BEFORE THE HEARINGS PANEL

IN THE MATTER OF	the Resource Management Act 1991
AND	Proposed Plan Change 95 to the Western Bay of Plenty District Plan: Pencarrow Estate Pongakawa

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PRIMARY BRIEF OF EVIDENCE OF HAMISH DEAN

ON BEHALF OF THE BAY OF PLENTY REGIONAL COUNCIL TOI MOANA

SUBMITTER NO: 27

ECOLOGY

INTRODUCTION

1. My full name is Hamish Alston Dean.

2. I hold the qualifications of Bachelor of Science (Ecology and Zoology) from Victoria University of Wellington, and Master of Science in Biological Sciences (Ecology) from the University of Waikato.

3. I have worked in the fields of ecology and natural resource management for 21 years, working in consultancy, not for profit organisations and at Bay of Plenty Regional Council (**BOPRC**). I am currently a Principal Ecologist at SLR Consulting (**SLR**). I have held this position since June 2021. Prior to joining SLR (then 4Sight Consulting) I was a Consents Team Leader at BOPRC.

4. I have considerable experience in ecological assessment of terrestrial and wetland ecosystems, significance assessments, ecosystem restoration, catchment management, and fauna survey.

5. I have worked most of my professional life in Tauranga and the wider Bay of Plenty and am very familiar with the ecosystems, flora and fauna of this area.

6. I have not visited the site for the purposes of this evidence but have visited the property and viewed the stream in the past.

7. I have not previously been involved in the Western Bay of Plenty District Council (**WBOPDC**) Plan Change 95 (**PC95**) process.

CODE OF CONDUCT

8. I have read and am familiar with the Environment Court's Code of Conduct for Expert Witnesses, contained in the Environment Court Practice Note 2023, and agree to comply with it. My qualifications as an expert are set out above. Other than where I state that I am relying on the advice of another person, I confirm that the issues addressed in this report 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 that I express.

EXECUTIVE SUMMARY

9. The Puanene Stream is a small, modified watercourse draining a catchment of around 1,500 hectares (ha) and is part of the wider Waihi Estuary Catchment.

10. The stream has relatively poor water quality but relatively good ecological health. However, the wider catchment and receiving estuary is in a very poor state and subject to considerable restoration effort and expenditure in an effort to stop and reverse the decline.

11. Planted riparian buffers provide an important link between terrestrial and aquatic environments and perform a number of functions including improvement of bank stability, attenuation of flood flows, filtration of sediment and other pollutants, provision of food and habitat to both terrestrial and aquatic biota, and regulation of water temperature and dissolved oxygen.

12. Residential development has a range of impacts on waterways such as increased flood flows and elevated sediment, pollutant and nutrient inputs, as well as adverse effects on aquatic biota.

13. Although riparian buffer width varies depending on the outcome sought, the adjacent land use and the slope of the land, wider buffers have been shown to be more effective and wide, planted buffers are more likely to become self-sustaining and provide wider benefits for water quality, stream ecological health, and terrestrial flora and fauna.

14. While the removal of the dairy effluent ponds adjacent to the stream are a positive effect of the proposal, residential development comes with its own suite of pressures on waterways and these need to be managed appropriately, and in the context of a highly degraded wider catchment and with consideration of precedent setting for future development.

SCOPE OF EVIDENCE

15. Bay of Plenty Regional Council (**BOPRC**) have submitted in support of an increased development setback from the Puanene Stream (submission point 27.5) and outlined the benefits of appropriately sized and planted buffers. This evidence is intended to provide ecological support for the setback.

16. In this evidence I will:

    (a) Outline the values of the Puanene Stream and the wider catchment;

    (b) Outline the function of the riparian zone and the effects of residential development on waterways; and

(c) Discuss appropriate buffer width.

17. In preparing this statement, I have read:

(a) The relevant sections of the Section32 and 42a reports and the relevant accompanying documents;

(b) The Assessment of Ecological Effects report[1] and

(c) The planning evidence prepared by Lucy Holden (Bay of Plenty Regional Council).

PUANENE STREAM

18. The Puanene Stream is a relatively small, modified watercourse draining a catchment of around 1,500 hectares (ha). Although it has been deepened and straightened near the proposed PC95 area this watercourse is not a drain and carries the Modified Watercourse with Ecological Values (MEV) Water Quality Classification in the Bay of Plenty Regional Natural Resources Plan[2] up to the northwest corner of the development site, from which point it is classified as Drain Water Quality.

19. The stream drains into the Wharere canal and then into the Waihi Estuary which is badly degraded as a result of catchment modification and land use and is subject to considerable restoration effort by the community through the Wai Kokopu Project and by BOPRC. The catchment is one of BOPRC's Priority Catchments for freshwater improvement and requires landscape scale change in order to recover the health of the waterways and estuary.

20. The Puanene has average to poor water quality with high readings of E.coli bacteria, nitrogen and phosphorus and high suspended sediment loads[3].

21. Despite this, the stream has some of the better ecological values of the area, with good scores for BOP Index of Biotic Integrity (IBI) which is a metric which compares the condition of macroinvertebrate communities to reference sites

[1] Wildland Consultants 2022. Assessment of Ecological Effects for the proposed Pencarrow Structure Plan area at Pongakawa. Wildland Consultants contract report 6334. Prepared for Keven and Andrea Marsh.
[2] BOPRC 2008. Bay of Plenty Natural Resources Plan. Strategic Publication 2008/06. ISSN 1176 4112.
[3] BOPRC unpublished data.

which represent low disturbance conditions[4]. Similarly, the stream has recorded excellent Fish IBI, which is a similar metric developed to evaluate the integrity of fish communities relative to the rest of the region[5]. Fish species using the stream include shortfin eel (*Anguilla australis*), longfin eel (*Anguilla dieffenbachii,* At Risk – Declining[6]), inanga (*Galaxias maculatus*, At Risk – Declining), redfin bully (*Gobiomorphus huttoni*) and smelt (*Retropinna retropinna*).

22. This wider catchment context and its values is important when considering any proposals that may impact the stream.

RIPARIAN BUFFERS

Function of the Riparian Zone

23. Planted riparian buffer zones represent an important ecological link between the terrestrial environment and aquatic environment and can reduce the impacts of land use activities on water chemistry, organic matter inputs, and shading, and consequently, can result in improved conditions for instream biota.

24. Riparian buffer zones perform many functions, including:

    (a) **Improving bank and channel stability**: Riparian buffers can have significant, measurable benefits, especially on channel morphology[7]. Planting appropriate native species in riparian zones has been shown to assist with slope and bank stability, as root systems strengthen stream banks[8]. Appropriate riparian setbacks also allow room for stream channels to move with natural events without risking adjacent buildings/ infrastructure.

    (b) **Attenuating flood flows:** Riparian setbacks assist in reducing peak flood flows, as there is a greater storage area and less constriction of the

[4] Suren 2018. Ecological and water quality conditions of drains and land drainage canals in the Rangitaiki and Kaituna Plains. Bay of Plenty Regional Council Environmental Publication 2018/05.
[5] Suren 2016. Fisheries assessment of waterways throughout the Kaituna-Maketu and Pongakawa-Waitahanui WMA. Bay of Plenty Regional Council Environmental Publication 2016/13. ISSN: 1179-9471.
[6] Dunn, N.R.; Allibone, R.M.; Closs, G.P.; Crow, S.K.; David, B.O.; Goodman, J.M.; Griffiths, M.; Jack, D.C.; Ling, N.; Waters, J.M.; Rolfe, J.R. 2018: Conservation status of New Zealand freshwater fishes, 2017. New Zealand Threat Classification Series 24. Department of Conservation, Wellington. 11 p.
[7] Hession, W.C.; Pizzuto, J.E.; Johnson, T.E., Horwitz, R.J. 2003. Influence of bank vegetation on channel morphology in rural and urban watersheds. Geology. 31:147-150.
[8] Marden M, Rowan D, Phillips C 2005.Stabilising characteristics of New Zealand indigenous riparian colonising plants. Plant and Soil 278:95-105

flood zone, thus protecting the immediate receiving environment, downstream environments, and adjacent properties. I note however, that Mr Hight states in his evidence[9] that the development will have no impact on flooding.

(c) **Filtration:** A vegetated riparian buffer zone increases filtration of overland and flood flows and reduces the amount of sediment and chemical contaminants reaching waterbodies, thereby helping to mitigate effects on water quality. This occurs by uptake through plant roots as well as a greater infiltration to groundwater through non-compacted soils, where filtering can occur by way of microbes.

(d) **Organic terrestrial inputs:** A vegetated riparian buffer provides woody debris and leaf litter inputs that contribute to habitat heterogeneity and food resources for aquatic invertebrates. The riparian community can also provide important food inputs (i.e., terrestrial invertebrates). This is considered particularly important in a context where residential development is too close to a stream, where the alternative to planting is often hard engineering solutions, which provide no organic inputs to stream systems.

(e) **Stream temperature regime control:** Shading from streamside vegetation helps to moderate water temperatures. This is particularly important during warm summer months, when high temperatures can result in low dissolved oxygen levels, causing stress to instream fauna. Low dissolved oxygen and elevated water temperatures can also cause the release of excess phosphorus stored in sediments[10]. Shading also reduces nuisance macrophyte or algal growth.

(f) **Habitat provision:** A planted riparian buffer provides both aquatic and terrestrial habitat. A riparian buffer zone provides instream habitat and cover for fish and macroinvertebrates, and suitable habitat for adult phases of stream macroinvertebrate species. A vegetated riparian

[9]Statement of Evidence of Daniel Hight dated 24 October 2024.
[10] Li, Haiyan, Liu, Liang, Li, Mingyi, Zhang, Xiaoran, Effects of pH, Temperature, Dissolved Oxygen, and Flow Rate on Phosphorus Release Processes at the Sediment and Water Interface in Storm Sewer, *Journal of Analytical Methods in Chemistry*, 2013, 104316, 7 pages, 2013.

margin can also provide habitat refuges and spawning substrates during flood events.

25. Residential land use and riparian degradation usually go hand in hand, with lowland residential/urban development often resulting in the restructuring or loss of riparian vegetation[8], and in this case preventing the establishment of an adequate vegetated buffer.

Effects of Residential Development on Streams

26. Residential development leads to increased impervious surfaces which, in turn, lead to higher peak stream flows and increased flashiness (faster increase and decrease of flow during flood events). Development is also often associated with an increase in stormwater outlets discharging into adjacent watercourses. Higher peak flows following rain events can lead to scour and erosion in the downstream receiving environment, changes in channel morphology, and potential degradation of water quality and instream habitat for aquatic organisms[11,12].

27. Increased flood flows and sediment inputs can result in changes to channel morphology and stability – the width and depth of stream channels adjust to the new regime. However, in some situations, planting a riparian area can lead to increased bank erosion in the short term. For example, planting of stream banks previously in pasture can result in release of sediment trapped by grasses as the grass is shaded out[13].

28. Although these effects are likely to be relatively limited in the Pencarrow Estate situation, because of the relatively short reach of stream affected, it is important that good practice is required for every development where they can lead to more significant cumulative effects, including in light of the catchment context identified above. This is also to avoid losing opportunities to provide riparian protection.

[11] Walsh, C. J., A. H. Roy, J. W. Feminella, P. D. Cottingham, P. M. Groffman & R. P. Morgan II, 2005. The urban stream syndrome: current knowledge and the search for a cure. Journal of the North American Benthological Society 24: 706–723.

[12] Storey R, Brierley G, Clapcott J, Collier K, Kilroy C, Franklin P, Moorhouse C and Wells R. 2013. Ecological responses to urban stormwater hydrology. Prepared by NIWA for Auckland Council. Auckland Council technical report TR2013/033.

[13] Hughes AO 2016. Riparian management and stream bank erosion in New Zealand, New Zealand Journal of Marine and Freshwater Research, 50:2, 277-290, DOI: 10.1080/00288330.2015.1116449

29. Increased concentrations and loads of chemical pollutants in stream water are typical of streams near developed areas[14], often occurring even at low levels of catchment development[15]. Stream water quality in developed areas is often characterised by high concentrations of heavy metals (i.e., copper, lead, and zinc) and PAHS[16]. In particular, in New Zealand catchments, zinc concentration in streams has been shown to be positively correlated with urban land use and imperviousness[12].

30. In addition, urban runoff tends to have relatively high concentrations of nutrients (nitrogen and phosphorus) and urban land use is also associated with high concentrations of faecal bacteria in waterways[17], reduced biotic richness, with increased dominance of tolerant species[18],[19]. However, in this situation I agree with the Ecological Impact Assessment (EcIA)[20] that there is likely to be an improvement in nutrients and bacteria entering the waterway from the site due to the removal of dairy effluent ponds and farming activities.

31. Abundant research shows in nearly all instances, streams in urban areas are characterised by species-poor assemblages, consisting mostly of disturbance-tolerant macroinvertebrate and fish taxa[21].

[14] Horner R, Booth D, Azous A and May C. 1997. Watershed determinants of ecosystem functioning *in* L. A. Roesner (editor). Effects of watershed development and management on aquatic ecosystems. Proceedings of an Engineering Foundation Conference, Snowbird, Utah, 4–6 August 1996. American Society of Civil Engineers, New York. 251-277.
[15] Hatt B, Fletcher T, Walsh C and Taylor S. 2004. The influence of urban density and drainage infrastructure on the concentrations and loads of pollutants in small streams. Environmental Management. 34:112-124.
[16] Gadd, J.; Snelder, T.; Fraser, C.; Whitehead, A. 2020. Current state of water quality indicators in urban streams in New Zealand. New Zealand Journal of Marine and Freshwater Research. 54:354-371.
[17] Larned, S; Scarsbrook, M; Snelder, T.; Norton, N; Biggs, B. 2004. Water quality in low-elevation streams and rivers of New Zealand: Recent state and trends in contrasting land-cover classes. New Zealand Journal of Marine and Freshwater Research. 38:347-366.
[18] Paul, M; Meyer, J. 2001. Streams in the urban landscape. Annual Review of Ecology and Systematics. 32:333-365.
[19] Meyer, J; Paul, M; Taublee, W. 2005. Stream ecosystem function in urbanizing landscapes. Journal of the North American Benthological Society. 24:602-612.
[20] Wildland Consultants 2022. Assessment of Ecological Effects for the proposed Pencarrow Structure Plan area at Pongakawa. Wildland Consultants contract report 6334. Prepared for Keven and Andrea Marsh.
[21] Walsh, C. J., A. H. Roy, J. W. Feminella, P. D. Cottingham, P. M. Groffman & R. P. Morgan II, 2005. The urban stream syndrome: current knowledge and the search for a cure. Journal of the North American Benthological Society 24: 706–723.

32. The closer the residential land use is to a stream, the larger the effect on macroinvertebrate community composition[22]. The greater the setback the better for stream health.

33. While the proposed development area is relatively small, and unlikely to have a large impact on water quality itself, ad-hoc development can result in cumulative effects because of a lack of integrated planning at the catchment scale.

BUFFER WIDTH

34. In general, wider planted riparian buffers provide more protection to the waterway and more ecological benefits. A wider riparian margin is more effective at providing ecosystem services, protecting the adjacent waterbodies and instream fauna and improving water quality. A wider vegetated buffer is also better in terms of self-sustainability and a reduction in the risk of weed invasion and maintenance needs in the long term[23,24].

35. The appropriate width for a riparian buffer does depend on the outcomes being sought, the size of the stream and the slope. For example, good shading of a waterway using a narrow row of densely planted trees can help to reduce water temperature and algal growth and aid in regulating dissolved oxygen, and a rough grass buffer of only a few metres wide can effectively reduce sediment and sediment-bound nutrient runoff into a stream, especially on low gradient land[25]. However, maintaining or restoring the ecological health of a waterway generally requires a wider buffer.

36. An Australian study looking at pine harvesting effects on waterways[26] showed that buffer widths of less than 10 m did not protect streams adequately from the impact of adjacent land use or from changes to algal, macroinvertebrate and fish

[22] King, R.; Baker, M.; Whigham, D.; Weller, D.; Jordan, T; Kazyak, P; Hurd, M. 2005. Spatial considerations for linking watershed land cover to ecological indicators in streams. Ecological Applications. 15:137-153.
[23] Parkyn S; Shaw W; Eades P. 2000. Review of information on riparian buffer widths necessary to support sustainable vegetation and meet aquatic functions. NIWA Client Report ARC00262.
[24] Parkyn SM, Davies-Colley R, Halliday NJ, Costley KJ, Croker G.F. 2003. Planted riparian buffer zones in New Zealand: do they live up to expectations? Restoration Ecology 11: 436-447.
Parkyn, S.M.; Davies-Colley, R.; Halliday, N.J.; Costley, K.J.; Croker, G.F. (2003). Planted riparian buffer zones in New Zealand: do they live up to expectations? *Restoration Ecology 11*: 436-447.
[25] Parkyn, S. 2004. Review of riparian buffer effectiveness. MAF Technical Paper No 2004/05. ISBN: 0-478-07823-4.
[26] Davies PE, Nelson M 1994. Relationships between riparian buffer widths and the effects of logging on stream habitat invertebrate community composition and fish abundance. Australian Journal of Marine and Freshwater Research 45: 1289-1305.

abundance and diversity, and in New Zealand vegetated riparian buffer widths between 8 and 27 m supported stream invertebrate communities similar to those in native forest[27]. Another New Zealand report recommended buffers of 10 – 20 m to support sustainable native vegetation and protection of most aquatic functions[28].

37. In the case of the Pencarrow Estate proposal, there is only one opportunity to get the riparian buffer width right, as once houses and other infrastructure are built, expansion of the riparian protection in the future is unlikely.

38. In my opinion the buffer does not necessarily need to be completely planted with native plants because a combination riparian buffer with a strip of grass to intercept sediment and a planted buffer closer to the stream would be effective. However, the self-sustainability of a narrow planting and the maintenance involved would need to be considered.

39. Fragmentation of ownership of the riparian area could also have negative impacts if the riparian area is managed differently by different owners. Riparian areas in multiple private ownerships can be progressively reduced and/or be subject to encroachment by garden vegetation and weeds.

SUMMARY

40. Residential development adjacent to the Puanene Stream could have adverse effects on a waterway which has high ecological value in a highly degraded catchment.

41. While the removal of the dairy effluent ponds adjacent to the stream is a positive effect of the proposal, residential development comes with its own suite of pressures on waterways including increased sedimentation and runoff, elevated levels of heavy metals and nutrients, and adverse effects on instream fauna.

[27] Quinn, J.M.; Boothroyd, I.K.G.; Smith, B.J. (2004). Riparian buffers mitigate effects of pine plantation logging on New Zealand streams 2. Invertebrate communities. Forest Ecology and Management 191: 129-146

[28] Parkyn, S.; Shaw, W.; Eades, P. (2000). Review of information on riparian buffer widths necessary to support sustainable vegetation and meet aquatic functions. NIWA Client Report ARC00262.

42. Allowing development in the riparian margin will preclude the ability to undertake future riparian protection in this area and sets a precedent for any other residential development in the catchment.

43. Streams and their buffers need to be seen as an asset for amenity, flora and fauna habitat provision, flood protection and ability to improve water quality.

44. In my opinion a 6-metre buffer is not adequate and it would be more appropriate that this be at least 8m. This also responds appropriately to the catchment context and values that I have described above.

Hamish Dean

4th November 2024