Before the Hearing Commissioners appointed by Hawke's Bay Regional Council

In the matter	of the Resource Management Act 1991 (**the Act**)
And in the matter	of applications APP-123534, APP-123548, APP-123526, APP-123550, APP-123535 & APP-123536 by the Regional Assets Section, Hawke's Bay Regional Council to remove gravel and undertake other earthworks at various locations along the Ngaruroro River, Tukituki Catchment Rivers and Tutaekuri River to the coast

Statement of evidence of Dr Robin Holmes

5 November 2021

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INTRODUCTION

Qualifications and experience

1 My full name is Robin James Patrick Holmes. I am a freshwater ecologist at Cawthron Institute.

2 I hold the qualifications of PhD and MSc (freshwater fisheries and macroinvertebrate ecology) from the University of Otago. I am a longstanding member of the New Zealand Freshwater Sciences Society.

3 Since, and during, my education I have accumulated 13 years' freshwater research experience at the Cawthron Institute, where I currently lead the River and Lake Ecology Team. I have specialist expertise in freshwater biomonitoring, ecological impact assessment, habitat restoration, freshwater fish ecology and environmental flows. I have been involved in aquatic ecology environmental effects assessments for major resource consent applications, including Meridian Energy's Mokihinui and Amuri hydroelectric projects and the Hawke's Bay Regional Council Ruataniwha Water Storage Scheme.

4 I have presented evidence to the Special Tribunal appointed to consider an application for a Water Conservation Order in the Ngaruroro River, on behalf of Hawke's Bay Regional Council. More recently, I presented evidence on behalf of Fish and Game at a water abstraction resource consent hearing for the Pig Burn Water Users Group.

5 I have published 7 peer reviewed papers in the field of stream ecology, freshwater fisheries and stream habitat modification. I have been an expert panel member for the recent flow setting process in the Te Whanganui-a-Tara catchments (Hutt / Te Awa Kairangi, Wainuiomata and Orongorongo rivers) for Greater Wellington Regional Council. I have participated in regional and national ecological advisory roles, including leading an investigation into potential river habitat modification indicators for national monitoring (for the Ministry for the Environment). I am also

a co-leader of the 'Fish Futures' MBIE-Endeavour research programme, which started in October 2021.

Expert witness Code of Conduct

6 I have been provided with a copy of the Code of Conduct for Expert Witnesses contained in the Environment Court's Practice Note dated 1 December 2014. I have read and agreed to comply with that Code. This evidence is within my area of expertise, except where I state that I am relying upon the specified evidence of another person. I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

PURPOSE AND SCOPE OF EVIDENCE

7 In 2017, I undertook an assessment of gravel extraction and beach raking in the braided rivers of the Heretaunga Plains (including the Tukituki, Ngaruroro and Tutaekuri rivers: hereafter 'the rivers'). I authored a report that identified the potential effects of these gravel management activities on key instream species, with a specific focus on native fish and salmonid fisheries. In that report I listed information requirements to enable an accurate ecological effects assessment and I suggested potential monitoring and evaluation methods to address information gaps.

8 The purpose of this evidence is to review my original assessment with respect to potential instream ecological effects arising from the applicant's proposal.

9 I will also comment on the aquatic components of the ecological monitoring programme proposed by the Applicant and respond to matters raised in the s42A Officer's Report and by submitters relevant to my expertise.

TECHNICAL REPORT – SUMMARY OF CONCLUSIONS

10 My report titled 'Effects of gravel extraction and beach raking on key instream species in Hawke's Bay rivers' (2017) is supplied in Appendix F

of the applications lodged with the Hawke's Bay Regional Council. Below I briefly summarise and update this report.

Instream Values

11 In total, 21 fish species have been recorded from the Tukituki, Ngaruroro and Tutaekuri catchments, of which 17 are native. Excluding the estuarine species (e.g. yellow-eyed mullet and the estuarine triplefin), 15 native freshwater fish have been recorded in the three catchments (Appendix 1).

12 Six of the fish species present in the rivers are listed by Dunn et al. (2017) as being 'At Risk, Declining', with lamprey having the higher conservation threat ranking of 'Nationally Vulnerable'. All the rivers also support regionally significant trout fisheries (for brown and rainbow trout) - with the Tukituki being the most popular of the three fisheries (Unwin 2009). Important mahinga kai species also occur within the rivers. These include longfin and shortfin eel, which are spread throughout catchment. In the lower river, juvenile īnanga and kōaro (which together constitute the majority of the whitebait catch) occur, as well as black flounder. A variety of other mahinga kai species can be found in the estuarine area (such as founder, yellow-eyed mullet and kahawai).

Potential instream effects

13 Gravel extraction and beach raking are tools the Applicant uses to maintain flood-flow capacity and reduce erosion of flood control infrastructure. These actions are employed to counteract sediment aggradation that reduces the channel capacity and can increase the risk of flooding. Gravel extraction within the braided rivers of the Heretaunga Plains is deemed necessary by the applicant to protect the lives and property of the communities surrounding the river.

14 Gravel extraction in any river has the potential to adversely affect instream ecology. Potential ecological effects can be thought of in two broad categories:

(a) Direct effects created by the disturbance of machinery crossing river channels or working within or near the flowing parts of a riverbed; and

(b) Indirect effects on channel morphology at the reach- to segment-scale that can be triggered by the removal of gravel (in other words., changes in channel morphology occurring over 100s to 1000s of metres of river length).

15 While I proposed methods for monitoring potential effects on channel morphology in my 2017 report, specific comment on the likelihood of wider-scale fluvial geomorphological effects arising from gravel extraction activities is outside of my expertise.

Direct effects of machinery on stream bed fauna

16 In relation to direct disturbance effects, when machinery crosses side-braids it will inevitably crush some benthic organisms, including benthic fish (such as bullies and juvenile eels). In addition, there will be some degree of resuspension of fine sediment trapped within the gravel matrix of riverbed at the crossing sites.

17 There are vast areas of habitat available for fish within each of the three rivers. Therefore, a substantial amount of riverbed disturbance would be required to have an effect on fish at the population level. For example, the proposed extraction area in the Ngaruroro will occur at sites within a 57 km segment of river (Williams and Ray 2017). At most, 10s to 100s of metres of side braid habitat will be affected periodically by crossings in a given year. Therefore, while there may be some localised (reach-scale) effects in the side-braids where crossings occur, the river fish populations as a whole are unlikely to be adversely affected.

18 At the time of writing the 2017 report, there was no information available on the amount of fish habitat affected by machinery crossings (that is, the area and frequency of machinery disturbance). To my knowledge this information still does not exist, so my recommendation in the 2017 report,

to record the occurrence of river crossings, is still relevant (see monitoring recommendations below). The applicant has committed to logging the occurrence of river crossings. Once collected, this information could inform a quantitative assessment of the amount of potential ecological harm caused by river crossings.

19 The HBRC gravel extraction Code of Practice (CoP) already requires that machinery avoids crossing side-braids as much as is practicable. I also recommend that crossing braids near or within shallow riffle habitat be avoided where possible. This would further reduce the potential for fish mortality. Riffle habitats in stable side-braids have disproportionately high densities of benthic native fish and invertebrates within braided rivers (Gray and Harding 2007, Jowett and Richardson 1995).

Elevated suspended fine sediment levels

20 The resuspension of fine sediment, either through machinery crossings or through gravel abstraction near the channel edge, has the potential to impact on a variety of fauna. In addition, as suspended sediment settles in deposition areas it can negatively affect benthic macroinvertebrate communities. At the time of writing the 2017 report, there was no information available on the degree or extent of turbidity increases as a result of gravel abstraction activities. To my knowledge this information still does not exist. Therefore, my recommendation in the 2017 report—to assess the severity, extent and duration of turbidity plumes that result from any gravel extraction activities, is still relevant (see monitoring recommendations below).

Monitoring and evaluation recommendations

21 The applicant has committed to undertaking a monitoring programme that takes into account my 2017 report recommendations (and this is now included as Condition 33 of consent conditions provided with the Council's section 42A report). The applicant has also suggested that monitoring results will be reviewed within 5 years. I support this approach.

My monitoring and evaluation recommendations are summarised below and remain relevant and unchanged - with the exception of one additional monitoring recommendation to address questions brought up by submitters regarding the adequacy of the proposed 1-metre buffer / bund between gravel extraction areas and the wetted channel (see recommendation 7):

1. Catalogue the frequency, extent and duration of channel management events that require machinery to cross wetted channels (side-braids included).

2. Assess the severity, extent and duration of turbidity plumes that result from re-suspended sediment below any gravel extraction areas that require machinery to cross wetted channels during works.

3. Undertake long-term (at least annual) substrate and invertebrate community monitoring at gravel management reaches and paired upstream control reaches.

4. Engage a qualified fluvial geomorphologist to assess how channel form changes in response gravel extraction, using indicators of channel complexity that can be identified on aerial photography. Initially, existing aerial photography could be used to compare managed and unmanaged reaches using a space-for-time substitution approach.

5. Collect aerial imagery after bed-defining flood events (at least annually) at gravel management reaches and paired upstream control sites. Once a time-series of imagery is developed, it could be analysed for changes in channel complexity indicators over time.

6. Undertake visual assessments to assess the potential for fish stranding in gravel extraction depressions at gravel extraction areas following floods.

7. Assess the severity, extent and duration of turbidity plumes that result from re-suspended sediment below gravel extraction areas where a 1m buffer / bund has been used between the extraction area and the wetted channel.

RESPONSE TO MATTERS RAISED IN THE SECTION 42A REPORT

22 I have reviewed the Council's section 42A report issued on 7 October 2021. Matters relating to instream ecology are addressed primarily under Section 2.1 (pg. 9) and Section 3.2 (pg. 13). The draft consent conditions provided with the report include a condition (Condition 33) requiring the applicant to submit a 'Water Quality Effects Investigation Programme of Work' four weeks before the resource consents are exercised. The Programme must take into account the recommendations made in my report and it must be implemented in full within five years of the consent commencing. In my view this Programme should also take into account my new recommendation 7 (above).

23 I note on p.38 of the Council's section 42A report that the officer queries whether proposed Condition 27 requires refinement to confirm the meaning of "increased turbidity".

24 I am comfortable that Condition 27 as drafted provides the direction for action should increased turbidity, to the extent that it causes ecological effects, be identified through the investigations required as a result of Condition 33.

RESPONSE TO MATTERS RAISED IN SUBMISSIONS

25 Submitters Ngati Kahungunu Iwi Inc. and Te Taiwhenua o Heretaunga raised concerns about matters within my expertise. Both submitters requested that gravel extraction should not occur during fish migration and spawning periods. Ngati Kahungunu Iwi Inc. also suggest that the minimum buffer / bund width between extraction activities and the wetted channel should be increased from one metre to two metres.

26 Fish migration periods are shown in Appendix 2 of my evidence. When considering the range of fish species present in the rivers, their combined spawning and migration periods have the potential to occur year-round. Therefore, it is not feasible to undertake gravel abstraction during periods that avoid all fish migration periods. The Environmental Code of Practice already provides that machinery access across the wetted channel is restricted during May through September to protect salmonid spawning values. This restriction period will also largely coincide with the downstream migration of īnanga (and other whitebait species) and the upstream migration period of torrentfish and lamprey (Appendix 2).

27 When the fish community is viewed as a whole, there is no reason to expect native fish populations to be more vulnerable to machinery crossing during their migration and spawning periods. Furthermore, gravel abstraction does not occur within the wetted channel.

28 As noted before, there is no information regarding extent and severity of sediment resuspension events related to the proposed gravel extraction activities. While there may be localised (reach-scale) and episodic effects from elevated suspended fine sediment concentrations, given the size of the rivers and the periodic nature of any resuspension events, I consider it unlikely that they will cause any significant adverse effects on native fish spawning or migration. That said, I support the applicant's commitment to collect turbidity data during operations to confirm that adverse effects are not occurring.

29 Within my 2017 report I expressed concern regarding the adequacy of the one-metre buffer width for bunds constructed between the wetted channel edge and extraction activities. I am not aware of any data available to assess if this measure is adequate to prevent ecologically significant levels of fine sediment being resuspended in the mainstem channels.

30 Some gravel extraction activities have been captured on Google Earth during 2018. The image in Appendix 3 shows that some resuspension of

fine sediment can occur in the mainstem during extraction activities (Appendix 3). There is no way to determine if the sediment plume pictured can be considered ecologically significant, or if it is the result of typical of gravel extraction practices. Therefore, I recommend that an evaluation of the resuspended fine sediment levels is undertaken during 'typical' operations, where the 1-metre bund method is used (see monitoring recommendation 7 above).

31 This evaluation could form part of the applicant's monitoring programme that is proposed to be developed and implemented prior to exercising the consent (should it be granted). If fine sediment plumes are created from extraction activities, and the plumes are deemed to be causing significant adverse effects by a freshwater ecologist, then I suggest that gravel extraction practices are amended to prevent this from occurring.

CONCLUSIONS AND RECOMMENDATIONS

32 The gravel extraction activities proposed by the applicant may have some localised effects on fish and macroinvertebrates, either through the resuspension of fine sediment or through crushing streambed fauna by machinery at side-braid crossing sites. However, these effects are unlikely to adversely affect the wider fish populations, because the areas affected will be small compared to the vast areas of habitat that will remain unaffected. This opinion is offered in a general sense in the absence of quantitative data on the extent and frequency of river areas affected by the activities. Comment on the wider effects on fluvial geomorphology are beyond my expertise.

33 Migration for any fish species is unlikely to be affected because extraction activities do not occur in the mainstem river-braids and crossing of side-braids are episodic. Any effects on fish spawning will be limited in extent and duration to the few reaches of river where extraction activities are occurring.

34 I support the commitment by the applicant to monitor potential instream ecological effects and review the data generated within five years. If effects are deemed adverse by an appropriately qualified ecologist (for example, if ecologically significant levels of resuspended fine sediment are detected), then I recommend that gravel extraction practices are amended to avoid these potential effects.

Dr Robin Holmes
5 November 2021

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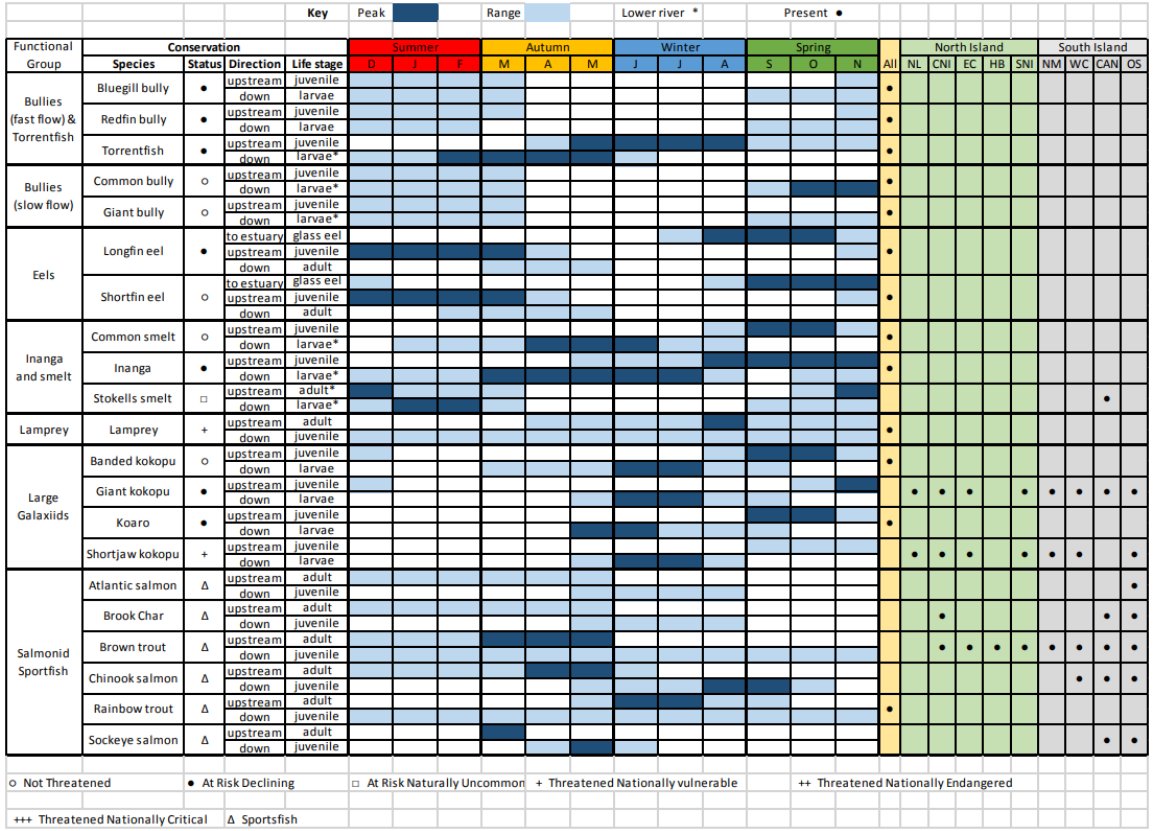
Appendix 1. Fish species recorded (as NZ freshwater fish database records) in the Heretaunga Plain braided river catchments (including the Ngaruroro, Tukituki and Tutaekuri rivers). Also shown are the national threat classification levels from Dunn et al. (2017).

Common Name	Scientific name	Threat classification
Lamprey	*Geotria australis*	Nationally Vulnerable
Longfin eel	*Anguilla dieffenbachii*	At Risk, Declining
Torrentfish	*Cheimarrichthys fosteri*	At Risk, Declining
Bluegill bully	*Gobiomorphus hubbsi*	At Risk, Declining
Īnanga	*Galaxias maculatus*	At Risk, Declining
Kōaro	*Galaxias brevipinnis*	At Risk, Declining
Dwarf galaxias	*Galaxias divergens*	At Risk, Declining
Giant bully	*Gobiomorphus gobioides*	At Risk, Naturally Uncommon
Redfin bully	*Gobiomorphus huttoni*	Not Threatened
Black flounder	*Rhombosolea retiaria*	Not Threatened
Cran's bully	*Gobiomorphus basalis*	Not Threatened
Upland bully	*Gobiomorphus breviceps*	Not Threatened
Common smelt	*Retropinna retropinna*	Not Threatened
Common bully	*Gobiomorphus cotidianus*	Not Threatened
Shortfin eel	*Anguilla australis*	Not Threatened
Yellow-eyed mullet	*Aldrichetta forsteri*	Not Threatened
Estuarine triplefin	*Grahamina sp.*	Not Threatened
Rainbow trout	*Oncorhynchus mykiss*	Introduced and Naturalised
Brown trout	*Salmo trutta*	Introduced and Naturalised
Gambusia	*Gambusia affinis*	Introduced and Naturalised
Goldfish	*Carassius auratus*	Introduced and Naturalised

Appendix 2. New Zealand freshwater fish migration calendar from Smith (2015). Show are the migration timing and the range and peak migration direction for fish life stages in New Zealand.



Appendix 3. Aerial image captured on Google Earth in 2018 (accessed 29 October 2021) showing gravel extraction occurring in the Ngaruroro River at Roy's Hill. Note some resuspended fine sediment in the main channel downstream of the digger (top right of photo). River flows from the bottom to the top of the photograph.