BEFORE AN INDEPENDENT HEARINGS COMMISSIONER AT NELSON

COUNCIL REF: RM200488, RM200489 AND RM220578

UNDER THE	Resource Management Act 1991
IN THE MATTER OF	Land use consent applications by CJ Industries Limited to extract gravel from 134 Peach Island Road, Motueka from the berm of the Motueka River and on the landward side of the stopbank at Peach Island with vehicle access via a right of way over 493 Motueka River West Bank Road, Crown land and unformed legal road (RM200488 and RM200489); and discharge permit application by CJ Industries Limited to discharge contaminants to land from backfill material associate with the proposed gravel extraction (RM220578)

STATEMENT OF EVIDENCE OF IAIN CAMPBELL ON BEHALF OF VALLEY RESIDENTS AGAINST GRAVEL EXTRACTION (PRODUCTIVE SOILS)

Dated: 11 November 2022

QUALIFICATIONS AND EXPERIENCE

1. My name is Iain Campbell. I am a Soil Scientist and a Fellow of the New Zealand Society of Soil Science.

2. I hold the qualifications of B Sc. And M Sc. With Honours in geology and also the degree of D Sc. (Doctor of Science, [soil]) from Canterbury University.

3. I have worked as a Soil Scientist for 60 years, initially for 27 years as a Soil Scientist with the Department of Scientific & Industrial Research, New Zealand Soil Bureau Division and latterly as a Soil Scientist and a consultant for 33 years.

4. A large part of my work has concerned the mapping and identification of soils, with over 4,500 km^2 surveyed and mapped throughout New Zealand and elsewhere, and more particularly in the Nelson and Marlborough regions over the past 45 years. This survey work has been reported in 35 published reports and numerous unpublished reports.

5. I have also conducted extensive scientific research into various aspects of soils which in the 1990's included environmental impacts and assessments.

6. I have been involved with soil restoration and land rehabilitation issues in the Tasman and Marlborough districts for more than 40 years.

CODE OF CONDUCT

7. I have read the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note (updated 1 December 2014) and I agree to comply with it. My qualifications as an expert are set out above. I confirm that the issues addressed in the statement of evidence below are within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed.

SCOPE OF EVIDENCE

8. My evidence is presented on behalf of objectors to the proposed gravel extraction at Peach Island.

9. My evidence in this submission addresses the identification and nature of the soils In the Peach Island area and their potential productivity.

10. My evidence provides an overview of the issues around soil restoration following gravel extraction, from two case studies located on the Waimea Plains near Nelson. It also outlines the problems and difficulties involved in regaining the productive capacity of soils prior to their disturbance and will include observations related to the present application. In addition, I comment on the draft Soil Management Plan proposed by the Applicant as part of its volunteered condition set.

11. My evidence will also address some broader issues around the management of soil and land resources and the need for aggregate materials.

12. In preparing my evidence I have read the evidence of:

    12.1 Mr Timothy Corrie-Johnston (15 July 2022 and 4 November 2022)

    12.2 Dr Reece Hill (15 July 2022 and 4 November 2022)

    12.3 Mr Michael Nelson (15 July 2022).

13. I have also read:

    13.1 the draft Soil Management Plan attached to Mr Hill's evidence

    13.2 the s42A reports as they relate to soil productivity and soil management issues

    13.3 submissions relating to soil management and loss of soil productivity concerns.

EXECUTIVE SUMMARY

14. I have reviewed the s42A Addendum and agree with the conclusions of council staff Ms Bernsdorf Solly and Ms Langford that the application site is highly productive land as defined under the National Policy Statement for Highly Productive Land (NPS-HPL).

15. I have assessed the soil productivity potential of Riwaka soils (which are the type of soils found on Peach Island). The soils are of high to moderate soil versatility class and can produce a wide variety of crops.

16. The 2021 Landvision Peach island LUC and Soil Survey (the Landvision report) claims that the productive potential of the land in Stages 1-3 of the proposal is limited. In my view the Landvision Report lacks soil science substance.

17. From my years of work with Riwaka soils, I am confident the soils have moderate to high productive potential and this is consistent with the highly productive classification of the land in the NPS-HPL. To allow extractive activities within pockets of the land will result in the fragmentation that has occurred for many decades and which the NPS-HPL is aiming to halt.

18. I have examined soils on numerous other gravel extraction sites on the Waimea Plains and I discuss two specific case studies below. Various best practice methods have been used aiming to minimise soil physical impairment, compaction, drainage impairment and promote soil restoration. In one case study I discuss, no foreign materials were allowed as backfill. Despite these measures, there has always been deterioration in soil properties as a result of the disturbance from removal and replacement and through the cultivation needed for seed bed preparation and sowing. Therefore, even using best practice methods, there was distinct soil productivity loss.

19. In my view, the disturbed soils on Peach Island will not be able to be restored to their high potential productive status. I am particularly sceptical about the measures proposed regarding backfilling at the site because foreign materials will be brought to

site with no independent third party checks before the backfill is placed in the pits. In the Staplegrove Farm case study I discuss in my evidence, it was clear that resource Consent Condition Clauses, including extraction and backfill replacements reasonably similar to those proposed for Peach Island, had not been adhered to. With a quarry project of this size, scale and duration, it will be very difficult to ensure no operational errors and therefore protection of the soil properties. Dr Hill talks in his evidence about the need for careful management, pre-planning and adherence to the Soil Management Plan. In my experience, this is very difficult if not impossible to achieve in practice.

20. The removal and replacement of the soils on low terrace surfaces cannot successfully maintain their physical characteristics and productivity potential. The natural network of pores and fissures and soil structure within the soil material, which are essential for moisture movement, moisture storage, root penetration and biological and chemical processes are destroyed during the removal, stock-piling and replacement, irrespective of whether or not excessive compaction occurs. Relying on there being no human error in operational practices over a 15 year timeframe for a project of this size is not realistic.

21. Alluvial aggregate is available from other nearby sources that will not impact on highly productive land. These sources should be preferred over extraction from the productive soils at Peach Island.

SOILS OF THE PEACH ISLAND AREA

22. The soils of Peach Island belong to the Riwaka soil type family, as identified in *NZ Soil Bureau Bulletin 30 (1966)* and the Landcare Research S-Map system. They are formed from recent alluvium of the Motueka River and are derived from a variety of rocks, of which greywacke, quartzite, limestone, granite and basic igneous rocks are the most common. I am familiar with this soil type from farm-scale soil surveys for various purposes that I have undertaken in the Motueka district over the years.

23. As with most soils of the low terraces and floodplains, soil mapping and examinations of the alluvial soils of the Motueka Plain have shown that the Riwaka soils are varied in

their properties and range from deep to shallow silt loams, sandy loams and sands with gravel sometimes at the surface and at variable depths. They are usually well drained except in small lower lying areas. Being of youthful age these river plain soils have weakly developed soil structure and a high to moderate natural nutrient status. Because they occur on a geologically recent river terrace system, lower surfaces have been subject to flooding in the historic past, as is evidenced by flood layers and buried topsoils observed within some soil profiles.

24. During the 1950's soil mapping of the Motueka Plain was undertaken by the Cawthron Institute at a semi-detailed scale of 1:15,840 (Figure 1 Appendix). This unpublished map is the compilation from the field work that was carried out in the 1950's and was used as the basis for the subsequently published soil report and map (Chittenden, Dodson & Hodgson Soil Bureau Bulletin 30, 1966). It is widely used by horticulturalists on the Motueka Plain.

25. For the Peach Island area, 11 differing Riwaka soil units are shown on the unpublished soil map and they differ in their depths and texture. This variable soil pattern at Peach Island is similar to other parts of the Motueka Plain where Riwaka soils occur and where they are intensively used for a range of horticultural crops, more particularly apples and kiwifruit.

26. Detailed soil mapping on the Waimea Plain, which I have undertaken for the Tasman District Council (*TDC Waimea Plain Soil Reports 2012-2017)* has likewise shown similar soil depth and texture variation patterns on the low terrace/floodplain Waimea river system. For example, at the western end of Bartlett Road, where Waimea soils occur, the area is intensively used for market garden crops with the depth of fine material over gravel varying from 15 cm to > 100 cm and with surface stones present in many places.

27. Notwithstanding the variable depths, textures, stoniness and drainage differences over small distances, most of the Waimea Plain is under intensive horticulture and or market gardening *(Tasman District Council Land Use cover map, Waimea Plains).*

28. Paragraph redacted at request of submitter.
Done by Alastair Jewell, Principal Planner 16/11/2022.

SOIL PRODUCTIVE CAPACITY

29. Various systems have been used in the past to categorise the productive capacity of land in New Zealand. In many earlier New Zealand Soil Bureau reports, productive capacity was assessed using non empirical data, which were considered to be the limiting soil factors that formed the basis for determining various classes for broad land use groupings, such as cropping, pastoral and forestry uses.

30. The Tasman District Council land classification system (*Classification for Productive Land in the Tasman District; Agriculture New Zealand 1994)* is a hybrid system that incorporated some soil climatic data, but it lacks objective definitions for the class limits. In that classification, Riwaka soils were grouped within class A.

31. The Land Use Capability system has been widely used, but along with the earlier NZ Bureau and TDC systems, it lacks objective definitions for the class limits and has poorly defined criteria. It has no clear relationship between factors used for the classification and crop production or management. The system is designed to assess general capability of land for cropping, pastoral, forestry use and soil conservation on a broad scale rather

than soil suitability and productive capacity for particular intensive land uses. It is inappropriate in some instances, for example with sandy textured and stony soils downgraded under dryland farming but highly productive under irrigation. It also emphasises the possibility of wind erosion which under many intensive horticultural uses is negligible or zero.

32. Webb and Wilson (1995) discussed the deficiencies of the LUC system, as outlined above. They provided details for a comprehensive system for evaluating the productive capacity of rural land *(Webb and Wilson 1995. A manual of land characteristics for the evaluation of rural land. Landcare Research Science Series No. 10).*

33. The central concept of the Webb and Wilson system is that numerical ratings for a range of soil and land attributes are based on measurable values which directly influence crop growth or management. The attributes used include key soil physical properties (for example, effective rooting depth, soil penetration resistance and density, profile available water, soil wetness, permeability, and stoniness) and also soil chemical properties and environmental and climatic characteristics. In this system, a range of measurable values are assigned to each attribute which thus provide a quantitative basis for land use assessments. It gives a measure of *soil versatility* and the relative value of a soil for productive use.

34. When the assigned attribute values for particular a soil are summed and averaged, the average value gives a measure of the *soil versatility* and the *productive potential* for that soil. The empirical basis of this land evaluation system results in reliable and reproducible soil versatility assessments that are seen to match with existing land uses.

35. In the table below, using the assigned values for each soil property assessed, the Soil Versatility Class and potential productivity for five Riwaka soil variants are given, along with 5 other soils from elsewhere in the Tasman district. The TDC Productive Land Class and the LUC Land Class assessments are given for comparison.

Soil unit	Riwaka deep	Riwaka mod deep	Riwaka shallow	Riwaka stoney	Riwaka mod drain	Ranzau v stoney	Waimea deep	Waimea mod drain	Mapua mod deep	Braeburn deep
Topography	1	1	1	1	1	1	1	1	4	1
Irrigability	1	1	1	1	1	1	1	1	3	1
Drainage	1	1	1	1	2	1	1	2	2	3
Plant available water	1	1	2	3	1	3	1	1	1	1
% Stones	1	2	3	4	1	5	1	1	2	1
Permeability	1	1	1	3	2	3	1	2	4	4
Potential rooting depth	1	3	4	4	3	4	1	2	3	3
Nutrients	2	2	2	2	2	2	2	2	2	3
Workability	1	1	1	1	3	1	2	2	3	4
Waterlogging	1	1	1	1	2	1	1	2	2	3
Erosion	1	1	1	1	1	1	1	1	4	1
flooding	2	2	2	2	2	1	1	1	1	1
Water availability	1	1	1	1	1	1	1	1	3	1
Soil Versatility Class	1.15	1.38	1.61	1.92	1.69	1.92	1.15	1.46	2.61	2.1
TDC Productive Land Class	A	A	A	A	A	A	A	A	B C	B
LUC Class	1s2	3w1	4s1	4s1	3w1	3s1	1s2	2s1	3e6 4e5	3w1
Soil Versatility Classes	1 High versatility		1-2 High - moderate versatility			2-3 Moderate to low versatility			3-4 Low versatility	

36. The five Riwaka soils fall within the high to moderate soil versatility class.The two Waimea soils (similar to the Riwaka soils) likewise are within the high to moderate soil versatility class. The very stony Ranzau soils on the Waimea Plain are at the lower end of the high to moderate versatility class but are classed as 3s1 under the LUC system. The Ranzau soils and the Waimea soils are extensively used for horticultural and market gardens on the Waimea Plains *(Tasman District Council Land Use cover map, Waimea Plain).* The Mapua soils from the Tasman district are within the moderate to low versatility class (3e6 & 4e5 in the LUC system), yet they are used extensively for a variety of horticultural crops including apples, pears, cherries, grapes and olives. They are not suitable for crops requiring cultivation because of multiple soil factors, hence their lower soil suitability ranking. The Braeburn soils, also within the moderate to low versatility class, (LUC class 3w1) are heavy textured soils that are imperfectly drained and occur in the Lower Moutere area where they are extensively used for horticulture and other crops.

37. To summarize, the Peach Island soils are Riwaka soils and in respect of their physical properties and variability, they are similar to other soils of the Motueka and Waimea Plains and the Takaka Valley river system, which, over most of the Motueka and Waimea

Plains areas, are under intensive horticulture and or market garden uses producing a wide range of crops.

38. The Nelson region has the smallest area of high value versatile soils compared with all other New Zealand regions (*Environment Ministry and Stats NZ Report 2021)*, and these soils are confined to narrow river valleys and three small valley plain areas. A significant portion of the most versatile soils on this land is already lost to urban development and is continuing to be diminished by inappropriate uses. For example gravel extractions alone on the Waimea Plain have taken place over around 1.5% of the area while > 20% of the 3,500 ha. Motueka Plain area is lost to urban uses.

THE SOIL MANAGEMENT PLAN AND PROPOSAL TO RESTORE THE QUARRIED LAND ON PEACH ISLAND

39. I have reviewed the draft Soil Management Plan (SMP) attached to Dr Reece Hill's evidence.

40. The proposal is not small-scale or temporary. Approximately 7.4ha of the site is proposed to be quarried (some 55% of the site area). Around 181,000 to 250,000m3 of aggregate is intended to be quarried over 15 years and I am informed that the applicant owns adjoining land at 493 Motueka River Westbank Road. If this land is also quarried this will be a very substantial operation with long-lasting impacts on the soil. I agree with Ms Bernsdorf Solly's view that the proposal is not small-scale or temporary in nature.

41. The aim of the draft SMP attached to Dr Hill's evidence is to ensure that the removal, management and placement of soil avoids or minimises impacts on the soil properties prior to and following placement, and that the re-established soil retains or exceeds the soil versatility of the original soil on the site while also minimising the potential for soil loss to water.

42. I have the same concerns as Ms Bernsdorf Solly and Ms Langford regarding the implementation of the SMP. In my view the SMP is unlikely to adequately restore the soil etc.. *Among other things, I note that the backfill will not be checked by a third party ie seems quite a high trust approach!]*

43. In numerous places in his evidence, Dr Hill emphasises the need for adherence to the SMP. For example, in paragraph 3.38 of his evidence of 15 July 2022 he states: "Provided the extracted gravels are replaced with a fine soil subsoil and topsoil in a way that the soil physical properties are not compromised by compaction, the reinstated soil profile will retain the same productive potential or improve to a similar level as the neighbouring land areas with deeper fine soil matrix soils. The recommendations in the Soil Management Plan provide for the soils to be managed in this way". Again at paragraphs 4.6 to 4.8 Dr Reece emphasises that "careful soil management throughout the operation and following reinstatement of the soil will reduce impacts on soil properties" and that "Key to the effective re-establishment of the soil on the gravel extraction site are careful pre-planning, adherence to the guidance provided in the Soil Management Plan".

44. I have experience with similar soil restoration projects. Even where similar management approaches to that proposed by Dr Hill have been followed, there has been a marked loss in soil productivity and physical impairment of various soil properties. Irrespective of directive wording and specific mitigation measures in the draft SMP, the likelihood of human error over the project's 15 year timeframe is high.

45. I discuss two case studies below. These studies show that once productive soil is disturbed through quarry activities, it is exceptionally difficult to restore it to its original productive capacity.

CASE STUDIES OF GRAVEL EXTRACTION-LAND RESTORATION IN THE NELSON REGION

Case Study 1

46. In 1974 a proposal was advanced to extract gravel from the stony Ranzau soils at a site in Waimea East (Ranzau Road). This was objected to by the Ministry of Works Town and Country Planning Division because in terms of the Town and Country Planning Act, the very stony Ranzau soils (Class A, TDC Classification system, Class 3s1 LUC system) were rightly judged to be of high, actual or potential value for food production as shown by the wide range of horticultural and market garden crops that are grown.

47. After a hearing before the Town and Country Planning Appeal Board at which technical evidence was presented, approval was given in July 1976 for gravel extraction and soil restoration to proceed on an experimental basis. The method of extraction was prescribed to minimise the destruction of the soils physical properties. *(Land Reclamation after Gravel Extraction on Ranzau Soils, Nelson, New Zealand. D J McQueen; New Zealand Soil Bureau scientific report 58. Department of Scientific and Industrial Research Wellington, New Zealand 1983).*

48. Narrow strips of land were to be worked from the upper surface to minimise compaction. The topsoil (A horizon) and the subsoil (B Horizons) were to be separately removed followed by the underlying gravel, with the subsoil then being replaced on top of the new surface by the excavator, working from the surface above. All this was to take place without the use of wheeled machinery. Following levelling of the mounds of replaced subsoil, the stockpiled A horizon topsoil was replaced.

49. No foreign soil materials were allowed as backfilling at this site.

50. The consent ordered that agricultural trials be carried out to assess the productive capacity of the replaced soil as against the original undisturbed soil and the consent conditions were strictly adhered to.

51. Extensive scientific investigation of soil properties of both the original soil and the replaced soil were also undertaken. The agricultural trials (carried out by MAF) showed a marked loss in soil productivity as assessed through various crops, while physical impairment of various soil properties was also recorded, including soil drainage impedance.

52. This exercise provided probably the best conditions for gravel extraction and soil restoration likely to be found anywhere on alluvial soils. The Ranzau soil is older than other alluvial soils on the Waimea Plain, has more stable topsoil structure, has a high topsoil stone content (commonly in excess of 30%) a very stony subsoil that should render it less prone to compaction, and has a deep subsoil. The combined topsoil (A horizon) and subsoil (B horizons) weathering depth are around 1.2 m. This meant that the replaced soil (about 1.2 m in total) provided a good medium for deeper rooting plant requirements.

53. Changes in certain soil physical conditions including soil structure breakdown, could not however be avoided.

54. The scientific report on the operation *(D.J McQueen, 1983. NZ Soil Bureau Scientific Report 58.)* suggested that a deterioration in the soil physical properties may have resulted from movement of soil materials when soil moisture levels were above the optimum desirable level. This conclusion however is regarded as equivocal for the following reasons:

    54.1 Subsoil materials (gravelly textured) were not stockpiled and were only placed in low mounds that were simply levelled in one operation, hence the amount of compaction from tracked machinery was minimal.

    54.2 No measurements of the soil moisture levels were taken at the time of re-spreading and have only been inferred from rainfall/evaporation record assessments. The soil materials were <u>not</u> handled under wet conditions.

54.3 Given the methods being employed (low ground pressure tracked machinery), it is unlikely that compaction would have occurred everywhere, yet ponding, indicative of impeded drainage was and is still present at various times.

54.4 The major sampling for the soil physical properties took place on September 27th which was after the field trial had been sown, so it might also be concluded that deterioration observed in soil properties was cumulative, as a result of the disturbance from removal and replacement, as well as the cultivation required for seed bed preparation and sewing.

55. So, under the best possible methods used for the gravel extraction and soil replacement, soil physical impairment, drainage impairment and productivity loss in these stony soils still occurred.

56. I have examined soils on numerous other gravel extraction sites that cover more than 100 ha on the Waimea Plains and at none of the earlier sites has the land been restored to its original intensive high potential productive status.

Case study 2

57. Gravel extraction began at Staplegrove Farm, Waimea West in the 1980's but the extraction and restoration process was not subject to the same level of scrutiny as the Ranzau soils exercise. A consent order granted following a hearing in February 1992 covered issues related to the expectation of an acceptable level of soil remediation following gravel extraction, notably, working methods, drainage and ground levels as summarised below.55. *Working Methods*

(a) Operation progress to be a strip by strip fashion.

(b) Topsoil and subsoil to be stripped and stored separately with stockpiles not more than 600 mm high

(c) No topsoil or subsoil to be removed if above 25% moisture content.

(d) No vehicle movement on top of topsoil or subsoil before stripping or while being stockpiled.

(e) The surface of the ground level after stripping to be contoured and ripped to ensure adequate subsurface drainage.

(f) A minimum thickness of 500 mm of replaced topsoil and subsoil over subsurface material and no compaction of topsoil or subsoil which would prevent adequate soil drainage.

(g) Topsoil and subsoil introduced into the extraction area to be compatible with existing materials and no toxic or foreign materials to be introduced.

(h) The land to be returned to at least an equivalent land capability that existed prior to disturbance.

(i) Appropriate drainage to be installed.

(j) A finished land surface with fall to take surface water to drainage channels.

(k) The level of the excavated ground to be not less than 0.3m above the normal winter water table.

(l) Wells be installed to determine the normal winter water table.

(m) Additional clauses required that gravel extracted be only used for high quality aggregate products.

AN INVESTIGATION OF SOIL RESTORATION AT STAPLEGROVE FARM

58. Prompted by complaints from members of the public about inappropriate proceedings at the extraction site, Tasman District Council ordered the operator to obtain a soil report for the Staplegrove gravel extraction site *(Client Report: Report on Soil Restoration at Staplegrove Farm Gravel Extraction site, Waimea West, May 2017. I Campbell).* I attach a copy of this report to my evidence statement.

59. From the examination requested by the contractor, ten very large (10 m length) randomly chosen pits were excavated to 2 m depth on land that was restored over several years prior to the latest phase of gravel extraction and the soils were described and sampled. In addition, observations and samplings were made at the current gravel extraction and backfill site. Observations of gravel extraction and backfilling operations had also been made in earlier years while undertaking detailed soil survey work on the Waimea Plain.

60. The soil examinations revealed:

60.1 The subsoil heavier-textured backfill material was severely compacted in each examination pit, but with no evidence that this was due to replacement under wet conditions. The backfill materials were not compatible with the existing alluvial materials.

60.2 Soil drainage was poor with reducing conditions (blue colours in the report) present in dense subsoil in many places;

60.3 Extensive surface ponding of water occurred after some rainfalls;

60.4 The replaced 'topsoil' thickness was not consistent, sometimes being very shallow and had a very high permeability. A recognisable A horizon (true topsoil) was virtually non-existent.

60.5 There was a considerable variety of foreign materials present in the backfill including treated timber, metals, plastics, concrete slabs, bricks, ash, and asphalt materials;

60.6 Similar materials were being dumped in the current excavation site;

60.7 Trucks driving over the backfill (early March, dry conditions) to unload more backfill were unavoidably compacting the fill materials;

60.8 Stock-piled surface soil materials were not separated into the soil A horizon (true topsoil) and subsurface soil horizons (B horizons) and were mixed;

60.9 Stock-piled material was stored in large mounds more than 3 m high and trucks had driven up and over the weakly structured soil material to form these mounds;

60.10 Excavation at the current site was taking place within the water table zone;

60.11 Chemical analyses of samples showed elevated levels of some heavy metals including cadmium, chromium and arsenic, many times above baseline levels in undisturbed soils.

60.12 Polyaromatic hydrocarbons were also found, probably a product of the asphaltic materials that were present.

60.13 It was clear that Resource Consent Condition Clauses had not been adhered to from the time that the resource consent for gravel extraction was granted.

60.14 The gravel extraction and backfill replacement method used at Staplegrove Farm was fairly similar to that proposed for Peach Island with a relatively small pit area exposed and back filling taking place at the same time, however the pit depth was not as great as that expected at Peach Island.

THE PROBLEM

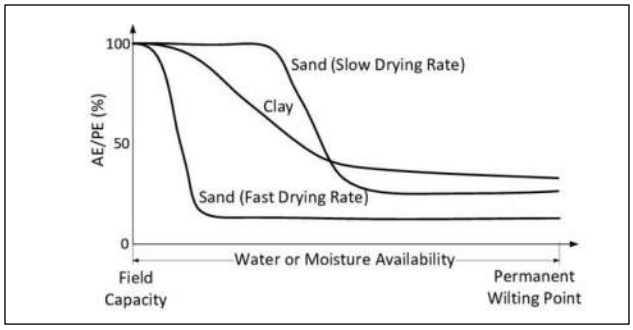
61. Most of the gravel extractions on the Waimea Plain have taken place on Wai-iti soils, which, like the Riwaka soils, are young soils with weakly developed soil profiles formed on the present flood plain or slightly older surfaces. Key features of these soils are:

61.1 A variable thickness (20 cm-100 cm+) of silty, sandy or sometimes gravelly textured soil over un-weathered coarser sandy gravel, sometimes stony at the surface;

61.2 Weakly developed soil structures because of their youthful age;

61.3 A close proximity to the groundwater table (3-5m) because of their low lying position.

62. There is an extensive world-wide scientific literature relating to the reinstatement of disturbed land and compaction is seen as a universal problem. Soil materials with clayey textures are especially vulnerable to compaction because it is very difficult to achieve a moisture content that is low enough to avoid compaction when the soil is compressed during backfilling. The figure below illustrates a drying curve for a clay textured soil, with less than 35% moisture content becoming difficult to achieve (a moisture content of 15% is acceptable for earth bricks made from clay).



(Source: Canadian Geotechnical Journal 1997 34: 144-155

63. The removal and replacement of the soils on low terrace surfaces can never be expected to be a successful operation in respect of maintaining their physical characteristics and primary production potential. The natural network of pores and fissures and soil structure within the soil material, which are essential for moisture movement, moisture storage, root penetration and biological and chemical processes are destroyed during the removal, stock-piling and replacement, irrespective of whether or not excessive compaction place.

64. Handling these weakly structured soils under dry conditions is more likely to lead to physical breakdown than when the soil is moist, as under dry conditions there is little

soil cohesion in these weakly structured soils, and more especially when the soils have sandy textures.

65. The destruction of pore spaces and soil structural aggregates inevitably leads to changes in the soil density, infiltration rates and moisture holding capacity, regardless of the soil moisture state at the time of disturbance.

66. In addition, soil biological processes and macro fauna populations which are essential for soil nutrient relationships are curtailed. The micro-pores present in undisturbed soil allow plant root hairs to grow into the network of pore spaces where the microbiological interactions associated with plant moisture extraction and nutrient uptake take place. This highly complex system is largely destroyed during soil removal and replacement when pore space, soil structure and soil moisture holding capacity are disrupted.

67. Also destroyed are the natural progressive chemical and physical changes that occur through the soil profile with increasing depth. These physical and chemical gradients are important for plant root adaptation and soil moisture movement within the soil profile and constitute one reason why some plants perform better on different soils.

68. The substitution of foreign subsurface materials with inferior qualities at close proximity to the surface inevitably creates a soil chemical and physical hiatus within the soil profile.

69. The back fill materials at Peach Island will come from a variety of sources (i.e. clay and quarry rubble, slip debris, excavations) differing soil types and various rock types. Across the reclaimed area they will not be consistent in their physical properties or conducive for consistency in deeper rooting crop production.

70. The introduction of foreign earth material at Staplegrove Farm occurred at the commencement of gravel extraction, but the justification for this has never been subject to any objective questioning or rigorous scientific examination. Inevitably, replacement

material will have heavier textures than the gravels that they are replacing as these are the materials that contractors want to dispose of.

71. The substitution of inferior heavier textured earth material into the subsurface at Peach Island is likely to lead to impeded downward water movement and soil drainage restriction within the soil profile, as was clearly evident at Staplegrove Farm where widespread surface water ponding occurred and blue colours (in the attached report), indicative of reducing conditions were present. The juxtaposition of the re-spread soil with many macropores over heavier textured fill materials with fewer macropores constitutes a barrier to water movement. What is a well-drained subsurface material at Peach Island would be replaced with a non-uniform medium that would be less well drained owing to the presence of heavier textured, and structure-less subsurface materials.

72. At Staplegrove farm, the absence of soil structure in the respreads soils was evident, while soil drainage, soil permeability, workability and waterlogging were soil properties that were all adversely affected. The lack of uniformity in thickness of the replaced soil horizons was not unexpected as attempting to re-spread various soil layers to a uniform thickness with heavy machinery is at best a difficult operation.

73. One of the most common causes of soil drainage impedance within a soil profile is the presence of a textural unconformity, as even a very thin textural contrast layer in gravelly subsoil soil material can cause drainage (and root penetration) to be impeded because of the adhesive properties of water. Periodic inundation of a pit at the proposed Peach Island gravel extraction site can be expected to leave a fine silt layer over the whole surface that will later act as an additional barrier to the downward movement of soil profile water.

74. Introduced foreign subsoil materials at Peach Island are also likely to be a problem for the management of deeper rooting horticultural crops. Significant variation over small distances in the texture, soil density, hydraulic conductivity, plant available water and

soil nutrient levels of the subsoil material can be expected as it is unlikely that the physical or chemical properties of the backfill material in each extraction area will be the same. This is likely to result in making crop management for consistent yield over an area difficult due to a lack of uniformity in the soil profiles.

75. It is indicated that the extraction areas at Peach Island would vary between 3 and >4 metres deep. Assuming that the backfill materials were able to be replaced without compaction as envisaged, there would be natural settlement within the loose soil materials when they later became saturated with fluctuating groundwater, which will rise to 1.2m from the soil surface. The amount of settlement that would follow will differ across the restored ground surface depending on the thickness and nature of the backfill. It would be expected that over time, the finished ground surface would develop uneven hollowing due to the differential subsurface settlement which would be exacerbated by the periodic saturations by the ongoing fluctuating watertable changes.

76. Dr Hill says that there will be reduced productivity in the short term (0-3 years) only, and then the site will be fully remediated after that, and probably better than before.

77. I do not agree with this statement for the reasons I have discussed above drawing on my experience on similar extraction projects over many years. Soil materials such as those at Peach Island are vulnerable to compaction, and their removal and replacement, backfilling with foreign materials is likely to lead to physical breakdown, loss of productivity characteristics and potential and destruction of the natural network or pores, fissures and soil structure which are essential for moisture movement, moisture storage, root penetration and biological and chemical processes.

78. This in turn curtails macro fauna populations which are essential for soil nutrient relationships. Highly complex soil biological and chemical processes which are important for plant root adaptation and soil moisture movement will be destroyed during the extraction and replacement operations proposed in this application. The substitution of foreign subsurface materials with inferior qualities at close proximity to

the surface will inevitably create a soil chemical and physical hiatus within the soil profile and lead to impeded downward water movement and soil drainage restriction as evident at Staplegrove Farm.

79. The well-drained subsurface material at Peach Island should not be replaced with a non-uniform, drainage impeded medium. This will cause significant effects on deeper rooting horticultural crops in particular.

PROPOSED EXTRACTION IN STAGE 1

80. The soils outside the stopbank will differ from those inside depending on the flooding history. Typically frequently flooded soils are downgraded for potential productive use because of flooding, but this does not preclude their use for very productive purposes. They can be used for market gardens growing root crops but not tree crops etc, so their versatility is lower. Lettuces are one of the most profitable crops to grow. It is just that the grower has to accept the risk of intermittent wipe out. This can be acceptable if the capital investment is low (ie no land cost as it is leased from the local authority at a reasonable rate and no infrastructure, apart from irrigation). There are many delta areas throughout the world which are flooded annually but still used intensively and annually. It is just that we are not accustomed to doing this in NZ. I do not think that factors such as an inherent seasonally high watertable, flood risk and variable or shallow soil depth necessarily preclude the land from being used for productive purposes.

MANAGEMENT OF EARTH RESOURCES AND THE NEED FOR AGGREGATE MATERIALS

81. A frequently advanced reason for continuing a gravel extraction operation in a local area, as opposed to going to some other source of less agricultural significance is the cost. This argument was raised at the 1975 hearing related to the Ranzau soils but was promptly dismissed by Judge Treadwell, who pointed out that in other parts of the country, as is the case for much of the North Island where no alluvial gravels are present, aggregate had to be transported large distances and or acquired from hard rock quarries.

82. Alternative sites for gravel mining exist, for example, in the upper reaches of the Motueka River, between Motupiko and Golden Downs. Here, the valley system is narrow, often heavily frosted in winter and the soils are Tapawera soils (Chittenden, Dodson & Hodgson Soil Bureau Bulletin 30, 1966) which are included in Class C of the Tasman District Council land Classification system and classes 4s3, 5s4 and 6s4 of the LUC system.

83. Cost cannot be a compelling reason in deciding for a less environmentally suitable activity or course of action, since this inevitably leads to a continuation of the multiple and compounding ongoing environmental problems being experienced throughout the world today. The National Policy Statement on Highly Productive Land aims to stop the fragmentation of productive land and protect it for use in land-based primary production.

84. Maintaining an ongoing supply of aggregate materials for the district would be better served if the Tasman District Council undertook a survey to find suitable sites for rock quarries within the Motueka area. This survey should also include finding suitable sites for the disposal of excavated hard fill materials, so that the convenient but unsuitable practice of dumping hard fill waste beneath replaced high value terrace and floodplain soils is not continued.

85. Hardfill materials should be considered as a resource, because with rising sea levels and a necessity in future to raise the heights of roads and stop banks, large quantities of fill materials will be required.

86. In his evidence statement Mr Corrie-Johnston says that river aggregate is essential for high end concrete products and sealing chip. I am aware that Hhrd rock quarries at Dunedin, Wellington, Tauranga and Auckland produce a range of aggregates which are used for concrete products and sealing chip with the rock types having a higher rating than some rock types in the Motueka River.

87. Sealing chip for a large part of the Nelson area comes from the Marsden Valley quarry at Stoke where the rock is Mesozoic sandstone with a high class weight rating. The Mapua bypass road which was constructed several years ago used Marsden Valley chip for the sealing with a transport distance of up to 25 km.

88. On their website, CJ Industries state they charge over $48 per ton for builders' aggregate. Horikiwi Quarries (hard rock) at Wellington charge $42.50/ton for builders' aggregate. Hard rock quarries at several other locations also charge around $48/ton. I note that gravel requires less processing compared with hard rock materials which need to be blasted out and crushed.

_____

Iain Campbell

APPENDIX

Figure 1. The unpublished original soil map of part of the Motueka Plain area is a compilation from the field work that was undertaken by the Cawthron Institute in the 1950's.

The published map (Chittenden, Dodson & Hodgson Soil Bureau Bulletin 30, 1966) that shows the Riwaka soils on the Motueka Plain was derived from this early compilation sheet.

[this page blank - redacted confidential 16/11/2022]

[this page blank - redacted confidential 16/11/2022]

[this page blank]

REPORT ON SOIL RESTORATION AT STAPLEGROVE FARM

GRAVEL EXTRACTION SITE, WAIMEA WEST, NELSON

Dr Iain Campbell
Land & Soil Consultancy Services
46 Somerset Terrace, Stoke
Nelson
June 2017

e-mail: iaincampbell@xtra.co.nz

CONTENTS

REPORT ON SOIL RESTORATION AT STAPLEGROVE FARM

GRAVEL EXTRACTION SITE, WAIMEA WEST, NELSON

Dr Iain Campbell
Land & Soil Consultancy Services
Nelson

INTRODUCTION

Staplegrove Farm in the Waimea West district Nelson, has been a site for gravel extraction since the 1980's. At the time of examination, gravel was being extracted to a depth of approximately 4m below the existing ground surface (Figure 14) with a thickness of about 3.5m of earth materials back filled. At a request from *Downer* (e-mail 27/2/2017), an examination of the soils and soil materials was undertaken for the purpose of preparing a report to ascertain if conditions of the Resource Consent issued by The Planning Tribunal Hearing 10/2/1992 were being fulfilled. The examination focussed on the conditions of the resource consent given as per the brief below. Other conditions of the Resource Consent are not addressed in this report.

a) *Fill used in areas previously restored contains no materials prohibited by the consent including toxic substances, concrete or other demolition-type materials;*
b) *That materials within the clean fill will not have significant adverse effect on the short term and long term productive capacity of the land;*
c) *That measures in respect of drainage as required in condition 18 are being complied with;*
d) *That there is adequate drainage through the restored ground including fill material which has replaced the extracted gravel;*
e) *That the subsoil and topsoil that has been restored is of a nature that does not have a detrimental effect on the productive potential of the land.*

Site visits were made on seven occasions, (15/3; 17/3; 24/4 and 14/4) for familiarisation and site observations and three (21/3; 22/3 2/4) for detailed examinations and soil material sampling. The examinations were restricted to the area that had been most recently restored and to the present fill site.

EXAMINATION PROCEEDURE

Ground that had been restored after earlier gravel extractions between 2008 and 2013 was examined at 10 randomly chosen sites (Figure 1 sites 1-10), with pit excavations which were 12m long and 2.5m in depth being exposed to assess the nature of the restoration materials. When carrying out the excavations, the soil between depths of 0-50cm, between 0.5-1m and from 1-2.5m from the ground surface was sequentially removed, kept separate, then backfilled in the same order to avoid undue mixing of the materials and to ensure that reinstatement conformed as far as

possible with the existing conditions. At each pit (sites 1-10) a sample of the subsurface materials (12 samples) and restored soil from 2 sites (2 samples) were collected for chemical analyses.

Additional samples (11 samples from site 11) were collected from the adjacent partly restored area (figures 15-23) and where waste materials at the time of inspections were being deposited. The earth materials in this area were examined because when the restoration is completed, the soil conditions will be analogous to those observed from former replacement and restoration area.

The samples that were collected for analysis represent a limited range of the differing earth materials that were observed in order to determine whether contaminants might be present due to the presence of foreign materials. In the pits, for example where multiple layers of earth fill material were observed, a single sample only was collected.

Undisturbed subsoil, seen in cutting exposures on the western boundary of the present gravel extraction area (Figure 1 site 12) was examined and sampled (1 sample) to provide a benchmark for comparison with all of the samples taken from the excavation pits and the site where fill materials were currently being deposited.

A total of 26 samples was collected for analyses, 7 in glass containers because of the presence of bitumen-like substances and the remainder in plastic bags. The samples were forwarded to R J Hill Laboratories for a range of chemical analyses.

Figure 1 location of sample sites

PHYSICAL DESCRIPTION OF RESTORATION MATERIALS

A) Pits

Each of the pits had a surface layer of replaced soil which was without any soil structure, was predominantly light olive brown coloured (2.5Y 5/4) and which varied in thickness from 20 to 70cm but with an average thickness of 39cm. This surface layer lacked an identifiable A horizon (topsoil*) and the stone content was in excess of 35% (gravimetric) and within the *very stony class* of soils. In deeper parts of the surface layer (e.g. Pits 6, 8), the replaced material is very dense and compacted. The upper 20cm of the surface layer is fragmented due to recent tillage. No foreign materials were observed within the surface layer of original soil. Permeability was measured at >300mm per hour (very rapid) and the soil was noted to be saturated after rainfalls, with extensive surface water

ponding 2 days after rainfall (Figure 14). There is no overburden present and the transition from replaced soil to underlying fill is abrupt.

The subsurface material in all of the pits consisted of imported earth matter (waste fill) with no clearly identifiable origin. The predominant colour is dark grey (10YR 4/1), suggestive of a high organic matter content (although there is little resemblance to what might have been former topsoil). There is a general absence of brown earthy materials or what might be described as *'common oxidised subsurface soil.'* The texture of the subsurface material is predominantly clayey-silty, with a variable stone content, while its appearance is mostly massive, compacted and layered to varying degrees. In all of the pits, foreign debris was present (Table 1) including, concrete, wood remnants (posts and other) plastic pieces, brick, metals, plastic and metal pipe and asphalt like substances. In several of the pits, the upper layer of the waste fill had a grey or bluish grey colour. This and the overall grey colour of the subsurface materials is suggestive of strong reducing conditions. This may be due to the absence of aeration and restricted movement of water due to compaction during the placement and movement of the fill materials. Groundwater fluctuation within this subsurface zone may also be contributing to anoxic conditions within this earth material. Table 1 below summarizes the range of foreign materials found in the ten pits and the latest backfill area.

***In soil science, earth science, or in an agricultural sense, the correct definition of a soil is as follows: A horizon (topsoil) B horizon (subsoil) and C horizon (parent material, regolith or overburden). In general usage, 'soil' has no specific meaning other than unspecified earth material and is ambiguous.**

Table 1
Foreign materials identified within earth fill materials

Waste Material	Pit 1	Pit 2	Pit 3	Pit 4	Pit 5	Pit 6	Pit 7	Pit 8	Pit 9	Pit 10	Site 11
earth pipe		#									#
concrete		#	#		#	#	#	#		#	#
wood (various)	#	#	#		#	#	#	#	#	#	#
wood shavings		#									
asphalt	#			#	#	#	#	#	#		#
metal	#				#		#				#
bark	#										
plastic pipe			#			#	#			#	#
plastic wrap			#		#			#		#	#
plastics		#			#						#
brick		#			#		#	#	#	#	#
vesicular fused glass					#						#
wire		#									#
ash?				#		#					#
charcoal				#							#
fabrics											#
polystyrene											#
Fibreglass											#

b) Current waste materials site

The area in which earth materials were being dumped at the time of the inspection was examined since this is the fill for the current phase of gravel extraction and the base for the soil when restoration is completed. The nature of the materials being disposed of is shown in Figures 14-20 and some of the materials that were noted are given in Table 1.

Following are observations with respect to the current waste fill area:

1) There are a wide variety of earth materials being disposed of, much with no clear origin. A typical excavation for a Nelson house site or subdivision would produce clean overburden, usually brown in colour, but there appears to be little of this type of earth matter present. Some very light coloured material appears to be 'chalky.' Some of the very dark or black material may be 'ashy' as charcoal was noted to be present and burning was observed to be taking place at the Downer site in Bartlett Road. The texture of the materials range from clay to gravelly. Dark coloured material does not resemble normal topsoil. Because of the diversity of earth materials, available plant nutrients will be variable but probably mostly low.
2) Foreign substances are widespread and of a similar nature to those seen in the pit sites. The presence of some fused, vesicular glassy material suggests an origin from a high temperature process and some baked earth material and charred wood is indicative of burning processes. The presence of asphalt (figures 1A, 19) suggests an origin from road materials.
3) The process of distributing and spreading the dumped materials is causing severe compaction (Figures 24).
4) Foreign objects present in the dumped materials are not being removed but buried with the spreading process (figures 20, 21).
5) Water ponding points to poor drainage within the fill materials, probably resulting from compaction and the introduction of clayey textured materials (Figures 22).

THE UNDISTURBED ORIGINAL SOIL

The undisturbed or original soil (Wai-iti family) as exposed in sections on the western edge of the site (site 12 Figure 12) has a shallow to moderately deep soil profile (between 45-100cm thick) overlying unconsolidated gravel. The topsoil*****(A horizon) has a dark yellowish brown colour, it averages about 20cm thick and it has well-developed soil structure. The subsoil***** (B horizon) colour is yellowish brown to olive brown and the soil structure is weakly developed. The subsoil passes into unconsolidated gravel (C horizon/overburden*****) that is sometimes weakly oxidised with reddish iron oxide staining due to water table movement within the gravel. Wai-iti soils (formerly Waimea soils on the Waimea Plains) were included in Class 1 of the Tasman District Council Classification System for Productive Land. In recent surveys of the soils of the Waimea Plains, they are classed as of moderate to high versatility, with slight limitations for intensive use. Wai-iti soils have a medium to high plant available water, have moderate permeability, have a deep to moderately deep effective rooting depth, have good drainage and are capable of cultivation throughout the year. These are essential elements for a potentially high producing soil.

RESULTS OF CHEMICAL ANALYSES

The heavy metals and polycyclic aromatic hydrocarbon analysis were chosen because of the observable presence of foreign substances likely to be producing contaminants related to these materials. The possible presence of other contaminants such as agrochemicals was not investigated.

The chemical analyses (Appendix 1 and Appendix 2) indicate the presence of contaminants including heavy metals, some at concentrations appreciably above background values, and also the presence of polycyclic aromatic hydrocarbons. These are associated with the foreign materials that have been brought in with the earth fill. (See Appendix 2 Report on contaminants).

SUMMARY OF ATTRIBUTES RELATED TO RESOURCE CONSENT ISSUES

a) Fill

1) The fill materials include a wide range of foreign substances at various concentrations and cannot be described as clean fill.
2) A range of contaminants are present in the form of heavy metals and petroleum products at values sometimes appreciably above 'background' levels measured in the original soil materials. (Appendix 1, & 2).

b) Effect of fill on productivity capacity

The deposited fill materials are detrimental to the short and long term productive capacity of the land.

1) They are of a contrasting textural nature to the upper layer of replaced original soil material. Textural contrasts within a soil profile are inhibiting to plant rooting and downward soil moisture movement.
2) The bluish grey subsurface colours indicate lack of aeration and is a sign of impeded water movement and possible waterlogging, which is restrictive for deep rooting. This may be due to impeded downward movement of water, or to the influence of groundwater when the water table is higher or both.
3) The compaction and consequent increase in soil density provides poor physical conditions for root penetration, soil moisture storage and soil drainage and has lowered the soil production potential.
4) There is a high degree of spatial variability in physical conditions of the subsurface earth material, due to the diversity of dump material and also unevenness of the spreading process (i.e. compaction, earth materials are not uniform). The fertility of the subsurface materials is also likely to be highly variable. This would make intensive crop management difficult, (i.e. irrigation, fertiliser management and nutrient loss, crop yield consistency) due to unpredictable soil variability.
5) What was a well-drained soil has now been replaced with earth material that has inferior physical and drainage properties and which impact on land management and potential crop use.

c & d) Drainage

1) As shown in Figures 13 and 21, there is significant surface and subsurface drainage impairment resulting from compaction and possibly also insufficient land surface gradient.
2) The summer groundwater table at the gravel extraction site (17/3/2017, 14/4/2017 Figures 14, 15) is at a level that will advance into the deposited fill material when the water table rises and will impede subsurface soil drainage.

e) Productive potential

1) The potential productive capacity of the restored soil at Staplegrove Farm, as evaluated by the soil criteria listed in Table 2 below, is assessed as being significantly diminished. The absence of an A horizon (topsoil), shallow and variable thickness of replaced original soil material, absence of soil structure and dense nature of subsurface materials have resulted in diminished water holding capacity, diminished effective soil rooting depth and reduced soil permeability. Properties of the deeper subsurface materials, including heavier soil textures and compaction have restricted the soil profile drainage. Together, all of the above, including an increased degree of soil variability, impose significant limitations for intensive use soil and crop management.

Table 2. Summary of key soil properties in Wai-iti soils and the Replaced Anthropic soils

Soil properties	**Undisturbed-Wai-iti**	**Replaced-Anthropic**
Profile drainage	well drained	imperfect
Profile available water	medium-very high	low
Permeability	moderate	rapid-slow
Trafficability	slight limitations	restricted
Workability	unrestricted	restricted
Waterlogging	negligible	severe
Aeration	unrestricted	restricted
Effective rooting depth	moderately deep-very deep	shallow
Soil horizon definition	distinct	nil
A horizon	distinct	nil
Horizon contrasts	transitional	abrupt
Pan	nil	compaction
Soil structure	moderate	nil/massive
Stoniness	non-very stony	very stony
Clay content	low	medium
Plant nutrients	moderate	low
Soil versatility class	high to moderate	low
Land class suitability (TDC)	A	D

CONCLUDING COMMENTS

a) Fill materials

As noted above, a variety of earth materials are used for back filling and include some foreign materials. It would be difficult to quantify the amount of foreign substances that are present but a guess would be somewhere within the range of 1-5% in some loads. Because of the variety of earth materials imported, not all dump loads contain foreign substances, some being free or with little foreign matter while other loads have higher amounts (for example where asphalt is present). This results in uneven distribution of foreign matter throughout the work site. The variation no doubt reflects the various sources from which the earth materials are derived. Since foreign materials are the likely source of the soil contaminants found in the chemical analyses, the inclusion of such material in the back fill should be avoided.

Removal of foreign materials that are within the already restored Staplegrove land area is probably impractical. It is suggested however, that consideration be given to screening the backfill materials before being brought to the site, in order to avoid this problem.

b) Soil contaminants

The results of the chemical analyses and the appended reports by Dr D Sheppard noted the presence of some contaminating substances. However, a number of the fill material samples that were analysed showed no evidence of the presence of contaminants above what is present in the undisturbed or original soil materials. Samples that did show elevated contaminant were related to the presence of foreign materials and are localised rather than being disseminated throughout the whole site.

c) Drainage

The impeded drainage conditions in the restored land is attributable to compaction of earth materials during the process of backfilling and returning the original soil onto the new land surface, while the introduction of heavier textured, less freely draining earth materials that now form the soil subsurface is a contributory factor. Avoidance of compaction during soil stripping, gravel extraction and land restoration is essential to minimise soil drainage problems. For the most part, this can be achieved by using a strip-extraction method rather than an open cast technique. Deep ripping within the restored land area should be considered as a way of lessening the present drainage impediment.

d) Land productivity

Wai-iti soils, because of their intrinsic properties related to their youthful age, present great difficulty in retaining their productive capacity throughout any process of removal then replacement. Key attributes including soil structural integrity, soil hydrological characteristics, soil biological signature and soil rooting depth are inevitably compromised. Avoidance of soil compaction, restoring separate soil horizons and maintaining a minimum thickness of 75cm above underlying fill would go some way towards minimising potential productivity loss.

APPENDIX 1. RESULTS OF LABORATORY ANALYSES

Hill Laboratories
TRIED, TESTED AND TRUSTED

R J Hill Laboratories Limited
1 Clyde Street Hamilton 3216
Private Bag 3205
Hamilton 3240 New Zealand

T 0508 HILL LAB (44 555 22)
T +64 7 858 2000
E mail@hill-labs.co.nz
W www.hill-laboratories.com

ANALYSIS REPORT

Client:	Land & Soil Consultancy Services	**Lab No:**	1754302 SPv1
Contact:	Iain Campbell	**Date Received:**	06-Apr-2017
	C/- Land & Soil Consultancy Services	**Date Reported:**	24-Apr-2017
	46 Somerset Terrace	**Quote No:**	84518
	Stoke	**Order No:**	
	Nelson 7011	**Client Reference:**	
		Submitted By:	Iain Campbell

Sample Type: Soil

Sample Name:		SG 1 Random Fill 21-Mar-2017	SG 2 Random Fill 21-Mar-2017	SG 3 Random Fill 21-Mar-2017	SG 4 Random Fill 21-Mar-2017	SG 5 Pit 1 Subsurfacefill 21-Mar-2017
Lab Number:		1754302.1	1754302.2	1754302.3	1754302.4	1754302.5
Individual Tests						
Dry Matter	g/100g as rcvd	93	90	85	91	85
Fraction >/= 2 mm*	g/100g dry wt	82.4	76.5	83.8	86.2	86.5
Fraction < 2 mm*	g/100g dry wt	17.6	23.5	16.2	13.8	13.5
Total Carbon*	g/100g dry wt	-	-	-	-	2.0
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	20	12	7	12	6
Total Recoverable Cadmium	mg/kg dry wt	0.23	0.30	0.18	0.16	0.12
Total Recoverable Chromium	mg/kg dry wt	57	45	62	49	66
Total Recoverable Copper	mg/kg dry wt	48	43	36	47	32
Total Recoverable Lead	mg/kg dry wt	18.4	31	19.3	250	23
Total Recoverable Nickel	mg/kg dry wt	41	36	47	61	87
Total Recoverable Zinc	mg/kg dry wt	106	124	99	140	82
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Acenaphthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03
Acenaphthylene	mg/kg dry wt	0.04	0.16	< 0.03	0.05	< 0.03
Anthracene	mg/kg dry wt	< 0.03	0.05	< 0.03	0.05	0.06
Benzo[a]anthracene	mg/kg dry wt	< 0.03	0.26	0.03	0.18	0.21
Benzo[a]pyrene (BAP)	mg/kg dry wt	< 0.03	0.35	0.04	0.24	0.22
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	< 0.03	0.58	0.05	0.35	0.28
Benzo[g,h,i]perylene	mg/kg dry wt	< 0.03	0.31	< 0.03	0.19	0.12
Benzo[k]fluoranthene	mg/kg dry wt	< 0.03	0.25	< 0.03	0.13	0.13
Chrysene	mg/kg dry wt	< 0.03	0.30	0.03	0.17	0.18
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.03	0.04	< 0.03	0.04	0.03
Fluoranthene	mg/kg dry wt	0.06	1.07	0.07	0.59	0.57
Fluorene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	< 0.03	0.04
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	< 0.03	0.24	0.03	0.19	0.14
Naphthalene	mg/kg dry wt	0.20	0.21	< 0.14	< 0.13	< 0.13
Phenanthrene	mg/kg dry wt	0.03	0.32	0.03	0.27	0.28
Pyrene	mg/kg dry wt	0.06	1.15	0.07	0.58	0.52
Total Petroleum Hydrocarbons in Soil						
C7 - C9	mg/kg dry wt	< 8	< 8	< 8	< 8	-
C10 - C14	mg/kg dry wt	< 20	22	< 20	63	-
C15 - C36	mg/kg dry wt	61	114	< 40	4,700	-
Total hydrocarbons (C7 - C36)	mg/kg dry wt	< 70	136	< 70	4,700	-

ilac-MRA IANZ ACCREDITED LABORATORY

This Laboratory is accredited by International Accreditation New Zealand (IANZ), which represents New Zealand in the International Laboratory Accreditation Cooperation (ILAC). Through the ILAC Mutual Recognition Arrangement (ILAC-MRA) this accreditation is internationally recognised.
The tests reported herein have been performed in accordance with the terms of accreditation, with the exception of tests marked *, which are not accredited.

Sample Type: Soil						
	Sample Name:	SG 6 Pit 2 Subsurfacefill 21-Mar-2017	SG 7 Pit 2 Topsoil 0-35cm 21-Mar-2017	SG 8 Pit 3 Subsurfacefill 21-Mar-2017	SG 9 Pit 4 Subsurfacefill 21-Mar-2017	SG 10 Pit 5 Subsurfacefill 21-Mar-2017
	Lab Number:	1754302.6	1754302.7	1754302.8	1754302.9	1754302.10
Individual Tests						
Fraction >/= 2 mm*	g/100g dry wt	81.1	87.3	94.2	87.8	86.9
Fraction < 2 mm*	g/100g dry wt	18.9	12.7	5.8	12.2	13.1
Total Carbon*	g/100g dry wt	3.6	0.92	4.1	2.6	3.2
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	4	5	7	5	18
Total Recoverable Cadmium	mg/kg dry wt	0.12	0.10	0.30	0.12	0.20
Total Recoverable Chromium	mg/kg dry wt	76	63	71	93	113
Total Recoverable Copper	mg/kg dry wt	28	24	39	37	58
Total Recoverable Lead	mg/kg dry wt	10.6	9.2	42	19.7	25
Total Recoverable Nickel	mg/kg dry wt	113	81	92	125	86
Total Recoverable Zinc	mg/kg dry wt	68	55	111	80	125

	Sample Name:	SG 11 Pit 6 Subsurfacefill 22-Mar-2017	SG 12 Pit 7 Subsurfacefill 22-Mar-2017	SG 13 Pit 8 Subsurfacefill 22-Mar-2017	SG 14 Pit 8 Topsoil 0-35cm 22-Mar-2017	SG 15 Pit 9 Subsurfacefill 22-Mar-2017
	Lab Number:	1754302.11	1754302.12	1754302.13	1754302.14	1754302.15
Individual Tests						
Dry Matter	g/100g as rcvd	84	78	82	-	84
Fraction >/= 2 mm*	g/100g dry wt	83.8	80.9	93.4	81.4	95.0
Fraction < 2 mm*	g/100g dry wt	16.2	19.1	6.6	18.6	5.0
Total Carbon*	g/100g dry wt	3.1	6.4	2.4	0.84	2.3
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	7	10	8	3	16
Total Recoverable Cadmium	mg/kg dry wt	0.23	0.25	0.16	< 0.10	0.16
Total Recoverable Chromium	mg/kg dry wt	40	41	220	63	45
Total Recoverable Copper	mg/kg dry wt	42	69	38	23	38
Total Recoverable Lead	mg/kg dry wt	22	31	25	9.1	26
Total Recoverable Nickel	mg/kg dry wt	46	37	187	87	53
Total Recoverable Zinc	mg/kg dry wt	130	114	90	56	96
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Acenaphthene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	-	< 0.03
Acenaphthylene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	-	< 0.03
Anthracene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	-	< 0.03
Benzo[a]anthracene	mg/kg dry wt	0.07	< 0.03	0.04	-	0.18
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.09	< 0.03	0.06	-	0.20
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.11	< 0.03	0.08	-	0.23
Benzo[g,h,i]perylene	mg/kg dry wt	0.06	< 0.03	0.04	-	0.10
Benzo[k]fluoranthene	mg/kg dry wt	0.05	< 0.03	0.04	-	0.08
Chrysene	mg/kg dry wt	0.07	< 0.03	0.05	-	0.16
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	-	< 0.03
Fluoranthene	mg/kg dry wt	0.17	0.06	0.13	-	0.36
Fluorene	mg/kg dry wt	< 0.03	< 0.03	< 0.03	-	< 0.03
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.07	< 0.03	0.05	-	0.12
Naphthalene	mg/kg dry wt	< 0.13	< 0.15	< 0.13	-	< 0.13
Phenanthrene	mg/kg dry wt	0.07	< 0.03	0.06	-	0.07
Pyrene	mg/kg dry wt	0.16	0.05	0.11	-	0.35

	Sample Name:	SG 16 Pit 9 Subsurfacefill 22-Mar-2017	SG 17 Pit 10 Subsurfacefill 22-Mar-2017	SG 18 Pit 10 Subsurfacefill 22-Mar-2017	SG 19 Pit 11 Undisturbed Soil 0-50cm 22-Mar-2017	SG 20 Random Surfacefill 22-Mar-2017
	Lab Number:	1754302.16	1754302.17	1754302.18	1754302.19	1754302.20
Individual Tests						
Dry Matter	g/100g as rcvd	85	-	86	-	92
Fraction >/= 2 mm*	g/100g dry wt	88.4	90.5	88.3	70.0	87.3
Fraction < 2 mm*	g/100g dry wt	11.6	9.5	11.7	30.0	12.7

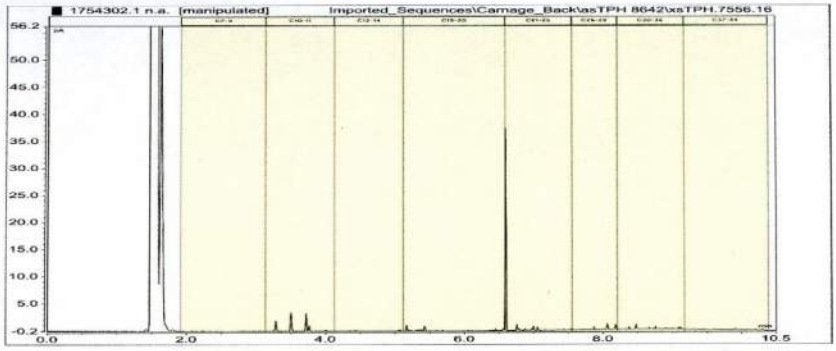
Sample Type: Soil						
Sample Name:		SG 16 Pit 9 Subsurfacefill 22-Mar-2017	SG 17 Pit 10 Subsurfacefill 22-Mar-2017	SG 18 Pit 10 Subsurfacefill 22-Mar-2017	SG 19 Pit 11 Undisturbed Soil 0-50cm 22-Mar-2017	SG 20 Random Surfacefill 22-Mar-2017
Lab Number:		1754302.16	1754302.17	1754302.18	1754302.19	1754302.20
Individual Tests						
Total Carbon*	g/100g dry wt	2.6	2.2	4.1	0.95	6.1
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	17	7	6	3	48
Total Recoverable Cadmium	mg/kg dry wt	< 0.10	0.13	0.13	< 0.10	0.31
Total Recoverable Chromium	mg/kg dry wt	53	41	44	47	66
Total Recoverable Copper	mg/kg dry wt	46	38	31	22	85
Total Recoverable Lead	mg/kg dry wt	24	18.0	34	10.2	65
Total Recoverable Nickel	mg/kg dry wt	59	50	45	59	43
Total Recoverable Zinc	mg/kg dry wt	114	79	91	55	220
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Acenaphthene	mg/kg dry wt	< 0.03	-	< 0.03	-	< 0.03
Acenaphthylene	mg/kg dry wt	0.03	-	< 0.03	-	0.05
Anthracene	mg/kg dry wt	< 0.03	-	< 0.03	-	0.07
Benzo[a]anthracene	mg/kg dry wt	0.11	-	0.07	-	0.09
Benzo[a]pyrene (BAP)	mg/kg dry wt	0.17	-	0.09	-	0.09
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	0.22	-	0.12	-	0.17
Benzo[g,h,i]perylene	mg/kg dry wt	0.12	-	0.05	-	0.05
Benzo[k]fluoranthene	mg/kg dry wt	0.08	-	0.05	-	0.05
Chrysene	mg/kg dry wt	0.11	-	0.07	-	0.09
Dibenzo[a,h]anthracene	mg/kg dry wt	< 0.03	-	< 0.03	-	< 0.03
Fluoranthene	mg/kg dry wt	0.29	-	0.17	-	0.34
Fluorene	mg/kg dry wt	< 0.03	-	< 0.03	-	0.09
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	0.12	-	0.06	-	0.08
Naphthalene	mg/kg dry wt	< 0.13	-	< 0.13	-	0.18
Phenanthrene	mg/kg dry wt	0.09	-	0.06	-	0.42
Pyrene	mg/kg dry wt	0.27	-	0.17	-	0.32

Sample Name:		SG 21 Random Fill 22-Mar-2017	SG 22 Random Fill 22-Mar-2017	SG 23 Random Fill 22-Mar-2017	SG 24 Random Fill 22-Mar-2017	SG 25 Random Fill 22-Mar-2017
Lab Number:		1754302.21	1754302.22	1754302.23	1754302.24	1754302.25
Individual Tests						
Dry Matter	g/100g as rcvd	-	-	-	96	95
Fraction >/= 2 mm*	g/100g dry wt	75.2	78.1	71.9	73.5	86.2
Fraction < 2 mm*	g/100g dry wt	24.8	21.9	28.1	26.5	13.8
Total Carbon*	g/100g dry wt	5.6	2.1	0.50	1.40	2.0
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	12	6	3	6	7
Total Recoverable Cadmium	mg/kg dry wt	0.46	0.14	< 0.10	0.11	0.16
Total Recoverable Chromium	mg/kg dry wt	66	49	20	38	45
Total Recoverable Copper	mg/kg dry wt	52	28	19	40	37
Total Recoverable Lead	mg/kg dry wt	17.9	10.5	14.3	18.3	23
Total Recoverable Nickel	mg/kg dry wt	57	71	15	25	41
Total Recoverable Zinc	mg/kg dry wt	131	65	54	96	109
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Acenaphthene	mg/kg dry wt	-	-	-	< 0.03	< 0.03
Acenaphthylene	mg/kg dry wt	-	-	-	< 0.03	0.26
Anthracene	mg/kg dry wt	-	-	-	< 0.03	0.21
Benzo[a]anthracene	mg/kg dry wt	-	-	-	0.05	1.07
Benzo[a]pyrene (BAP)	mg/kg dry wt	-	-	-	0.07	1.37
Benzo[b]fluoranthene + Benzo[j] fluoranthene	mg/kg dry wt	-	-	-	0.09	1.85
Benzo[g,h,i]perylene	mg/kg dry wt	-	-	-	0.05	0.96
Benzo[k]fluoranthene	mg/kg dry wt	-	-	-	0.04	0.68
Chrysene	mg/kg dry wt	-	-	-	0.05	0.86

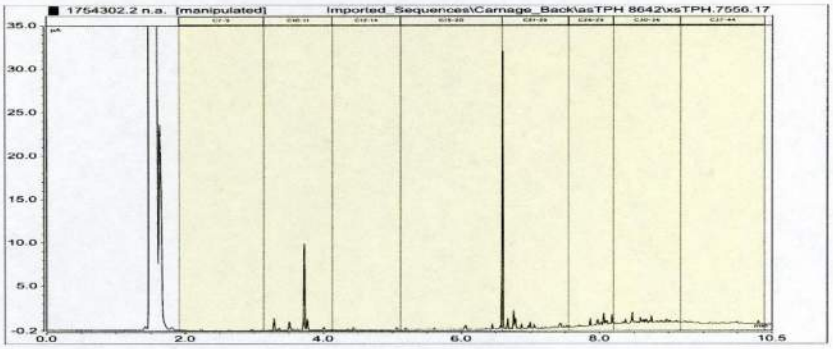
Sample Type: Soil						
	Sample Name:	SG 21 Random Fill 22-Mar-2017	SG 22 Random Fill 22-Mar-2017	SG 23 Random Fill 22-Mar-2017	SG 24 Random Fill 22-Mar-2017	SG 25 Random Fill 22-Mar-2017
	Lab Number:	1754302.21	1754302.22	1754302.23	1754302.24	1754302.25
Polycyclic Aromatic Hydrocarbons Screening in Soil						
Dibenzo[a,h]anthracene	mg/kg dry wt	-	-	-	< 0.03	0.28
Fluoranthene	mg/kg dry wt	-	-	-	0.13	2.3
Fluorene	mg/kg dry wt	-	-	-	< 0.03	0.05
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	-	-	-	0.05	1.43
Naphthalene	mg/kg dry wt	-	-	-	< 0.12	< 0.12
Phenanthrene	mg/kg dry wt	-	-	-	0.04	0.83
Pyrene	mg/kg dry wt	-	-	-	0.13	2.2

	Sample Name:	SG 26 Random Fill 22-Mar-2017				
	Lab Number:	1754302.26				
Individual Tests						
Fraction >/= 2 mm*	g/100g dry wt	66.3	-	-	-	-
Fraction < 2 mm*	g/100g dry wt	33.7	-	-	-	-
Total Carbon*	g/100g dry wt	4.3	-	-	-	-
Heavy Metals, Screen Level						
Total Recoverable Arsenic	mg/kg dry wt	6	-	-	-	-
Total Recoverable Cadmium	mg/kg dry wt	0.21	-	-	-	-
Total Recoverable Chromium	mg/kg dry wt	32	-	-	-	-
Total Recoverable Copper	mg/kg dry wt	32	-	-	-	-
Total Recoverable Lead	mg/kg dry wt	49	-	-	-	-
Total Recoverable Nickel	mg/kg dry wt	37	-	-	-	-
Total Recoverable Zinc	mg/kg dry wt	89	-	-	-	-

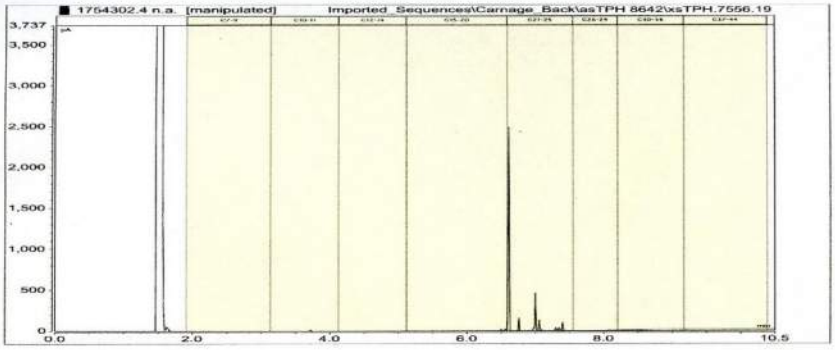
1754302.1
SG 1 Random Fill 21-Mar-2017
Client Chromatogram for TPH by FID



1754302.2
SG 2 Random Fill 21-Mar-2017
Client Chromatogram for TPH by FID



1754302.4
SG 4 Random Fill 21-Mar-2017
Client Chromatogram for TPH by FID



Analyst's Comments

Carbon particulates were observed in the matrix of sample 1754302.1 and .2 and this has absorbed some of the System Monitoring Compounds in the PAH, e.g. the recovery of Anthracene-d10 was 7% and 32% respectively. Therefore the results presented for these analytes may not represent the actual concentration in the sample.

SUMMARY OF METHODS

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.

Sample Type: Soil

Test	Method Description	Default Detection Limit	Sample No
TPH Oil Industry Profile + PAHscreen	Sonication in DCM extraction, SPE cleanup, GC-FID & GC-MS analysis. Tested on as received sample. US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:5786,2805,10734;2695]	0.010 - 60 mg/kg dry wt	1-4
Heavy Metals, Screen Level	Dried sample, < 2mm fraction. Nitric/Hydrochloric acid digestion US EPA 200.2. Complies with NES Regulations. ICP-MS screen level, interference removal by Kinetic Energy Discrimination if required.	0.10 - 4 mg/kg dry wt	1-26
Polycyclic Aromatic Hydrocarbons Screening in Soil	Sonication extraction, Dilution or SPE cleanup (if required), GC-MS SIM analysis (modified US EPA 8270). Tested on as received sample. [KBIs:5786,2805,2695]	0.010 - 0.05 mg/kg dry wt	5, 11-13, 15-16, 18, 20, 24-25

Sample Type: Soil			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Dry Matter (Env)	Dried at 103°C for 4-22hr (removes 3-5% more water than air dry) , gravimetry. US EPA 3550. (Free water removed before analysis).	0.10 g/100g as rcvd	1-5, 11-13, 15-16, 18, 20, 24-25
Environmental Solids Sample Preparation	Air dried at 35°C.	-	1-26
Fraction >/= 2 mm*	Calculation: 100% - % < 2.00 mm sieve fraction.	0.1 g/100g dry wt	1-26
Fraction < 2 mm*	2.00 mm sieve, gravimetry.	0.1 g/100g dry wt	1-26
Total Carbon*	Catalytic Combustion (900°C, O_2), separation, Thermal Conductivity Detector [Elementar Analyser].	0.05 g/100g dry wt	5-26

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

This report must not be reproduced, except in full, without the written consent of the signatory.

Ara Heron BSc (Tech)
Client Services Manager - Environmental

APPENDIX 2. GEOCHEMICAL REPORTS

Geochemical Solution

Dr Doug Sheppard (Geochemist)

27 Natusch Road

Belmont

Lower Hutt

d.sheppardnz@gmail.com

Report 1

I have examined the chemical analyses of soils and fill material carried out by Hill Laboratories on samples from the Staplegrove Farm Gravel extraction Site, Waimea West, Tasman, as provided by Dr Iain Campbell of Land and Soil Consultancy Services. I have also been supplied with a draft of his report.

I have divided the sample set into three types of sample:

1. Undisturbed soil from 0 to 15 cm depth in Pit 11 (SG19) and clean, original topsoil Pit 2 (SG7) at 0 to 35 cm depth and Pit 8 (SG14) also at 0 to 35 cm depth.
2. "Random fill" samples collected on 21 March 2017 (SG1 to SG4) and "Random Surface fill" samples collected on 22 March 2017.
3. Subsurface fill samples taken at various depths within pits of up to 2.5m depth (SG5, 6, 8 to 13, 15 to 18).

The undisturbed soils are here used to provide baseline chemical compositions against which to compare the fill sample compositions.

Heavy Metals

Metal	Type 1 average mg/kg	Type 2 average mg/kg	Type 3 average mg/kg
(Total Recoverable fraction)	Baseline soils (3 samples)	Fresh fill (11 samples)	Subsurface fill (12 samples)
As	4	13 (48 max.)	10 (18 max.)
Cd	<0.10	0.19 (0.46 max.)	0.16 (0.30 max.)
Cr	57	48 (66 max.)	75 (220 max.)
Cu	23	42 (85 max.)	41 (69 max.)
Pb	9.5	47 (250 max.)	25 (42 max.)
Ni	76	43 (71 max.)	85 (187 max.)
Zn	55	112 (140 max.)	98 (130 max.)

The analytical method for the metals involves analysing the solution that results from crushing a sample and exposing to an acid mixture. This method does not indicate total amounts of the metals in the sample, but what may be regarded as being potentially easily mobilised or available to organisms.

As can be seen from this table, the fill materials (Types 2 and 3) have, on average, significantly more of five of the extractable metals, when compared to the relatively undisturbed, baseline sample soils (Type 1). The averages of the extractable chromium and nickel concentrations are lower in the fresh fill samples than the baseline samples and only slightly higher in the subsurface fill samples.

While most arsenic concentrations are less than 10 mg/kg in the fill materials it is at 48 mg/kg in sample SG20.

Cadmium is high in three samples (SG21 0.46 mg/kg, 0.31 mg/kg in SG20 and 0.30 mg/kg SG2, compared to less than 0.10 average for undisturbed soils). These samples also have relatively high zinc concentrations and cadmium is a normal contaminant of zinc metal as they have similar chemical properties in geochemical and metal refining environments.

Chromium is in remarkably high concentration in one sample (220 mg/kg in SG13 compared to the 57 mg/kg average in the baseline samples) and also elevated concentration in another (113 mg/kg in SG10). Copper is at its highest concentration in SG20 at 85 mg/kg, at about 3 times the baseline concentration but is generally about double the baseline, quite consistently.

Lead shows a very high level in the fill material sampled as SG4, at 250 mg/kg which is more than 25 times the baseline average concentration of 9.5 mg/kg. This is very much an outlier as most samples have about twice the baseline concentrations.

Zinc has been detected at two to three times the baseline concentrations in several samples with a maximum of 140 mg/kg in SG4. Zinc is generally twice the baseline concentration in the fill materials.

The fill material is, or is intended to be, buried below soil in an agricultural environment. However, Dr Campbell considers that there is evidence that the water table is high in this area and has observed that rainwater ponds on the surface due to poor drainage through the site. Anaerobic conditions are likely in such conditions and are suggested from his observations. Under these conditions, and particularly if the groundwater level fluctuates and hence transitory oxidizing conditions can exist, then concentration of these metals into zones is possible, particularly for arsenic, and mercury if present. Such reactions depend on the nature of the compounds in which the metals exist as well as the chemical and physical conditions present.

In general, the levels of most of the metals in some of the fill material is near to, or exceeds, levels which some guidelines consider should trigger further investigation for agricultural soils.

Polycyclic Aromatic Hydrocarbons

PAHs are organic molecules derived from coal deposits and they are also produced by the incomplete combustion of petroleum oils and fuels and of other organic matter in engines and incinerators, or when biomass burns in fires. They are commonly found in soils and sediments which drain industrial and busy roaded areas, gas works, coal processing facilities etc. Some levels of some components in the analysed fill materials are of concern when compared to ANZECC guidelines – e.g. pyrene at 1.15 mg/kg in SG2, the benzo- compounds and pyrene and fluoranthene in SG25. These measurements would indicate that further sampling and analysis is required of the types of fill from which these samples were obtained.

The fill from SG2 and SG4 had elevated petroleum hydrocarbon levels, particularly the latter sample. Only four samples were analysed for these and three of them showed evidence of longer chain oils. This suggests that fill materials contain oil or asphalt.

Concluding comments

It is evident from the chemical analyses that the fill materials, when compared to original, clean soils, are contaminated with heavy metals and organic materials.

I consider that there is sufficient indication of contaminated fill being, and having been, deposited. One implication of this is that there is a strong possibility of other chemicals of concern being present, such as agricultural chemicals. I consider that it would be wise to screen for these, particularly as there are indications that the fill material is exposed to groundwater movement and so has the potential to carry contamination beyond the immediate site.

Geochemical Solutions

Dr Doug Sheppard (Geochemist)

27 Natusch Road

Belmont

Lower Hutt

d.sheppardnz@gmail.com

Report 2: comparison of analytical results with accepted environmental guidelines

I have examined the chemical analyses of soils and fill material carried out by Hill Laboratories on samples from the Staplegrove Farm Gravel extraction Site, Waimea West, Tasman, as provided by Dr Iain Campbell of Land and Soil Consultancy Services. In my first report to Iain I analysed the results of the chemical analyses that he had had carried out. I divided the sample set into three types of sample:

1. Undisturbed soil
2. "Random fill" samples and "Random Surface fill" samples
3. Subsurface fill samples

The undisturbed soils were used to provide baseline chemical compositions against which to compare the fill sample compositions. The results of that ordering of the data were summarised on the following table for the Heavy Metals**.**

Metal	Type 1 average mg/kg	Type 2 average mg/kg	Type 3 average mg/kg
(Total Recoverable fraction)	Baseline soils (3 samples)	Fresh fill (11 samples)	Subsurface fill (12 samples)
As	4	13 (48 max.)	10 (18 max.)
Cd	<0.10	0.19 (0.46 max.)	0.16 (0.30 max.)
Cr	57	48 (66 max.)	75 (220 max.)
Cu	23	42 (85 max.)	41 (69 max.)
Pb	9.5	47 (250 max.)	25 (42 max.)
Ni	76	43 (71 max.)	85 (187 max.)
Zn	55	112 (220* max.)	98 (130 max.)

**Reported incorrectly in my first report*

Table 1 Average heavy metal concentrations and maximum concentrations from soils and fill from the Staplegrove Farm site

Samples taken were not random. Dr Campbell targeted samples which contained materials which contained materials which were not normal rock and soil, i.e. were visibly contaminated, as well as the three clean samples for baseline comparison purposes. The purpose of this report is to illustrate, from the data available, what some of the chemical contaminants are, at what sort of concentration and how these compare with some relevant guidelines which are likely to be used by consenting authorities.

The analytical data can be compared with guideline values accepted by New Zealand authorities to assess the seriousness of any contamination found, in terms of expected land-use. I have used the Canadian CCME guidelines as these are recommended by MoE in their document *Contaminated Land Management Guidelines No.2: Hierarchy and Application in New Zealand of Environmental Guideline Values (Revised 2011). Ministry for the Environment, 2011.* I have formulated the following table to more easily allow assessments to be made. The following table shows the guideline limits in mg/kg dry weight.

Metal	Agriculture mg/kg	Residential mg/kg	Commercial mg/kg	Industrial mg/kg	% at or above agricultural limit	Range mg/kg
Arsenic	12	12	12	12	35	4 to 48
Cadmium	1.4	10	22	22	0	<0.10 to 0.46
Chromium	64	64	87	87	35	20 to 220
Copper	63	63	91	91	9	19 to 85
Lead	70	140	260	600	4	9.1 to 250
Nickel	45	45	89	89	70	15 to 187
Zinc	200	200	360	360	4	54 to 220

Table 2: Analytical results for heavy metals compared with CCME guideline values for use in areas with different land-use.

It is evident that a large fraction of the samples exceed the guideline values for Arsenic, Chromium and especially for Nickel. However, the Nickel results may need to be disregarded except for the highest as the baseline samples themselves all exceed the guideline limits, and may indicate a source which is in the local gravels and soils themselves. The outliers (e.g. the 250 mg/kg Lead result) indicate that there are some components in specific areas and layers of the fill which are significantly contaminated.

Polycyclic Aromatic Hydrocarbons

The guidelines that I have used to compare the analytical results with are the Canadian CCME 2008 (revised 2010) guidelines for Polyaromatic Hydrocarbons (PAH), and are in the set of such guidelines listed as suitable for use by our Ministry for the Environment.

The use of these guidelines for PAHs are complicated by the need to separately assess carcinogenic and non-carcinogenic effects on human health from contact with both contaminated soil and potable water resources, and those for the non-carcinogenic effects for the protection of environmental health. Given the nature of the site and its likely future use, I have evaluated the analytical results only for the last of these i.e. the non-carcinogenic effects for the protection of environmental health. If the land-use (and any

derived groundwater) is to be used where human contact with them is possible, then the situation will need to be re-evaluated for carcinogenic risk.

PAH compound	Agriculture mg/kg	Residential mg/kg	Commercial mg/kg	Industrial mg/kg	% at or above agricultural limit	Range mg/kg
Anthracene	2.5	2.5	32	32	0	<0.03 to 0.21
Benzo[a]pyrene	20	20	72	72	0	<0.03 to 1.37
Fluoranthene	50	50	180	180	0	0.06 to 2.3
Naphthalene	0.013	0.013	0.013	0.013	>23*	<0.12 to 0.21
Phenanthrene	0.046	0.046	0.046	0.046	77	0.03 to 0.83
Benz[a]anthracene	0.1	1	10	10	46	<0.03 to 1.07
Benzo[b] fluoranthene	0.1	1	10	10		Not resolved**
Benzo[k] fluoranthene	0.1	1	10	10	31	<0.03 to 0.68
Benzo[b+j+k] fluoranthene	0.1	1	10	10	77	<0.06 to 2.53
Dibenz[a,h] anthracene	0.1	1	10	10	15	<0.03 to 0.28
Indeno[1,2,3-c,d] pyrene	0.1	1	10	10	39	<0.03 to 1.43
Pyrene	0.1	10	100	100	92	0.05 to 2.2

*The detection limits for Naphthalene analysis are high compared to the guideline limit. It is possible that all of the samples are above this limit: the sensitivity of the analysis compared with the guideline value does not allow any other conclusion.

** Benzo[b]fluoranthene was not analysed separately by Hill Laboratories; it is included in the Benzo[b+j+k]fluoranthene line.

It is evident from this analysis that the fill samples are significantly in excess of the guideline values for a number of PAH compounds when compared to the guidelines for agricultural use; to some extent for

residential or parkland use; and slightly for industrial or commercial use. However, the samples analysed for PAH were those which contained observable asphalt-like materials.

This analysis shows that some of the material in the fill materials has concentrations of several components in excess of one relevant set of guideline values for agricultural use in soils. The extent to which this is an issue needs to be evaluated in view of the risk of buried contaminants becoming available to plants, animals and humans, through physical or chemical mobilisation in the soils themselves or through the medium of ground- and surface waters.

31 May 2017

Figure 1 A

Pit 1. top left, soil profile;
top right, trench cross section;
right, asphalt waste material.

Figure 1B

Figure 1C

Figure 2A

Pit 2. above left, soil profile;
above right, trench cross section;
right, waste materials.

Figure 2B

Figure 2C

Figure 3A

Pit 3. Top left, soil profile;
top right, trench cross section;
right, waste material.

Figure 3B

Figure 3C

Figure 4A

Pit 4. Above left, soil profile;
above right, trench cross section;
right, black material including asphalt and charcoal.

Figure 4B

Figure 4C

Figure 5A

Figure 5B

Figure 5C

Pit 5. Top left, soil profile top right, trench cross section; right, waste materials.

Figure 6A

Figure 6B

Figure 6C

Pit 6, above left, soil profile; above right, trench cross section; right, concrete & plastic waste materials.

Figure 7 A

Figure 7B

Figure 7C

Pit 7. top left, soil profile
top right, trench cross section
right, metal and concrete waste materials

Figure 8B

Figure 8A

Figure 8C

Pit 8. above left, soil profile
above right, trench cross section
right, plastic, concrete & asphalt waste

Figure 9A

Pit 9. top left soil profile, top right, trench cross section right, concrete waste material

Figure 9B

Figure 9C

Figure 10A

Pit 10. above left soil profile, above right, trench cross section, right plastic, brick, concrete & wood waste material.

Figure 10B

Figure 10C

Figure 12. Undisturbed original soil

Figure 13. Water ponding on restored land.

Figure 14. Excavation and backfilling.

Figure 15. Backfill showing the variety of materials being deposited.

Figure 16. Backfill showing materials being deposited.

Figure 17. Foreign material.

Figure 18. Foreign material.

Figure 19. Foreign material, asphalt

Figure 20. Earth spreading and compaction.

Figure 21. Spreading compaction and drainage impairment.

BEFORE AN INDEPENDENT HEARINGS COMMISSIONER AT NELSON

COUNCIL REF: RM200488, RM200489 AND RM220578

UNDER THE	Resource Management Act 1991
IN THE MATTER OF	Land use consent applications by CJ Industries Limited to extract gravel from 134 Peach Island Road, Motueka from the berm of the Motueka River and on the landward side of the stopbank at Peach Island with vehicle access via a right of way over 493 Motueka River West Bank Road, Crown land and unformed legal road (RM200488 and RM200489); and discharge permit application by CJ Industries Limited to discharge contaminants to land from backfill material associate with the proposed gravel extraction (RM220578)

STATEMENT OF EVIDENCE OF PETER JOHN TAIA ON BEHALF OF VALLEY RESIDENTS AGAINST GRAVEL EXTRACTION (LANDSCAPE PLANTING / MITIGATION)

Dated: 11 November 2022

QUALIFICATIONS AND EXPERIENCE

1. My full name is Peter John Taia. I have worked as a self-employed nurseryman for 15 years providing plants and personalised landscape design services including planting, planning and advice for projects large and small within and outside of the Motueka area. I have a Certificate in Horticultural Practice.

2. I have lived in the Motueka Valley for 15 years. I have considerable experience with the conditions in this area, and I also have over two decades experience with landscape planning and planting.

3. I have provided services and plants in the local area for a number of consented developments including provision of planting services and implementation of landscape plans for 10 or more years. I have supplied plants for some Canopy (now Boffa Miskell) designed plans in the past.

4. I live and operate my native plant nursery business, Westbank Natives at 370 Motueka River Westbank Road, Motueka.

CODE OF CONDUCT

5. I have lodged a submission opposing the proposed land use and discharge applications and therefore I acknowledge I am not independent. However, I have read the Code of Conduct for Expert Witnesses in the Environment Court Note 2014 and I agree to comply with it. My evidence is within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed in my evidence.

SCOPE OF EVIDENCE

6. My evidence discusses the mitigation planting CJ Industries Limited (CJs) propose as part of the quarry development at 134 Peach Island Road.

EXECUTIVE SUMMARY

7. In my view, it is very unlikely that the mitigation planting proposed by Canopy will successfully establish in the Stage 1 area. This area is outside the stopbank in a flood plain. It is well draining and is either too dry for the proposed species to establish in the

proposed 6-year period, or the area is subject to frequent flooding which will inhibit effective root development and prevent them from establishing.

8. Some of the species identified by Canopy are deciduous and would not provide effective visual screening in winter months.

CJ'S PROPOSAL

9. CJs propose to carry out gravel extraction in the Stage 2 and 3 areas first before moving into Stage 1. This is to allow landscape mitigation planting around the Stage 1 area to establish prior to quarrying activities in that area commencing.

10. I have reviewed the Landscape graphic attachment (13 July 2022) and the 2022 Canopy landscape mitigation plan proposed by Liz Gavin for the CJ Industries application. I have read the Landscape Evidence submitted by Ms Gavin on 15 July 2022.

11. I understand the Canopy plan is for the mitigation of visual impacts associated with the establishment of a proposed quarrying activity at 134 Peach Island Road.

12. I understand the Canopy plan also outlines a suggested river terrace restoration of a portion of the stage 1 area following the gravel extraction from that area.

13. The report is dated 13 July 2022 which is mid-winter, though the photos attached by Ms Gavin are clearly all taken much earlier in the year. All of the trees and vegetation on site have full leaf-cover. 95% or more of the existing vegetation on stage 1 and surrounding orchard trees, including orchard shelter belts are deciduous species and are bare for up to five months of the year. This provides a very low level of visual mitigation for residents on Westbank Road for four-five winter months of the year.

14. 27 photos included in the Canopy report show the site from various heights, distances and angles which serves to only represent the views observed for approximately 7 months of the year. As for the remaining months from late autumn through winter, almost all vegetation is absent.

15. My view is that this plan presented is a concept plan only as there is no detail of a planting plan or individual species numbers. There is a mention of PB18 grades, which I believe is a 10L volume potted grade, which costs $25 minimum each at a wholesale rate. These, depending on the species concerned would be a significant expense for the scale and expected duration of this planting, considering the flooding risks that present

because of the location in the floodplain. It is not specified what species or number are suggested to be planted at that grade size.

MITIGATION PLANTING PROPOSED

16. Landscaping is proposed to be undertaken on the site within the first full planting season available following the grant of consent. This is to provide screening to mitigate the visual effects of quarrying activities. Ms Gavin's evidence discusses planting along the periphery of extraction areas and the haul road, and Stage 1 is proposed to be replanted with native 'river terrace' species following completion of the Stage 1 works. I understand this is intended to provide for visual amenity and ecological betterment.

17. The landscape assessment suggests the Stage 1 area is considerably altered and does not represent the original character of the locality. In my view the historical alteration, whether purposely altered or naturally changed, of both river and berm lands over time requires the site to continue to be maintained if not managed as a floodplain, particularly now as we are subjected to heavy rain events more frequently and intensely. The Tasman District Council (TDC) is currently working with landowners to reduce the vegetation that impedes or inhibits water flow from the flood plain during flood events, specifically where the Back channel intersects with the Shaggery River prior to the Peach Island bridge. TDC plans to be able to clear the 'blockade' caused by the built-up vegetation to relieve high flood waters from the area.

18. My understanding is that the proposed river terrace restoration planting in the stage 1 area following extraction and backfilling will commence the first opportunity/planting season at completion ie in 15 years' time **if** consent is granted. It will take 5-6 years, all going well, for planting to show any result. This makes it a 20 plus year timeframe. I do not believe that I will be seeing completion of this planting in my time.

19. I note that Ms Gavin uses the wording 'river terrace' to describe the area to be restored at the completion of the quarrying consent period. This area is not a terrace, it is floodplain and will remain so even after reinstatement post quarrying.

20. I understand the river terrace restoration at the completion of extraction implies a wetland planting as all the species suggested are distinctly wetland types. Ms Gavin provides a generic list of first stage appropriate species for a bare site. However, the floodplain is a very dry zone other than when in the midst of a flooding event. The view of the area implies that it may be suitable for wetland restoration but in reality, it is particularly free draining and does not hold water, as it is a flood plain. The only time water is a feature is when it becomes inundated during flood events.

IMPACTS OF FLOOD EVENTS ON THE PLANNED MITIGATION PLANTING

21. The Le Frantz, a local family that farm Peach Island and associated flood channel land for many years, have provided their historical records that demonstrate the frequency of significant flood events, which inundate this land regularly.

22. 10 years recorded flood events provided by landowners LeFrantz who live adjacent to the application site:
    (a) 2013 Three floods
    (b) 2014 One flood
    (c) 2015 None
    (d) 2016 One flood
    (e) 2017 One flood
    (f) 2018 One flood during ex-cyclone GITA
    (g) 2019 None
    (h) 2020 None
    (i) 2021 Two floods including 17 July 2021
    (j) 2022 One flood including July 2022

23. Based on the frequency of flooding events in the back channel, this area can be expected to be inundated an estimated 10 times in the next 10 years, making establishment of the mitigation planting unlikely in the suggested 6-year period.

24. The landscape concept suggests root trainer grade plants with protective guards (and canes to secure is assumed as per standard practice) to protect from predation from rabbits (and hares) around each individual plant during the establishment period. These guards are critical to any restorative planting using root trainers also to protect from harsh winter conditions and form protection from herbicide or mechanical weed control maintenance that is critical to the successful establishment of the planting.
    These guards need to be maintained around each plant for at least two growing seasons ie. two years or more depending on the conditions. Due to the harsh nature of the environment of the flood plain and back channel they may need to be protected for longer.

25. In reality, protective guards, whether plastic or cardboard, are not robust to withstand flood water velocity of the levels that occur when the channel flows with flood water.

26. The evidence provided above of almost yearly channel flooding events and the associated water flow velocity in the channel, such as July 2021 where the whole of stage 1 was 1-2 meters deep, will inevitably result in significant to almost total failure of any planting undertaken in the floodplain.

27. In my view the function of the flood plain is to take water away from the land which reduces the damage of inundation. The floodplain is not a suitable medium by its nature for the establishment of a mitigation planting.

COMMENTS ON SPECIFIC SPECIES MENTIONED IN THE CANOPY REPORT

28. The two Poplar species mentioned in the 2022 Canopy landscape mitigation plan are deciduous and will offer little to no visual mitigation over the winter months. Poplar species root systems can be aggressive when hunting water under dry conditions and this can lead to damage to infrastructure.

29. Personal experience with Eucalyptus nitens and its susceptibility to nuisance aphid infestation required us to remove a wood lot from our property at 370 Motueka River Westbank Road. This pest susceptibility could create problems for nearby orchards to the east and west of the proposed planting.

30. Kahikatea is a wetland native slow growing species. It needs plentiful and regular water. It will not establish well in the dry and exposed floodplain.

31. A combination of the four species offered, the two poplars, eucalypt and kahikatea will create a dry shade situation if they have the opportunity to establish. However, they will also compete for the limited water availability making the establishment of the native understory very difficult as they will be starved of water over the dry months of the year.

_____

Peter Taia

17 July 2021 - Stage 1 site in peak flood.

 17

17 July 2021 - Stage 1 Close up view during peak flood.

12 July 2022 - Stage 1 site in flood.

[this page blank]

BEFORE AN INDEPENDENT HEARINGS COMMISSIONER AT NELSON

COUNCIL REF: RM200488, RM200489 AND RM220578

UNDER THE	Resource Management Act 1991
IN THE MATTER OF	Land use consent applications by CJ Industries Limited to extract gravel from 134 Peach Island Road, Motueka from the berm of the Motueka River and on the landward side of the stopbank at Peach Island with vehicle access via a right of way over 493 Motueka River West Bank Road, Crown land and unformed legal road (RM200488 and RM200489); and discharge permit application by CJ Industries Limited to discharge contaminants to land from backfill material associate with the proposed gravel extraction (RM220578).

STATEMENT OF EVIDENCE OF JOACHIM LANG ON BEHALF OF VALLEY RESIDENTS AGAINST GRAVEL EXTRACTION (NOISE)

Dated: 11 November 2022

6.1 visited the proposed site of the quarry, taken noise measurements and calculated noise attenuation during sound propagation and in relation to the noise-barrier proposed by the Applicant

6.2 used a sound level meter with data logger LT SL-4033SD which meets IEC 61672 class 1 specifications. The device was calibrated before and after the measurement with a Protech QM1598 acoustic calibrator

6.3 reviewed the Applicant's Assessment of Environmental Effects, an in particular Appendix C: The Assessment of Noise report prepared by Hegley Acoustic Consultants

6.4 reviewed the evidence statements of Rhys Hegley (uploaded to the Council site on 15 July 2022 and 4 November 2022)

6.5 reviewed the memorandum of Daniel Winter, Team Leader Environmental Health at Tasman District Council dated 11 October 2022

6.6 reviewed those parts of the Council s42A reports relevant to noise matters

6.7 reviewed the relevant noise provisions in the Tasman Resource Management Plan including Rule 17.5.2.1(c)

6.8 reviewed NZS 6802:2008 Acoustics – Environmental Noise and NZS 6801: 2008 Acoustics – Measurement of Environmental Sound

6.9 reviewed ISO 9613-2 Acoustics — Attenuation of sound during propagation outdoors — Part 2: General method of calculation, and

6.10 reviewed submissions relating to noise.

SCOPE OF EVIDENCE

7. The purpose of my evidence is to discuss the potential noise levels and noise disturbance effects of CJ Industries Limited's proposed quarry as well as the measures it proposes to adopt, avoid, remedy or mitigate acoustic effects.

8. My evidence:

   8.1 evaluates the appropriateness of the standards, guidelines and methodology used by CJ Industries to assess potential noise from the proposed quarry development,

   8.2 assesses the existing noise environment,

   8.3 assesses the potential noise effects of the proposed development on nearby residences,

   8.4 assesses the measures CJ Industries proposes to use to address potential effects,

   8.5 determines whether CJ Industries' proposed operations will be unreasonable in the context of the environment in which they will occur

   8.6 evaluates the conclusions reached by CJ Industries as to the potential noise effects of the extraction of aggregate and transport of aggregate materials

EXECUTIVE SUMMARY

9. In my expert opinion I consider the excavation and machinery noise as unsuitable for this environment and an excessive disturbance. My colleague and I measured ambient levels on a calm day as being under 40dBA LA_{90}. This is a similar measurement to that taken by Mr Winter from the Tasman District Council. This level is well below the predicted noise levels of the excavation noise.

10. The noise levels of the operation have to be under the required plan limits at all times during a 15min interval and at all days without exception (for example unfavourable wind conditions etc).

11. I took measurements of the type of heavy machinery such as excavators that the Applicant proposes to use for the operation. This machinery has special audible characteristics such as an audible tonal component as well a strong impulsive character. Therefore a 5dBA adjustment needs to be applied and also a 3dBA margin for errors as well together with a +3dBA adjustment for atmospheric conditions such as winds over 5 Beaufort, which is common in New Zealand and in this valley. The average wind-speed per day in Ngatimoti in the years from 2009 to 2017 was between 8km/h -15km/h and maximum average wind-speeds over 32km/h for several hours.

12. In accordance with my assessment, the quarry operation would exceed the permitted activity limits in the Tasman Resource Management Plan (the Plan).

13. While I appreciate the noise limit in the Plan for the Rural 1 Zone is **L_{Aeq} 55dB** during the day, in my opinion, the nature of the machinery and gravel extraction noise requires more stringent regulations than the ones required by the Plan. I agree with the council reporting planner and Mr Winter that the proposed operation is not anticipated in this particular environment. I also agree that the noise limits need to reasonable and must maintain an appropriate level of amenity. Many of the local residents talk in their submissions about the existing amenity levels (such as Ollie and Nataliya Langridge (submission #109 and 132 for land use, and 54 and 55 for discharge permit applications).

14. I do not agree with Mr Winter and the council reporting planner that a noise level of 51dB LAeq is reasonable in this environment, in particular given the special audible characteristics of the machinery the Applicant proposes to use.

15. In my view, a noise limit of 45dBA is appropriate in this environment and this level will be exceeded by the proposed operation.

DESCRIPTION OF LOCATION

16. The location of the proposed operation is at 134 Peach Island Road, Motueka which is next to the Motueka River and surrounded by several residential dwellings. (For details and plans please refer to the Planscapes Report).

BACKGROUND

17. The zoning for this location is rural 1 and the Tasman District Council resource management plan rules for this zone state:

> "…. Noise generated by the activity, when measured at or within the notional boundary of any dwelling in a Rural zone (other than any dwelling on the site from which the noise is being generated)… does not exceed:
>
> **Day Time**
> L_{Aeq}: 55 dB
> **Other Times**
> L_{Aeq}: 40 dB and L_{AFmax}: 70 dB
>
> b) Daytime means 7am to 9pm Monday to Friday, and 7am to 6pm Saturdays.
> All other times are night times including Sundays and public holidays.
> All measurements and assessment in accordance with ZS6801:2008 and NZS6802:2008."

18. NZS6802 states:

> C4.1 "The degree of protection will depend upon the nature of the area under consideration. A residential area in a quiet environment may reasonably expect a higher degree of protection than a residential area in an already relatively noisy environment. Sound which is acceptable on a commercial site adjacent to a residential area, may be unacceptable if received in a quiet residential area (e.g. from a home occupation). Many Territorial Authorities have, for instance set L10 limits of 50 dBA daytime and 40 dBA night-time for such areas. **In some cases, limits have been set up to 10 dBA below the existing background level in order to ensure no degradation of the existing sound environment and long term the sound level may be reduced"** (my emphasis).

19. Many District councils rules require L_{aeq} to be below 40dB at other times than daytime and the daytime limits to be under 50dBA. This applies to rural zones (no matter whether they are used residential or not) and includes Auckland, Christchurch, Marlborough, Palmerston North and others. Considering that the location here is rural and residential the specific character of this environment has

to be considered as well. This is a point also made by Mr Winter and the reporting officer.

20. This is also emphasised in NZS6802 which states:

> "Community reaction to noise is determined not only by the sound level, but also by the characteristics of the noise itself and the previous exposure of the community to noise. This Standard provides a guide for estimating the acceptability of sound based on sound level, and when community reaction is influenced by other factors, the assessment procedure may require modification."
>
> And:
>
> "However, when the sound(s) under investigation does comply this does not necessarily satisfy the duty to adopt the best practicable option for controlling noise under section 16 of the Resource Management Act."

21. It is therefore the decision of the Council to decide whether the maximum levels in the plan are applicable or if a more stringent level needs to be applied.

22. NZS6802:91 defines background noise levels as:

> "Description of background sound: The descriptor for background sound in this Standard is L95. NZS 6801 includes procedures for the determination of background sound."

23. In addition, NZS6802:2008 states:

> "A3.1 The result of the measurement and assessment will determine whether the activity in question complies with the relevant consent condition, rule or national environmental standard during the day the measurements were taken. No averaging of measurements from one day to the next is permitted."

24. Furthermore NZS6802:2008 states:

> "A3.2 If the activity complies on one day and not another, the activity may be deemed non-compliant under the conditions which cause the higher level, or non-compliant overall. For this reason, an appropriate assessment would be one which assesses the worst-case level with regards to day-to-day variation."

This means that the day when the activity has the highest noise level is to be assessed.

25. WHO guidelines also pick up on this issue. The WHO states on their website (https://www.who.int/docstore/peh/noise/Comnoise-4.pdf):

> *"When the noise is composed of a large proportion of low-frequency sounds a still lower guideline value is recommended, because low frequency noise (e.g. from ventilation systems) can disturb rest and sleep even at low sound pressure levels. It should be noted that the adverse effect of noise partly depends on the nature of the source. A special situation is for newborns in incubators, for which the noise can cause sleep disturbance and other health effects. If the noise is not continuous, LAmax or SEL are used to indicate the probability of noise induced awakenings. Effects have been observed at individual LAmax exposures of 45 dB or less. Consequently, it is important to limit the number of noise events with a LAmax exceeding 45 dB. Therefore, the guidelines should be based on a combination of values of 30 dB LAeq,8h and 45 dB LAmax. To protect sensitive persons, a still lower guideline value would be preferred when the background level is low. Sleep disturbance from intermittent noise events increases with the maximum noise level. Even if the total equivalent noise level is fairly low, a small number of noise events with a high maximum sound pressure level will affect sleep.*
>
> *To protect sensitive persons, a still lower guideline value would be preferred when the background level is low.*
>
> *Noise with low frequency components require even lower levels. It is emphasized that for intermittent noise it is necessary to take into account the maximum sound pressure level as well as the number of noise events. Guidelines or noise abatement measures should also take into account residential outdoor activities.*
>
> *Specific Environments Noise measures based solely on LAeq values do not adequately characterize most noise environments and do not adequately assess the health impacts of noise on human well-being. It is also important to measure the maximum noise level and the number of noise events when deriving guideline values. If the noise includes a large proportion of low-frequency components, values even lower than the guideline values will be needed, because low-frequency components in noise may increase the adverse effects considerably. When prominent low-frequency components are present, measures based on A-weighting are inappropriate. However, the difference between dBC (or dBlin) and dBA will give crude information about the presence of low-frequency components in noise. If the difference is more than 10 dB, it is recommended that a frequency analysis of the noise be performed.*
>
> *Dwellings*
>
> *In dwellings, the critical effects of noise are on sleep, annoyance and speech interference. To avoid sleep disturbance, indoor guideline values for bedrooms are 30 dB LAeq for continuous noise and 45 dB LAmax for single sound events. Lower levels may be annoying, depending on the nature of the noise source.*
>
> *To protect the majority of people from being moderately annoyed during the daytime, the outdoor sound pressure level should not exceed 50 dB LAeq. These values are based on annoyance studies, but most countries in Europe have adopted 40 dB LAeq as the maximum*

> *allowable level for new developments (Gottlob 1995). Indeed, the lower value should be considered the maximum allowable sound pressure level for all new developments whenever feasible."*

26. So the WHO states that daytime levels should not exceed 50 dBA to avoid people from being moderately annoyed. In a residential area I think it is not appropriate for people to be even moderately annoyed.

27. WHO also states that when low frequencies are present (as it is the case here) A weighted levels are not appropriate for assessment and a spectrum analysis needs to be carried out. As quoted above: "*When the noise is composed of a large proportion of low-frequency sounds a still lower guideline value is recommended, because low frequency noise (e.g. from ventilation systems) can disturb rest and sleep even at low sound pressure levels."*

28. The Resource Management Act states:

> "Duty to avoid unreasonable noise: Every occupier of land (including any premises and any coastal marine area), and every person carrying out an activity in, on, or under a water body or the coastal marine area, shall adopt the best practicable option to ensure that the emission of noise from that land or water does not exceed a reasonable level."

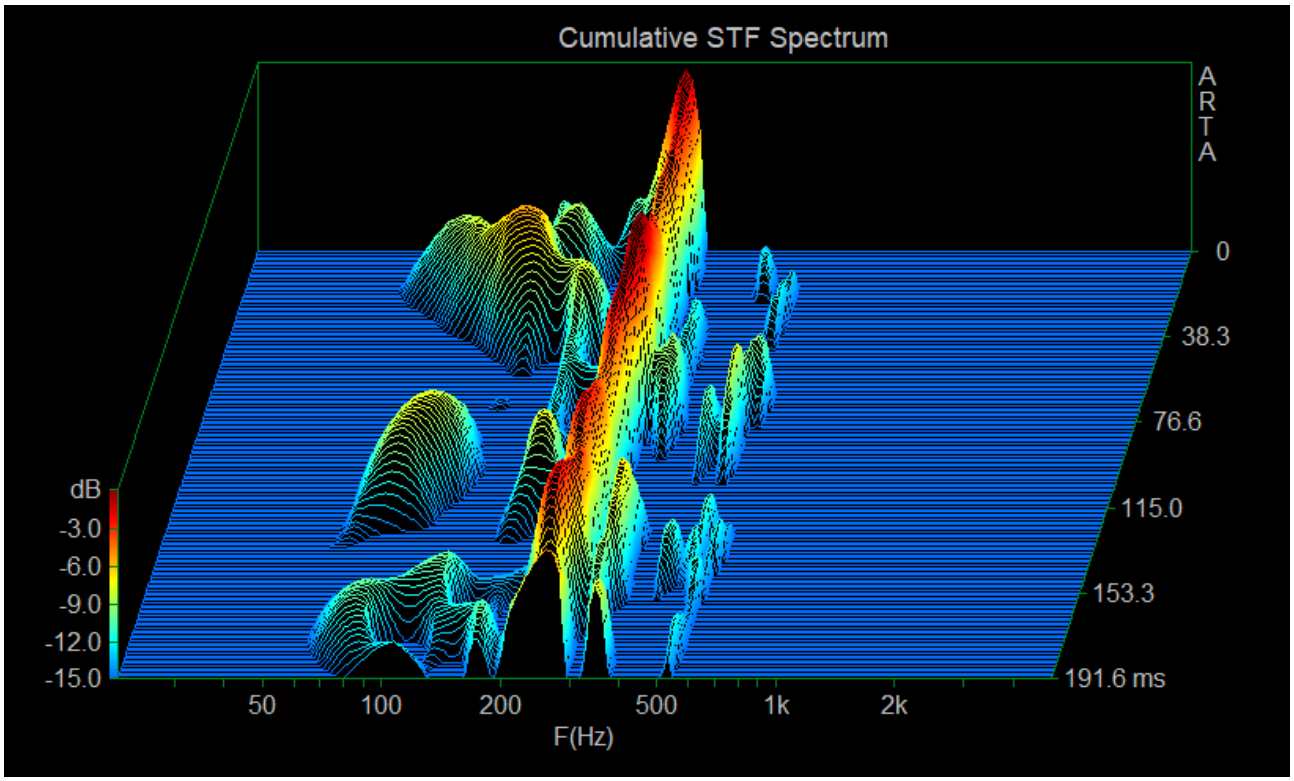
29. I consider any audible machinery noise and in particular at the levels proposed by this operation, to be unreasonable in this environment and especially because they will contain special audible characteristics.

30. NZS6802 states:

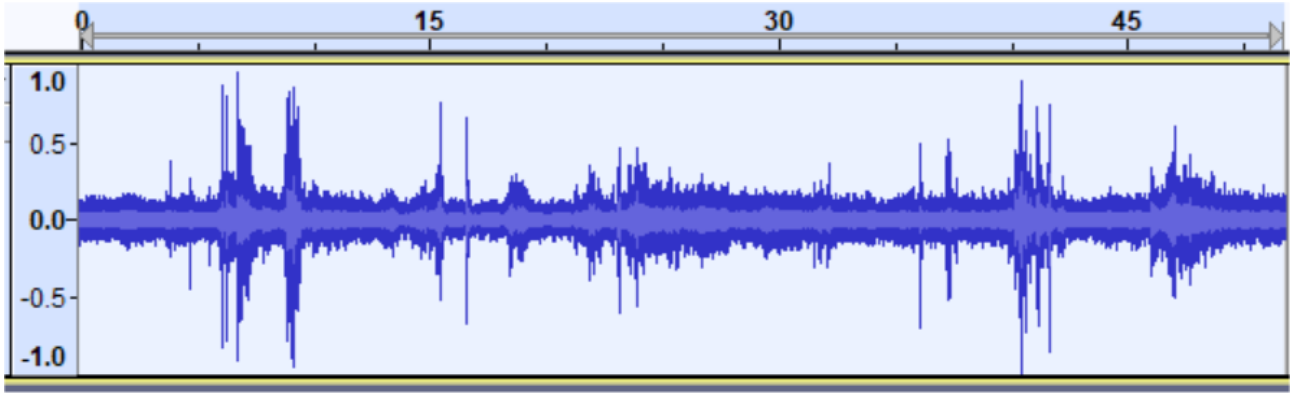
> "Special audible characteristics
>
> Noise that has special audible characteristics, such as tonality or impulsiveness, is likely to arouse adverse community response at lower levels than noise without such characteristics. At present there is no simple objective procedure available to quantify special audible characteristics, and subjective assessment is therefore necessary, (supported where appropriate by objective evidence, e.g. frequency analyses)."

31. When listening to excavation and truck noise it becomes apparent that this noise has special audible characteristics such as tonality and impulsiveness and the frequency analyses provides some objective evidence for this.

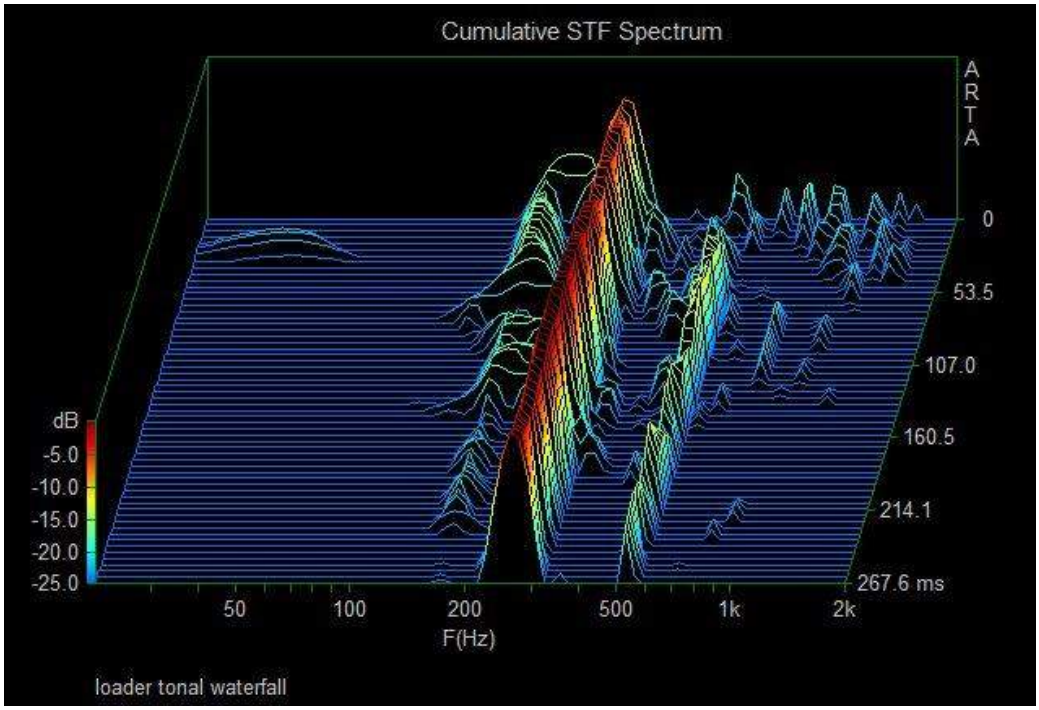
32. The graphs below show a strong tonal component at around 260Hz of a 20t excavator of the type that the applicant proposes, recorded by me on 9.November 2022 near Motueka.

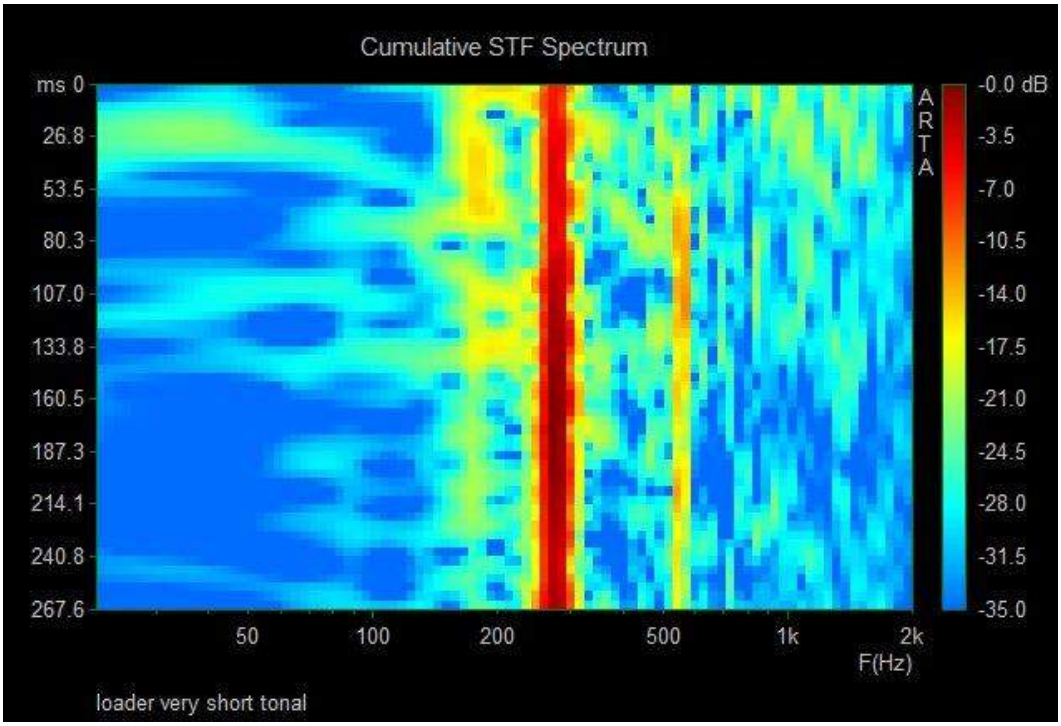


33. The following graph shows the impulsiveness of this excavator scooping gravel from the river and dumping it into a truck. The audio file can be found on youtube: https://www.youtube.com/watch?v=l5Q22VGA02Q



34. Additionally a video clip from youtube (https://www.youtube.com/watch?v=JvzUNfbKobI) was analysed at 41sec-44sec into the clip (no reverse beeping noise present at that time). The graphs below also show a strong tonal component of a Cat 972M standard loader at around 270Hz.

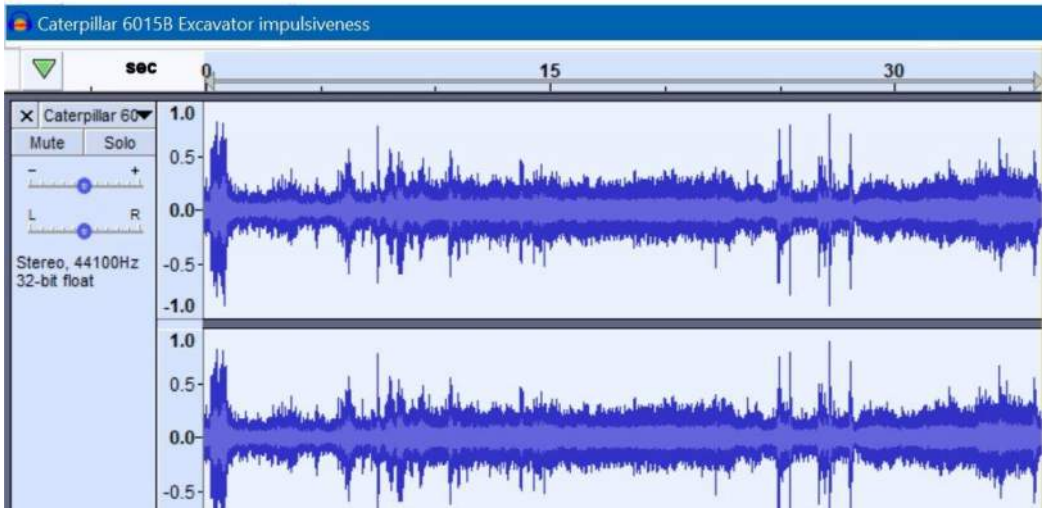




35. The tonal components are not present all the time and they also vary in pitch and intensity, however this has to be considered as an intermittent tonal component and certainly has characteristic that cannot be considered random or unobtrusive.

36. This clip on youtube also demonstrates the tonal characterisitics : https://www.youtube.com/watch?v=lTkmDxb0F5U

37. The amplitude/time graph over 35sec of this 6015B Caterpillar Excavator shows a high impulsiveness of the excavator, see below:



38. Analysed from youtube videoclip: https://www.youtube.com/watch?v=M9Ki29rLGEQ

39. When listening to excavation and truck noise it becomes apparent that this noise has special audible characteristics such as tonality and impulsiveness and the frequency and time analyses provides some objective evidence for this.

40. The NZ standard clearly states that impulsive noises are a special audible characteristic and that a subjective evaluation can be "*supported where appropriate by objective evidence, e.g. frequency analyses".* Which I have done in the analysis with graphs above.

41. While construction and excavation noises from a large number of machinery creates more randomness at several kilometres distance, a single machine at close proximity does not have any randomness but clearly has impulsive character as demonstrated above.

42. Therefore a 5dBA special audible characteristics adjustment must be made.

CALCULATIONS

43. I disagree with the findings of Hegley Acoustics in several points as outlined below.

44. The Hegley report does not mention any calculations with noise spectra as required by ISO 9613-2 but only total levels. Since the noise from the operation has a high level of low noise components this has to be taken into consideration, especially since low frequencies travel with much less attenuation over the ground and also bend around obstacles, such as bunds.

45. The notional boundary of the houses at 131 and 132 Peach Island Road are approximately 130m away from the closest excavation position, and the notional boundary of the house at 458 Motueka River West Bank road is 190m away from the closest excavation position.

46. A bund has not been included in the calculations below and will be addressed further down.

47. Why Hegley acoustics calculates a higher level for 470 and 472 Motueka River West Bank Road, which are further away than no 458, is unclear.

48. A 35t excavator produces a L_{AW} of around 114dB (as cited in https://www.acoustics.asn.au/conference_proceedings/AAS2009/papers/p11.pdf). But assuming an excavator with lesser tonnage is used we subtract 6dBA from this value and use 108dBA for the excavating machinery.

49. The following spectra have been measured from the above sound samples of an excavator (normalized to 118dB and 108dBA total as discussed above):

Frequency - Hz	63	125	250	500	1k	2k	4k	8k	Total unweighted	A weighted
Power level - dB	115	112	111	106	102	95	84	57	118	108

50. The levels will certainly differ slightly from machine to machine, an uncertainty of plus/minus 3dBA can be expected.

51. But assuming the above values of Lw =118dB for the excavator we calculated the following L_{Aeq} at different distances.

20t loader					
Frequency - Hz	Lw	LAW	LAeq 50m	at 130m	at 190m
level - dB	117.7	108	63	55	51
20t excavator					
Frequency - Hz	Lw	LAW	LAeq 50m	at 130m	at 190m
level - dB	110	106	61	53	49

52. These values were calculated according to ISO 9613-2 with ground factor 0.6, temp 20 degrees, humidity 70% and an average height of 2.5m.

53. ISO 9613-2 uses a downwind situation of 1-5m/s windspeed. According to the international Beaufort Scale that is 3 Beaufort, which means gentle breeze, id est leaves and twigs in constant motion. In contrast 5 Beaufort mean fresh breeze, small trees in leave begin to sway, crested wavelets form on inland waters. Considering that the property is in a valley a fresh breeze can be expected on many days. So a 3dBA higher level for stronger winds is to be added.

54. ISO 9613-2 states: Estimated accuracy for broadband noise: 0-5m height and 0-1000m distance: plus/minus 3dB. Therefore a margin of 3dBA needs to be applied to ensure that the noise levels will not exceed the set limits at any time.

55. A confidence range of 1dBA is absolutely unrealistic, especially considering that noise is stochastic and the levels that have been assumed are average levels with an uncertainty of plus minus 3dB.

56. MAS environmental UK writes:

> "We try to avoid using predicted sound levels when it is possible to take real-world measurements. This is to rule out any potential error and loss of accuracy, including not using road counts to estimate the sound level of a road as a replacement of measuring the road with a sound level meter."
>
> Ground height and building heights can be hugely important in noise mapping results by affecting the sound path-lengths and barrier efficacy. However, the ground levels used for modelling often cannot be easily inspected from a resulting noise map included with a noise impact assessment."

57. In the past I have measured a gravel extraction operation in Golden Downs and found that the noise level at 30m was 76dBA, according to noisemapping this value should have dropped to 60dBA at 210m, however the measurements showed levels of 6dBA more, id est 66dBA. This was caused by reflections from the hills across the river. In this case here the situation is similar since the river is surrounded by hills on each side and impulsive sounds produce echoes as noticed when we conducted tests in the valley. This indicates that noise mapping is not always as accurate as suggested. Further measurements on a calm day (Beaufort 1) in the valley showed that a small excavator operating at 691 Motueka River West Bank Road produce a noise level of $L_{AW(15min)}$ = 105dB and was measured at 200m down the river at a level of L_{Aeq} = 50dB. However, noise mapping resulted in a level of L_{Aeq} = 48dB under the assumption of no barrier. The excavator was operating behind a dwelling of 7m height though, it was therefore shielded and without a line of sight. Calculations with a barrier of similar dimensions would have resulted in a L_{Aeq} well below 40dB. Again this was caused by the reflections of the hills close by. An accuracy of 1dB for calculations is therefore absolutely unrealistic.

58. Additionally it is very likely that there is not only one machine operating but several at the same time. If 2 machines of similar noise levels operate close to each other then then total noise level would be 3dBA higher for both machines together. This is omitted in the Hegley Acoustic report. If four machines operate close together then the total would be approximately 6dBA higher.

59. Calculating only the noise of the machinery is not adequate in this case since the loading and handling of gravel, stones etc. produces much more noise than the

machinery itself. We conducted measurements of a similar operation in the Golden Downs and Motueka area and the measured noise levels were much higher than just the machinery itself. The dumping of rocks and gravel onto trucks and loaders produces a very high level of noise especially when the trucks are empty and the rocks fall onto the metal surface. Noise levels of L_{AW} = 120dB and more are typical. It is therefore not realistic to assume max levels of L_{AW} = 108dB.

60. The limits in the plan are meant as upper limits and not average limits. So those upper limits need to be achieved at any one time and not just on calm days. The worst scenario has to be assumed, which in this case is: several machines working close together, strong wind from and an unfavourable direction and noise from gravel and rock material producing excessive noise. This can easily be over a 15 minute interval as defined by the standard and the highest possible value has to be calculated.

61. Additionally, a 3dBA margin should be adopted considering the uncertainty about the machinery.

62. So to sum up the unfavourable conditions:

Dumping gravel and rocks on trucks L_{AW} = 120dB would result in a L_{Aeq} = 63dB at 190 metres, plus unfavourable windspeed and direction +3dBA, plus special audible characteristic since the noise is clearly impulsive plus 5dBA, plus a 3dBA margin of error brings the rated value for 458 Motueka River West Bank road to L_{Aeq} = 74dB.

63. NZS6802:2008 states: "However, when the sound(s) under investigation does comply this does not necessarily satisfy the duty to adopt the best practicable option for controlling noise under section 16 of the Resource Management Act."

64. "Best practicable option in relation to emission of noise means the best method for preventing or minimising the adverse effects on the environment considering, among other things, certain matters defined in the Resource Management Act."

65. The idea behind those rules is that people can enjoy their property without unreasonable noise considering the existing environment. This is a rural environment not an inner city environment and therefore much less background noise is present.

Even levels of 40dBA of machinery noise can be quite disturbing especially on a quiet day and with a background level of under 40dBA (as measured on 4.8.22 from 4.15pm – 4.30pm with little wind (Beaufort 1).

66. It is therefore my opinion that the maximum daytime level should be below 45dBA to maintain the rural characteristic of the area since machinery and excavation noise is not typical for this environment. Considering that this operation is planned to be carried out for over 15 years adds to the impact that the noise has on the residents.

67. As demonstrated above this machine has tonal components and a high component of low frequencies which are also more disturbing than broadband noise and therefore a 5dBA adjustment for special audible characteristics should be made.

68. It also has to be noted that the NZ standard NZS6802:2008 allows for an adjustment of minus 5dBA if noise is present less than 30% of the time. In other words this could mean that the gravel extraction could be 5dBA louder than the limit in the plan if present less than 30% of the prescribed time. Although this is the rule in NZS6802 it is my opinion that a 5dBA higher level for several hours a day is an excessive disturbance in this kind of environment. I therefore agree with Mr Winter that the maximum allowed noise level should be reduced accordingly.

NOISE BARRIERS

69. CEDR states:

> "The nature of sound is crucial because low frequency sounds, due to their large wavelength, bend more easily over a sound barrier than high frequency sounds. The result is that the sound spectrum recorded before the installation of a noise barrier is situated rather in the medium- and high-frequency region than the spectrum recorded after the installation of a noise barrier. This also means that a noise barrier will be less effective along a road with a high percentage of trucks emitting a sound of a lower frequency than the sound that cars would normally emit.
>
> If the noise barrier dimensions are well proportioned, and taking into account all these parameters, a LAeq reduction of 10 dB(A) can be achieved at ground level in an area situated closely behind the noise barrier. As the distance to the noise barrier increases, the noise level reduction decreases. At a distance of 250 meters, the LAeq reduction is limited to a few dB(A).
> "

(Cited at https://www.cedr.eu/download/Publications/2017/CEDR-TR2017-02-noise-barriers.pdf)

70. At 130m distance (for the properties at 131 and 132 Peach Island Road) the calculated levels would be around 4dBA higher than at 190m distance.

71. If a bund of 3m height is constructed then this reduces the noise level at the boundary by 5-10dBA (a reduction of 10dBA is considered the maximum according to the ISO standard), which brings down the rated from L_{Aeq} = 78dBA to 68dBA at best.

72. If the bund is over 100m away from the noise source then a maximum reduction of 5dBA can be expected.

CONCLUSION

73. In my opinion the suggested maximum noise levels of 51dBA will be exceeded by the operation of the gravel extraction. It is my belief that the maximum noise levels of 55dBA are not appropriate for this location and we recommend that max rated levels of 45dBA should be applied.

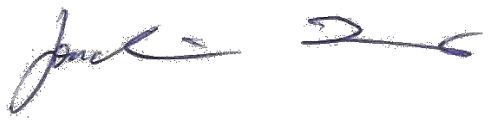
74. Additionally, an adjustment of +5dBA should be applied because of the special audible characteristics as demonstrated above, plus adjustment for unfavourable windspeed and direction of +3dBA, as well as a +3dBA error margin.

75. The assumption of a maximum noise level of L_{AW} = 108dB for the machinery is not accurate for this kind of operation since it omits the fact that usually several machines operate at the same time, for example excavator and dump truck but also the noise from the dumping of the stones and rocks onto the trucks produces much higher noise levels than the machinery as our measurements have shown.

76. The construction of a 3m high bund is inadequate to reduce noise levels to an acceptable level.

77. The special rural character of the location requires more stringent maximum allowed levels so residents can live in the area without major disturbance.

Signed:



Joachim Lang – Nelson Acoustics

APPENDIX A
GLOSSARY OF TERMINOLOGY:

A,B,C-weighting
Defined by IEC 61672-1 takes into account the average sensitivity of human's ear as a function of frequency. It is used to convert a physical quantity of sound pressure into a psychacoustic quantity to quantify how noise is perceived by humans.

dB Decibel
The unit of sound level. Expressed as a logarithmic ratio of sound pressure P relative to a reference pressure of
Pr=20 µPa i.e. dB = 20 x log(P/Pr)

dBA
The unit of sound level which has its frequency characteristics modified by a filter (A-weighted) so as to more closely approximate the frequency bias of the human ear.

L_{A90} (t)
The A-weighted soundlevel just exceeded for 90% of the measurement period and calculated by statistical analysis. Also referred to as the background noise level.
The suffix "t" represents the time period to which the noise level relates, e.g. (8 h) would represent a period of 8 hours, (15 Min) would represent a period of 15 minutes and (2200-0700) would represent a measurement time between 10 pm and 7 am.

L_{Amax}
The A-weighted maximum noise level. This is not equal to the peak level.

L_{Aeq} (t)
The A-weighted equivalent continuous sound level having the same total sound energy as the fluctuating level measured.

STC
Sound Transmission Class calculated according to the ASTM E413 classification

BEFORE AN INDEPENDENT HEARINGS COMMISSIONER AT NELSON

COUNCIL REF: RM200488, RM200489 AND RM220578

UNDER THE	Resource Management Act 1991
IN THE MATTER OF	Land use consent applications by CJ Industries Limited to extract gravel from 134 Peach Island Road, Motueka from the berm of the Motueka River and on the landward side of the stopbank at Peach Island with vehicle access via a right of way over 493 Motueka River West Bank Road, Crown land and unformed legal road (RM200488 and RM200489); and discharge permit application by CJ Industries Limited to discharge contaminants to land from backfill material associate with the proposed gravel extraction (RM220578)

STATEMENT OF EVIDENCE OF DR MICHAEL HARVEY ON BEHALF OF VALLEY RESIDENTS AGAINST GRAVEL EXTRACTION (FLOOD PLAIN, STOPBANK AND EROSION IMPACTS)

Dated 11 November 2022

QUALIFICATIONS AND EXPERIENCE

1. My full name is Dr Michael David Harvey. I am a retired water resources engineer/fluvial geomorphologist. I currently reside in the Tasman District and I am very familiar with the Motueka River having fished it for over 50 years.

2. I have a PhD in Fluvial Geomorphology (1980 Colorado State University), an MSc in Soils and Hydrology (1973 University of Canterbury) and a BSc in Agricultural Science (1969, University of Canterbury). I have worked as a consultant in the field of river engineering/fluvial geomorphology for over 40 years, primarily based in the USA. I have authored and co-authored over 100 technical publications and four books, and I have prepared in excess of 150 technical reports during my career. I have extensive experience with hydrologic, one-and two-dimensional hydraulic and both fixed- and mobile- bed sediment transport models.

3. As a consultant, I have worked on identifying the impacts of aggregate mining as well as developing mitigation and restoration solutions, in rivers and on floodplains throughout the western USA (California, Colorado, Arizona, New Mexico), Jamaica and Indonesia. I have also investigated the impacts of mineral extraction and mine waste disposal on rivers and floodplains in New Zealand, the western USA (Washington, Idaho, California, Nevada, Montana, Wyoming, Colorado, South Dakota, New Mexico), Western Australia, Papua New Guinea and Peru. I have been qualified as an expert witness and testified in both U.S. Federal and State Courts on matters related to in-channel and floodplain mining and levee (stopbank) failure.

CODE OF CONDUCT

4. I have lodged a submission opposing the grant of consent. Therefore, I acknowledge I am not completely independent. My submission focused on review of technical aspects submitted by consultants in support of the CJ Industries Ltd application. I have read and sought to comply with the Code of Conduct for Expert Witnesses as contained in the Environment Court Practice Note 2014. The issues addressed in this statement are within my area of expertise. I have not omitted to consider material facts known to me that might alter or detract from the opinions I express.

BACKGROUND AND ROLE

5. My evidence is given on behalf of Valley Residents Against Gravel Extraction Inc (Valley R.A.G.E), a submitter on CJ Industries Limited's resource consent applications to extract and transport gravel from Peach Island, Motueka.

6. In preparing my evidence I have:

   6.1 visited the area of the proposed quarry in Peach Island and viewed the Motueka River at the upstream and downstream limits of the Peach Island Stopbanks; the Motueka River overbank channel (also referred to as the backchannel) from its upstream point of divergence from the current channel of the Motueka River to its downstream confluence with the river; the un-named local tributary channel that flows within the former Motueka River channel; and the Peach Island stopbanks.

   6.2 read the Tonkin & Taylor Hydraulic and Stopbank Stability Analysis report dated 16 December 2020

   6.3 read the Envirolink groundwater analysis (4, June 2021)

   6.4 read the LandVision, Ltd Peach Island LUC and Soil Survey report (May 2021)

   6.5 reviewed the conditions volunteered by CJ Industries, and

   6.6 reviewed the information provided in the Assessment of Environmental Effects (AEE) on effects on the flood plain and stopbanks (pages 43 – 46) including the comments made by the Council's River and Coastal Engineer, Giles Griffith summarised in the s42A report (28/10.2022), including Recommended Conditions (Attachment 2).

7. In addition, I have read the 15 July 2022 and 4 November 2022 statements of evidence of the following:

7.1 Timothy George Corrie-Johnston – Corporate and Operations.

7.2 Simon James Aiken – Flooding

7.3 David John Averill – Geotechnical

7.4 Dr Calum MacNeil – Surface Water Quality and Ecology

7.5 Dr Reece Blackburn Hill – Soil Management and Land Productivity

7.6 Ryan Charles Smith Nicol – Groundwater and Clean Fill Management.

8. I have reviewed the following documents regarding the construction, maintenance, design flows and potential failure modes of the Motueka River Stopbanks and alternative sources of aggregate in the Tasman region:

8.1 Tasman District Council Motueka Flood Control Project Newsletter, Issue 01, July 2010

8.2 Tasman District Council Motueka Flood Control Project Newsletter, Issue 02, April 2011

8.3 M.P. Hill, 2021. Aggregate Opportunity Modelling for New Zealand, GNS Science Report 2021/10. (Appendix 2, Map 22, Aggregate Opportunity Modelling- Gravel model results- Marlborough-Nelson).

SCOPE OF EVIDENCE

9. My evidence will focus on the potential effects of the proposed quarry activities on erosion of the Motueka River floodway (backchannel) during Stage 1 of the mining and immediately following pit backfilling and consequent fine sediment delivery to the Motueka River and Taman Bay, which are within my field of expertise.

10. My evidence:

10.1 Describes CJ Industries proposal

10.2 Describes the floodplain area

10.3 Describes the impacts of the gravel extraction on floodplain erosion at the margins of the pits

10.4 Describes the potential for erosion of the backfilled pits during flood flows

10.5 Addresses the potential for stopbank failure regardless of the proposed mining

10.6 Sets out conclusions based on my assessment.

EXECUTIVE SUMMARY

11. Erosion and sediment run-off risks from the quarry proposal are significant and have not, in my view, been accurately modelled or assessed by the applicant's experts. In addition, flooding events are more common than those modelled by Tonkin & Taylor. The annual probability of flooding is 100% as evidenced from the multiple large flood events in 2021 alone. The erosion and flooding risks cumulatively have a strong potential to increase sediment loading to the Motueka River and Tasman Bay.

12. Backfill for the borrow pits in Stage 1 will be obtained from a range of sources and the physical characteristics of the backfill material will be variable. This combined with a seasonally variable water table means there is likely to be differential settlement of the backfilled pits. This in turn will adversely affect the regraded contour and therefore the potential for erosion of the placed, overlying uncompacted subsoil and topsoil. Again, this creates an increased risk of sediment loading to the Motueka River and Tasman Bay during flood events.

13. Alluvial aggregate is available from other sources in the Region and these should be preferred to Peach Island given the existing residential development, rural characteristics and risks of increased sediment loading outlined in my evidence.

THE APPLICANT'S PROPOSAL

14. The following is a summary of the application as I understand it, and as it relates to river hydrology, flood management and floodplain erosion.

15. The applicant is proposing to excavate an area of approximately 7.4 ha, consisting of about 2.49 ha (Stage 1) located outside of the Peach Island Stopbanks within a former channel of the Motueka River (backchannel) and 4.5 ha (Stages 2 and 3) between the stopbanks. Proposed excavation depths are in the order of 5m but will be dependent on groundwater elevations at the time of mining. The applicant intends to maintain a minimum separation at any time of one metre to groundwater. At any given time, the area of active mining in Stage 1 will not exceed 1600 m^2, in a pit with dimensions of 20m x 80m, oriented parallel to flow.

16. The applicant proposes a 20m buffer strip between the toe of the Peach Island stopbanks and its extraction activities to mitigate any potential impacts on stopbank stability resulting from pit mining.

17. After the aggregate resource is extracted, it will be stockpiled on site within the stopbanks and then taken to a processing plant.

18. I understand that there will be stockpiles of topsoil and overburden stripping as well as backfill materials located within the stopbanks, with the exception of temporary topsoil and backfill materials that will be used to meet the daily 1600 m^2 open pit condition, stored on the floodplain.

19. The applicant proposes to partially backfill the excavated areas with clean fill brought into the site from a wide range of locations that meets the WasteMINZ clean fill standards. Backfilling is an important part of site rehabilitation to approximate the pre-mining contours. Uncompacted subsoil and topsoil will be replaced over the backfill and will be revegetated within one month of reinstatement.

DESCRIPTION OF THE FLOODPLAIN AREA

20. Stage 1 of the site is located on the modern floodplain of the Motueka River and is primarily composed of a former channel of the river that is also partially occupied by an unnamed channel that conveys flows from three westside tributaries via the

former channel to the confluence with the Shaggery River and thence to the Motueka River.

21. Because the site is located in a former channel of the Motueka River, the underlying materials are composed of river emplaced alluvial sediments, that are generally finer (sands, silts and clays) at the ground surface and coarser (sands, gravels and cobbles) at depth.

22. Topographically, the Stage 1 site is relatively flat with slopes between 0 and 7 degrees (Hill, 2022; 3.28) but a former channel depression that is in the order of 2m in depth occupies much of the site and extends south-eastwards to the Motueka River (Figure 1).

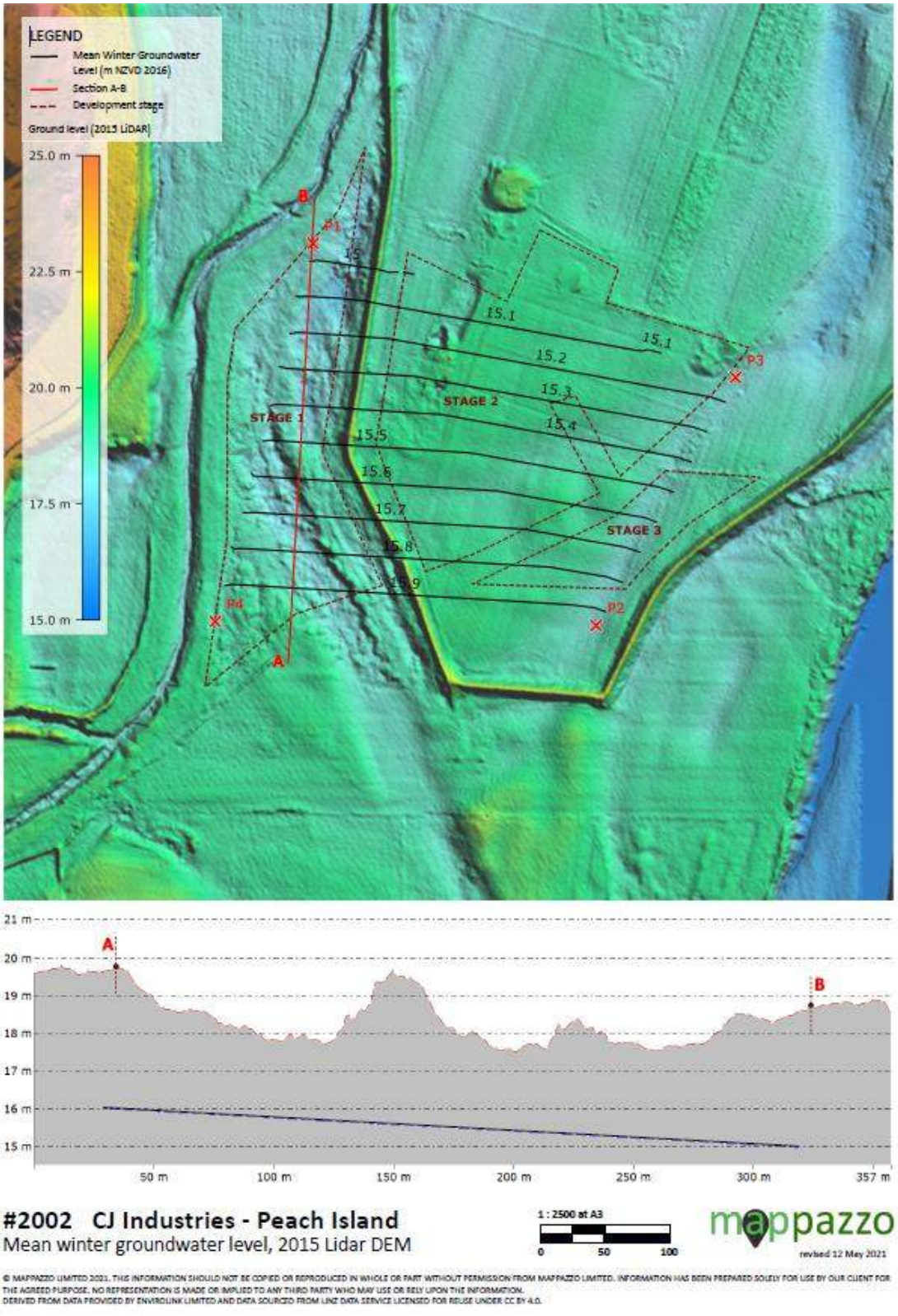


Figure 1. Site topography (Mappazzo, 2021)

FLOOD RISK AND SEDIMENTATION / RUN-OFF TO THE MOTUEKA RIVER AND TASMAN BAY

23. To assess potential project-related flood conveyance impacts and risks to the Peach Island stopbanks, Tonkin & Taylor (2020) modelled a 10-year Annual Recurrence Interval (ARI) (10% Annual Exceedance Probability (AEP)) and 100- year ARI (1% AEP) flood event with- and-without 2 borrow pits and provided flow depth and velocity distributions for each condition within the Stage 1 mining area (backchannel). No assessment of floodplain erosion risks in the vicinity of modelled borrow pits in Stage 1, either during mining, or following backfilling was undertaken. Given the surface area of Stage 1 (2.49 ha), provided that open borrow pit areas are limited to 20m x 80m, there is a potential for approximately 15 pits to be active over the life of the mine.

24. Local records (provided by Coralie Le Frantz at 131 Peach Island Road) indicate that the backchannel where Stage 1 of the mining is proposed has been flooded 10 times between 2013 and 2022 (10 years), which indicates that the annual probability of flooding is approximately 100% (Table 1). These observations are supported by Dr Hill's statement that "the land outside the stopbank is not suited for agricultural land development due to limitations of an inherent seasonally-high water table, flood risk and variable or shallow soil depth" (Hill, 2022 2.7). Figure 2 shows flooding around Peach Island during the July 2021 event that had an estimated annual recurrence interval of 30 years (Martin Doyle, TDC, 2021). During that event, portions of the west Peach Island stopbank were overtopped (Figure 3). Therefore, the Tonkin & Taylor analysis that only considers the 10% and 1% AEP flood events understates the erosion risk associated with backchannel flooding.

Year	No. of Floods	Year	No. of Floods
2013	3	2018	1 (TC Gita)
2014	1	2019	0
2015	0	2020	0
2016	1	2021	2
2017	1	2022	1

Table 1. Backchannel flooding records provided by Coralie Le Frantz 131 Peach Island Road

Figure 2. View downstream of the Peach Island reach of the Motueka River during the July 2021 floods (Photo provided by Ollie Langridge).

Figure 3. Overtopping of the west Peach Island stopbank during the July 2021 flood. The backchannel is located to the left of the stopbank. (Photo provided by Rob O'Grady, TDC, 2 November 2021).

25. Acceleration of flood flows into both the upstream and downstream margins of a modelled pit (Figures 4 and 5; Aiken 2022) prior to the pit filling clearly indicate that erosion of the pit headwalls (headcutting) will occur during a flood event (Kondolf, 1997). This will release fine sediments (sands, silts and clays) from floodplain storage (topsoil and subsoil thickness varies from 0.5m to 1.0; Corrie-Johnson, 2022 3.7) into the flows thereby increasing the suspended sediment load that ultimately will be transported downstream to the Motueka River and then into Tasman Bay. The potential for this mode of erosion was not evaluated by Tonkin & Taylor even though its omission had been identified in my previous submission (27 January 2022). Visual evidence of the headcutting process on the Motueka River floodplain can be seen in Figures 6 and 7 which were taken at the head of the Douglas Road pit following the 17-18 July 2021 flood.

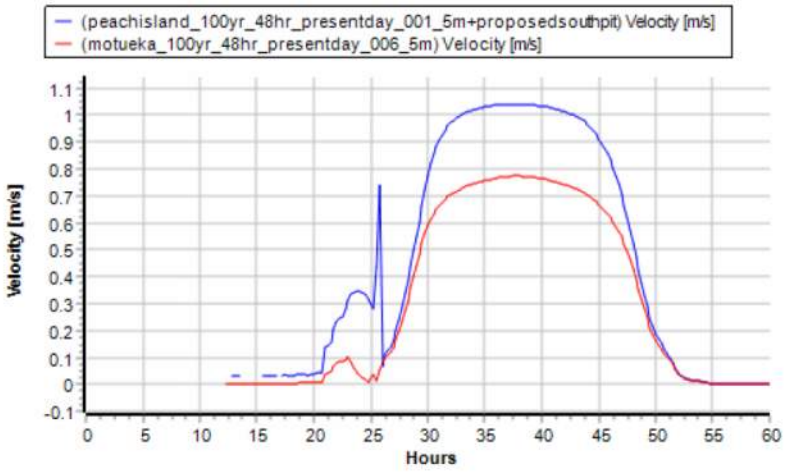


Figure 4. Time series of velocity for model cell immediately adjacent to modelled borrow pit for the 1% AEP flood event (Aiken, 2022, Figure 6)

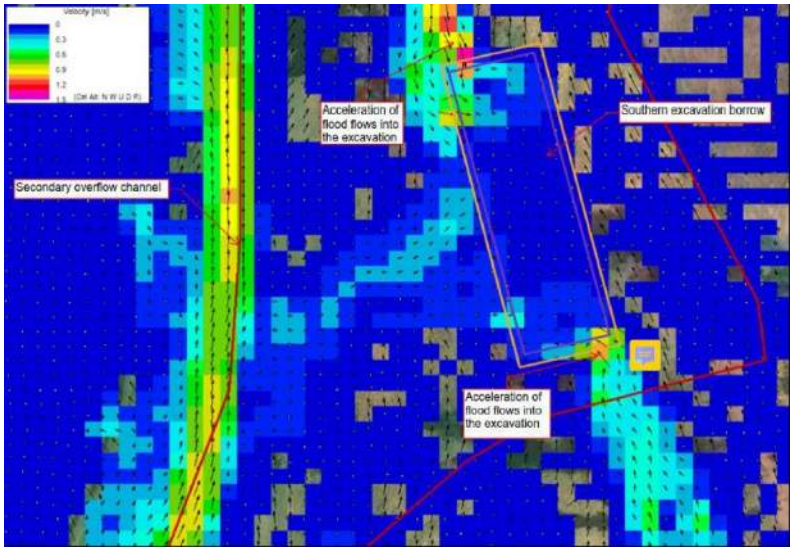


Figure 5. Flood flows accelerating into the excavation pit at the 25 hr timestep for the modelled 1% AEP event (Aiken, 2022, Figure 7).

Figure 6. View west of headcut erosion of fine-grained floodplain sediments at the upstream end of the northern pit at Douglas Road following the 17-18 July 2021 flood. The Motueka River is in the background. (Photo provided by Pete Taia)

Figure 7. View east of the headcut erosion of fine-grained sediments at the upstream end of the northern pit at Douglas Road following the 17-18 July 2021 flood (Photo provided by Pete Taia)

26. Contrary to the statement by Mr Aiken (3.14) that he considered the scenarios assessed in the Tonkin & Taylor report as being conservative representations of the proposed activity because a significantly larger excavation footprints was modelled

(30m X 100m) than is currently being proposed (20m x 80m), engineering literature (Barman et al., 2019) indicates that the headcut erosion potential at the upstream pit margin increases as the Length/Width ratio of the pit increases. Reduction of the pit dimensions from 30m x 100m to 20m x 80m increases the Length/Width ratio from 3.3 to 4 and therefore is likely to increase the headcut erosion potential for any given borrow pit.

BACKFILL

27. Backfill for the borrow pits in Stage 1 will be obtained from a wide range of sources (Corrie-Johnson, 2022 3.42) and the physical characteristics of the backfill material will be highly variable as a result. Because there are no requirements for compaction of the backfill (TDC s42A report; 91-96) and there is a seasonally variable water table, there is likely to be differential settlement of the backfilled pits which will adversely affect the regraded contour and thus the potential for erosion of the placed, overlying uncompacted (Hill, 2022, 3.24) subsoil and topsoil.

28. I do not agree with the evidence provided by Dr MacNeil that the presence of stopbanks and separation distance from stopbanks and water bodies will protect the water quality of the Motueka River. Neither Dr MacNeil nor Mr Aiken have evaluated the erosion potential of the backfilled pits and the overlying replaced soils prior to vegetation becoming established. Dr Hill states that the main erosion risk is associated with exposure of bare soils (Hill, 2022: 3.28) and I agree with this. Given the annual probability of flood flows in the backchannel and its hydraulic connection to the Motueka River downstream of the Peach Island stopbanks (Figure 8), there is potential for erosion of the backfilled soil before it becomes revegetated and thus an increase in the suspended sediment delivery to the Motueka River and Tasman Bay.

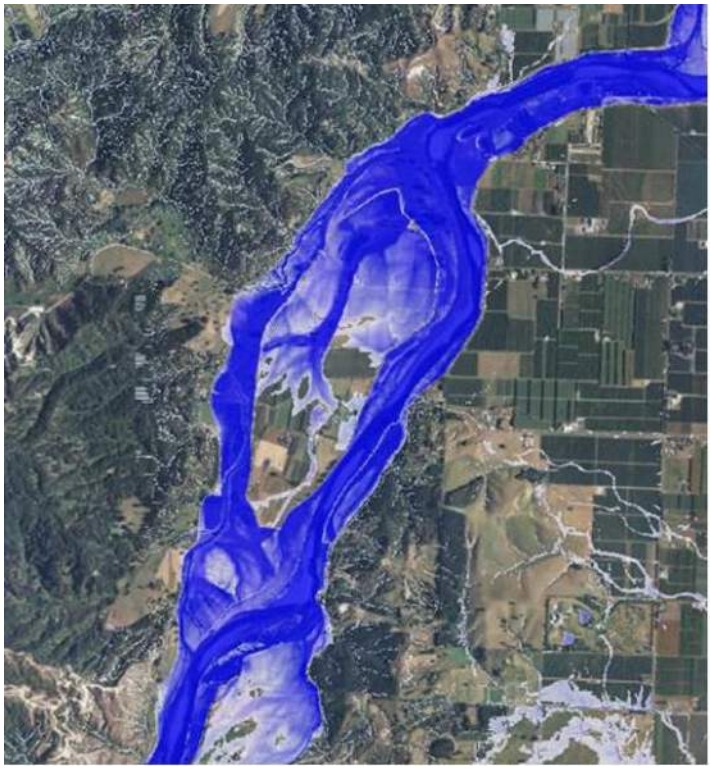


Figure 8. Modelled flow distribution of the 1% AEP event showing the hydraulic connection of the backchannel and the Motueka River in the vicinity of Peach Island. (Image provided by R. O'Grady, TDC, from Peach Island Flood Response and Mitigation Public Meeting 2 November 2021)

29. Soil textures in the Stage 1 mining area are predominantly silt loams (LandVision, Ltd. 2021) composed of sands (~20%), silts and clays (~ 70%). Permissible velocities (i.e. non-eroding velocities) for these soil textures range from 0.46 m/s to 0.69 m/s (Table 2; Fischenich, 2001), and therefore velocities in excess of these values are likely to cause erosion. Time series velocity plots on the floodplain in the Stage 1 mining area for the existing conditions 100-yr ARI event (Figures 9 and 10; Aiken, 2022), show that the velocities on the floodplain exceed the range of permissible velocities for most selected locations (Figure 3; Aiken, 2022) for durations of between 20 and 30 hours. Under these conditions, bare, uncompacted soils of these textures are expected to erode thereby increasing the fine sediment delivery to the Motueka River and Tasman Bay. While time series plots of velocities for the 10% AEP event were not produced, it is likely that the absolute velocities over the floodplain will be of the same magnitude, or possibly higher, than those for the 1% AEP event because

of downstream backwater caused by flow constriction below Peach Island (refer to Figure 8).

Soil Texture	Permissible Velocity (ft/s)	Permissible Velocity (m/s)
Fine sand	1.5	0.46
Sandy loam	1.75	0.53
Alluvial silt	2	0.61
Silt loam	1.75-2.25	0.53-0.69

Table 2. Permissible velocities for various soil textures (Fischenich, 2001, Table 2)

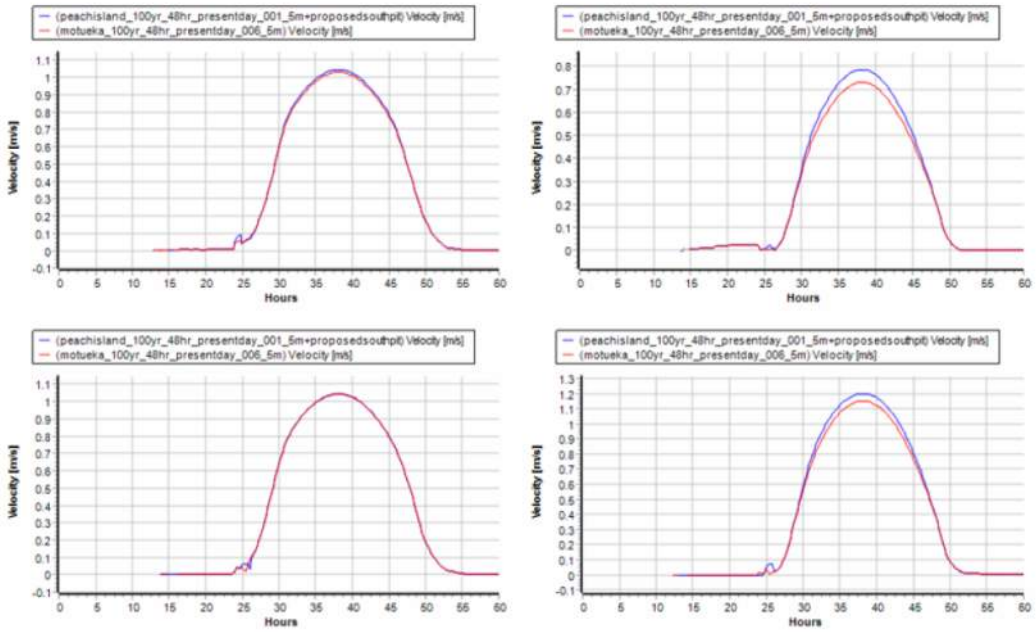


Figure 9. Time series plots of velocity during the 1% AEP flood event from four locations in the vicinity of the southern modelled pit. (Aiken, 2022, Figure 4)

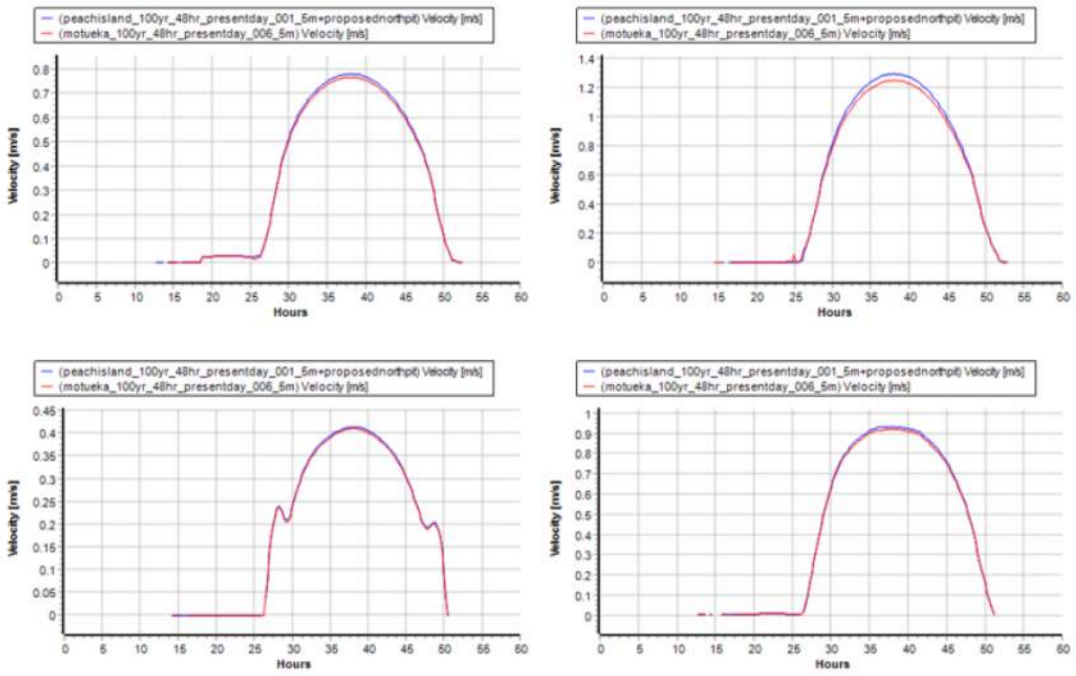


Figure 10. Time series plots of velocity during the 1% AEP flood event from four locations in the vicinity of the northern modelled pit. (Aiken, 2022, Figure 5)

STOPBANKS

30. I agree with Mr Averill that the proposed mining, provided that the 20m setback from the levee toe is maintained, is unlikely to adversely affect the stability of the existing Peach Island stopbanks (Averill, 2022; 2.3). However, because the stopbanks were constructed in the 1950's from local floodplain materials with methods that are unacceptable today (Figure 11) there is a risk that there will be failure (Figure 12), primarily as a result of seepage or sloughing of a saturated embankment during a flood event with an undetermined ARI (Tonkin and Taylor, 2020, p.4). Maintenance activity on the Peach Island stopbanks is intermittent and there is evidence of stock tracking and rabbit burrowing, both of which compromise the integrity of the stopbanks (TDC, Rob O'Grady meeting notes, 2 November 2021.) If the stopbanks were to fail, stockpiles of overburden material, topsoil and backfill material stored between the stopbanks at all 3 stages of the mine life would be at risk of erosion and

would significantly increase fine sediment loading to both the Motueka River and Tasman Bay.

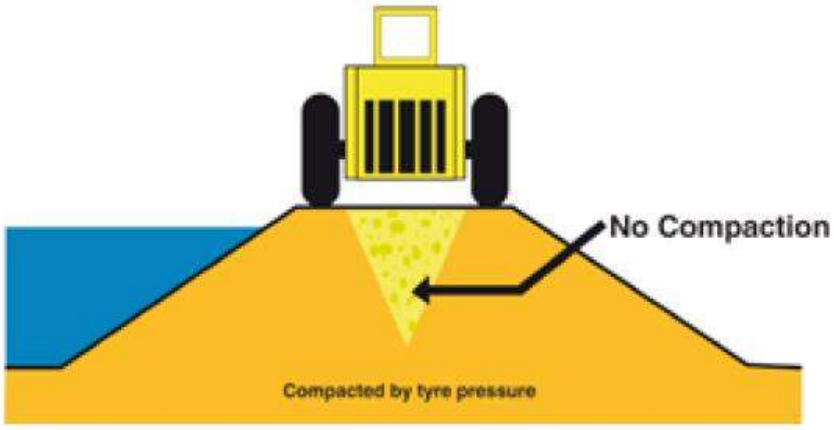


Figure 11. Schematic of Motueka River stopbank construction methods during construction in the 1950's showing lack of compaction in the stopbank core (TDC, 2010; Motueka Flood Control Project, Newsletter Issue 01, July 2010)

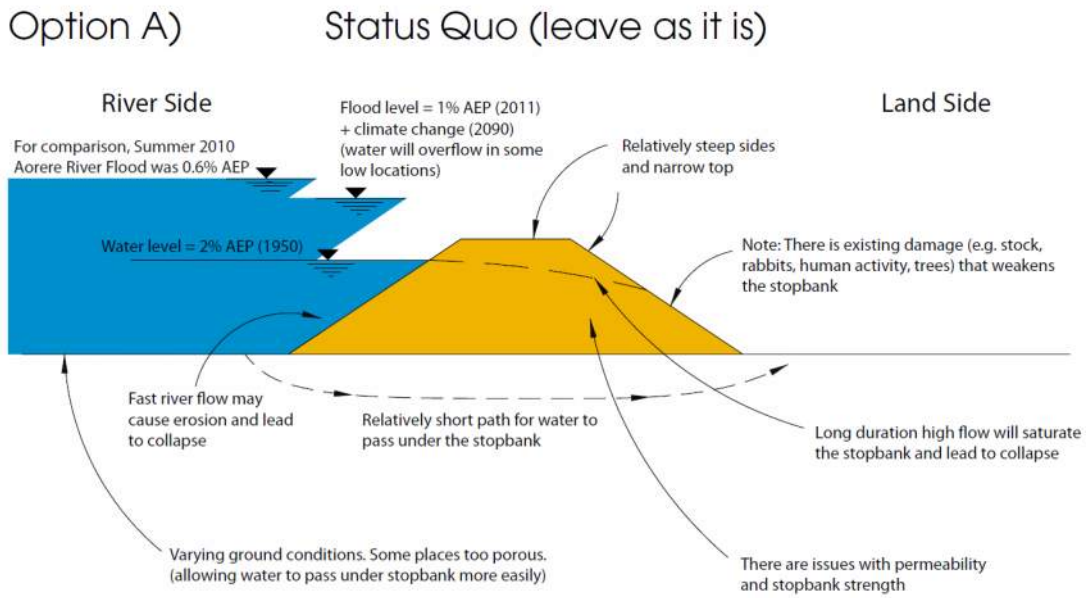


Figure 12. Schematic of the Motueka River stopbanks identifying design flows, projected future flow elevations for the 1% AEP flood event and various modes of likely failure (TDC, 2011; Motueka Flood Control Project, Newsletter Issue 02, April 2011)

POTENTIAL IMPACTS ON TASMAN BAY

31. As I have indicated in paragraphs 25 and 29, fine sediment loading to Tasman Bay as a result of pit headcut erosion and erosion of unvegetated pit backfills is likely to occur, especially since flooding of the backchannel is an annual event and the backchannel is hydraulically connected to the Motueka River downstream of Peach Island. Silts and clays from this erosion will be transported in suspension by the river and then be delivered into Tasman Bay. Scallops have all but disappeared from Tasman Bay and this decline has been in part attributed to fine sediment loading from the upstream Motueka River watershed (Fenemor, 2013). Integrated catchment management is critical to reversing the decline in fish and species habitat (Basher, 2003).

MY ASSESSMENT OF THE APPLICANT'S PROPOSAL AND METHODOLOGY

32. Tonkin & Taylor's assessment of the impacts of the proposed mining on the Motueka River floodplain in Stage 1 fails to take into account headcut erosion of the pits during flows in the backchannel and further does not consider erosion of the uncompacted soils emplaced above the pit backfill material prior to establishment of a vegetation cover. Assessment of the 1% and 10% AEP events is appropriate for evaluating the impacts of the project on flood conveyance and flow depths with respect to overtopping of the stopbanks, but it understates the erosion risk to the floodplain since flood flows in the backchannel occur on an annual basis.

OTHER OPPORTUNITIES FOR AGGREGATE EXTRACTION IN THE REGION

33. I am familiar with the geology and geomorphology of the Motueka River catchment (Basher, 2003) and I am also familiar with the fluvial sediments transported and deposited by the Motueka River that comprise potential sources of aggregate in the riverbed and floodplain of the river. I am also familiar with the history of aggregate extraction from the river (Basher, 2003) and TDC (2022).

34. I have reviewed the Aggregate Opportunities database published by GNS Science (https://data.gns.cri.nz/geology/) and the accompanying report (Hill, 2021).

35. The GNS maps show that alluvial aggregate is available from other sources in the region (Figure 13). Their particular accessibility and constraints would need to be investigated.

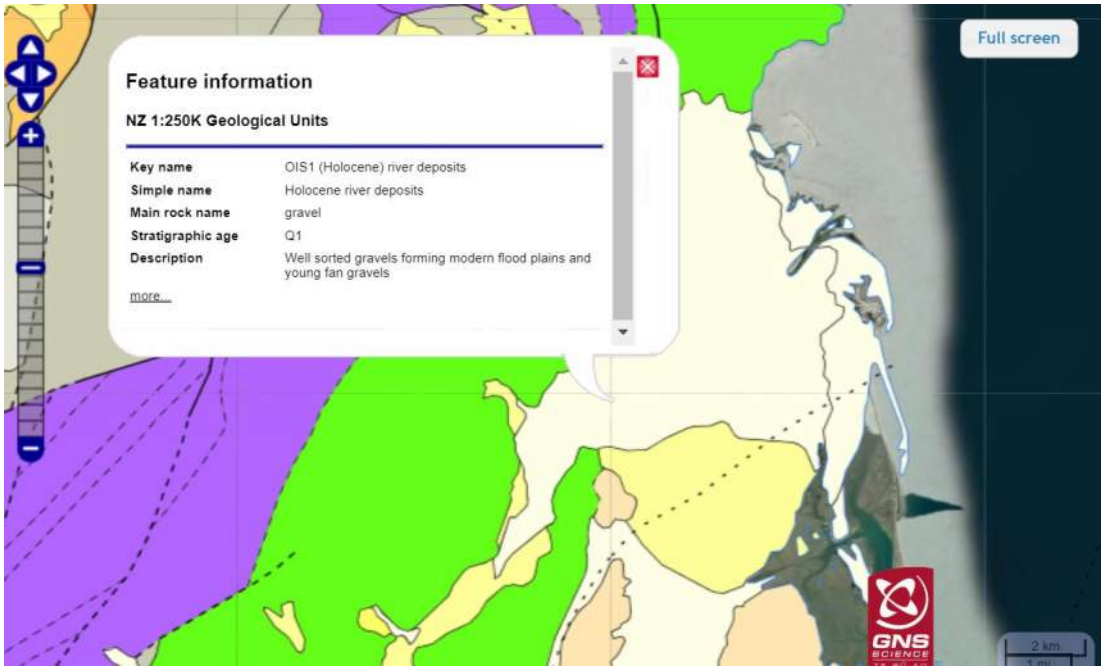


Figure 13. Aggregate resources (Holocene river deposits) within the Motueka area (GNS, 2021).

36. In addition, aggregate is also readily available from other sources (eg Waimea River) that do not seem to impact on highly productive soils (Figure 14). More detailed analysis of this is obviously needed but I understand has not been provided in the application documents. I have calculated the approximate travel distance from the Hau Road processing plant to these Waimea River sources as around 25km, so not much more than the current proposed haulage and transport route from Peach Island (15 km), especially when taking into account the relative road conditions.

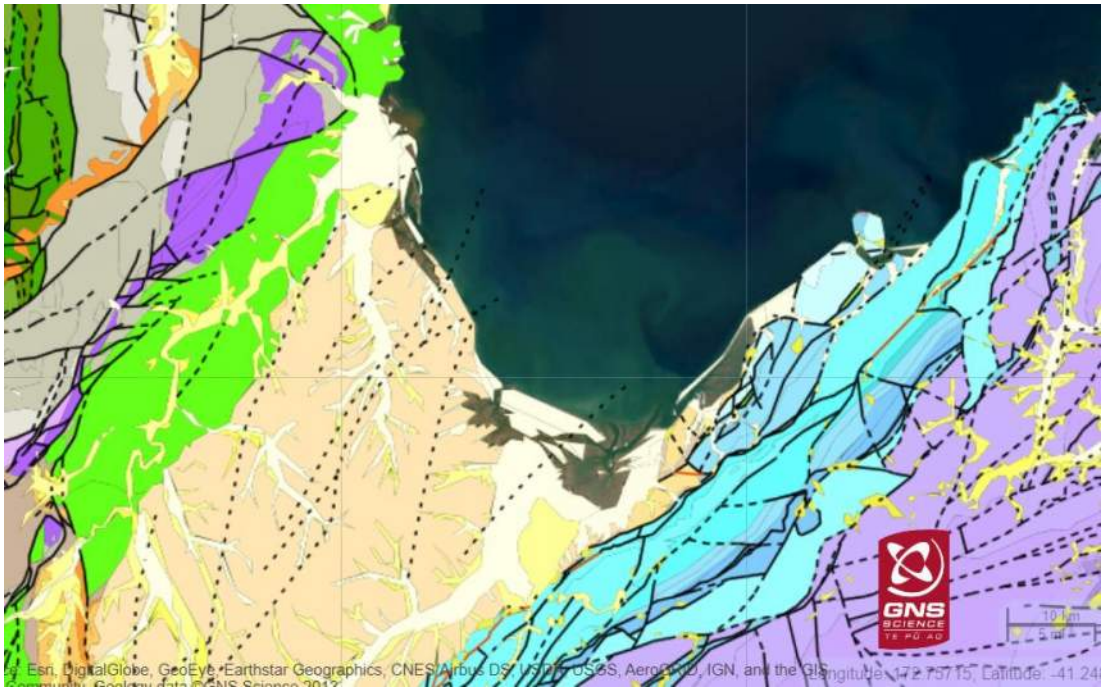


Figure 14. Aggregate resources (Holocene river deposits) within the wider Tasman area (GNS, 2021)

_____

Dr Mike Harvey

References Cited

Barman, B., Kumer, B. and Sarma, A.K., 2019. Dynamic characterisation of the migration of a mining pit in an alluvial channel. Int. J. Sediment Research, v.34(2), 155-165.

Basher, L., 2003. The Motueka and Riwaka catchments: a technical report summarizing the present state of knowledge of the catchments, management issues and research needs for integrated catchment management. Technical Report, Landcare Research, January 2003.

Doyle, M., 2021. Presentation to Motueka Catchment Collective Flood Meeting, 2021-10-11.

Fenemor, A., 2013. A summary of outcomes and selected formal publications from the Integrated Catchment Management (ICM) research programs: 2000-2011. Landcare Research.

Fischenich, C., 2001. Stability Thresholds for Stream Restoration Materials. USACE Research and Development Centre, Vicksburg, MS, Report ERDC-TN-EMRRP-SR-29.

Hill, M.P., 2021. Aggregate Opportunity Modelling for New Zealand, GNS Science Report 2021/10. (Appendix 2, Map 22, Aggregate Opportunity Modelling- Gravel model results-Marlborough-Nelson).

Kondolf, M., 1997. Hungry Water: Effects of dams and gravel mining on river channels. Environmental Management, v.21(4), 533-551.

O'Grady, R., 2021. Notes from Peach Island Flood Response and Mitigation Public Meeting on 2 Nov 2021.

TDC., 2010. Tasman District Council Motueka Flood Control Project Newsletter, Issue 01, July 2010

TDC., 2011. Tasman District Council Motueka Flood Control Project Newsletter, Issue 02, April 2011.

TDC, 2022. Powerpoint presentation. River Gravel Management,

BEFORE AN INDEPENDENT HEARINGS COMMISSIONER AT NELSON

COUNCIL REF: RM 200048, 200489 AND 220578

UNDER THE	Resource Management Act 1991
IN THE MATTER OF	Land use consent applications by CJ Industries Limited to extract gravel from 134 Peach Island Road, Motueka from the berm of the Motueka River and on the landward side of the stopbank at Peach Island with vehicle access via a right of way over 493 Motueka River West Bank Road, Crown land and unformed legal road (RM200488 and RM200489); and discharge permit application by CJ Industries Limited to discharge contaminants to land from backfill material associate with the proposed gravel extraction (RM220578)

STATEMENT OF EVIDENCE OF JESSICA LEE HOLLIS ON BEHALF OF VALLEY RESIDENTS AGAINST GRAVEL EXTRACTION INCORPORATED (PLANNING)

Dated: 11 November 2022

QUALIFICATIONS AND EXPERIENCE

1. My full name is Jessica Lee Hollis. I am a resource management planning consultant. I hold a Bachelor's degree in Resource Studies, majoring in Environmental Management, and I am an Associate Member of the New Zealand Planning Institute. I also hold a Postgraduate Certificate in Science with a focus on Māori resource and environmental management, including Māori natural resource policy.

2. I currently operate as an independent resource management consultant based in Mangawhai, in the Northland region, and undertake work throughout New Zealand. I have been employed in resource management planning roles within local government in the Buller, Nelson, Auckland and Northland regions over the past 18 years, including as the Policy and Planning (Consents) Manager at Kaipara District Council from 2017 to 2019.

3. My career to date has been pre-dominated by work as a practicing planner in the area of resource consents, including in the Nelson and Tasman regions. I have also worked in resource management policy development, interpretation and review, and compliance, monitoring and enforcement functions. I am currently contracted by the Ministry for the Environment to assist in the implementation of the COVID-19 Recovery (Fast-track Consenting) Act 2020, including providing advice and recommendations to the Minister for the Environment on applications under that legislation.

4. I have processed a number of resource consents for district councils, including providing planning evidence at hearings, involving mineral and aggregate extraction in the Buller and West Coast regions.

CODE OF CONDUCT

5. I have read and agree to comply with the Code of Conduct for expert witnesses as set out in the Environment Court Consolidated Practice Note 2014. I have also read and am familiar with the Resource Management Law Association / New Zealand Planning Institute "Role of Expert Planning Witnesses" paper. I confirm that the

evidence on planning matters that I present is based on my qualifications and experience, and within my area of expertise. I am not aware of any material facts which might alter or detract from the opinions I express. If I rely on the evidence or opinions of another, my evidence will acknowledge that.

BACKGROUND AND ROLE

6. I was engaged by Valley Residents Against Gravel Extraction Incorporated (Valley R.A.G.E) in June 2022 and I was not directly involved in its submissions on resource consent applications RM200048, 200489 or 220578.

7. In preparing my evidence, I have read the following documents insofar as they relate to the scope of my evidence:

   7.1 Resource Consent Applications and the Assessment of Effects on the Environment prepared by the Applicant, dated 15 June 2020 and 15 July 2022

   7.2 Section 92 requests by Tasman District Council and the responses from the Applicant

   7.3 Submissions of Valley R.A.G.E

   7.4 Submissions of Wakatū Incorporation, Te Ātiawa Manawhenua Ki Te Tau Ihu Trust and Te Rūnanga o Ngāti Rarua

   7.5 Section 42A reports and addendum

   7.6 Statements of evidence prepared on behalf of the Applicant

   7.7 Draft statement of evidence of Mr Iain Campbell (Soil Science – Valley R.A.G.E)

SCOPE OF EVIDENCE

8. The scope of my evidence is generally restricted to planning matters relating to land productivity for RM200488, being the land use consent application to disturb land

for gravel extraction within the Rural 1 zone. I also make brief comments on noise effects in relation to amenity values, and cultural effects.

9. Effects on land productivity and alignment with the relevant planning provisions of the Tasman Resource Management Plan (TRMP) and the National Policy Statement for Highly Productive Land 2022 (NPS-HPL), are outstanding matters of contention between the Council's s42A report author, Ms Susanne Bernsdorf Solly, and the Applicant's planner, Mr Hayden Taylor. Both Ms Bernsdorf Solly and Mr Taylor also acknowledge that they are not in a position to come to a conclusion with respect to cultural effects.

10. My evidence does not address all areas of concern of Valley R.A.G.E. I understand representatives of Valley R.A.G.E are providing separate evidence on a range of matters raised in its submissions.

11. My evidence is structured as follows:

11.1 Introduction

11.2 Executive Summary

11.3 Site and Setting

11.4 Project Description and Consents Required

11.5 Land Productivity

11.6 Noise Effects

11.7 Cultural Effects

11.8 Other Matters

11.9 Conditions

11.10 Conclusions

EXECUTIVE SUMMARY

12. To summarise, my evidence expresses the following opinions in respect to the proposed gravel extraction and associated activities:

12.1 With respect to land productivity, having considered the relevant matters set out in the NPS-HPL, TRPS and TRMP, I consider the applicant has not provided sufficient information to adequately determine the application. In particular, they have not provided an adequate assessment of alternative locations or demonstrated that the proposal provides significant regional public benefit that could not otherwise be achieved using resources within New Zealand. In my view, the applicant cannot justify the development has a functional or operational need to locate at 134 Peach Island Road simply on the basis of economic or property ownership considerations. Based on the information that has been provided, and the evidence of Mr Campbell and Dr Harvey, I consider the proposal will be inconsistent with some, and contrary to other, relevant provisions of the NPS-HPL and TRMP.

12.2 With respect to noise effects, I agree with Ms Bernsdorf Solly that noise effects from the proposal do not fall within the permitted baseline and should not be disregarded under s104(2) of the Act. I consider that a more stringent noise limit than the 55dBA LAeq as specified in the TRMP should be applied to the proposal to ensure that any noise generated is compatible with the ambient and background noise levels in the area, and in recognition of the existing amenity of the receiving environment.

12.3 With respect to cultural effects, having considered the submissions of Wakatū Incorporation, Te Ātiawa Manawhenua Ki Te Tau Ihu Trust and Te Rūnanga o Ngāti Rarua, I consider the applicant has not provided sufficient information to adequately determine the application.

SITE AND SETTING

13. The site and setting has been described in the Application and the s42A report circulated by Council on 4 March 2022. I do not intend to repeat this here.

14. I have viewed the application site from adjoining land, and the wider surrounding area, during a site visit on 2 July 2022. During that site visit I also had the opportunity to view the applicant's quarry operations at Douglas Road, Motueka (again from adjoining land).

15. I agree with Ms Bernsdorf Solly and Mr Taylor's identification of the relevant zoning and overlays under the TRMP.

PROJECT DESCRIPTION AND CONSENTS REQUIRED

16. The project has been described at length in the Application and the s42A report circulated on 4 March 2022, and the addendum to the s42A report and s42A report on the discharge permit application circulated on 28 October 2022. I do not intend to repeat this here.

17. A total of three consents to authorise the proposal have been applied for and publicly notified. As previously noted, the scope of my evidence is generally restricted to planning matters relating to land productivity, cultural effects and noise in relation to rural amenity for RM200488, being the land use consent application to disturb land for gravel extraction.

18. I accept Ms Bernsdorf Solly and Mr Taylor's assessment that the land use consents (RM200488 and RM200489) should be bundled and considered as a discretionary activity.

LAND PRODUCTIVITY

19. In the addendum to her s42A report, Ms Bernsdorf Solly identifies three matters[1] that she considers are in contention relating to land productivity (included within points 19.1 and 19.6 below). Based on my review of the s42A report and addendum,

[1] Bernsdorf Solly (21 November 2022), S42A report addendum, para 9.39, pg 43

Mr Taylor's evidence and Mr Campbell's evidence, I consider that the following matters are in contention:

19.1 the interpretation of the definition of highly productive land;

19.2 whether the flooding risk to the Stage 1 area of the proposal constitutes a permanent or long-term constraint on the land that means the use of the highly productive land for land-based primary production is not able to be economically viable for at least 30 years;

19.3 whether the proposal is a small-scale or temporary land-use activity that has no impact on the productive capacity of the land;

19.4 whether the proposal provides significant national or regional public benefit that could not otherwise be achieved using resources within New Zealand;

19.5 whether there is a functional or operational need for the use or development to be on the highly productive land;

19.6 whether the practical implementation of the Soil Management Plan (SMP) can successfully achieve the outcomes sought and prevent a loss of productive value of the land, and whether the conditions (as volunteered by the applicant) will lead to a degradation in productive capacity.

20. I address these matters in turn below.

Extent of Highly Productive Land / High Productive Value land

21. The definition of 'highly productive land' under the National Policy Statement on Highly Productive Land 2022 (NPS-HPL) has been covered in evidence and I do not intend to repeat it here. There is a difference in opinion between Ms Bernsdorf Solly and Mr Taylor as to what part of the application site should be considered as highly productive land under the NPS-HPL. Ms Bernsdorf Solly concludes that the entire site is defined as highly productive land, whilst Mr Taylor considers that, at most, only 1.3ha of land on the landward side of the stop bank and 1.8ha of land on the river side of the stop bank meets the definition.

22. The evidence of Mr Iain Campbell raises concerns with the report prepared by LandVision Ltd[2] that has been used by the applicant's experts to identify the 1.3ha and 1.8ha of highly productive land. Mr Campbell considers the report "*lacks soil science substance*"[3]. Mr Campbell has considerable experience in the field of soil science, particularly within the Tasman district, and has assessed the soil productivity potential of Riwaka soils (which are the type of soils found on the site) as being of high to moderate soil versatility class and capable of producing a wide variety of crops[4]. Mr Campbell is confident the soils have moderate to high productive potential and considers this is consistent with the highly productive classification the land in the NPS-HPL[5].

23. I accept the opinion of Mr Campbell, and therefore agree with Ms Bernsdorf Solly, that the entire application site should be considered as highly productive land under the NPS-HPL.

24. Based on the information contained in the s42A report and addendum, and the evidence of Mr Campbell, I also agree with Ms Bernsdorf Solly that the land within the entire application site, which is classified as LUC Class 3, meets the definition of 'high productive value' in the TRMP.

Flooding risk to the Stage 1 area of proposed works

25. Both Ms Bernsdorf Solly and Mr Taylor have concluded that the land within Stage 1 (outside of the stop bank) has limited productive value due to flooding risk. However, as detailed above, Ms Bernsdorf Solly accepts that the land within Stage 1 still meets the definition of 'highly productive land' under the NPS-HPL.

26. Mr Reece Hill states that the land "*outside the stop bank is not suitable for agricultural land development due to soil and land limitations of an inherent seasonally high watertable, flood risk, and variable or shallow soil depth*"[6]. With

[2] LandVision Ltd (May 2021), Peach Island LUC & Soil Survey, Peach Island Road Motueka Valley, CJ Industries

[3] Evidence of Campbell (11 November 2022), para 16, pg 3.

[4] Evidence of Campbell (11 November 2022), para 15, pg 3.

[5] Evidence of Campbell (11 November 2022), para 17, pg 3.

[6] Evidence of Hill (15 July 2022), para 4.2, pg 18

respect to clause 3.10(1)(a) of the NPS-HPL, Ms Bernsdorf Solly, Mr Taylor and Mr Hill agree that the land within Stage 1 has "*permanent or long-term constraints … that mean the use of the highly productive land for land-based primary production is not able to be economically viable for at least 30 years*"[7].

27. Mr Campbell considers that whilst frequently flooded soils are downgraded for potential productive use because of flooding, this does not preclude their use for very productive purposes[8]. Mr Campbell also notes that "*notwithstanding the variable depths, textures, stoniness and drainage differences over small distances, most of the Waimea Plain is under intensive horticulture and or market gardening*"[9], and he provides examples of this for market garden crops and a kiwifruit orchard.

28. Based on the evidence of Mr Campbell, I consider that insufficient evidence has been provided to demonstrate that flood risk, in and of itself (as referred to by Ms Bernsdorf Solly and Mr Taylor), is a permanent or long-term constraint that means the use of the highly productive land for land-based primary production is not able to be economically viable for at least 30 years.

Is the proposal small-scale or temporary?

29. There is a difference in opinion between Ms Bernsdorf Solly and Mr Taylor as to whether the proposal is small-scale or temporary, which is relevant under Clause 3.9(2)(g) of the NPS-HPL. Ms Bernsdorf Solly concludes that the proposal is neither small-scale nor temporary, whilst Mr Taylor considers it is 'debatable' whether the activities are small-scale but considers they are temporary.

30. I agree with Ms Bernsdorf Solly that the proposal is neither small-scale nor temporary. This is also the view of Mr Campbell. Neither of these terms are defined in the NPS-HPL, however the s32 report for the NPS-HPL provides an indication of what was intended by the allowance for small-scale or temporary activities:

---

[7] NPS-HPL, clause 3.10(1)(a)

[8] Evidence of Campbell (11 November 2022), para 80, pg 21.

[9] Evidence of Campbell (11 November 2022), para 27, pg 5.

> "***Is a small-scale or temporary land-use activity that has no impact on the productive capacity of the land*** *– this ensures the NPS-HPL does not prevent temporary land-use activities (such as concerts, farmers markets) from occurring on HPL, where it is acknowledged these activities are of a short duration and will not restrict or compromise the land from being used for land-based primary production. It also allows for small-scale activities (eg, a home business run from a farmhouse) where these have no impact on the productive capacity of the land. Guidance will provide more direction to territorial authorities on the range of activities that could be anticipated under this clause*."[10]

31. When compared to the examples used for temporary activities – concerts and farmers markets, and small-scale activities – home business run from a farmhouse, I consider that the proposed gravel extraction does not fit what is intended by either category. This is also supported by the s32 efficiency assessment of Clause 3.9 that details the benefits of enabling "*small-scale (eg, a home business) or temporary land-use activities on HPL that provide an economic benefit to the landowner, <u>while ensuring the predominant use of the land continues to be land-based primary production</u>*"[11] (my emphasis).

Does the proposal provide significant national or regional public benefit that could not otherwise be achieved using resources within New Zealand?

32. Mr Taylor considers the proposal will provide significant national or regional public benefit that could not otherwise be achieved using resources within New Zealand, which is relevant under Clause 3.9(2)(j)(iv) of the NPS-HPL. Ms Bernsdorf Solly considers the applicant has not provided sufficient evidence to demonstrate this.

33. I note that the applicant has provided additional evidence from Dr William Kaye-Blake and Mr Wayne Scott, CEO of the Aggregate and Quarry Association, on this

[10] MfE (2022), National Policy Statement for Highly Productive Land: Evaluation report under section 32 of the Resource Management Act, pg 98

[11] MfE (2022), National Policy Statement for Highly Productive Land: Evaluation report under section 32 of the Resource Management Act, pg 100

point, however I do not consider this evidence is sufficient to clearly demonstrate that the proposal provides significant regional public benefit that could not otherwise be achieved using resources within New Zealand. Neither Mr Kaye-Blake nor Mr Scott have undertaken a detailed analysis of alternative sites (both in the region and elsewhere in New Zealand) that may be available to undertake the proposed gravel extraction, nor a cost-benefit analysis on those sites (as has been undertaken for the application site).

34. Mr Campbell considers that there are other nearby sites where alluvial aggregate is available that will not impact on highly productive land[12]. This aligns with the evidence of Dr Mike Harvey who has referenced Aggregate Opportunities maps by GNS Science that show gravel river deposits near to Peach Island. Mr Harvey advises that "*aggregate is also readily available from other sources (eg Waimea River) that do not seem to impact on highly productive soils*"[13]. In my opinion, the applicant should be required to consider possible alternative locations for the activity in greater detail, including a comparison of the regional public benefits from extraction at those sites. This is particularly important given the strong policy direction of the TRMP and NPS-HPL.

35. Given the importance of this matter to the consideration of the application, i.e. it is a determinative factor for whether the proposed gravel extraction activity is considered an 'inappropriate use of highly productive land', I also consider it would have been appropriate for the Council to have engaged a technical specialist to review the assessment and evidence of Mr Kaye-Blake. Whilst Council is not obliged to do so, a review could provide assurance to both Council and submitters that the methodology and findings are sound. In my opinion, the onus should not be on the submitters to obtain a technical review in an area that is critical to the consideration of the application under the NPS-HPL.

[12] Evidence of Campbell (11 November 2022), para 21, pg 4.

[13] Evidence of Harvey (11 November 2022), para 36, pg 19.

Is there a functional or operational need for the use or development to be on the highly productive land?

36. Ms Bernsdorf Solly and Mr Taylor agree that there is an operational need for the proposal to be located on highly productive land, however they disagree as to whether there is a functional need.

37. With respect to functional need, I agree with Ms Bernsdorf-Solly that there is not a functional need for the proposed gravel extraction to be on highly productive land as alternative sources of aggregate are available (that are not on highly productive land) according to Mr Campbell and as evidence from the GNS Science database referred to in Mr Harvey's evidence. Mr Taylor's evidence details that there is a functional need for the proposal to locate on the application site and in an alluvial river plain environment in general. Whilst aggregate deposits are location specific and therefore aggregate extraction may be limited to river plain environments, this should not be confused with a functional need for aggregate extraction to be on highly productive land. These are two different matters.

38. 'Operational need' is not defined in the NPS-HPL and the s32 report for the NPS-HPL only details that 'established case law' is available on the term. 'Operational need' is defined in the National Planning Standards (that predate the NPS-HPL) as:

> *"…the need for a proposal or activity to traverse, locate or operate in a particular environment because of technical, logistical or operational characteristics or constraints"*[14]

39. In my opinion, the applicant has not provided sufficient evidence that there is an operational need for the proposal to be on highly productive land. The applicant notes the "*site is considered to be a desirable location for gravel extraction to take place because of the high-quality aggregate that is available and the relatively close carting distances*"[15]. The primary drivers for utilising the application site for gravel extraction appear to be that the applicant owns the land at 134 Peach Island and the

[14] MfE (2019), National Planning Standards November 2019, pg 62

[15] Planscapes (NZ) Ltd (June 2020), Application for Resource Consent, pg 6

cost of transporting the material is lower than other sites. However, property considerations are not relevant to decision-making under the Resource Management Act 1991, and I do not agree that reduced transportation costs is sufficient to demonstrate 'operational need'.

40. The applicant should be required to consider possible alternative locations (not on highly productive land) for the activity in greater detail, including a comparison of the technical, logistical or operational characteristics or constraints that exist at alternative sites. This consideration of alternatives should also include the opportunity to extract increased amounts of gravel under the Council's global resource consent. Such an analysis would provide clearer evidence on whether there was an operational need for the proposal to be on highly productive land, or rather whether the proposed location was preferable due to profit margins.

Will implementation of the SMP successfully achieve the outcomes sought and prevent a loss of productive value of the land, or will the proposal lead to a degradation in productive capacity on the site?

41. Relying on the evidence of Mr Hill, and subject to the activity being carried out in accordance with the SMP, Mr Taylor considers that the proposal minimises and mitigates any loss of the availability and productive capacity of highly productive land. The evidence of Mr Hill states:

> *"…although there will be a temporary loss of productive land (during and immediately following gravel extraction), the soil and land will be restored and no loss of potential productive value will result. In my opinion, the productive capacity of the soil will be restored, and potentially enhanced, within 0-3 years of restoration. As a result, the potential of land productivity to provide for future generations is not compromised."*[16]

42. With respect to the availability of highly productive land, Mr Hill considers that any effects on the productive capacity of the soils will be remedied beyond a 3-year

[16] Evidence of Hill (15 July 2022), para 3.61, pg 18

period. I note the applicant is seeking a consent duration of 15 years (and does not propose to commence works on the Stage 1 area for approximately 6 years), therefore granting consent to this application would make the highly productive land 'unavailable' for productive purposes for up to 18 years.

43. Mr Taylor's evidence appears to be focused on the availability and productive capacity of highly productive land in the long term, however the NPS-HPL seeks to protect highly productive land for use in land-based primary production, both now and for future generations[17]. Mr Taylor has referred to the definition of 'productive capacity' in the NPS-HPL as the "*ability of the land to support land-based primary production over the long term*"[18]. However, this does not imply that the availability of highly productive land should also be considered over the long term as this would contradict Objective 2.1 that seeks to protect the land both now and into the future.

44. In my opinion, a timeframe of up to 18-years does not minimise or mitigate the loss of availability of highly productive land in the district. I discuss consent duration further in paragraph 74 of my evidence.

45. With respect to the loss of productive value and productive capacity of the land, Ms Bernsdorf Solly has raised concerns regarding the practical implementation of the SMP. Similarly, Mr Campbell, based on experience with similar soil restoration projects, is concerned that "irrespective of directive wording and specific mitigation measures in the draft SMP, the likelihood of human error over the project's 15 year timeframe is high"[19]. Mr Campbell is particularly concerned about the soil management measures proposed including with respect to backfilling and the reliance on self-certification of backfill material.

46. Mr Campbell disagrees with Mr Hill that after 0-3 years the site will be fully remediated, and probably better than before, and considers "*the disturbed soils on*

[17] NPS-HPL, Objective 2.1, pg 7

[18] NPS-HPL, Interpretation, pg 4

[19] Evidence of Campbell (11 November 2022), para 44, pg 10.

Peach Island will not be able to be restored to their high potential productive status"[20].

Relevant statutory provisions for land productivity

NPS-HPL

47. I generally agree with the identification of the relevant objective (there is only one) and policies of the NPS-HPL in the s42A addendum.

48. The objective of the NPS-HPL is for highly productive land to be protected for use in land-based primary production, both now and for future generations. I consider the proposal is contrary to this objective as the highly productive land will be 'unavailable' for productive purposes for up to 18 years, and then will have a reduced productive value and productive capacity beyond that time.

49. Mr Taylor notes the NPS-HPL does not provide absolute protection of highly productive land, nor specifies that there should be no loss of highly productive land within a region or district[21]. I accept this; however, Mr Taylor also acknowledges the intent of the objective (as detailed in the s32 report) is to ensure that land uses that are not land-based primary production only occur on highly productive land:

> "• *in circumstances where it is appropriate and necessary*
>
> • *when alternative options have been appropriately considered*
>
> • *where those alternative uses provide wider environmental, economic, social and cultural benefits*"[22]

50. In my opinion the applicant has failed to demonstrate that the proposed gravel extraction on highly productive land is necessary. Alternative options to gravel extraction on the highly productive land have not been appropriately considered,

---

[20] Evidence of Campbell (11 November 2022), para 19, pg 3 - 4.

[21] Evidence of Taylor (4 November 2022), para 4.7, pg 39

[22] MfE (2022), National Policy Statement for Highly Productive Land: Evaluation report under section 32 of the Resource Management Act, pg 44

and the gravel extraction activity will provide limited wider environmental, and no cultural, benefits.

51. Policy 1 of the NPS-HPL is highly productive land is recognised as a resource with finite characteristics and long-term values for land-based primary production. In my opinion the proposal does not recognise the long-term values of the site for land-based primary production as it will result in reduced productive value and productive capacity. The proposal is therefore inconsistent with Policy 1.

52. Policy 4 of the NPS-HPL is the use of highly productive land for land-based primary production is prioritised and supported. The proposal does not prioritise nor support the use of the highly productive land for land-based primary production and is therefore contrary to this policy. Mr Taylor considers the proposal is consistent with this policy on the basis the proposal will not impact on the long-term productive potential of the land. I disagree that this policy relates to the long term use of highly productive land as there is no such reference made.

53. Policy 8 of the NPS-HPL is highly productive land is protected from inappropriate use and development. Clause 3.9(1) of the NPS-HPL details that "*territorial authorities must avoid the inappropriate use or development of highly productive land that is not land-based primary production*" (my emphasis). Clause 3.9(2) details that a use or development of highly productive land is inappropriate except where specified circumstances as set out in (a) – (j) apply, and the measures in subclause (3) are applied.

54. Mr Taylor considers that the proposal is not inappropriate as clause 3.9(2)(g) applies – "*it is a small-scale or temporary land-use activity that has no impact on the productive capacity of the land*". As detailed in paragraphs 29 - 31 of my evidence, I do not consider the proposal is small-scale or temporary, and therefore clause 3.9(2)(g) does not apply.

55. Mr Taylor also considers that the proposal is not inappropriate as clause 3.9(2)(j)(iv) applies – "*it is associated with one of the following, and there is a functional or operational need for the use or development to be on the highly productive land… (v)*

aggregate extraction that provides significant national or regional public benefit that could not otherwise be achieved using resources within New Zealand". As detailed in paragraphs 32 - 35 of my evidence, I consider the applicant has not provided sufficient evidence to demonstrate that the proposal provides significant national or regional public benefit that could not otherwise be achieved using resources within New Zealand. Further, as detailed in paragraphs 36 - 40 of my evidence, I consider the proposal also fails the second limb of 3.9(2)(j)(iv) as there is not a functional need for the proposal to be on highly productive land and the applicant has not provided sufficient evidence that there is an operational need for the proposal to be on highly productive land.

56. I therefore consider that none of the exceptions provided under clause 3.9(2) apply and the proposal represents an inappropriate use of highly productive land. The proposal will be in direct conflict with the avoid directive in clause 3.9(1) and will be contrary to policy 8.

57. For completeness, should the Commissioner decide that the proposal meets either (or both) exceptions under clause 3.9(2)(g) or 3.9(2)(j)(iv), I also consider that the proposal will not minimise or mitigate any actual loss or potential cumulative loss of the availability and productive capacity of highly productive land in the district, as required by clause (3)(a). I have discussed this in paragraphs 41 - 46 of my evidence.

58. Clause 3.10(1) of the NPS-HPL provides exemptions for subdivision, use and development on highly productive land that is subject to permanent or long-term constraint and details that:

> "*Territorial authorities may only allow highly productive land to be subdivided, used, or developed for activities not otherwise enabled under clauses 3.7, 3.8, or 3.9 if satisfied that:*
>
> *(a) there are permanent or long-term constraints on the land that mean the use of the highly productive land for land-based primary production is not able to be economically viable for at least 30 years; and…"*

59. There are additional criteria in subclause (b) and (c) that also need to be met. Ms Bernsdorf Solly considers that it is open to the Commissioner to grant resource consent to Stage 1 as that area of land has limited productive use due to flooding risk and therefore meets the exemption under clause 3.10(1)(a). As detailed in paragraphs 25 - 28 of my evidence I consider that insufficient evidence has been provided to support this assessment.

Tasman Regional Policy Statement (TRPS)

60. I have reviewed the relevant provisions of the TRPS relating to land productivity and agree with Ms Bernsdorf Solly that these are reflected in the provisions of the TRMP. I have therefore not undertaken a separate assessment of the TRPS.

TRMP

61. I agree with the identification of the relevant objectives and policies of the TRMP relating to land productivity in the s42A report.

62. Overall, I agree with Ms Bernsdorf Solly that the proposal is inconsistent with the objectives and policies relating to land productivity. Further, I consider that the proposal is contrary to Objective 7.1.2.1 that seeks to avoid the loss of value for all rural land of existing and potential productive value to meet the needs of future generations, particularly land of high productive value. The proposal is also contrary to Objective 7.1.2.2 as it fails to retain and enhance opportunities for plant and animal production on land with high productive values in the Rural 1 zone.

63. Section 7.50 of the TRMP details the environmental results anticipated in relation to rural environment effects. Clause 7.50.1 anticipates minimal cumulative loss of availability of rural land for plant and animal production purposes, and maintenance of a sustainable level of availability of land of high actual or potential productive value. In my opinion the applicant has not demonstrated that the proposal will achieve this environmental result.

NOISE EFFECTS

64. Following a review of Mr Taylor and Mr Rhys Hegley's supplementary evidence (of 4 November 2022), I understand the only matter that remains in contention between the applicant and council relating to noise is the noise limit, and therefore consent condition wording, that should apply to the proposal.

65. I note that both Ms Bernsdorf Solly and Mr Taylor appear to disagree over whether noise effects from the proposal should be considered as falling within the permitted activity baseline and therefore be disregarded. However, Mr Taylor concludes that "*discounting of adverse effects that form part of the permitted baseline is not relied upon*"[23] for his conclusions on noise effects.

66. For similar reasons as identified by Ms Bersndorf Solly, I consider that noise effects from the proposal should not be disregarded under s104(2) of the Act. I do not consider that permitted activities within the Rural 1 zone, including horticultural and agricultural activities, provide a reasonable comparison of adverse effects to the gravel extraction activity as proposed. Whilst I acknowledge that such permitted activities do generate noise and rural working environments should not be expected to be 'quiet', I agree with Ms Bernsdorf Solly that noise associated with the gravel extraction will be dissimilar in character, intensity and duration. Mr Joachim Lang on behalf of Valley R.A.G.E has also raised the issue of special audible characteristics present in excavator noise.

67. As the application is for a discretionary activity, consideration needs to be given to whether the site overall is a suitable location. I agree with Ms Bernsdorf Solly that the test with respect to noise is not whether the noise levels can be met, but whether the potential adverse effects of the noise are going to detract from the rural amenity of the area, and whether the noise is reasonable[24].

68. I agree with Ms Bernsdorf Solly, Mr Daniel Winter from council and Mr Lang, that a more stringent noise limit than the 55dBA LAeq as specified in the TRMP should be applied to the proposal. I note that Mr Winter and Mr Lang have differing views on

[23] Evidence of Taylor (15 July 2022), para 3.28, pg 18

[24] Bernsdorf Solly (4 March 2022), S42A report, para 8.5, pg 30

the appropriate noise limit, but I consider this should be set to ensure that any noise generated is compatible with the ambient and background noise levels in the area, and in recognition of the existing amenity of the receiving environment.

69. I understand that Mr Lang has raised a number of additional concerns in his evidence regarding the noise report of Mr Hegley.

CULTURAL EFFECTS

70. Ms Bernsdorf Solly and Mr Taylor both acknowledge they are not in a position to come to a conclusion with respect to cultural effects. Ms Bernsdorf Solly raises concern that the proposal is inconsistent with the National Policy Statement on Freshwater Management 2020 (NPS-FW) and the TRMP in relation to cultural values, but regardless she considers it is open to the Commissioner to grant consent for Stage 1.

71. I have reviewed the submissions from Wakatū Incorporation, Te Ātiawa Manawhenua Ki Te Tau Ihu Trust and Te Rūnanga o Ngāti Rarua. In my opinion the matters raised have not been sufficiently addressed by the applicant or in the s42A report and addendum.

OTHER MATTERS

72. Tasman District Council and Nelson City Council adopted the Nelson Tasman Future Development Strategy 2022-2052 (NTFDS) on 29 August 2022. The NTFDS is a 30-year high-level strategic plan that outlines areas in the regions, including outside of existing urban environments, where there is potential for future housing and growth. The NTFDS has been prepared in accordance with direction of the National Policy Statement on Urban Development 2020 and has followed "*months of community engagement, detailed feedback, and informative deliberations*"[25], including 568 submissions.

[25] https://www.tasman.govt.nz/my-council/key-documents/more/future-development-strategy/

73. The NTFDS identifies two areas of land described as T-17 Mytton Heights Hills, located to the east of the application site, as a Rural Tasman Growth Area (shown in Figure 1 on the following page). The land is identified for future rural residential development with an anticipated yield of approximately 540 dwellings based on a density of 1-2 dwellings per hectare. The NTFDS does not provide indicative timeframes for re-zoning of the T-17 land but details that the staging and rollout of growth areas will be set out in annual implementation plans in response to market information and feedback, and annual monitoring results. However, what can be concluded from the NTFDS is that via a thorough public participatory process, the land immediately to the east of the application site has been identified as a growth area that will enable council to provide sufficient development capacity.

Figure 1: Showing T-017 Mytton Heights Hills as per the NTFDS

74. Whilst the NTFDS may have limited weight in terms of the receiving environment for this application, I consider it is relevant with respect to the consent duration sought by the applicant. Mr Taylor states that "*duration of consent is a method used to address uncertainty about the adverse effects of consent, particularly if the sensitivity of the receiving environment may change over time. In this case, a significant level of expert advice is available to provide a high level of certainty regarding adverse effects, which have been confirmed to be no more than minor, and; the local receiving*

environment is well understood"[26] (my emphasis). In my opinion, the identification of the land to the east of the site in the NTFDS as a Rural Tasman Growth Area with an approximate yield of 540 dwellings is relevant to the consideration of consent duration. The sensitivity of the receiving environment has the potential to change within the 15-year consent duration sought by the applicant, and a lesser consent duration should therefore be considered.

CONDITIONS

75. As previously noted, Mr Campbell is concerned that "*irrespective of directive wording and specific mitigation measures in the draft SMP, the likelihood of human error over the project's 15 year timeframe is high*"[27]. Mr Campbell is specifically concerned about the measures proposed regarding backfilling at the site and the reliance on self-certification of backfill material.

76. I agree with Mr Campbell that if the material and methodology of backfilling is critical to the success of the rehabilitation of the site for future productive purposes, then the reliance on self-certification is not appropriate.

77. I have not provided detailed evidence on the conditions of consent as I consider there are substantive barriers to the granting of the consent that are yet to be resolved. I anticipate that the potential wording of consent conditions, should the Commissioner consider it is appropriate to grant consent, may be further refined through the hearing. I can be available to participate in expert caucusing on consent conditions in the event the Commissioner considers that is appropriate.

CONCLUSION

78. The proposal requires land use consents and a discharge permit under the TRMP. The land use consents (RM200488 and RM200489), when bundled together, have been identified by the Council planner, Ms Bernsdorf Solly, and the applicant's planner, Mr Taylor, as a discretionary activity.

---

[26] Evidence of Taylor (15 July 2022), para 3.122, pg 56

[27] Evidence of Campbell (11 November 2022), para 44, pg 10.

79. With respect to land productivity, having considered the relevant matters set out in the NPS-HPL, TRPS and TRMP, I consider the applicant has not provided sufficient information to adequately determine the application. Based on the information that has been provided, and the evidence of Mr Campbell and Dr Harvey, I consider the proposal will be inconsistent with some, and contrary to other, relevant provisions of the NPS-HPL and TRMP.

80. With respect to noise effects, I agree with Ms Bernsdorf Solly that noise effects from the proposal do not fall within the permitted baseline and should not be disregarded under s104(2) of the Act. I consider that a more stringent noise limit than the 55dBA LAeq as specified in the TRMP should be applied to the proposal to ensure that any noise generated is compatible with the ambient and background noise levels in the area, and in recognition of the existing amenity of the receiving environment.

81. With respect to cultural effects, having considered the submissions of Wakatū Incorporation, Te Ātiawa Manawhenua Ki Te Tau Ihu Trust and Te Rūnanga o Ngāti Rarua, I consider the applicant has not provided sufficient information to adequately determine the application.

_____

Jessica Hollis