HEARING STREAM 2 – Day 2

Greater Wellington Regional Council

HEARING STREAM 2
Day 2

Ecosystem Health and Water Quality Policies

Date: Tuesday 8th of April 2025

Time: 11.00am

Hearing Stream: Two – Day 2

Venue: Greater Wellington Regional Council Chambers
100 Cuba Street, Te Aro, Wellington

Hearing Panel: Dhilum Nightingale (Chair)
Sharon McGarry (Deputy Chair)
Gillian Wratt
Sarah Stevenson
Puawai Kake

[Hearing Stream 2 – Day 2 – Part 1]

Chair: Kia ora. Karakia tātou.

Admin: *Tukua te wairua kia rere ki ngā taumata*
Hai ārahi i ā tātou mahi
Me tā tātou whai i ngā tikanga a rātou mā
Kia mau kia ita
Kia kore ai e ngaro
Kia pupuri
KIa whakamaua
Kia tina! TINA! Hui e! TĀIKI E!

Chair: Mōrena everyone. Welcome to Day 2 of hearings for Hearing Stream 2, PC1 to the Regional Plan.

We will just do some very brief introductions, just in case there is anyone new online listening in.

Ko Dhilum Nightingale tōku ingoa. I am chairing both Panels, the freshwater and Schedule 1 Panel. Welcome. It's really nice to be back here again in Council Chambers. I will pass over to the Deputy Chair.

McGarry: Mōrena, I'm Sharon McGarry.

Kake: Mōrena tātou, Puawai Kake, Independent Commissioner. Kia ora.

Wratt: Mōrena ko Gillian Wratt tōku ingoa. Independent Commissioner.

Stevenson: Ngā mihi nui kia koutou. Ko Sarah Stevenson tōku ingoa. I'm an Independent Commissioner based in Wellington.

Chair: Just seeing if there's any matters of process or anything like that, that anyone would like to raise. All of our tech is working well. Great.

Just a reminder to please turn cell phones and laptops to silent and to hit the button the mic if you're in the room to speak. Other than that I think we are probably ready to start.

[00.10.00]

We have got the second day of Council presentations and listening to experts and technical advice.

We welcome again Dr Greer. I think we are starting with you this morning.

O'Callahan: If I perhaps just come back to you on one bit of policy redrafting that was discussed yesterday. It's wording but in relation to Objective WH.09.

I was directed to clause (e)(i) of WH.09 and a similar provision in P.06 as well. The wording that's in there at the moment is in red. It says, "When the specific polices and rules are fully satisfied then the target attribute states can be considered to be consistent with this objective."

That's not worded correctly, in terms of the intention there.

What it should say is "when the activity specific policies and rules are fully satisfied then the activity can be considered to be consistent with the target attribute states."

Chair: I just missed the beginning words there Ms O'Callahan.

O'Callahan: It's little (i) and most of the first line is correct. So when the specific policies and rules are fully satisfied… and then you should cross out "target attribute states" and replace it with "activity". Then continue with, "can be considered to be consistent with…" cross out "this objective" and write "the target attribute states."

Chair: Thank you very much. I will just see if anyone has any clarification.

[End of Part 1 recording – 16.35]

[Hearing Stream 2 – Day 2 – Part 2]

Greer: …on the extent to which specified rivers become more swimmable with and without Ms O'Callahan's amendments. That can be provided on reply in terms of kilometres of specified river that has become swimmable. It's about the percentage and absolute distance.

Wratt: It's something that would be helpful. What's in Appendix 3 of the NPS-FM is quite specific, but it's also quite hard to connect it back to the Plan Change provisions, so I think that would be useful thank you.

Greer: I will endeavour to have that provided with reply for this hearing stream.

Today, this morning, I just want to touch on some of the changes to Table 8.4 and 9.2 that can be scientifically justified, and some that have been suggested by submitters that cannot.

I also intend to touch on the extent to which the target attribute states, as amended by Ms O'Callahan, will be achieved by the notified provisions.

To be clear, these are simply science and were not even recommended. They're just identification of where changes can be justified from a science perspective. They have not necessarily all been carried through into the s42A report which balances a range of factors and not just the science. So these are not necessarily a discussion of the full breadth of the changes amended by Ms O'Callahan.

Also, in terms of the structure of today, given the comment around speed yesterday, I was just wondering if it would be helpful if we stop after each amendment and answer questions on that, instead of shooting through and then coming to it at the end.

The first change that I identified that would be justified related to toxicants – so those are chemical attributes that have a direct toxicity effect on animals. There are a number in there, a number of target attribute states for copper, zinc and ammonia in urban streams in the notified version of PC1 that was set at the (a) state.

As noted yesterday, the level of ecosystem health being sought for urban rivers really only sits at fair, and the (a) states sets a sort of unnecessary level of stringency to achieve the macro invertebrate target attribute states for those rivers.

The specific issues lie with the copper and ammonia target attribute states for the Waiwhetū Stream. The ammonia target attribute states for the Wainuiomata urban streams bar FMU, so that's Black Creek, the zinc target attribute states are Kaiwharawhara Stream and the zinc and copper target attribute state for the [03.15] FMU which relates to Duck Creek are under the best available guidelines, which is the Australian and New Zealand Guidelines for Marine and Freshwater Quality.

The most appropriate level to set these target attribute states would be the (b) state; however, due to physical achievability issues, and this is not a financial cost but actually a physical constraint on the level of improvement that can be

made, the (c) state is the most appropriate target for copper and zinc in the Waiwhetū Stream – copper and ammonia sorry in the Waiwhetū Stream.

Is there any questions on those toxicity and attributes then I'm happy to take them now.

Waiwhetū Stream, Wainuiomata urban streams and Kaiwharawhara are Table 8.4. The copper and zinc in [04.24] is Table 9.2. They are all over the place on Table 8.4, so I can't direct you to a specific page there.

Wratt: Which stream was that comment you just made in relation to?

Greer: Which comment in particular?

Wratt: You said for scientifically a (b) state but achievability it should be (c).

Greer: So that's the Waiwhetū Stream and that is based on the extent to which retro-fitted stormwater devices can generate low reductions across that catchment. There is a cap on the extent to which reductions can be made. To get to the (b) state requires more than that. So that would require land use change.

[00.05.20]

O'Callahan: If it assists the Waiwhetū Stream is on page-360 of the printed appendix that Sarah had yesterday.

Greer: I also note that these target attribute states still drive an improvement in these attributes for the most part and are not inconsistent with the improvement required for macroinvertebrate health in these streams.

Chair: Dr Greer, yesterday I was looking at Appendix 1A of the NPS-FM, the compulsory values. Aquatic life which you were just talking about, I just want to ask first of all if you could elaborate on what "end points" means? It comes up in a few places and also in Ms Callahan's evidence. I just want to understand what that means and if that's about achieving the TAS. But, of course there's nothing specific for aquatic life, so I guess two questions.

If you could please explain aquatic life, which is a compulsory value in Appendix 1A. What are the specific target attribute states that show ecosystem health for aquatic life? And, then if you could talk about the end point, just so I can make sure I understand that concept. Thank you.

Greer: In terms of the attributes that cover it in the notified versions and for rivers it is fish ibi – fish community health, macroinvertebrates. I'm not sure if they're referenced this way, but one of two which would be quantitative macroinvertebrate community index compared with the macroinvertebrate community index; and the second macroinvertebrate attribute which is the ASPN [07.37] in growth is also a belief covered by that part of ecosystem health.

In lakes it is phytoplankton, submerged plants, and it's arguable whether the invasive submerged plants comes under that, but the native ones certainly do.

In terms of the end point being sought, Appendix 1A ecosystem health value has five components and it lists them. But, at the end of that list it explicitly says all five biophysical components are suitable to sustain the indigenous aquatic life.

So from an NPS perspective and just from a general science perspective you have to kind of pick something that you're looking to manage for, and everything else, all the other targets sit under the macroinvertebrate and fish targets. We're generally trying to set them to achieve the macroinvertebrate and fish targets.

That's why I have called them the end points. They're the things that people want to see. Everything else is the things they want to manage to get the things they want to see.

Chair: When you say what people want to see, are you linking that back to the Whaitua Programmes?

Greer: Yes, the theory being that the macroinvertebrate community health index reflects what the subset of a community wanted in their rivers, and everything else below it is more relevant to how to get there, rather than being something they valued in and of themselves – except for E.coli which is for a different value.

Chair: Thank you. That's really useful.

[00.10.00]

So MCI, can I just talk about it as MCI? Do I need to differentiate between 1 and 2 or the QMCI?

Greer: MCI is fine, as long as we're on the same page that we're referring to that one of two macroinvertebrate community attribute states and that the ASPM is different. We haven't used the APSM, or I haven't considered it when I've been making the assessment of the levels of ecosystem health being sought.

Chair: MCI I understand you've found is degraded in all the monitored catchments. So does that reflect poor aquatic life conditions?

Greer: Yes, in terms of degraded generally they don't meet the target attribute states, so they're degraded under that part of the NPS definition of degraded. They don't all fail to meet the national bottom line. In rural rivers they tend to meet it, but they don't necessarily meet the target attribute state that's been set by PC1 and they're degraded for that reason.

Urban rivers they almost across the board failed the national bottom line for macroinvertebrate community health under the NPS-FM. And, that is simple.

Chair: Just trying to check I have that. Did you say in rural they fail to meet the TAS, but they meet the national bottom line?

Greer: Yes. I'm just going to get Greater Wellington's monitoring website up, just to make sure I am correct on that. It will be faster than trawling through the baseline state assessments.

Yes there is a pattern of most part FMUs in rural areas being in the (c) state for MCI under the NPS-FM; but uniformly in the (d) state in urban rivers. That is pretty par for the course in urban rivers. For context there is only one urban river in the whole country that is monitored and meets the (b) state and none meet the (a) state. It's a symptom of urban development.

McGarry: Dr Greer, just confirm what you said yesterday when I was relooking at your evidence. You went through and you said which were compulsory and which weren't, but you were silent on that fish community health. Yesterday in the hearing I think you said it's not a mandatory under the NPS, is that correct?

Greer: That was Ms O'Callahan who said that. Yes, I developed that attribute to capture a narrative that was included in the Porirua WIP, rather than the NPS.

Chair: Just keeping with Appendix 1A of the NPS-FM, is it that the PC1 (and maybe this a question for Ms O'Callahan) but threatened species which is another compulsory value in Appendix 1A, that's not specifically within the scope of this plan change other than I guess benefits that these provisions might have for threatened species.

Greer: Sorry, I thought actually there was a different part and it was that threatened species was being included in Schedule F of the operative NRP.

O'Callahan: Yes, that's right. You've already heard about those because it was part of Mr O'Brien's presentation in Hearing Stream One. There is a requirement, as I understand it, under the NPS. I haven't really spent a lot of time thinking about it because it hasn't been in my topic, but to cover threatened species, well as it happened this regional plan already had schedules and provisions that protects the threatened species in its Schedule F. So what was done in the plan change, as I understand it, was an update and an inclusion of where those species meet the NPS requirements through notations or something I think was the equivalent of the exact detail.

Chair: Thank you, yes, I recall that now. Thank you.

I had some specific questions about periphyton, but I don't know if you're coming onto more. Shall we let you continue with your presentation or is now a good time to ask you about periphyton?

[00.15.10]

Greer: I'm not sure. It looks like we have quite a bit of time and the scope of my presentation today only covers amendments recommended in my evidence, so anything additional to that there's not going to be a natural stopping point in this presentation to ask questions. So, it could wait till the end or it could happen now – whatever you would like.

Chair: Thank you. We don't want to run out of time. Did you have more prepared slides to go through?

Greer: I have a slide to talk about these things on this screen here, which is simply the amendments identified in my statement of evidence; and then a quick go-through of the amendments requested by submitters and why I do not agree with them; and then I was going to touch on the extent to which the notified provisions

achieved the amended five attribute states – but very briefly. Effectively, "Here look at this paragraph in my evidence and here's the table," rather than going over everything in particular detail. So there isn't a huge volume of content to churn through in the actual presentation itself.

Wratt: Before we move on, just coming back to your explanation of end points, it was very useful, thank you Dr Greer. Just to make sure that I have got it right, what you're really saying is that the end points are macro invertebrates and the fish targets from an ecosystem health perspective; and the end points you didn't specify it, but in my end point the end point around human health is E.coli in rivers, if we're talking about rivers and lakes and not going to coastal.

The other TAS – essentially you're saying that dissolves in copper and everything else essentially in Table 9.9, or I'm looking at Table 8.4, are measures associated with those end points.

Greer: Yes, they could be considered drivers or stressors that impact the end points. There's a huge list in the NPS-FM. The extent to which different ones will drive those end points will vary by river, and some are of questionable relevance across the board, but that's where we are at.

Wratt: Do any of those have I guess impacts on the health of the freshwater bodies other than that? I guess I'm thinking human health impacts for example that aren't E.coli and aren't bacteria or whatever related.

Greer: In terms of human health, unless there's surface water takes taking nitrate contaminated water that is a human health issue, but as far as I know it just does not occur. It's very questionable whether we have sufficiently high nitro concentrations to generate an adverse health effect.

Copper and zinc are actually a dietary requirement for humans. It's not like that's taken up into the flesh of fish and then the fish become unhealthy. Most humans actually do not have enough copper and zinc in their diets, and that's why people earn billions of dollars selling A to Z and that sort of thing.

Periphyton has aesthetic issues beyond the impact it has on macroinvertebrate community health. The attribute states for that attribute actually tie into that. They're based on guidelines developed by MFE in 2001 and they actually correspond below the (a) states to thresholds set for trout fishery; and not just are there trout, but do people want to go fishing in them, because are they choked with algae or not.

That's probably the one attribute which has an actual impact beyond its impact on the macroinvertebrate community health.

Wratt: There's a sign of bacteria issues are there with periphyton in human health, and animal health.

Greer: Yes, sign of bacteria is covered within periphyton biomass attribute; though you've seen from submissions that people are asking for specific attribute for it.

[00.20.00]

It's very variable spatially. For the most part it doesn't contribute to periphyton. It kind of pops up and then has a big impact while it's there. It's not directly captured from a health perspective inside the periphyton attribute. It's not really set up for it for that effect, and certainly not for the protection of dogs.

Wratt: Is it in there in terms of the human health? I should know that from having read the documents.

Greer: No, it's not in the NPS-FM for human health benthic sign of bacteria, which is the periphyton component. And it's not in PC1 as a target attribute state in Tables 8.4 and 9.2.

Wratt: Thanks for that explanation.

Kake: I do have a question but I think it might be useful just to get the presentation and the slides to see whether or not the questions that I've got are answered through that presentation; otherwise I will just ask the questions at the end.

Chair: Just to my periphyton specific questions if that's okay.

Looking at the table at Point 4, periphyton's statistic is 92nd percentile. My understanding of that is that means periphyton biomass shouldn't exceed 50mm of chlorophyll a square metre more than eight percent of the time?

Greer: That's the (a) state threshold. The national bottom line is 200 milligrams per metre square.

Chair: Which is (d)?

Greer: Yes. Once you exceed that you're into (d).

Chair: I know you've said periphyton TAS for Waiwhetū Stream likely exceeds the baseline state amending to (b). In the version of the table I have, which I think is a rebuttal version, it looks like Waiwhetū Stream [22.20] east that the baseline in the TAS have been struck out.

Greer: Yes, that's Ms Callahan's amendment and not one I disagree with. That river does not actually grow periphyton and if it did I'm sure it would be absolutely choked with it. It's a macrophyte dominated system. It has had very well publicised issues with Cape pond weed in particular. You could set the target attribute state to (a) because it simply doesn't grow periphyton, but that's not the issue. It has massive plant growth problems but they are not associated with algae, they're associated with rooted plants.

I note that in my statement of primary evidence and Ms Callahan has taken that part of my evidence rather than you could amend it to (b) when she's made her amendments to Table 8.4.

Ms O'Callahan just advised me that's also partly informed by Dr Valois' evidence that they don't monitor it there; and the extent to which it's not an issue there is that they don't even take cover estimates there. In rivers where they don't do biomass directly they generally take cover estimates, but they've just stopped periphyton in that river all together because it just doesn't grow there.

Chair: I guess I'm still a bit confused because what we are looking at on the slide here says periphyton for Waiwhetū likely exceeds baseline state. It doesn't grow and is not monitored, so not going to provide a TAS for it?

Greer: I believe the target attribute state for it was (c), which periphyton biomass there will be an (a) state because it doesn't grow at all. It will be zero. So in theory that allows for a degradation but in practice there's no scope for that degradation because it's a macrophyte dominated system.

I believe that the same approach may have been taken with the Taupō Stream in Table 9.2, as notified. Two of the target attributes is set for that stream or not?

Chair: It's not. It's NA.

Greer: Yes, so the Porirua WIP I believe took the plant community into account when they set their objective for that attribute in Taupō Stream, but the Te Whanganui-a-Tara did not, hence the discrepancy between the two; but they're effectively the same situation.

[00.25.00]

Chair: The same situation. The same for Takapū? I think it's been deleted there as well.

Greer: I am less familiar with Takapū. I believe that may have been on the basis of Dr Valois' evidence around future monitoring, rather than coming from my evidence itself.

Chair: Just a couple more questions about perihphytons. The Wainuiomata River and I can't recall what DS stands for.

Greer: [25.59] downstream.

Chair: Yes, that makes sense. The TAS in numeric is less than or equal to 200 and the state is (b), but elsewhere I think I noticed that if the numeric is less than or equal to 200 the state is (c). Is that again because of the particular river characteristics? So for instance, in the column to the right of that for Makara, that's less than or equal to 200 and the state of (c).

Greer: In the notified version of PC1 I have the exact same for Wainuiomata rural streams. Do you have a greater than sign there?

Chair: No, it's a less than. I guess I'm just saying less than or equal to 200 for Wainuiomata the TAS is (b); but less than or equal to 200 for Makara the TAS is (c).

Greer: In the notified version it's (c). I believe Ms O'Callahan hasn't made the necessary update to the numeric in her Appendix 4 of her primary s42A. So that should be 120 to be (b).

Chair: For Wainuiomata?

Greer: If the target actually says (b) that would be the threshold.

Chair: Yes, because I think in other places where the equal to 120 is (b) like Korokoro.

Greer: Yes.

Chair: That makes sense. Thank you.

Another one that I noticed is Kaiwharawhara the numeric is 191 and the state of (d) for current; but elsewhere a (d) state has a higher numeric, so 324 is the baseline for Wainuiomata.

Greer: Yes, there's different ways of assessing compliance with the periphyton biomass attribute state. I understand that baseline states the actual letter banding has been calculated on how many and what percentage of samples exceed the threshold, but the number that's been reported beside it is simply the statistical 92nd percentile. If you have a big gap between your ninth and eighth percent of sample, that 92nd percentile can end up in weird places. But, in terms of technical compliance with the attribute states, it still falls within. You can't really generate a number for value. It's not exceeding with 80 percent of samples because it doesn't work that way.

That's just a reporting issue around the periphyton biomass attribute state rather than an error.

Chair: So the key thing is the TAS numeric should all be consistent and within the right band.

Greer: Yes. There is no variability in the actual numeric thresholds, just the allowable number of exceedances for productive rivers, which doesn't factor in here. If you see any discrepancies in the targets they will be something that Ms O'Callahan and I need to work on to tidy up in the final version of the tables.

Chair: Thank you.

[00.30.00]

Chair: I have some other questions on the details on these tables about suspended fine sediment and dissolved in organic nitrogen. Again I could quickly go through those now or wait.

Greer: If no-one has got any other questions on periphyton I have one more point on that side of things and then we can move on to the next one, and the next one falls into suspended fine sediment. So that could be a natural point for that question.

Does anyone have any other questions on periphyton?

I do have one more point in relation to the periphyton side of the equation. There was another amendment that identified could be justified from a scientific perspective and it was in relation to the dissolve reactive phosphorous nutrient outcome for the Whakatikei River. The target attribute state as notified requires a 25 percent reduction in that attribute, and the reason for that was that the TAS was set by the Whaitua Committee at the NPS-FM (a) state, rather than being managed and set at a level that's required to achieve the periphyton target attribute state.

Dissolve reactive phosphorous is one of the nutrients that drives plant growth, including periphyton. A 25 percent reduction and dissolve reactive phosphorous concentration in that catchment is unlikely to be physically possible. It's a huge amount of that catchment is in native vegetation and the remainder is in commercial forestry. There's also no evidence to suggest that the periphyton biomass target attribute state for that river is not being met currently, and our assessment of the nutrient level that you would set to achieve that periphyton biomass attribute state results in a much higher target.

So on that basis there is justification I believe to amend that target attribute state to simply maintain the current concentrations which would result in the amendment of less than or equal to 0.006 to 0.008.

Wratt: So in the table that I'm looking at, TA numeric has in fact been changed from .006 to .008.

Greer: Yes, Ms O'Callahan has adopted that suggestion in her amendments.

Wratt: So what you're recommending is what's now in the Appendix 2 document?
Greer: Correct.

Chair: I understand better now. I think the point that you make, that in that river the dissolve reactive phosphorous attribute should primarily be managed be in relation to the periphyton biomass.

Greer: Correct. I also was going to talk today about the dissolve reactive phosphorous nitrate and dissolved inorganic nitrogen target attribute states for the Korori Stream, but we did discuss those yesterday. It was my scientific suggestion that they be amended to 1mg per litre for [33.55] nitrate and 0.25mg per litre for DRP. But, as discussed yesterday, Ms O'Callahan has not carried that suggestion through to her amendments due to the vast amount of stormwater treatment that would be required to achieve them.

A final amendment that I think I suggest in my evidence relates to visual clarity in the Mangaroa River – it was the Te Awa Kairangi rural main schemes and rural streams and part FMU. Submissions are correct that colour was not accounted for in this part FMU and as discussed yesterday, Dr Valois, myself and Mr Blyth have conducted a number of analyses to generate an amended bottom line for this river of 1.67 metres and that relates to the (d) state.

[00.35.00]

That is in the (d) state under the NPS-FM and Ms O'Callahan has adopted that suggestion in her amendments as well.

Were there questions on suspended fine sediment in general? Could we ask that there?

Chair: Yes. Suspended fine sediment is measured by this black disc test. I understand how far in the water horizontally you can see a black disc.

Te Awa Kairangi urban streams, I'll just check I understand this correctly. The black disc test visibility is at 1.2 and that puts in an (a) for baseline. But, to the left of that, Mangaroa at 1.5 the baseline is (d). Are you able to just explain that?

Greer: Absolutely. Under the NPS-FM there is different attribute states which show four different sediment classes of river. With river class three having the most stringent national bottom line of 2.22, while Hulls Creek, which is the target attribute state for Te Awa Kairangi urban streams I believe is river class 2, but it may be 1 – please don't quote me on that one exactly. I can't remember off the top of my head. But, I believe it's national bottom line is 0.9 metres.

The way the attribute states work is they consider their benchmarks against the natural state, the model natural state of the river. So for those rivers which have naturally poorer clarity, they have more lenient attribute states. With rivers like the Mangaroa, setting river class 3, having very stringent national bottom lines. Whereas some of the other rivers have been very, very lenient national bottom lines from an effects perspective on amenity.

I believe the lowest one is 0.6 metres.
Submissions have raised that point. There's been a vibe that the Council have colour adjusted the target attribute states for Hulls Creek. That isn't the case.

Chair: Thank you, that's really helpful. I was actually going to ask if the colour from the CDOM, but I've forgotten now what that stands for, but if that is taken into account in establishing the baseline.

Greer: For [38.49], for Mangaroa?

Chair: I guess for any river as the naturally occurring colour.

Greer: The only river that has been colour adjusted now, and this is right up to the latest amendments, is the Mangaroa River. There were questions raised about whether Black Creek, which is in the Wainuiomata urban part FMU, should also be coloured adjusted; but Dr Valois' team recommended that that's probably not appropriate. That river is black. It's black for different reasons – rampant pollution probably. If you've been there, and I'm not sure if you went there on your site, but there is a frequently overflowing pipe bridge and pump station next to it. There is also a huge amount of macrophytes in it which could be breaking down and releasing that colour themselves.

There is also I understand no peat in its upper catchment and no significant bush that you would expect large amounts of colour to come from.

[00.40.00]

On the West Coast of the South Island you get a lot of colour from native bush, but we don't see that in Wellington as much. There is no reason to expect there to be a naturally occurring colour there, even though there is colour there now.

So there's been no adjustments to anywhere else other than Mangaroa.

When we were discussing about how to develop or how to factor colour into the Mangaroa we looked at two options. One was to colour adjust the baseline and every resulting measurement from there on and compare it to the existing

national bottom line; so basically factor up our clarity measures each time. And, the second option was to reduce the target grade. We chose to go with the reducing the target grade approach because operationally it's easier. You don't need to do a complicated calculation for every single measure of black disc that you do going forward.

So that's why colour isn't factored into the baseline states.

There is a mechanism to do that. We can flip the process around to develop it.

Chair: I have probably what is a very basic question about the difference between suspended fine sediment and deposited fine sediment. Does this come back again to what you're saying about the river classifications? I understand that flow affects that.

When you're looking at that are you looking at the input, so where the sediment in that area would be coming from or is it simply about what happens to it once it's in the waterbody if it's suspended or if it sinks.

Greer: Deposited fine sediment is simply a measure of the cover of sediment on the bed at the monitoring site; whereas suspended is how much is in the water column at the time of the sample.

Sediment that's input into a river will be transported in two ways – bed transport, so along the bed, which is slow; and in suspension, so when it's picked up from the bed and travels in the water column.

The relative proportion of bed transport will depend on the flow characteristics of the river. High-energy rivers will move sediment out faster. Spring fed streams will have a much higher percentage of bed transport in the sediment that goes in there and will stay in there for a long time. If you've got a purely ground water fed system it can be decades that it sits in there.

Deposited sediment has an effect on benthic macroinvertebrates but smothering and reducing oxygen concentrations near the bed; whereas suspended fine sediment does things like it braids gills and reduces visibility.

They're a symptom of the same issue, which is increased sediment input, but they have different effects.

Chair: I think my final question on that is, so could you talk a bit about soft-bottomed rivers and how that impacts the monitoring and the achievement of target attribute states.

Greer: There are soft-bottom rivers, or I think a number of soft-bottom rivers in the area covered by Plan Change 1, but there is only one river that meets the definition under the NPS-FM of a naturally soft-bottom river. That definition isn't perfect. It's not going to accurately help you identify every single river that has a natural soft bottom.

Rivers other than Taupō Stream, which is classified as a naturally soft-bottom and therefore is exempt from the deposit of fine sediment attribute in the NPS-

FM, all other rivers that currently have a soft-bottom under the NPS are assumed to not have a naturally soft-bottom, and therefore are classified as degrading, as they don't meet the national bottom line for that attribute.

There were submissions on the fact that soft-bottom streams like the Pāuatahanui Stream that's a natural source of increased suspended sediments. There's a bunch of sediment sitting on the bottom that keeps being disturbed by flows and that's what's causing the national bottom line not to be met.

[00.45.00]

If that sediment on the bed isn't natural then the resulting impacts on visual clarity are also not natural. In my rebuttal I provide that assessment and disagree with those submission points.

McGarry: Dr Greer I've got a few questions that are all over the place. I will try and avoid lakes, because we're going to go there later.

Greer: Could I just jump in really quickly? Do you as the Panel want to hear my responses to individual submissions, or is that something that we can just take as read and move through onto just these substantive questions now?

Chair: Are they points that you've made in your rebuttal?

Greer: Rebuttal and primary evidence and they're clarified in the conclusion section of my primary evidence in more detail that I intend to go into today.

Chair: I think we are saying yes, but in particular we also want to hear your views on Ms O'Callahan's revised recommendations in terms of achieving the TAS. We want to make sure we have time for that too.

Greer: So you do want to hear the responses to submissions?

Kake: If I may through the Chair, it is in relation to these particular tables as well, and a particular submission point. But, again pre-empting what's coming. I'm conscious of time and your availability as well, and the ability to answer this question. It's hopefully a quick one.

Just with respect to your primary evidence, including mahinga kai as a target attribute state, that's already included in the NRP, your evidence at paragraph 170 basically says because you're not a cultural expert you can't comment on the relevance of that attribute.

Is that the only reason why that attribute hasn't been included in Tables 8.4 and 9.2?

Greer: I did actually create these tables but only from the WIPs and the requirements of the NPS-FM. Is there wasn't a mahinga kai attribute put in this table, it's because there wasn't a specific lesser grade threshold through the WIPs themselves – the tables and the WIPs. I understand Te Mahere Wai might have some cultural monitoring attributes, but they weren't included in the process as specified target attribute states in here, which are pretty much from the NPS-FM or equivalent attribute states.

So I think why there isn't a mahinga kai attribute carried through here is probably a question for Mr Sharp from yesterday unfortunately.

Kake: That's okay. Just in addition to that then, acknowledging that under the NPS mahinga kai is a compulsory attribute, in Appendix 1A, would it be relevant then for these particular tables? That might be a planning question as well, that Ms O'Callahan might want to refer to also.

Really, that's the substantive amount of my questioning around these tables.

Greer: From a scientific perspective I'm sure there are some measures of mahinga kai that can be translated into similar attribute state thresholds, like we have here. For example, tuna is encapsulated in the fish ibi attribute. That's probably the only one that's currently in them at the moment.

I think the species can be managed through this similar approach, just from a scientific perspective – bearing in mind that I'm not a cultural expert at all. But, I think the main reason I steered clear of commenting on the mahinga kai and the operative NRP, is as I understand it mahinga kai isn't just the species themselves but the experience of collecting it, the sites, what the site looks like and smells like – which is so far outside my realm of expertise that I thought it easier just simply not to comment on it.

Kake: I suppose that goes back to my first question and the reason why mahinga kai hasn't been included is because you're not a cultural expert?

[00.50.02]

Greer: No, it's nothing to do with my opinion on mahinga kai at all. That decision was not mine. I believe it was made in terms of specific objectives. These tables are drawn from tables in the WIPs themselves and those tables did not include mahinga kai objectives. So that's why they're not carried through. The decision why they didn't include mahinga kai objectives, I think that would have been a question for Mr Sharp.

Would you like me to make a note of that for Mr Sharp to answer?

Kake: Yes please, that would be great. I understand and I accept that your expertise is relevant to the science, but because we have specific submission points on this particular topic in understanding the importance of that particular attribute.

Greer: I wasn't trying to be dodging the question. I just didn't want to get myself in trouble there. But, I will definitely ask Tim if he knows why Te Mahere Wai mahinga kai attributes weren't included in the final [51.18].

Kake: Thank you.

O'Callahan: I think you suggested that was a compulsory attribute or an attribute in the NPS and you referred to Appendix 1A, so that's the values part rather than the targets part. So it is acknowledged as a value and it's referenced in one of those more narrative objectives. But, it's not a compulsory target in the sense of the 2A and 2B.

Kake: Options, yeah. Confusing the matters. I think there will be some more questions I suppose that will come later on this week, in terms of how you might monitor that value as well from a mātauranga perspective and that will be reserved I suppose for mana whenua.

McGarry: I've just got some perfunctory corrections in your evidence and I don't want to change your evidence without you agreeing. I will start with your rebuttal.

I think there's just a repeat of paragraphs 10 and 11 of your rebuttal. I would just like to strike one of those out with your agreement.

Greer: It looks that way to me.

McGarry: So we can strike out 11 I think.

Just checking in that paragraph 10, 10.2 and the Waiwhetū Stream and it's got the (a) to (c). That's the only one that's a two band jump and I just wondered if you could explain the difference there. Is that just because it's so degraded that it needs to jump two bands.

Greer: That's in relation to the physical achievability issue that we talked about in the first part of this talk. It's not actually possible to treat your way to the (b) states in the Waiwhetū Stream. The (c) is about as good as it can get before we start needing to think about land use change.

McGarry: Before I go to your evidence in chief for some corrections, I just have some questions. It might be something that you're going to cover in terms of your response to Wellington Water.

I'm looking at your paragraph 16. You're talking there about the assumption of the 100 percent treatment performance, and then in the last sentence you say you consider the risk to be small. I just wonder if you could just clarify what that risk is? I think I understand what you're saying.

Greer: From memory I should have added more context to that statement. It was because the target attribute states that are either easily met or they're so hard to meet that the differences in performance of the devices doesn't really factor in to whether the targets will be achieve or not.

[00.55.00]

The ones that are going to be met require very small improvements and the ones that aren't going to be met require vast improvements and so reducing the treatment performance of the devices doesn't really change anything in terms of the assessment.

McGarry: So the risk you're talking about there is really the risk of whether that hundred percent has been an over-estimate?

Greer: Yes.

McGarry: In paragraph 17, am I getting it right, is it all will be very difficult to meet except Wellington urban?

Greer: Yes. This paragraph actually just summarises what I was just saying – is that we've got a one part FMU where the reduction needed to achieve the amended TAS is very small, ten percent. So the risk of under-estimating treatment performance is low there and every other copper and zinc target attribute state is not expected to be met as it is; except I am now noting that the Waiwhetū Stream also fits in there and that's covered in my paragraph 18 by the looks of it.

McGarry: So the Wellington urban and the Waiwhetū.

So what you're saying to us is all need to achieve a seventy percent efficiency in treatment and then only fifty percent of the stormwater systems need to be retrofitted. Have I got that right?

Greer: That was the subjective threshold that I have used to identify where the target attribute states will be difficult to meet. To clarify that, that's a high performing rain guard capturing and treating fifty percent of the impervious area in those catchments.

McGarry: And, that's the difficult threshold?

Greer: Yes, but I believe that financial feasibility is considered in the evidence of Dr Walker. That threshold is simply based on that's most of the catchment, rather than inherent knowledge of operational or financial feasibility.

McGarry: Sorry, working backwards in your evidence and chief, just because I've scrolled right through to the end to pick some of these up.

Your paragraph 242 of your evidence in chief.

Greer: I don't have a 242.

McGarry: In your evidence, your main evidence, not your rebuttal?

Greer: I am ending at 237 and at Table 22. I printed this one off the website.

McGarry: I'm on page-122 of your evidence. It's a note.

Greer: I am well finished my evidence by page-122.

McGarry: Mine goes right through to 155 on the electronic version.

Greer: There as an update made to the evidence once it had been published, because a large number of the captions had been split and they were shifting. Every time a table started it shifted the table onto a new page halfway through the caption. I believe that the Council thought they'd picked that up fast enough before anyone would have downloaded it, but I'd say that you've been pretty speedy. You may identify some formatting errors from that version which may no longer be an issue.

McGarry: Perhaps you could go to Table 21. Don't tell me you haven't got a Table 21.

Greer: Labelled 'The Changes to TAS' in Tables 8.4 and 9.

McGarry: That's right. Correct.

If I come down two paragraphs then you've got a very large note in italics.

[01.00.05]

Greer: Yes.

McGarry: Then it's the third paragraph and the notes starts that "Some of the Q/MCI TAS in PC1 have been identified in Table 19." Got that one?

Greer: Correct.

McGarry: Should that be Table 22? I couldn't make sense of that in terms of Table 19.

Greer: You are correct. That cross-reference has not been updated.

McGarry: It is 22?

Greer: The final version, yeah.

McGarry: So that's a yes. Just bear with me – I'm going to figure out what my paragraphs are to yours. My notes on here though.

The beginning of the section is "Submissions on consistency between how the TAS and tables, 8.2, 8.4 and 9.2 were set in the requirements."

Greer: I'm familiar with the paragraph, it will just take me a while to find it.

McGarry: The paragraph I'm looking for begins, "Furthermore the TAS cannot have been set."

Greer: I have it.

McGarry: I'm interested in this functioning freshwater accounting system. I was wondering if you could just tell us a little bit more about what a functioning freshwater accounting system is and whether or not something is in development.

Greer: To be honest with you I haven't actually stayed up-to-date with the freshwater accounting system since this [01.02.34] was released. It's not something that I've been asked to contribute to for the Council.

I understand historically it was a means to, being blunt, allocate nitrogen to people, and has now extended into a comprehensive system to monitor the uptake the limits set in a plan and the extent to which current water quality are meeting target attribute states. I think it's the second part of that which was a fundamental difference from the earlier version. The earlier version was just about allocating resources and now the current approach requires monitoring and reporting of loads and concentrations in rivers.

I've been involved in Greater Wellington's NPS-FM implementation since 2017 and at various points in time it has been quite aggressive moves to start

developing a freshwater accounting system; that I understand has then stopped in response to new guidance from MFE – sort of being every time something started it's changed and reset everything. To date there has been no accounting system developed, though there has been reports on it. Mr Blyth might actually know a bit more. I understand he was looking at how to use the Porirua model in that context.

Blyth: There has been no accounting system developed. Mr Greer is correct. Accounting systems can be a combination of monitoring and modelling. The Council is still going through the process of determining what models to use where across the whole region. Currently it's been focused on delivery process of Whaitua by Whaitua can now through a plan change process. In terms of a region-wide accounting system, in some ways it might be useful to finish the Whaitua processes and reflect on the best way to do an accounting system across all of them, given some of the approaches vary between each of the Whaituas and how modelling and monitoring is being used, which will eventually form part of future plan changes.

[01.05.00]

McGarry: Thank you.

I'm at 184, so 179 I think for you and this is talking about the Wainuiomata River at Richard Prouse Park. This is one of the ones where I was wondering whether there's been any faecal source work done, any tracking work done. You go on to say that you think that it is mainly human source.

Greer: There isn't an animal source.

McGarry: There isn't?

Greer: At that site. When I was writing this I looked at the aerial photographs of all of these sites that require improvement. My understanding of this site is it is effectively just out of the water protection zone and that the only obvious source of E.coli in terms of like a point or a diffuse discharge is a sludge pipe from the water treatment plant, but they monitor E.coli in that effluent frequently, and it couldn't possibly generate the concentrations we're seeing here. But, there is a tributary that comes in just upstream which has got housing development. It looks like they're on sceptic tanks there, so it could potentially be that. But, that's the only obvious source of E.coli, because they cull out the wild animals out of that catchment very hard.

McGarry: So this is a classic example where the costs to improve water quality at that particular site aren't actually through upgrades or any work; it's actually a compliance issue isn't it? But, PC1 hasn't caused this.

Greer: I'm unsure of the extent to which those sceptic tanks would actually have to perform from a compliance perspective. From memory, the NRP requires that they be maintained in accordance with best-practice guidelines. It doesn't necessarily mean if they're old they had to be installed to be high performance tanks. So they may not be non-compliant.

I believe Mr Willis, who is presenting in Hearing Stream 3, worked on those provisions and he may be able to explain more about what they do to have to comply.

McGarry: My understanding is there are no sceptic rules in PC1. There are some sceptic tank requirements in the operative plan. So there's no change to those.

On this side of the table what we're struggling with a little bit is a lot of the numbers that we're seeing, that are being pointed towards PC1, seem to be matters that aren't PC1 driven. So it's the difference between if you assumed from a legalistic perspective that everybody was doing what they were required to under the law, isn't that the existing environment Ms O'Callahan?

O'Callahan: This is the issue you raised yesterday.

McGarry: Yes.

O'Callahan: You're thinking about the dry weather discharges from the network, is that right? So, under the operative plan there is no rules that address those. The plan provides for wastewater treatment plant discharges and wet weather overflow discharges. My view is it probably wouldn't be possible to get a consent to stage your implementation of dry weather improvements. It's this plan change that is trying to set the starting point for trying to address those issues, by bringing them into a clear regulatory framework.

The reason I say it wouldn't be possible to get a consent is because the plan talks about existing and new discharges and doesn't recognise the dry weather discharges as existing and makes those a non-complying activity.

McGarry: This is the bit I'm struggling with - when you see the economic costs that come through Mr Walker's evidence and they're talked about as upgrades.

[01.10.00]

I'm trying to find an analogy. It's like getting a warrant for your car that you've already got existing problems and you can't then call it an upgrade; you're just trying to meet the current law, and then we bring in a new law or a new requirement to meet.

My next question really was on the next paragraph 2, where you talk about the 95 percentile concentrations must be reduced by 23 percent. It's very difficult to understand what that 23 percent reduction is if we don't know the contribution between those activities that are existing and may be causing contamination, versus those that are consented.

O'Callahan: If I can just comment on the consenting and the compliance.

Yes the Territorial Authorities should have been fixing their pipe networks, but that doesn't change the fact that these costs are going to be experienced by the community. So I'm not sure that it really gets you anywhere that we're introducing the regulatory framework to enable them to be managed to a timeframe and an expectation through this plan change. To me that's the important thing, and the important thing is that those costs, given they don't appear to be provided for in the LTPs as Mr Walker sets out to date, that is still

going to be experienced as a step up. That's just the reality that we're dealing with. I don't see it as whether it's a legal or compliance issue as such; it's a change that affects the community that needs to happen and this is the trigger for it to start happening.

McGarry: So you don't see a difference in somebody who might have an old sceptic tank, who maybe should have upgraded long ago, and the cost to that individual versus the cost to the community as a rate payer cost, you don't see any difference?

O'Callahan: Plan Change 1 is dealing with them differently. It hasn't changed the rules for the sceptic tanks. I can't quite work out your analogy in that. But, it is changing the regulations for the wastewater networks.

Greer: There is no cost tied to anybody else with that Richard Prouse Park site, because there is no network upstream and no rural land use. There is no-one to bear the cost. I'm not saying that the sceptic tank owners are being forced to bear the cost, but there is no-one being disadvantaged by that target attribute state, because there's three or four hundred metres of pipes that carry sludge from the water treatment plant to the wastewater treatment plant, and that's the only network upstream. The rest of it is in regional park and water protection areas, which are heavily managed. There is no way to reduce the E.coli out of those areas; more they're being managed to achieve a drinking water standard.

Wratt: Can I just explore that a little bit? So, what you're saying or I'm hearing, is that the sceptic tanks are probably the source of the E.coli that's been detected in the stream. To address that, and those discharges don't come within the TAS, how would you actually address that? The only thing that can be done surely is that those residents have to upgrade their sceptic tanks.

Greer:` I just want to start off by saying I can't point the finger at the sceptic tanks; I just want to say that there is no other source apart from some rural residential areas in a side tributary that you could easily attribute E.coli to.

Wratt: Let's make it a hypothetical question then, which is where there is an issue with private sceptic tanks that are causing pollution issue, how does that get addressed through implementation to plan change?

Greer: At the moment, it gets implemented. The operative NRP rules haven't had a huge amount of time to bed in, and I assume at some point those tanks will have to be replaced. So, if there's no rules associated in PC1 to achieve the TAS then it will be a timing thing associated with the lifespan of those tanks – if it is those tanks.

[01.15.00]

Blyth: Could I please add some value on the sceptic tanks? I was part of the project team for Te Whanganui-a-Tara with the Council and we discussed some of the sceptic tanks with the Whaitua Committee. Primarily to deal with sceptic tanks was related to either the District Plan in a health or potential public health issue, or if there was cause for thinking it had a freshwater quality implication would require localised research closer to the source, rather than sort of state of environment monitoring sites that are downstream receiving.

The Council, as far as I am aware, have done very few of those investigations, even though there's a number of properties with legacy and old sceptic tanks. They may not be having an effect on the freshwater quality depending on how they're discharged, and effluent fields have been designed, and how often they get cleaned out.

So it may not always be an old tank results in a poor water quality, but localised investigations would be needed to help confirm that, and as far as PC1 there are no specific rules to require people to upgrade those old tanks. It's probably a grey area, but the committee did discuss things such as warrant of fitnesses for sceptic tanks and ultimately didn't end up as part of the WIP recommendations.

Greer: Would you like me to whip through the achievability side of things before a break – then I can deal with any further areas on paper, Commissioner McGarry?

McGarry: Perhaps we could return back. It's helping us on this side of the table when there's specific examples, where we can talk through what's going on. A lot of this is very theoretical on a very high level and when we start to get down to a site it's easier. So maybe we could turn back to your 181 and the 95 percentile concentrations must be reduced by 23 percent in order to achieve TAS – this is at the Hutt River milling bridge site.

My question there was to change that 95 percentile would that require addressing weather flows or could this be addressed by getting onto those dry weather faults and leaks.

Greer: Ms O'Callahan has herself expressed displeasure that this as far as I can go with this statement.

The weekly monitoring undertaken at primary contact sites does not allow for the same level of modelling that I have been able to do for the monthly SOE sites. They're collected every week, sometimes every two days, for I believe September to April. There's no link to annual loads that can be established on that monitoring data. There's no way to figure out what a 95th percentile over summer translates to in terms of a percentile on an annual basis that you could then link to the frequency of wastewater overflows.

Really all that is known about the level of improvement required to achieve the TAS is that it needs to be 23 percent. Tying it to specific actions is unclear.

In terms of wastewater overflows and Mr Blyth might be able to answer here, I understand there is quite a large one upstream of this site at Silver Stream. It actually is in the middle of the river from memory. It's got a large diameter pipe that spills I can't remember under what conditions, but not very frequently from what I understand.

It's also important to understand that this site, and I deal with this in my rebuttal, 50 percent of the E.coli that comes through this site is generated in the rural major sub-catchments upstream. The Hutt River is predominantly a rural and forest catchment more than an urban catchment, until you get to its lower reaches.

So it's not necessarily that this is even an urban issue.

Ruddock: Apologies to Dr Greer and Commissioners, I have just been informed that Ms Ira who was to speak from 12.10 to 12.30 has limited time availability. I was just wondering if might move to her slot now and then return to this, if that's okay with the Commissioners.

[01.20.15]

McGarry: I will leave this other one with you and you might be able to come back to me. It is my paragraph 120, which will be your 115. You have referred us to another paragraph there without a number. I just wonder if you could tell me what that number is when we come back. Thank you.

Greer: Absolutely.

Chair: Ms Ira have we got you online?

Ruddock: That's correct, Ms Ira will be joining us online. I will just unlock her camera and mic now.

Chair: Welcome Ms Ira. Sorry to keep you waiting.

Ira: Kia ora.

Chair: Just to check, you're available with us is it until 12.30?

Ira: Yes, unfortunately I have to step into a workshop which starts at 1.30 and then goes through until I think it's either 3.30 or 4.00. I could speak after 4.00pm if that's more convenient for the panel. I'm just not too sure what your timing is.

Chair: While we've got you here let's start and see how we go. What time do you need to finish?

Ira: I can finish when we finish my evidence, that's no problem. I'll make a plan. As long as I'm not too late for the next meeting that will be fine, thank you.

Chair: Mr Ruddock we'll try to finish by 12.40pm if we can. Thank you. Over to you. Would you like a quick introduction?

Ira: Yes thank you that would be lovely. I haven't been as involved as everyone else, thank you.

Chair: No problem. Dhilum Nightingale, Chair of both panels.

McGarry: Kia ora Sharon McGarry, Independent Commissioner from Christchurch.

Kake: Kia ora Commissioner Puawai Kake.

Wratt: Kia ora Gillian Wratt based in Nelson.

Stevenson: Kia ora Sarah Stevenson based in Te Whanganui-a-Tara Wellington.

Ira: Kia ora tatou.

Chair: Ms Ira, we've read your rebuttal evidence and it is very clear thank you. We'll pass over to you to present your evidence how you would like to. Thank you.

Ira: Thank you. I did have some slides which were part of the slide deck that was prepared. Perhaps if someone could put that up for me I would appreciate it. If not, I guess the main thing I really wanted to cover today is just a few points around my main conclusions in my evidence, and just really informing you all that my evidence relates primarily to a statement by Mr Foster in paragraph 8.29 of his evidence and that's about retrofitting stormwater infrastructure into existing urban areas and the difficulties of that process.

I think I was slide 36. Thank you.

Whilst I generally agree with Mr Foster's statement, I wanted to make the important point that this does mean that retrofitting in existing urban areas is not an appropriate option for stormwater treatment.

In many instances we can't through our retrofitted stormwater infrastructure capture that full water quality volume that needs to be treated and this generally relates to the fact that often there's a lack of space in urban areas because of our roads and underground services or park areas, but also because of clashes with existing infrastructure that can be above or below ground.

So what that means generally in terms of our stormwater management is that either the devices themselves end up being too expensive to construct and often they get value engineered. I call it devaluing engineering – out of the decision process for a particular project; or simply there is just not enough space for it.

If you could go onto the next slide please.

In my evidence I address some different ways that councils across New Zealand and internationally have dealt with this issue retrofitting stormwater treatment. This diagram comes from some practice notes that the USEP put out around retrofitting green infrastructure.

[01.25.05]

It tells us that there are four main ways that we can retrofit and accommodate stormwater treatment within the urban area.

The first one and obviously the easiest one is actually just to avoid the existing services that are there.

The second one is around co-existing; so perhaps making compromises in terms of things like clearance or protection requirements of different infrastructure.

The third one is around modification. This is where the utilities would agree that actually the stormwater treatment and the utility can co-exist together but we will have to alter either the design performance or some of those elements around things like inlets and outlets.

The final one, the fourth one, is to actually replace infrastructure; so that would be to avoid any conflict. You would go and replace and relocate existing utilities

like water pipes, wastewater pipes, fibre, electricity and that sort of thing. But, obviously as you can imagine that has the highest cost for any project and so that's often not a viable option.

Ideally when we are thinking about retrofitting our aim needs to be around how we can allow that stormwater infrastructure, those water treatment devices to co-exist or to avoid existing services. The way that we need to do that is that our designers often need to be innovative to facilitate these retrofits. There needs to be some accommodation made around the fact that perhaps that particular device won't look exactly as how it is portrayed in a stormwater design manual.

If we go to the next slide, you will see that I have provided you with an example of perhaps what a retrofitted rain garden or bar retention device might look like in an urban areas. This is from the urban design garden in London where you can see whilst the bar retention device would have the same surface area as what would be required through a particular design guide, what actually happens is it has a smaller linear infiltration or longitudinal infiltration profile but it's longer.

So what we are doing is we're allowing these services there to co-exist and making amendments to the rain garden by increasing the depth of that filter media rather than having a shallower one.

Something else we see quite commonly is if there's no space. Sometimes we can create what they call **bell baths** [01.27.58] which is the diagram on the right hand side where you can see the tree pit which comes into the road. They are used a lot in the United States and in Europe as traffic calming devices, but also providing for stormwater treatment within existing urban areas.

If we could go to the next slide.

Basically the conclusion that I made in my evidence, and it's based on my expert opinion, is that if we are going to be retrofitting stormwater management into existing urban areas this will often lead to a compromise in the level of the water quality.

The challenge for the planning process is being able to estimate or calculate what that likely reduction in performance would be. The reason for this is that the constraints in an existing urban area are very site specific. You only actually often know about them once you're at that detailed design stage and you can start to go and investigate where various underground services may be.

That is a challenge for the planning team but I think it's important to note that even though we might compromise some of that water quality treatment, we do know through international studies that smaller rain gardens, that might have been adapted because of this exact issue, actually tend to provide quite a good level of stormwater treatment and function very well.

What we see is that it's not actually the treatment capacity itself of the device that suffers, but it's that it needs to be maintained on a more regular basis, so that that water quality treatment can be achieved. What that means is potentially by doing this co-existing or avoiding of services, what we're seeing is we're having a reduced construction cost, but possibly your long term maintenance cost might

be a bit higher because you need to maintain the device more often as it becomes overwhelmed with contaminants.

[01.30.10]

I've quoted two overseas studies in my evidence for your which just gives you a bit of an example on that.

I have also included this Table 3.1 which is from a technical publication called TP10 which was used in the Auckland Regional Council a number of years ago as the design guideline for stormwater management in Auckland prior to the use of GD01. In New Zealand this is probably the main table that is used to work out what your potential efficiency might be, depending on how much of your water quality volumes, so the volume of water that drains, that you're able to capture.

So what we tend to assume is that if you are capturing a hundred percent of your water quality volume or flow, that you're getting a 75 percent treatment efficiency. But, just to point out that this table does relate to total suspended solids. It doesn't relate to metals. So you would see different levels of efficiencies for metals, specifically the dissolved metals; but it does help to give us some level of indication that if we know that we can only achieve 50 percent of our water quality volume then potentially our efficiency is going to drop to 60 percent. Or, we could increase our maintenance regime to try and increase the efficiency of that device.

I think my final slide please. That one was my final, I apologise.

Just in conclusion, what I would really like to say is that the implementation of green infrastructure and stormwater practices, such as bar retention devices, wetlands and swales that are spoken about in PC1, it can be difficult to retrofit them in existing urban areas. It can be technically challenging and it can be disruptive to the community. And, whilst the treatment function may be compromised to an extent, with innovative design and careful design they can come close to meeting the objectives and the targets which Mr Greer has discussed in his evidence for PC1.

What's also really important is that those green infrastructure practices provide a number of co-benefits or other advantages like carbon sequestration, increased biodiversity, reducing the urban [01.32.34] effect. Those co-benefits along with the water quality treatment aspects will in my opinion anyway outweigh many of the constraints and the challenges that are faced.

Thank you.

Chair: Thank you very much Ms Ira. Who has got questions? Commissioner Wratt.

Wratt: Excuse my ignorance but WQV water quality volume, can you just explain what that is?

Ira: Of course, yes, no problem. When we design our stormwater treatment devices we have to design it to capture a certain amount of run-off or rainfall that falls onto the ground and gets captured. That really tends to focus on the smaller everyday storms that we get. I think in Wellington it's around about somewhere

between 25 and 30mls of rainfall, that when it gets captured it gets taken to a treatment device and that's the water quality volume as we call it. That then actually needs to be treated.

It's based on that water quality volume that a lot of the contaminant modelling that's done relates to. So when we talk about a particular treatment efficiency from a device it links back to how much of the water the rainfall runoff that you've captured can actually flow through the device and get treated.

Wratt: So how is what that hundred percent should be decided?

Ira: That is I believe a topic of this hearing; I think it's hearing topic number four we will talk about the hydrological requirements. Certainly I can tell you in Auckland, which is where I'm based, and in many regions of New Zealand, it's based on what we call the 90th percentile storm; in other words 90 percent of the rainfall that falls to the ground or approximately that amount will be captured by these devices and treated.

[01.35.00]

It will not account for larger storm events or extreme storm events. Rainfall run-off from those storm events will bypass any stormwater treatment.

That setting of what that water quality volume is, is done locally by different regional councils and they have gone through a process for that, for Plan Change 1.

Wratt: Thank you that explanation.

Ira: Pleasure.

McGarry: So how does that WQV relate to what's often referred to as the "first flush" capture?

Ira: It is very similar. The notion of the first flush is around the fact that many contaminants as soon as it rains will run off with that rainfall and then be captured by a device. Then as it continues to rain, that impervious surface is cleaner, so we don't have to capture and treat that water.

That is correct for some contaminants, but not all contaminants. If we think of something like dissolved zinc from a roof, it will continue to leach zinc for the entire time that it's raining. So dissolved zinc for example from a roof does not exhibit a first flush effect.

What the 90th percentile storm event does, it's a little bit more than the first flush because it's capturing, as I mentioned, almost 90 percent of those initial smaller storms and it's slightly better at dealing with some of those dissolved contaminants that don't exhibit that first flush effect.

I actually will be presenting some evidence around that in Hearing Stream 4. The difference between first flush and the other kind of larger storm events and how it works, in terms of coming up with a realistic guideline for water quality volume.

I'm not sure if that answers your question sorry.

Chair: Ms Ira, I'm not sure if this is a question you can answer or if it might be better directed towards Ms O'Callahan, but my question is around the provisions that will be coming in time into the regional plan that are directed from the RPS around water sensitive urban design both for I think Policy 14 of the RPS which is now beyond challenge, so requirements for urban development and new subdivisions, the extent to which that has come into modelling and the impact that might have in terms of achieving TAS for dissolved metals and sediment run-off.

I'm asking the extent to which these requirements that are being directed from the RPS for water sensitive urban design to manage stormwater contaminants and run-off, if that has been to the achievability of the TAS going out to 2040 and I think now in some instances in 2050 in your recommendations.

Ira: I haven't been involved in the modelling. I would have to defer to those who have on that question.

What I will say is that generally what the modelling does is it focuses on specific devices. So what the contaminant removal potential is of a particular device.

Green infrastructure or nature-based solutions are one approach within a greater water sensitive urban design toolbox. The efficiency of those green infrastructure practices, the rain gardens, the wetlands, the swales and so on, would have been taken account of through the contaminant modelling process and that's really important because it's the vegetation itself and the organic matter within much of those devices that provides for the uptake and removal of dissolved contaminants zinc and copper that we're concerned about.

[01.40.00]

Water sensitive design is far broader than just the green infrastructure practices; it's also around how we develop our land, how we actually reduce impervious areas whilst still maintaining the densities that we need to achieve housing outcomes. It's about how we change the way we earthwork to reduce the volume of sediment that is actually being generated; and it's about how we change how we build and what materials we use within our cities to reduce the sources of contamination.

Things like using inner roofing materials to make sure that we are not getting dissolved zinc leaching all the time, or having restrictions on our earth-working practices to reduce the volume of sediment that's coming off the sites that then needs to be treated.

I am not sure of the extent to which those aspects of water sensitive design would have been covered, but certainly within the modelling the models themselves would take account of the green infrastructure practices that we can use to reduce contaminants.

Chair: Thanks very much for that explanation. Dr Greer?

Greer: Yes, it has been factored into the approach taken to assess the achievability of the TAS in particular around the Schedule 28 requirements of the NRP PC1.

Chair: We might have to come back to this and it might actually be more, but I thought Schedule 28 was more limited in terms of specific stormwater immediately to hand – stormwater treatment devices; whereas I'm interested in knowing has anyone looked the broader impact if all of the water sensitive urban design requirements that are directed in the RPS, when they come through into the regional plan and then place requirements on urban development and subdivisions; if that has been accounted in modelling in terms of achievability of the TAS.

Geer: The Whaitua modelling work incorporated increasing levels of water sensitive urban design in the scenarios tested, with a specific water sensitive urban design scenario which included treatment, but I also understand James in specific analysis on the effect of hydrology… is that correct Mr Blyth?

Blyth: That's correct. I will talk about it later on today when I'm scenario modelling, but there was comprehensive water sensitive design ranging from media filtration, constructed wetlands via retention applied to roads, commercial, residential at different levels of efficacy and application depending on the scenario. So water sensitive scenario had comprehensive amounts of treatment being applied and then the Whaitua Committee used those scenarios as a guide to set their targets amongst everything else – their values, costs and things like that.

Greer: Just to be clear though, those effects of water sensitive urban design are largely to limit the impacts of new development and they're largely swamped by the improvements required across the existing network to meet the target attribute states, which is more important. The water sensitive urban design from the PC1 perspective is to limit the extent to which we move away from the TAS, and the offset that then has to be put in place across the existing urban network to reduce beyond that.

Ira: Perhaps if I can add to that, because I was involved in the original collaborative modelling team for the Porirua Whaitua Process. I did all the lifecycle costing modelling work for that. So I'm quite familiar with the water sensitive design scenarios.

They did include source control of roofing materials as well as treatment in existing and new urban areas. They included water reuse through rain tanks – again to address that hydrological component. And, they factored in an improved regime around earthworking to reduce source of TSS from earthworking activities, as well as all the green infrastructure components.

[01.45.15]

What unfortunately I can't help you with is the link between that work and where things are at now with the plan change, but it sounds like Mr Blyth is able to provide that to you.

Chair: Thank you very much. I will just see if anyone has got any other questions.

Ms Ira just one final one before we let you go. Your evidence talks about the ability to retrofit and that's helpful, but it doesn't go into costs and how cost is shared. Are you able to comment on that?

Ira: Yes, I can. This topic is within my area of expertise. I do a lot of lifecycle cost analysis work forced on a lot of infrastructure.

Recently I have built lifecycle cost models for the Auckland Council for their freshwater management tool programmes to inform their plan change. Unfortunately, there isn't a lot of data in New Zealand around the effect of retrofitting devices on the construction costs of those devices, so we've had to look internationally for that data.

Just to preface what I am going to tell you, by saying that, please remember that it is very site specific; so while I can give you a rule of thumb that we use in terms of the change in cost between greenfield and urban brownfield development, it is very site specific.

We use the US EPA recommendations around including a cost development factor for any stormwater infrastructure that is constructed within an existing urban area, and that factor range is between 1.5 and 2 times the original construction costs. So if you're construction cost for a rain garden was $10 per metre squared, it would become $15 to $20 per metre squared if we were to retrofit that in an existing urban area. That is just the construction cost, it's not the total lifecycle cost. That lifecycle cost might change depending how you construct it and the level of maintenance that's needed.

That's the first part of your question around the influence on costs.

The second part around who pays, we actually had a really good debate and discussion around this through the Porirua Whaitua process when I spoke to many of the politicians on the cost outputs of that work. We can work out where that cost might fall – like does it fall with the developer, does it fall with the network operator, does it fall with a private individual. So depending on the type of device we can make the split of saying new infrastructure in greenfield areas for example is going to be built and paid for by developers and operated and maintained by a network operator; so that's where the two separate costs would fall – developer and then rates funded.

With water sensitive design a lot of the infrastructure becomes onsite infrastructure which means private individuals start bearing the cost through having to build rain tanks or rain gardens on their properties and then maintaining that infrastructure, similar to how you would with a sceptic tank, which is quite common in rural areas.

Retrofitting of urban areas can become a little bit more messy depending on who's actually doing the construction of those works, but I guess for all intents and purposes whilst the costs might vary in terms of the value chain of where it falls, all those costs are borne by the community – be it the person who is buying that property from the developer, or be it the ratepayer who is having increased rates to pay for stormwater treatment or whatever it might be.

[01.50.05]

The cost does fall in different places but actually in the end it's all borne by you and I as ratepayers and community members. I think that is because stormwater

is a public good infrastructure. That's probably why that is the case. Slightly different from wastewater and water supply finances.

Hopefully, that's helpful.

Chair: Yes, thanks very much for your explanation. I don't think we have anything else, so thank you very much for your time. All the best for your workshop this afternoon.

Ira: Thank you. Thank you for making space for me and squeezing me in. Good luck with the rest of the hearings.

Chairs: Thanks very much.

Ira: Thank you.

Chair: We will take an adjournment now and be back maybe at 1.35pm.

Greer: Can I just quickly provide the information that was requested?

I believe it's my paragraph 117 and it's not uniform throughout the evidence how far off that version was. I believe where it says paragraph 0, it should be paragraph 118 to 122 on my version of the evidence. I am unsure of the offset but it is the next paragraph.

Chair: Thanks very much. We'll see you soon.

[Hearing adjourned – 01.51.45]

[Hearing resumes – 02.38.35]

Chair: Kia ora koutou. Welcome to the afternoon session. Just in terms of our schedule for the afternoon we have some more questions for Dr Greer but we are scheduled to hear from Mr Blyth now, followed by Dr Valois. Any preference in terms of timing? Dr Greer, what's your availability like this afternoon?

Greer: Wide open. If you need to go late I can go late. I'm just staying in a hotel room otherwise.

Chair: Thank you. We'll try not to go past five. It's more what about Mr Blyth, would you prefer to present your evidence now or if we hear further from Mr Greer?

Blyth: I'm completely fine to carry on with the line of questioning that we had prior to lunch while it's fresh in your minds. I'm flexible this afternoon. But, it might mean everyone else gets shifted as well.

Chair: Dr Snelder is online.

[02.40.00]

Dr Valois, do you have any time constraints this afternoon?

Valois: I don't have any time constraints so I'm happy to move it to later.

Chair: I don't think we'll need to shift things too much. Shall we start with Dr Greer but we will maybe do a time check in fifteen minutes. We might have wrapped up by then and then we can move onto you then Mr Blyth.

Commissioner McGarry, did you want to finish your questions?

McGarry: No, I snuck that one in.

Chair: Let me just check with the others – any questions for Dr Greer? It might just be me then.

Wratt: One question - you were going to run through your responses to the submitters.

Chair: Yes and TAS.

Wratt: Is that still on the agenda?

Chair: Yes. I think maybe should we start with that, because I thinks probably the most important thing before we lose you for the day.

Perhaps while we're just getting the tech sorted, Dr Greer, for dissolved inorganic nitrogen I have a question about why in Table 9.2 for Te Awarua-o-Porirua for Taupō does it seem to increase?

Greer: That is because it has a modelled baseline state, so there is uncertainty around the exact level from a numeric viewpoint that it needs to be maintained at. There's uncertainty around whether that is an increase.

The decision has been made basically to [02.42.42] which is comprised of ammonia and nitrate. It's the sum of the ammonia and nitrate TAS; but also acknowledging that it's not intended to allow for a degradation. The NPS-FM still requires an assessment of whether an attribute is degrading and the implementation of the action plan if it does. So there's not an expectation that that DIN target provides headroom. It's simply been set in a manner that accounts for the uncertainty associated with the model baseline state.

Chair: I didn't actually look at Footnote 4. Is that Footnote 4 – further monetary need to confirm with [02.43.43]? I just wondered if Footnote 4 was saying that there's uncertainty around the baseline, but I don't think it says that.

Greer: There should be a footnote there that says baseline state modelled based on model data, based on E.water source model results further monitoring needed to confirm the attribute meets the TAS. That is Footnote 4 in the notified version of that Table. I'm unsure of what it is…

Ms O'Callahan may have populated that measured current state data. Did you replace the model estimates for measured [02.44.40].

O'Callahan: Are you looking at something in Table 9.2, is that right? So it's Footnote 4?

Chair: Yes, next to Taupō currently the baseline. We've just heard from Dr Greer that there's uncertainty around the baseline state.

[02.45.00]

Greer: It still is Footnote 4 of Ms O'Callahan's table.

Chair: And, just one final question, dissolved copper it comes up in a few places. Is it clear what it means if the TAS is to improve within a band, so within (c) band? As I understand it, that is not necessarily a reference back to the NPS-FM Appendix 2.

Greer: In retrospect PC1 doesn't actually define the attribute states for that attribute. It is clear if you go back to the tech reports, but as a standalone document the thresholds of the (c) band potentially aren't clear to a plan user.

Chair: Would they be clear in terms of the monitoring agencies, so for the Council it would be clear?

Greer: Yes the Council report using the same attribute states that I understand are on their state of the environment monitoring reporting website, so it is in use in-house at the Council – the attributes states. But, I am just aware that there isn't an equivalent table like and NPS-FM Appendix 2A table that someone can quickly go and refer back to identify the boundaries of that improvement.

Chair: Do you think that's problematic, that if the TAS is to improve with band (c) that people should know what band (c) is?

Greer: Yes and I can provide the table if that's something that needs to be incorporated into the decisions version. Obviously, Ms O'Callahan may have thoughts on the appropriateness of including an explanatory table like that.

Chair: Thank you, we'll leave that. We might put a note in the minute that follows the hearings about that.

Greer: Would you like provide the table through reply, or are you happy to leave that?

Chair: I think through reply is fine, yes. Thank you.

We'll pass over to you. You were going to talk to us about submitters and also how the provisions as recommended now by Ms O'Callahan do, may or may not meet the target attribute states.

Greer: Yes. I do not agree with submitters universally that insufficient data for baseline states justifies the deletion of the associated TAS, which I note has been requested, I think frequently by Wairarapa Federated Farmers.

That note reflects past not current data availability. We have got a number of target attribute states that we can now benchmark that we couldn't in 2017. Some attributes and sites still have significant numbers of insufficient data – predominantly dissolved oxygen, ecosystem metabolism and the sites that have been added to the Council monitoring network through this process. I think Korokoro Stream has the shortest data record of the new sites.

Certainly, I don't think there is justification to delete all of the target attribute states with insufficient baseline simply because of that note.

I consider that submissions requesting the nitrate toxicity target attribute states for the Kaiwharawhara Stream be made more stringent is not scientifically justified. That is for the same reasons as described this morning for copper and zinc. There is no reason to reduce toxicity risk beyond what is required to achieve the macroinvertebrate target attribute states for those sites and submitters have requested that it be moved to the (a) state.

I do not see scientific merit in the submissions requesting amendments to the periphyton biomass attribute states outside the Waiwhetū Stream or amendments to the macroinvertebrate attribute states. The periphyton biomass target attribute states, my view is that there's not a strong evidence base to suggest that the improvements being requested is justified by the macroinvertebrate targets being sought.

[02.50.10]

And then the macroinvertebrate targets themselves reflect what has been chosen by the WIP process. So I don't see a scientific justification in changing those. There may be some other justification.

It is also my opinion that submissions requesting the deletion of the copper and zinc target attribute states, especially in urban areas, are not appropriate. These are key driers of ecosystem health in urban streams and I also do not consider that the addition of a natural character target attribute state, or the attributes and especially the river classes in Table 3.4 of the operative NRP is necessary.

That's the high legal summary of my responses to submissions. I can go straight onto the extent to which the provisions achieve the TAS, or I can answer questions on submissions including those not covered in this presentation, if you would like now.

Chair: I think just one question. Can you explain in para 60 of your rebuttal evidence your responding to NZTA. You are talking about the TAS for dissolved metals should not be applied as end of pipe standards for stormwater outfalls. You agree with NZTA's statement about that.

Do you mind unpacking that for me? I would just like to understand that better.

Greer: Absolutely. The target attribute states are designed to capture the cumulative effects of all activities in the upstream catchment. Because they apply at sites they are not mean to apply at every single river reach upstream. There's an understanding in them that some sites will be better and some sites will be worse upstream. The target attribute states can be seen as reflective of the average impactable activities upstream.

They are not meant to be applied as receiving environment standards beyond the point of reasonable mixing to control for the direct effects of a point source discharge. That's not to say that copper and zinc shouldn't be considered when consenting a point source discharge and that the water quality be on the zone of reasonable mixing shouldn't factor in, it should just be standard effects based threshold considered in that case and not the target attribute states.

The target attribute states don't reflect the point of significant adverse effects necessarily, or the point where there's a more than minor adverse effect for a notification decision.

McGarry: I'm still one conversation behind. I'm just thinking about that explanatory note for the dissolved copper and dealing with it in the right of reply. I think we would probably be better to deal with it as soon as possible, so that it's visible to submitters.

Greer: In terms of the explanatory note I was suggesting to provide a target attribute state table for both copper and zinc consistent with what you would see in the NPS-FM. I wasn't aware of the scope of an explanatory note.

I was actually thinking about here's the table with the attribute state threshold so people can see here's the possible extent of improvement within the (c) band. That probably needs to be provided somewhere for copper and zinc as well.

I can provide that. I have a version sitting on my computer right now. I can table that tomorrow if you like.

Chair: Dr Greer, thanks for your explanation.

[02.55.00]

I know we don't have a lot of time but just the explanation that you gave in response to the question about NZTA's statement, why I'm struggling with that still (and we might need Ms O'Callahan's help) but there are some policies that are coming up in future hearing streams and I just don't understand.

Policy WH.P6 for instance, which talks about the cumulative adverse effects of point source discharges and there is still a reference in there about declining in relation to the target attribute states.

Why I'm confused is that if you're agreeing with NZTA that the TAS for dissolved metals shouldn't be applied as end of pipe standards for stormwater outfalls, and yet this policy WH.P6 does refer to a discharge being inappropriate if it will result in decline in relation to a target attribute state.

Greer: I believe Ms O'Callahan has some view on this as well, but from a scientific perspective, the applicant should still consider the extent to which they contribute to the target attribute state downstream and the potential for them to degrade baseline state even further from that target, but at the immediate point of reasonable mixing the TAS doesn't apply there. So they need to consider both – their adverse effects beyond the zone of reasonable mixing; and their contribution to the TAS, which can be much further downstream than the zone of reasonable mixing. But, they do need to consider both.

O'Callahan: Is that clear? The policy that you referenced, WH.P6, wouldn't apply to NZTA's situation anyway, because that's just to try and capture the general discharges that are not say falling into the activity specific categories of wastewater, stormwater, rural land use, etc. So that's what that is. They've got to meet both the localised end of pipe issue and situation, so that's dealing with trying to make sure there's no significant toxicity effects in the case of stormwater in the immediate point of the discharge; and then if it's NZTA they've got to deal with

their contribution towards meeting TAS if TAS requires an improvement, or if TAS requires maintenance and it's about contributing to maintenance so that they're not allowing their discharges to increase the pollutants which could arise in a roading situation if traffic increased for example. They would need to contribute to that TAS in that situation.

Those particular ones are for more bespoke discharges – the ones that are not catchment wide rules and policies.

Chair: So relevant in terms of contributing to achieving a TAS – relevant in that sort of 104 assessment perspective; but there's no way, as I understand from what you're saying, of looking at a particular consent applicant's point source discharge and saying, "You breach the TAS," or "you don't breach the TAS?"

Greer: When you're considering whatever activity it would be, that was discharging, when you're considering whether they're contributing toward the target attribute state, in the case of the improvement you would be looking at whether they were decreasing their discharge loads at the point of discharge; and in the case of a maintaining target attribute state it would be if they were maintaining their loads.

They could be doing both of those things and still be generating significant adverse effects beyond the zone of reasonable mixing, which you would then factor into site specific thresholds for copper and zinc when assessing them.

On the other hand they could be contrary to contributing to the target attribute states while still achieving the numeric TAS below the point of discharge. They are two very different things that need to be considered in isolation from each other.

Chair: Thank you I'll just keep reflecting on that one. That's complicated. Were there any further questions about submitter's relief for Dr Greer, before we quickly move onto your view on whether these provisions supported by Ms O'Callahan are they likely to meet the TAS for the various attributes?

[03.00.30]

Greer: In paragraphs 84-90 of my statement of primary evidence I do include quite a complicated method section on how the extent to which the provisions will contribute to the TAS has been assessed. It's too big of a topic to go into today, but if there are specific questions on that methodology, especially around use of Whaitua assessments, I can answer questions on that.

The end result of that assessment is that it's expected that the proposed regulatory provisions of PC1 require outcomes or actions that are likely to achieve between 85 to 95 percent of the target attribute states. However there are a number that will not be met and most importantly a very high proportion of the E.coli attribute states, especially in rural part FMUs are not expected to be achieved by the provisions alone. This remains true even when Ms O'Callahan's amendments to the target attribute states are accounted for.

This is a summary table of the target attribute states that are not expected to be met. You can see that the number is small. You do see E.coli pop up for almost single part FMU.

I'm happy to take questions now.

Wratt: Can I just clarify that the TAS attributes you've got there, is that against what's in the changes made in the rebuttal reports, or is that the s42A reports?

Greer: This is from the s42A reports. It's from my rebuttal evidence which was drafted before Ms O'Callahan's. I just can't remember off the top of my head, but I'm pretty sure [03.03.01].

Wratt: If that is the case it would look different, the table would be different against Appendix 2 of Ms O'Callahan's rebuttal report?

Greer: There would be potentially some changes for copper, where it's been changed to maintain it in a band. I can't requite remember what the part FMU for that is. Then other changes – is Te Awa Kairangi urban in that list, which it isn't; and there would be potentially some changes for E.coli for that first row. Takapū I believe has had a further amendment to the E.coli test in Ms O'Callahan's rebuttal and I would need to revisit. So there may be an amendment to that.

This table was relied on by Ms O'Callahan to further inform her. These amendments did come first.

Chair: These take into the account the longer timeframe for some attributes in achieving the TAS?

Greer: None of my assessments factor in timeframes. They assume full implementation, like where you will end up once you are fully implemented. They don't factor in any timeframe for implementation. They assume that whatever the timeframe is all actions required to meet the TAS are in place and fully mature.

[03.05.00]

Stevenson: I am just trying to get in my mind the planning framework. Although E.coli TAS can then be addressed in out periods through future plan changes driven through the objectives in that 2100 waiora vision - probably to Ms O'Callahan.

O'Callahan: Subsequent to this assessment I have made further adjustments to some of the E.coli; so just to be clear on those, it is the one for Taupō, one for Takapū. Those ones have been moved down to the national bottom line of minimum required improvement. They were rural catchments.

Then timeframes have been pushed out for moderate [03.06.44] ones but that's being driven by the economics work, in terms of where that has an impact around affordability.

I think your question was what do you do about the ones that aren't going to be met. So, there's a mix in there. Some of them are matters that get addressed through non-regulatory methods, so the MCI ones – some examples there. And, some other ones – so fish community health is proposed to be removed in any case. There are E.coli ones that will not be met that are not suitable for non-regulatory methods and that is they would require significant destocking and basically returned to forest. That's not what is proposed under Plan Change 1. Now or in the future I haven't considered a timeframe extension for that, it's just

something that is probably not going to be actually achieved in the current environment, but it is a factor of the NPS.

I probably just need to test with Dr Greer but perhaps the phosphorous ones, were they in a similar camp? I may just come back to you about the phosphorous ones. I'd consider this, but I just can't remember the response off the top of my head.

Does that help explain the concept? There's a mixture of things. We've done what we can on the timeframes where it will make a difference, where there will possibly still be a small handful of ones that the modelling is suggesting may not be met, but that's what will be tracked through the reporting against the targets in terms of the state of environment and monitoring. Perhaps things will be different and perhaps they won't. The Council will need to consider with national direction at the time in the future whether this is still something that is being sought through the national direction in NPS.

Greer: It is important to realise that the inability to meet the targets for E.coli is not a reflection of the particular poor quality of Wellington's rivers and streams. The bottom attribute states for E.coli is effectively limitless.

[03.10.00]

You can have 99 percent reduction required to move on attribute state for that, because you can be very, very far into the (e) band that a (d) band is actually a huge improvement; and you can have massive improvements within that (e) band.

This won't be unique to Wellington these challenges. It's very hard to move the E.coli attribute state.

Chair: We'll talk to Mr Walker shortly about this, but there could be an argument that E.coli as the national bottom line is not going to be met in so many freshwater bodies that does it skew the cost benefit; so that the cost of the network improvements that are needed to achieve it in some places does that sway the equation, because you're not going to be able to achieve the benefits throughout the region with the cost of the improvements that you need to make?

O'Callahan: I don't think the situation is the same between the urban and the rural E.coli. Is that something that we've talked about?

Greer: In terms of costs?

O'Callahan: No in terms of swimmability – the rural sources are not as dangerous as the urban ones.

Greer: Yeah.

In both environments a massive reduction in E.coli even within an attribute state will reduce the human health risk associated with campylobacter. Simply not achieving the target attribute states to apply to the benefits that can be achieved, especially in rural land use areas, you could go from never being able to swim in a river to being able to swim 50 percent of the time within that band and not see a letter change. In urban environments the target attribute states potentially

don't even really reflect the health risk associated with faecal contamination. They are generally derived from campylobacter risks in rural landscapes and raw wastewater has a very different risk profile.

Reducing wastewater overflows reduces that risk by the amount that you reduce. So the number of days that you don't have wastewater contamination is effectively the number of days that you can increase the time that you have primary contact with those rivers.

In saying that, meeting the (c) state in urban rivers does not necessarily mean they'll be safe to swim in either. In rural areas the target attribute states may undersell the level of improvement that's being made within the bands. In urban areas it could be argued the opposite: that simply moving an attribute state isn't the be-all and end-all, it's actually the extent to which you are reducing raw human wastewater and not E.coli concentrations in the river itself. That's the more important thing.

So if these targets still drive the Territorial Authorities to significantly reduce the amount of raw wastewater going into rivers, there is benefits. That's not to say the rivers will be safe to swim in but they will be more safe than what [03.13.53].

Chair: Thank you very much. I do apologise. We've taken up quite a lot of your time – more than we expected. I think we are moving on now to Mr Blyth.

Welcome. I think you were here when we did all the introductions. You know who we all are. We'll pass over to you. Sorry to keep you waiting.

Mr Blyth

Blyth: Kia ora tatou. Ko James Blyth tōku ingoa. [Māori 03.14.42]

Thank you for the delay. I just want to flag, do we need to let Dr Snelder know, he's online, about the delay, or Josh will you be able to do that.

[03.15.02]

Ruddock: I can confirm we are one speaking slot behind at the moment. Dr Ira was scheduled to speak at 2.15 and Dr Snelder was to speak at 2.40. However, I leave it up to the Panel for how they would like to proceed.

Chair: Let's start with Mr Blyth. It might be that we don't have that many questions and we might be able to catch-up some time.

Blyth: Thank you. My name is James Blyth and I am a Water Scientist and a director at Collaborations. I have been involved on both Whaitua processes and supporting Plan Change 1 for Te Whanganui-a-Tara Whaitua. I was on the Council project team and for Te Awarua-o-Porirua Whaitua I helped managing the source model which I will describe today.

Josh could you please skip through the slides.

I have only compiled two primary sets of evidence for PC1. The first is an overview of the freshwater modelling that undertaken in both the Whaitua processes and the second is suspended sediment load reductions required to meet

the visual clarity targets at six sites – five within Te Whanganui-a-Tara and one within Te Awarua-o-Porirua.

There is only three slides up at the moment. What I will do is just talk through an overview of the freshwater modelling and then I will pause for questions, if you have any questions about that, and then I will move onto visual clarity and suspended sediment load reductions.

In terms of the freshwater modelling I'm starting with Te Awarua-o-Porirua Whaitua. That was where the most comprehensive water quality modelling was undertaken. A various number of models were developed and at its simplest level there was an annual average load model called a contaminant load model; that's a spatial model linked to an Excel spreadsheet where you can apply yields such as a metal concentration off a roof, and you can identify every different land use and sum up potential loads might be – annual leverage loads from different land use types.

That was customised through local data and then that information fed into the more complicated model with is the source model.

The source model is 'Source' and is actually the name of the software. It's developed by eWater in Australia. Source is just the name of their modelling platform.

This was the primary model used for that Whaitua and used in Te Whanganui-a-Tara Whaitua as well, as a proxy. That model is a daily hydrological model. You can input daily rainfall data, evapo-transpiration data, land use information across the entire catchment and that's fed into this model and then you can use it to inform changes I guess in hydrology and water quality over time.

The way this is done is that for Te Awarua-o-Porirua Whaitua a baseline model was built which represented approximately the 2012 land use data and it was calibrated to hydrology at four of the Council's monitoring sites. Once a suitable flow calibration was achieved we then moved onto building water quality and contaminant load models within that source model.

So that's where you start modelling things like nitrate and nitrogen, E.coli, suspended sediment.

That process involves also using a range of input parameters for different land use types that are common in modelling literature and you then try and calibrate and model to a satisfactory, good and very good levels based on the Council's state of environment monitoring data.

We went through that process of calibrating each of the different contaminants to a point where we were comfortable that the baseline model represented that 2012 system and climate over a ten year period quite well and a collaborative modelling group at that point, which Sue Ira mentioned earlier was on, they informed yes this is appropriate as a baseline to then start considering scenarios.

[03.20.00] The scenarios are important because they've been touched on by Dr Greer previously but they're basically a sensitivity analysis of how different or

increasing levels of mitigations and land use change within a catchment can have certain effects on water quality and hydrology.

There are three scenarios that were considered and these were developed by a modelling group within the Porirua Whaitua; so that's business as usual which generally represented what a natural resources plan would be; then there was the improved scenario and water sensitive scenario. Water sensitive is the most intensive treatment option I suppose.

It was hopeful that would give a guide to the committees about this extent of advice and land use change, such as pole planting or retiring rural land, adopting a whole bunch of treatment and water sensitive design such as rain guard and zinc constructed wetlands in the urban environment; and it also accounted for growth.

Future growth was predicted. For example, the northern corridor heading up where Plimmerton Farms is going in, some of that was included in the modelling as well.

Those scenarios were built – incorporated those mitigations and then used to predict the changes in water quality of all the different contaminants. That was then compared back to the baseline model and kind of for simplicity linked back to I guess attribute states like in the NPS – a, b, c and d.

The Whaitua Committees had that data available and used that information from the modelling to inform, and their own values and economics to inform possibly where targets could be set.

That was the primary model for Te Awarua-o-Porirua Whaitua that fed into a dynamic coastal model, harbour model. Mr Oldman will talk about that in a day or two about how basically the outputs from this freshwater model was used as inputs into that.

In addition, moving onto Te Whanganui-a-Tara Whaitua, there was a shorter period, it was only a two year process for that Whaitua. And, because of similarities to Te Awarua-o-Porirua the source model was actually used as a proxy. So there is no comprehensive source modelling of contaminants in that Whaitua; instead an expert panel of a number of scientists was organised and they used similar catchments – catchments of similar land classes and catchment size to the Porirua Whaitua. They used outputs of that model as a guide about what the water quality changes could be and they assessed the exact same scenarios.

The expert panel more did it in a qualitative way using a whole bunch of information from science libraries and some of this modelling data.

Essentially they then also predicted what they thought the attribute state changes might be and the Whaitua Committee used the expert panel report to help inform how far they could get in terms of targets under those different scenarios in the Wellington Hutt Valley.

I will just pause it there. Happy to take any questions. I realise there's a lot of complex jargon in modelling so feel free if you need clarification. Thanks.

McGarry: Thanks very much for your evidence. Very helpful. I'm very conscious that the water quality you're modelling relies on inputs from numerous other models. I just wondered what that results in, in terms of compounding levels of uncertainty with models built on models and models?

Blyth: Thanks for your question Commissioner. I guess every model needs input data at some point and it's informed by both monitoring data that's available and the Porirua Whaitua the contaminant load model, which is something that was developed in Auckland, that's based off stormwater monitoring data from different types of land uses – for example, collecting run-off from rooves to understand what some of the yields might be zinc and copper. That was customised as best as possible for Wellington specific monitoring data and stormwater data from a range of sources.

Then that's fed into a model and through the calibration processes where those uncertainties and those inputs kind of can be manipulated with international literature like appropriate bounds; so what are common parameters that are used.

[03.25.10]

As long as you stay within these well published parameters and don't step outside them through that calibration process you can manipulate some of those inputs to try and line up to the state of environment monitoring data.

There's always going to be uncertainties in models but in terms of the tests there's some quite well-published papers and I reference some of them in my evidence. Most of the contaminants were good, very good and I think there was only one that was satisfactory. But, all of them passed that stress test I guess for international literature around model performance and uncertainty.

McGarry: You mean good and satisfactory in terms of calibration of what you would expect to see?

Blyth: Yes, that's right. Those papers have tables of quite specific bands that if you achieve a certain… there's various metrics, such as the Nash-Sutcliffe efficiency or PBIAS which is variability plus or minus the observed results. Those are all tests that are run on the model data compared to the observed data and then categories of good, very good, etc.

I think I have listed in the evidence how well they performed against those international metrics.

McGarry: In terms of the yields, I'm looking at your paragraph 34 of your evidence. You're talking about the ceiling developed for the Porirua Whaitua. I'm just looking there and you've talked about roads, pave surfaces, urban grasses, trees. I just wonder, is there good estimates available for contaminant loads or sediment loads from forestry land pre and post-harvest?

Blyth: Thanks for your question, that's a good one. I will address that in detail in Hearing Stream 3. There's a section of evidence that's being prepared at the moment which isn't available to the Commissioner but there is a lot of detail

about pre and post-harvest sediment loads and relative comparisons to pastural land, which perhaps if you're happy we can leave it till that hearing stream.

McGarry: In paragraph 55 of your evidence you've got a sentence here at the end saying, "Greater attenuation and load reduction was evident through calibration in the rural environment compared to the urban for all contaminants." I just wonder why that is.

Blyth: It's a combination of rural environment streams and some of it is stream length and hydrologics and rainfall runoff, or natural hydrology that's happening within those stream systems and there's also some attenuation within riverbanks, filtration, benthic recycling in urban streams that are usually shorter and steeper, or more paved. You have less time or residents' time for attenuation.

McGarry: Just one last one and it's really this accounting for climate change. I'm at your paragraph 70 now. You touched on it when you spoke to us just before. I guess it's something that's played on all our minds here in terms of we thought or not it has been taken into account in this modelling work. I guess you have said in paragraph 70, "No climate change modelling was undertaken in the source model," and then in the last part of that paragraph you say that the Committee could only account for climate change in a qualitative manner.

I just wondered if you could explain to us what you mean there?

Blyth: Essentially, my understanding in correspondence with people involved in the development of those scenarios, it was deemed it could be relatively complex to try and run a number of quite extensive scenario packages and then add climate change on top of it which could make it harder to discern the results when compared back to the baseline.

[03.30.05]

I believe there were a number of presentations about future climate change predictions that were given to the Whaitua Committee. But, it wasn't extensively modelled. So that was more narratively that they were aware climate change was an issue and they're likely to get more intense short duration events, and that was I guess part of their knowledge bank when they went into setting target attribute states and timelines.

Wratt: Could I just explore that climate change one a little more. You mentioned more frequent high intensity events. There are I guess other climate change considerations like temperatures, droughts or other potential climate change factors.

Blyth: Yes Commissioner, a range of factors; so increased evapo-transpiration, greater periods or likelihood of dry days, temperatures or hots days increasing over 25 degrees – the number of hot days increases over time as well.

I'm pretty sure NIWA has done some quite good climate change modelling predictions for the Wellington Region that were available and you can spatially see in different areas; you can click on a cell and basically get a predicted output in certain timeframes of hot days, rainfall intensity at certain timeframes, like 2080 and 2120, which align with the RCP climate change scenarios.

Wratt: So when you say those were qualitatively considered and the WIP committees understood them, were they taken account of in any way, or the process to date has really just been in terms of the climate expectations based on what there has been in the last however many years.

Blyth: I would say the latter, yes. I wasn't involved in the actual Whaitua meetings in Te Awarua-o-Porirua Whaitua, but I was through Te Whanganui-a-Tara. My understanding is exactly that, that they were aware of some these projections about drier conditions or more intense rainfall. As far as I'm aware that was kind of a general consideration when they were going through a target setting process and thinking about timelines and limits.

Greer: If you don't mind me jumping in here quickly: I was the technical lead for the Te Whanganui-a-Tara expert panel. All of the components of climate change were baked into the assessments provided to the Whaitua Committee out of that. We considered the impacts on flood frequency and also reduced summer flows and extended dry periods.

Even if the Committee didn't themselves factor all of that information in from a scientific perspective the expert panel certainly did on their assessments that were being provided to the committee.

Wratt: So when you say they were baked in, what does that actually mean?

Greer: There was a current state assessment that was provided and then there was a BAU scenario that was provided. That BAU scenario incorporated an expected future under climate change and then all of the mitigation scenarios that were on the BAU scenario – not the baseline. They reflect a future where I believe climate change to 2090 had had its effects and the benefits of any mitigation was offset or compounded by those climate change effects.

When the committee were assessing the benefits of specific mitigation they weren't considering the benefits from today, they were considering the benefits we will have once the effects of climate change have been realised at 2090. I believe it was from that point scenario, 2090, that was considered by the expert panel.

Wratt: So how is that then reflected? Is that reflected in policies?
[03.35.00]

Greer: I assume when they were looking at achievability and under the different scenarios when they were looking at the outcomes of certain actions they may not have been aware of the fact that there was climate change driving reduced performance and certain mitigations. But, when they looked at what was available through say a stormwater sense of urban design scenario, it was with the effects of climate change in place.

The biggest example is probably sediment. In the western hills under climate change scenarios the expert panel assumed a large increase in sediment input under the business as usual scenario because of climate change. So when looking at the impacts of retirement and space planting on those hills, the expert panel considered first an increase to your climate change and then the benefits of those

mitigations from that starting point, which if they had assessed it on the baseline the effects of those mitigations looked a lot larger.

It just factored into however they could use the scenario assessment results to set the targets. They were just implied in every aspect of that.

Wratt: Thank you.

Kake: Just wanting to clarify I think it was just two natural hazards that you mentioned with respect to the climate modelling. Was it just the flooding and the drought?

Greer: This is going back quite a few years. For every river reach there were statistics provided for increase in flood frequency and magnitude. James, jump in if I'm saying something wrong. Then there was a change in seven man annual low flow was the summertime statistic to reflect how much water levels are going to drop over summer, which is then a proxy for temperature, dissolved oxygen and plant growth. The panel did consider all of those when considering those attributes.

Chair: Thank you. I think we are up to your sediment note reduction evidence thank you.

O'Callahan: Can I just note that this is the evidence that relates to one of the ecosystem health policies, is that right? Yes. So this is taken out of order. We will come to the provisions that this relates to on Thursday I think.

Blyth: There's two slides on sediment. Just a correction: it says 'fine suspended sediment' but that should be 'suspended fine sediment' in the NPS.

There are six sites that have been set through Tables 8.5 and 9.4 in PC1 that require load reductions to achieve their clarity states. The individual clarity states have been assigned by Dr Greer and Ms O'Callahan in I think Tables 8.2 and 9.2.

This next slide summarised the approach that was taken to, I guess, predict the suspended sediment load reduction that would be necessary to meet visual clarity. In a natural environment, in a stream or river setting there's a relationship where fine suspended sediment has negatively correlated with visual clarity, and that chart in that slide is a useful image whereas you have higher suspended sediment you will have lower visual clarity.

The slope of that line is implied in the example is Makara and that will vary depending on catchments and local monitoring data. It will vary by climate, by land use, by geology and by naturally occurring processes such as the Mangaroa River's contributions of peat tannins, which was identified through this plan change process.

The Council undertakes state of environment monitoring. They collect suspended fine sediment through monthly sampling and undertake visual clarity measurements. Through this process we recognise that there are six sites. Five of them in Te Whanganui-a-Tara and one within Te Awarua-o-Porirua Whaituas, that were requiring sediment load reductions to meet their NPS-FM visual clarity target states.

[03.40.05]

In addition, my primary evidence addresses that I have utilised a longer dataset. Previously in 2023 we had only used a five year dataset and this has not been extended to roughly eleven years. Also the medium clarity state has changed to reflect the baseline aligning with Dr Greer's evidence. The baseline is now 2012 to 2017 for the median clarity states.

We have also undertaken a colour correction – a colour dissolved organic matter [03.40.42] on correction, which Dr Valois will talk about shortly and that's shifted the national bottom line to a site base bottom line. So it's shifted Mangaroa from 2.22 as a target to 1.67.
The approach to predict the suspended sediment load reduction is relatively simply. You plot the visual clarity monitoring data-peered samples where they collect clarity measurement and suspended sediment. You plot all of those up and then put a power equation through it. Then using some of the variables there you can then apply a reasonably simple formula to predict what reduction sediment is necessary to achieve that target visual clarity state.

I have highlighted there that the plan changes notified in Tables 8.4, 8.5 and 9.4 identified a D-SegNet modelled load; so I have recommended of any reference to that model.

While a model was built for that Whaitua it's just a baseline model and that was more an indicative load, but I don't believe it should be included in the plan. This approach, this method that's been adopted is based off monitoring data, and while the monitoring data is monthly it's the best available for a lot of the Whaitua and plan changes.

Then in addition I have also advised the Mangaroa River sediment reduction. That's another notable change, where that's reduced down to approximately 17 percent.

I am happy to take any questions around visual clarity and load reductions. Thanks.

Stevenson: I'm interested in the D-SegNet model. One of my questions was going to relate to the accuracy and it's applicability at a site level. It's more a regional modelling tool. I'm interested in your views regarding that, acknowledging you have recommended it's removed from the model.

Blyth: Thank you Commissioner. D-SegNet, people may be familiar with the national SegNet model which is a static annual average load sediment model that predicts erosion from different sources such as land-sliding, [03.43.32] stream bank. PC Net is similar but it was one of the first applications in this country and it's specific to the source modelling platform. It's essentially a daily sediment model that's predicting loads from land-sliding, surface and stream bank. It was possible because the Council recognised the Whaitua process and installed a number of continuous turbidity and suspended sediment monitoring sites in Te Awarua-o-Porirua Whaitua. So they managed to collect three to four years of continuous sediment data which enabled this more dynamic sediment model to be calibrated and that's in the overview of my primary modelling evidence. There's a chart showing the calibration performance from that D-SegNet model

to observed data. That was, I would say, state of the art at the time. There was no other Council that I was aware of that was modelling sediment and calibrating it to all the sampling continuous records for three to four years at that point.

So that's a robust modelling exercise to give data. However, that continuous monitoring record does not exist for Te Whanganui-a-Tara Whaitua. There's three sites in Te Awarua-o-Porirua that have been continued, they're getting up around that ten years of data now; but the rest of Plan Change 1 there's no additional monitoring.

[03.45.03]

The D-SegNet model that was built for Te Whanganui-a-Tara is simply based off calibrated parameters from Porirua. It's not calibrated to actual sediment data within that Whaitua, hence there's greater uncertainty around how it's predicting things as you move into some of the headwaters or into different geologies.

Hopefully, that helps.

Stevenson: Thank you Mr Blyth. So is it readily transferrable, the Porirua data to the Te Whanganui-a-Tara context?

Blyth: Yes it is. It's transferrable particularly for catchments in closer proximity to Porirua. I would say the Makara catchment, [03.45.55]. But, as you move towards say the Orongorongo River you're starting to get to a point where you would want to have additional monitoring data to confirm.

You can still run D-SegNet model and calibrate it to state of environment monitoring data, but the problem is it misses and may miss some of the really large events. Over time you'll capture enough events but continuous monitoring is really useful for highlighting the effects of a landslide and that was captured in the source modelling for Porirua where a landslide event occurred in Porirua Stream that brought the same sediment load that was equivalent to previous annual loads for the last two years – and it brought it down in three days.

If you didn't have continuous monitoring, state of environment monitoring, you'd miss that type of data unless somebody was keen enough to be out there sampling in that flood event.

Chair: Mr Blyth you might be aware that the TAS, some attributes and some part FMUs, the reporting officer is supporting our relaxation largely for feasibility and achievability reasons. Has there been any revised modelling work done, the context of those new recommendations and sediment load reductions that are needed – land use changes, just basically where or how the new recommended TAS might be achieved, where in the region the changes are going to need to occur to reduce sediment loading?

Blyth: Thanks for your question. This is a little bit nuanced I suppose. The primary evidence I have which identifies the recommended updates to Tables 8.5 and 9.4, that's probably closely aligned with Ms O'Callahan's for those six sites that require sediment load reductions.

It's a good segue actually, because in my rebuttal evidence in paragraph 8 I have identified that an additional model has been developed. This was in part of my

primary modelling evidence because we hadn't developed it at the time, but in the last three months we've amalgamated those annual average load models for all of PC1 which will be presented in more detail in Hearing Stream 3 and 4, relative to the rural land use and metals topics; but that seeks to simulate the Plan Change as notified on an annual average model, and then run revised provisions that are being considered at the moment.

Chair: Thank you. When we do see that, which might be in Hearing Stream 3 we would have a better idea. It's really the whole picture as I see it.

[03.50.00]

What is required to achieve the suspended fine sediment TAS, the loading reductions that are needed, where they're needed, what actions, what land use changes, what other changes are needed to achieve those – that is something we'll have clearer picture of in Hearing Stream 3?

Blyth: Yes, that's correct. The sediment provision in particular were a focus of this revised annual average load model, and that included trying to model the as notified PC1 provisions; for example, identifying highest erosion risk land which may need to be retired to woody vegetation by catchment and then retiring it that and reducing the sediment load from that area by the appropriate factor in national literature.

There will be an output from that technical memo that will provide a summary by target attribute site about the percentage reductions that will be achieved in sediment and metals by notified provisions.

But, it's only annual average loads. It's not for concentrations relative to not attributes, because you need a hydrological model to do that with confidence.

Chair: Finally, I'm sure that I've seen somewhere in the Council suite of evidence there's a memo from Stantec I think to Wellington Water. It appears in Wellington City Council's evidence, but I think it is included in the Council suite. There's some tables at the back of that which talk about the required load reductions for metals and E.coli – so not sediment.

Do you know what I'm talking about? Is this based on a different model – and I know or I think you're focused on sediment load reductions. I think the question is, is this something that we can also look at as part of our analysis? I'm sorry, I think it is somewhere in the Council evidence too but I just can't find it.

Greer: Mr Cameron – I think it's originally appendicised to Liam Foster's statement. Wellington Water has imply extrapolated the low reductions in my Table 18 of my statement of primary evidence, to the Wellington Water's hydrological sub-catchments.

He's basically just the part FMU number and applied it to the sub-catchment based on whatever party can make use of it. He doesn't actually do any new modelling for it. It's just a spatial exercise.

Blyth: It's a good point and it's worth flagging that we haven't modelled E.coli in this revised annual average load model. There won't be any extra notified plan change modelling of E.coli in Hearing Stream 3 or 4. Thanks.

Chair: Unless there's anything else, thank you very much for your evidence. We will hear from you in Hearing Stream 3.

Dr Valois we are very behind. Over to you. We have read your primary evidence in chief and your rebuttal. Over to you.

Valois: Kia ora my name is Dr Valois. I'm a Team Leader for the monitoring water team at Greater Wellington. I have been here approximately five years. Before that I was working at NIWA as a freshwater scientist. My background experience is in water quality.

I'm going to give evidence relating to the application of setting objectives for suspended fine sediment in the Mangaroa River, as well as submissions that the dataset is too small for correcting the national bottom line.

According to clause 3.32 the NPS-FM states that if a water body is affected by naturally occurring processes that means that the current state is below the national bottom line and a target attribute at or above the national bottom line cannot be achieved.

[03.55.07]

We can set a target attribute state as below the national bottom line; and so the Mangaroa River has a large peat land and because of that a lot of colour dissolved organic matter that influences visual clarity measurement and I guess monitoring for CDOM or colour dissolved organic matter has shown a high amount and relatively consistent amount over the nine monitoring times that we have collected data.

The target attribute state was recalculated using this data and recommending a national bottom line for the site of 1.67 metres. Although the dataset is small it really shows minimal variation and is consistent of what would be expected from the literature and is the best available evidence for recommending a new TAS for this site.

Chair: Thanks very much. That was very clear. Does anyone have any questions?

McGarry: Thanks for your evidence. You said it's a small dataset with minimal variation but you do acknowledge that you haven't really captured high flow data, is that correct?

Valois: We have not collected any data above I think its 10… we are missing the very high flows and I don't know where I have the number; but we have 90 percent of the flows. We don't have the top I guess 10 percent over the last five years, and that's just very hard to capture.

Those very high flows though we've shown have a very minimal amount of CDOM. They are dominated by sediment. At high flows the visual clarity measurements are about 98 percent due to sediment, and about 2 percent due to CDOM, which is what would be expected.

So even though we're missing that top 10 percent at that point it is almost virtually all sediment.

McGarry: So you aren't recommending an interim or anything like that on more data? You're comfortable based on that last response, that this is a permanent recommendation?

Valois: I do recommend that it is permanent. It is an estimate but so is a median. It is a recommended median. Using the data we have we'd done simulations using different numbers across this kind of current distribution of data and that would only change the TAS as low as 1.58 metres and maybe as high as 1.7 metres. So although we don't have maybe that exact number within two standard deviations the change would be so small that it wouldn't really affect the calculation of a five year median.

Stevenson: Thank you for your evidence. I'm interested in for Mangaroa the visual clarity TAS has accounted for natural colour. Thinking about implementation are there other waterbodies across the two Whaitua where ways of measuring visual clarity should be clarified for consent applicants, in your view?

Valois: Visual clarity is mostly impacted by sediment but there are two other light attenuating attributes, or light attenuating constituents that would affect visual clarity and that's phytoplankton and CDOM. Phytoplankton would only impact areas where it's a hydro lake – so this is not in the areas that we measure; and also CDOM is what…

[End of Part 2 – 04.00.00]

[Hearing Stream 2 – Day 2 – Part 3]

Valois: There is large wetland or peatland and unfortunately Mangaroa is the only significant source left in PC1. As far as peatlands go, no other area has ones of enough size that it would actually change the concentrations of organic matter enough to influence visual clarity.

Chair: Thank you very much. Apologies again for keeping you waiting. Your evidence is very clear. Thank you.

I think we will turn to Dr Snelder. Sorry, we are still a speaking slot behind. Is Dr Snelder available online? Then we'll take the break after that and hopefully we won't need to go too much over five.

The alternative is that we take a very short break now and come back in ten minutes. We can take a break now then Dr Snelder and then Mr Walker.

Let's do that. I'm just conscious of giving everyone enough time. Let's come back at 3.10pm. Thank you.

[Adjournment – 00.03.30]
[Hearing Resumes]

[00.16.15]
Chair: Kia ora everyone. Sorry again for the scheduling delays. I think we are still having some technical issues getting Dr Snelder online. Mr Walker you're here.

Would you be willing to present your evidence now? We will hopefully be able to talk with Dr Snelder after.

Thank you very much. We have read your evidence in chief with a lot of interest and also your rebuttal. Did you have a presentation?

We will see how we go for time. We don't want to keep Mr Walker waiting any longer. But, Mr Sharp if you're able to stay around for a bit.

Over to you Mr Walker.

Walker: Kia ora koutou. I'm David Walker. I'm the Market Leader for Business Advisory at GHD. I'm a CA and trained economist and have worked in microeconomics for quite a number of years – principally at PwC and now at GHD.

In terms of my evidence, as the background highlights, this was produced in response of PC1 submissions which raised issues of affordability and a need for economic analysis. The initial focus was on the direct cost impact to ratepayers through to 2040.

In terms of the scope, this is very much based around the estimation of costs associated with upgrading the existing wastewater and stormwater assets, and also an estimate of costs based on targeted interventions for E.coli, dissolved copper and zinc.

It's probably useful to point out that we weren't scoped to do a full cost-benefit analysis. Our focus was on affordability and achievability.

I would also note in terms of exclusions new greenfield assets were assumed to be covered by direct growth funding mechanisms, such as development contributions which applied on new developments to fund either for structure impact of those developments.

Similarly, costs attributable to other landowners such as NZTA which was discussed earlier on, they're assumed to have their own funding mechanism – which they do. NZTA aren't funded through the rates mechanism.

[00.20.00]

In terms of the methodology I used, it was based on basically four steps, heavily relying on the scientific and engineering impact to initially estimate the load reductions required; and then from those interventions the scientists and engineers had to define what that would require in terms of infrastructure interventions.

There were a number of options with those and that's why we looked at both high case scenario and a lower cost scenario, because there is a different mix you can use.

From gaining those interventions we were able to cost that using a combination of our own professional experience and also utilising Wellington Water, where they were able to contribute.

That then gave us a cost-base from which we could undertake the fourth step, which was to understand how those costs proportionally related to each Council area; and then from there we were able to understand the cost impact to ratepayers in those areas.

In terms of the outputs, as the first chart on the right hand side of the screen shows, when you actually look at s42A recommendation, the cost goes from a potential low option around the $2.4b through to the high cost option which is $3.6b.

Then using the actual rates that we know are already imbedded in Council long-term plans, we were actually able to place these new numbers on top of those predicted and forecast rates increases to come up with the incremental rate step that would be required in each Council rating area. By doing that, we have been able to form two tests in terms of the affordability – one is, what that a total step change rate increase in line with recent rate increases that have been happening across each of those councils; and secondly what we call the Shand inquiry benchmark, which has estimated that around about five percent of rates, of household income, was in the acceptable bounds of affordability for ratepayers.

As I have stated on the chart here, in the case of Wellington City, even without the s42A recommendations they will breach through that at five percent barriers, as shown on the lower chart. As you would have seen the evidence, there are two councils that stay within the five percent and there are two that would go over.

My initial evidence indicated that the recommendations around the 2040 targets were too severe and would be too unaffordable and unachievable.

What we were able to do is, because we'd built the data up from the PMFU levels, we were able to basically scenario test different end dates for the projects that were required within each PMFU. You can see in the top table on the right hand side of this chart there's a mix where we've landed on what is thought or seems to be the optimal mix, which still has eleven PMFUs completed by 2040, there would be two by 2050, and five by 2060.

[00.25.00]

It's interesting that the numbers change significantly as you obviously go through the years and extend it out. What we found is that when you model everything going to 2060 it actually wasn't that much more expensive in terms of the rates step change, than if you actually went for a mixed model, which has a range and has the advantage that obviously the majority of the PMFUs are still completed by 2040. We thought that looked like quite an optimal result.

What it does in terms of rates step changes, as we've shown in the lower chart, in terms of the Lower Hutt City example there, it's a 15.1 percent increase, and that's the highest single step change increase across the councils. The others are lower including Wellington City which is only 11.5 percent.

I would also make the point that with that chart we are talking about a single step change. The reason we've represented the chart as it is, is that it actually shows you over the long-term where you get the drop-offs as the PMFU works are completed. So we are not saying it's 15.1 percent every year, it's just that it

shows you the 15.1 going through to the 13 percent at the end of the period in 2060.

The outcome going back to the Shand comparison, we tried to illustrate with the top two charts here, where we are showing Wellington City, which as I mentioned earlier is going to breach that five percent benchmark whether or not the s42 recommendations go through, and the other example is Upper Hutt City which has the lowest rating against the almost favourable rating against the benchmark.

What it actually shows is the actual s42A recommendations only attribute to less than .5 of a percent increase in that comparison. If you look at the Wellington City chart the yellow line is the current rate growth which goes over the five percent. The high rest in it is the breadline. As you can see, it's only a marginal increase.

The next point I would like to make relating to the bottom chart on the right hand side is achievability. What was shown on this chart is there's a red line which finishes at 2040 which was the original target dates. That shows a requirement of about $220m spent per year, but by moving to this mix model, which is the green line, you can see that it actually comes under what the current Wellington Water annual renewal spend is at $150m. So that's much more achievable.

The actual expenditure, if s42A was adopted on the mixed model, would still be higher than the $150m shown by Wellington Water. But, in terms of what analysis we can do of the proposed spending in the long-term plans, with regard to projects that were of the same nature of the s42A improvements, there actually wasn't a lot.

A good proportion of the Wellington Water expenditure over the next ten years in that black line actually relates to items such as wastewater treatment plant upgrades, which once they're completed will actually drop off, which will actually then increase the capacity of Wellington Water to spend this higher amount that would be required with s42A.

[00.30.00]

I think that probably concludes the presentation of the key points from my evidence.

Chair: Thank you very much Mr Walker. Who would like to start? Commissioner Wratt.

Wratt: Thank you Mr Walker. Looking at your bottom right graph there, spend required, I'm just not very clear. You've got $150m as your black line, but then your blue, green and yellow lines are below that. So are you actually saying that the spend would be less than what is currently planned on Wellington Water best value improvements? Or somehow do they have to be added together?

I might be being really obtuse, but I don't quite understand what that graph is telling us.

Walker: Yes, they would have to be added together, but the point I was trying to make about the black line is that the black line is Wellington Water's current capacity in terms of what it is able to deliver in terms of physical projects.

The point I was making about the black line is that it will come down over the next few years as these wastewater treatment plant costs drop out, which by implication mean they've got the capacity to fill up the void with these additional works required under the s42A recommendations.

Wratt: I'm still not quite clear about the green TAS extended mixed timeframe spend and how that relates.

Walker: I will just go back. If we go back to this chart here, the top right hand chart, that's what we are referring to as the mixed model, because there's a mixture of days. By pushing a number of the PMFUs out to 2050 and 2060 the nett result when come to the affordability chart is the red line up the top, which finishes at 2040. Effectively that's replaced by the green line. You can see the effect of the expenditure being spread over a longer period, and that compares favourably to current Wellington Water spending.

Wratt: But, you would have to add – in essence what you're saying is that that black line would probably drop off, but you would have to add the black line and the green step line together, to get the total spend on existing planned work, plus work for the document PC1.

Walker: Yes, that's correct, but what we're saying is it won't be a hundred percent.

Wratt: And, that's where you get the percentage spends in your previous rebuttal evidence. On page-8 you've got three charts there showing Lower Hutt, Upper Hutt and Wellington, from 7.2 percent to 13 percent for Lower Hutt. Those are the combined.

Walker: Yes. Correct.

Wratt: I think I've got my head around that one. Thank you.

Stevenson: Thank you Mr Walker. A question that we revisited with a few experts over the last couple of days is what's required in order to meet current standards – so I would imagine the $150m black line for Wellington Water's projected expenditure and has that taken into account compliance with existing standards, and therefore what is the additional expenditure needed to meet the requirements under Plan Change 1.

Walker: We haven't got a precise number for that, because it is very difficult to build up from the Council long-term plans.

[00.35.00]

But, I did note in the evidence that Wellington Water is actually currently dropping the number of network improvements in these years as they're doing their wastewater treatment plant updates, which is actually putting the whole network renewal programme further behind.

Certainly, they're literally going backwards and not keeping up with required standards.

Stevenson: Does that mean then that the costs attributable to upgrades needed for Plan Change 1 can't be quantified against maintenance and renewals to meet current standards, with the information you've had?

Walker: Not with the information we've had. We did an analysis of each of the long-term plans, but it's just too high level in general and we obviously engage with Wellington Water as well, and there just isn't enough granularity in the data to actually do that exercise without further work.

Wratt: Can I just explore that a little bit. To be blunt, I guess, the question is, it's going to cost what it costs to do these improvements, but actually hidden in these costs is the message that what's being said, "This is the cost of implementing the PC1 changes," is that actually a cost of catching up with work that in essence should have been done previously – and I'm not talking about the Waste Water treatment plant, but all this stuff around wastewater pipes and stuff that should have been being done anyway, is that distorting the real cost of the implementation of PC1.

Walker: What we have come up with is a normal encompassing cost which includes both elements. What we can't do is say, with any level of definition, what is the catch-up piece and what is the increment required for these standards.

Like I say, the data just isn't available to actually tease those two components apart.

Wratt: I think I understand that. It does give, you could say, an erroneous message about the costs of what's come out of the WIP processes and what actually is cost of the improvements to meet TAS attributes.

Walker: Yes.

McGarry: On a similar line of questioning, is there a risk here that we are double-counting the costs, because the black line has already got costs of the councils that they've given you of work that they need to do for maintenance, repairs or replacing pipes that should have been done? Is it possible that you've counted then work that needs to be done to meet the standards of PC1, or to meet the outcomes of PC1? Is there a risk here that's been a double-counting? Because if that work is not done by the Council wouldn't that be double-counting.

Walker: I might defer to Dr Greer here as well, but my understanding is that what has been defined is like the end state of where we want to get to. So whatever is the current state you're not double-counting, or having to do what we have defined, and in this programme it costs to actually get to that end state.

I'm not sure if you can add anything to that Dr Greer?

Greer: I'm not sure that I can. I'm not entirely sure that I can sorry.

O'Callahan: This is the issue that I tried to clarify earlier today.

[00.40.00]

This is the mechanism for enabling the regulatory response. These pipe repairs are required for water quality improvement. This is what we are introducing here.

I'm not clear when you're saying this has been a standard or something that's been required all along. I don't find that particularly clear in the operative NRP because it doesn't deal with the dry water [40.36].

What I think Mr Walker is trying to say is that we're at a current state of water quality in terms of the E.coli attribute in particular, and we've got to get to this point. That is what he has quantified.

So, whether it is something that is deferred maintenance that should have been done (bad councils) or whether it's something that is required because of Plan Change 1, it's a cost required on the community, and that's what the information is trying to portray.

Greer: If I could just add something. I think if the existing environment assumed that these leaking pipes were not part of the existing environment, the whole approach taken in PC1 would probably be different. The urban area would be identified as not being a significant contributor to E.coli and therefore the need for management would not be there, to require them to reduce further.

It's not so much we're saying part of the discharges should be factored out from the current state. If one of them should be they probably all should be. If they'd been doing everything right we wouldn't be regulating them under PC1.

O'Callahan: That just really highlights the point that we are not considering something, like in a resource consent situation against the existing environment; it's the existing environment that we're trying to fix.

Blyth: I'm unsure if the Panel have read the wastewater and stormwater report that was developed for Te Whanganui-a-Tara Whaitua. That may provide a bunch of context around the extent of the condition of some of these wastewater pipes. As an example there is 583 kilometres of grade 4 and 5 wastewater pipe, and the CapEx expenditure in 2018 and 2019 was roughly two to three times lower than Auckland. So there are comparisons in that report about what other councils have been spending and the extent of pipes for that snapshot in time by catchment. That's for stormwater and wastewater.

McGarry: So, Mr Walker what you're telling us is the level of information you have doesn't allow us to have any more finer grain information in terms of what those costs are, and just an overall cost to meet the end point of the water quality that the stakes [43.41] or the environmental standard?

Walker: The costs we've estimated give an indication of the cost to actually get to the Plan Change 1 outcome. As we've been discussing, we haven't got enough information to actually estimate the cost of the impact of Wellington Water being behind on their renewal programme.

Wratt: I appreciate that what we are saying is this is the cost of doing what we need to do, but from my perspective there is a message there [inaudible 44.46]. If everything had been done when it should have been done then [44.59].

[00.45.00]

Just from a transparency point of view, they're not just costs associated with… well, they are costs associated [45.13]. They aren't costs that are just a result of PC1, they're costs of a historic situation of underspend is the message.
Personally, I think it's important to be transparent about that in the messaging around PC1.

McGarry: Thank you for your rebuttal, because one of the questions I had from your original evidence is whether there was any evaluation methods for putting a money value on reductions and infection risk. You've come back in your rebuttal and given us a willingness to pay type of thing, which is sort of the non-market evaluation techniques for other environmental services that get used isn't it – you know, what people are willing to pay.

There's nothing else in terms of cost to the health system, or anything like that, of infections or human health. There's no other evaluation techniques?

Walker: There are other evaluation techniques. Certainly, what we have presented here was only one component of the benefits. It wasn't in our scope to do a full cost benefit analysis, as I outlined earlier on in the presentation. There's all sorts of other benefits like economic tourism, recreational, which certainly haven't been costed, but there are techniques by which you could estimate them if you went through that exercise.

Kake: I'm just picking up on that point a little bit and going to your primary evidence at paragraph 68. You've mentioned that some of this work has been done elsewhere, and in particular I think you've referenced the Waikato.

Just so I'm clear, when you mentioned a full CVA wasn't undertaken in a full CVA would your environmental, social, cultural values be evaluated?

Walker: Obviously, it would come down to what the final scope was, but certainly that would be taking it to its fullest extent, if you actually assessed it against the four wellbeings. That's correct, yes.

Kake: An additional question, which kind of leads back to I think someone mentioned grade 4 and 5 pipes.
I suppose in your opinion and based on this evidence is that a good starting point?

Walker: Yes. The upgrade of the condition 4 and 5 pipes actually formed a large component part of the costings that have gone into our overall forecast estimations.

McGarry: Is there any ability to break down your cost estimates to those required to prevent your dry weather contamination versus wet weather; so taking out kind of the overflows and what I would call more upgrade works, rather than the kind of fixing faults?

Walker: The numbers were really predicated on targets against the dry weather flows, rather than the wet weather. Again we didn't have that sort of differentiation between the two.

[00.50.05]

Greer: In terms of what was provided to GHD for the economic assessment, I was looking at the load reductions that were required to achieve the E.coli and options were provided to GHD in terms of how they could be achieved through prioritising wastewater overflows, prioritising dry weather lakes, or a combination. In many places it was only one, where the loads were predominantly from wastewater overflows. The only way to achieve the load reduction was generally through managing wastewater overflows, and in catchments where the load was predominantly from dry weather leaks that was the only option that came out of that analysis. But, there were in some catchments multiple options provided. I'm not sure how they were incorporated or which one was selected in each part of FMU.

Walker: That information went into our high and low estimations. We created the band between what we thought were the lowest cost estimations versus the higher cost estimations. That's how we use that information.

The actual recommended mix of maturity for the PMFU outcomes is actually based on the high numbers not the low numbers.

McGarry: Just back to that double-counting and your response to that.

If there was programmed work replacing pipes that's been deferred and the money has already been collected through rates, then you've accounted for that in that your work takes in the total spend and then the extra spend on top of that. So it's not dependent on whether that money was spent or not – it's just the total.

Walker: Yes, it is just a total, but in reality when it comes to implementation Wellington Water would have to actually re-evaluate that whole current programme. You might end up with a slightly different variation between where they're currently at and what we are suggesting, because it will depend on the mix of the projects – because even they're not currently the final. You almost have to take each PMFU by PMFU when you get down to the technical solutions, because outlined there are different options and some are more expensive than others. I would imagine Wellington Water would decide that at a programme or at a project level.

McGarry: In your view is that one of the benefits of PC1, is that it will require the District Councils or the Territorial Authorities to do that exercise and re-prioritise, so that they're being driven by those works that get you faster to the end point, rather than those works that they might see as a priority before PC1?

Walker: Yes, I think that's a fair statement. Essentially they'll be given definitive targets which they'll have to work towards achieving compared to the current state.

McGarry: That feeds into what you've been saying Dr Greer through your evidence, where you have been trying to highlight what I would call the low-hanging fruit, or where you're going to get the biggest bang for your buck in terms of end points.

Greer: Yes – noting that the low-hanging fruit may not necessarily be the best action. The low-hanging fruit from an operational perspective will probably always be the cheapest, but that's probably not necessary for E.coli the best way to go about achieving the target attribute states – which is probably already factored into Mr Walker's evidence seen as he's used the high cost option in his later analysis.

[00.55.20]

McGarry: Just one final one from me. It's really about that you looked across the Wellington region for costs. I just wondered if you had done any cross-checks to other regions. I'm just a bit aware of what's been a report in terms of the very high costs to get anything done here in Wellington and whether that itself may be a bit of a distortion and whether you've cross-checked that to other regions.

Walker: We have in the sense that when we costed the infrastructure interventions we were using our general GHD database of project knowledge which is national. Obviously, we used Wellington Water input as well. But, because we're using national level data then you would assume that it would sort of average out and you wouldn't get potentially the higher costs that may be happening in the Wellington region in our numbers.

Kake: Just one final question from me. It's around and to do with some interventions that have been mentioned in your evidence. It's building off some of the evidence that we've just had from Ms Ira on water sensitive urban design, swales, rain gardens and the like.

There's a comment around doing some of those interventions on council owned land, that being essentially a cheaper option, notwithstanding that maybe some of that land is probably sensitive to mana whenua. Has there been any analysis done in terms of that land availability, in terms of those interventions?

Walker: No, not at that level of detail. What we were doing though was just making the point that once you again get down to the project level you will be able to define what land you need, and then obviously it will be subject to what's available in the locality. You've obviously also got different interventions such as swales or rain gardens. There's a whole optimisation mix that has to happen at that individual project level.
Certainly if Council land was available – because the land is the significant component of the costs in these estimations.

Chair: The Territorial Authorities have raised affordability and achievability as reasons for seeking an extended timeframe rather than, as I understand it, a relaxation of TAS targets for E.coli and dissolved metals. In your evidence you agree that based on a 2040 timeframe that yes the targets are unaffordable and unachievable – unaffordable for ratepayers.

The mixed model, the mixed timeframe, which has a higher stepped rates increase until 2040 but then dropping, is it your view that that means achieving the TAS targets for these attributes will be affordable and also achievable in terms of the workforce capacity?

[01.00.15]

Walker: Yes, because it really comes back to again the current spend that Wellington Water has already been able to achieve, as shown on that bottom chart on the right hand side. If the revised expenditure, which as through the discussion I

explained will be higher than the black line, it's actually going to be a lot more achievable in terms of the resources that are in the region that can actually physically deliver these projects, as opposed in the 2040 which would just require too big of a step up. You'd be talking about more than doubling the current output of the industry and that would probably take a number of years for them to work up to that level.

Ironically, you would actually end up probably again with some of those PMFUs being extended, just because the work wasn't being able to undertaken in the earlier years.

Chair: Is that because having advance notice there's just much bigger ability to bring in the contractors and increase your staff and just be able to plan for it. You know you've got the pipeline of what's needed there.

Walker: Yes that's correct. The infrastructure industry really needs a consistent constant pipeline for the benefit of its own planning and certainly for the efficiency of what's delivered, compared to a [01.02.11] that might be going up and down.

Chair: Thank you. I know you didn't or you weren't asked to factor in maintenance servicing, costs of borrowing, remediation – costs to remediate, cost connections; you didn't consider all the other costs that would be needed to meet the target attribute states for E.coli and dissolved metals.

Are you able to comment, or you haven't done the analysis to know if all of those other costs would tip the balance and make the mix model unaffordable and unachievable?

Walker: We haven't done the analysis. Some thinking has gone on about those sort of components. There's a number of different aspects. With the depth one for instance, that was raised in the context of if you are able to borrow more, which ostensibly may come through the water reform, you could actually do more works – assuming. But, then you'd get into the achievability issue.
To achieve Plan Change 1 outcomes is over such a long period of time. With debt in particular, what you would be intending to do is just lowering the initial cost on ratepayers, but eventually it would catch-up because the money has to be paid back. So when you were getting twenty years out your rates increase will actually be higher at the beginning.

In terms of aspects like maintenance, with such a big programme you're putting out a lot of new infrastructure which doesn't actually need a lot of repairs and maintenance in its early part of its life; so we didn't think it was that significant in the overall scheme of this programme.

Chair: Can I just check that I understand the step change in rates point. I'm just looking in your rebuttal evidence at the Wellington City graph for instance.

[01.05.00]

So that's 11.5 percent. For instance, if someone's rates in that year were $1,000 this would require 11.5 percent on top of that, being $1,115. Then the following year another 11.5 percent on top of the $1115?

Walker: No. It's a single increase of 11.5 percent, which just carries on for the period of the implementation, albeit it reducing as the example is shown on the slide there, and the outer years some of the PMFUs are completed. It's definitely just a single one-off rates increase.

Chair: Whereas if I understand, taking Wellington City, taking their evidence, I think they're saying if it was 2060 across the TAS for E.coli and dissolved metals, then I think they say it's only a nine percent rates increase; so one step of nine percent all the way out to 2060, if I understand what they're saying; whereas in the mixed model you're showing that after 2040 the rates increase drops 8.2 percent, 7.2 percent.

Walker: Yes, that's correct. The mixed model, as we call it, the Wellington rates increase as pointed out would be about 11 percent compared to nine percent if everything was at 2060; but you have to then weigh that up against for the extra two percent you're going to have another 13 PFMUs finished ten to twenty years before 2060. So that's sort of the trade-off. In my mind it's quite a minor.

In reality, the programme will be made up of individual projects and different requirements. The mix might be slightly different in each city. It's almost a margin of error when you're only talking about two percent difference between say nine and eleven percent.

Wratt: I think is the same – on your rebuttal evidence, page-8 and those charts there. After 2040 you've got the rates dropping to 8.2 percent. So presumably your 9 percent would just continue on, whereas the rates associated with the mixed model would actually be less than the 9 percent. Is that correct?

Walker: Yes it would be.

Wratt: So over that period out till 2060 it makes that difference between the 9 and the 11?

Walker: That's correct, yes.

Chair: I think it's the Porirua planner, so this might be a question for Ms O'Callahan. It's critical that it's not possible to know the costs of achieving the PC1 recommendations in the absence of factoring all of the other costs that Mr Walker hasn't looked at, into the equation.

I'm just saying it leaves the Panel in a bit of a difficult place, in that we've got Mr Walker's evidence, and it's been really useful hearing his evidence on the 2050 mixed timeframes; but how do we factor in the concerns of submitters like PCC that might come along later in the week and just say, "Okay, fine, but you still haven't convinced us that this is affordable for our ratepayers because you're missing a whole lot of costs from the economic analysis."

[01.10.30]

My question is, do you think that there is enough information here Ms O'Callahan to make a recommendation on the provisions – and I think we're going to now call them the mixed model. I think the mixed model tag has stuck. The mixed model, the mixed timeframe option, do you think there's enough information for you to make a recommendation that the mixed model timeframe is achievable and affordable?

O'Callahan: Sorry, can you just point to the specific paragraph? I take it you're referring to Rogers' evidence.

Chair: Yes. Sorry, I was just taking some notes and I don't have the paragraph number. I think Ms Rogers has said that the full cost of achieving the recommendations is not known.

O'Callahan: There's paragraph 5.6 and she's talking about the fact that it excludes maintenance and servicing costs, business as usual, rates increases, costs, pump stations and rising maintenance." Is that the thing? Or, are you talking about the other TAS. The costs of borrowing, the costs to remediate, cost connections. Is that what you're talking about?

I think you've got some economic evidence here. At the end of the day we're trying to get an indication of scale, of the big aspects and some of those aspects are possibly not related to the Plan Change – pumping stations. I'm not sure. You've got evidence of an economist here and you've got evidence of a planner. I'm not sure what that is informed by. From my perspective it was important to have economic evidence on matters of cost and not a planner's evidence.

So that would be my response. We might be able to put those to Mr Walker, but he would have to be directed to the paragraph if he thinks any of that would make any material difference. That could be useful for you to do. I haven't got a printed copy but I can certainly pass my laptop over to him so he could answer that.

Walker: Again I would just refer back to the earlier discussion around debt over the long-term evens itself out. It all has to be paid back and because it's such a long programme the debt potentially is a bit of a red hearing.
Then in terms of the repairs and maintenance, and this is very much behind the thinking in the water reforms and why there needed to be increased funding for the sector generally, a lot of it was predicated on the fact that you're going to be replacing a lot of very old assets with longer lives and you're not going to be needing to maintain them. You're actually offsetting current repairs and maintenance which are higher because you're assets are quite worn out.

So, to do that piece of work you would actually have to look at their current repairs and maintenance to assess would that actually reduce in value, given that you're going to be replacing the assets, so you're maintaining the new assets that don't need repairs and maintenance.

So there is a balance between the two.

Chair: Thank you. That's really helpful and I think does capture.
[01.15.00]
There just seems to be an information gap, but we will do the best that we can with the information that we have available to us. I'm sure Wellington Water and the TAs will also be providing a lot of comment later in the week.

Walker: I didn't make a comment on the cross connections point, but again our brief was related to what the Council currently funds. The issue of cross-connections on

private land, and I've noted in the evidence, that's the cost to the private landowner. That was just also probably something worth noting - that it's not a cost to the Council.

McGarry: I'm looking at the evidence of **Mr Mendonic** [01.16.17] from Porirua and he is suggesting that your costs are likely to be low. I just wondered if you could respond to that.

Walker: I think coming back to us being able to quantify what we thought were the lower costs of achieving PC1 and the higher costs, we've allowed a range in that. Because the actual rates increases were suggesting would be around the estimates are actually based at the high end, there should be capacity within that to deal with any sort of variation where there may be under-costing in the base infrastructure.

So I think there's enough flexibility and range in those numbers to actually cover more of a worse-case scenario.

Blyth: I'm just adding for the cross-connection costs. I know it's not relative to the economic evidence at the moment, but the 2020 report that will be distributed to the Panel members, Wellington Water provided a level zero cost estimate to identify and fix private wastewater laterals between $250-350m for the Te Whanganui-a-Tara Whaitua. That's approximately four years old. That was based I'm assuming on 32 percent of those laterals were in poor condition and in need of repair.

Kake: The definition of cross-connections, just for my lay-brain – assuming it's the point where a private property owner's system is intercepting with the Council's asset?

Walker: Yes.

Kake: Is it defined anywhere I suppose is the question in my head?

Walker: I'm pretty sure it's in the evidence somewhere. It is effectively putting stormwater into wastewater networks, or the other way around.

Kake: Just on that then, there is a point in the appendix to your evidence, where it says essentially our Wellington Water don't envisage a programme to determine where these are, or where these exist. I'm sure they will respond to that.

I will just keep that in mind and ask then. Thank you.

Blyth: I can clarify on the cross-connections. That's specifically a wastewater connection to stormwater. So it's raw sewerage getting into a stormwater pipe and ending up in the receiving environment. They're infrequent but can have a high contaminant load.

[01.20.00]

Part of the identification is a whole bunch of either camera inspections or smoke testing and things like that, to identify a mis-connection.

The primary wastewater issue that leads to overflows is inflow and infiltration which is where you're getting stormwater and ground water into broken pipes, which leads to a capacity issue, that then causes overflows at constructed locations. That's when you get those above-ground overflows, like at Silverstream where in 2018 they had 194,000 cubic metres of raw sewerage that was discharged into the Te Awa Kairangi Hutt River through a constructed wastewater overflow.

Chair: So Mr Blyth, will be having the additional capacity through the new wastewater treatment farm – or I'm aware that there's at least one, I'm not sure if there's more that are currently being built – but will that mean that there's less likelihood of the overflow leaks happening?

Blyth: It will improve the through-put but there will still obviously be a dependency on the network connecting to that wastewater treatment plant and the state and grade of that. So while they can improve the treatment efficiency and the output quality that's discharged out to sea, it still requires upgrades of the wastewater mains that having inflow and infiltration issues.

Chair: And, that doesn't deal with the dry flows which is the grade 4/5 and just the old pipes issue. Thank you.

Unless there is anything else, thank you very much Mr Walker for your evidence and being here this afternoon.

O'Callahan: Commissioner Nightingale I just have a point of clarification.

Mr Walker referenced his primary statement in his rebuttal. There was also a supplementary correction that he filed on the 2nd of April. I just want to make sure that the Commissioners all have that.

Chair: Thank you. Great. Thank you very much.
We have our last Council expert for the day. Is Dr Snelder available now?

Good afternoon Dr Snelder. We do apologise for running so behind .Thank you for your patience and for staying with us.

We have read your evidence in chief and nutrient outcomes is a topic we are yet to fully get into. We are looking forward to hearing you present. We do have plenty of time for questions. We'll pass over to you. Thank you.

Snelder: Kia ora Commissioners. Thank you. My name is Tom Snelder. I am from Christchurch. I'm an Environmental Scientist. I have assisted Greater Wellington with the development and application of the nutrient concentration criteria that are included in the plan as nutrient objectives, and I have a very short presentation that overviews my evidence and then obviously I can answer questions.

I'm assuming you can see my presentation page.

Just briefly then, the development of nutrient concentration criteria is complicated because the effects of nutrients depend on factors other than

nutrients – several of them, including things like light, temperature, flow regime and the substrate of the riverbed that is where the periphyton grows. There has been significant recent effort, in fact over the last two decades, to develop appropriate nutrient criteria across New Zealand and most of that has been focused on limiting peak periphyton biomass.

The Greater Wellington Regional Council used the existing published periphyton nutrient criteria to define nutrient objectives, and I was the lead researcher that developed those nutrient criteria.

[01.25.00] The Council applied those in a manner that was consistent with MFE guidance. The nutrient objectives that they derived very spatially and that's appropriate because of these other factors that are so important in determining the outcome of nutrients on periphyton.

The nutrient objectives are primarily based on controlling peak periphyton biomass and that's associated with the periphyton target attribute state.

There's an assumption that stream bed-shading will apply in smaller rivers and there's a complication that's been dealt with, which is that the criteria involved choosing the risk of actually not achieving the target attribute state.

Council went through a process to decide carefully what that risk should be. In many cases the primary basis for the nutrient objectives are overridden by other considerations. For example, in some locations the criteria that are derived from my nutrient criteria are in fact lower than the reference state, or the conditions that could be achieved in a catchment was largely in a natural land use. So in that case it was the reference state that was used as the criteria, rather than the criteria from the periphyton criteria.

In other situations the criteria that was adopted in the Whaitua Implementation Plans have been used, when they're more stringent than the criteria derived from the nutrient concentration criteria.

Finally, the alternative concentration criteria that were proposed by Environmental Defence Society and the University Canoe Club are not necessary; and the main reason for that is that the nutrient objectives represent the best information that we currently have.

Thank you.

McGarry: Thanks for your evidence Dr Snelder. I just wanted to understand a little bit more of your paragraph 19. You just touched on it before where you talked about the complexity of the underlying mechanisms. I assume you're talking about climatic factors, but maybe you could just explain to us a little bit more about what those mechanisms are you're referring to.

Snelder: A conceptual model that we have of periphyton biomass is that it's a function of counteracting processes of accrual, which is really growth, and that's controlled by concentration of the nutrients but also temperature and light. So they obviously control the rate of growth.

That is counteracted by disturbance. In rivers disturbance is really the frequency of floods that flush the periphyton from the riverbed.

All of those factors are involved in determining the likely peak periphyton biomass, or the 92nd percentile of the observed monthly periphyton observations. I heard you talking about that earlier – so you understand that idea.

That's really a measure of peak periphyton biomass. That expression is the outcome of these counteracting processes that I've just mentioned.

McGarry: In paragraph 23 you talk about the Council assumption that the sites would be shaded, except for the Hutt River at Boulcott. How critical is that in terms of the assumptions of the modelling and this correlation that you're talking about?

Snelder: The criteria are correspondingly higher where we assume there's shading; so in other words, because shade is acting to decrease the periphyton biomass you could have a higher nutrient concentration where you assume there is shading. So it is a relatively important assumption and the idea is that shading is achievable. It's also desirable for many reasons – not just to reduce the periphyton biomass. That is the basis for the nutrient objectives – the assumption that shading will be achieved where that's possible.

[01.30.05]

It obviously excludes wide rivers such as the Hutt River where shading couldn't be achieved.

McGarry: It's interesting that you used the words "where possible" because I have been exploring this with Ms O'Callahan as to whether she says a difference between "where practicable" and "where possible".

I see "where possible" as a much higher threshold.

You're saying it's a very important assumption, isn't it, to these criteria.

Snelder: Yes it is an important assumption.

McGarry: Just one more. It's really about your validation exercise that you've been through – paragraph 26.

You've done two science exercises for validation from what your evidence says, and I just wondered why you wouldn't validate all of the sites.

Snelder: The validation is based on all of the Council's monitoring network. That's the short answer. All the sites were used in the validation.

McGarry: So when you say the two exercises that was for all science was it?

Snelder: Yes, there were two validations done. The first set was done a previous set of criteria. A new set of criteria were developed and the validation was performed again. The outcome of that was that the second set of criteria performed better than the first set, and those were the criteria that were adopted by the Council for the development of the nutrient objectives.

McGarry: It's a good analogy of what you've done here, because I haven't got any experience with this; where you get a correlation between say suspended sediments and water clarity and then you use NTU as your measure. Is that pretty similar to what you're doing here? You're basically looking for a correlation of nutrients and then coming up with indicator is periphyton?

Snelder: That's exactly right. The simplest way to think about this is there's a relationship between peak biomass, because that's the target attribute state for periphyton, is actually a measure of peak biomass; so there's a correlation between that and nutrient concentration. We use that correlation to derive an appropriate nutrient concentration that will achieve the peak biomass. It will mean that the peak biomass will not be exceeded.

It's quite a lot more complicated than just a simple bivariate relationship; it's not just the relationship between the nutrients and the biomass, because there's other factors involved. They complicate the process but in general terms that exactly how these criteria are derived.

McGarry: Thank you for your evidence.

Wratt: Thank you Dr Snelder for your evidence and explanations. Just interested in exploring a little about your final bullet point on your slide there, in relation to the EDS and Victoria University Canoe Club submission.

I know you do run through that in paragraph 29 and subsequent paragraphs, but can you just elaborate on that a little too please?

Snelder: At around about five sites the submitters were wanting the criteria to be lower than what GWRC had derived. They didn't produce any evidence to support the need for a lower concentration and I'm satisfied that the method that GWRC have used has used the best evidence to derive a concentration that is justifiable. And, on that basis I don't think we need to lower the concentrations that have been proposed to those that the submitters have asked for.

[01.35.00]

Wratt: So do you think in their evidence or their submission it's more of value judgement of the amount of periphyton that it looks right to have in a river?

Snelder: I'm not sure where they derived their numbers from. I don't know on what basis they've done that. That's the easiest answer I think to that question.

Wratt: Thank you. I think that answers my question.

Chair: Dr Snelder, and I know I'm explaining this probably too simplistically, but so much depends on periphyton and if you get that right, because there are so many attributes that are affected by periphyton and also nutrients.

My very crude understanding is it's periphyton that's really critical to get right and get it as close to the peak biomass as possible. Then if that happens then there should be some other really good positive ecological outcomes that follow.

Sorry, I don't mean to overly simplify what is very complicated science, but just in terms of my understanding is that roughly along the right track.

Snelder: Those are good questions and you are right, but I would add to that the derivation of nutrient criteria is a worldwide challenge that scientists are working on all over the world all the time. It's difficult.

The reason we do it for primary production, which in rivers is periphyton, is that there's a relatively short distance, if you like, between what's available in the water column in terms of resources for periphyton growth and what happens on the riverbed in terms of the biomass that's achieved. Those are relatively simple and there's a direct route between the cells growing on the riverbed and what's available in the water column.

The other variables, which are undoubtedly influenced by both periphyton as you said and nutrient concentrations, such as fish and invertebrates, the relationship and the distance if you like between those animals and what's in the water column is far more complicated. There are far more factors that are intervening.
It's much more difficult to derive credible scientific criteria for these higher trophic levels such as macroinvertebrates and fish. Because there's so many factors involved for those higher trophic levels, the signal of nutrients is extremely confounded and that makes it very, very difficult to derive credible and justifiable criteria.

So that's why we pick on periphyton, given that it's the base of the food chain, but it can also become a problem if it's too high. The general assumption is if we manage the river periphytons to a reasonable level then we will achieve conditions that are suitable for higher trophic levels, and that's the assumption that we need to use.

So there's a degree of simplification that is needed in order to get a tractable problem that we can actually solve with the current level of knowledge and science that we have.

Chair: As a scientist and very renowned and absolute expert in this field, to achieve the levels of periphyton peak biomass, what would you say are the critical things that need to happen in terms of managing land use and other activities?

[01.40.00] One of the issues that I've been thinking about, and we haven't got to the rules yet, but how agile is the whole planning framework?

Can activities actually be properly managed to contribute to achieving the TAS for periphyton? Or is it that once the monitoring results are completed and it's shown that a TAS is exceeded, is it too late to wind it back and put controls and limits on activities to come back to periphyton biomass?

I'm sorry, do you understand what I'm trying to say? I guess it's maybe two things. What do you think are the key things that are needed to achieve peak biomass; and also comments on the limitations and also opportunities within the planning framework to manage activities to help us get there and achieve the TAS?

Snelder: I need to be pretty careful with answering that question because I could easily get outside of my expertise and what I have been asked to do for Greater Wellington, but you raise some good questions and good points.

I would say that the two things that are most important to ensuring that we don't exceed the peak biomass target attribute state is managing nutrient concentrations and also managing light – so managing shading where that's possible. Those are both obviously things that the plan is promulgating.

I agree with you that in some situations in New Zealand we have catchments where we have gone well beyond the nutrient concentrations that are acceptable in terms of achieving periphyton biomass outcomes, and winding those back is obviously difficult because we've got existing land use.

In those situations, all I am going to say is that's a difficult challenge. I am not here to talk about how that could be achieved in this instance.

Chair: I understand. Thank you. I will just see if anyone has anything else?

Stevenson: Thank you Dr Snelder for your evidence. I had what I think is a related question to what Commissioner Nightingale just posed. The nutrient criteria that you have recommended, how flexible are they in terms of forward looking, monitoring and understanding land use and other activity change, so that we could avoid getting into that state where they're already breached and it's hard to wind things back.

I'm just wanting to know, I guess, what anticipation is built into those criteria, if any.

Snelder: Yes, that's a tricky question for me to answer as well Commissioner Stevenson.

I think it's very important to have nutrient concentration criteria in river because it basically sets a level of resource use in terms of a similar capacity for nutrients by the environment for a catchment. So even at locations where we are currently achieving our periphyton target attribute state, it's important to have nutrient concentration criteria because from that the Council would in future be able to understand the risk associated with any contemplated additional resource use.

[01.45.00]

In that sense, nutrient concentration criteria can be forward looking in the sense that they help to define limits on resource use and perhaps head off resource uses that would cause a breach of the target attribute states.

Obviously, as we talked about I think in the last question, in some circumstances the criteria provides strong evidence that concentrations need to be decreased; so that then justifies any policies that are intended to bring about those decreases.

I hope that answers the question.

Stevenson: Yes, thank you Dr Snelder.

Chair: Dr Snelder, just a question about your table on page-11, Table 1 of your evidence. I've had a lot of information today and I think Dr Greer may have already explained this, but without being able to find my notes on this, what's

your view on for Wai-o-hata, which is row three, the current state is (a) but the TAS for periphyton is (b). I think we have had this explained and it might be because there is some uncertainty around the accuracy of the current state.

Snelder: I would defer to Dr Greer to answer that question.

Greer: The target attribute state is (b) and that was selected in the absence of monitoring data. If you turn to page-59 of my statement of primary evidence you will see the benchmark against that. You will also see that it only has fifteen data points next to it. The periphyton biomass target attribute states generally requires at least three years of data because it is a peak measure. One good year does not mean that the peak measure won't be exceeded in other years.

In saying that, I would say there was significant uncertainty around where it sits, or whether the (b) state requires an improvement against the baseline or not. There was simply no periphyton data for that site, and it was not modelled under the Whaitua process.

Wratt: There is also that same issue with Porirua Stream at the milk depot. Is that the same? On Table 1 of Dr Snelder's evidence, on page-11 of his evidence. The current periphyton state is given as (a) and the TAS given as (b).

Greer: If I could just grab a version of Table 9.2.

That's exactly the same situation. It didn't have a baseline state. We have slightly more data but still only 21 data points.

McGarry: So that information Dr Greer should be visible to us by looking at Appendix 3, the insufficient data summary table – which I think was appended to Ms O'Callahan's – the summary of insufficient data table.

So when we pick up a situation like that, we should be able to look at that table without having to ask you for clarification?

Greer: I believe I identified the ones with insufficient data in my…

[01.50.00]

McGarry: So I'm looking at the Wai-o-hata on that table and then it says periphyton biomass…

O'Callahan: Sorry, are you talking about Appendix 3 to my rebuttal? Is that what you're referring to?

McGarry: I assume that's where I got it from. It's printed out from your rebuttal, yeah.

I might just need to confer with Dr Greer. I guess what my question is getting at is when we get into deliberations and we see these things that look to us like, "Why?" It brings the question. My question is whether this table is sufficient for us to go back to, to understand.

I've tested it with one. So my question is whether this is, I guess, sufficient detail?

O'Callahan: I think in the body of the s42A report and the rebuttal I indicate we're still probably working on this and we'll close it out in the Hearing Stream 5.

What this does is show that there are some things resolved and there were some which I can go through and highlight to be clearer to you. Some of them I have recommended deleting, and then obviously I've reversed that since I wrote this – I presented to you on that. So I probably need to update this to you. I can perhaps do that and table it tomorrow.

So the ones that need to be updated and the ones that I'm still working with the science team to understand in the absence of data whether we can get any confidence, or any kind of indication from the experts, as to whether or not the target has been set appropriately.

Some of them have been set at (a) state in the absence of any baseline data, which is probably they're the ones that I'm wanting to test out. I don't think I'm suggesting they be deleted if the science team is intending to monitor them, but we need to be just checking that we're comfortable that the objectives have been set an appropriate level.

So, if I update this to correct the ones that I have reversed the issue on, that was the stormwater metal ones, and then we can just work out what I'm suggesting I think it kind of parks from my perspective - I am comfortable with them, and which ones that I'm still trying to work through and just encouraging and understanding whether any bits of data can be collected in the meantime as well.

McGarry: I think that's an extremely helpful appendix for us. I'm comfortable with it just being completely updated with the right of reply, but I guess it might be helpful working through with submitters to update it to at least the point you're at currently.

I appreciate that.

O'Callahan: I think particularly given I've already told you I've changed position on some of it. It's just not helpful because it's not current.

Greer: Just to note that there will be attributes that have improved since the baseline state, just by having appropriate… meeting the full data requirements since then as well. I believe there was a couple of sites that have to change from nitrogen (b) state to the (a) state in the intervening period and there may be some for nitrate as well.

McGarry: Ms O'Callahan, is there a way (and I'm thinking out loud again which is dangerous) for some of these perhaps to be shown as an interim, and that they could be updated without going through a plan change process – being that it's really just a data collection, and having that five years or however many data points you need for it to be confirmed? Is there a mechanism in the plan that that could happen?

O'Callahan: There's certainly an ability for the baseline state or current state to be updated – not the baseline, that can't change, but the current state can. I don't believe

there's a mechanism to recalibrate the TAS. They are objectives. A change to the objectives requires a plan change.

[01.55.00]

Chair: Dr Greer was there anything you want to add?

Greer: I just was wondering in terms of that question whether the expectation was that if something had improved since the baseline state that that would necessitate a change to the target attribute state becoming more stringent, because my understanding is that that wasn't how the targets are necessarily meant to apply; and that if there is an improvement where there is maintenance that that (and I don't want to say 'head room' because I'm sure it's going to be a bit of a red flag) but that does allow for additional resource use. I didn't think they were necessarily a sinking lid, the targets.

McGarry: I was more thinking of the visibility of the information in Appendix 3, in the table, without just saying "insufficient data". I was only thinking of one direction in my head as well. Not getting more stringent but perhaps getting more refined and more the other way.

As I say I'm thinking out loud.

Greer: I've had this in front of me the entire hearing, but Greater Wellington continually publish the current states of their targets online. They're actually very good about doing it. It goes into significantly more detail than is in [01.57.00]. They have a mechanism to continue to refine current state assessments and certainly consent holders have unlimited access to those data.

O'Callahan: Certainly we could put a footnote with another footnote for the reference to the existence of that data. It can be a bit tricky to find it if someone operating the website moves it to some other location in the future, but even just a reference.

Presumably if people are looking and trying to understand it they will assume that there's some monitoring and that things are being reported somewhere.

Greer: I understand it as (a) would be incorporated by a reference because the url updates every water year. So there's a different url for 2022-23, 2023-24. I am not sure if that's going to get resolved in time to incorporate by reference there.

Chair: Thank you. We might end it there. Mr Ruddock, only six minutes over.

Sorry, Mr Sharp, please go ahead. I had set myself a target attribute of 5.00pm, so you've got four minutes.

Sharp: The question was about mahinga kai target and whether that could be set, is that correct?

Kake: I'm trying to remember the question. I just wanted to get some clarification I suppose in terms of there were some submissions points requesting for mahinga kai to be included in Tables 8.4 and 9.2. It was explained to us that those recommendations came from the WIPs. The WIPs didn't include mahinga kai? Those rivers?

Sharp: They do but not in a quantitative sense.

Kake: Not in a quantitative sense.

Sharp: I've got a little bit of a narrative about it.

Certainly from a qualitative sense there's quite a bit of narrative about mahinga kai, including mana whenua having visible presence in the management of mahinga kai, able to serve fresh mahinga kai including a date there by 2041 – and I'm not quite sure what the reasoning for that was, but twenty years I imagine; that they are of a size and abundance to be sustainably harvested.

Te Mahere Wai presents a framework for further development, Te Aranga Wai, which does have a range of qualitative measures that could be developed into a cultural health framework index, where a baseline or target baseline could be set; where targets could be set but mana whenua haven't completed that work to pick particular measures that they would want to prioritise for taonga species, mahinga kai areas, mahinga kai activities.

[01.00.22]

So that work needs to be done.

Probably the most closest we've got to quantifiable targets are still relatively rough in the sense that one is [02.00.35] five or more mahinga kai species being present – that's a quantifiable thing; that mahinga kai are free from disease; that harvest of mahinga kai is available twice a year – that's quantifiable; and that populations are regenerating.

My last comments on this, which I think are perhaps the most useful, are that mahinga kai could be considered as a bit more like a higher order objective like MCI, being a broader representation of a health [02.01.22].

The other attributes collective contribute to the MCI score, much like they collectively contribute to a healthy mahinga kai. MCI could be something of a proxy. It has been discussed quite a few times with mana whenua about being the closest proxy for mauri or mahinga kai; and that E.coli would be the most significant attribute to manage – because if it's mahinga kai and it's being ingested and E.coli is the most significant attribute to be considering, it's food for thought.

Kake: Again I'm conscious of time. I will I think reserve the rest of my questions for now. It has given me a bit more of a better understanding with respect to those submission points at least. Thank you.

Chair: Karakia to finish?

Admin: Was there any more questions for Dr Snelder?

Chair: No. Thank you very much for your evidence. You took us on quite a discussion. Thank you.

Snelder: Thank you.

Admin: Karakia tātou.

E Rongo, whakairia koe ngā kōrero
Ki roto i te kete waitau.
Ana, ka tāpiri atu ki te pātū o tēnei whare
Ko Ranginui e tū nei
Ko Papatūānuku e takato nei
Ko te aroha o te taiao
e tauawhi nei i a tātou.
Tūturu whakamaua kia tina!
Tina! Haumi e, hui e! TĀIKI E!

[End of recording 02.04.01]