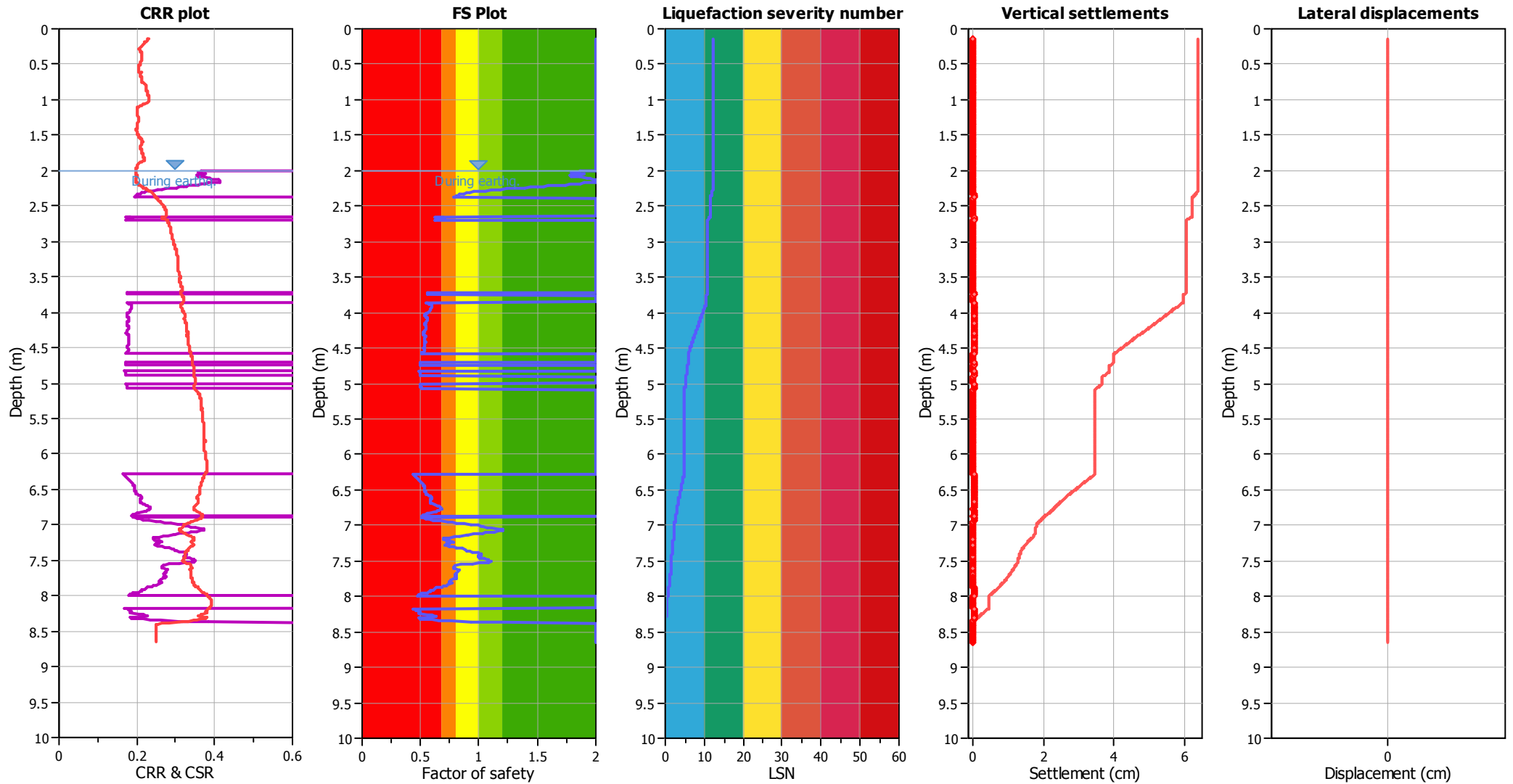
**F.S. color scheme**

- 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

**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

### Liquefaction analysis overall plots



**Input parameters and analysis data**

|                                |                   |                           |              |                             |            |
|--------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| Analysis method:               | B&I (2014)        | Depth to GWT (erthq.):    | 2.00 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         | $K_{\sigma}$ applied:       | Yes        |
| Earthquake magnitude $M_w$ :   | 6.20              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:      | 0.44              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu): | 2.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

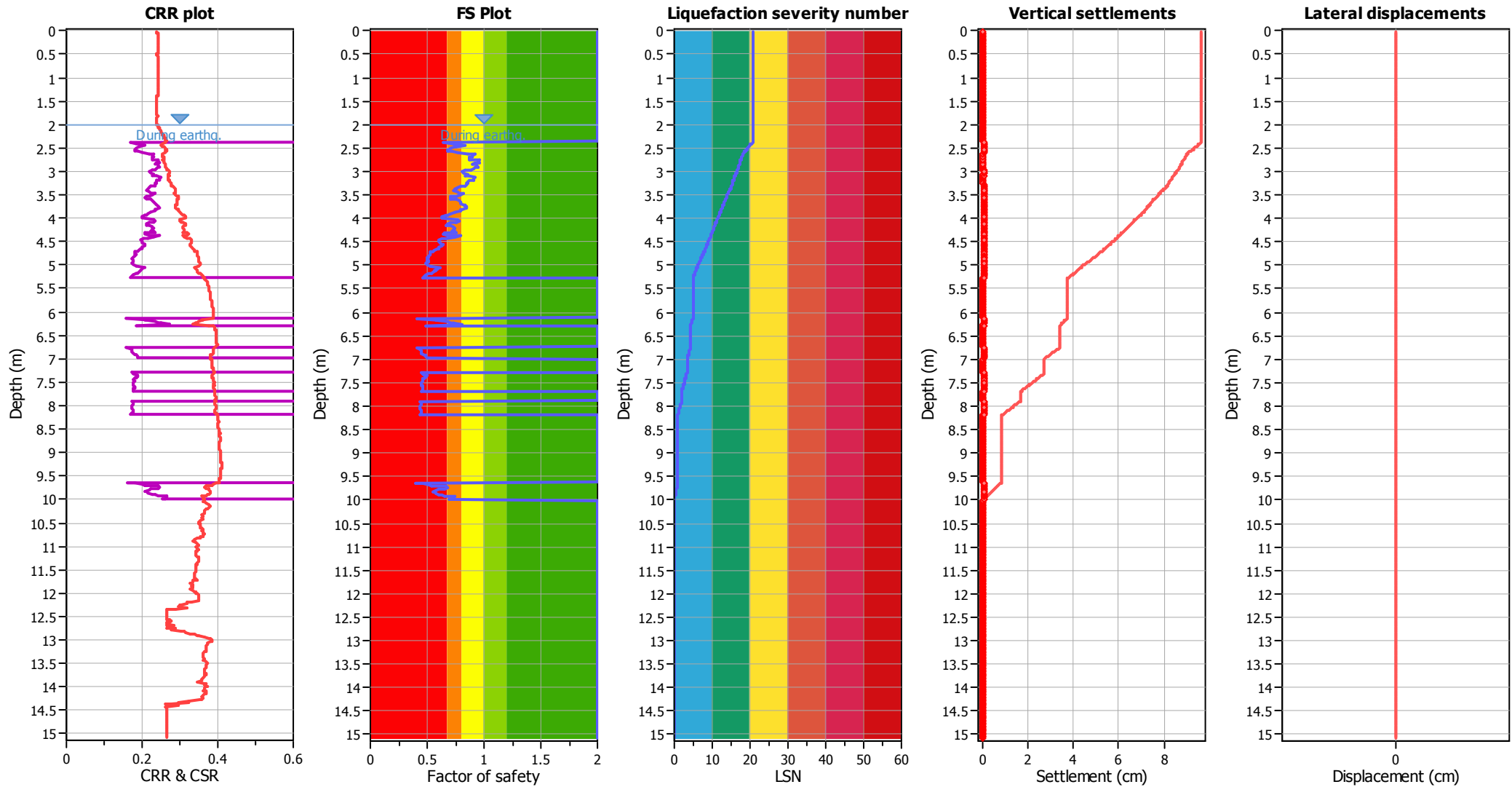
**F.S. color scheme**

- 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

**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

### Liquefaction analysis overall plots



**Input parameters and analysis data**

|                                |                   |                           |              |                             |            |
|--------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| Analysis method:               | B&I (2014)        | Depth to GWT (erthq.):    | 2.00 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         | $K_{\sigma}$ applied:       | Yes        |
| Earthquake magnitude $M_w$ :   | 6.20              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:      | 0.44              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu): | 2.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

**F.S. color scheme**

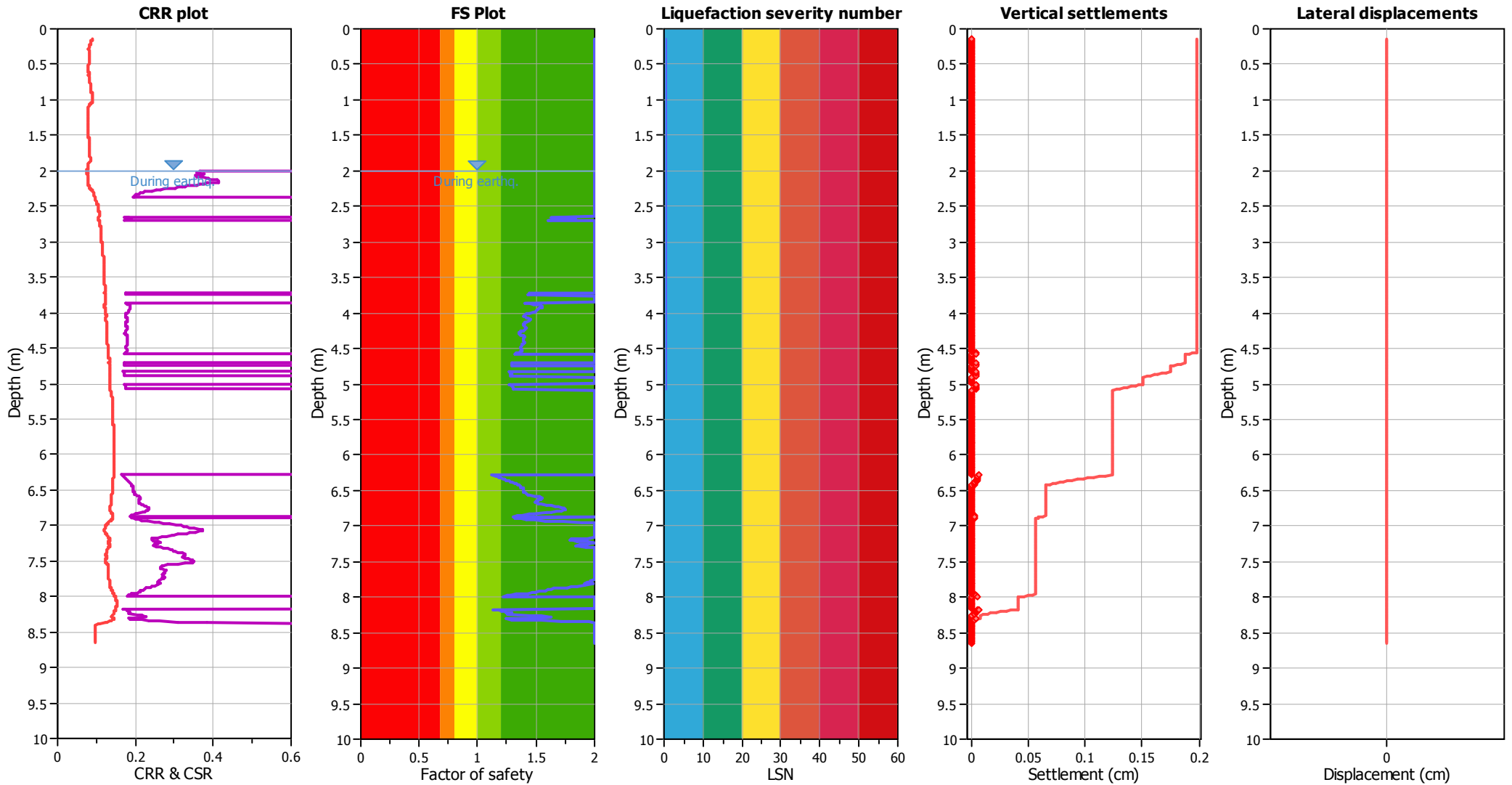
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**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



### Liquefaction analysis overall plots



**Input parameters and analysis data**

|                                |                   |                           |              |                             |            |
|--------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| Analysis method:               | B&I (2014)        | Depth to GWT (earthq.):   | 2.00 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         | $K_{\sigma}$ applied:       | Yes        |
| Earthquake magnitude $M_w$ :   | 6.20              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:      | 0.17              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu): | 2.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

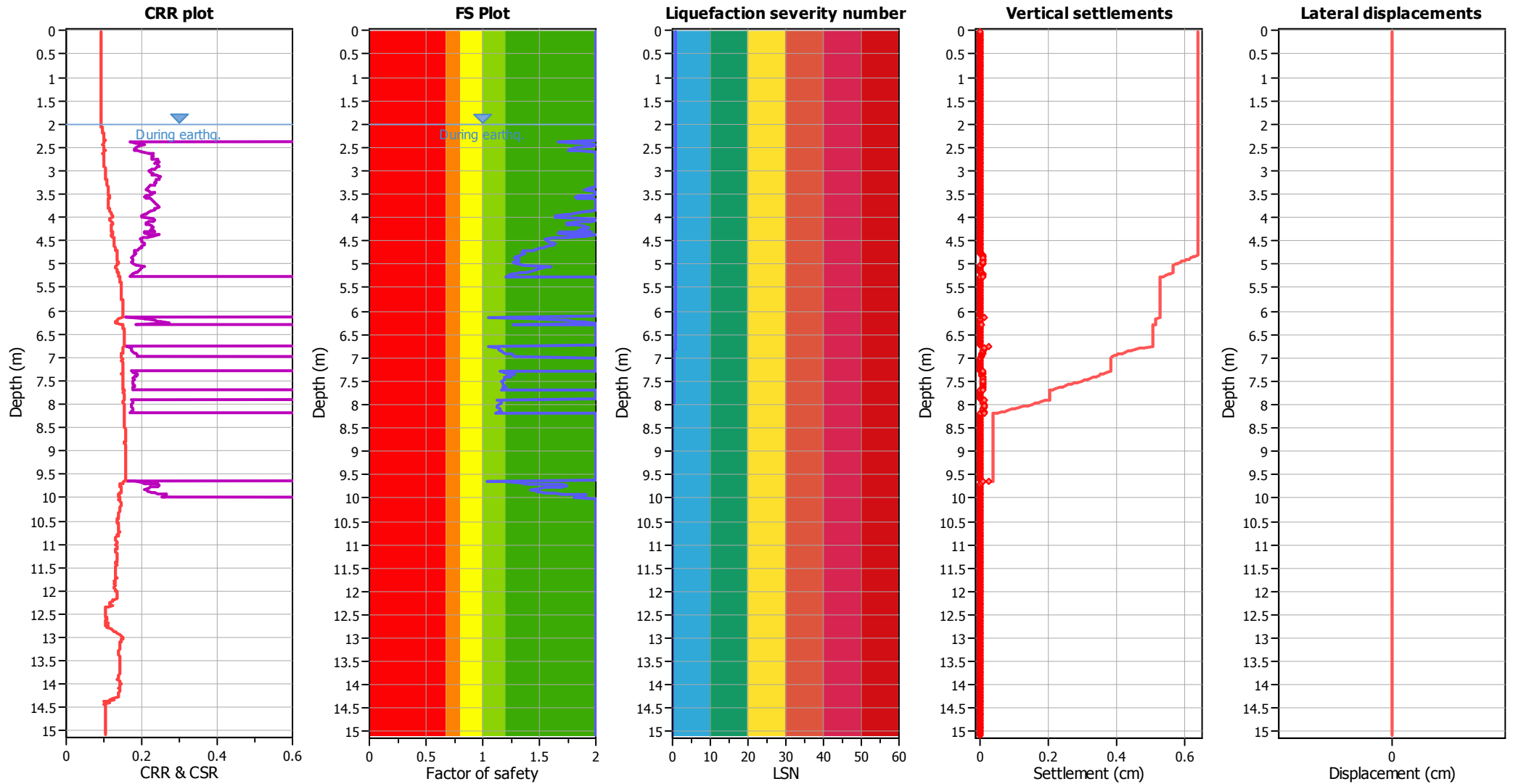
**F.S. color scheme**

- 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

**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

### Liquefaction analysis overall plots



**Input parameters and analysis data**

|                                |                   |                           |              |                             |            |
|--------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| Analysis method:               | B&I (2014)        | Depth to GWT (erthq.):    | 2.00 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         | $K_{\sigma}$ applied:       | Yes        |
| Earthquake magnitude $M_w$ :   | 6.20              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:      | 0.17              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu): | 2.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

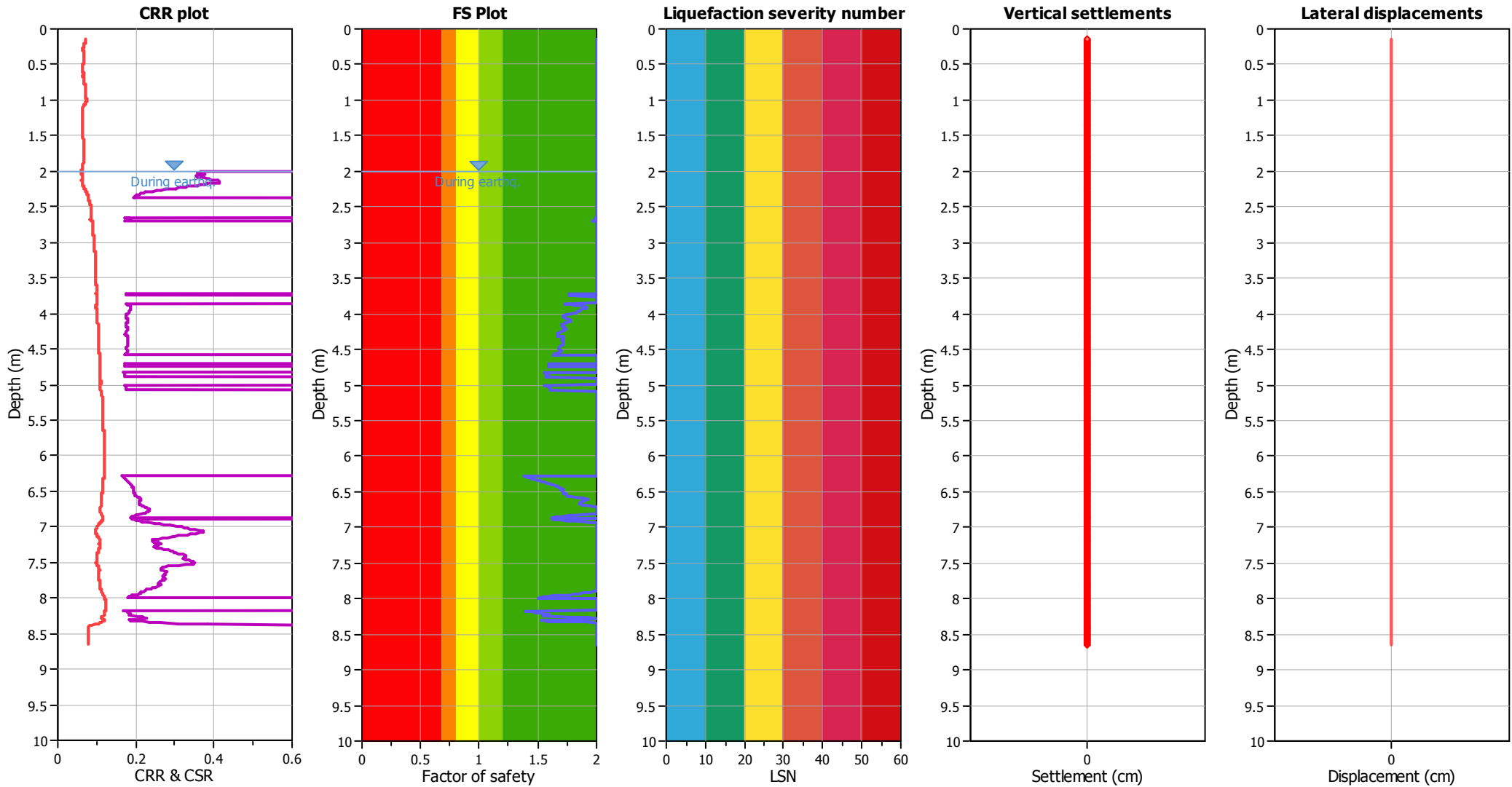
**F.S. color scheme**

- 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

**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

### Liquefaction analysis overall plots



#### Input parameters and analysis data

|                                |                   |                           |              |                             |            |
|--------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| Analysis method:               | B&I (2014)        | Depth to GWT (earthq.):   | 2.00 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         | $K_{\sigma}$ applied:       | Yes        |
| Earthquake magnitude $M_w$ :   | 6.10              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:      | 0.14              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu): | 2.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

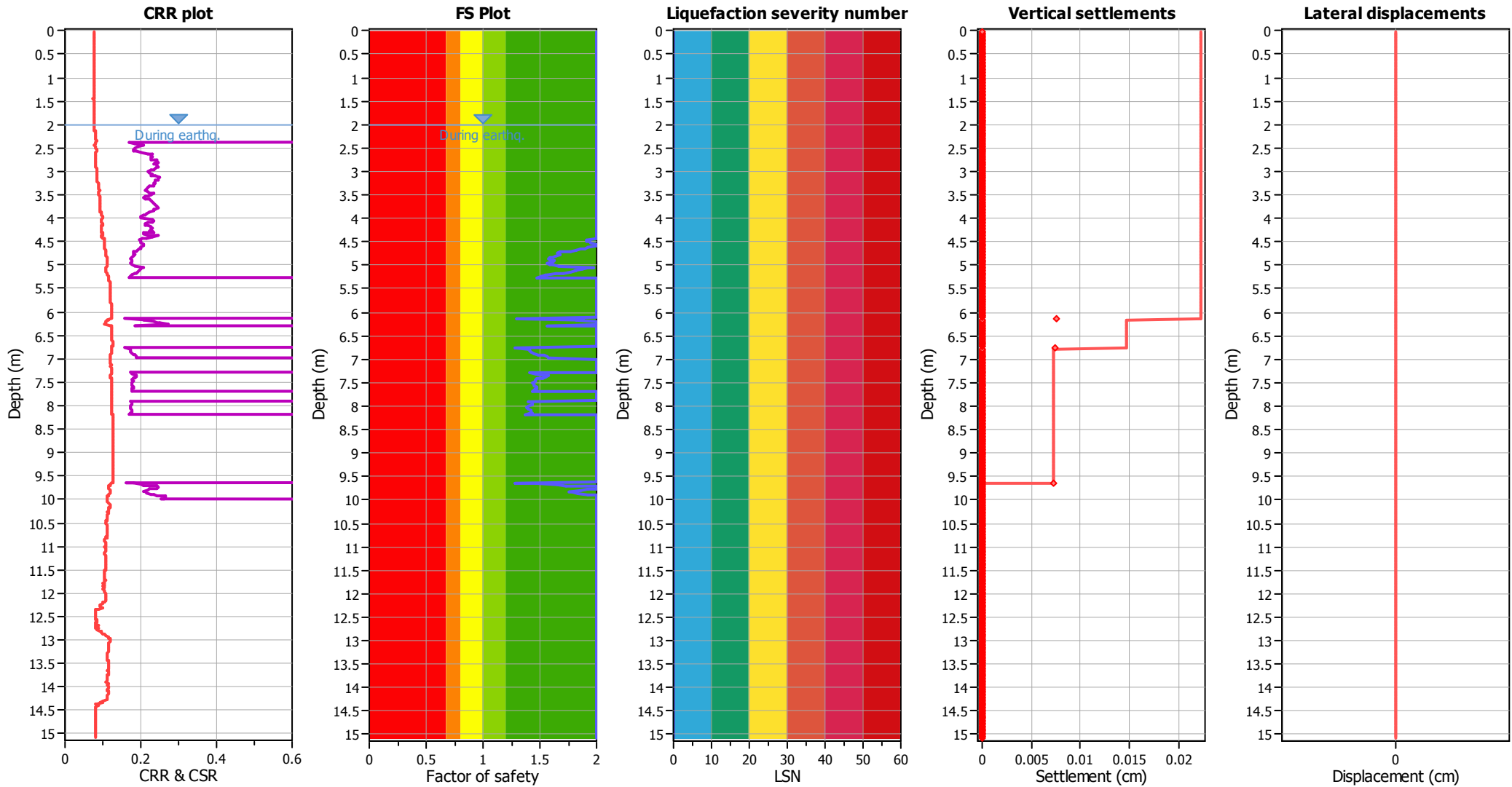
#### F.S. color scheme

- 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

#### 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

### Liquefaction analysis overall plots



**Input parameters and analysis data**

|                                |                   |                           |              |                             |            |
|--------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| Analysis method:               | B&I (2014)        | Depth to GWT (earthq.):   | 2.00 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         | $K_{\sigma}$ applied:       | Yes        |
| Earthquake magnitude $M_w$ :   | 6.10              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:      | 0.14              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu): | 2.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

**F.S. color scheme**

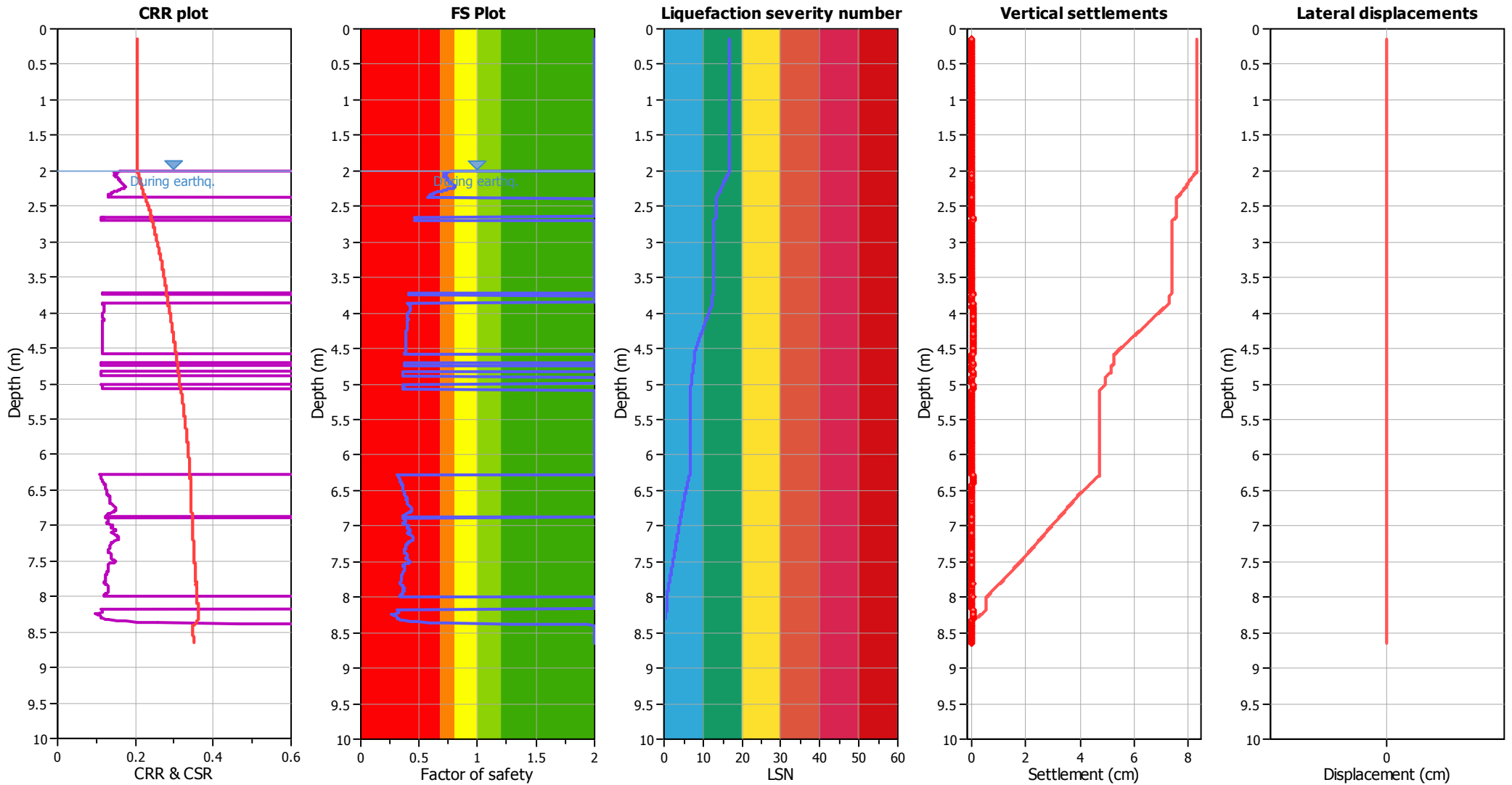
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**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

**APPENDIX E**  
**MBIE Model Earthquake Liquefaction Analysis Outputs**

### Liquefaction analysis overall plots



**Input parameters and analysis data**

|                                |                   |                           |              |                             |            |
|--------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| Analysis method:               | B&I (2014)        | Depth to GWT (erthq.):    | 2.00 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         | $K_{\sigma}$ applied:       | Yes        |
| Earthquake magnitude $M_w$ :   | 7.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:      | 0.35              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu): | 2.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

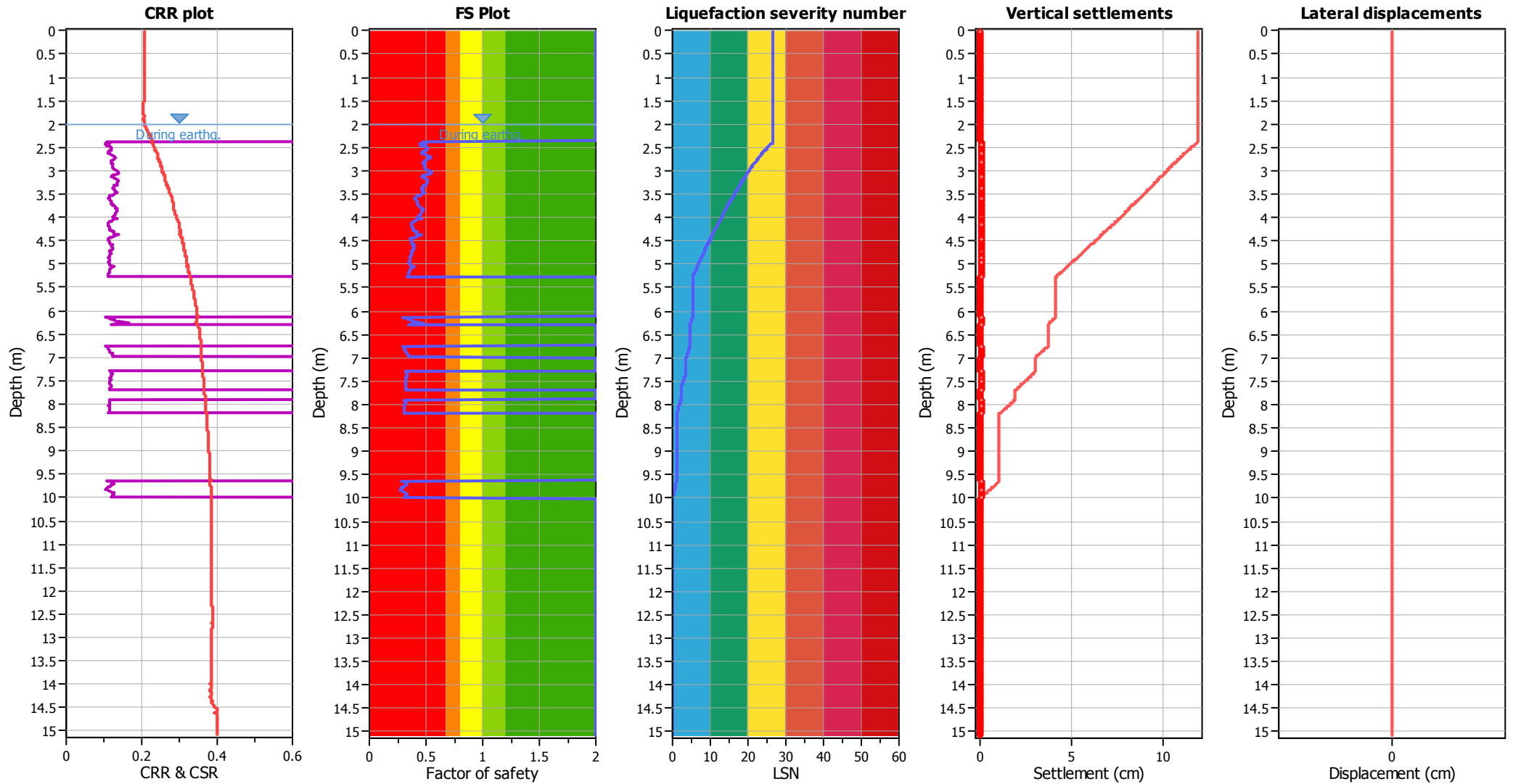
**F.S. color scheme**

- 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

**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

### Liquefaction analysis overall plots



**Input parameters and analysis data**

|                                |                   |                           |              |                             |            |
|--------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| Analysis method:               | B&I (2014)        | Depth to GWT (earthq.):   | 2.00 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         | $K_{\sigma}$ applied:       | Yes        |
| Earthquake magnitude $M_w$ :   | 7.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:      | 0.35              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu): | 2.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

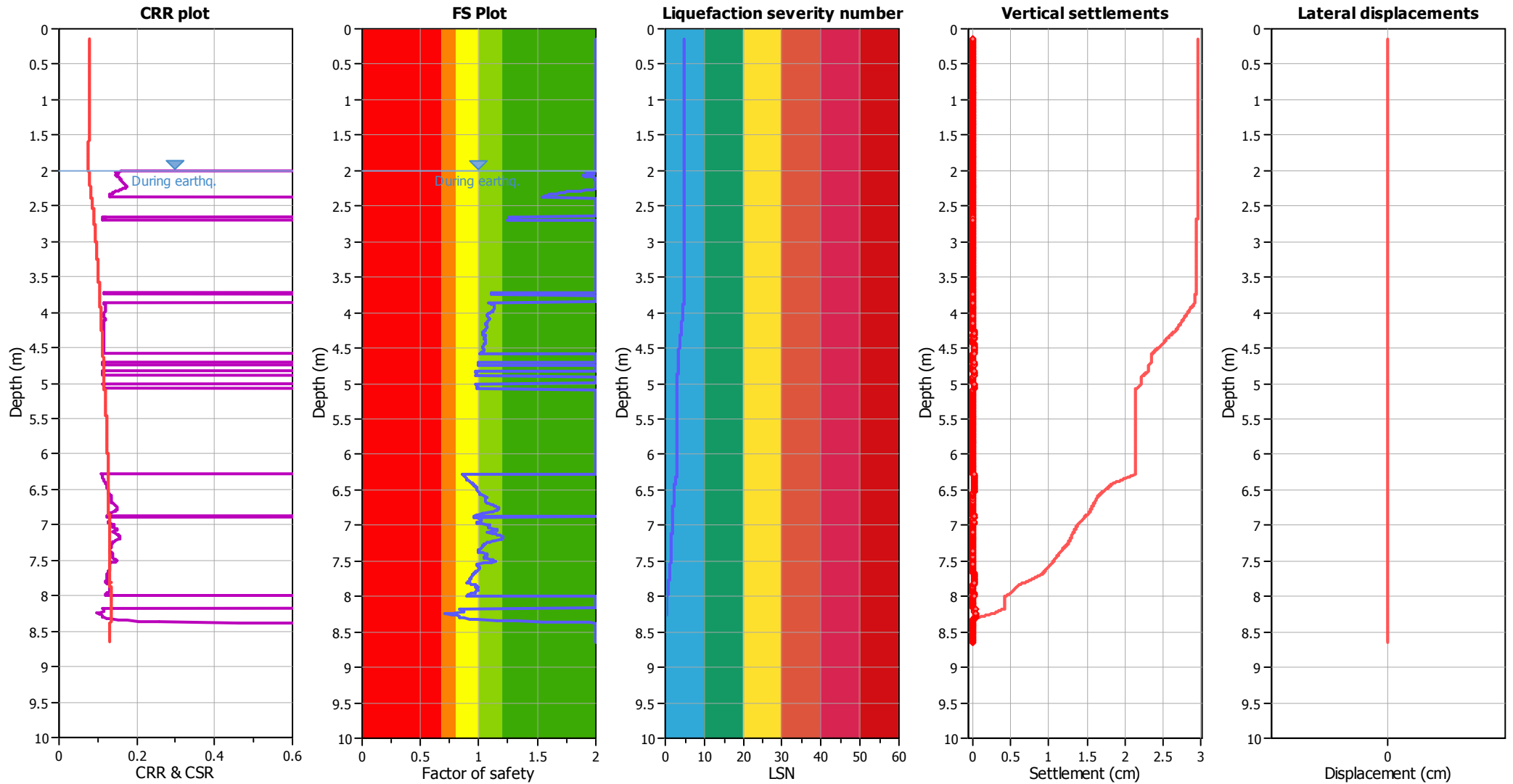
**F.S. color scheme**

- 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

**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

### Liquefaction analysis overall plots



**Input parameters and analysis data**

|                                |                   |                           |              |                             |            |
|--------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| Analysis method:               | B&I (2014)        | Depth to GWT (earthq.):   | 2.00 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         | $K_{\sigma}$ applied:       | Yes        |
| Earthquake magnitude $M_w$ :   | 7.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:      | 0.13              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu): | 2.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

**F.S. color scheme**

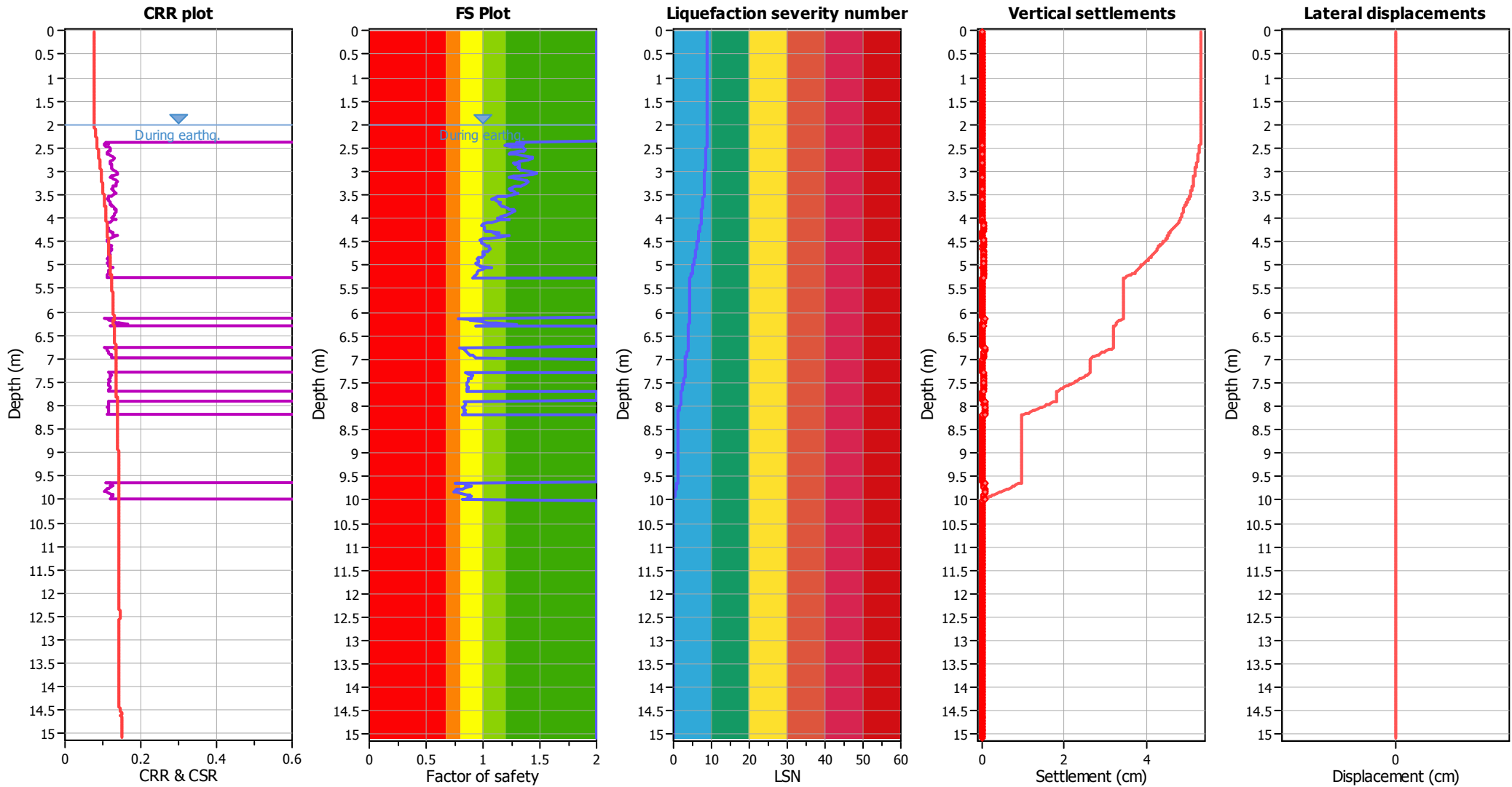
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**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



### Liquefaction analysis overall plots



**Input parameters and analysis data**

|                                |                   |                           |              |                             |            |
|--------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| Analysis method:               | B&I (2014)        | Depth to GWT (erthq.):    | 2.00 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         | $K_{\sigma}$ applied:       | Yes        |
| Earthquake magnitude $M_w$ :   | 7.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:      | 0.13              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu): | 2.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

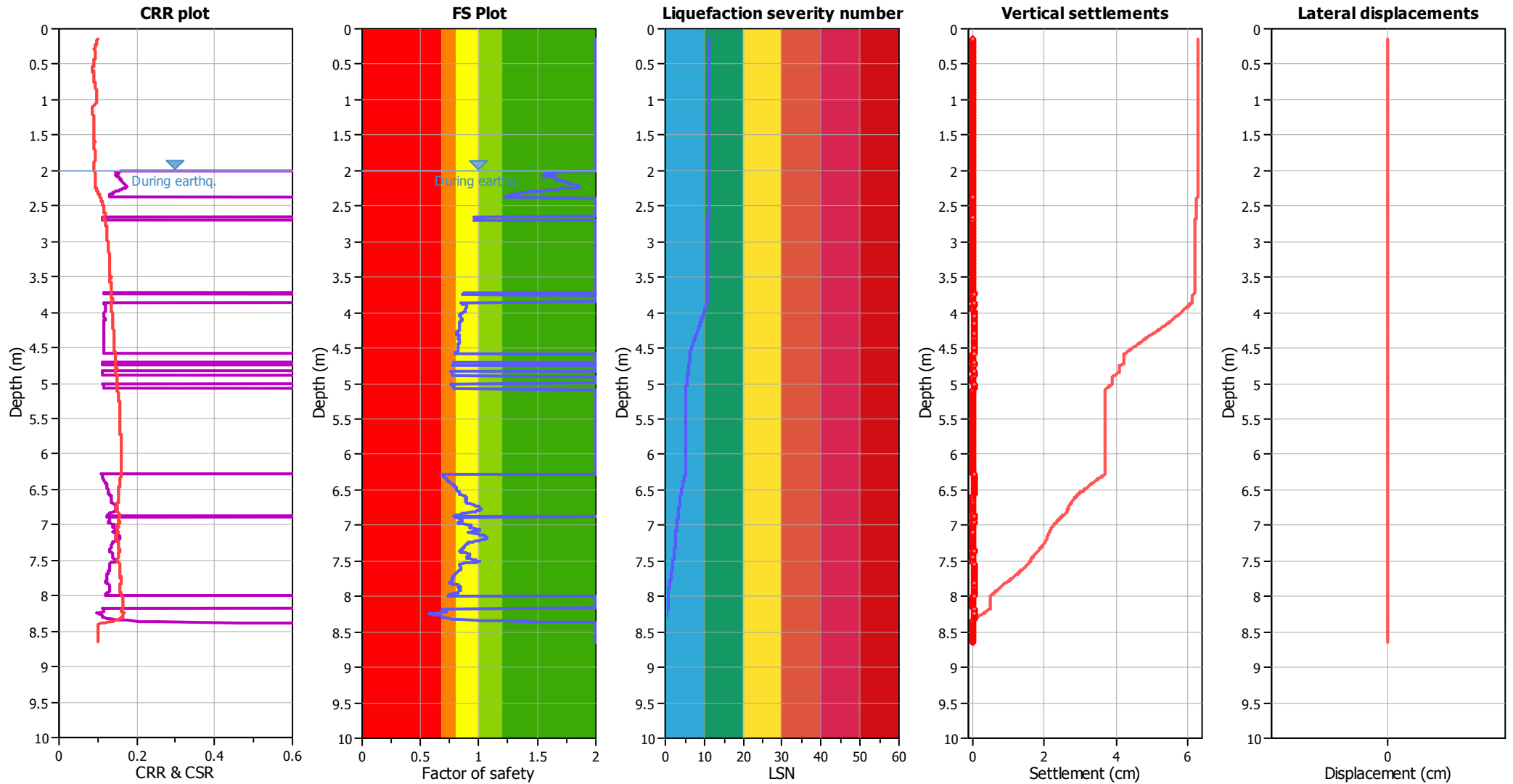
**F.S. color scheme**

- 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

**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

### Liquefaction analysis overall plots



**Input parameters and analysis data**

|                                |                   |                           |              |                             |            |
|--------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| Analysis method:               | B&I (2014)        | Depth to GWT (earthq.):   | 2.00 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         | $K_{\sigma}$ applied:       | Yes        |
| Earthquake magnitude $M_w$ :   | 6.00              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:      | 0.19              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu): | 2.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

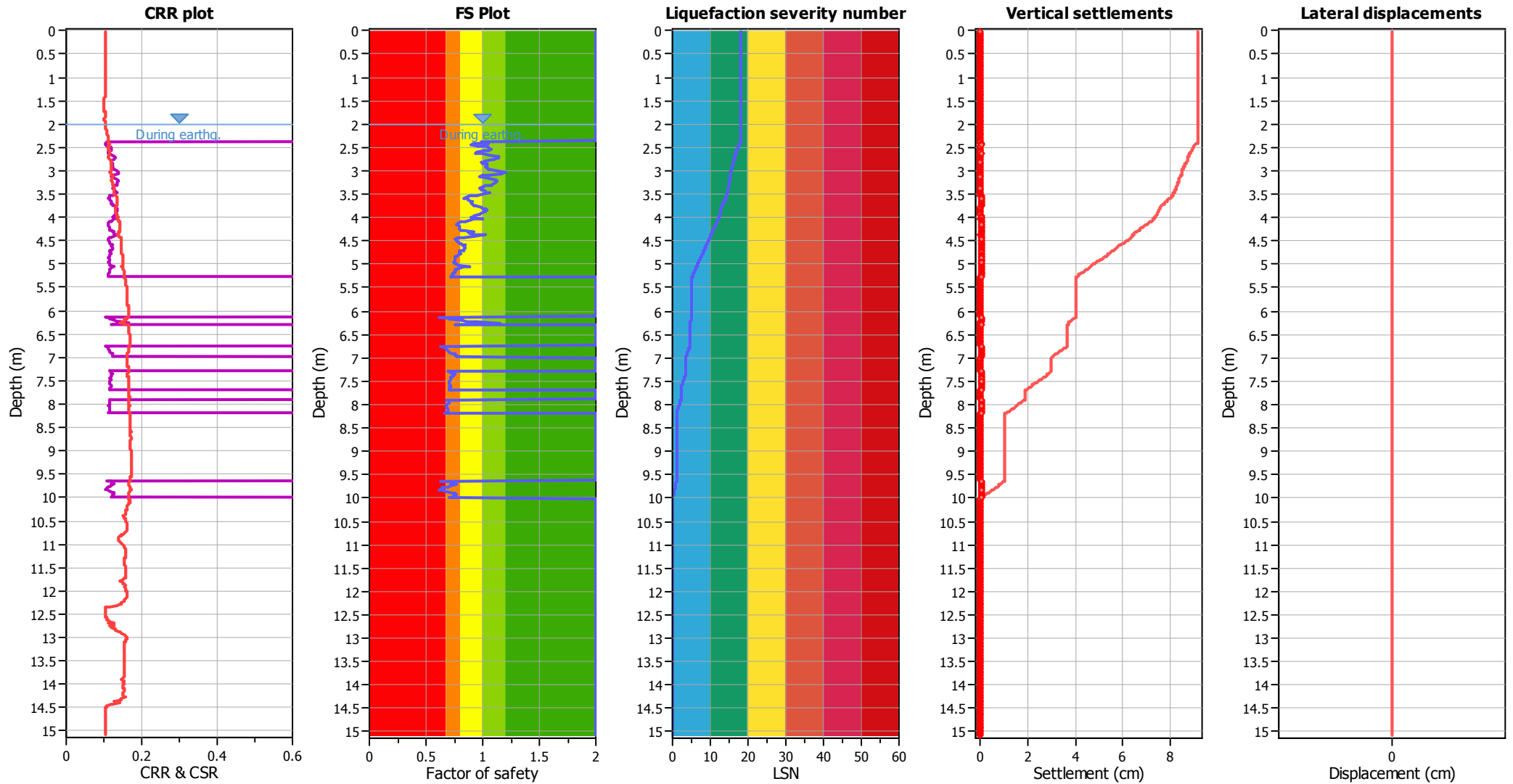
**F.S. color scheme**

- 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

**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

### Liquefaction analysis overall plots



**Input parameters and analysis data**

|                                |                   |                           |              |                             |            |
|--------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| Analysis method:               | B&I (2014)        | Depth to GWT (erthq.):    | 2.00 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         | $K_{\sigma}$ applied:       | Yes        |
| Earthquake magnitude $M_w$ :   | 6.00              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:      | 0.19              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu): | 2.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

**F.S. color scheme**

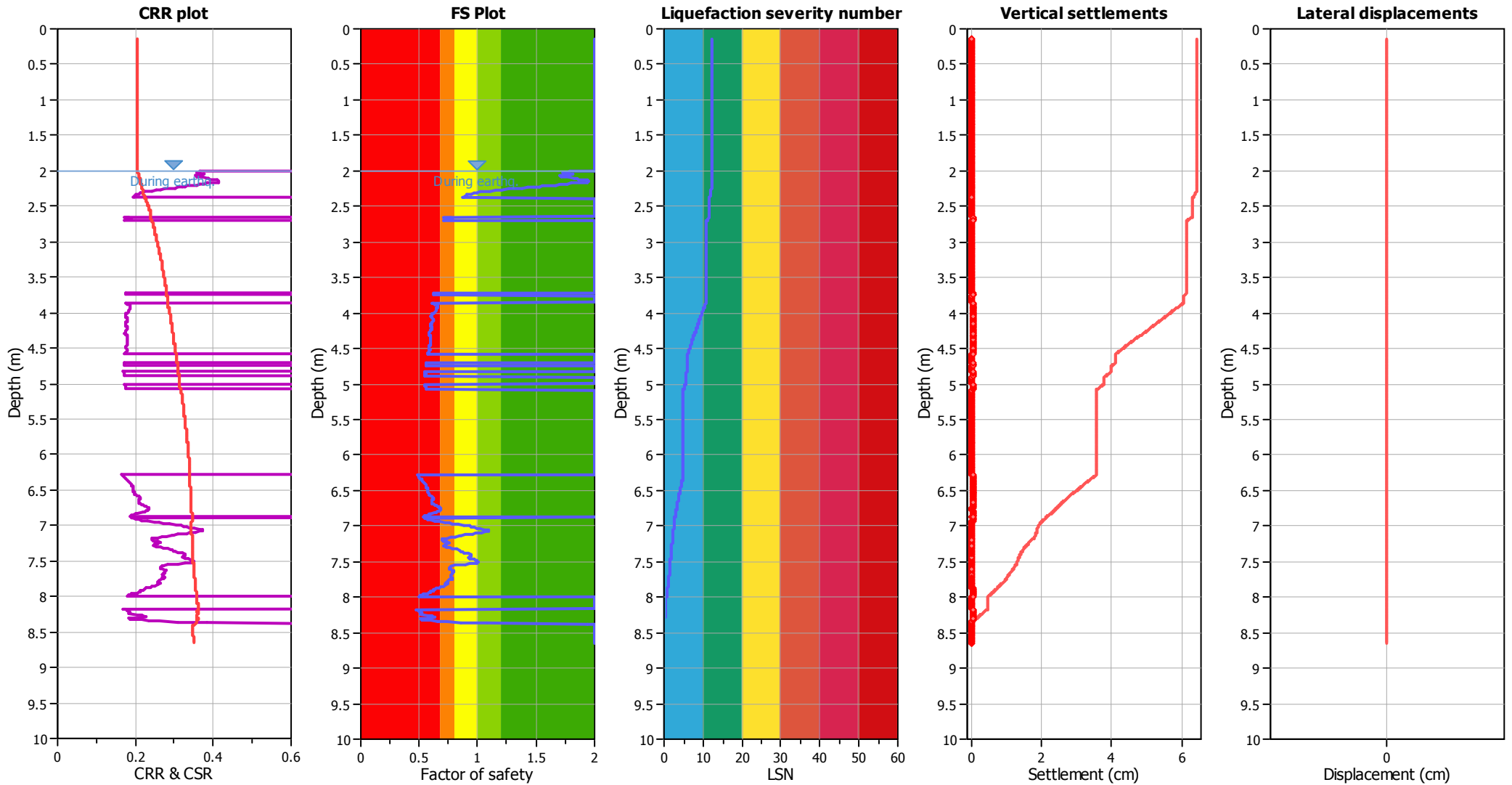
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**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

**APPENDIX F**  
**Model Earthquake Liquefaction Analysis Outputs with Soil Specific  
Correction**

### Liquefaction analysis overall plots



**Input parameters and analysis data**

|                                |                   |                           |              |                             |            |
|--------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| Analysis method:               | B&I (2014)        | Depth to GWT (erthq.):    | 2.00 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         | $K_{\sigma}$ applied:       | Yes        |
| Earthquake magnitude $M_w$ :   | 7.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:      | 0.35              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu): | 2.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

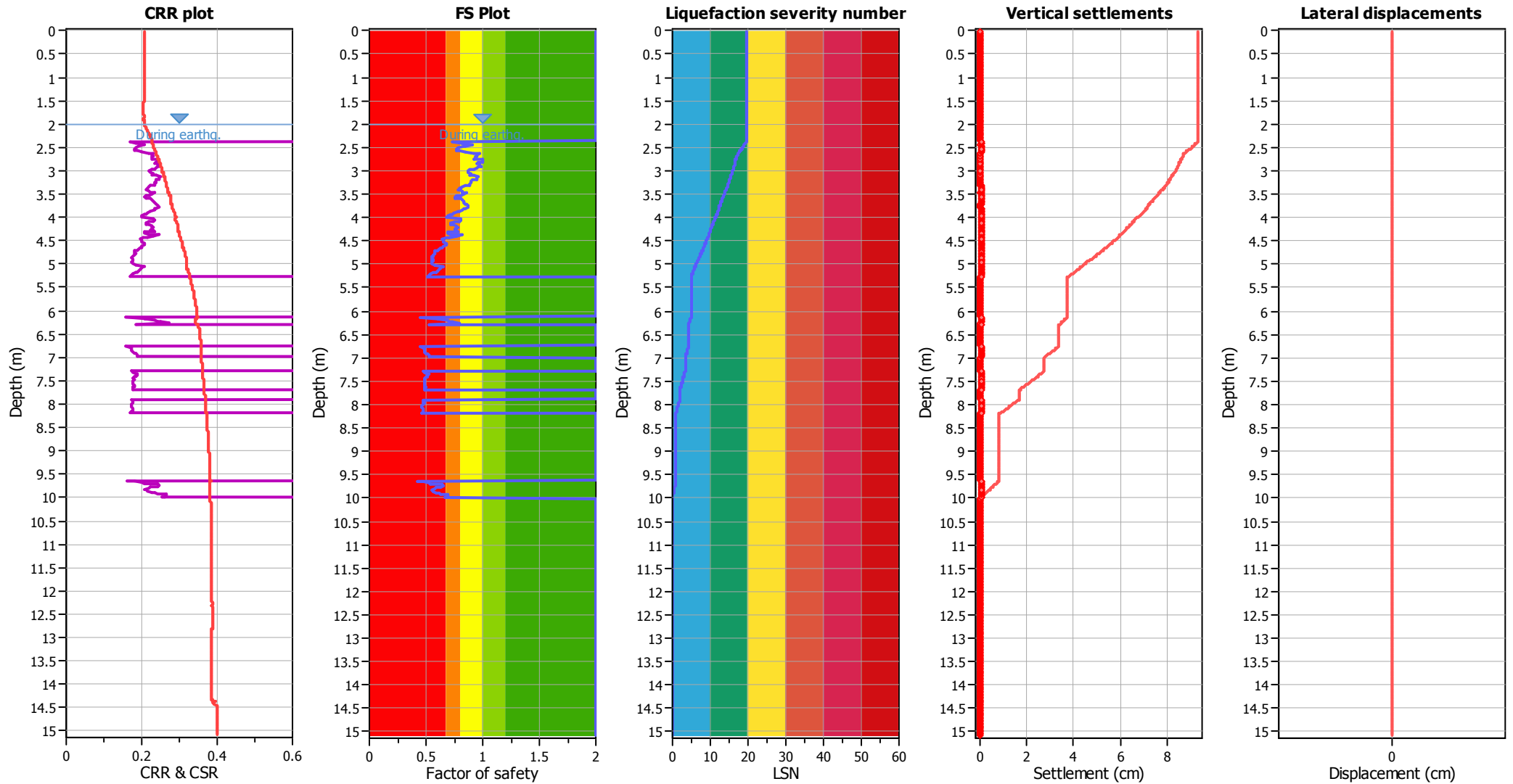
**F.S. color scheme**

- 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

**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

### Liquefaction analysis overall plots



**Input parameters and analysis data**

|                                       |                   |                           |              |                             |            |
|---------------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| Analysis method:                      | B&I (2014)        | Depth to GWT (erthq.):    | 2.00 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 <sub>σ</sub> applied:     | Yes        |
| Earthquake magnitude M <sub>w</sub> : | 7.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.35              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 2.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

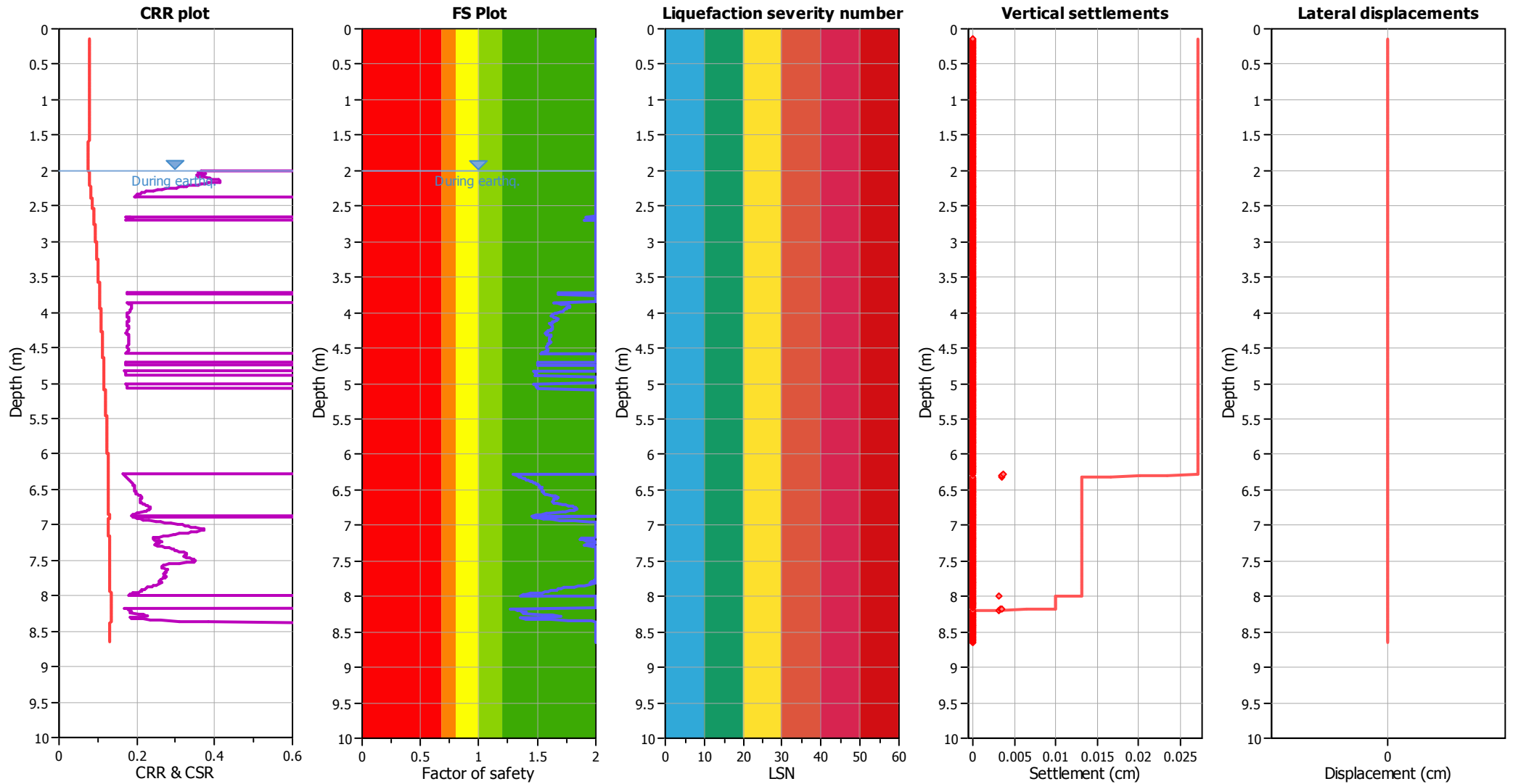
**F.S. color scheme**

- 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

**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

### Liquefaction analysis overall plots



#### Input parameters and analysis data

|                                |                   |                           |              |                             |            |
|--------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| Analysis method:               | B&I (2014)        | Depth to GWT (erthq.):    | 2.00 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         | $K_{\sigma}$ applied:       | Yes        |
| Earthquake magnitude $M_w$ :   | 7.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:      | 0.13              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu): | 2.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

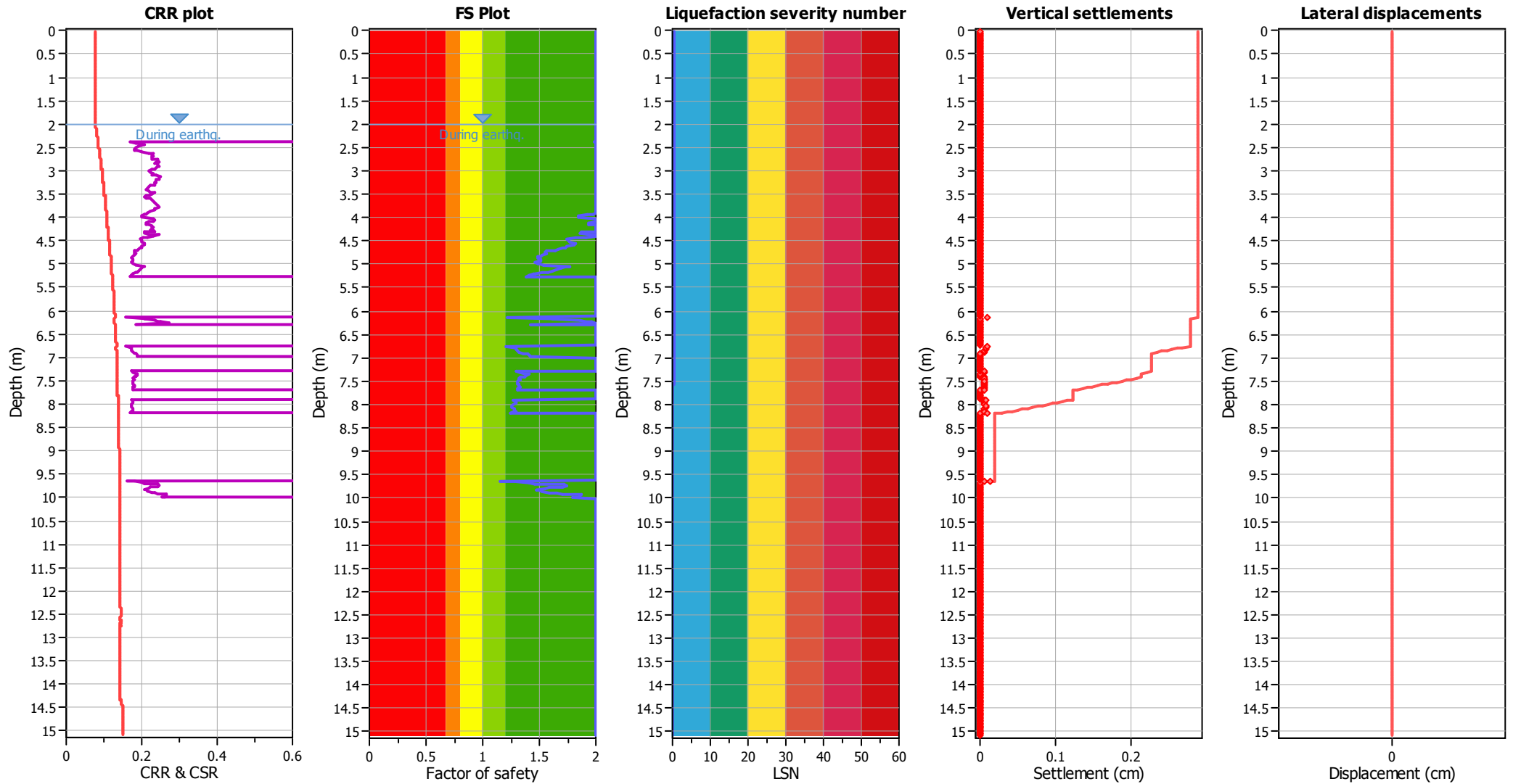
#### F.S. color scheme

- 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

#### 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

### Liquefaction analysis overall plots



**Input parameters and analysis data**

|                                |                   |                           |              |                             |            |
|--------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| Analysis method:               | B&I (2014)        | Depth to GWT (erthq.):    | 2.00 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         | $K_{\sigma}$ applied:       | Yes        |
| Earthquake magnitude $M_w$ :   | 7.50              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:      | 0.13              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu): | 2.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

**F.S. color scheme**

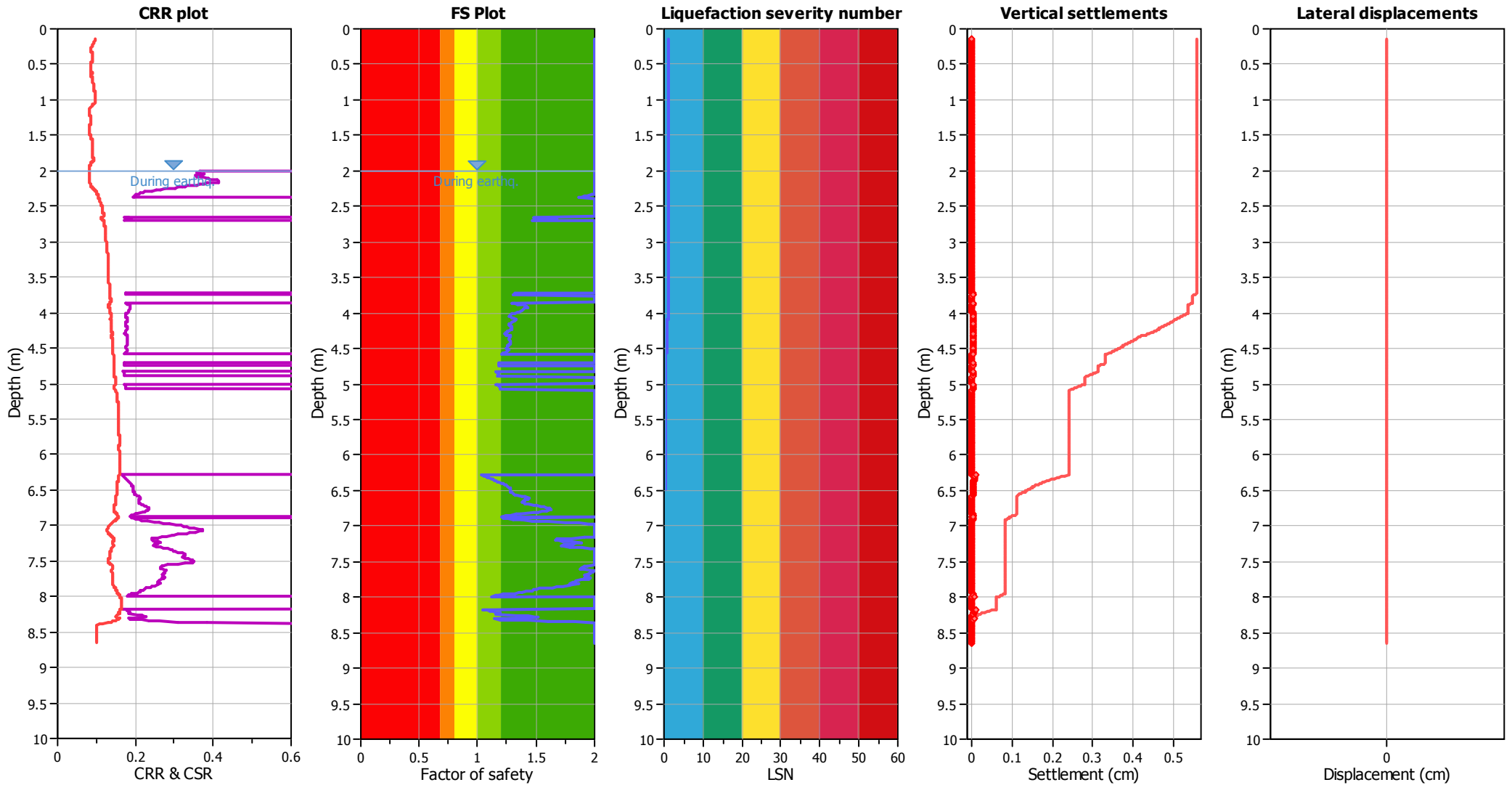
- Almost certain it will liquefy
- Very likely to liquefy
- Liquefaction and no liq. are equally likely
- Unlike to liquefy
- Almost certain it will not liquefy

**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



### Liquefaction analysis overall plots



**Input parameters and analysis data**

|                                       |                   |                           |              |                             |            |
|---------------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| Analysis method:                      | B&I (2014)        | Depth to GWT (earthq.):   | 2.00 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 <sub>σ</sub> applied:     | Yes        |
| Earthquake magnitude M <sub>w</sub> : | 6.00              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:             | 0.19              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu):        | 2.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 m    |

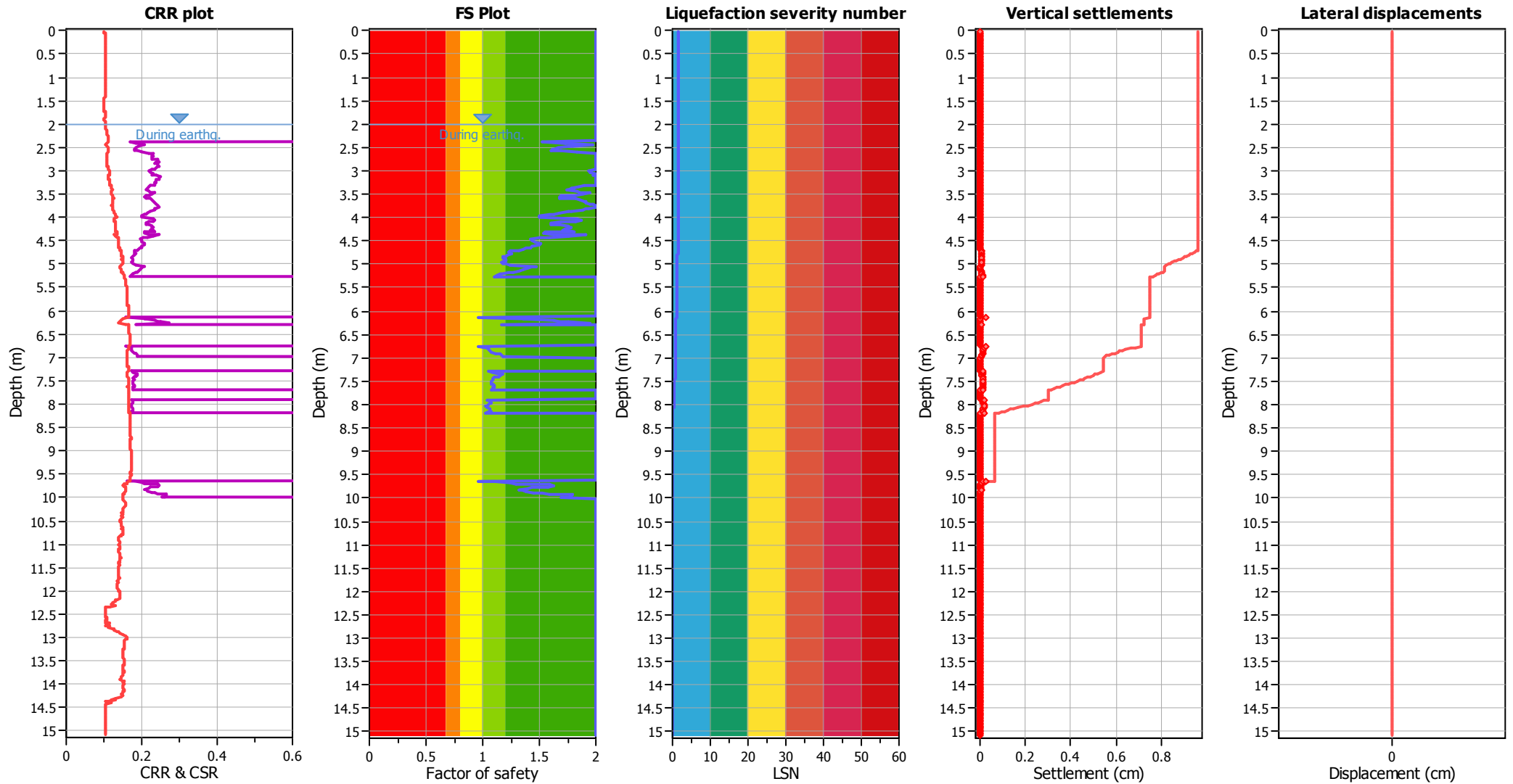
**F.S. color scheme**

- 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

**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

### Liquefaction analysis overall plots



**Input parameters and analysis data**

|                                |                   |                           |              |                             |            |
|--------------------------------|-------------------|---------------------------|--------------|-----------------------------|------------|
| Analysis method:               | B&I (2014)        | Depth to GWT (earthq.):   | 2.00 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         | $K_{\sigma}$ applied:       | Yes        |
| Earthquake magnitude $M_w$ :   | 6.00              | Unit weight calculation:  | Based on SBT | Clay like behavior applied: | Sands only |
| Peak ground acceleration:      | 0.19              | Use fill:                 | No           | Limit depth applied:        | Yes        |
| Depth to water table (insitu): | 2.00 m            | Fill height:              | N/A          | Limit depth:                | 10.00 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

**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

## Appendix F

### Policy 6.3.11 Monitoring and Review – Regional Policy Statement

#### Policy 6.3.11

#### Monitoring and Review

In relation to development in Greater Christchurch:

1. The Canterbury Regional Council, in conjunction with the territorial authorities, shall undertake adequate monitoring to demonstrate both in the short term and the long term that there is an available supply of residential and business land to meet the Objectives and Policies of this Chapter.
2. The Canterbury Regional Council, in conjunction with the territorial authorities, shall undertake monitoring of the supply, uptake and impacts of rural residential land use and development.
3. Prior to initiating a review of this chapter, for the purposes of information the Canterbury Regional Council may request the organisation or agency responsible for the operation of Christchurch International Airport to undertake a remodelling of the air noise contours relating to the airport.
4. The Canterbury Regional Council, following relevant territorial authority input, shall initiate a review of the extent and location of land for development if any of the following situations occur:
  - a. a shortfall in available land is identified by monitoring under Policy 6.3.11; or
  - b. it is identified that altered circumstances have arisen or will arise either in one or more parts of Greater Christchurch, in relation to the expected availability of sub-regional infrastructure, and a reconsideration of the extent, location and timing of land for development is necessary to achieve the objectives and policies of this chapter.
5. Any change resulting from a review of the extent, and location of land for development, any alteration to the Greenfield Priority Areas, or provision of new greenfield priority areas, shall commence only under the following circumstances:
  - a. infrastructure is either in place or able to be economically and efficiently provided to support the urban activity;
  - b. provision is in place or can be made for safe, convenient and sustainable access to community, social and commercial facilities;
  - c. the objective of urban consolidation continues to be achieved;
  - d. urban land use, including industrial and commercial activities, does not increase the risk of contamination of drinking water sources, including the groundwater recharge zone for Christchurch's drinking water;
  - e. urban development does not lie between the primary and secondary stopbanks south of the Waimakariri River which are designed to retain floodwaters in the event of flood breakout;
  - f. the landscape character of the Port Hills is protected;
  - g. sufficient rural land is retained to maintain the open space landscape character either between or surrounding the areas of urban activity within Greater Christchurch; and
  - h. the operational capacity of strategic infrastructure is not compromised.

#### ***This policy implements the following objectives:***

Objectives [6.2.1](#), [6.2.2](#), [6.2.3](#), [6.2.4](#), [6.2.5](#), [6.2.6](#)

#### **Methods**

1. The monitoring for Policy 6.3.11 may include but is not limited to:

- any information published by or sought from Statistics New Zealand.
  - annual surveys of business and residential land uptake, including Greenfield Priority Area development and redevelopment.
  - annual surveys of the development capacity of zoned and serviced land.
  - obtaining and analysing a range of information to assist with the understanding and prediction of future needs, including information on market behaviour and social and economic trends.
2. The monitoring for Policy 6.3.11 shall include such matters as the councils consider relevant and appropriate.
  3. The Canterbury Regional Council shall prepare a comprehensive monitoring report in relation to Policy 6.3.11 at least every three years, and make it publicly available.
  4. Any remodelling in terms of Policy 6.3.11(3) shall:
    - involve an assessment of projected future airport business growth and operation, and shall take into account, but not be limited to aircraft movements, flight tracks, fleet mix and runway utilisation; and
    - be accompanied by the report of an independent panel of airport noise experts who have undertaken a peer review of the inputs, assumptions and outcomes of the remodelling; and
    - shall be provided to the Canterbury Regional Council in the form of a comprehensive report along with an executive summary or summary report.
  5. The Canterbury Regional Council shall make the summary report of any remodelling under Method 4 publicly available as soon as practicable after receiving it.
  6. Any amended growth pattern shall be given effect through the provisions of any relevant regional plan, changes to the Regional Policy Statement, district plans, the Regional Land Transport Strategy, the Regional Land Transport Programme, Annual Plans, Three Year Plans, Long Term Plans and any relevant strategic planning process, as appropriate.
  7. Territorial authorities shall make appropriate arrangements to enable the achievement of any changes resulting from a review under Policy 6.3.11.

***Principal reasons and explanation***

Relocation, population, household and business growth can be affected by a wide range of variables. The policy framework should be responsive to this variation in order to meet any changes in circumstances. Policy 6.3.11 is intended to ensure enough land is available and in the right locations to facilitate recovery through to 2028. Monitoring a range of statistics and trends is a key factor in this management. Anticipating the number of relocated or new households and the business activity to be accommodated, as well as the form that these are likely to take, indicates the land areas required for successful recovery.

Policy 6.3.11 also provides that the circumstances for altering the priority area provisions of this chapter are:

- a. There is determined to be insufficient land within the Priority Areas over the recovery period;
- b. Altered circumstances have arisen in relation to anticipated timing of the infrastructure required to support the development planned by this chapter;
- c. There are changes to the relocation and growth management assumptions upon which the objectives and policies of this chapter are based.

**Appendix G**

**Pre application meeting minutes – Christchurch City Council**

# Meeting Record

|                             |  |                             |             |
|-----------------------------|--|-----------------------------|-------------|
| <b>Site Address:</b>        | 564 Cashmere Road  |                             |             |
| <b>Project Description:</b> | Proposed project is high amenity mixed density subdivision |                             |             |
| <b>Date</b>                 | 24 <sup>th</sup> January 2019                              | <b>Pre-application #</b>    | PRE40006955 |
| <b>Meeting Start Time:</b>  | 11:00am  | <b>Meeting Finish Time:</b> | 12:03pm     |

## Council Attendees

| <b>Name:</b>     | <b>Role:</b>                        | <b>Contact Information:</b>  |
|------------------|-------------------------------------|--|
| Louisa Armstrong | Planner                             | <a href="mailto:Louisa.Armstrong@ccc.govt.nz">Louisa.Armstrong@ccc.govt.nz</a> |
| Sarah Oliver     | Principle Advisor Planning          | <a href="mailto:Sarah.oliver@ccc.govt.nz">Sarah.oliver@ccc.govt.nz</a>         |
| Brian Norton     | Senior Stormwater Planning Engineer | <a href="mailto:Brian.norton@ccc.govt.nz">Brian.norton@ccc.govt.nz</a>         |
| Craig Marshall   |                                     |  |

## Applicant and Agent Attendees

| <b>Name:</b> | <b>Role/Company:</b> | <b>Email Address:</b>  |
|--------------|----------------------|--|
| Carl Fox     | Surveyor             |  |
| Liz Stewart  | Planner              | <a href="mailto:liz@astonconsultants.co.nz">liz@astonconsultants.co.nz</a> |
| Ernst Frei   | Owner                |  |
| Andrew Tisch | Stormwater           |  |

## Meeting Discussion and Action Points

### Meeting Record

#### Planning

Nga Wai Rivers overlay – need to consult with MKT  
 High Flood Hazard Management Area – partly within  
 Flood Ponding Management Area – partly within  
 Liquefaction Management Area  
 Partly zoned Open Space Water and Margins, RNN and Rural Urban Frindge.

#### Applicant

- The applicant owns an 18.5 Ha of land. Balance of land of 6 Ha including the amenity area. Looking to move figure 16 map a boundary line and the next stage if no agreement can be met then the policies of the regional policy statement will be applied to be changed.
- Is compensatory storm water storage required?
- Transport and geotechnical requirements.
- In the existing zoned land 25 dwellings is the yield.
- Is it likely more evidence would be required than what is prepared currently?
- The applicant's house will be part of the new subdivision.
- If Figure 16 and map A can be moved would a resource consent be required?
- What barriers will ECan put up?
-

**Louisa Armstrong**

- Urban development outside of the urban limit would not be supported by a resource consent application. There are objectives and policies in the District Plan which provide for urban activities only within the existing urban areas and on greenfield land; and seeks to avoid new sites of less than 4 hectares in the rural zone. Case law has determined that the word 'avoid' has its ordinary meaning of 'no allow' or prevent the occurrence of'. There are several examples of resource consent applications for urban activities in rural zones where the above has been applied and the applications have been declined.
- If the current proposal was to be applied for now through a resource consent application it is likely that it would be declined.
- For the current proposal to be considered favourable the Regional Policy Statement would need to be amended to change the urban limit boundary. The District Plan would then need to be changed to reflect these changes.

**Brian Norton – Left 11:42**

- Council understands the RNN and RPS boundaries relevance have drifted since they were established. Current flood modelling for Hendersons basin has 200-year water levels RL19.2m so finished floors for new dwellings need to be above RL19.6m which puts minimum lot levels around RL19.45m. As long as houses are protected from existing flooding and maintain the flood ponding storage capacity of Henderson basin then from a technical point of view this is all that needs to be satisfied.
- In a lot of cases some sites want to develop within the flood ponding area but don't have access to "high ground" that can be used to provide compensatory storage. However this site is different as there are portions of the site which are above the flood level (and outside the urban limit).
- Council have undertaken some modelling and in some respects the area acts as two flood plains split by an island of high ground. Water will spill out of Cashmere stream and ideally wouldn't want to change how the ponding basin fills. Need to make sure that when the basin is full that there is no net displacement of flood waters onto other land.
- Council owns much of the land around this site and as such there are a few options that can be considered in making this development work.
- A problem with digging too deep to provide compensatory storage is the ground water level will be breached and the ponds will only fill with ground water. If some piezometers were sunk into the ground to monitor the ground water level and monitor groundwater levels over the next couple of years. This may provide some guidance on the feasibility of compensatory storage.
- Council would want for the storage to be equivalent as the ponding increases. Storage and filling is to be roughly in the same order.
- This could be demonstrated with some fairly simple engineering cross sections of the ponding area, or flood modelling could be performed for more complex systems.
- Council owns much of the land in Hendersons basin and has installed bunds.
- Need to treat the stormwater and a treatment system can be built that is vested to council or the applicant can tip the stormwater into a Council already owns.
- The future of Cashmere stream needs to be considered and Council has finding for waterway enhancements that can occur over the next 10 years. If the applicant wants to upgrade the stream on behalf of Council then there may be compensation to the applicant for this work.
- The land needs to be bought up to TC2 equivalent.

**Sarah Oliver**

- If all of the technical issues can be resolved then the applicant can approach ECan stating that all matters of issue are resolved and the only matter preventing the most appropriate development of the land is the need for a change to Chapter 6 of the Canterbury Regional Policy Statement.
- A change to the Christchurch District Plan will also need to be undertaken should the required change to the CRPS be undertaken, and the as part of this the Council will need to support the rezoning from a technical perspective (i.e. through the required engineering and planning assessments).
- This is a different layout than what was looked at during the district plan review. Whilst resolving any transport matters is not of the highest priority to progress the proposal (assessments on

compensatory storage potential being the highest priority), as more houses are being proposed transport effects will need to be assessed and discussed with Council transport engineers.

- Geotechnical advice is important and the land is equivalent to TC3. The geotechnical information is important at subdivision consent stage.
- The NPS-UDS contains policy requirements for any new residential land to be commercial feasible and to be supported by the required infrastructure. Any assessment will need to address these policy matters. Importantly, the assessment may be able to use 'commercial feasibility' and the benefits of the proposal in regard to being more commercially viable, could be pursued. It may also be worth noting that overall the total household yield for some greenfield priority areas has been less than first expected, due to removal of stormwater management, geotechnically constrained and ecological areas (in accordance with the definition of 'net density' under the CRPS). Therefore the additional houses that are proposed to be yielded could be presented as beneficial or better meeting the strategic intent of GPA's to meet projected household demands (noting also that this area has been planned for development for many years through SWAP, CC Infrastructure Strategy, and the UDS).
- The City Council has lodged its own submission on Our Space Greater Christchurch Settlement Pattern Update. The Council will be providing its own evidence to support its submission. The Greater Christchurch Partnership is preparing an Officers Report. Whilst Council officers may have certain views on matters, it is not certain that these views and positions will be the same as the GCP Officers.
- The biggest hurdle is for ECan to support a change to the CRPS to change the boundaries of the GPA such to enable the proposal. ECan are not planning on making a change until 2022. This review of the CRPS is extensive and will take years possibly to finalise. The applicant needs to make it clear to ECan the adverse impact of the timing of this process and preventing the applicant from developing their land in a better more appropriate manner.
- ECan could be minded (if convinced) to give the review of Chapter 6 priority and may get decisions out sooner. The applicant needs to state the timeframe and show Ecan practically how this would work. Policy changes up front are needed and they are needed urgently to allow for these developments to take place.
- If there was a policy exchange that allowed minor extensions then there may be a willingness to allow Councils to make the decision on what is deemed minor.
- Should the CRPS be changed, any subsequent change to the CDP would have to be through a private plan change (if it amounted to only a minor boundary change to the ODP area/Residential New Neighbourhood Zone). Council has no resourcing to undertake plan changes. Could keep the s32 focused as it is not like this land has not been looked at in the past for development. The Council would likely undertake an policy change CDP, particularly if it was required to give effect to a change in the Chapter 6 CRPS.
- The applicant might also wish to consider the pathway of facilitating a change to the CRPS and CDP through preparation of a Regeneration Plan (similar to the Cranford Regeneration Plan).
- Our Space submission process provides the applicant with an opportunity for convincing ECan to be more open to resolving the procedural constraints that currently exist and have been in place for some time now. It will however be up the Our Space Panel to decide whether this should result in any changes to Our Space, at best an action that signalled ECan investigating an earlier change to the CRPS prior to 2020, including the possibility of this occurring through a streamlined planning process. The inability to alter the lines makes undertaking good planning impractical for this site. Obtaining the high level support to do something different is important. The barriers to ECAN changing Chapter 6 ahead of the 2020 review appear to be more administrative in nature.
- The applicants house can stay rural. The applicant can put a covenant over the house and land to stop further subdivision.
- The proposed policy change is significant as it would apply to multiple ODP areas. Some refinement of the proposed policy is considered needed to address containment and urban creep risk.
- Need to yield 15 houses per Ha. Comprehensive developments is a rule mechanism in the plan. The applicant may wish to speak with Josie Schroder, Principle Urban Designer at Council, in regards to achieving the kind of design outcomes sought by the applicant. The RNN rules were designed to give maximum flexibility and the applicant can have covenants on the development to protect areas of particular ecological value.



| Invoicing                      |      |         |                   |                 |
|--------------------------------|------|---------|-------------------|-----------------|
| Name                           | Time |         |                   | Amount Due      |
|                                | PRE  | MEETING | POST              |                 |
| Louisa Armstrong               | 2.00 | 1.00    | 0.25              | \$601.25        |
| Brian Norton                   |      | 0.69    |                   | \$141.45        |
| Council Administration Officer | 0.25 | 1.00    | 0.25              | \$180.00        |
|                                |      |         | <b>Amount Due</b> | <b>\$922.70</b> |

**How to pay your invoice:**

You can use internet banking to pay Pre Application Meeting fees. Please note that all payments will be credited to our account on the next business day. Any payment made without your details below may take some time to be lodged against the correct account. *Please note this will show as "RENT" in the description.*

**Our details are:**

Bank: Bank of New Zealand  
 Account Name: Christchurch City Council  
 Account Number: 02 0800 0044765 003

**The information required to identify your payment:**

Particulars: Name of Customer  
 Code: PRE Number (you will find this on your invoice or above)  
 Reference: Invoice Number

**NOTE:**

Preliminary application advice is given without prejudice on the basis of information available at the time of the meeting. Please note that the provision of further information or changes in project scope may impact on this advice.

For reference, please include your Preliminary Application number when applying for a consent (e.g. PRE4000XXXX)

**Appendix H**

**Christchurch City Council Submission on Draft Land Use Recovery Plan - 2015**

29<sup>th</sup> May 2015

Comments on the Land Use Recovery Plan Review  
Environment Canterbury  
PO Box 345  
Christchurch 8140

Via email: LURP@ecan.govt.nz

To Whom It May Concern:

**Land Use Recovery Plan Review – Christchurch City Council - Written Comment**

**1. Introduction**

Thank you for the opportunity to comment on the review of the Land Use Recovery Plan. The Christchurch City Council (Council) is a strategic partner in the development of the Land Use Recovery Plan (LURP) and supports its vision and intent. We have split our comment into two parts. The first part provides general comment on the LURP and the process for its review, whereas the second part focuses on the actions.

**2. General Comment**

**2.1 LURP Review - Process**

We remain concerned about the need to undertake a full review of the LURP when it is only a year and a half old and some of the actions are yet to be completed. The full review process has the potential to be very resource hungry when staff of this, and other organisations, are fully committed. Notwithstanding the issue of resourcing, Council is concerned about the review's potential to confuse those people who are currently engaged in the Replacement District Plan (RDP) and Long Term Plan (LTP) processes. For example, the review's consultation pamphlet raises 'considerations' on residential and business activities when these are being heard through the RDP process. Similarly, it's also asking questions about infrastructure (wastewater, cycleways and stormwater etc) when these issues are being addressed through the LTP. A significant amount of work has gone into both the LTP and the RDP and we don't want them being re-litigated through the LURP Review.

**2.2 Timeframes**

When Council endorsed the LURP in 2013 it did so on the assumption that it wouldn't carry any significant weight in decision making post the Canterbury Earthquake Recovery Act (CER Act) expiring in April, and any ongoing work would be reintegrated within the Urban Development Strategy (UDS) work programme. The consultation pamphlet indicates that the LURP review will be presented to the Minister for Canterbury Earthquake Recovery (Minister CER) by 30 September 2015, and presumably a revised document will be gazetted after that. Given the revised LURP will be 'approved' close to the time that the CER Act expires it raises the issue of whether the 'life' of the document is proposed to be extended post April 2016. From the Council's perspective, the LURP has been important for Christchurch's recovery, however, by April 2016 key documents such as the RDP, the Regional Land Transport Plan (RLTP), the LTP and changes to the Canterbury Regional Policy

Statement (CRPS) will be embedded, and as outlined below we do not consider it necessary to continue the majority of the actions, or create new ones. Therefore, by April 2016 the LURP will have served its purpose and any ongoing issues should be addressed through the UDS framework.

### 2.3 Land availability

One of the key issues the LURP addressed was residential land supply. Appendix A of Council's 'comment' provides an overview of residential land supply. In summary, Christchurch has a plentiful supply of land to meet recovery needs and its growth needs into the future. Furthermore, the programme of work to bring forward infrastructure to support development is maintaining around 7-8 years of 'shovel ready' land with other sites expected to come online later in 2015 as well as 2016. As well as urban redevelopment and intensification opportunities, there is a competitive range of sources in the supply of residential land. Therefore, apart from the 'residual' land around Cranford Basin (refer section 3.11) we do not consider the LURP needs to re-zone additional Greenfields residential land.

That said, there is concern that the current CRPS policies that provide for new residential development lack some flexibility. Specifically Policy 6.3.1 - Development within the Greater Christchurch area ensures that "...new urban activities occur only within existing urban areas or identified greenfield priority areas as shown on Map A, unless they are expressly provided for in the CRPS." This direction has been carried through under Strategic Direction Objective 3.3.7 Objective - Urban growth, for and design, specifically clause 3.3.7.c. Whilst the Council is not advocating for any major changes to the existing urban area or greenfield priority areas, there are some relatively minor changes to the existing urban boundary (i.e. a change in zoning from rural to residential) that are considered to have merit at the local level and do not compromise any higher level policy direction. It was the Council's past position that some flexibility is provided for within regional growth policies to enable local councils to make minor boundary adjustments. Proposed Change 1 to the CRPS usefully included the following and a similar policy could be directed to be included as part of CRPS Policy 6.3.1:

*"Policy 12: Resolution of Urban Limits (a) During the process of completing district plan changes and Outline Development Plans, territorial authorities may make minor amendments to provide for urban zoning outside the Urban Limits shown on Map 1 provided all the following conditions are met: (i) Any proposed extension or reduction will not change the Outline Development Plan area by more than 5 %; and (ii) Any additional land is contiguous with the Outline Development Plan area; and (iii) Economies of scale or other efficiencies for infrastructure would arise; and (iv) All other provisions of Policy 8 are met."*

### 2.4 Actions - Overall Feedback

Of the fifty actions contained with the LURP, twenty-five relate to Council. Of these eleven required either immediate amendments to Council's Operative City Plan, or directed the District Plan Review. The remaining fourteen address a range of issues, which are subject to specific comment below. In summary, we do not consider that the revised LURP needs to include the majority of these actions as they have either been completed, or they simply represent work that is being undertaken as part of Council's or the UDS work programme.

## 3. Comment - Specific Actions

### 3.1 Actions 7-10

These actions were aimed at supporting change in the Christchurch housing market, in particular to increase the supply and quality of urban living alternatives to the traditional suburban style single house on a site model. Providing for housing choice remains a critical response to changing demographics, affordability constraints and different lifestyle choices.

**Action 7** - Council undertook an evaluation of options in response to this action in mid-2014. This identified a range of interventions which could influence urban intensification. Some of those attributable to the Council, such as Development Contributions policies and planning requirements, have or are being actively progressed. Others, such as local amenity upgrades to stimulate higher density urban renewal, will be undertaken once spatial patterns of growth become clearer. Other options to support residential intensification were also identified but lay in the hands of central government agencies, particularly financial and fiscal tools (e.g. purchase guarantees, loan underwrites, taxation differentials).

A clear area for focus, whether in the LURP review or elsewhere, would be on consistency and coherence of incentive approaches across the city. For example, the LURP (which is guiding the land use framework for wider Christchurch) has driven District Plan based incentives such as density bonuses (i.e. enabling higher density redevelopment where multiple sections are developed as part of one comprehensive development). In contrast, within the Central City, while there is a collective view that higher density residential development should be encouraged, no such mechanism has been promoted in the Christchurch Central Recovery Plan's residential chapter "A Liveable City." This means that there is inherent tension between the two planning approaches. Giving a more coherent view of where the priority lies will help investors who are seeking out development opportunities and public agencies who need to plan ahead for investment in infrastructure upgrades to support that growth.

**Action 8** - This action was aimed at actively supporting the delivery of a number of pre-advanced projects through regulatory and operational processes. The projects, based on concepts produced by their promoters, offered clear potential to demonstrate a step change in the nature of housing delivery.

*Affordable Sector proposals:*

The two Christchurch City Council mixed tenure proposals are advancing with tendering processes underway and development expected to proceed during 2015. Housing New Zealand's (HNZ) exemplar projects, which were identified early in 2013, have not progressed despite the LURP putting in place a very enabling planning framework.

*Private Sector proposals:*

The first, and so far only, exemplar project to be approved - at Spreydon Lodge, North Halswell - has committed to a different and innovative subdivision process. The project has committed to Homestar6 rated homes, comprehensive design and mixed density development along with over 20% of the homes being provided values at \$350-450,000. Having gained approval as an exemplar in April 2014, the inability to find an expedited pathway to enable the land to be rezoned for development has meant that this development, which could have commenced in late 2014, is now unlikely to see its first homes built until 2016. The Riccarton Racecourse proposal is now being progressed as a Christchurch Housing Accord project. Whilst not delivering anything significantly new in terms of housing choice, the release of the Racecourse Reserve (under the guidance of the

Minister of Housing and Building) is being tied to the delivery of 30% of the 600 homes at prices of \$450,000.

The main issues around this action have been the limited degree to which the projects have been incentivised. For the CCC and HNZ projects, the LURP had already provided planning rules to enable development, regardless of the proposal being otherwise exemplary. To some extent this has influenced Housing New Zealand's decision making. In the case of Spreydon Lodge, the rezoning of the land for residential development (accelerated marginally ahead of the main residential proposals of the District Plan review) and behind the scenes some flexibilities around infrastructure connectivity represent tangible incentives, along with the significant time that has been spent resolving complex implementation issues.

Looking to the future, there is a place for encouraging, incentivising and showcasing good quality examples of Medium Density housing. Examples which can help educate the development industry and new streams of buyer interest are important in helping people explore their housing choices. Alongside the exemplar projects, proposals like the East Frame, 36 Welles St and 350 Colombo St are case studies that, if well executed, can help reframe impressions of urban living, in turn stimulating the social vibrancy and economic vitality which a major urban centre should have.

Whether the LURP needs to continue to explicitly include an action in this area is questionable. However, as part of an action drawing together incentives (Action 7) and affordability (Action 10) there may be a case for a consortia of public agencies to invite, evaluate and support suitably framed and commercially viable projects in the future.

**Action 9** - This recognised that HNZ's longer term programme needed coordinated action with other agencies, especially Council, to effectively plan for particular areas. With concentrations of stock in areas like Shirley, Aranui and Bryndwr, the Masterplans were intended to be a vehicle to positively work through the practicalities of delivery of area wide renewal and change. There was also recognition that the Dallington/Avonside area warranted future attention although progress would be pegged to decisions yet to be made about the future of the adjacent Residential Red Zone.

In 2013, prior to LURP being finalised, CCC and HNZ had already embarked upon a masterplanning exercise for Shirley. In early 2014, HNZ staff identified that they would see benefit in progressing area wide plans for the Bryndwr area and residual areas of Aranui. However, soon after that HNZ's resource focus shifted towards its short term priorities with more time being spent on dealing with issues on current sites. Notwithstanding this, HNZ recognise that a lack of masterplanning will impose pressures on their programme in future years and have recently (in April 2015) commissioned further resources to help work more closely with Council.

As such this matter is a practical relationship between HNZ and CCC and does not warrant a formal action, especially one that attributes the Council as the lead agency for the masterplanning of Housing New Zealand's redevelopment programme. The Council has allocated staff resources in each of the last 2 years to support these planning exercises and following a review in August 2014 and April 2015, looks forward to working with HNZ on these matters.

**Action 10** - Council was a supporting partner to MBIE and others in delivering this action although in reality much of the activity has been incorporated into activity around the Christchurch Housing Accord. This vehicle has proven to be a more productive interface for discussion about affordable housing, future models of public housing management and delivery of a number of development projects.

**Recommendation - Remove Actions 7-10.**

### **3.2 Action 14 - Enhancement programmes**

This requires that Council's identify and implement programmes through relevant LGA instruments for public facilities at key activity centres and neighbourhood centres. Council responded to this action within the 12 month timeframe outlined in LURP, and we note that all suburban centre master plans agreed in 2011 have now been adopted and are being implemented. However, as indicated in section 2.4 of this 'comment', this is something that Council undertakes as part of its business-as-usual work programme and is not necessary to include an action within LURP.

**Recommendation - Remove Action 14**

### **3.3 Action 23 - Provision of infrastructure to support development**

This requires Councils to coordinate the funding, sequencing and provision of infrastructure to support actions 19-22. Council achieves this through its LTP and Annual Plan process in accordance with the relevant legislation. It is not necessary for this to be an action within the LURP.

**Recommendation - Remove Action 23**

### **3.4 Action 24/North West Review Areas**

Council seeks that Areas 1 and 3 in the North West Review Area be removed from the LURP as part of the review due to a number of issues identified with each site. These are summarised below:

#### **Area 1**

- Pressure on the intersections of Waimakariri Road/Harewood Road and Watsons Road/Harewood Road with long delays for traffic seeking to turn onto Harewood Road;
- Significant costs to mitigate effects with a new road recommended between Area 1 and Harewood Road, to consolidate the primary access to Area 1 with the existing intersection of Harewood Road and Stanleys Road. Alternatives were considered including:
  - Signals at Watsons Road/Harewood Road (in addition to signals at Wooldridge Road/ Harewood Road to mitigate the effects of Area 2)
  - Realignment of Waimakariri Road to form an all-movements intersection with Sawyers Arms Road, to the east of its existing alignment
  - Reduced area for rezoning without upgrades to intersections with Harewood Road
- These alternatives raise other issues, for example, signals at Watsons/Harewood Road would not be supportive of the intended function of an arterial road while also leading to delays for traffic on Harewood Road.

#### **Area 3**

- The Integrated Transport Assessment concluded that the space between the interchanges of Memorial Ave and the Southern Airport Access is 'substandard' without the development of Area 3, resulting in efficiency and safety effects. In practical terms, vehicles travelling southbound on SH1 have difficulty moving from the right hand to the left hand lane to exit at the Southern Airport Access due to the large volume of traffic predicted to join the left hand lane southbound on Russley Road from Memorial Ave.

- The issue described above is exacerbated by the development of Area 3 on the basis that additional traffic from Area 3 increases the load on the network, making weaving movements more difficult.
- A connection with the Southern Airport Access (proposed interchange adjoining Area 3) would require the designation and/or acquisition of land. This would be at a significant cost for the Council, notwithstanding the ability to recover costs through development contributions.
- Additional traffic on Hawthornden Road and Merrin Street as a result of Area 3 may pose an actual or perceived risk for school children. In addition to effects on safety, the increased traffic on Hawthornden Road and Merrin Street is anticipated to impact on residential amenity.
- Insufficient capacity in the wastewater network but capable of being addressed through upgrades to the network.

The relevant *draft* section 32 information is contained within **Appendix B**.

**Recommendation** - Amend action 24 and Figure 4: Map A as required to reflect the above, and change the CRPS accordingly.

### **3.5 Action 30 - Case management approach**

Council has reviewed the Suburban Centre Case Management service and concluded that there is little demand for a proactive approach at this time. However, staff involved in the preparation the master plans remain available and well placed to support projects coming forward in the relevant suburban centres as they emerge.

### **3.6 Action 31 - Case management approach**

Over the past three years Council and Canterbury Development Corporation (CDC) staff have provided case management services to businesses in the earthquake-damaged industrial zones of Woolston and Bromley. While there are still a few insurance issues to settle most firms are now focusing on business-as-usual issues. As such, these industrial businesses may continue to access the usual industry sector support from CDC advisory staff if they need it. Notwithstanding this, Council acknowledges there are a range of issues that need to be addressed around the Woolston area arising from the industrial nature of some of the activities and adjacent commercial and residential land use. However, these are longstanding issues that are not about earthquake recovery and case management per se. Council will consider an appropriate response on these issues in due course.

Given that many firms are now engaged in activities that are hard to differentiate from normal business-as-usual activity and that standard processes enable a case management response for both earthquake and non-earthquake development issues, there is little value in retaining reference to an earthquake-focused case management role in the revised LURP.

**Recommendation** - Remove actions 30 and 31.

### **3.7 Action 33 - Prioritised infrastructure programmes**

Council has addressed this action within the timeframe outlined in the LURP. Notwithstanding this, it is noted that the purpose of action 33 was to enable quick amendments to Local Government Act



(LGA) plans without going through unnecessary process. However, as the LURP was gazetted on 6 December 2013, the 6 month timeframe for completing this action coincided with the Annual Plan process. The Annual Plan set out the proposed amendments to the Three Year Plan 2013/16. This has now been revised through the draft Long Term Plan. Therefore, Council has a process to ensure that infrastructure is aligned with development, and as such it is not considered necessary roll-over action 33.

**Recommendation** - Remove action 33.

### 3.8 Actions 40 - Transport

The title of this section is "support an integrated transport network", and action 40 refers to "protecting future opportunities in network rebuild". The philosophy behind action 40 is captured in the relevant transport planning documents, and in the body of the LURP itself. Having this as an action has achieved little tangible benefit and Council does not consider there needs to be a specific action on this matter.

**Recommendation** - Remove action 40.

### 3.9 Actions 49 & 50

These two actions address the Canterbury Sustainable Homes Working Party work process (action 49) and improving access to information and advice (action 50). This work is occurring independent of the LURP and they do not need to be included as actions in the revised document.

**Recommendation** - Remove actions 49 and 50.

### 3.10 Infrastructure map

Figure 5: Key regional infrastructure requirements through to 2028 on page 33 of the LURP represented a snapshot of thinking at a particular time, which made it almost immediately out of date. It also only addressed transport infrastructure, and does not denote 'three waters' infrastructure. Many projects had not been through the Better Business Case process, the relevant land use decisions were yet to be made (e.g. Halswell KAC/exemplar and Lincoln Road) and funding has been re-considered through the LTP and the RLTP. These projects are best assessed and prioritised through the appropriate processes, which are the LTP /Annual Plan and the RLTP.

**Recommendation** - Remove Figure 5 - Key Regional infrastructure requirement through to 2028.

### 3.11 Cranford Basin

Council is seeking to have areas of land around the periphery of Cranford Basin rezoned (subject to the relevant Notices of Requirement being confirmed) from rural to a low density urban residential zone which would equate to approximately 200-250 household units. A report and map are attached explaining why such a re-zoning should now be considered and showing the extent of the land to be re-zoned, which is approximately 40 Ha. The relevant *draft* section 32 information on this forms appendix C of this feedback.

**Recommendation** - Make the appropriate changes to the LURP and the CRPS.

4. Monitoring

We understand that the Minister CER will want to monitor the LURP's achievements, but most of the actions have either been addressed, are in train through the RDP and LTP process, or are simply occurring as part of the business-as-usual work programmes. Therefore, any on-going monitoring can occur as part of the UDS work programme. The UDS work that informed the LURP demonstrates that the partners were addressing the elements needed to guide macro level land use planning and these matters can continue to be addressed through that forum.

5. Conclusion

The Council would like to thank Environment Canterbury for the opportunity to provide feedback on the Land Use Recovery Plan Review. Should any issues need clarifying then Council staff are happy to discuss the content of this comment further.

Yours sincerely



Michael Theelen  
Chief Planning Officer

## Appendix I

### Section 80C Resource Management Act 1991

#### 80C Application to responsible Minister for direction

- (1) If a local authority determines that, in the circumstances, it would be appropriate to use the streamlined planning process to prepare a planning instrument, it may apply in writing to the responsible Minister in accordance with [clause 75](#) of Schedule 1 for a direction to proceed under this subpart.
- (2) However, a local authority may apply for a direction only if the local authority is satisfied that the application satisfies at least 1 of the following criteria:
  - (a) the proposed planning instrument will implement a national direction:
  - (b) as a matter of public policy, the preparation of a planning instrument is urgent:
  - (c) the proposed planning instrument is required to meet a significant community need:
  - (d) a plan or policy statement raises an issue that has resulted in unintended consequences:
  - (e) the proposed planning instrument will combine several policy statements or plans to develop a combined document prepared under [section 80](#):
  - (f) the expeditious preparation of a planning instrument is required in any circumstance comparable to, or relevant to, those set out in paragraphs (a) to (e).
- (3) In relation to a private plan change accepted under [clause 25\(2\)\(b\)](#) of Schedule 1, a local authority must obtain the agreement of the person requesting the change before the local authority applies for a direction under this section.
- (4) If an application is made under this section, it must be submitted to the responsible Minister before the local authority gives notice—
  - (a) under [clause 5](#) or [5A](#) of Schedule 1, in relation to a proposed planning instrument; or
  - (b) under [clause 38](#) of Schedule 1, if it intends to use the collaborative planning process; or
  - (c) under [clauses 25\(2\)\(a\)\(i\)](#) and [26\(b\)](#) of Schedule 1, in relation to a request for a private plan change.

Section 80C: inserted, on 19 April 2017, by [section 66](#) of the Resource Legislation Amendment Act 2017 (2017 No 15).

## Appendix J

### Section 32 Resource Management Act

#### 32 Requirements for preparing and publishing evaluation reports

- (1) An evaluation report required under this Act must—
  - (a) examine the extent to which the objectives of the proposal being evaluated are the most appropriate way to achieve the purpose of this Act; and
  - (b) examine whether the provisions in the proposal are the most appropriate way to achieve the objectives by—
    - (i) identifying other reasonably practicable options for achieving the objectives; and
    - (ii) assessing the efficiency and effectiveness of the provisions in achieving the objectives; and
    - (iii) summarising the reasons for deciding on the provisions; and
  - (c) contain a level of detail that corresponds to the scale and significance of the environmental, economic, social, and cultural effects that are anticipated from the implementation of the proposal.
- (2) An assessment under subsection (1)(b)(ii) must—
  - (a) identify and assess the benefits and costs of the environmental, economic, social, and cultural effects that are anticipated from the implementation of the provisions, including the opportunities for—
    - (i) economic growth that are anticipated to be provided or reduced; and
    - (ii) employment that are anticipated to be provided or reduced; and
  - (b) if practicable, quantify the benefits and costs referred to in paragraph (a); and
  - (c) assess the risk of acting or not acting if there is uncertain or insufficient information about the subject matter of the provisions.
- (3) If the proposal (an **amending proposal**) will amend a standard, statement, national planning standard, regulation, plan, or change that is already proposed or that already exists (an **existing proposal**), the examination under subsection (1)(b) must relate to—
  - (a) the provisions and objectives of the amending proposal; and
  - (b) the objectives of the existing proposal to the extent that those objectives—
    - (i) are relevant to the objectives of the amending proposal; and
    - (ii) would remain if the amending proposal were to take effect.
- (4) If the proposal will impose a greater or lesser prohibition or restriction on an activity to which a national environmental standard applies than the existing prohibitions or restrictions in that standard, the evaluation report must examine whether the prohibition or restriction is justified in the circumstances of each region or district in which the prohibition or restriction would have effect.
- (4A) If the proposal is a proposed policy statement, plan, or change prepared in accordance with any of the processes provided for in [Schedule 1](#), the evaluation report must—
  - (a) summarise all advice concerning the proposal received from iwi authorities under the relevant provisions of [Schedule 1](#); and
  - (b) summarise the response to the advice, including any provisions of the proposal that are intended to give effect to the advice.
- (5) The person who must have particular regard to the evaluation report must make the report available for public inspection—

- (a) as soon as practicable after the proposal is made (in the case of a standard or regulation); or
  - (b) at the same time as the proposal is notified.
- (6) In this section,—
- objectives** means,—
- (a) for a proposal that contains or states objectives, those objectives:
  - (b) for all other proposals, the purpose of the proposal
- proposal** means a proposed standard, statement, national planning standard, regulation, plan, or change for which an evaluation report must be prepared under this Act
- provisions** means,—
- (a) for a proposed plan or change, the policies, rules, or other methods that implement, or give effect to, the objectives of the proposed plan or change:
  - (b) for all other proposals, the policies or provisions of the proposal that implement, or give effect to, the objectives of the proposal.

**BEFORE THE GREATER CHRISTCHURCH PARTNERSHIP**

**IN THE MATTER** of the Local Government Act 2002

**AND**

**IN THE MATTER** of a submission by Ernst Frei on Greater Christchurch Settlement Update – Our Space 2018-2048

**EVIDENCE – CARL ALEXANDER FOX**

**1.0 Introduction**

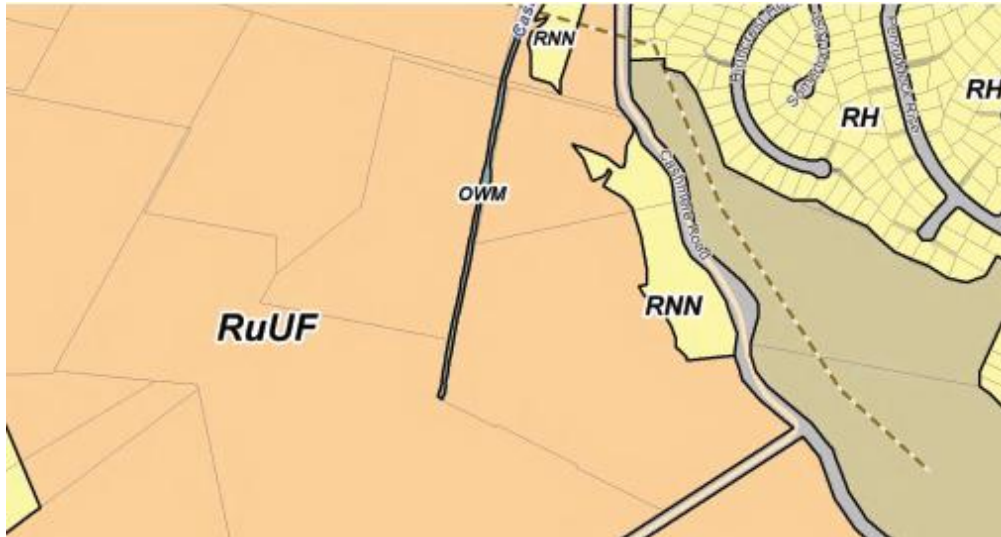
- 1.1 My name is Carl Fox (Bachelor of Surveying Degree, Member of Survey + Spatial New Zealand, Registered Professional Surveyor, Licenced Cadastral Surveyor, Board Member of the Consultants Division S+SNZ). I am the Managing Director and a Shareholder of Fox and Associates, a Land Development and Surveying Consultancy firm based in Christchurch.
- 1.2 I have over 25 years of land development consultancy experience and I am currently undertaking a land development project of my own.
- 1.3 I am also an Independent Director and the elected Chairperson of the Board of Directors of Texco, a group of construction companies based in Christchurch.
- 1.4 I work extensively throughout Canterbury including in the Greater Christchurch area, with numerous clients with interests in subdivision, land development and land use planning matters.
- 1.5 Ernst Frei has asked me to provide Land Development evidence in relation to his submission on the Greater Christchurch Settlement Update 2018 - 2048 (hereafter referred to as 'Our Space').

## 2.0 Background, Site and Development Proposal

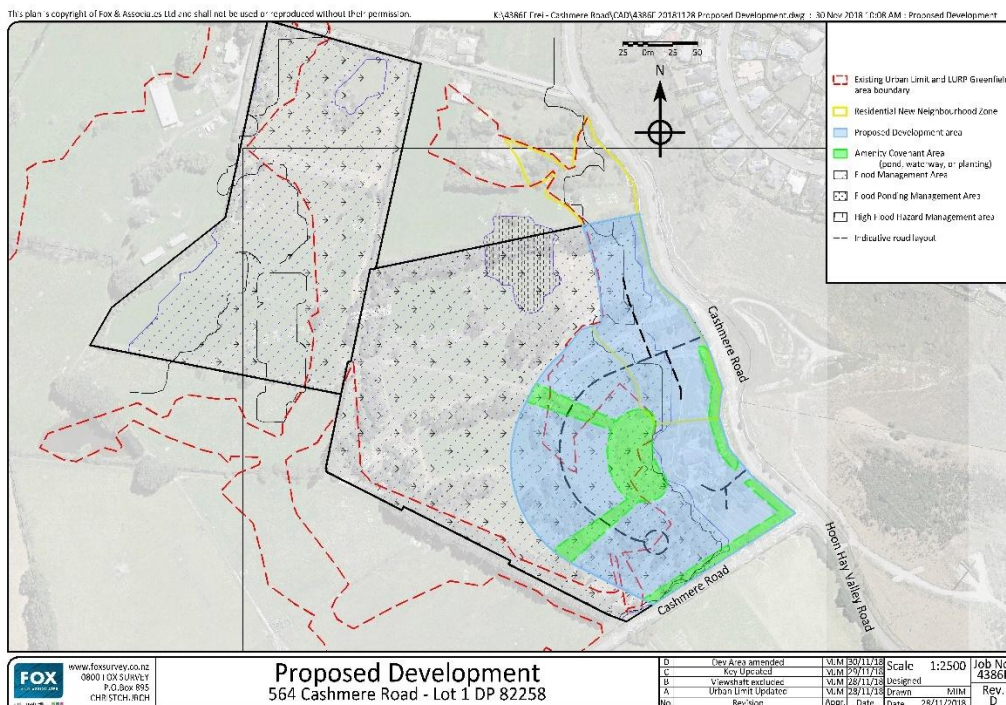
- 2.1 Our clients have owned the property at 564 Cashmere Rd, Halswell, for some decades, operating an organic farm from the site in the early years. Over the years they have planted significant areas of the proposed development area with native planting, and the proposed development is sympathetic to these existing plantings.
- 2.2 The site is located adjacent to the proposed Eastman Wetlands (*see Appendix B*) and is bound on the east and southern boundaries by Cashmere Road.
- 2.3 The majority of the land is flat and rises to the edge of Cashmere Road on the eastern boundary.



- 2.4 Approximately 1.5ha of the land in the northeast corner of the site is zoned RNN (Residential New Neighbourhood).
- 2.5 The Urban Limit / LURP line traverses the site in a very irregular path, it does not consistently follow any discernible natural features therefore making the reasoning for the location of this line unclear.



- 2.6 The proposed development (see Appendix C) area is based on existing features including levels, drainage and vegetation and so we believe it is more sympathetic to site topography than the existing zone lines. The proposed development area comprises approximately 5.9ha.





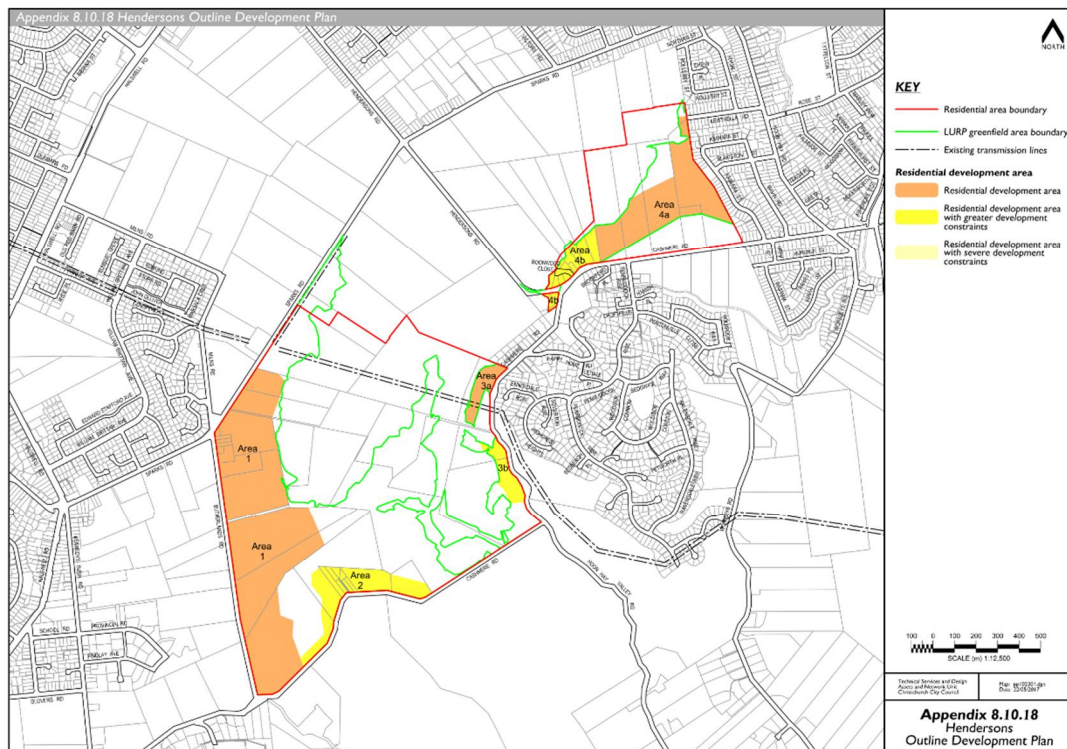
2.7 Our client proposes to protect existing vegetation, waterways and a pond with covenants and/or consent notices to restrict development in these areas, thus providing amenity to resultant dwellings, and also to the public that transits via Cashmere Road or the adjacent future wetlands.

2.8 The proposed development area has been identified for development potential in several ways as is clearly shown on the Henderson Outline Development Plan (See Appendix A [Council Appendix 8.10.18]). The site is:

2.8.1 Partially covered by the *RNN (Area 3b)* residential zoned land as shown on the Hendersons Outline Development Plan (See Appendix A)

2.8.2 Is entirely contained within the *Residential Area Boundary* (red boundary) as shown on the Hendersons Outline Development Plan (See Appendix A)

2.8.3 The majority of the proposed development area is also contained within the LURP area (green boundary) also shown on the Hendersons Outline Development Plan (See Appendix A)



2.9 In a pre-application meeting with Council it was recorded in the minutes that ‘Overall the total household yield for some greenfield priority areas has been less than first expected, due to removal of stormwater management, geotechnically constrained and ecological

areas". The quantum of this reduction could range between 20-30% less allotments than the original estimate. Therefore, this proposal could help somewhat with redressing the decrease in the existing developable land within the urban limit.

- 2.10 We also wish to bring to the Hearing's attention that the existing RNN zoned land owned by Ernst Frei is classified as "*Residential development area with greater development constraints*" therefore is our expectation that the proposed development area will result in a lesser density outcome (less than 15 lots/ha) than non-constrained RNN zoned land (minimum 15 lots/ha).

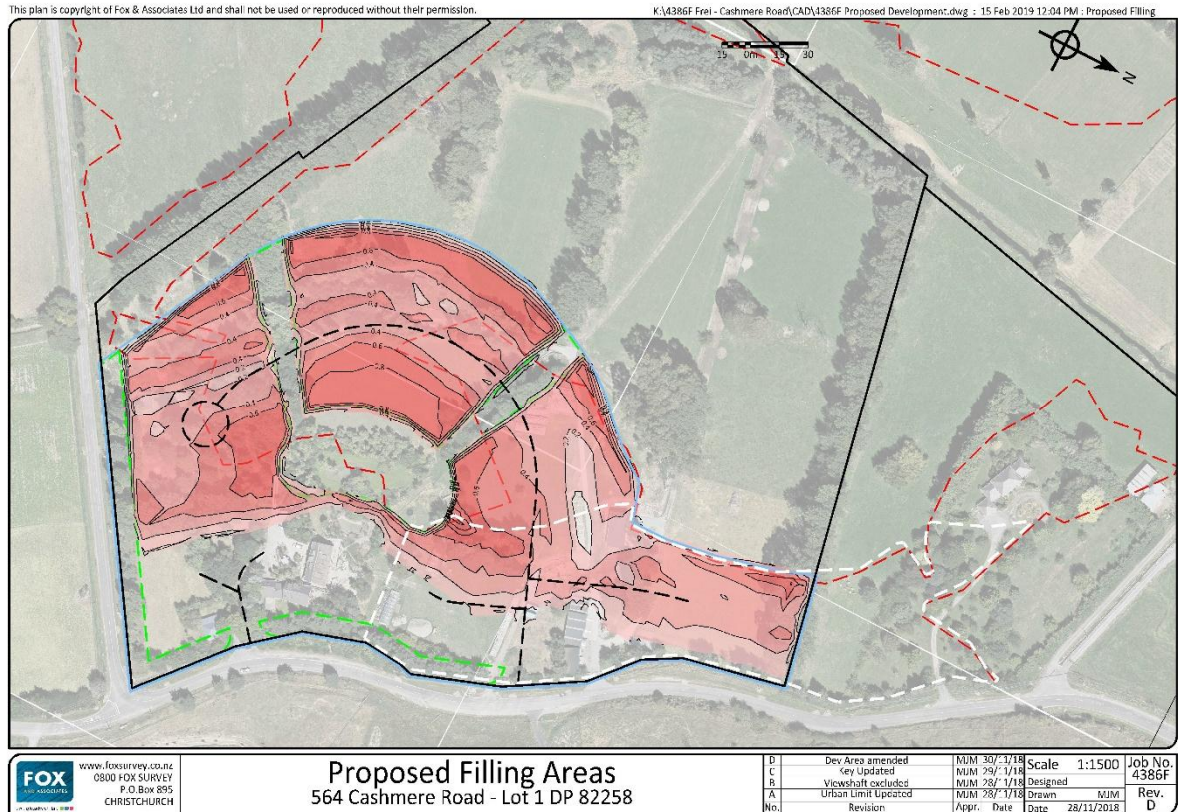
### **3.0 Services**

- 3.1 Discussions have been held with the Christchurch City Council (Council) and it has been confirmed that a Low-Pressure Sewer (LPS) main could be extended from the site along Cashmere Road and outfall to the existing gravity network.
- 3.2 Discussions have also been held with Council regarding stormwater. While on-site stormwater treatment and retention could be achieved on the lower parts of the site the Council's preference is for a more integrated approach. The adjacent property to the west is being developed by Council for large scale stormwater treatment and retention. It is Council's preference for the surface water to be conveyed to the Council system rather than replicate infrastructure on the site.
- 3.3 A water supply network could be extended from an existing Council 300mm  $\varnothing$  water supply main in Cashmere Road to service the site.
- 3.4 Electric power reticulation can be extended from the existing overhead high voltage network in Cashmere Road to service the site.
- 3.5 Phone and fibre broadband reticulation could be extended from the existing network along Cashmere Rd.

### **4.0 Constraints**

- 4.1 The proposed development is a physical extension of the currently zoned RNN land and is seen to have similar topography and geomorphology.
- 4.2 A preliminary geotechnical report has been obtained and states the proposed development area is generally suitable for residential purposes but will of course be subject to more detailed investigation at the time of subdivision consent.

- 4.3 The report advises that the land would be typically classified as Technical Classification 2 and 3 which is consistent with neighbouring land. Development of this type of land is achievable with proven appropriate and affordable engineering solutions.
- 4.4 Discussions with Council regarding floor levels indicate that some of the land is lower than the 200-year flood level. These lower lying areas could be filled to raise the building platforms to the required levels (see Appendix D).



- 4.5 An assessment has been made by the applicant’s stormwater engineers and in discussion Council has verbally confirmed that compensatory storage could be provided to mitigate/offset the effects of filling within the existing flood storage/management areas.
- 4.6 Allowance has been made in our Economic Feasibility Assessment for geotechnical fabric/mesh combined with certified fill material to bring the site levels up to the required level. Subject to further detailed geotechnical testing and assessment there may be a secondary benefit from filling the land for flood management purposes in that it is one method used for ground improvement.

## 5.0 Economic Viability

5.1 To assess the economic feasibility of development of the site we have conducted two block valuation assessments, one for the current zoned land and one for the proposed 50-allotment development. The block valuations estimates used for the feasibility assessment takes into consideration the development yield, revenue, costs and finally accounts for the residual land.

| Block Valuation for   | Ernst Frei at 564 Cashmere Rd, Halswell, Christchurch |               |
|---|---|---------------|
|   |   |               |
| <b>Number of Allotments in Subdivision</b>                  | <b>25</b>   | <b>50</b>     |
|   |   |               |
| <b>Gross Realisation (Exclusive GST)</b>                    | \$ 5,913,000  | \$ 13,739,000 |
|   |   |               |
| <b>Net Realisation (Exclusive GST)</b>                      | \$ 5,649,000  | \$ 13,135,000 |
|   |   |               |
| <b>Less Profit &amp; Risk on Outlay at 20%</b>              | \$ 1,412,000  | \$ 3,284,000  |
|   |   |               |
| <b>Outlay (Exclusive GST)</b>                               | \$ 4,237,000  | \$ 9,851,000  |
|   |   |               |
| <b>Total Development Costs (Exclusive GST)</b>              | \$ 3,497,800  | \$ 8,491,800  |
|   |   |               |
| <b>Indicated Market Land Value of base title (incl GST)</b> | \$ 850,000  | \$ 1,563,000  |

5.2 The Block Valuation is prepared on the basis of an independent developer specifically purchasing the site for development purposes.

5.3 Our assessment shows that developing the current RNN zoned land into 25 allotments results in a base land value currently below current bare land value. For the development to be viable either the applicant would therefore either need sell the land for less than market rate or a developer would need to accept a significantly lower than standard market return on their investment, neither of which are likely.

5.4 However, the proposed 50 allotment development results in a land value similar to the current bare land value which means that the applicant could sell the land for the market rate and a developer could purchase the land knowing that they will likely make the standard market return. This therefore implies that this is the approximate breakeven level for a viable development on this site.

5.5 The economic viability is a combination of the greater number (higher yield => 50 allotments) therefore the ability to spread the fixed costs (connections and extension of infrastructure etc..) across the larger number of lots but also a greater range of allotment

sizes resulting in a higher average sale value than the smaller allotments on the 25-Lot proposal.

## **6.0 Conclusion**

- 6.1 The proposed development serves to assist Council with providing additional suitable land for development in the short to medium term.
- 6.2 The land is contiguous with existing zoned RNN land and is similar in terms of topographical and geomorphological characteristics.
- 6.3 This proposal provides a certain harmony from a planning perspective as it is not inconsistent with District Plan objectives, continues seamlessly with zone boundaries and provides better utilisation of the land.
- 6.4 The resultant land is not a viable rural block (size or shape) and so a development of approximately 50 allotments provides for better utilisation of the land.
- 6.5 The applicant has a clear and compelling development vision for the site as they want to create an environmentally sensitive development that reflects the surrounding environment including the future Eastman Wetlands.
- 6.6 The current RNN zone (and associated rules) for this site doesn't lend itself for great urban design outcomes and will likely result in a ribbon/strip type development which adds little amenity to an area. The larger proposed development area allows for greater flexibility for good urban design outcomes, but also generates sufficient funds to allow the applicant to invest back in to the development and create high quality living environments.
- 6.7 From the assessment undertaken we determine that the current RNN zoned land producing 25 allotments is not economically viable to develop as it will not generate sufficient capital to cover the fixed costs associated with developing this site.
- 6.8 We estimate that approximately 50 allotments should provide sufficient capital to pay for the construction works and fixed costs whilst providing a developer with an opportunity to generate a standard market rate of return.
- 6.9 If the land is not rezoned then it is likely that this land will never be developed and so Council losses more potential house-sites within the urban limit.
- 6.10 Rezoning of this site should be relatively easy to justify from a Regulators perspective as it is not controversial:

- 6.10.1 It is located within in the general area identified for residential development with some of the land already zoned for residential purposes. It could be argued that the majority of the proposed development land is already located within the urban limit (LURP). This application is just tidying up some of the detail in a document that was produced for a very high-level purpose and therefore as is often the case not able to get all such details right.
- 6.10.2 The size of the proposed development is not swamping the market rather it is a minor increase but an increase that helps offset some of the losses incurred in other locations.
- 6.10.3 No new zones or rules are being introduced as it is ultimately a minor extension of the urban limit and residential zone similar that is not inconsistent to that originally shown in the LURP.
- 6.10.4 The loss of developable land in Council's zoned areas through infrastructural, ecological or geotechnical issues means replacement of suitable land needs to be found within or at the edge of the urban limits.
- 6.10.5 The development of this site is purely of a technical planning issue not about the appropriateness of the site for residential activities. Therefore, the proposed changes sought by the applicant are in our opinion entirely consistent with the obligations and objectives of the Regional and Christchurch City Councils to identify and facilitate the development of suitable land for residential purposes.

## **Appendices**

**Appendix A** Hendersons Outline Development Plan (CCC Appendix 8.10.18)

**Appendix B** Eastman Wetlands Concept Plan

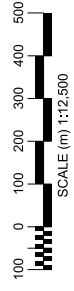
**Appendix C** Fox and Associates proposed development area plan

**Appendix D** Proposed Development-Fill Plan



**KEY**

- Residential area boundary
- LURP greenfield area boundary
- Existing transmission lines
- Residential development area**
- Residential development area
- Residential development area with greater development constraints
- Residential development area with severe development constraints

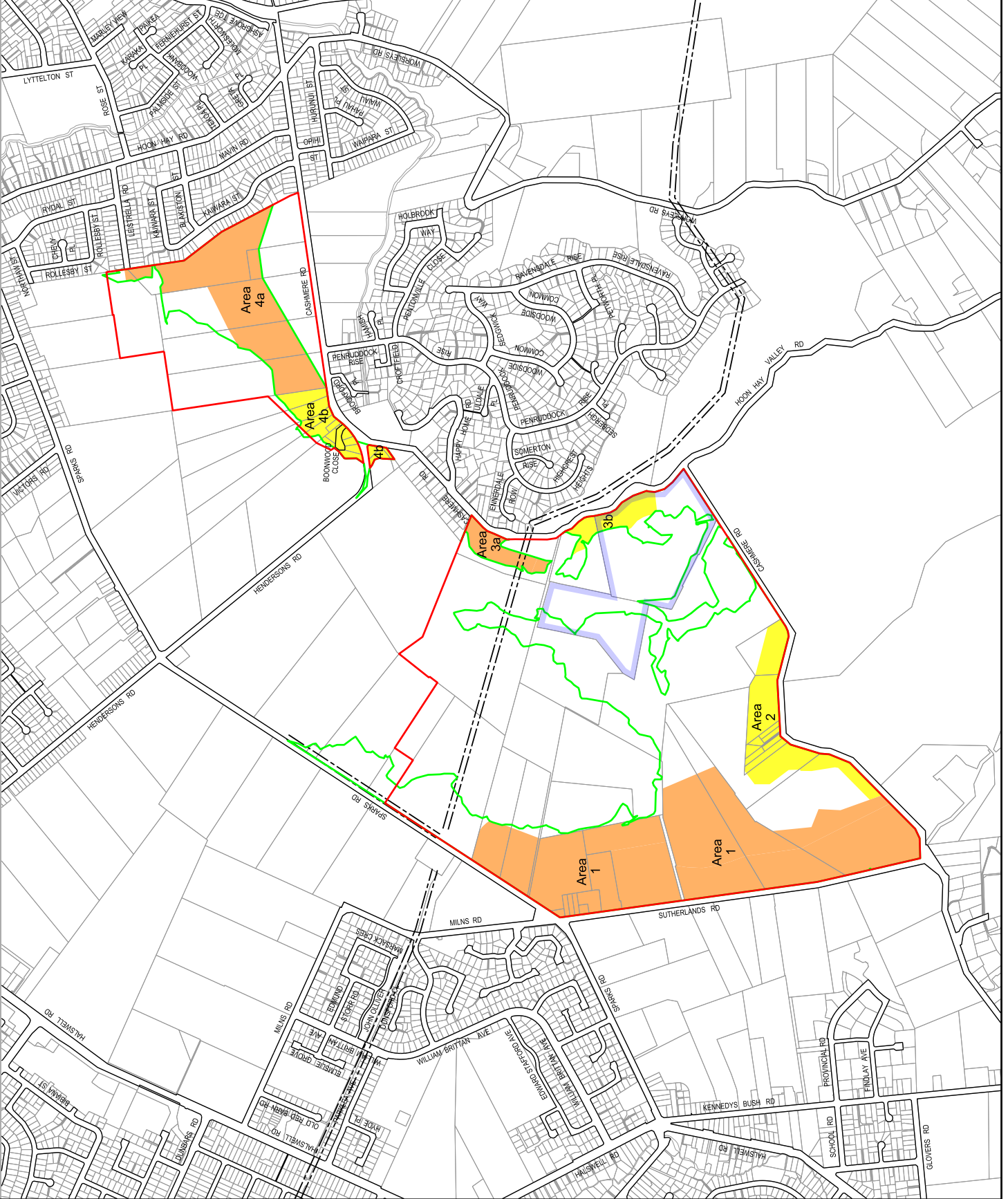


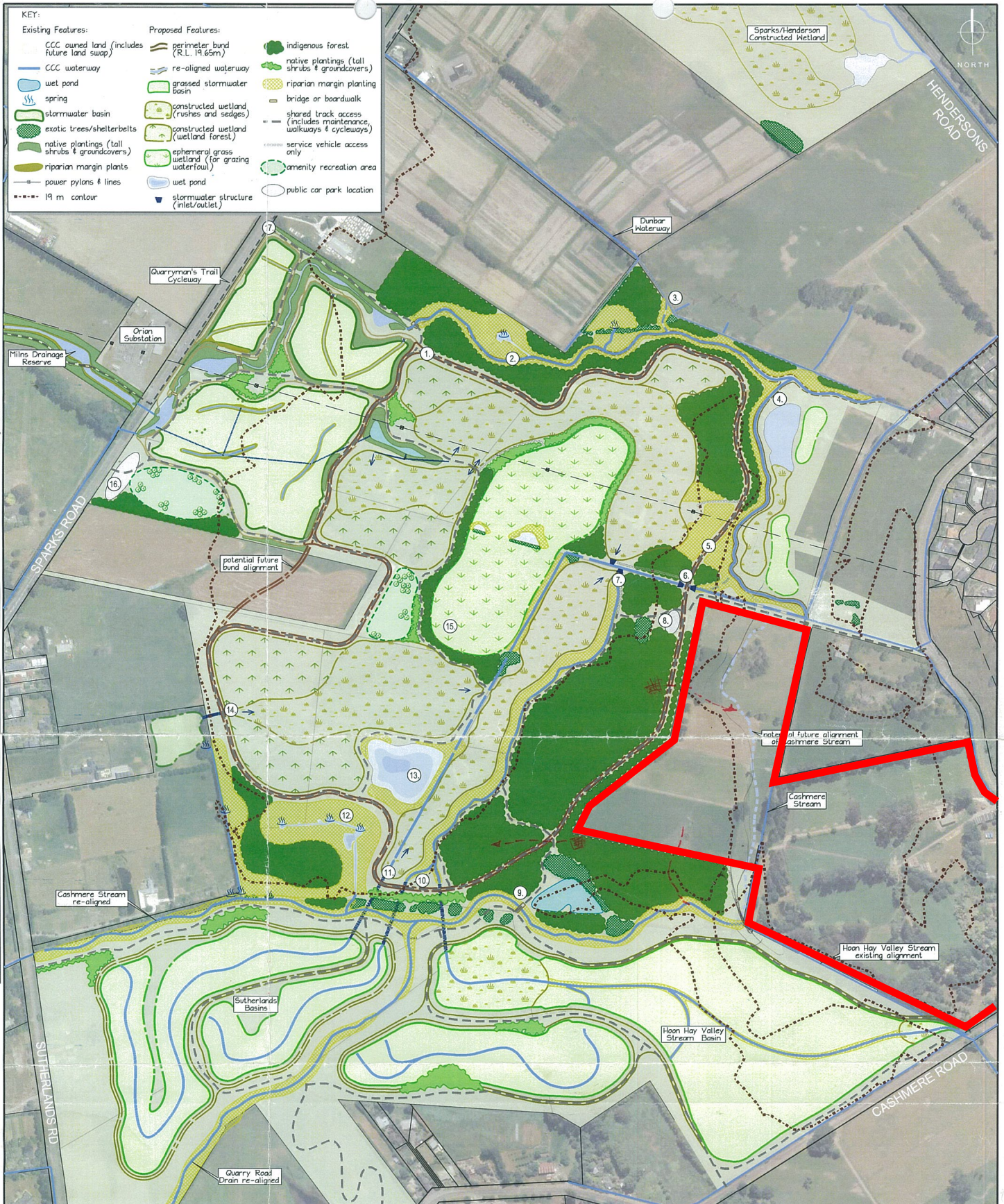
Technical Services and Design  
Assets and Network Unit  
Christchurch City Council

Map: 05102301.dfm  
Date: 22/05/2017

**Appendix 8.10.18**  
**Hendersons**  
Outline Development Plan

Appendix 8.10.18 Hendersons Outline Development Plan





**KEY:**

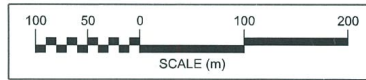
| Existing Features:                            | Proposed Features:   |
|---|--|
| CCC owned land (includes future land swap)    | perimeter bund (R.L. 19.65m)                                     |
| CCC waterway                                  | re-aligned waterway  |
| wet pond                                      | grassed stormwater basin   |
| spring  | constructed wetland (rushes and sedges)                          |
| stormwater basin                              | constructed wetland (wetland forest)                             |
| exotic trees/shelterbelts                     | ephemeral grass wetland (for grazing waterfowl)                  |
| native plantings (tall shrubs & groundcovers) | wet pond   |
| riparian margin plants                        | stormwater structure (inlet/outlet)                              |
| power pylons & lines                          | indigenous forest  |
| 19 m contour                                  | native plantings (tall shrubs & groundcovers)                    |
|   | riparian margin planting   |
|   | bridge or boardwalk  |
|   | shared track access (includes maintenance, walkways & cycleways) |
|   | service vehicle access only                                      |
|   | amenity recreation area  |
|   | public car park location   |

- CONCEPT PROPOSALS:**
- The proposed bund varies in height from existing ground level and up to 1.5m but is typically 0.6m to 1.20m. The top of the bund is typically R.L. 19.70m.
  - Milns Drain is realigned to outside the proposed bund and the existing spring flow is also re-routed into this new channel.
  - Once upstream development occurs, Dunbars Waterway is rerouted into Milns Drain before flowing into the proposed realignment of Cashmere Stream.
  - Cashmere Stream is realigned and naturalised. This re-alignment is part of a land swap agreement that facilitates the subdivision of land along Cashmere Road while ensuring CCC has a better connection to Cashmere Road.
  - Bund spillway at R.L. 19.20.
  - Outlet/control structure in bund along the existing Milns Drain alignment.

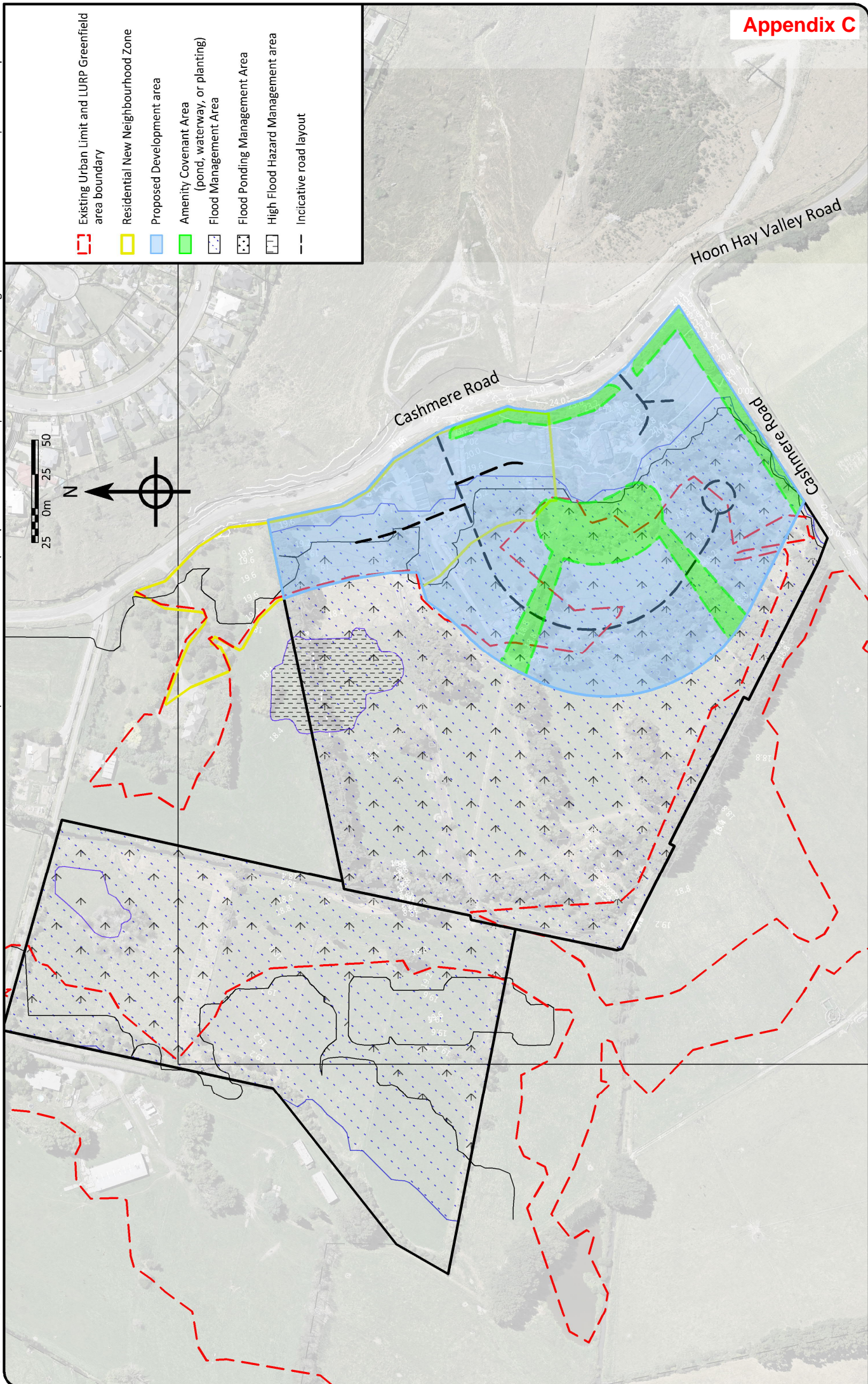
- The low flow channel draining Sutherland and Hoon Hay Valley flood attenuation basins flows into the existing alignment of Milns Drain.
- Proposed public car park off Cashmere Road (smaller than main carpark off Sparks Road).
- Bridge over control structure in Cashmere Stream.
- Stormwater pipes under Cashmere Stream from the Sutherland and Hoon Hay Valley flood attenuation basins to the low flow channel.
- Inlet structure to wetland providing treatment for Sutherland's First Flush Basin.
- The existing springs in this location are to be protected and their flow directed into Cashmere Stream via Bunz and Bowis Drains.
- The existing wetpond is reshaped to allow for the construction of the bund outside of the protection zone around the springs.
- Inlet structure to wetland providing treatment for First Flush from Subdivision at 78 Sutherland Road.

- The proposed ephemeral grassed wetland utilises the naturally wet, low lying paddocks retaining this habitat for grazing waterfowl. Remnants of the existing alignment of Milns Drain are retained and widened to provide small permanent ponds (perimeter to be planted with riparian margin plants).
- Proposed public car park off Sparks Road.
- The proposed cycleway links Cashmere Road to Sparks Road and the Quarryman's Trail Cycleway via the top of the bund.

**DRAFT**







|   |  |   |  |                  |  |
|---|--|---|--|------------------|--|
| www.foxsurvey.co.nz<br>0800 FOX SURVEY<br>P.O.Box 895<br>CHRISTCHURCH |  | <b>Proposed Development</b><br>564 Cashmere Road - Lot 1 DP 82258 |  | Job No.<br>4386F |  |
| Revision  |  | Date  |  | Date             |  |
| No.   |  | Revision  |  | Date             |  |
| A   |  | Urban Limit Updated   |  | MJM 28/11/18     |  |
| B   |  | Viewshaft excluded  |  | MJM 28/11/18     |  |
| C   |  | Key Updated   |  | MJM 29/11/18     |  |
| D   |  | Dev Area amended  |  | MJM 30/11/18     |  |
|   |  | Scale   |  | 1:2500           |  |
|   |  | Designed  |  | MJM              |  |
|   |  | Drawn   |  | MJM              |  |
|   |  | Date  |  | 28/11/2018       |  |





**Appendix D**

**Proposed Filling Areas**  
564 Cashmere Road - Lot 1 DP 82258

www.foxsurvey.co.nz  
0800 FOX SURVEY  
P.O.Box 895  
CHRISTCHURCH

|     |                     |       |          |          |            |         |       |
|-----|---------------------|-------|----------|----------|------------|---------|-------|
| D   | Dev Area amended    | MJM   | 30/11/18 | Scale    | 1:1500     | Job No. | 4386F |
| C   | Key Updated         | MJM   | 29/11/18 | Designed |            | Rev.    | D     |
| B   | Viewshaft excluded  | MJM   | 28/11/18 | Drawn    |            |         |       |
| A   | Urban Limit Updated | MJM   | 28/11/18 | Drawn    |            |         |       |
| No. | Revision            | Appr. | Date     | Date     | 28/11/2018 |         |       |

