Before the Independent Hearing Panel of the Hawke's Bay Regional Council

In the matter of the Resource Management Act 1991 (the Act)

And

Proposed Plan Change 9 to the

Regional Resource Management Plan

Supplementary evidence of Maurice Wayne BLACK on behalf of Te Taiwhenua o Heretaunga

Re: Appendix 11 to the s42A report

September 2021

Introduction

1. My name is Maurice Wayne Black. My qualifications and experience are outlined in my Evidence in Chief[1].

2. My supplementary evidence is provided pursuant to Minute 9 from the Independent Hearings Panel. It is specifically in consideration of the subject matter in Appendix 11 provided as part of the s42A report from the Hawke's Bay Regional Council (HBRC), subsequent deletions to Appendix 11 and ancillary matters. Also referred to as the "Science Memo" the original Appendix 11 is titled "*Summary of Key Elements Pertaining to Water Quantity in Proposed Plan Change 9*".

3. Te Taiwhenua o Heretaunga (TToH) provided further submissions to the hearings panel in early July. Those submissions included analysis and comments on both the original and amended versions of Appendix 11.

4. I am aware of recently issued Minute 10 requesting a response from HBRC to the further submissions and evidence of Te Taiwhenua o Heretaunga and Ngāti Kahungunu Iwi Incorporated, and the content of the groundwater memo of 20 September 2021, addressed to HBRC staff.

5. I have read the Code of Conduct for Expert Witnesses in section 7 of the Environment Court Practice Note (2014) and agree to comply with that Code. Except where I state that I am relying on documents or evidence of another person or party, the content of these submissions are within my area of expertise. I have not purposely omitted to consider material facts known to me that might detract from my evidence or the opinions I express.

[1] Statement of Evidence MWBlack TToH Sub132 - Cultural and Planning FINAL – 11 May 2021.

Summary of my evidence

6. My evidence today is restricted to water quantity matters for both groundwater and surface water, including:
    - Water quantity in the Heretaunga Plains Aquifer System and other groundwater resources in TANK catchments
    - The uncertainty around Heretaunga Plains Aquifer recharge volumes and the estimates for the water budget
    - Potential adverse effects on groundwater quality associated with excessive groundwater abstraction
    - Stream depletion rates and volumes and management of these
    - Surface water abstraction matters
    - Effects on Māori relationships and values due to stream depletion.

7. The Appendix 11 memo expressed the views from the perspective of the authors, and it is unethical to alter or amend it in a manner that implies the original authors have changed their views/opinions when they have not been consulted on the amendments. I can understand minor corrections, but do not support deletions of duly referenced statements of fact.

Heretaunga Plains Groundwater use

8. Management of Heretaunga Groundwater through PPC9 is confusing and does not promote the sustainable management of the groundwater resource, leaving mitigation of adverse effects due to stream depletion for future activities to potentially resolve.

9. The key questions in terms of resource management and Heretaunga groundwater are whether the allocation quantities set through PPC9 are sustainable, and is the interim allocation quantity/limit a sustainable yield? Being “interim” suggests uncertainty and a need for caution. This appears to be supported through the prohibited status for any new allocations of groundwater which was one of the early consensus agreements reached by the TANK Stakeholder Group.

10. One definition of sustainable yield is: "*The groundwater abstraction regime measured over a specified planning time frame that allows acceptable levels of stress and protects dependent economic, social and environmental values*".
    This definition[2] does not refer to cultural or tikanga Māori values but does include environmental values. It would be helpful if PPC9 contained a similar definition.

11. Connectivity between groundwater and surface water throughout the TANK catchments has been acknowledged through various council reports and media releases as being greater than previously thought. Excessive groundwater takes increase the volumes and rates of stream depletion across the Heretaunga Plains, and these are not included in surface water allocations, meaning consequential depletion from surface water due to groundwater abstraction is not part of the criteria for surface water take assessments, or applications for resource consent.

12. Given the high degree of connectivity between groundwater and surface water, the allocation rules that apply for Heretaunga Plains groundwater, and parts of the Karamū catchment should acknowledge the water short areas in RRMP Schedule VI.

Actual and reasonable use definition

13. The "*actual and reasonable use*" definition in PPC9 is biased towards extractive uses and water demand, and omits consideration of sustainable yield, and sustainable management as defined in the Resource Management Act. It does not consider effects on either groundwater or surface water values, other than economic imperatives. In my opinion the promotion of actual and reasonable use detracts from sustainable management of water resources in TANK catchments as it enables large volumes and rates of stream depletion per day without addressing the effects apart from Zone 1 restrictions. up to 60% depletion in Zone 2 is not accounted for in PPC9.

[2] Australian National Groundwater Committee, 2000

14. To provide a buffer against drought years, groundwater storage should not be depleted to the extent that it does not recover before the commencement of the next irrigation season. The actual and reasonable use scenario, where it enables 90 Mm^3 groundwater allocation per year, contributes to continual decline in groundwater storage. The groundwater take total needs to be considerably less than the annual average sustainable yield to provide for the occurrence of droughts given the prevailing Hawke's Bay climate and future climate change predictions.

Surface water/stream depletion rates

15. Groundwater connections to surface water are known to be far greater than previously thought. Allocatable volumes and allocation rates for surface water in PPC9 do not take into account surface water depletion attributable to groundwater takes, apart from those in Zone 1. A large volume of water is therefore unaccounted for in terms of appropriate monitoring and management of water volume, cumulative rates of depletion and their adverse effects, particularly where these contribute to longer flow recessions and irrigation bans in streams and rivers.

16. Across the Heretaunga Plains 1700 L/s stream depletion occurs due to groundwater abstraction of 90 Mm3[3], if that volume is averaged out over 365 days. 1700 L/s equates to 146,880 m3 per day, and 53,611,200 m3 per year. This means that of the interim groundwater allocation limit, over 50% is actually derived from intercepting surface water recharge or the reversal of spring flows.

17. In reality, most depletion occurs over the 6-month irrigation season. I acknowledge that part of this is attributed to public water supply wells, e.g., those in Eastbourne Street Hastings, but these provide a public good and contribute to public health and safety. It is also a statutory requirement for territorial authorities to provide a safe water supply.

[3] 5029 RM18-38 Heretaunga Stream Depletion Report, p38

18. Groundwater abstraction is impacting on irrigators who use surface water, due to groundwater abstractions contributing to the extended irrigation ban periods within surface water bodies and Stream Management Zones. Affected zones include the water short areas identified in RRMP Schedule VI. In some cases, bans of over 60 days occur in Karamū tributaries[4], which is over 30% of the irrigation "season".

19. Two operative RPS objectives are directive and require:
    "*The avoidance or remedy of any significant adverse effects of water takes on the long-term quantity of groundwater in aquifers and on surface water resources*"[5] and
    "*The avoidance or remedy of any significant adverse effects of water takes on the operation of existing lawful efficient groundwater takes*"[6].

    In its current (amended) form PPC9 ignores these two objectives as it enables 1700 L/s of stream depletion to continue for up to ten years.

20. Although RPS objectives and policies were intended to restrict stream depletion and adverse effects on springs, groundwater allocation processes in the past have tended to ignore this aspect in favour of supporting economic pursuits. Regional councils including HBRC have a statutory responsibility for –

    "*the maintenance of the quantity of water in water bodies and coastal water*" (s30(1)(c)(iii), and
    "*the maintenance and enhancement of ecosystems in water bodies and coastal water*" (s30(1)(c)(iiia).
    In terms of groundwater abstraction and stream depletion, PPC9 needs to be amended to enable these requirements to be achieved and give effect to the RMA.

21. There is the option to utilise a range of methods to meet the requirements of the operative RPS in terms of addressing reductions in spring flows and effects on surface

[4] MW Black EIC Appendix 9: TToH_MBlack - Irrigation Ban Days
[5] RRPS Objective 23.
[6] RPA Objective 24.

water quantities. A reduction in the interim allocation limit is one method to help achieve this and reduce the scale of adverse effects on surface water and their values, including tikanga Māori and environmental values.

Water take criteria/management

22. Criteria for groundwater take applications and renewals in my opinion, need to give greater consideration to surface water depletion and its effects on surface water values. The current provisions in PPC9 are not strong enough.

23. Likewise, the management of surface water takes and allocable volumes need to be amended so they are cognisant of surface water depletion rates and volumes, and where this occurs.

Clarification of groundwater areas and applicable volumes

24. There are differences between the HPAS which has specific protective objectives and policies in the RPS that are not being amended through PPC9, and the Heretaunga Groundwater Quantity Area in Schedule 31 E. The Heretaunga Groundwater Model references Dravid and Brown's estimates for aquifer inputs and outputs, but these are restricted to the Heretaunga Plains Aquifer System, whereas Schedule 31 E is far larger and includes groundwaters around Maraekākaho, Matapiro and in the Moteo Valley. I re-iterate here that the connections between the Moteo Valley groundwater and the HPAS are tenuous. The Tūtaekurī River recharges the Moteo Valley Aquifers at around 850 L/s with 750 L/s (median measurement) of this emerging as spring discharge into the Tūtaekurī-Waimate Stream[7].

25. It is unclear whether the proposed interim allocation limit of 90 Mm^3 applies to all the Schedule 31 E areas or just the Heretaunga Plains Aquifer System portion. The Heretaunga Stream Depletion report (page 38) implies that the 90 Mm^3 is for the Heretaunga Plains Aquifer System (HPAS), which could be interpreted as meaning that

[7] Report 4996 – Heretaunga Springs June 2018, page 72.

groundwater allocations/volumes outside of the HPAS are additional to the 90 Mm^3 interim limit. It would be helpful if council staff could clarify this matter.

26. PPC9 appears to promote a dual management approach for the groundwaters specified in Schedule 31-E Heretaunga Groundwater Management Area. The HPAS has elements of protection attached to it due to RPS Objective 21, and restrictions on discharges over the unconfined aquifer, but it is unclear whether these provisions apply to the remainder of the groundwater this Schedule. It would assist plan users if the unconfined aquifer area was specified in the schedule.

Proposed Plan Change 7

27. The Hearing Panel's decisions on Proposed Plan Change 7 (PPC7 – Outstanding Water Bodies) were recently notified. When proposed by HBRC, the Outstanding Water Bodies schedule (Schedule 25) included water bodies in the Heretaunga considered to be outstanding, including the Heretaunga Aquifer and Lake Poukawa. The decisions version of PPC7 has removed these from the schedule, despite the RPS recognising the Heretaunga Plains Aquifer System as the most significant groundwater resource in the region[8]. The decisions on PPC7 and the removal of the HPAS and other water bodies in the TANK catchments[9] from Schedule 25, have been appealed to the Environment Court and are yet to be resolved. I consider this a matter that needs to be taken into consideration for PPC9.

Heretaunga Aquifer recharge rates and volumes

28. There is uncertainty around what the aquifer recharge rates and volumes are. The officers' s42A report (OR) references specific parts of the Appendix 11 Memo, that have subsequently been deleted[10]. Historically, HBRC and others have relied on the inputs and outputs derived from Dravid and Brown 1997, where input estimates are just below 188 Mm^3 per annum.

[8] Regional Policy Statement - 3.8.2.
[9] Lower Ngaruroro River and the recharge zone down to Chesterhope, Heretaunga Plains Aquifer System, Lake Poukawa and Pekapeka Wetland.
[10] "Interim allocation and sinking lid" and "Actual and reasonable use as defined in PPC9" sections of the memo.

INPUT (m^3/yr x 1,000,000)		OUTPUT (m^3/yr x 1,000,000)	
Source	**Input**	**Source**	**Output**
Ngaruroro River	157.7	Public Water Supply	24.1
Tutaekuri River	25.2	Rural Domestic	2
Rainfall	5	Industries	11
		Irrigation	23.9
		Frost Protection	2
		Drainage Dewatering	3
		Total Pumped	***66.00***
		Spring leakage	119.8
		Submarine outflow	Unknown
		Total Natural	***119.8***
TOTAL	**187.9**	**TOTAL**	**185.8**

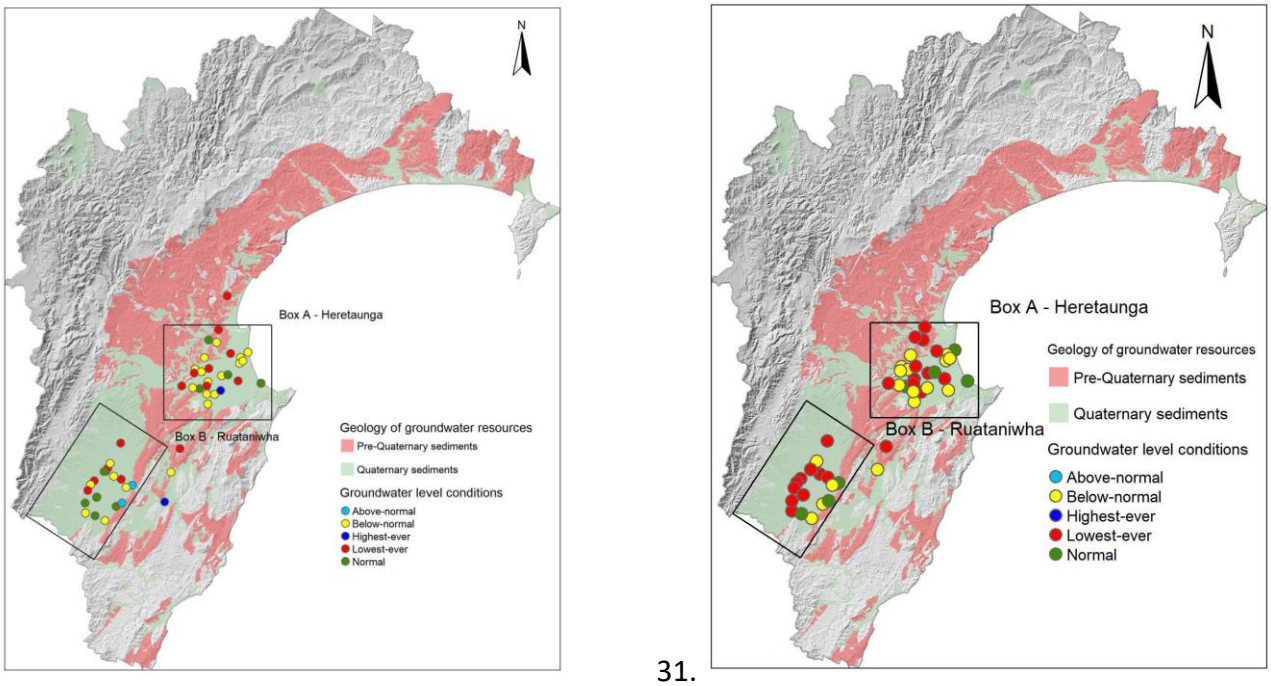
Table 1: Inputs and outputs[11]. Yellow shading indicates data that may need updating in light of more recent and emerging information.

29. Although published in 1997, the bulk of the report's data is derived from research up to 1995. Some of it I now consider to be unreliable or insufficient to base sound environmental decisions on due to:

    - The 1997 report assuming a relatively constant rate of recharge from the Ngaruroro River
    - More recent research and reports (GNS 2017) indicating both diurnal and seasonal fluctuations in recharge rates and volumes due to variable water temperatures
    - Substantial increases in land drainage volumes from the Heretaunga Aquifer System since 1995
    - Increases in groundwater irrigation and frost protection (storage and use)
    - Diversion of the Ngaruroro River away from main recharge zones as part of flood control and drainage works[12]
    - Deepening of the Ngaruroro main river channel below Roy's Hill that decreases natural braiding and water storage capacity within the braided plain aquifer, and
    - No evidence of submarine outflow volumes

[11] Derived from Table 6.10, Dravid and Brown 1997, page 168.
[12] Photos in EIC of Marei Boston Apatu.

30. In terms of irrigation from HPAS groundwater in Table 1, this volume has more than doubled since 1995, while spring leakage would now be less due to periodic spring reversal and stream depletion volumes of > 53 Mm^3 per year.



31.

32. **Figure 1:** Heretaunga groundwater monitoring wells for the months of July and August. Source – HBRC SOE reporting July 2021 and August 2021.

33. The most recent SOE monitoring of groundwater in Heretaunga wells show lowest levels ever recorded for the months of July and August, occurred in 2021, meaning they have not yet recovered from the last season's abstraction, at the start of the new irrigation season.

34. Groundwater allocation volumes and rates from the Heretaunga unconfined aquifer and the confined aquifer should be separated in the PPC9 management regime. Original assessments from bore logs were predicated on well recovery from the part of the aquifer each specific bore accesses. Although part of the same aquifer system, assessments for renewals and transfers of water takes need to ensure the take remains within the same part of the aquifer system so the scale and nature of effects remain similar to the original take.

35. I believe that groundwater takes within the Moteo Valley and other valley aquifers need to have their own percentage of the total allocation limit. It would not be advisable to transfer groundwater takes across too large a distance. To help achieve effective management of Heretaunga Groundwater, Schedule 31-E and groundwater allocation policies should divide the total allocation for Heretaunga Groundwater into specific sub-zones or units:

    - The unconfined part of the Heretaunga Aquifer
    - The confined Heretaunga Aquifer
    - Moteo groundwater
    - Matapiro groundwater
    - Lower Tukituki Aquifer contributions to the Clive/Karamū
    - Allowance for the coastal margin (outside of RRMP regulation)
    - Other valley aquifers

Groundwater budget considerations

36. Council modelling and estimates imply an increase in Heretaunga groundwater inputs of 80 Mm^3 per annum (Table 2), from the estimates of Dravid and Brown, but the additions are not substantiated by actual monitoring. The majority of the purported increase is from the LSR rainfall estimates (78.5 Mm^3). Tukituki River loss estimates are to a shallow aquifer that overlies the main Heretaunga Aquifer, and the Tukituki Aquifer discharges into Muddy Creek, the Karamū and Clive.

37. The Tukituki catchment and some abstractions from the Tukituki Aquifer are regulated through operative provisions in the RRMP that were part of Tukituki PC6. These takes intercepted water before it reaches the main Heretaunga Aquifer, or the Karamū/Clive system, are outside the scope of PPC9. A proportion of the interim groundwater allocation limit should be reserved for the Tukituki catchment, particularly for frost protection and irrigation takes along the true left bank.

38. The sea discharge volume is suspected but not confirmed. Dravid and Brown's report states "*The chemical and isotope data suggest a longer groundwater residence time and a slower flow below 117 m depth and perhaps a "blind" aquifer without an*

offshore outflow[13]". Higher aquifer pressures at Whakatu, Jervoistown/Meeanee and Awatoto support the premise of an eastern barrier to the deeper part of the aquifer.

Table 2: Groundwater budget for the Heretaunga Aquifer System.[14]

	Type	**Description**	**Mm^3/year**	**L/s**	
INFLOWS	River recharge (to groundwater)	Total river recharge to groundwater (based on observed major river losses by HBRC) including: Ngaruroro loss Tukituki losing Tutaekuri losing	**188.6** 138.8 24.6 25.2	**5,980** 4,400 780 800	**71%**
	Land Surface Recharge from rainfall	LSR calculated by Aqualinc for the unconfined area	78.5	2,489	29%
	TOTAL INFLOWS		**267.1**	**8,469**	
OUTFLOWS	Spring discharges	Measured summer discharges	111.0	3,520	42%
	Groundwater pumping	Some data, and estimated from demand modelling	78.1	2,475	29%
	Sea discharge	No observations	78.0	2,474	29%
	TOTAL OUTFLOW			**267.1**	**8,469**

39. Some groundwater in the Moteo Valley is intercepted before it reaches the Tūtaekurī-Waimate Stream with stream depletion here being second highest after the Ngaruroro River. Groundwater abstractions from the Moteo system need to be reserved and accounted for within their own unit separate from the rest of the groundwater area in Schedule 31-E.

40. Groundwater levels continue to decline with between 65 Mm^3 and 78 Mm^3 abstraction from the Heretaunga groundwater resource. The 20 September Groundwater Memo points out that between 1989 and 2018, summer levels declined by an average of 5 centimetres per year or just under a metre. This equates to a loss

[13] Dravid and Brown 1997, page 73.
[14] From Table 2-3 Heretaunga Aquifer Groundwater Model Development Report

of storage of millions of cubic metres. If we extend the 2018 date above out to 2020, the total decline in groundwater levels[15] averages out at 1.05 metres.

Surface water allocation

41. In my view, surface water trigger flows and minimum flows should be cognisant of and take into account, stream depletion effects of groundwater takes. In its current (amended) form, PPC9 restricts stream depletion due to Zone 1 groundwater takes but not for Zone 2, so is remiss in terms of managing adverse effects, and the statutory requirement to avoid, remedy or mitigate adverse effects is compromised.

Stream depletion volumes

Table 3 (from Table 3-3[16]):
Maximum flow depletion against typical river flow for spring-fed streams.

Stream	Typical Flow L/s	Estimated depletion in February 2013 L/s	Estimated naturalised flow	% Flow Loss
Irongate	168	272	440	62%
Karamu	575	1107	1682	66%
Karewarewa	25	341	366	93%
Mangateretere	46	253	299	85%
Raupare	402	242	644	38%
Tūtaekurī - Waimate	1831	435	2,266	19

Table 4: Stream depletion volumes due to groundwater abstraction– Karamū tributaries.

Stream depletion volumes – Karamū tributaries				
	Depletion L/s	m^3 per day	m^3 per week	Over 4 weeks
Irongate	272	23,500	164,505.6	658,022.4
Karewarewa	341	29,462.4	206,236.8	824,947.2
Mangateretere	253	21,859.2	153,014.4	612,057.6
Raupare	242	20,908.8	146,361.6	585,446.4
Totals	**1108**	**95,730.4**	**670,118.4**	**2,680,473.6**

[15] 1 hectare at 1 metre deep = 10,000 m^3 loss of storage. Aqualinc study area for Heretaunga groundwater is the same as the Schedule 31-E area, which is 52,500 hectares making >500,000,000 m3 loss of storage over 20 years.
[16] 5018 – Heretaunga Aquifer Groundwater Model Scenarios Report

Table 5 – Stream depletion volumes due to groundwater abstraction – Tūtaekurī-Waimate.

Stream depletion - Tūtaekurī-Waimate				
	Depletion L/s	m^3 per day	m^3 per week	Over 4 weeks
Tūtaekurī-Waimate	435	37,584	263,018	**1,052,072**

Rainfall inputs - Aqualinc Report

42. The Aqualinc report on Land Surface Recharge (LSR) assumes there is a 78.5 Mm^3 rainfall contribution to the Heretaunga unconfined aquifer, whereas the estimate in the 1997 report was 5 Mm^3. Aqualinc does not accurately quantify rainfall or soil moisture losses to surface water through sub-surface drainage systems[17], or through runoff (called quick flow in the report) and the modelling detracts a 5% portion of rainfall as quick flow to arrive at their additional 78.5 Mm^3 LSR. This increases their input calculations to 267.1 Mm^3 per year.

43. I regard the Aqualinc report[18] and conclusions with a degree of caution. There are a number of assumptions made about soil moisture loss, it uses methods derived from North Otago[19] which has a different climate to Hawke's Bay, and the use of the Irricalc model tends to over-estimate actual crop water needs. The study area (Figure 1 in the report) is calculated as 52,500 hectares and includes land in the Upper Ngaruroro, Moteo Valley and Ahuriri catchments – i.e., lands outside of the Heretaunga unconfined aquifer area. It is also difficult to reconcile the continual decline in SOE monitoring wells in Heretaunga with the presumption that 267.1 Mm^3 is going in and a maximum of 78 Mm^3 is abstracted.

Appendix 11 – Consequential matters

44. I note the date on the amended version of Appendix 11 is 09 June 2021, almost two months after the original was filed with the s42A report. In the intervening period, the

[17] Sub-surface drainage through pumped systems and Nova-flow, field tile, mole-plough and other methods.
[18] Irrigation Water Demand – Land Surface Recharge Assessment, Aqualinc 2018.
[19] Aqualinc page 5.

bulk of submitters' expert evidence has been filed and considered, some of which highlights matters raised in the original Appendix 11. If we follow the timeline for filing evidence for PPC9 as outlined in Minutes 1 - 3 from the hearings panel:

- Submitters' expert evidence to be filed by 5pm on 7 May 2021[20] – extended to 5pm on 11 May 2021[21];
- The Council Officer's section 42A report (including appendices) and all expert evidence will be taken as read[22] by the hearings panel;
- Council staff to respond to expert evidence by 5pm 19 May[23]
- Smith and Robotham deletions/amendments to Appendix 11, 09 June.

45. HBRC staff decided which submitters had the right to make further submissions and speak to those submissions on September 27th, 2021. Reporting staff selected those submitters that, in the staff's opinion, were eligible to provide this additional input.

Conclusions

46. Groundwater Modeling is useful but is not as accurate as the data acquired from actual monitoring. Modeling outcomes are theoretical and dependent on model input accuracy. I consider it unwise to rely on model outcomes more than on actual monitoring data, which for groundwater, clearly shows a consistent decline in groundwater levels for over a decade.

47. The Heretaunga Groundwater Model is used to project potential outcomes due to a range of scenarios. It is more focused on meeting water demand and predicting likely effects on water abstraction and water users than on sustainable management of a limited resource. I consider it inappropriate to base a regional plan on modeling predictions rather than sustainable management principles and results from monitoring data.

[20] Minute 1 para 6b.
[21] Minute 3 para 4.
[22] Minute 2 para 5.
[23] Minute 3 para 5.

48. Nowhere does use of the model for PPC9 quantify or predict what is required to meet tangata whenua values and interests associated with the Heretaunga Aquifer System, emerging springs, surface waters that are replenished by the aquifer, or resultant effects on these from stream depletion effects or a range of abstraction scenarios. This is despite the RRMP containing the Treaty principle of active protection.

49. Surface water allocation policies and criteria in TANK catchments should be revised to account for surface water depletion amounts that result from groundwater abstraction. Failure to do so will mean that all matters necessary to make an informed decision on surface water management in TANK catchments have not been taken into account.

50. Heretaunga Aquifer storage has declined by more than 525,000,000 m^3 over the last 20 years, clearly indicating mining of the aquifer. The seasonal retreat in spatial area of the HPAS, particularly around the western perimeter (Pakipaki/Bridge Pa/Omahu) is an indication of this. It is also the result of HBRC's past and current unsustainable management practices, and failing to give effect to RPS directive objectives and policies.

51. There is a risk that undue prejudice will result for other submitters where HBRC has been asked to supply additional information to the Hearings' Panel, and to address a range of questions. It may be necessary to provide time for other submitters to submit on any changes to information that s42A reporting staff relied on when drafting amendments to PPC9.

Signed: _____ Date: 24 September 2021

Maurice Wayne Black for Te Taiwhenua o Heretaunga