Before the Expert Fast-track Panel

FTAA-2511-1150

Under	the Fast-track Approvals Act 2024 (**FTAA**)
And	
In the Matter	of an application for approvals by **MCCALLUM BROTHERS LIMITED** for the Te Ākau Bream Bay Sand Extraction Project located at Te Ākau Bream Bay, Northland

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Statement of Trevor Mark Sawyer on behalf of McCallum Brothers Limited in Response to Invited Comments

(Head of Technical Firth Concrete)

Dated 12 August 2026

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Introduction

1. My full name is Trevor Mark Sawyer.

2. I am the Head of Technical for Firth Concrete. In my role at Firth Concrete, I am involved in the production and supply of ready-mix concrete across the Auckland region. Firth is the largest supplier in the Auckland market and provides concrete for a wide range of applications, including residential, commercial, and major infrastructure projects. I have worked in this capacity for 2 years, prior to that I was the Research and Development Manager for the Heavy Buildings Materials division of Fletcher Building Ltd. Prior to this I was the South Island Plant Engineer for Firth Concrete.

3. I have extensive experience in ready-mix concrete production, materials selection, and concrete mix design, including the practical application of natural sand, manufactured sand, and crusher fines (PAP) within New Zealand and abroad. My experience includes direct involvement in plant operations, concrete mix development, troubleshooting of concrete performance issues, and evaluation of aggregate materials for a wide range of applications, including pumped concrete, self-compacting concrete including concrete piling mixes. From my direct experience in ready-mix operations, including the assessment and trialling of manufactured sands, I have observed both the potential benefits and the practical limitations associated with their use in commercial concrete production.

4. I have read the Concrete Suitability report by Mr Paul Donaghue, his two statements of evidence in response to RFI 1 and 2 from the Expert Panel, and the relevant submissions by other parties in regard to manufactured sand. I am in general agreement with his statements subject to any points of difference that might arise from the contents of this statement.

5. As an employee of Firth, I cannot provide independent expert evidence. However, I have prepared this evidence in my capacity as a technical expert within the capacity of my role at Firth and understand my

obligations as an expert witness, including the requirement to provide impartial opinion evidence within my area of expertise. I have read and am familiar with the Code of Conduct for Expert Witnesses and, to the extent that it is applicable given my role, I have complied with it in preparing this evidence.

6. My opinions in this evidence are based on my professional experience and technical expertise. Nonetheless, to the extent possible, I confirm (acknowledging this is not a hearing before the Environment Court), that:
    a. I have read and am familiar with the Environment Court's Code of Conduct for Expert Witnesses as specified in the Environment Court's Practice Note 2023 (Code); and
    b. Any reports and other relevant documents referred to as authored by me:
        i. Are within my area of expertise (except where I state that I rely upon the technical reports of other expert witnesses);
        ii. Have been prepared in accordance with the Code; and
7. I have not omitted to consider any material facts known to me that might alter or detract from the opinions expressed.

Scope of Evidence

8. This evidence is provided in response to comments from other parties in regard to MBL's Te Ākau Bream Bay Sand Extraction Application under the Fast Track Approvals Act 2024. In particular, I will respond to the following comments;
    a. The joint comments by Allied Concrete Ltd and Brookby Quarries Ltd in relation to Paragraph 61 of Mr Paul Donaghue's Concrete Suitability Report. The claim is made that natural sand can be replaced by manufactured sand in all facets of concrete at various strengths and applications.
    b. Similar claims are made by Bream Bay Guardians in 3.15 and 3.16 of their Submission dated 25 May 2026 with reference to

J. R. Mackechnie in his paper "Manufactured Sand Uses and Potential for Concrete in Auckland" dated May 2026 and included in the material lodged with the Panel by Bream Bay Guardians. In his conclusions, Mr Mackechnie draws on his understanding of Allied Concrete's use of manufactured sand in its Penrose plant to claim that manufactured sand can be used as a complete substitute for natural sand in most concrete mixes and can result in lower material costs, savings in cementitious materials and lower carbon emissions of concrete.

9. I should say at the outset that I disagree with statements that Brookby Quarry or Kayasand manufactured sand or any other manufactured sand produced in the Auckland Region is a satisfactory replacement for 100% of the natural sand in ready mix concrete. My experience strongly suggests that there will be a continuing demand for the foreseeable future for natural sand as a critical constituent to produce a full range of concrete products that are fit-for-purpose as supplied at a typical Firth plant in Auckland.

10. I propose to address these statements by reference to the following matters:
    a. The role of natural sand in concrete production;
    b. Manufactured sand.
    c. The risks to the concrete industry in Auckland of assuming that natural sand can be replaced by manufactured sand;

11. It is important to understand what is meant by the terms commonly used in the industry that refer to the different components of the finer aggregate portion of the ingredients in concrete blends. In this statement, I use the relevant terms as having the meanings set out in Table 1 below.

Table 1: Glossary of Terms

Sand Type	Origin and Description	Particle Size	Comments
Natural sand	In the Auckland market the natural sand available for concrete manufacture is a naturally occurring quartz/feldspar fine aggregate typically characterised by a rounded particle morphology. The principal sources are from the Kaipara Harbour (and until recently from Pakiri), and dune sand from Tomorata.	Particle sizes after screening typically range from 2mm down with the bulk of the material within the 0.15mm to 1.18mm size fractions.	The use of natural sand provides the range of particle sizes and morphology to produce optimum blends for all concrete mixes.
PAP7/PAP	Virtually all PAP7/PAP produced in Auckland is made from crushed greywacke rock. PAP7 comprises the largest proportion of fine aggregate used in concrete manufacture.	PAP7 (Premium All Passing 7 mm) is an industry term used by aggregate suppliers in New Zealand to describe a fine aggregate where 100% of the material passes a 7 mm screen.	Although I have used the term PAP7 throughout my Concrete Suitability Report and my response to RFI's, in fact, different quarries in Auckland do produce PAP to slightly different specification including PAP5, PAP6 and PAP7. The most common is PAP7 and I have adopted that term as being typical of the PAP used in most concrete mixes in Auckland.
Manufactured Sand	The term manufactured sand can give rise to some ambiguity as it is sometimes used as being synonymous with the term PAP7. However, within the Auckland concrete industry manufactured sand is a further processed PAP7 (greywacke in origin). This is re-crushed, washed or air blown and then screened. The resulting product is finer than PAP7 and is promoted as being a suitable substitute for natural sand.	A purpose-engineered crushed fine aggregate, with at least 95% passing the 4.75 mm sieve, produced to a controlled grading envelope and particle shape specification.	Although the range of particle sizes in manufactured sand overlaps the particle sizes in both natural sand and PAP7, it is my experience that manufactured sand is better used as a substitute for PAP7 in most concrete mixes than as a substitute for natural sand.

The Role of Natural Sand in Concrete Production

12. Firth's concrete mixes are designed to meet the technical requirements of the contractor and the specifications for the design engineer, and this requires a careful blend of all the main constituents, of which sand plays a critical role. Natural sand ranges in volume between mixes but based on the current Auckland product range Firth use approximately 55% PAP and 45% natural sand regionally within the fine aggregate fraction. This corresponds to approximately 21% and 17% respectively, of each of these materials in a cubic metre of concrete. Based on the average consumption of materials these figures are generally aligned with the figures given by Mr. Donoghue in paragraph 21 and the pie chart in Figure 1 of his original statement.

13. PAP provides the structural bulk of the fine aggregate but is relatively coarse and angular in form. Natural sand provides the finer fraction and particle shape characteristics that enable the mix to function as concrete rather than as an unworkable aggregate blend. The presence of this finer material allows the concrete to flow, to be pumped, and to be placed and finished reliably.

14. Without the natural sand component, the remaining material is too coarse and lacks sufficient fines to achieve the necessary workability. In practical terms, concrete produced without natural sand cannot meet the requirements for placement or performance in normal construction conditions.

15. This is not a question of preference or efficiency. It is a functional requirement of the mix design. The availability of suitable natural sand is therefore critical to Firth's ability to produce concrete for the Auckland market using the materials currently available.

Manufactured Sand

16. In 2023 and 2024 Auckland concrete manufacturers were faced with serious shortages of natural sand. On the one hand the construction

market was very busy and on the other supplies of Pakiri sand from MBL significantly reduced as a result of Environment Court decisions. The shortages of sand led to Firth having to delay work and turn away some customers.

17. As a result, at Firth, a series of laboratory assessments and full-scale commercial production trials were undertaken over late 2024 into early 2025 to evaluate the performance of an engineered manufactured sand supplied by Kayasand. The objective of these trials was to determine whether the use of such a material could provide a satisfactory substitute or partial substitute for natural sand across the range of our concrete mixes.

18. Our criteria for the manufactured sand were that it met our standards of pumpability, workability, and finished quality. Cost was important, as we are in a highly competitive market, and a major part of that was whether water demand and therefore cement demand were on a par with or better than the equivalent concrete mix made with natural sand. Cement content is a vital issue in concrete manufacture as it is the most expensive ingredient and is a major contributor to the carbon footprint of the product, a matter of great importance to Firth and the wider concrete industry.

19. The Kayasand manufactured sand was produced in accordance with the supplier's recommended grading and processing parameters and was reported by the supplier as compliant with the ASTM C33 - Standard Specification for Concrete Aggregates. The material was assessed by Firth through both laboratory testing and full-scale production under typical operating conditions.

20. The results of these assessments of the Kayasand manufactured sand were that it could not replace the natural sand and the manufactured sand did not satisfy the requirements as a single fine aggregate material. The work did highlight that the manufactured sand could be used as a satisfactory replacement for PAP and, in some mixes, to lower the proportion of natural sand required within the fine aggregate fraction.

The water requirement of the manufactured sand exceeded the water requirement of the base mix with PAP and natural sand, driving both cost and embodied carbon up due to the need for higher cement contents to achieve the design strength.

21. I understand that there is an opinion that the challenges associated with manufactured sand can be overcome through the use of chemical admixtures. In my view, this is not good concrete practice. Industry guidance generally advocates that admixtures should be used to enhance an otherwise robust mix design rather than to compensate for shortcomings in aggregate grading, particle shape, or fines distribution. Reliance on admixtures to overcome deficiencies in the aggregate system introduces additional risk because the performance of the concrete becomes increasingly dependent on the correct selection, dosage, and interaction of the admixture with the cementitious system and aggregate source. Examples of these risks include the use of pump aids or viscosity modifying admixtures to improve the pumpability and cohesion of mixes containing poorly graded sands. While such admixtures may improve fresh concrete properties, they can increase the risk of plastic shrinkage cracking by reducing bleed water and altering the moisture loss characteristics of the concrete. Similarly, air-entraining admixtures may be used to compensate for a deficiency in the finer aggregate fractions, however, increased entrained air can result in a reduction in compressive strength and, if not carefully controlled, may adversely affect the long-term durability and performance of the concrete. For these reasons, my preference is that the aggregate system itself should be capable of producing a robust and economical concrete mix without undue reliance on chemical admixtures to correct inherent material shortcomings.

22. Firth tested a variety of manufactured sands from its own crushing trials and Kayasand, using manufactured sand as the sole source of fine aggregate, with variations in grading, fines content, and processing parameters. None of these met all of our criteria and, in particular, none resulted in any material reduction in the level of water demand required

to achieve target workability (see paragraph 18 for the importance of this aspect). By comparison, the test results consistently demonstrated that where a manufactured sand was used as the primary fine aggregate and blended with natural sand, as part of a blended fine aggregate system, a measurable reduction in water demand was achieved (in comparison to a product where manufactured sand fully replaced natural sand).

23. These results indicated that the observed improvement in water demand was attributable to the contribution of the natural sand in improving grading continuity and moderating the overall particle characteristics of the fine aggregate system.

24. One of the results of our trials was the conclusion that, whereas the use of an engineered manufactured sand as a replacement for natural sand did not produce concrete that met our requirements, the use of a manufactured sand as a replacement for PAP, combined with the use of natural sand, could meet those requirements. In other words, manufactured sand does represent an improvement over crushed PAP but does not represent a complete replacement for natural sand, particularly in higher specification mixes.

25. I acknowledge that since Firth's trials of manufactured sand, Brookby Quarries has developed a manufactured sand product and Allied has demonstrated its use in a specific plant (Allied Penrose), operating with a high proportion of this manufactured sand. I assume this indicates some improvement in the useability of manufactured sand since 2024.

26. I do not have any knowledge of the commercial arrangements between Brookby and Allied or of why Allied has chosen to adopt the use of manufactured sand on this scale. However, I am doubtful about drawing conclusions from Allied's experience for the entire Auckland market. The Auckland market consists of multiple ready-mix concrete plants supplying a wide range of customers and applications. These plants operate with diverse mix designs that must consistently meet different requirements for workability, strength, durability, and finish.

27. A solution that is applied across the market must therefore be demonstrated to perform reliably across this full range of conditions. A single example, involving one plant operating with a particular supplier and under specific conditions, is not sufficient to establish that the same outcome can be achieved consistently across the sector as a whole.

28. There is also a structural consideration. Reliance on a single manufacturer of an alternative material introduces the same type of supply concentration that arises with a single natural sand source. It creates dependence on one production point and raises similar questions about resilience, continuity of supply, and market balance.

Misperception Regarding Manufactured Sand

29. While it is acknowledged that improvements in manufactured sand quality are being achieved, there appears to be a perception outside of the concrete industry that a high-quality manufactured sand can be used as the sole source of fine aggregate in a concrete blend, thereby replacing the need for natural sand.

30. In my opinion this is a misinterpretation of the role of manufactured sand. As I have indicated, a better approach is not to replace natural sand, but to improve the overall fine aggregate system by using manufactured sand as a replacement for crushed PAP.

31. Natural sand is not simply a corrective material. It plays a critical role in optimising the fine aggregate system, providing grading continuity and balance, moderating the effects of angular particles, improving workability and enabling the required balance between flowability, cohesion, and cement paste demand. This allows the mix designer to tailor the concrete to specific applications.

32. A well-engineered manufactured sand can replace the PAP7 and, depending on the requirements of the specific mix, may also reduce the proportion of natural sand within the mix. The extent to which natural sand can be reduced varies with mix performance requirements, the

characteristics of the manufactured sand and the specifications of the mix.

The risks to the concrete industry in Auckland of assuming that natural sand can be replaced by manufactured sand

33. If, as I am saying, manufactured sand cannot be relied upon to replace the Auckland market's need for natural sand then a situation in which the Auckland market largely relies on a single source of natural sand (the Kaipara Harbour) introduces both commercial and operational risks.

34. From a commercial perspective, where one supplier dominates supply for a critical input, that supplier effectively holds a high degree of market power. Concrete producers are then exposed to pricing and supply conditions over which they have limited control. This reduces competitive tension and creates an imbalance within the market.

35. From an operational perspective, reliance on a single source creates a lack of resilience. Any disruption to that source, whether caused by operational issues, environmental conditions, logistical constraints, or regulatory change, has the potential to affect a substantial proportion of the Auckland concrete market at the same time. There is no meaningful redundancy in the system, and there are limited options available to compensate for that loss of supply.

36. Given the role of concrete in infrastructure delivery, commercial construction, and housing, this lack of resilience presents a wider risk. If supply from a dominant single source is interrupted, in my view the effect is not isolated. In my opinion and experience it is transmitted directly into the construction sector, leading to delays, increased costs, and reduced capacity to deliver projects. As I have indicated above in paragraph 16, Auckland experienced this kind of disruption in September 2024 when sand from Kaipara/Helensville was at risk of stopping due to supply chain issues. An urgent technical assessment was undertaken with alternative sands identified and trialled. One of the critical

infrastructural jobs that were being supplied at the time was the Whenuapai airbase where no manufactured sand available at the time satisfied the needs and requirements of this concrete. The only suitable replacement sand was an alternative natural sand.

37. A resilient supply system for a critical construction input depends on diversity of source. This includes having more than one supplier and, ideally, sources that are geographically distinct. This allows the system to continue functioning if one part of the supply chain is disrupted. Firth actively applies this approach within its own operations. For example, the seven Christchurch Metro plants, servicing the region from Darfield to Amberley, maintain supply resilience through access to three separate sources of fine aggregate. This diversity of supply reduces reliance on any single source and provides operational continuity in the event of production, transport, weather-related, or other supply chain disruptions affecting an individual supplier.

38. The introduction of an additional natural sand source at Te Ākau Bream Bay would provide this diversity. It would reduce reliance on any single supplier and introduce an additional level of resilience into the system. It would also support a more balanced market structure by avoiding the concentration of supply in one location or with one provider.

39. This approach is consistent with standard supply chain principles, particularly where materials are essential to economic activity and there are limited short-term substitutes.

Conclusion

40. From the perspective of concrete production at scale, in my opinion natural sand is a critical input that cannot be removed from current mix designs without compromising the ability to efficiently and effectively produce workable concrete. The balance between PAP and natural sand reflects the functional requirements of the material rather than an interchangeable choice.

41. At the same time, the Auckland market faces increasing reliance on a limited number of supply sources for natural sand. This creates both commercial concentration and a lack of resilience, with the potential for disruption to affect the majority of the market.

42. While developments in manufactured sand are acknowledged, in my view a single example of its use does not provide a sufficient basis for making decisions that affect all producers and all applications. Nor does reliance on a single manufacturer address the underlying issue of supply concentration.

43. Speaking for Firth, we would welcome the development of an additional source of supply for natural sand from Bream Bay. That would greatly relieve the concerns we have about security of supply and choice of supplier.

Trevor Sawyer

12 August 2026