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Tēnā tātou,

**Ōtaki to north of Levin Highway Project- – Response to request for additional information pursuant to section 92 of the Resource Management Act 1991**

This letter provides a response to the request for further information pursuant to section 92 of the Resource Management Act 1991 (“RMA”) received on 9<sup>th</sup> December 2022 in relation to the applications for resources consents<sup>1</sup> to authorise the Ōtaki to north of Levin Highway Project (“Ō2NL Project” or “the Project”)

The information requested and the Waka Kotahi NZ Transport Agency (“Waka Kotahi”) response is set out in the following table.

No.	Jurisdiction	Information requested	Waka Kotahi response
<b>Surface Water Takes</b>			
1.	MWRC	<i>a) The Applicant has outlined that part of the water demand strategy is to utilise water that becomes available to the project through existing consented takes on land that is acquired to allow construction of the O2NL project. The application has not outlined if and/or how the surface water allocation/abstraction will be reduced if water is acquired through these means. Can the Applicant please provide an estimate of how much water is expected to become available through this process? (The regional council can supply consents information to assist with this</i>	<p>The Design and Construction Report in Appendix Four of Supporting Information and Assessment of Effects on the Environment’ Report (Volume II) describes strategy for the taking of water. This strategy confirms that, if water from bores becomes available it will be used for the Project where this bore water is:</p> <ul style="list-style-type: none"> <li>• able to be used to support construction activities;</li> <li>• at a volume and rate that is useful; and</li> <li>• is located in close proximity to the physical works.</li> </ul> <p>At this stage the location and volume of any bores that have the potential to be used to support construction activities is unknown. That said, resource consent is sought for a maximum amount of water to support construction sourced from a hierarchy of sources. Abstraction from rivers and streams will only be used to ‘top up’ the available</p>

<sup>1</sup> Horizons Regional Council – APP-2021203231.00 and Greater Wellington Regional Council – WGN230122.

No.	Jurisdiction	Information requested	Waka Kotahi response
		<p>assessment)</p> <p>b) <i>If additional water is expected to become available to the Applicant through the utilisation of existing consented takes on land that is acquired to allow construction of the O2NL project, can the Applicant please outline a strategy to reduce the amount of water taken and/or consented to be taken from the rivers to ensure an efficient allocation of water?</i></p>	<p>water to meet the actual demand. This will assure optimal efficiency of water use and minimise abstraction from rivers and streams.</p>
2.	MWRC	<p>2. <i>An audit of the allocation information for the Ōhau River has revealed that there is no water remaining in the core allocation. This change is due to uncertainty around the degree of surface water connection of a bore that is currently going through the renewal process. Until the degree of connection can be established, it is necessary to take a cautious view and assume that the bore will have a degree of connection to surface water that would result in the bore being managed under the surface water allocation framework, and the Ōhau River becoming fully allocated. Therefore, any proposed abstraction from the Ōhau River at this time will be treated as a proposed over allocation, and a non-complying activity (Rule 16-8). Can the Applicant please advise how they would like to proceed? Please note that there is currently capacity within the Waikawa Stream core allocation to accommodate an additional 409m<sup>3</sup>/day (i.e. the amount initially proposed to be taken from the Ōhau River). If the Applicant wishes to proceed with the application to take water from the Ōhau River, a full assessment of effects will be required.</i></p>	<p>Waka Kotahi continues to seek resource consent to take water from the Ohau River as initially proposed. That is, it is proposed to take water from the Ohau River at a maximum rate of 70 L/s with a minimum flow at which abstraction would cease of 820 L/s (see Table 4-4 of Design and Construction Report included as Appendix 4 to the Supporting Information and Assessment of Effects on the Environment' Report (Volume II)). Proposed Condition RWT1 establishes the parameters within which water may be taken, including a requirement to cease taking water in circumstances when the minimum flow is reached. It is the adverse effects of the taking of water within the parameters established by the proposed Conditions that has been assessed in the information that accompanies the application for resource consent (irrespective of activity status). For completeness Waka Kotahi confirms that, in terms of the potential adverse effects, from a hydrological perspective, a take of 70 L/s would be within the inherent level of error for measuring river discharge, even when discharge was approaching the minimum flow level.</p> <p>From an ecological perspective, adverse effects resulting from reduced flows are directly related to a suite of habitat changes that can be exacerbated by low flow conditions (that is, increased sedimentation, increased periphyton biomass, increased water temperatures, lowered dissolved oxygen concentrations). At the location that the Ohau River is traversed, the riverbed has minimal fine sediment cover, low periphyton cover, and a macroinvertebrate community indicative of high habitat and water quality, and a fish community indicative of excellent habitat conditions. This is despite long term, existing Levin water supply abstraction occurring.</p> <p>Given the size and gradient of the Ohau River, it is improbable that an abstraction rate of up to 70 L/s would result in any measurable ecological changes. In this regard, ecological monitoring required by</p>

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			<p>proposed Condition RFE4 includes monitoring of the Ohau River upstream and downstream of the location where the River is traversed.</p>
3.	MWRC	<p><i>How is the Applicant intending to manage and comply with the proposed condition RWT1? The response to this question should address:</i></p> <p><i>a) Will the Applicant install flow monitoring sites at the proposed abstraction points? Please note these will need to be up to NEMS standard.</i></p> <p><i>b) If monitoring sites will not be located at the point of abstraction (i.e. if the Applicant is going to rely on existing flow monitoring sites), can the Applicant please illustrate how the flows measured at the respective flow monitoring sites are representative of the flows at the points of abstraction? The response to this should consider the points highlighted under point 3.</i></p> <p><i>c) Will the rate of abstraction be scaled automatically or manually?</i></p>	<p>Waka Kotahi does not propose to install in-stream flow monitoring sites specifically as part of the Project. Rather, existing flow sites will be used, together with their various flow regimes, statistics and established minimum flows.</p> <p>Since any abstraction will be taken from locations that are upstream of any 'losing reach' on the various streams, the flows measured at the gauging station will be the same or very similar to those at the point of abstraction. The stopping of abstraction at the minimum flow will ensure that there is no significant adverse effect on the duration a river or stream may go dry naturally during extreme conditions. The streams go dry at a flow significantly below the current minimum flow.</p> <p>The volume and rate of water take proposed to support construction activities will, in almost all instances, be within the measurement error and uncertainty associated with open channel flow measurements, that is +/- 8%. Since water will only be abstracted existing allocations set by the Regional Councils, above the minimum flow and at a rate of 10% of the minimum flow, any effects will be very small and not likely to be able to be measured.</p> <p>Proposed Condition RWT1, at clause (f) provides for the actual amount of water taken on a daily basis to be measured (with the records provided to MWRC) in order to confirm the water take is within the low volume and rate required by Condition RWT1. The monitoring of abstractions from all sites across the Project will also ensure that the combined take is consistent with the limit that may be allowed by the granting of resource consent.</p> <p>Flows decrease slowly during the recession when abstraction has the potential to have a greater effect. Therefore, it is proposed that abstraction up to the maximum allowed will occur whenever the mean daily flow on the day previous exceeds the minimum flow for that river or stream. Since the minimum flows have been established to avoid any significant adverse effects of abstraction, and all abstraction will cease at this threshold, any adverse effects will be less than minor.</p> <p>All water abstracted will be metered continuously to ensure that the maximum rate and volume of abstraction are consistent with the conditions of resource consent, if granted. This will ensure compliance.</p>

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4.	MWRC	<i>Can the Applicant please outline the proposed rate of take from each of the two abstraction points in the Manakau subzone? Is the proposed rate of take to be split evenly between the two abstraction points, or is the proposal to be able to abstract this full volume from either of the two abstraction points?</i>	Waka Kotahi confirms that the application for resource consent is intended to allow for the proposed maximum rate of take to be from either of the abstraction points or a combination of both. In this regard, it is noted that the maximum abstraction rate and volume of abstraction cannot be exceeded when abstractions from the two locations are combined and will not be taken from both abstraction points at the same time. These requirements are embedded in proposed Condition RWT1.
5.	MWRC	<i>Section 14.4.8.2 of Volume II Supporting Information and Assessment of Effects on the Environment outlines that the water will be taken on a 'continuous trickle' basis. Presumably, this would mean that the maximum daily volume is abstracted evenly over a 24 hour period. Section 4.7.6.8 of Appendix Four DCR states that the daily volume will be taken over the course of 12 hours. However, in some rivers, the maximum abstraction rates sought allow the water to be taken in much less time. Given that storage will buffer the timing of the supply of and demand for construction water, can the Applicant please explain why the water cannot be taken continuously over a 24-hour period (when the storage ponds aren't full), rather than sporadically in &lt;12 hour periods as requested?</i>	While water could be abstracted at a lower rate over a 24-hour period, from a practical perspective this is inconsistent with management and operation of the water take during the normal working hours. As such, taking water over a 24-hour period also represents a significant risk to a reliable supply of water in situations where, for example, the pump fails outside of normal working hours. That said, given the low rates and volumes of abstraction proposed, the taking of water over a 12-hour period provides resilience and security of supply, while the adverse effects of taking water in this manner are less than minor (that is, immeasurable).
6.	MWRC	<i>Appendix 4.7 of Appendix 4 (Design and Construction Report) states that 'the Project Aquatic Ecologist should provide advice as to the maximum rates of abstraction that can be sustained at any specific site without affecting instream values significantly'. Has this information been provided? If not, could this be provided please? The assessment should consider the effects of the maximum rates of take sought in the wider context of the level of allocation in the relevant water management subzone and existing takes. This assessment should be done at the point(s) of abstraction and at the most sensitive downstream environment.</i>	It is proposed to abstract water from surface waterbodies at a very low rate in order to maintain a constant supply of water in out-of-channel storage ponds. Table 4-4 of the Design and Construction Report included as Appendix 4 to the Supporting Information and Assessment of Effects on the Environment Report (Volume II) includes the maximum proposed rates of abstraction, although it is proposed to allow for water harvesting by providing for greater volumes of water to be abstracted when flows are above median. This is set out in proposed Condition RWT1. Proposed Condition RWT1 also provides that at any time, no more than 10% of the discharge as measured at a defined flow gauge will be abstracted. A 10% rate of abstraction is within the inherent level of error for measuring river discharge. From an ecological perspective, adverse effects

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			<p>resulting from reduced flows are directly related to a suite of habitat changes that can be exacerbated by low flow conditions (for example increased sedimentation, increased periphyton biomass, increased water temperatures, lowered dissolved oxygen concentrations). It is highly unlikely a trickle rate of abstraction under the proposed Condition RWT1 would result in any changes to ecological condition. In this regard, it is also assumed that the core allocation limits established by MWRC have been set based on a consideration of the ecological effects of abstracting water up to the core allocation limit.</p>
7.	MWRC	<p><i>Further to point 6, can the Applicant please provide an assessment of the effects of the proposed abstractions on other water takes? This assessment should pay careful attention to the potential effects on other water takes in highly allocated areas, where the proposed instantaneous rate of take as a proportion of river flow is disproportional to the proportion of the core allocation being sought, and where there are losses to groundwater downstream of the abstraction point.</i></p>	<p>Further to the information provided in response to previous requests, it is concluded that the proposed water takes will not result in adverse effects on the environment (including on existing water takes) because:</p> <ul style="list-style-type: none"> <li>- proposed Condition RTW1 ensures that disproportional takes are avoided;</li> <li>- the water takes are temporary and at a low abstraction rate (until storage ponds are filled); and</li> <li>- the water takes are from existing allocations set by the Regional Councils.</li> </ul> <p>As set out above, there are some 'losing downstream of the Project. These waterbodies 'go dry' naturally under extreme conditions (being conditions when the measured flow is significantly lower than the current minimum flow). Since the minimum flows have been established to avoid any significant adverse effects of abstraction, and all abstraction will cease at this threshold, any effects will be less than minor.</p>
8.	MWRC	<p><i>Can the Applicant please provide an assessment of the proposed supplementary allocation against Policy 5-17(b)?</i></p>	<p>In respect of One Plan Regional Policy Statement Policy 5-17(a) provides for, in addition to the core allocations set out in Policy 5-15(a), a supplementary allocation from rivers, '<i>where water is only taken when the river flow is greater than the median flow, and the total amount of water taken by way of a supplementary allocation does not exceed 10% of the actual flow in the river at the time of abstraction.</i>' The proposed water take for the Project includes supplementary allocation that is within the parameters of clause (a).</p> <p>Policy 5-17(b) provides for supplementary allocation where the allocation will not:</p> <ul style="list-style-type: none"> <li>• increase the frequency or duration of minimum flows;</li> <li>• lead to a significant departure from the natural flow regime, including the magnitude of the median flow and the frequency of flushing flows;</li> <li>• cause any adverse effects that are more than</li> </ul>

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			<p>minor on the Schedule B Values of the water body or its bed;</p> <ul style="list-style-type: none"> <li>• limit the ability of anyone to take water under a core allocation;</li> <li>• derogate from water allocated to hydroelectricity generation.</li> </ul> <p>As set out in Appendix 4.7 to the Design and Construction Report that is Appendix Four to the 'Supporting Information and Assessment of Effects on the Environment' Report (Volume II), the supplementary allocation sought does not give rise to any of the circumstances in Policy 5-17(b) (in particular it will not increase the frequency or duration of minimum flows) and as such the proposed water take is consistent with Policy 5-17 of the One Plan.</p>
9.	MWRC	<p><i>Can the Applicant please illustrate how the proposed regime represents an efficient allocation of water? This should take into account all sources of water being sought (i.e. from all river systems and from both the core and supplementary allocation), the amount of proposed storage, and the amount of time expected to be in minimum flow restrictions (based on historical records).</i></p>	<p>The Design and Construction Report that is Appendix Four to the 'Supporting Information and Assessment of Effects on the Environment' Report (Volume II) describes why water is needed and the rates of take proposed. In addition, the strategy and approach to taking water is provided in Volume II.</p> <p>The strategy is to minimise the taking of surface water by utilising water on site, in the first instance, where it is practicable to do so. For example, through the use of an existing bore water where it is permitted to be used for road construction purposes.</p> <p>Further, Appendix 4.7 of the Design and Construction Report provides information and analysis on surface water demands and constraints. This includes approaches to managing water takes to ensure that water does not need to be taken below minimum flows.</p> <p>Based on the approach set out above, Waka Kotahi considers that the proposed approach to sourcing water to support construction activities (being the use of on-site water sources first and then taking water at low abstraction rates, within allocation and storing that water for future use) is an efficient short duration allocation of water.</p>
10.	MWRC	<p><i>Table 11 of Appendix 4.7 of Appendix 4 (Design and Construction Report) states that the core allocation will be limited to 3,900 m<sup>3</sup>/day across all rivers and streams. Can the Applicant please explain how this will be managed, given the total volume being sought across all rivers systems is 5,900 m<sup>3</sup>/day? This issue should also be considered in the response to question 9.</i></p>	<p>The requirement for water in different locations will change over the duration construction of the Project but the total volume of water take across the Project will not exceed 3,900m<sup>3</sup>/day.</p> <p>The rate and volume of water take from each source from each river or stream will be monitored continuously to confirm that the maximum volume per day is not exceeded. Such monitoring will likely involve the telemetry of pump data to the Project site office.</p>



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11	GWRC	<p><i>How is the Applicant intending to manage the operation of the abstraction to comply with the proposed condition RWT1? Can the Applicant please provide details on;</i></p> <p><i>a. What streamflow monitoring site is proposed to be used?</i></p> <p><i>b. Will the rate of abstraction be scaled automatically or manually?</i></p> <p><i>c. How frequently will abstraction settings be reviewed and changed if necessary to adjust for natural flow changes?.</i></p> <p><i>d. Is it intended that the take operate as a 24 hour trickle feed or at a higher intermittent (e.g. 12 hour on/off) rate? (refer to Q5 ... for context)</i></p>	<p>Waka Kotahi is not proposing to undertake streamflow monitoring or scaling of flows on the basis that management in this manner is considered unnecessary given the limited volume and rate of water take from the Waitohu Stream.</p> <p>In terms of the daily duration of water take, it is proposed to take water during normal working hours. This is because taking water over a 24-hour period also represents a significant risk to a reliable supply of water in situations where, for example, the pump fails outside of normal working hours. Given the low rates and volumes of abstraction proposed, the taking of water over a 12-hour period provides resilience and security of supply, while the adverse effects of taking water in this manner are less than minor (that is, immeasurable).</p>
12.	GWRC	<p><i>What is the Applicant's assessment of the natural flow rates (L/sec) at SH1 and at Taylor's Road Bridge when flow at the GWRC monitoring site is measuring between 140 L/sec (the minimum flow) and about 500 L/sec (median flow)?</i></p>	<p>Waka Kotahi has not estimated the 'natural' flow regime at State Highway 1 or Taylors Road Bridge because any such assessment would be subject to a high degree of uncertainty. In this regard it is noted that, although losses to groundwater upstream have the potential to reduce the flows recorded at the monitoring site, the proposed abstraction is still a maximum of only 10% of the minimum flow. The Project has also only sought consent for 67% of the available/remaining unallocated core allocation for a short duration. For this reason, the potential for any adverse effects on the environment is limited.</p>
13.	GWRC	<p><i>Can the take regime be operated and scaled in such a way that abstraction rate at SH1 does not exceed 10 per cent of stream flow at the most sensitive downstream reach (indicatively considered to be in the Taylor's Road Bridge area)?</i></p>	<p>It would be possible to operate the water take from the Waitohu Stream at an abstraction rate that does not exceed 10% of stream flow at a downstream reach. However, the water take for which a water permit is sought is based on established minimum flow and allocation limits for the stream and as such it is considered that the rate and volume of water take proposed is appropriate and avoids potential adverse effects (including downstream of the location of the water take).</p>
14.	GWRC	<p><i>Can the Applicant please provide any existing advice from the Project Ecologist about the impacts of the proposed regime in order to demonstrate no more than minor effects? This should be made with reference to:</i></p> <p><i>a. the most sensitive downstream reaches where flows are naturally lower than at the point of</i></p>	<p>By way of context, Waka Kotahi notes that the Waitohu Stream has naturally drying reaches and as such the hydrology and ecology of the system will reflect this natural state.</p> <p>In terms of the potential impacts of the proposed water take on freshwater ecology values, any adverse effects are assessed as minimal and acceptable on the basis the proposed water take is for a temporary duration; is at a low rate; and is from the existing allocation. It is noted that the minimum</p>

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		<p><i>abstraction;</i></p> <p>b. <i>flow depletion associated with the take operating at maximum proposed instantaneous rates and daily volumes;</i></p> <p>c. <i>how the change in the frequency, magnitude and duration of flows downstream would impact flow-dependent stream values and functions?</i></p>	<p>flow and allocation for the Waitohu Stream has been defined with reference to the flow regime and record at the monitoring site and it is assumed that the potential effects on the environment (including in downstream reaches) were considered as part of setting the minimum flow and allocation limits.</p>
<b>Terrestrial Ecology</b>			
15.	MWRC and GWRC	<p><i>Can the Applicant please describe the present state and condition of the areas to be restored within Te Ripo o Hinemata?</i></p>	<p>The area to be restored is dominated by the exotic grass species reed canary grass (<i>Phalaris arundinaceus</i>). Willow is also frequent throughout the wetland. Indigenous vegetation is scattered throughout, some of which has been planted. The loss of wetland hydrology has allowed the reed canary grass to spread across much of the central and northern areas of the site.</p>
16.	MWRC and GWRC	<p><i>A draft Ecological Management Plan (EMP) was not included in the material lodged. Does the absence of the draft EMP impact on the conclusions reached by the bird and invertebrate experts as to adequacy of the mitigations discussed in their reports?</i></p>	<p>The absence of a draft Ecology Management Plan does not impact the conclusions reached in relation to birds and invertebrates in Technical Assessment J. This is because proposed Conditions RTE2 to RTE6 set out a range of standards that must be achieved. The way in which these standards are achieved will be set out in the Ecology Management Plan, with the content of the Ecology Management Plan being prescribed in Schedule 7 to the proposed Conditions.</p>
17.	MWRC and GWRC	<p><i>There appears to be an inconsistency between, (as an example) the high value of Kohekohe-titoki-karamu forest for lizards Table 4, Appendix J.6 versus a moderate value for the same forest reported in Table J.1a Appendix J.0. Is this apparent inconsistency as to the level of ecological value of habitats material to the magnitude of effects assessment and the degree offsetting required, material to the assessment?</i></p>	<p>There is no inconsistency in the values. A habitat type may have a different ecological value when compared to the value of a particular fauna species. For instance, an area of vegetation could have a high ecological value based on its rarity and representativeness, but only a low to moderate value for fauna.</p> <p>That said, if there were any inconsistency in the value assigned to the kohekohe-titoki-karamu forest, it would not be material to the assessment of effects because this habitat is not within the Project construction footprint and is therefore retained.</p>
18.	MWRC and GWRC	<p><i>What is the residual effect for the loss of "Gravelfield" habitat (TG1) and how will this loss be offset (if it is above the "low" threshold)?</i></p>	<p>The extent of loss of gravelfield habitat (TG1), and the adverse effects of that loss, will be confirmed once bridge design is complete and the footprint of the bridge abutments has been finalised (refer to Table J.3 in Technical Assessment J).</p> <p>If the level of adverse effects is above the 'low' threshold, options for offsetting or compensation for</p>



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			<p>loss of gravelfield include the direct transfer of gravel habitat to other parts of the river and/or restoration of adjacent gravelfield through, for instance weed control and indigenous planting.</p> <p>Condition REM17 explicitly allows for the further assessment of effects and associated revision to the offsetting requirements.</p>
19.	MWRC and GWRC	<i>For wetland transfers, if the transfer is unable to take place (as potentially implied by “where needed and practicable” per Para 203, Appendix J.0), does this increase the threshold of loss above “irreplaceable”?</i>	<p>None of the habitats within the Project construction footprint are irreplaceable in the sense that they could not be created elsewhere. In the unlikely scenario where wetland transfers cannot take place, restoration planting of the same suite of plant species can be undertaken at the donor site.</p>
20.	MWRC and GWRC	<i>How does the Applicant propose to manage pest plants across all lands under the jurisdiction of the Project at time of construction, including all potential pest plant species (environmental, agricultural, and amenity) where incursion or spread is exacerbated by the Project’s activity (including inactivity on acquired lands or loss of control intensity as a result of the change in tenure)?</i>	<p>Waka Kotahi will manage pest plants in accordance with the rules and obligations set out in:</p> <ul style="list-style-type: none"> <li>• Horizons Regional Council Regional Pest Management Plan 2017-2037; and</li> <li>• Greater Wellington Regional Pest Management Plan 2019-2039.</li> </ul>
21.	MWRC and GWRC	<i>With reference to Para 205, Appendix J.0, how are the opportunities to maximise connectivity and quality to be implemented and is there a threshold of “maximise” below which the ecological mitigations are less than anticipated?</i>	<p>All natural areas within the Project are currently isolated from each other. The extensive natural character planting proposed for the Project provides connectivity through the establishment of corridors for wildlife. Connectivity will be further enhanced through the riparian planting that is proposed. In addition, buffer planting is proposed to ‘protect’ the high value forest remnants adjacent to the Project construction footprint. Together these measures result in connectivity that does not currently exist.</p> <p>Paragraph 205 in Technical Assessment J reflects the author’s view that the measures proposed are appropriate, and “<i>required to maximise potential habitat availability and connectivity</i>”.</p>
22.	MWRC and GWRC	<i>Why has percent survivorship been used for natural character and landscape plantings in preference to the simpler approach to using percent cover across all planting plans, particularly when it appears the intent is to integrate as much planting as possible to “maximise” connectivity?</i>	<p>The proposed Conditions include a standard requiring 90% survival rate at five years for landscape, natural character and offsetting planting, while a 90% canopy cover at eight years standard is also proposed for offsetting planting.</p> <p>Waka Kotahi does not oppose the inclusion of a condition in respect of canopy cover for natural character and landscape planting, where appropriate to the planting proposed. In the context of the resource consents, this would necessitate an amendment to Condition RWB3. It is noted that such</p>

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			an approach is consistent with Waka Kotahi P39 Standard Specification for Highway Landscape Treatments.
23.	MWRC and GWRC	<i>A planting specification has not been provided as part of the application, therefore it is difficult to assess whether the statement that the proposed tree land offset (by number of trees) is the more conservative approach (as opposed to offset by area) (Para 269). Could the Applicant please provide additional information on this matter, including the anticipated planting spacing for tree and shrub species across the project?</i>	The total loss of indigenous treeland will be approximately 2,300m <sup>2</sup> , although this is likely to be an overestimate given that the polygons include open grassland between the trees. If the treeland was to be offset by area, the offset planting would need to comprise revegetation species such as kanuka, manuka, karamu and cabbage tree – and it would not account for the age and size of each tree. With the proposed replacement ratio per tree species, only the species affected will be replanted (as opposed to fewer numbers scattered amongst revegetation planting using an offset area approach). The replacement trees will be planted within existing forest and scrub habitats as enrichment species. It is anticipated that they will be planted at between 5 and 10 metre spacings that, based on planting a total of 486 trees, would cover an area of between 2,430m <sup>2</sup> and 4,860m <sup>2</sup> . Accordingly, Waka Kotahi considers that the tree replacement approach will result in a better ecological outcome than planting by area alone.
24.	MWRC and GWRC	<i>The residual effect on the Australian bittern' is assessed as "moderate" and includes potential ongoing mortality effects (Para 227, Appendix J.0). How are the potential ongoing mortality effects on Australasian bittern catered for in the proposed offsets?</i>	Mitigation measures relating to bittern and other wetland birds are outlined in Table 8 of Appendix J.5 (Avifauna) in Technical Assessment J, including means by which to minimise the risk of collisions with vehicles.  The offsetting model for combined wetlands predicted that the number of 'Threatened' wetland bird species will increase from zero to one as a result of the habitat creation and restoration that will take place. The 'Threatened' wetland bird species most likely to use the newly created habitat is bittern.  Notwithstanding the potential for collisions with vehicles, the creation of up to seven hectares of new habitat (open water and wetland veg within the rehabilitated borrow sites) and the restoration of around 8 hectares of degraded, together with targeted pest animal control, should address ongoing mortality effects on bittern if they are present in the area.
25.	MWRC and GWRC	<i>Para 273, Appendix J.0 states "Prior to the commencement of construction works, it is proposed to use compensation to achieve Net Gain..." Is this intended to imply that the planting at the offset sites will commence prior to construction, or</i>	This statement means that the offset requirements will be checked and confirmed prior to construction commencing, not that planting will commence prior to construction.

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		<i>that offsets will demonstrate net gain prior to construction?</i>	
26.	MWRC and GWRC	What is the level of risk that the accidental discovery of contaminated land will affect the instigation of ecological mitigation, ecological offset, natural character, and landscape planting?	<p>In the first instance, the risk of the accidental discovery of contaminated land is reduced by the requirement for detailed site investigations to be undertaken at several locations (identified as higher risk through the preliminary site investigation that has been undertaken) prior to construction (proposed Condition REW4).</p> <p>Proposed Condition REW4 also sets out a similar approach to the accidental discovery of contaminated soils, include the requirement for further resource consents.</p> <p>In practice, the response to the discovery of contaminated soil will be commensurate with the level of risk of the contaminant discovered to people and the environment (including planting) and the most appropriate method to manage the material. Thus, the level of risk depends on the nature and location of any contamination found, and how the site is rehabilitated.</p> <p>Waka Kotahi considers there a little to no risk that the discovery of contaminated soils will affects the implementation of planting because:</p> <ul style="list-style-type: none"> <li>• for wetland restoration areas, the location and setting of the wetlands involved are not likely to be contaminated;</li> <li>• all land that is proposed for terrestrial offset planting is being grazed (and has not formerly been used for industrial or market gardening purposes) and similarly is not likely to be contaminated;</li> <li>• if soil is found to be contaminated, alternative sites for offset planting have been identified;</li> <li>• if soil is contaminated, the details of site preparation may be altered but it is unlikely to change the nature and extent of proposed natural character and landscape planting; and</li> <li>• much of the landscape planting is located on cleanfill batters.</li> </ul>
27.	MWRC and GWRC	<i>How will it be ensured that there is sufficient retention of water in the open water offset area to achieve the biodiversity outcomes proposed?</i>	<p>Condition REM9 requires the creation of open water (0.48 hectares). Condition REM19 provides for the monitoring of offsetting measures, including the creation of open water. Should any element of the offsetting measures fail to achieve the required outcomes, Condition REM19 requires the implementation of further measures to achieve a net gain outcome.</p>

No.	Jurisdiction	Information requested	Waka Kotahi response
<b>Water Quality</b>			

### Technical Assessment K – Freshwater Ecology

28.	MWRC and GWRC	<p><i>Could the Applicant please provide further information/clarification on the linkage between the proposed clarity standard/trigger at the end of the sediment treatment devices (100 mms) and how this proposed clarity standard/trigger links to the proposed instream standard of no greater than a QMCI change of 15% during the operation of the project or greater than 20% at the completion of the project?</i></p>	<p>The two triggers are for different purposes. The proposed clarity trigger is to responsively manage erosion and sediment control devices. Not achieving the target triggers immediate actions to improve erosion and sediment control practices and event reporting.</p> <p>The proposed QMCI trigger relates to regular but less frequent instream monitoring that contributes to quarterly/annual reporting, including any recommendations for additional monitoring, remediation, mitigation or offsetting of adverse effects, where, and if, appropriate.</p> <p>There has been no attempt to establish a quantitative link between water clarity of 100mm intermittently discharged from erosion and sediment control devices and a 15% change of QMCI in the streams.</p>
29.	MWRC and GWRC	<p><i>The proposed consent condition RFE4 requires if there is a decrease in the receiving environment of greater than 15% for QMCI that response action(s) set out in the EMP and ESCP are implemented so the trigger levels are no longer exceeded. Can the Applicant please advise:</i></p> <p><i>a. Is the implementation of the action(s) timebound? At what time period should we see an improvement above the trigger level? If this improvement is not meet, what options then become available in terms of managing or offsetting the effect?</i></p> <p><i>b. The condition requires a comparison to baseline data for the sites. Over what time period is this baseline data to be collected and how will assessment against the trigger be assessed i.e. how does the applicant propose to assess the monitoring data results against the baseline information collected? Given the proposed</i></p>	<p>In response to clause (a), Waka Kotahi confirms that it is intended that implementation actions will be timebound and suggests a period of one year to see an improvement above trigger levels as a result of the implementation of response action. If no improvement is achieved, it is anticipated that additional or different response actions will need to be implemented.</p> <p>In terms of monitoring and baseline data, it is intended that baseline data is over as long a period as reasonably practicable prior to construction. In this regard, a freshwater ecology monitoring regime is currently being developed (a water quality monitoring programme is already in place). The baseline monitoring will provide an indication of variability in key metrics over time (for example, QMCI<sup>2</sup>, EPT<sup>3</sup> and deposited sediment cover).</p> <p>Waka Kotahi confirms that it is proposed to use monitoring sites upstream and downstream of the designation on key waterways.</p>

<sup>2</sup> Quantitative Macroinvertebrate Community Index

<sup>3</sup> Ephemeroptera, Plecoptera, and Trichoptera

No.	Jurisdiction	Information requested	Waka Kotahi response
		<i>road placement, has the Applicant considered the use of upstream vs downstream monitoring sites to potentially account for different climatic conditions and the associated effects on macroinvertebrate communities during the baseline collection period vs the proposed construction period?</i>	
30.	MWRC and GWRC	<p><i>At Table K11 (Pages 71 – 75) one of the proposed management actions to manage effects is to “avoid where practical, any instream works or diversion at key migration times of the fish species known to be present at a site”. Could the applicant please advise:</i></p> <p><i>a. Does this apply only to upstream migration?</i></p> <p><i>b. Will the information collected through eDNA will be used to define those species, or if surveys will be undertaken at the site?</i></p> <p><i>c. Can the Applicant please also provide a calendar of expected species in the works envelope and what the key migration period is for each of the species?</i></p>	<p>It is intended that the avoidance of instream works of diversions at key migration times also applies to downstream migration, given that adult inanga can be present and require passage to downstream spawning habitats.</p> <p>The data collected through eDNA data will be used as to determining species presence because this approach is more sensitive and may detect other migratory species that are present upstream.</p> <p>It is anticipated that the calendar table requested will be provided as part of the Ecology Management Plan. Waka Kotahi notes that fish passage is to be maintained throughout the construction period for all streams, and that any temporary diversions constructed in streams where fish are present are required to allow fish passage (see proposed Condition RFE2).</p>
31.	MWRC and GWRC	<i>At Paragraph 16 (Page 7), where ephemeral waterways have permanent habitat upstream, the application notes that “may use a flexible baffle design to facilitate fish passage at times when there is surface water following”. Is the proposal to allow this?</i>	Yes, it is proposed to facilitate fish passage in this manner. This is set out in, and specified by, the ‘Catchment Culvert, Swale and Pond/Wetland Schedule’ referenced in proposed Condition RFE2.
32.	MWRC and GWRC	<i>The technical assessment for the Freshwater Ecology uses the EclAG matrix for the assessment of effects. While this maybe a useful tool to inform the effects of the proposal, this method also relies on defining a time period over which effects may be seen and then defining them as temporary, short, medium, or long term. At Para 169 (Page 91) the effect is considered in relation to the effects and associated timescales</i>	<p>Waka Kotahi notes that in many stream and river systems, regular disturbance by high flows/floods has a very strong influence on habitat condition and composition of the biota that live there. On this basis, it is agreed that freshwater ecosystems in general have a shorter timescale over which effects may occur and also recover from compared to most terrestrial ecosystems.</p> <p>In this regard, Technical Assessment K implicitly considers ecologically relevant timescales and as such the nature of effects that have been assessed is unchanged. For example, for temporary stream</p>

No.	Jurisdiction	Information requested	Waka Kotahi response
		<p><i>that have been developed within the EclAG. In river systems timescales are different to terrestrial environments, timescales for freshwater should be based on those aquatic organisms that would be expected to be found in the receiving such as macroinvertebrates and fish species. For example, redfin bully has an average lifespan 3 years, inanga usually 1 year. A short-term temporary effect can be up to 5 years, and a long-term temporary effect up to 15-25 years with the use of the EclAG timescales. Does the Applicant consider that these are appropriate for freshwater ecosystems which in general have a shorter timescale over which effects can occur and also recover from? Considering the freshwater species that are expected downstream of the alignment and their lifespan would this change the nature of the assessed effect/s?</i></p>	<p>diversions it is accepted that while 'temporary' these may be in place for years, and if they were to impede fish passage, this could have adverse impacts on recruitment of some fish species (which generally occurs on an annual basis). If this were to occur, then this could be considered a long-term adverse effect as it would result in the absence of certain year classes in the affected fish populations. For this reason, that Project includes fish passage through temporary diversions.</p> <p>Waka Kotahi is comfortable that the assessment of effects on freshwater ecology values, including the application of the EclAG framework, is appropriate.</p>
33.	MWRC and GWRC	<p><i>The offsetting methodology has used the SEV to calculate the value of the lost stream length and the volumes required to offset the effect. In order to fully understand the proposed quantum proposed to be offset and ensure a net gain, could the Applicant please clarify the following points in relation to paragraph 77 of the Freshwater Ecology Assessment:</i></p> <p><i>a. Para 77(c) – the Vshade measure is considered high for planted riparian zones greater than 20 metres, however, anything lower than this was given moderate. Was this same moderate rating applied to the widths that are lower than 5 metres (between the 5 and 3 metre distance)? At a riparian zone of only 3 to 5 metres will the Applicant be able to have vegetation shading the stream that could be considered moderate especially given the</i></p>	<p>Waka Kotahi understands that it is possible to have large mature trees, such as mature totara, present within a 3-5 metre wide fenced riparian zone and providing extensive shading of a stream channel. Therefore, it is considered possible and appropriate assumption for "moderate" shading<sup>4</sup> to be achieved within a 3-5 metre wide fenced zone given sufficient time for vegetation to mature.</p> <p>Similarly, the parameters described in paragraphs 77(d), 77(e) and 77(h) of Technical Assessment K, have been considered in terms of whether more categories could be used to reflect different riparian widths. Noting that a Stream Ecological Valuation score is a holistic measure, it is concluded that altering the categories in this manner would have limited to no impact on the overall Environmental Compensation Ratio due to the conservatism built into Waka Kotahi's calculations. For example, for the Waiauti Stream, the existing state SEV score of 0.48, has been predicted to increase to 0.59 on those properties with more limited riparian planting widths, and 0.68 on those properties where it is likely a 20m width can be achieved. Given a theoretical maximum SEV score of 1, it is considered that these predicted scores are conservative and realistic.</p>

<sup>4</sup> defined in Stream Ecological Valuation as "shading from vegetation and topographical features 51-70%"



No.	Jurisdiction	Information requested	Waka Kotahi response
		<p><i>limited space to enable the growth of larger shading trees? Would it be more appropriate for 20 metres to be high, 15 – 20 to be moderate, and then 3- 5 metres to be either low or low-moderate?</i></p> <p>b. <i>The same questions also applies to 77 (d), (e), and (h)? In this regard should there be a greater number of categories that reflect the various riparian widths that are proposed to be used? This to reflect that as the riparian width becomes less the benefit to the stream reduces and that at the lower distances especially at three metres the improvement is less than say at 15 metres?</i></p>	<p>More specifically:</p> <ul style="list-style-type: none"> <li>with reference to Paragraph 77(d) of Technical Assessment K, the Vrough SEV function is a list of various riparian vegetation types, that do not align well with describing riparian plantings and Waka Kotahi is satisfied that the selected categories are the best options from that list to describe what the proposed riparian plantings will look like given sufficient time to develop;</li> <li>with reference to Paragraph 77(e) of Technical Assessment K, the Vripfilt SEV function describes the ability of the riparian zone to filter surface runoff and the application of the Vripfilt function in this case reflects the relatively flat topography and lack of defined drainage channels for runoff at the majority of stream offsetting sites; and</li> <li>with reference to Paragraph 77 (h) of Technical Assessment K, the Vphyshab SEV function gives scores on a 1-20 scale for five separate habitat parameters. For the “channel shade” and “riparian vegetation integrity” parameters, the values predicted for proposed offset sites’ SEV reflect the Vshade categories that were selected (as described above).</li> </ul>
34.	MWRC and GWRC	<p><i>Para 142(d) (Pages 65-67) makes a number of references to meanders being created into the new stream channels and that these are included through into the Volume III drawings. Some of the wording in this section of the report infers that they should occur. Can the Applicant please advise as to sections 142 (d) (i to vii), which are proposed to definitely occur and for the others which require more detailed design to occur?</i></p>	<p>At this concept design stage, the indication is that the meanders shown on the Project drawings and in the CEDF are able to be constructed. However, all are subject to the detailed design process. If, during detailed design, changes need to be made that affect the length and extent of any permanent diversions, this will be captured by the offsetting review embedded in proposed Condition REM18.</p>
35.	MWRC and GWRC	<p><i>Table K12 (Pages 77-81) - refers to works for a number of the ephemeral channels with the wording “undertake works when no water is present to minimize risk of sediment being transported to downstream freshwater habitats”. While this is an effective way to avoid the associated effect, can the Applicant please advise if this is taken through into the proposed consent conditions, the ESC measures, and is possible in a project of this scale?</i></p>	<p>Waka Kotahi confirms the intention to undertake works in ephemeral channels wherever practicable to do so. Schedule 7 to the proposed Conditions includes a clear presumption to ‘avoid’ in the first instances though requiring the Freshwater Ecology Management Plan to explicitly detail “<i>approaches to on-line stream works that, where such works cannot be avoided</i>”. Schedule 8 to the proposed Conditions requires the Erosion and Sediment Control Plan to also include stream works procedures to manage works associated with waterbodies.</p> <p>In addition, Waka Kotahi can confirm that it is generally practicable for a works on a project of this</p>

No.	Jurisdiction	Information requested	Waka Kotahi response
			scale to be planned to be undertaken when no water is present. If work needs to occur when water is present, the procedures required by the management plans (described above) would be in place.
36.	MWRC and GWRC	<i>In relation to fish passage there appears to be some disconnect between Technical Assessment K and the reference to the “Catchment Culvert, Swale and Pond/Wetland Schedule” VIII in the proposed consent conditions? Technical Assessment K refers to stream name/code 39.2, 34.5, 27.1, 9, 6.1. This does not appear to be referenced in Catchment Culvert, Swale and Pond/Wetland Schedule” VIII. Can the Applicant please clarify?</i>	<p>Some small flow paths itemised in Technical Assessment K are proposed to be realigned to slightly different locations. The Schedule in Volume III relates to proposed transverse culverts in the concept design, as follows:</p> <ul style="list-style-type: none"> <li>• 39.2 (artificial ephemeral channel) is directed to culvert 39.su;</li> <li>• 34.5 has no catchment upstream of highway therefore subsoil drain only;</li> <li>• 27.1 (natural permanent stream) should appear in Vol III in the third column – the .1 reference was omitted in error;</li> <li>• 9 (natural ephemeral channel with upstream farm dam) is directed to culvert 8, via a permanent diversion of Stream 10;</li> <li>• 6.1 (natural ephemeral channel) is directed to culvert 6 via a constructed ephemeral channel.</li> </ul>
37.	MWRC and GWRC	<i>For fish passage at temporary structures, it is observed that fish passage will only be provided if the structure/diversion is in place for a period more than seven days. Technical Assessment K does not mention a timeframe which fish passage cannot be provided for. Can the Applicant please expand on why seven days is considered appropriate?</i>	<p>The 7-day time period is to allow the constructors some flexibility for very short term temporary crossings and is a short enough period of time that there can be certainty of planning and weather forecasting.</p> <p>From an ecological perspective, blocking fish passage for seven days will not have a measurable impact on fish populations, especially when considering the effect of proposed Condition RFE1 that limits such activity during migration periods.</p>
38.	MWRC and GWRC	<i>Para 158 (Page 82) refers to a discussion in the next para – the para is missing, could this please be provided?</i>	Paragraph 158 in Technical Assessment K should refer to the previous paragraph, rather than the following paragraph.
39.	MWRC and GWRC	<i>At Para 168 (Page 91) it is noted that deposited sediment effects after, effects management will be moderate for Stream 17 and 19. Does the applicant propose to undertake additional Sediment and Erosion Control measures within these catchments to further reduce these effects?</i>	In paragraph 170 of Technical Assessment K it is noted that these streams are small modified channels that were deemed to have ‘moderate’ ecological value because of the presence of longfin eel. In turn, the potential adverse effect of the Project on these streams is assessed as ‘moderate’ as a result of sedimentation after effects management measures are implemented. This is because the small size of the stream catchments upstream of the Project means that the construction footprint is relatively large. That said, the proposed erosion and sediment control are appropriate and sufficient to protect the

No.	Jurisdiction	Information requested	Waka Kotahi response
			existing values of these streams. No additional effects management measures are considered necessary.
40.	MWRC and GWRC	<i>Para 173 (Page 192) refers to pre-construction, baseline monitoring should begin as soon as possible to capture potential site variability. Does the applicant have a timeframe around when this monitoring will start? The proposed consent conditions rely on this information in the development of triggers/standards for effects in stream so having the natural variability accounted for in these triggers/standards will be important.</i>	Waka Kotahi intends to start monitoring prior to July 2023.
41.	MWRC and GWRC	<i>Para 194 (Page 105) refers to culverts that have been designed based on the stream stimulation culvert design will also have a riparian zone upstream and downstream that is planted. This is proposed to be for the length of stream within the designation. Would the Applicant please identify the condition that addresses the intent of Para 194?</i>	The proposed riparian planting, and the location of this planting, is described on the suite of planting plans included in Volume III. The implementation of the proposed planting is through: <ul style="list-style-type: none"> <li>• proposed designation Condition DLV1 Landscape planting; and</li> <li>• proposed Condition RWB3 Natural character planting.</li> </ul>
42.	MWRC and GWRC	<i>Para 209 (Page 117) refers to the potential for offsetting for outlet structures which discharge of stormwater from treatment facilities, but that this will not be confirmed until detailed design. However, the linkage to ensure this occurs within the conditions is not clear. The revision of offset measures in proposed condition REM11 allows for revision though conditions ROC18 (which is assumed to be REM18) however, the condition does not specifically include the potential offsetting of the outlet structures. Could the Applicant please expand on how this proposal in para 209 is reflected in the conditions?</i>	Condition REM18 'Review of measures to offset residual effects on freshwater ecology' provides for "Following the completion of construction activities, the offset measures required by Condition REM11 must be recalculated using stream ecological valuations and environmental compensation ratio methodologies in respect of the Project construction impact on stream habitat and confirmed locations for the offsetting measures." It is intended that this proposed Condition allows for a full calculation of the measure to offset any adverse effects on freshwater ecological values and that this review would include the need to offset any adverse effects of outlet structures.
43.	MWRC and GWRC	<i>Para 214 (Page 118), in relation to the creation of diversion channels could the Applicant please provide information on how they will ensure</i>	Proposed Condition REM11 requires stream creation and enhancement measures to be generally consistent with the design for stream diversions shown on the Stormwater: Typical Details Swales

No.	Jurisdiction	Information requested	Waka Kotahi response
		<i>that any stream channels created as a part of the project will ensure that flows especially during low flows remain at the bed level and that flows do not completely go below the upper bed layer?</i>	and Open Channels included in the 'Notices of Requirement for a Designation and Application for Resource Consents' dated 1 November 2022 'Volume III Drawings and Plans'. The design of the stream diversions will form part the Ecology Management Plan (that is subject to certification) (proposed Condition REM1) and shown on the relevant Ecology Offset Site Layout Plans (proposed Condition REM14). Ensuring continuous surface flow will be a key aspect of stream diversion channel design.
44.	MWRC and GWRC	<i>Para 228 (Page 121), in relation to the riparian planting of the streams in particular the four streams in close proximity to the artificial lighting. Could the Applicant please provide the reference in the proposed consent conditions that reflect this riparian planting to help manage this effect on flying insects?</i>	The proposed riparian planting is described on the suite of planting plans included in Volume III. The implementation of the proposed planting is through: <ul style="list-style-type: none"> <li>• proposed designation Condition DLV1 Landscape planting; and</li> <li>• proposed Condition RWB3 Natural character planting.</li> </ul>
<b>Technical Assessment H – Water Quality</b>			
45.	MWRC and GWRC	<i>Regarding Para 50 (Page 26), as all of the appeals have been determined by consent order and are deemed operative, could the Applicant please undertake an assessment of:</i> <ol style="list-style-type: none"> <li><i>the current state of the waterways affected by this proposal within the Greater Wellington Region in comparison to the attribute states for these waterways in Table 3.4 River and Streams, Objective O19 of the PNRP?</i></li> <li><i>how the attribute states will potentially change in comparison to Table 3.4 as a result of the proposal?</i></li> <li><i>Policy P79 of the PNRP, noting that this policy excludes discharges from operational stormwater, but not from other works such as earthworks.</i></li> </ol>	Waka Kotahi notes that the attribute states in Table 3.4 of the PNRP are based on regular, long-term monitoring and refer to matters such as annual maximums. Waka Kotahi has now commenced regular long-term monitoring of all of the relevant Table 3.4 in waterways in the Wellington Region, but this is yet to have occurred over a duration that provides results over a long-term. That said, the Project includes the removal of livestock and the opportunity to create some improved habitat in diversion channels. These are considered to be positive effects, albeit that the livestock exclusions and diversion channel creation is not likely to alter the attribute states because larger, catchment-scale forces, dictate these, as opposed to the Ō2NL Project. The discharges that are captured by Policy P79 will, by virtue of the erosion and sediment control measures to be put in place during construction of the Project, comply with the water quality standards set out in the Policy.
46.	MWRC and GWRC	<i>At Para 52 (Page 27) it states, "Based on monitoring results, we have assumed a lower hardness value of 20 mg/L for the Manakau, Waiuiti, Waikawa, Kuku Streams and Ohau River." Referring to the</i>	The Manakau Stream and Waiuiti Stream have hardness measurements of about 25 mg/L. For the purpose of the assessment this was rounded down to 20 mg/L as it is more conservative and results in applying a more stringent guideline when assessing toxicity of metals such as zinc and copper.

No.	Jurisdiction	Information requested	Waka Kotahi response
		<i>monitoring data provided with the application, could the Applicant please advise if the Manakau and Waiuiti more closely align with the default of 30 mg/L?</i>	
47.	MWRC and GWRC	<i>Figure H.3 (Page 40) would the applicant please be able to clarify which of the colours in the graph represent flows vs turbidity?</i>	In Figure H.3, the flow in the Koputaroa Stream is indicated by the blue line and the turbidity by the purple line.
48.	MWRC and GWRC	<i>Building on the capture of baseline information identified in Technical Assessment K at Para 118 it is noted that catchments B (Waitohu), C (Waitohu), I (Mangahuia) are identified as a high priority for monitoring due to the risk of sediment release from earthworks and high ecological values. Has this recommendation been carried through into any proposed monitoring regime for the proposal?</i>	<p>Where catchments B and C are traversed by the Project, they consist of very small, highly modified tributaries of the Waitohu Stream that have stream beds comprised of silt, macroinvertebrate communities indicative of severely degraded conditions and only two species of fish were found. Discharges from erosion and sediment control devices will be monitored throughout the Project (as set out in proposed Condition RES9).</p> <p>In the context of these catchments, deposited sediment cover monitoring is not proposed because it is not considered to be useful in soft bottomed streams, while the macroinvertebrate community is already dominated by taxa tolerant of such conditions. Undertaking deposited sediment and macroinvertebrate monitoring in such locations would be unlikely to provide useful information and not be a good use of resources.</p> <p>Catchment I, where it is traversed by the Project, consists of very small, highly modified tributaries of the Mangahuia Stream, itself a tributary of Manakau Stream. These streams have macroinvertebrate communities indicative of severely degraded conditions and only three species of fish were found. As described above for catchments B and C, any discharges from erosion and sediment control devices will be monitored. In terms of additional ecological monitoring as for catchments B and C this will similarly be unlikely to provide useful information.</p>
49.	MWRC and GWRC	<i>At Para 155 (Page 59) it is noted “for receiving tributaries in catchment P, M and I the total impermeable area indicates a potential risk of adverse ecological effects from changes in hydrology or temperature for these streams. The risk is partially mitigated with the use of the proposed stormwater treatment devices and could be further mitigated with infiltration”. Is this further mitigation proposed to be</i>	From an ecological perspective all stormwater treatment devices should incorporate infiltration except where local soils are unsuitable. Soil properties and the ability to incorporate infiltration will be further investigated as part of the detailed design process.

No.	Jurisdiction	Information requested	Waka Kotahi response
		<i>undertaken?</i>	
<b>Water Sensitive Design</b>			
50.	MWRC and GWRC	<i>Section 20 of the Technical Assessment H (Water Quality) states that over 95% of the highway will receive some form of treatment, the drawings provided do not clearly show the areas that are not receiving treatment. Could the Applicant please provide a clear plan(s) showing areas of the proposed road which will not receive full stormwater treatment and comment where these may be in proximity to freshwater receiving environments?</i>	<p>In general, the areas that will not receive some form of treatment include the short lengths of untreated road surface at bridge/culvert approaches, the extremes of the project where topography slopes away from the works area or where practical or physical constraints prevent stormwater treatment. Each location is a minor length. The accumulation of the minor lengths amount to less than 5% of the Project.</p> <p>For the purpose of the Contaminant Load Model, the following lengths of road from which stormwater will have minimal or no formal treatment have been identified:</p> <ul style="list-style-type: none"> <li>• Catchment B, 20m;</li> <li>• Catchment E, 50m (20% via grass batters);</li> <li>• Catchment J, with 250 m of road near bdg. (30% discharging over grass batters);</li> <li>• Catchment L, 50m road (30% discharging over grass batters);</li> <li>• Catchment M, 130m of road near Ohau Rv bdg. (40% discharging over grass batters);</li> <li>• Catchment P, 250m of road at N end discharges to 2.5ha area flowing east (30% via grass batters).</li> </ul>
51.	MWRC and GWRC	<i>Could the Applicant please confirm that the "Total Pond facility footprint area" column from the relevant table on Drawing number: 310203848-01-300-C3001 correlates directly with the light blue stormwater wetland polygons from the drainage layout plans?</i>	<p>The surface areas quoted in the schedule on drawing C3001 are minimum surface areas for the three components of the stormwater treatment facility. The light blue polygon areas on the drainage layout plans are 20% larger than the schedule item to allow for internal bunds, access tracks, other maintenance necessities such as boundary planting, fences, and internal landscaping, which will be determined during detailed design.</p>
52.	MWRC and GWRC	<i>Could the Applicant please confirm that space for batter slopes (which reflect topography), bunds and maintenance access has been allowed for in the nominated treatment areas and that the polygons will support a functional wetland form (shape).</i>	<p>As set out in response to request 51, the polygon outlines are indicative and allow sufficient space to modify and improve the functional and aesthetic details as part of detailed design.</p>
53.	MWRC and GWRC	<i>Could the Applicant please confirm that no proposed stormwater infrastructure where infiltration may occur (unlined swales and infiltration systems) will be intersecting any area</i>	<p>Proposed Condition REW4 sets out a process for detailed site investigations and discovery protocols to ensure that, if contaminated soil is intercepted, the appropriate management approaches are established and implemented through standalone application/s for</p>



No.	Jurisdiction	Information requested	Waka Kotahi response
		<i>of contaminated soil which could mobilize hazardous substances into groundwater?</i>	resource consent. This would apply to any situation where proposed stormwater infrastructure intersects with contaminated soil.
54.	MWRC and GWRC	<i>Could the Applicant please clarify the sizing methodology for wetlands and comment on target rainfall events and inclusion of extended detention to support intended wetland function?</i>	Constructed wetlands are sized to the water quality storm event (90 <sup>th</sup> percentile rainfall) with bypass facilities to the attenuation basin in larger events (extended detention). The design methodology is based on 'GD01 Stormwater Management Devices in the Auckland Region' as accepted best practice in NZ. Guidelines in the Wellington Region are substantially similar. The extended detention is nominally sized to the 1%AEP, 24 hour duration, with climate change to RCP8.5/2100, rainfall depth. Swales and internal channels are sized to 1%AEP short duration events.
55.	MWRC and GWRC	<i>Could the Applicant please advise as to what consideration has been given to the influence of vegetated swales on stormwater volumes (retention of runoff in small rainfall events) and whether this has implications for the detailed design and operation of downstream constructed wetlands?</i>	<p>The vegetated swales are generally ahead of the stormwater treatment facilities and together operate in a treatment train approach as encouraged through best practice. The swales and treatment facilities are sized and designed for three key design events:</p> <ul style="list-style-type: none"> <li>• the water quality event (approximately 10mm/hr rainfall),</li> <li>• the 10 year return event scenario; and</li> <li>• the 100 year return event scenario.</li> </ul> <p>Very small rainfall events are not considered. Infiltration along the swales is not considered in the sizing, reflecting a conservative assumption. Plant species selection will follow best practice and local ecological advice during detailed design.</p>
56.	MWRC and GWRC	<i>Could the Applicant please confirm that shallow groundwater levels will not impact the construction or operation of proposed lined treatment wetlands?</i>	While based on a concept design that has the purpose of providing an 'envelope' of potential adverse effects within which the Project must be designed and constructed, Technical Assessment G (Appendix I of Appendix G.1) considers the potential interaction of the proposed treatment wetlands with shallow groundwater and confirms that shallow groundwater levels will not be adversely impacted by the operation of the wetlands. This is because the hydraulic connections between surface water and groundwater are retained.
57.	MWRC and GWRC	<i>Could the Applicant please confirm whether the wetland forebays will be lined and could therefore draw down between rainfall events which could lead to further flows not reaching the wetland and potentially infiltration of dissolved contaminants to groundwater?</i>	The forebay (as part of the concept design) is not intended to be formally lined so that a deep pool (drowning hazard) is not permanently in place. The forebay will practically self-line at low levels and maintain a shallow pool to contain sediments. In contrast, the constructed wetland is lined to retain water for plants in dry conditions, but it is not deep (range 0.3-1.0m typically). Contaminant infiltration to groundwater is expected to be minimal. A large part

No.	Jurisdiction	Information requested	Waka Kotahi response
			<p>of dissolved contaminant loading will be reduced through the roadside vegetated swales as part of the treatment train, and another portion will feed into the constructed wetland. A small fraction will be retained in the forebay and perhaps filter through the ground, but this is likely to be after a 'first flush' flow and have lower contaminant concentrations.</p>
58.	MWRC and GWRC	<p><i>Could the Applicant please provide additional information on the current typical online arrangement which shows the forebay being online to all inflows which is likely to result in accumulated contaminants being re-suspended and flushed through to soakage area?</i></p>	<p>The forebay (as part of the concept design) is sized to allow capture of contaminants through low-velocity settling, between maintenance episodes, and is intended to only capture the heavier fraction of suspended solids. The forebay is also used to split flows to the constructed wetland or attenuation pond. This allows a single flow channel from the road side swale to the stormwater treatment facility which could be some distance away.</p> <p>The volume and surface area of the pond of the forebay is considered large enough to fill and flood 'quietly' over a weir without strong flowlines in large flood events. As a redundancy, heavy contaminants can still be captured in the attenuation volume, where additional settlement will further reduce the quantity of contaminants that proceed to soakage.</p>
59.	MWRC and GWRC	<p><i>Could the Applicant please provide additional information on the reasoning for including attenuation of runoff to predevelopment flowrates in locations where discharge is directly to soakage? It appears that attenuation could be required where infiltration rates limit the overall infiltration volumes during rainfall events but it appears there is no requirement for infiltration to align with a pre-developed flowrate such as is required where discharge is to an open stream or similar receiving environment?</i></p>	<p>For the concept design, a conservative approach has been used to ensure sufficient space for storage. This can be refined during detailed design to optimise the arrangement and associated rates. The soakage field area and the attenuation volume operate together to dispose stormwater from all events under the runoff regime. That is, a smaller attenuation basin volume means a larger soakage disposal area. To understand the potential adverse effects, the concept design soakage field area is reduced to discharge nominal pre-development runoff rates in preference to a reduced surface attenuation volume.</p>
60.	MWRC and GWRC	<p><i>Could the Applicant please provide justification for wetland design arrangement which separates the sediment forebay, wetland body and detention basin using bunds and pipe connections, these features could be better configured to reduce maintenance requirements and the risk of blockages?</i></p>	<p>The concept design forebay wetland attenuation pond arrangement with bunds is indicative and intended to reserve extra ground area footprint for detailed design. Pipe/weir connections, pond configurations and final footprint areas are intended to be designed at a later stage.</p> <p>The concept design for consenting prioritises a smaller constructed wetland that is well-lined, carefully laid out and planted, maintainable, and able to contain captured contaminants without risk of being flushed out in a large runoff event. The arrangement keeps the attenuation and wetland</p>

ponds broad and shallow in all events to minimise drowning and embankment failure hazards.

## Hydrogeology and Groundwater

### Technical Assessment G – Hydrogeology and Groundwater

61.	MWRC and GWRC	<p><i>The Technical Assessment G at Paras 188 and 189 states;</i></p> <p><i>“188. The modelling indicates that dewatering to install Culvert 4 would potentially lower the groundwater below the seasonal lowest level in two wetlands, one of which is expected to have a high dependence on groundwater.</i></p> <p><i>189. Dewatering to install Culvert 11 is unlikely to reach depths that would result in a more than minor drop of the seasonal lowest groundwater level beneath the wetland. Consequently, any effects of dewatering can, in my opinion, be considered ‘less than minor’.”</i></p>	No information requested.
62.	MWRC and GWRC	<p><i>Could the Applicant please clarify on what basis the conclusion in Para 189 was reached, and is this conclusion in relation to both Culvert 4 and Culvert 11? The question is asked considering the predicted drawdown in addition to seasonal oscillation of groundwater on the identified wetlands (EWG5 and EWG4) of 0.8 m and 0.5 m, respectively (ref. Appendix H)). If the response to the question is because the effect is transitory (such as inferred in Paras 230 and 231), please provide further information on the maximum timeframe that the maximum anticipated drawdown could occur, and coordinate a joint response with the project ecologists?</i></p>	<p>While based on a concept design that has the purpose of identify an envelope of potential effects of the Project, Technical Assessment G, Appendix H of Appendix G.1 considers the potential effects of temporary dewatering that might be necessary to install culverts 4 and 11. The degree, extent and duration of any dewatering required will depend on the environmental conditions at the time of the works and the ultimate design and construction methodology for the culverts. However, since the culverts will likely be installed during summer, when seasonal groundwater levels are low, the need for and extent of any dewatering will be either avoided or minimised. Any dewatering will also be only for installation of the culverts and therefore will be of short duration.</p> <p>In this regard, it should be noted that, where the Project will have more than a ‘less than minor’ adverse effect on wetlands, including at these two culverts based on a conservative assessment. it has been assumed that the wetland is completely lost. The adverse effects of this loss are to be offset. This assumption is conservative and most wetlands will not be affected to this extent or degree.</p>

No.	Jurisdiction	Information requested	Waka Kotahi response
63.	MWRC and GWRC	<u>Groundwater levels in the soakage sites</u> – A key aspect for groundwater soakage is whether the sites have capacity to take more groundwater during periods of high groundwater levels, noting that the 2022 winter has been one of the wettest on record. Could the Applicant please conduct Eigen modelling for each of the soakage site including climate data through this 2022 winter?	Eigen modelling has not been undertaken because such modelling is not considered to provide a higher level of certainty or add further to the information provided in Technical Assessment G. The concept design stormwater treatment devices have the capacity to store the entire volume of runoff and ‘intrude’ only a short distance below the existing ground level. Therefore, even if groundwater levels rise to the ground surface (being the most extreme scenario) the device will retain/contain all the runoff until conditions allow it to drain naturally.
64.	MWRC and GWRC	<u>Groundwater levels this winter</u> – Could the Applicant please update the Eigen model to include this winter and present the same plots as shown in Appendix G.1.B?	The initial Eigen modelling was undertaken when options for a possible design of the Project East of Levin were being considered. One option was to have the highway below ground level and therefore some indication of maximum groundwater levels was required. The highway is now essentially ‘at grade’ and the maximum groundwater levels at key locations has been assumed to be at the ground surface. This assumption is considered to be conservative and negates the need for additional Eigen modelling.

### Erosion and Sediment Control

65.	MWRC and GWRC	<i>Auckland Council Erosion and Sediment Control Guidelines for Land Disturbing Activities in the Auckland Region (GD05) provides ‘best practice’ erosion and sediment control tools for earthworks sites and has been adopted by Horizons Regional Council and Greater Wellington Regional Council (through updates to the Erosion and Sediment Control Guide for Land Disturbing Activities in the Wellington Region) as the best practice guidance document for erosion and sediment control. Any deviation from GD05 standard requires sound technical justification as to why the deviation could be considered best practice. Could the Applicant please provide further technical justification around the use of the Waka Kotahi Erosion and Sediment Control Guidelines for State Highway Infrastructure, September 2014 (Waka Kotahi Guidelines) including an assessment</i>	<p>The key difference between GD05 and the Waka Kotahi Guidelines, is that the Waka Kotahi guide provides for a more nuanced hydrological design approach that takes into account:</p> <ul style="list-style-type: none"> <li>• soil;</li> <li>• slope;</li> <li>• rainfall;</li> <li>• ground cover; and</li> <li>• risk associated with the design.</li> </ul> <p>In this regard, the erosion potential of the site depends in part on the soil type and slope steepness<sup>5</sup> with the erosion potential of the gravel soils at the site being low – medium.</p> <p>In terms of runoff from gravel soils the Environment Canterbury ESC Guidelines 2007 include runoff coefficient values for different soil types and slope for bare soil conditions that demonstrate the fact that gravel soils generate significantly less runoff than clay based soils.</p> <p>Compaction through construction can result in a significant reduction in infiltration rates. This applies across the board to all soils, but to a lesser extent for sands and gravels.</p>
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<sup>5</sup> Table 2-1 of the Waka Kotahi ESC Field guide for Contractors (State of Vermont, 2006) provides general information about soil and slope erosion potential.

No.	Jurisdiction	Information requested	Waka Kotahi response
		<i>of how expected infiltration will impact on erosion and sediment control devices?</i>	<p>Soils have variable permeability rates and sizing of sediment control practices (gravel soils) will be based on the amount of water that runs over the soil rather than what goes into it. In general, the higher the rate of infiltration the lower quantity of stormwater runoff that is generated.</p> <p>For this reason, the Waka Kotahi Guidelines are promoted where the predominant soils are gravels, as determined by the geotechnical advice. In other locations GD05 is proposed to be used.</p> <p>As demonstrated on the neighbouring Peka Peka to Ōtaki Expressway Project, this general approach has proven to be effective.</p>
66.	MWRC and GWRC	<i>Could the Applicant please provide further information on how devices constructed in accordance with Waka Kotahi Guidelines are going to be monitored for performance and how erosion and sediment control measures are going to be adjusted if there is poor performance below what is being achieved with GD05 compliant devices? This may include a change from the Waka Kotahi Guideline's devices to GD05 measures as best practice.</i>	<p>The approach to monitoring that is set out in the Project Erosion and Sediment Control Monitoring Plan (that forms part of the Erosion and Sediment Control Plan). In this regard, it is proposed that, if there is poor performance then the following occurs:</p> <ul style="list-style-type: none"> <li>• within 24 hours of a threshold exceedance, a full audit of the condition of the control device and its contributing catchment will be carried out and recorded in writing;</li> <li>• any obvious on-site causes of a threshold exceedance will be recorded and remedied as soon as practicable;</li> <li>• any additional reasons for the exceedance and opportunities to modify the management of the site to improve overall efficiency will be identified, including: <ul style="list-style-type: none"> <li>○ possible additional erosion and sediment control measures;</li> <li>○ refinement of chemical treatment systems;</li> <li>○ progressive stabilisation in sub-catchments;</li> <li>○ increased maintenance of controls; and</li> </ul> </li> <li>• amendments to methodologies and sequencing of works and refinement of existing controls necessary.</li> </ul>
67.	MWRC and GWRC	<i>Could the Applicant please provide further information and justification on the use of clarity as a performance measure on site, and how this relates to actual potential sediment discharge (as calculated in the USLE and relied upon when assessing sediment discharge effects) as opposed to actual measurements through turbidity and total suspended</i>	<p>Turbidity, total suspended solids and visual clarity are strongly correlated with each other, but the strength of the correlation is often site-specific and flow specific because different types of sediments can have different optical properties<sup>6</sup>.</p> <p>The monitoring of clarity of the discharge from erosion and sediment control devices is intended to provide a rapid and responsive way to measure the effectiveness of the devices. The monitoring is not intended to be used for validating the USLE model.</p>

<sup>6</sup> Franklin et al. 2019, Davies-Colley and Smith 2001

No.	Jurisdiction	Information requested	Waka Kotahi response
		<i>solids?</i>	Water clarity is an actual measurement. Water clarity is directly inversely related to the light beam attenuation coefficient (a fundamental physical property of water). It is less variable than turbidity and many experts argue that it is a more effective basis for managing fine sediment than using either turbidity or TSS. <sup>7</sup>
<b>Air Quality</b>			
68.	MWRC and GWRC	<i>To provide a better understanding of how discharges from construction activities will be managed and the potential for residual effects on nearby receptors, could Applicant please provide a copy of the draft Construction Air Quality Management Plan (CAQMP)?</i>	<p>The potential impacts of construction activities on air quality are managed through the conditions of consent that establish standards that must be achieved. The methods and monitoring necessary to achieve these standards are to be included in a Construction Air Quality Management Plan. The content of this Plan is specified in Schedule 2 to the Conditions.</p> <p>Waka Kotahi anticipates that, because the Construction Air Quality Management Plan relates to construction management, the Plan will be prepared by the construction contractor for the Project. At this time, the certification of the Construction Air Quality Management Plan provides the reassurance that the relevant standards are achieved through appropriate management and monitoring practices.</p>
69.	MWRC and GWRC	<i>Could the Applicant please clarify how much water will be required for dust management and whether sufficient supply is available for the project?</i>	The water requirements for the Project are described in the Design and Construction Report included as Appendix 4 to the Supporting Information and Assessment of Effects on the Environment' Report (Volume II). Water requirements have been estimated based on the volume of water that has been required for other similar Waka Kotahi projects in similar climates and receiving environment. This includes the Mackays to Peka Peka Expressway and the Peka Peka to Ōtaki Expressway projects.
70.	MWRC and GWRC	<i>Could the Applicant please identify the properties that could potentially require upgrades to the roof-water collection system to mitigate the effects of dust deposition?</i>	<p>Properties with roof water collection systems have not been identified at this time. It is anticipated that between now and when construction commences the number and location of properties that rely on roof-water collection systems that have the potential to be impacted by construction related dust will change.</p> <p>The approach Waka Kotahi has taken to the management of dust associated with construction activities is primarily focussed on management at the source of the dust (as opposed to at the receiver). Where construction related dust has an impact on</p>

<sup>7</sup> Davies-Colley et al. (2014) 'Light attenuation – a more effective basis for the management of fine suspended sediment than mass concentration?' Water Science and Technology 69:9.



No.	Jurisdiction	Information requested	Waka Kotahi response
			properties, despite management at the source of the dust, Schedule 2 to the proposed Conditions requires the Construction Air Quality Management Plan to identify “triggers and contingency measures to address identified and verified adverse effects on sensitive receptors” and more specifically to set out “methods to monitor and contingency measures to respond to effects of dust deposition ... at any rainwater collection tank that is used for drinking water purposes”.
71.	MWRC and GWRC	<i>Could the Applicant please provide further information on the procedures and mitigation measures that will be used to manage air discharges from contaminated material, should it be encountered during construction?</i>	<p>As also set out in respect to requests 95 and 96, the initial procedures for managing contaminated material, including associated discharges, are established by proposed Condition REW4. This Condition requires that a detailed site investigation be undertaken prior to works commencing at specified sites. In the event that the detailed site investigation identifies the presence of contaminants earthworks and land disturbance activities within the potentially contaminated site will cease until all necessary resource consent for the works, including associated discharges, have been granted. Therefore, it is these subsequent resource consents that will manage discharges.</p> <p>Condition REW4 also sets out a similar procedure for any unexpected discovery of contaminated soil.</p>

### Natural Character

72.	MWRC and GWRC	<i>Offset and natural character planting is ‘subject to landowner approval’ as describe in the Legend on the Planting Concept Plan: Indicative Typology Sheets 1 -18 and Planting Concept Plan RMA Purpose Type 1 - 18. Could the Applicant please provide additional information as to how ‘subject to landowner approval’ is factored into the assessment and how does it relate to the mitigation of effects?</i>	<p>In terms of planting for offsetting purposes, the proposed Conditions (Condition REM7) require a ‘quantum’ of offsetting to be provided. If there are any offset planting areas where landowner approval is not obtained the planting can be located elsewhere. Waka Kotahi can confirm that, while landowner conversations are progressing well, there are sufficient alternative sites available if landowner approval cannot be secured.</p> <p>Where the natural character planting referenced in proposed Condition RWB3 is on land that is not owned or controlled by Waka Kotahi, this planting is subject to landowner approval. Such land is generally where the planting is outside of the proposed designations. Without landowner approval this planting will not occur and the extent to which adverse effects on natural character values are mitigated will be constrained.</p> <p>This approach is consistent with One Plan Policy 6-9 that directs the restoration and rehabilitation of natural character “where that is appropriate and practicable”.</p>
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No.	Jurisdiction	Information requested	Waka Kotahi response
73.	MWRC and GWRC	<i>A draft Ecological Management Plan (EMP) was not included in the material lodged. Could the Applicant please provide a copy of a draft Ecology Management Plan and Landscape Management Plan (or a combined plan) to address the questions raised in Question 72. above?</i>	<p>The potential impacts of the Project on terrestrial and freshwater ecology are managed through the conditions of consent that establish a suite of standards and effects management requirements that must be achieved. The methods and monitoring necessary to achieve these standards and implement the required measures are to be included in a Ecology Management Plan (including a suite of sub-plans). The content of this Plan is specified in Schedule 7 to the proposed Conditions.</p> <p>Waka Kotahi anticipates that, because the Ecology Management Plan will be prepared by ecologists engaged by the construction contractor for the Project so that the effects management approach and offsetting requirements can be appropriate reviewed and confirmed. At this time, the certification of the Ecology Management Plan provides the reassurance that the relevant standards are achieved through appropriate management and monitoring practices.</p> <p>In this regard it is noted that the ecology offset measures are addressed in the Ecology Management Plan, whereas landscape and natural character mitigation measures are addressed directly by:</p> <ul style="list-style-type: none"> <li>• proposed designation Condition DLV1 Landscape planting; and</li> <li>• proposed Condition RWB3 Natural character planting.</li> </ul>

## Hydrology and Flooding

### Modelling of the 0.5% Annual Exceedance Probability (1 in 200-year Average Return Interval) Flood Event

74.	MWRC and GWRC	<i>Could the Applicant please provide information (including a plan of the extent of the modelled flooding) on the effects of the works on flooding during a 0.5% AEP (1 in 200-year) flood event, including the impacts of climate change?</i>	<p>Waka Kotahi acknowledges that the One Plan policy framework that responds to the risk of flooding references a 0.5% AEP flood event.</p> <p>As set out in the Technical Assessment F, the 1% AEP event including climate change used to inform the Ō2NL Project is larger than the 0.5% AEP event that is referenced in the One Plan. Therefore, a more extreme flood has been used as the design event when considering potential effects of the Project on hydrology and flooding.</p> <p>The approach adopted for the Project is consistent with the agreed design event for the Te Ahu a Turanga Manawatū Tararua Highway Project.</p> <p>Waka Kotahi is not aware of any policy direction or precedent for adopting a 0.5% AEP event with climate change as the required design standard for the Project and therefore has not modelled this scenario.</p>
75.	MWRC and	<i>Could the Applicant please provide</i>	Figure F.1 in Technical Assessment F shows that the

No.	Jurisdiction	Information requested	Waka Kotahi response
	GWRC	<i>information to support the statement in Para 55 of Technical Assessment F, that “The 1:100 AEP RCP 6.0 to 2130 is significantly larger than the 1:200 AEP current climate...”?</i>	1% AEP event, increased to allow for climate change under the RCP6.0 scenario is significantly larger than the 0.5% AEP event under the existing climate.
<b>Quantification of Effects Outside the Designation</b>			
76.	MWRC and GWRC	<i>Could the Applicant please provide information on the distance beyond the designation that effects have a non-zero quantity?</i>	Technical Assessment F identifies all areas where the Project may result in an increased flood level of $\geq 0.05\text{m}$ (50mm) outside of the proposed designations. Waka Kotahi considers that this threshold is reasonable and realistic on the basis that adverse effects at this threshold will not be discernible. The justification for using this threshold is further explained in Technical Assessment F.  It is note that updated drawings (that include a scale) are now included in this response.
77.	MWRC and GWRC	<i>Could the Applicant please provide additional information on the changes in flooding outside the designation for all of the events modelled? This should include: a) The maximum increase or decrease in flood depth or level at each area of flooding? b) The quantum of the area flooded under the existing configuration, the quantum of the area flooded with the concept design in place, and the increase or decrease in the quantum of the area flooded. If there are “overs and unders” at any particular location where flooding occurs, then these should be quantified and reported? c) The maximum increase or decrease in velocity at each area of flooding?</i>	Technical Assessment F includes the results from two design scenarios, including the extreme design event (1% AEP + climate change).  However, it appears that the ‘legends’ from a number of the figures in the Technical Assessment have not been included in the final report.  An updated copy of the Technical Assessment, complete with the associated figure legends will be provided. The revised figures provide the information requested.
78.	MWRC and GWRC	<i>Could the Applicant please provide information on the assessment of the changes to flooding of buildings? Where the model results show any change to flooding depth or extent at a building whose perimeter intersects the floodplain extent for any of the events and scenarios modelled, up to and including the 0.5% AEP (1 in 200-year) flood event + climate change, please provide:</i>	The modelling undertaken in respect of the concept design (with the purpose of establishing an envelope of effects), including of the potential effects of the Project during the extreme design event (1% AEP with climate change), shows that the Project will have no effect on risk of flooding to buildings.  The Waka Kotahi response to request 74 sets out the rationale for the adoption of a 1% AEP with climate change scenario as the modelled flood event used to assess potential adverse effects of the Project.

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a) the maximum flood level at the building under the existing configuration, with the concept design in place, and the increase or decrease in the maximum flood level at the building?

b) the percentage of the perimeter of each building that overlaps the floodplain under the existing configuration, with the concept design in place, and the increase or decrease in the percentage of the perimeter of the building that intersects the floodplain?

**Flood Hazard – depth and velocity**

79.	MWRC and GWRC	<i>Could the Applicant please advise where the changes in flooding that are referenced as best practice in Para 90 of Technical Assessment F are placed with respect to the designation applicable to each project referenced?, i.e. are the changes upstream of the designation, within the designation, or downstream of the designation?</i>	Technical Assessment F considers the maximum scale of any potential adverse effects at each location, both within and outside of the designation (upstream and downstream). The examples provided from previous Projects discuss the scale of effects but not the location relative to the designation. <sup>8</sup>
80.	MWRC and GWRC	<i>Could the Applicant please confirm the basis for referring to the examples provided in Para 90 of Technical Assessment F as “best practice”?</i>	The intent of paragraph 90 in Technical Assessment F is to provide recent examples of setting ‘thresholds of effects’ for comparison. Waka Kotahi considers that the examples reflect recent and accepted practice.
81.	MWRC and GWRC	<i>Could the Applicant please provide an assessment of flood hazard (which is a function of depth and velocity)?</i>	At paragraph 122 of Technical Assessment F the change in flood hazard (a function of depth and velocity - both of which are considered less than minor) is assessed as being less than minor. Further, the overall conclusion from the comprehensive computational hydraulic modelling undertaken of the potential effects of the Project (assuming a concept design) is that it will result in a small but net reduction in the existing flood hazard due to the physical works and provision of a more resilient highway with less risk exposure compared to existing State Highway 1.

<sup>8</sup> Te Ahu a Turanga Manawatū Tararua Highway Project and the Peka Peka to Ōtaki Expressway Project.

No.	Jurisdiction	Information requested	Waka Kotahi response
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**Geomorphological Assessment**

82.	MWRC and GWRC	<i>Could the Applicant please provide a geomorphological assessment of the relevant watercourses to assess compliance with Policy 25(f) of the PNRP?</i>	<p>Policy 25(f) is of little relevance given that in the Wellington Region there are no significant waterway crossings (a potential extension of the PP2O No.1 culvert by up to 10m may be required at the Greenwood Stream).</p> <p>A geomorphological assessment has not been undertaken and is not considered necessary because:</p> <ol style="list-style-type: none"> <li>the Project affects a relatively short reach of each watercourse;</li> <li>design criteria adopted for the various culverts are suitably stringent;</li> <li>the design event used to inform the assessment of potential adverse effects of the Project is extreme (that is, 1% AEP plus climate change); and</li> <li>to minimise and mitigate any potential adverse effects, the concept design for structures allows for generally unrestricted flow, with only small effects on velocity and existing flow paths, with the potential effects of any increase in velocity and bed shear stress to be mitigated by scour protection.</li> </ol> <p>Further, modelling of the existing environment indicates that a number of culverts and stream crossings ‘constrict’ watercourse channels. Where these crossing are impacted by the Project they will be removed and replaced with structures that will alleviate this constriction and allow the uninterrupted flow of water and sediment down the channel maintaining and improving existing fluvial processes and dynamics. The concept design has also maintained the continuity of flow and existing hydraulic connections.</p> <p>All of the above demonstrates that the Project is consistent with PNRP Policy 25(f) to the degree it is relevant.</p>
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**Threshold for Changes in Velocity**

83.	MWRC and GWRC	<i>Could the Applicant please provide additional information on the method used to determine that changes in velocity are minor and, if applicable, please provide quantification of the threshold values?</i>	<p>As noted in response to request 77, the legends for many of the figures in Technical Assessment F have inadvertently been left off the figures. An updated version of the Technical Assessment F, that includes the figure legends is now attached.</p> <p>Technical Assessment F, at paragraph 122, states that “<i>changes in velocity are assessed on a site-by-site basis, including by comparison with baseline velocity in upstream and downstream reaches</i>”. Waka Kotahi considers that a change in velocity of <math>\leq 0.5\text{m/s}</math> will have a less than minor effect relative to the</p>
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No.	Jurisdiction	Information requested	Waka Kotahi response
			<p>existing environment. The velocity change maps included in the Technical Assessment F show changes in velocity of 0.2-0.5m/s so that any potential change in these areas can be compared manually with the existing scenario. This approach was adopted in preference to using a percentage change which can result in unrealistically high apparent changes in areas of low existing velocity. Smaller percentage changes at higher velocities are likely to have a greater potential effect than large percentage changes at low velocity.</p>
<b>Freeboard</b>			
84.	MWRC and GWRC	<p><i>For all bridges, culverts, stock underpasses, pedestrian and cycleway underpasses, possible property access routes, and Shared User Path bridges and culverts, could the Applicant please provide information on the quantum of freeboard achieved and the extent to which the individual component complies with the requirements of the current Bridge Manual or other applicable standard?</i></p>	<p>A concept design, rather than the detailed design of the bridge and culvert structures, has been used to establish an envelope of potential adverse effects on the environment within which the Project, including all structures, will be designed and constructed. This means that the design of the structures that form part of the Project must ensure that the any adverse effects in respect of flooding are no greater than those described and assessed in the application documentation. This is confirmed through Conditions RGA1 and RBS1.</p> <p>If necessary, Condition RBS1 could be amended to include a standard in respect of freeboard.</p> <p>The role of the Bridge Manual is addressed in the response to request 91.</p>
<b>Effects at Te Repo o Hinemata</b>			
85.	MWRC and GWRC	<p><i>Could the Applicant please provide an assessment of the effects of the works at Te Repo o Hinemata on flooding?</i></p>	<p>As set out in Part D of Volume II, while wetland restoration is required by the proposed Conditions to offset residual effects on terrestrial and freshwater ecology, it is only once landowner agreements are in place and the detailed plans for any confirmed restoration sites have been developed that any necessary resource consents will be sought.</p> <p>Condition REM14 requires that the Ecology Offset Site Layout Plans confirm that any necessary resource consents have been obtained for the offsetting measures.</p> <p>It is noted that Te Repo o Hinemata is located entirely within the Manawatū - Whanganui region.</p>
<b>Surface Roughness</b>			
86.	MWRC and GWRC	<p><i>Could the Applicant please provide plans showing the surface roughness applied to the “Baseline” and “With-Scheme” Models in more detail? The</i></p>	<p>The areas of scour protection are shown in Volume III (drawing set 310203848-01-300-DRAINAGE). As indicated in Technical Assessment F, Section 2.3.1 of Appendix F.2, “where the drawing set indicated scour</p>



No.	Jurisdiction	Information requested	Waka Kotahi response
		<i>plan provided in Appendix E of the “Baseline” report is of too greater scale to confirm the modifications made for the “With-Scheme” model are appropriate for describing the effects. This should include information on the locations of scour protection.</i>	<i>protection, these polygons were added as roughness patches with a new surface roughness of 0.055”.</i> For the concept design, the approach that has been taken is conservative, and demonstrates that less than minor effects will be achievable following final design and construction.
87.	MWRC and GWRC	<i>Could the Applicant please provide further information to support the statement in section 2.8, Para 3 (Page 16, Appendix F.2) of the “With-Scheme Report”, that the impact of scour protection on modelled water levels is expected to be minimal, or provide an assessment of effects that explicitly includes scour protection works?</i>	The model results presented in Technical Assessment F and ‘with-scheme’ appendices all include scour protection. Consequently, any potential effects of scour protection have been included in analysis and conclusions reached in the Technical Assessment.
<b>Blockage (Page 16, Appendix F.2)</b>			
88.	MWRC and GWRC	<i>Could the Applicant please provide the findings of the blockage risk assessment described in section 3.3 of the “With-Scheme” report?</i>	As set out in Appendix F.2, given that a concept design has been used to establish an envelope of potential adverse effects of the Project, a topographical screening exercise was undertaken to ensure that alternative flow pathways do exist should blockage occur. This screening exercise involved the concept design earthworks surface around each culvert being viewed in GIS and 3D views to ensure that in the event of blockage, water could either pass along the highway embankment to another nearby culverts or pass over the highway at shallow depth, without posing risk to upstream dwellings or preventing emergency services from passing through floodwaters. This informed the preliminary recommendation for upstream debris arrestors (soldier piles or large screens) reflected in the culvert schedule. The debris loads and debris arrestors were not applied to the hydraulic model but it is considered that the screening exercise provides sufficient detail and comfort that any adverse effects associated with culvert blockages are appropriately managed so that any impacts of flooding caused by blockages are minimal.
89.	MWRC and GWRC	<i>Could the Applicant please describe the method that was used to assess the effects of the debris arrestors on flooding, and the outcomes of the assessment?</i>	
90.	MWRC and GWRC	<i>Could the Applicant please provide further information on the effects of blockage on water levels, velocities, and flood extents, to supplement and provide further detail for the information in Para 3 of Section 3.3 of the “With-Scheme” report?</i>	
<b>Version of Bridge Manual</b>			
91.	MWRC and GWRC	<i>Could the Applicant please provide information on the differences</i>	The Waka Kotahi Bridge manual (SP/M/022) 3 <sup>rd</sup> Edition was published in May 2022. This includes a

No.	Jurisdiction	Information requested	Waka Kotahi response
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*between the version of the Bridge Manual used for the assessment and the current version that are material to the project, and updated information for the assessment of effects that is consistent with the current version of the Bridge Manual?*

schedule of the amendments included the new version.<sup>9</sup>

The Bridge Manual establishes conservative parameters for bridge design, as opposed to directly being a tool to manage potential effects on the environment. That said, Waka Kotahi understands that the 'standards' embedded in the Bridge Manual are significantly more stringent than could be expected in respect of any resource consent granted under the RMA. In this regard, the hydraulic basis of the concept design was informed by the previous version of the Bridge Manual.

### Borrow and Fill Sites

92. MWRC and GWRC
- It appears that some of the borrow and fill sites are located within floodplains. Could the Applicant please provide further information on the effects of the borrow and fill sites on flooding; especially as it pertains to the damming and diversion of flows; including:*
- *The areal extent to which the floodplain overlaps each borrow site;*
  - *The areal extent to which the floodplain overlaps each fill site;*
  - *Current estimates of borrow volumes for each borrow site; and*
  - *Current estimates of the volume of fill that is below the flood level for each fill site.*

Technical Assessment F – Hydrology and Flood includes an assessment of the effects of the material supply sites and fill sites on flooding (beginning at paragraph 170). The material supply sites and fill sites have been identified to confirm where the material for the construction of the Project might be obtained and disposed of (as opposed to confirmed and designed). As such, the assessment of effects in Technical Assessment F has been undertaken conservatively based on inferences from available model results; the potential hydraulic behaviour; and an assumption that the sites will be developed to their fullest extent. Given that the material supply sites and fill sites are conceptual, any firm estimate of volume or area of the sites (beyond the conservative assumptions that have been made) is speculative, of limited value and likely to change.

### Shared Pathway

93. MWRC and GWRC
- Could the Applicant please advise as to the basis for determining the appropriate level of service for locations where the Shared User Path crosses a transverse drainage feature?*
94. MWRC and GWRC
- Could the Applicant please confirm the level of service for each location where the Shared User Path crosses a transverse drainage feature?*

The applications for resource consents include indicative culvert sizing for the locations where the shared pathway crosses a drainage flow path. In most situations, the culverts are an extension of the culvert crossing the new highway as opposed to being independent of the new highway.

While there are no specific standards for shared paths, where these are independent, the design has been based on anticipated volume of flow within drainage channel to accommodate a 1 in 10 year ARI without overtopping/surcharging.

In a practical sense this standard is considered appropriate noting that the use of a shared path will

<sup>9</sup> <https://www.nzta.govt.nz/assets/resources/bridge-manual/docs-3rd-edition/Bridge-manual-pdf-introduction-v3.4.pdf>

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			be limited during inclement weather.
<b>Contaminated Land</b>			
95.	MWRC and GWRC	<i>Could the Applicant please provide further information on the procedures and mitigation measures that will be used to manage discharges to water, and to land that may enter water, from contaminated material, should it be encountered during construction?</i>	<p>Further to the Waka Kotahi response to request 71, the initial procedures for managing contaminated material, including associated discharges, are established by proposed Condition REW4. This Condition requires that a detailed site investigation be undertaken prior to works commencing at specified sites. In the event that the detailed site investigation identifies the presence of contaminants earthworks and land disturbance activities within the potentially contaminated site will cease until all necessary resource consent for the works, including associated discharges, have been granted. Therefore, it is these subsequent resource consents that will manage discharges.</p> <p>Condition REW4 also sets out a similar procedure for any unexpected discovery of contaminated soil. In addition, it is noted that the erosion and sediment control measures for the Project will contain and treat soil and sediment run-off to prevent direct discharges to water in any case.</p>
96.	MWRC and GWRC	<i>Could the Applicant please advise how any additional consenting requirements for this matter will be reflected in the relevant management plans?</i>	<p>The requirements of Condition REW4 will be set out in the Construction Environmental Management Plan required by Condition RCM5 (and as described in Schedule 2 to the Conditions). The requirements of future resource consents will be addressed through separate conditions. These conditions may include a requirement for further management plan/s that would sit alongside those proposed for the Project as a whole.</p>

Waka Kotahi trusts that the above responses sufficiently address matters raised in your request for additional information. Please do not hesitate to contact myself or Ainsley McLeod if you have any queries.

Nāku noa, nā



**Caitlin Kelly, Principal Planner**

**Attachment:** Revised Technical Assessment F – Hydrology and Flooding.

**Attachment 1: Updated Technical Assessment F (Hydrology and Flooding)**

A revised version of this report has been uploaded to the SharePoint site and also to the Waka Kotahi web site: [RMA applications | Waka Kotahi NZ Transport Agency \(nzta.govt.nz\)](#)