BEFORE THE CHRISTCHURCH CITY COUNCIL

UNDER	the Resource Management Act 1991
AND	
IN THE MATTER	of an application for resource consent by Ryman Healthcare Limited (RMA/2020/673)
SUBMITTER	Gordon & Christina Bennett **(Submitter #2168/2169)**

STATEMENT OF EVIDENCE OF JOHN THOMAS ARAMOWICZ, Jr.

18 January 2021

Qualifications and experience

1. My full name is John Thomas Aramowicz, Jr.

2. I am currently a Director and Senior Civil & Geotechnical Engineer with Eliot Sinclair & Partners Ltd. in Christchurch.

3. I graduated from Curtin University of Technology in 1995 with a Bachelor of Engineering (Honours).

4. My professional accreditations include:

   a) Chartered Professional Engineer, CPEng (No. 1008112);

   b) Chartered Member of Engineering New Zealand, CMEngNZ.

5. I have been employed by Eliot Sinclair since April 2003.

6. In 2009 I was recognised as a Chartered Professional Engineer in the practice fields of civil and geotechnical engineering.

7. I have undertaken a wide range of projects for a variety of clients that have included government agencies, developers, local iwi, insurers, and private individuals. The projects I have worked on have ranged from small residential properties to very large residential and commercial land development (subdivision) projects.

8. I have extensive experience in geotechnical investigation and characterisation of the alluvial soils across Canterbury, assessment of slope stability, design of ground improvement, general subdivision engineering, supervision of bulk filling earthworks, the design and construction of residential foundations and retaining structures, and forensic engineering investigations of ground and foundation settlement and damage, particularly after the Canterbury earthquakes.

9. Before 2004, I was employed by Carter Holt Harvey as a Process Development Coordinator during 2002. In this role I was responsible for investigation of production-related constraints, identifying opportunities to improve production processes, and reduce costs.

10. From 1995 to 1999 I was employed by Mount Isa Mines Ltd as a Mining Engineer. In this varied role I was responsible for detailed engineering design, long-term mine planning, detailed scheduling and coordination of all underground activities, supervising drilling and blasting operations, and provided mentoring for students and graduates.

Code of conduct

11. Although this is a Council hearing, I have read Environment Court New Zealand's Practice Note 2014, in particular Part 7, which relates to Expert Witnesses and agree to comply with the Code of Conduct for Expert Witnesses.

12. I confirm the matters on which I have been asked to give evidence are within the scope of my expertise.

Scope of Evidence

13. I have been asked by Gordon & Christina Bennett to comment on the potential geotechnical and environmental risks to at 15 Salisbury St. that could arise from construction of Ryman Healthcare Limited's (RHL) proposed Bishopspark development.

14. [redacted]

15. As part of my further assessment I have read the following reports and statement that are shown on the Council's website;

a) *Application Summary* (by Ryman Healthcare, not dated).

b) *Assessment of Environmental Effects* (AEE) by Ryman Healthcare Ltd., March 2020.

c) AEE Appendix G – '*Geotechnical Engineering Assessment of Environmental Effects'* by Tonkin & Taylor, March 2020.

d) *Bishopspark Technical Drawings* - by Warren & Mahoney, dated 23/07/20, specifically Sections J & K.

e) Final further information response Final 13 July 2020; Appendix D Temporary protection plan by DPA, dated 24 June 2020

f) RMA/2020/673 and RMA/2020/679 s42A Report and Appendices, issued 30 September 2020;

g) RFI Response 18 Nov Appendix D - Draft Conditions

h) RFI Response 18 Nov Appendix G – Construction Management Plan

i) Statement of Evidence of Pierre John Malan (Geotechnical Engineer, Tonkin & Taylor) on Behalf of Ryman Healthcare Limited, dated 6 January 2021.

16. [redacted]

The property

17. The property at 15 Salisbury Street, is legally described as Part Section 23 TN RES Christchurch and has an area of approximately 746m^2.

18. A two-storey dwelling is located at the mid-south part of the site, and a below-ground pool and a long masonry boundary wall at the north.

19. I note the aerial photo shown on Warren & Mahony's (WAM) drawing 'Existing Site Plan', dated 27/03/20, is quite old and does not show the swimming pool that is present at the north part of 15 Salisbury St. The swimming pool can be identified in aerial photographs from around October 2016, which suggests the photo used by WAM is quite old and was taken before October 2016.

Geotechnical Setting

20. The site was classified by MBIE as technical category three, i.e.TC3, which identifies that there is '*moderate to significant potential for land damage*' in future large earthquake events.

21. Tonkin & Taylor's (T&T) geotechnical investigations confirm the land near 15 Salisbury St comprises sands, silts and clay-like soils to around 9m bgl, with groundwater likely to be present around 1.1 to 1.3m bgl. There is also a layer of peat that was encountered just north of 15 Salisbury St.

22. T&T calculated the amount of liquefaction-induced 'index' settlement from design level earthquakes and agree the site is consistent with TC3. In short, these values indicate there is a high risk of liquefaction, with significant liquefaction calculated to occur even in a serviceability limit state (SLS) earthquake scenario.

23. Put simply, the masonry wall along the north boundary of 15 Salisbury St, and the swimming pool, are founded over soft alluvial soils that are at high risk of liquefaction, and peat.

Proposed Work

24. T&T's March 2020 report, along with WAM's concept drawings for the Bishopspark development, indicate a basement garage is to be constructed immediately north of 15 Salisbury St. This would require substantial retaining structures to be constructed before deep excavations for the basement.

25. T&T's report acknowledges there will need to be around 37,900m^3 of soil removed from below natural groundwater level. I calculate a further 14,000m^3 would need to be excavated *above* the natural groundwater level, for the basement area. In short, over 50,000m^3 will need to be excavated from the Bishopspark site with excavations extending to around 5m below current ground level (bgl).

26. Importantly, Warren & Mahoney drawing S01.A0-040, titled *'Site S01 – Proposed Site Plan – Basement'*, dated 27/03/20, confirms the basement is designed to be only 0.6m from the north boundary of 15 Salisbury St

27. The same setback applies to many other parts of the site, all with similar geotechnical and groundwater conditions.

28. T&T identify welded *'steel clutch tubes'* are to be used to retain the 5m deep basement excavations and to limit horizontal groundwater seepage entering through the wall system.

29. The design of the steel clutch tube retaining wall is not addressed in any detail in the original application, although the recent statement by Mr Malan (6 Jan 2021) provides some further supporting information.

30. T&T's report concludes, without providing any supporting evidence, that *"the risk of subsidence affecting adjacent sites due to the construction of the Proposed Village is negligible"*. This statement is

repeated in the Assessment of Environmental Effects submitted by RHL.

31. Importantly, page 9 of T&T's report states *"The Proposed Village Buildings will be setback from the property boundaries and the construction sequence will be designed to limit lateral and vertical movement at the property boundary"*.

32. In summary, the RHL proposal appears to assume the basement retaining wall, dewatering and deep excavations are capable of being carried out without causing damage to adjoining property.

33. As I explain below, in my opinion, due to the proximity of the proposed installation of the clutch-pile retaining wall, the need for dewatering close to internal property boundaries and the presence of soft/loose saturated soils and peat, I consider there is a high risk that the construction works will cause ground subsidence and damage to the north part of 15 Salisbury St and to other nearby properties.

Council's s42A report

34. In relation to the Bishopspark Site, Christchurch City Council's s42A report acknowledges *"Earthworks of approximately 55,000m^3 are required to construct the foundations and basements of the various buildings, establish the internal road network, and install infrastructure services."*

35. Council's review of relevant rules identifies under Activity Status Rule 8.9.2.3 RD1, that the volume and depth of the proposed earthworks will exceed the Permitted Activity criteria and therefore Rule 8.9.4 sets out the matters of discretion, including *'8.9.4.3 -Land stability'*. In this case, the potential for land instability arising from permanent and temporary works needs to be considered.

36. Page 49 of the s42A report seeks to address '*Earthworks and Construction Effects*'. Council acknowledge RHL's proposal to carry out pre- and post-construction building surveys, and to monitor noise and vibration. This suggests to me that there is a moderate to high risk of damage occurring to adjacent property, which is not unreasonable given the considerable depth and close proximity of the proposed excavations to property boundaries.

37. Paragraph 246 states "*Ms. McDonald considers that vibration from the foundation construction will not be an issue given the foundation methods and I accept this advice*" and in relation to the intention to take foundations below the peat layers, paragraph 247 states "*Ms. McDonald considers this should therefore also reduce the potential for cross boundary settlement and does not anticipate there would be cause for damage to neighboring properties*".

38. Appendix D of the s42 report contains the complete record of Ms. McDonald's assessment for Council, which was issued by way of an email to Louisa Armstrong on 27 November 2020.

39. Ms. McDonald's email acknowledges the nature of the soil conditions, shallow groundwater and the intention to support the new building on "*rigid inclusions or continuous flight auger piles*".

40. Regardless of how the permanent building foundations will be installed, Ms. McDonald does not consider or comment on the need to install a temporary retaining wall before the 5m deep basement can be excavated, nor whether there is an unacceptably high risk its installation could result in damage to adjacent private property.

41. Importantly, paragraph 281 identifies Objective 5.2.1.1 and Policy 5.2.2.2.1 "*generally seek to avoid development where the risk from natural hazards in unacceptable and development is undertaken in a manner that ensures the risk of natural hazards to people and property are appropriately*

mitigated". The intention of the Objective and Policy is to mitigate the risk of damage to adjacent property, this must include any risk that can arise during the course of construction.

42. Despite this, paragraph 301 concludes "*Given this the proposal is considered to create adverse effects that are at least minor, but with the conditions recommended and in consideration of the overall contribution of the development to achieving the outcome sought for the Central City, these are acceptable*".

43. Proposed condition 21 would require RHL "*to undertake a survey of the properties within 20 metres of where excavation will occur on the site, where the property owner has given their written approval*".

44. This suggests to me that there is a risk of damage occurring up to 20m from the proposed works. In my opinion, if there this is correct, then I do not believe this to be trivial, nor should it be considered '*acceptable*'.

45. Despite this, Ms. McDonald's email in Appendix D of Council's s42A report, states "*I therefore don't anticipate there would be cause for damage to neighboring properties*".

46. Council assume that RHL's draft Construction Management Plan (CMP) will "*control dust, noise, vibration, traffic …*".

47. In relation to RHL's Bishopspark proposal, I do not believe there is sufficient detail in the draft CMP, nor are there practical construction methods that can be used for the known ground conditions, that would be effective in guaranteeing 15 Salisbury St would not be damaged by RHL's development proposal.

48. In summary, Council's s42 report does not adequately consider the likely subsidence and damage that is likely to occur to adjacent property, particularly due to construction-related works.

DPA's Site Specific Temporary Protection Plan

49. The DPA report on the former Bishop's chapel, identifies the risk of potential damage to the chapel arising from construction activities, in particular the risk of ground vibrations from piles or excavation works.

50. To minimise this risk, DPA advise *"piles shall be drilled and not driven. Construction traffic shall be minimised in the vicinity of the building. The recommendation by Mitchell Vranjes Consulting Engineers that the chapel shall be structurally upgrading prior to any construction works involving piling or excavation is supported"*.

51. In short, DPA acknowledge the likely effect of ground vibrations and excavation and have required specific limitations to minimise the risk of damage to the chapel. DPA do not comment on whether the risk is associated with ground settlement, or shaking damage to the superstructure, or both.

52. I have a similar concern to DPA in relation to the effect of ground vibration and excavations that, in my opinion, are likely to result in subsidence to adjacent private property, particularly rigid structures, paving, walls and pools that are close to the proposed work.

RHL's Application Summary

53. Section 2.1 of RHL's application sets out the key design principles utilised by WAM to develop the final design of the Proposed Village, including *"Distributing building mass in a manner that respects the use and amenity of surrounding properties"*.

54. In my opinion, there is an unreasonably high risk of the temporary works causing damage to adjacent property. Given this, I consider the current proposal does not *respect the use and amenity of surrounding properties*.

Potential for Vibration-Related Subsidence

55. Intense and/or long-duration vibration of soft/loose soils, particularly saturated soils, can result in consolidation and subsidence, and even liquefaction.

56. Mr Malan confirms the steel clutch tube boundary retaining wall will be constructed by driving into position. Driving of piles can be achieved by high frequency vibrations or by drop-hammer. Regardless, they result in ground vibration.

57. Paragraph 75 of Mr Malan's statement indicates the basement foundations would be set back between 1.5 to 2m from the property boundaries".

58. Paragraph 43 of Mr Malan's statement indicates there could be 10-15mm of subsidence at the boundary (presumably associated with a 1.5-2m setback). Importantly, Mr Malan acknowledges *"this setback is meaningful as deformations reduce away from excavation faces"*. Despite this, Mr Malan does not comment on the setback needed to avoid the risk of subsidence to adjacent property.

59. In relation to the potential for subsidence to 15 Salisbury St, Mr Malan tries to explain why 10-15mm of subsidence is not *"likely to result in consequential damage"* but acknowledges Ryman would offer to *"repair any damage attributable to its works"*.

60. In short, there is a risk of damage to adjacent property.

61. Even if construction-related vibrations result in only a small amount of differential settlement (subsidence) to the north boundary wall at 15 Salisbury St, it is likely to result in cracking and possibly rotation of the long masonry wall that is located along the internal boundary between 15 Salisbury St and the Bishopspark site.

62. Likewise, of minor settlement occurred to the north part of the pool at 15 Salisbury St, even by 10-15mm, it may be visually obvious and therefore should be avoided.

63. In relation to the 1.5-2m setback assumed by Mr Malan, I note the WAM drawings indicate there will only be minimal clearance between the legal boundary and the back of the proposed basement foundation walls. At 15 Salisbury St, WAM's drawings indicate the basement wall will be 0.6m from the internal boundary. Given this, the steel clutch tube piles would need to be installed hard against the boundary.

64. While Mr Malan does not comment on the magnitude of subsidence that would occur if the steel tube wall was to be constructed immediately adjacent to a property boundary, i.e. where the proposed basement is to be located 0.6m from internal boundaries, it would obviously be much more than compared to a 1.5-2m setback.

65. Mr Malan states in paragraph 71 of his statement of evidence that *"vibratory techniques cannot typically cause consequential liquefaction effects as the energy levels are low compared with seismic shaking."*

66. I have recent experience with a site at the corner of Victoria and Dorset Street where deep ground improvement by way of stone piling was undertaken to around 8m bgl, adjacent to the internal property boundary. The work required inert materials to be inserted into the ground by way of a deep vibrating probe. Unfortunately, the work resulted in the loose, saturated soils consolidating and subsiding leading to unintended settlement and damage to the neighboring driveway and building that was around 3 to 4m south from the area of work. The subsidence appears to have been caused by consolidation of loose soils and, in part, by

temporary localised liquefaction around the area of ground improvement.

67. Further to this, subsequent ground improvement work that was carried out several metres away from the internal boundary resulted in additional subsidence to the driveway.

68. In short, I have seen that vibratory techniques can result in consequential liquefaction and subsidence, particularly close to the source of vibration.

69. The soil profile at the corner of Dorset and Victoria Streets is very similar to the soil profile across the Bishopspark site.

70. Given the subsidence that occurred at the Dorset/Victoria St site, I believe the soils at the Bishopspark site are likely to be very sensitive to ground vibrations and appropriate caution needs to be taken to avoid the risk of subsidence and damage to adjacent land and structures.

71. Compared to the site at the corner of Dorset and Victoria Streets where ground improvement work was intended to be carried out to around 8m bgl, the Bishopspark development will require the steel tube piles to be driven much deeper to around 12m bgl, against the internal boundaries.

72. Given the need to install steel clutch tube piles very close to, or against, the internal boundary between 15 Salisbury St and the sensitivity of the soils in this area, in my opinion there is a high risk of construction-related vibrations causing consolidation settlement and damage to the masonry wall and swimming pool at 15 Salisbury St, and to any other property that is close to the proposed basement.

Potential for Subsidence from Dewatering

73. T&T suggest the installation of welded steel clutch tubes is intended to limit any horizontal groundwater seepages, with welding provided above the excavation level. T&T state *'groundwater flows will occur upwards through the base of the excavation rather than laterally (through the retention system)'.*

74. Appendix C of the T&T report identifies the proposed excavation is to be supported by sheet piles to 12m bgl, but that excavations would terminate around 5m bgl. I note the steel clutch piles can only be welded after the area is dewatered and excavated, and that welding would be limited to the upper 5m of the 12m deep piles.

75. T&T also acknowledge *"The thickness of peat around the Site means that this layer could be subject to the effects of consolidation if it is dewatered. The proposed perimeter wall around the excavations limits any horizontal groundwater flow, which then restricts the amount of dewatering in the adjacent in-situ strata"* and conclude *"Combined with the retention system, the potential to cause consolidation (settlement) adjacent to the sites through dewatering is minimal, and we do not assess any consequential settlement risks"*. T&T state *"that there is no credible risk of the Proposed Village causing consequential adverse effects on the groundwater, either to existing groundwater users, to the Avon, or through settlement of adjacent land"*

76. It is almost certain that some amount of groundwater drawdown will occur to adjoining land, although from the information available I am unable to assess whether this would be any greater than normal seasonal variations in groundwater levels from summer to winter.

77. Whilst T&T summarise the results of their groundwater and dewatering modelling in Appendix C of their report, their work appears to have been carried out only to assess the potential effects

on the Avon River and to calculate the rate of dewatering needed to achieve a dry basement excavation.

78. There is no evidence in T&T's report to support their assertion that there is no credible risk of *'settlement of adjacent land'*.

79. I consider further modelling should be carried out by RHL to confirm the risk of dewatering-induced subsidence to 15 Salisbury St, and other adjacent properties, is acceptably low.

Potential for Subsidence from Deflection of Temporary Retaining Wall

80. Finally, the stiffness and potential deflection of the steel tube wall is not specifically stated in the T&T report but is addressed by Mr Malan's 6 Jan 2021 statement of evidence.

81. Mr Malan suggests the deflection would be limited to less than 10mm, he does not indicate the pile diameter assumed for his analysis.

82. As I identify in paragraph 58 above, it appears Mr Malan's assessment assumed the basement will be located 1.5-2m from the internal boundary.

83. The stiffness of the steel tube wall will most likely be limited by the tube diameter, which will be limited by the 0.6m clearance that is shown between the basement wall and the north boundary of 15 Salisbury St.

84. RHL's geotechnical engineer, Tonkin & Taylor, should confirm the minimum pile diameter for the steel tube boundary wall, and the minimum clearance to be provided between the steel tube and the boundary, to limit subsidence to the 10-20mm stated in paragraph 63 of Mr Malan's statement.

Risk of Proposed Work

85. The location of the proposed basement is shown to be only 0.6m from the internal boundary with 15 Salisbury St.

86. In my opinion, there is a high risk that the installation of the temporary retaining against the internal boundary, the need for extensive dewatering for at least 18 months, along with the sensitivity of the insitu soils will result in subsidence and damage to the land, pool and masonry wall at the north part of 15 Salisbury St.

87. RHL have proposed to carry out a pre-start and post-construction dilapidation survey and to repair any damage that is obviously caused by their work. This confirms there is a risk of damage.

88. As I have explained, I believe the risk of damage to 15 Salisbury St is high and therefore should be avoided.

Obligations of the Building Act & Building Code

89. Section 71(1) of the Building Act states *"A building consent authority must refuse to grant a building consent for construction of a building if...(b) the building work is likely to accelerate, worsen or result in a natural hazards on that land or any other property"*. At time of application for Building consent the Council will need to consider the potential for land slippage and subsidence occurring from vibrations, excavation and dewatering works. I have explained, ~~I believe~~ subsidence is likely if RHL attempt to construct the proposed building, and therefore I would expect Council would decline the application.

90. Further, under Section 71(2)(a,b), Council must be satisfied that *"adequate provision has been or will be made to – (a) protect the land..... or (b) restore any damage"*. Regardless of whatever conditions of consent could be imposed by Council by a future building consent,

in my opinion it almost impossible to construct the proposed basement without causing subsidence and damage to 15 Salisbury.

91. I also consider it would be unreasonable for Council to issue Resource Consent that would allow damage to adjoining property without the express permission of the adjoining property owner.

92. In short, it is my opinion that the proposed basement is too close to the internal boundary with 15 Salisbury St, and other private properties, and that due to the risk of damage to adjoining property occurring as a result of temporary works, Council would have to decline an application for building consent for that aspect of the project.

93. If this occurred, then RHL would most likely have to redesign part of their development to allow for increased setback from internal the boundary with 15 Salisbury St, and presumably other properties, which may well trigger trigger the need for a substantial amendment to their Resource Consent.

94. In my professional opinion, the current building proposal is inadequate as the temporary works would have to be installed very close to private property which will result in a high risk of subsidence and damage to adjacent property. Given this, in my opinion, the current proposal should be declined.

Possible mitigation

95. As Mr Malan acknowledges in his 6 Jan 2021 statement, the risk of subsidence will decrease as the distance between the temporary steel tube wall and adjacent property is increased.

96. Given the basement excavations are proposed to extend around 5m bgl, and based on the subsidence that occurred near the corner of Dorset and Victoria Streets in 2020, I expect the basement wall may need to be setback art least 5 to 6m from internal boundaries to

significantly reduce the risk of subsidence and damage. However, the minimum setback should be confirmed by the RHL's geotechnical engineer after taking into account a practical construction methodology and the dimensions of equipment and materials needed to achieve the work.

97. I recommend a suitable building and excavation setback be specified as a Condition of Resource Consent. The setback should be sufficient to allow all temporary works, such as the steel clutch-pile retaining wall, to be installed without causing subsidence and damage to adjoining properties.

Conclusion

98. In conclusion, in my opinion the current proposal by RHL presents an unacceptably high risk of construction-related subsidence and damage to adjacent property and should therefore be declined.

Recommendation for Redesign

99. I recommend RHL be required to carry out further detailed geotechnical assessment to confirm the minimum setback from any temporary ground improvement, deep excavation and dewatering works to avoid subsidence and damage to adjacent property.

100. The building should then be re-designed to comply with the minimum setback requirement.

101. The Council should impose the revised minimum setback as a Condition of Resource Consent.

John Aramowicz

18 January 2021