APPENDIX D

BEFORE THE PROPOSED NATURAL RESOURCES PLAN HEARINGS PANEL

IN THE MATTER	of the Resource Management Act
AND	
IN THE MATTER	of maintenance of drains provisions
AND	
IN THE MATTER	**o**f stream reclamation provisions
AND	
IN THE MATTER	of Right of Reply evidence to matters raised during Hearing Stream 5

STATEMENT OF RIGHT OF REPLY EVIDENCE OF DR MICHAEL GREER ON BEHALF OF WELLINGTON REGIONAL COUNCIL

TECHNICAL – IN REGARD TO

1. PROVISIONS FOR MAINTENANCE OF DRAINS AND HIGHLY MODIFIED RIVERS AND STREAMS (R121)
2. PROVISIONS FOR STREAM RECLAMATION (R115 AS IT RELATES TO RECLAMATION)
3. GENERAL CONDITIONS FOR ACTIVITIES IN WETLANDS AND THE BEDS OF LAKES AND RIVERS (SECTION 5.5.2 AND SECTION 5.5.4).

10 July 2018

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1. SUMMARY

1.1 My name is Michael John Crawshaw Greer.

1.2 I have been asked to provide technical evidence on matters raised at Hearing Stream 5 for the proposed Natural Resources Plan (the proposed Plan) in response to the S42A Report: Beds of Lakes and Rivers, including provisions that manage drains and highly modified rivers and streams (R121) and the beds of lakes and rivers general conditions.

1.3 My key conclusions are:

(a) For the most part, the conclusions made in my statement of primary evidence remain unchanged;

(b) I disagree with Dr Keesing's suggestion that fish species found in highly modified rivers and streams are "tolerant" to human activities, thus are unlikely to be impacted by drain clearing. Peer reviewed research on the effects of aquatic vegetation removal, established ecological theory and the conservation status of many native fish species suggest that fish communities in highly modified rivers and stream are not tolerant to environmental degradation, and are likely to be adversely impacted by drain clearing;

(c) R121(h) – fish recovery: I agree with submitters who consider that it is unreasonable to expect people to be able to ascertain whether a fish is in a stressed or unstressed condition. In my opinion the original wording of clause (h) is easier to understand and implement.

(d) R121(h) – fish recovery: I do not consider that it is necessary to add an additional clause to Rule R121 describing the fish recovery process;

(e) Dr Keesing's recommended changes to clauses (i) through (l) of Rule R121 are not appropriate;

(f) Sediment and vegetation clearance in "stormwater drains" and "water races" should not be permitted under Rule R121;

(g) There is no reason not to permit the removal of weeds on the banks of drains and highly modified watercourses during drain clearing; providing that Rule R121 clearly stipulates that weed removal shall be targeted and not achieved by scraping the banks with an excavator;

(h) I agree with Ms. Petrove (Minister of Conservation) that drain clearance in fish migration periods should be avoided to limit the population level impacts of the activity. However, imposing the exclusion period recommended by Ms. Petrove as a condition of Rule R121 would have the same effect as changing the activity status of the drain clearing, as most people would require resource consent to conduct the activity in a way that achieves its desired purpose;

(i) I agree with submitters that the term “original grade or cross section” in clause (f) of Rule R121 is open to interpretation. However, giving effect to the clause when conducting drain clearing operations should be straightforward providing that a pragmatic approach is taken and the intent, as well as the wording, is considered;

(j) The maximum culvert length permitted under Rule R115 was set to reduce the potential for stream piping. That longer culverts can provide fish passage does not justify increasing the maximum length permitted under Rule R115;

(k) Allowing for the temporary obstruction of fish passage during the construction of small structures is appropriate; and

(l) The clarity and colour change standards in the sediment condition of the activities in beds of lakes and rivers general conditions should apply at all times.

2. INTRODUCTION

2.1 My name is Michael John Crashaw Greer. I work for Aquanet Consulting Ltd as a Senior Freshwater Scientist.

2.2 I hold a PhD degree in Ecology and a Bachelor of Science in Zoology from the University of Otago. The title of my PhD is 'The effects of macrophyte control on freshwater fish communities and water quality in New Zealand streams'.

2.3 I have worked for local government, the Department of Conservation and NIWA. I have over 6 years of work experience in freshwater ecology. Since the 4th of March 2018, I have been employed by the Aquanet Consulting Ltd. Prior to that I was employed by the Greater Wellington Regional Council as a Senior Environmental Scientist.

2.4 I have read the Right of Reply: Beds of Lakes and Rivers prepared by Pam Guest on the drain maintenance and stream reclamation provisions in the proposed Plan.

2.5 My evidence relates to the approach taken by Council on the following specific matters:

(a) Provisions for maintenance of drains (Rule R121);

(b) Provisions for stream reclamation (Policy P102, Rule 115 (as it relates to reclamation) and Rule R127); and

(c) The general conditions for activities in wetlands and the beds of lakes and rivers (Section 5.5.2 and Section 5.5.4).

3. CODE OF CONDUCT

3.1 I confirm that I have read the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note and that I agree to comply with the code. My evidence in this statement is within my area of expertise. I have not omitted to consider material facts known to me that might alter to detract from the opinions which I express.

4. SCOPE

4.1 I have been asked to provide Right of Reply evidence on the

following matters:

(a) Dr Keesing's (Masterton District Council and South Wairarapa District Council) assessment of the effects of drain clearing on native fish;

(b) Dr Keesing's and Ms. Whitney's (clause (h) only) recommendations on the individual clauses of Rule R121;

(c) Dr Keesing's recommendations on the clauses of Rule R115;

(d) The appropriateness of permitting vegetation and sediment removal in "stormwater drains" and "water races" under Rule R121 as requested by submitters;

(e) The appropriateness of allowing weed removal on the banks of drains and highly modified watercourses under Rule R121 as requested by submitters;

(f) The appropriateness of imposing an exclusion period for fish migration in the clauses of Rule R121 as requested by submitters;

(g) The appropriateness of the use of the term "original grade or cross section" in clause (f) of Rule R121;

(h) The appropriateness of provision for temporary obstruction of fish passage in Section 5.5.2 (d) and Section 5.5.4 (d)); and

(i) The appropriateness of the timeframes set out in the sediment condition (g)(ii) of Section 5.5.4.

4.2 Although the options that I consider take into account submissions received on the proposed Plan, my conclusions are limited to technical matters and I do not provide recommendations on policy.

5. RESPONSE TO DR KEESING'S ASSESSMENT OF THE EFFECTS OF DRAIN CLEARING ON FISH

5.1 A key message in Dr Keesing's statement of primary evidence and his presentation in Hearing Stream 5 was that vegetation and sediment removal in drains and highly modified rivers and streams

is unlikely to have a significant impact on resident fish populations. It is important to note that Dr Keesing himself does not suggest that this is a reason to completely de-regulate drain clearing; in his statement of primary evidence (para. 59) and presentation in Hearing Stream 5, he acknowledged that avoiding and minimising the impact of drain clearing is important. Nevertheless, I consider it likely that upon reading Dr Keesing's evidence and listening to his presentation, a reasonable person may question whether it is necessary to put conditions on Rule R121, especially considering the level of submitter opposition to the rule. However, it is my opinion that Dr Keesing has underestimated the potential impacts of drain clearing on freshwater fish, and that comments made in his statement of primary evidence and presentation in Hearing Stream 5, do not justify reducing the level of control on drain maintenance activities set in Rule R121.

5.2 In his presentation in Hearing Stream 5, Dr Keesing stated that "highly modified waterways […] often contain high numbers of fish. This is even and despite the regular annual or bi-annual cleaning that has gone on for the last 100 years or so. These high numbers of fish and these high diversities of fish persist because they are the tolerant species that are left after deforestation and farming […]. These fish do not curl up and die because the streams have been cleared". Dr Keesing then used this line of evidence to conclude that "these populations are not under duress because of these activities". I disagree with Dr Keesing's line of evidence for the reasons outlined in para. 5.3 to para.5.8.

5.3 In his statement of primary evidence, Dr Keesing presents fish numbers from the Waimeha Stream that appear very large and uses these data to support his conclusions that fish populations in this stream are healthy, despite frequent cleaning. While the numbers provided by Dr Keesing seem large, they do not represent a meaningful measure of fish abundance as:

(a) Fish abundance is dictated largely by area, not stream length; and

(b) Based on para. 22 of Dr Keesing's evidence, it is unclear if the

fish numbers presented by Dr Keesing are from a single survey or have been pooled from “several” different surveys.

5.4 Even if the numbers of fish presented by Dr Keesing were an accurate measure of current fish abundance in the Waimeha Stream, they still do not provide any insight into the effects that regular drain clearing is having on this system. Although the Waimeha Stream may well have the potential to support many fish despite frequent clearing, this does not mean that fish abundance would not be higher still if the activity was avoided. Without knowing what the actual carrying capacity of the stream would be if it was not cleared, the numbers presented by Dr Keesing are redundant. Furthermore, referencing high fish numbers in a small number of frequently cleared streams is not evidence that the activity does not impact fish abundance; especially when there are published peer reviewed studies in the scientific literature demonstrating that is does (e.g. Greer et al., (2012)). After drain clearing, fish will move into cleared reaches to replace those that have died, making it appear that the long-term effect on abundance is not great and that the resident fish community is tolerant. However, fish will still have been killed and the wider population reduced as a result.

5.5 In his presentation at Hearing Stream 5, Dr Keesing indicated that frequent disturbance of highly modified rivers and streams through drain clearing has no influence on fish abundance and diversity, as only tolerant species are found in these waterways due to water quality and habitat degradation from agricultural land-use. While I agree with Dr Keesing’s view that fish communities in many highly modified rivers and streams would be degraded by land-use pressures even without regular clearing, I do not agree that this means drain clearing cannot degrade fish communities further.

5.6 Established ecological theory suggests that the presence of only tolerant species in regularly cleared drains is, at least in part, the result of frequent disturbance from drain clearing. The frequency at which a stream is disturbed, either naturally, by floods or droughts, or unnaturally, by human activities such as drain clearing, has a significant influence on the resident animal community, with tolerant

species becoming more dominant as disturbance frequency increases (Reice et al., 1990; Resh et al., 1988). The sort of streams that are regularly subjected to drain clearing tend to have a low gradient and be groundwater fed, meaning that they generally have stable flows and are not subject to frequent natural disturbances from floods. Therefore, regular disturbance from drain clearing represents a significant variation from natural state, and in my opinion is potentially a key driver of fish community structure in drains. Accordingly, the presence of tolerant species in highly modified rivers and streams may not reduce the potential for fish communities to be impacted by drain clearing, as Dr Keesing suggested in his presentation in Hearing Stream 5 (see para. 5.2 for quote), but may be a deviation from natural state driven, or partially driven, by regular clearing.

5.7 Dr Keesing's assertation that drain clearing is unlikely to have long-term impacts on resident fish, as only tolerant species live in drains, is also contradicted by the conservation status of New Zealand native fishes, over 70 percent of which are either "at risk" or "threatened" (Goodman et al., 2014). Of the species that Dr Keesing recorded in highly modified rivers and streams in the Kapiti District, long-fin eel, redfin bully, inanga and giant kokopu are all classified as "at risk" due to declining populations, and lamprey are already considered to be "threatened" (Goodman et al., 2014). That these species are in decline suggests that the view that they are tolerant to human activities is misguided.

5.8 Drain clearing is both sufficiently damaging and widespread that the cumulative effects of this activity are, in my opinion, likely having some level of impact on native fish populations. Given, that native fish are already in a precarious position, it is important that the impact of this activity, and indeed all activities that impact on fish populations, are carefully managed to reduce the risk to already "at risk" or "threatened" species.

6. RESPONSE TO DR KEESING'S AND MS WHITNEY'S RECOMMENDATIONS ON THE INDIVIDUAL CLAUSES OF RULE R121

Clause (h)[1] – Fish recovery

6.1 In his statement of primary evidence, Dr Keesing signals that he supports the intent of clause (h) (with Ms. Guest's recommended amendments) but finds the wording imprecise (para. 30). I agree with Dr Keesing; the amendments recommended to clause (h) are difficult to interpret and implement. Specifically, it is unreasonable to expect people without a background in fish biology to be able to ascertain whether a fish is in a stressed or unstressed condition. I understand that other submitters (Masterton District Council (MDC)/South Wairarapa District Council (SWDC), Wellington Water Ltd. (WWL), the Minister of Conservation and Federated Farmers) have also raised concerns over this issue. In my opinion, the wording of this clause in the notified version of the proposed Plan was easier to understand and implement.

6.2 In her evidence, Ms. Whitney recommends the inclusion of an addition clause to Rule R121 (clause (ha) in Appendix C of Ms. Whitney's evidence), that provides detail on the fish recovery process. While this clause certainly describes an appropriate method of conducting fish recovery, it is worded as guidance, and does not stipulate that fish salvage must be conducted in a certain way (i.e. it describes what fish recovery should involve, not what it must involve). Therefore, it is no more prescriptive than the existing clauses of Rule R121, and it is my opinion that the information it contains is best disseminated to landowners and contractors through the guidance documents GWRC will develop when implementing Method M14.

Clause (i) – Placement of Spoil

6.3 Dr Keesing has recommended that clause (i) (with Ms. Guest's recommended amendments) be deleted as:

(a) It is impractical in urban environments;

[1] Although I consider the wording of Ms. Guests amendments clause lettering is consistent with the notified version the proposed Plan and that used in Dr Keesing's evidence.

(b) It will only be successful in allowing eels to re-enter the stream, not other fish species; and

(c) It is not necessary if thorough fish salvage is undertaken.

6.4 I do not agree with Dr Keesing recommendation that clause (i) be deleted for the following reasons:

(a) Rule R121 does not apply to waterways in the urban environment. Therefore, that clause (i) is difficult to meet in this setting does not mean that it should be deleted;

(b) Dr Keesing is correct in that the clause will primarily be beneficial to eels (it will also benefit kōura, which are not discussed in Dr Keesing's evidence). However, the purpose of Ms. Guests amendment to clause (i) was primarily to allow eels and kōura to re-enter the stream, rather than all fish species;

(c) If fish recovery was conducted only by people with experience and training in this process, then clause (i) would not be necessary. However, fish recovery will generally not be conducted by a trained ecologist with the sole task of salvaging fish; in small-scale operations carried out in full by land-owners and/or earthmoving contractors, it is likely that more stranded fish will be missed than if a specially trained person was doing the recovery. Accordingly, it is my opinion that clause (i) is needed to maximise eel and kōura survival during drain clearing; and

(d) Dr Keesing has recommended the deletion of clause (i) in its entirety, not just Ms. Guest's amendments. The purpose of clause (i) is not just to allow eels to re-enter the stream, but to also prevent spoil from re-entering the waterway. As there is no other mechanism in Rule R121 to prevent sediment and plant material from washing or slumping back into the stream, as well as the reasons set out above, it is my opinion that clause (i) should be retained.

Clause (j) – Fish refuge

6.5 Dr Keesing has recommended that Clause (j) (with Ms. Guest's recommended amendments) be deleted as:

(a) Nether partial clearance ((j)(i) and (j)(ii)(1)) nor the installation of fish refuge bays ((j)(ii)(2)) will prevent the stranding of fish;

(b) Partial clearance (allowed under (i) and (ii)(2)) still results in a completely cleaned channel with little post activity "refugia" (vegetation cover), as vegetation is unlikely to recover sufficiently in three months to provide effective fish refugia;

(c) Research conducted by Dr Greer (myself) and others concluded that there was no evidence to suggest that staggered macrophyte removal minimised the impacts of drain clearing on native fish abundance; and

(d) The fish refuge bays (allowed under (j)(ii)(2)) are too small to be effective.

6.6 I do not agree with Dr Keesing's recommendation that clause (j) be deleted for the following reasons:

(a) It is not the intent of clause (j) to prevent fish stranding;

(b) Dr Keesing's assertion that partial clearance will still result in all cover being removed after three months is, in my opinion, incorrect. Macrophyte stands are often re-established rapidly after drain clearing, and by the time three months has passed there is generally ample fish cover. Dr Keesing's own evidence supports this view. In para. 17 of his statement of primary evidence Dr Keesing describes his experience with annually or even biannually cleared lowland streams in the Kapiti Region. Such frequent cleaning would not be required if macrophytes did not rapidly recover after excavation. It is my experience that cleared vegetation will generally have re-established sufficiently after three months, that the previously uncleared vegetation can be extracted without removing all available habitat;

(c) The retention of fish habitat in cleared reaches can only help mitigate the negative effects of drain clearing that are caused by habitat loss. While Dr Keesing is right in that previous research published by myself and others found that staggered clearing still results in a significant reduction in fish abundance, this does not mean that this clearing approach did not reduce the impacts of drain clearing (Greer et al., 2012). Indeed, in Greer et al., (2012) I found that partial clearance reduced the need for large giant kokopu to leave cleared reaches in search of habitat. Partial clearing will still cause fish stranding and water quality issues, and as a result will reduce fish abundance. However, the impacts of habitat loss on fish populations will be reduced; and

(d) While the amount of habitat the fish refuge bays will provide is unclear (see para. 9.9 of my statement of primary evidence) I do not agree with Dr Keesing's assumption that it will be "tiny". Firstly, the refuge bays should primarily be employed in streams that are too narrow for the partial clearance technique described in clause (i). Secondly, fish refuge bays should be filled with complex artificial habitat structures. I have previously trialled such structures (made of concrete masonry units), and found that they are an effective method of replacing habitat lost during drain clearing.

Clause (k) – Sediment trapping

6.7 Dr Keesing does not oppose clause (k) with Ms. Guest's recommended amendments, and in his statement of primary evidence (para. 54), he supports the use of sediment retention devices. However, it is Dr Keesing's opinion that the option to trap sediment by retaining aquatic vegetation is not appropriate, as 10 metres of uncleared vegetation every 200 metres will not be sufficient to trap sediment.

6.8 Dr Keesing's recommendation is not relevant to this clause, as he has confused Ms. Guests amendments to Rule R121. The retention of 10 metres of vegetation every 200 metres comes from clause (j)(ii)(1), with a purpose of providing fish refuge. Clause (k) requires that a length of aquatic vegetation seven times the width of the

waterway be retained to trap sediment.

Clause (l) – Woody debris

6.9 From an ecological perspective, Dr Keesing's view on clause (l) is correct; there is no harm in removing woody debris from the channel providing it is returned to the water. However, it is my understanding from discussions with GWRC flood protection and compliance staff that this clause is not aimed at preventing the removal of aquatic habitat, but at preventing people from removing large woody debris from waterbodies that contribute to the structural integrity of the bed and banks. The removal of such debris can cause erosion issues.

7. APPROPRIATENESS OF PERMITTING VEGETATION AND SEDIMENT REMOVAL IN "STORMWATER DRAINS" AND "WATER RACES" UNDER RULE 121

7.1 It is my understanding that MDC, SWDC, supported by Kapiti Coast District Council (KCDC), and WWL have recommended that activities carried out to maintain urban stormwater networks ("stormwater drains") and water race networks ("water races") (MDC and SWDC only) also be permitted under Rule R121, as these systems have similar ecological attributes to drains and highly modified rivers and streams draining pasture (submitters rely on Dr Keesing's evidence to support this view).

7.2 In my opinion, vegetation and sediment clearance in watercourses which are part of stormwater and water race networks should not be permitted under Rule R121. I agree with Dr Keesing that the streams classified as "stormwater drains" and "water races" in the Wellington Region often contain similar values to those streams that fall under the current definition of "highly modified river or stream". Furthermore, it is not my view that clearing a given length of stormwater drain or water race will have more severe effects than clearing the same length of highly modified river or stream. Rather, my concern with permitting vegetation and sediment removal in stormwater drains and water races under Rule R121, is the potential increase in the extent of the activity.

7.3 Drain clearance operations in streams draining privately owned pasture are typically small-scale, as the length of waterway an

individual can clear is constrained by the size of their property. These constraints do not exist in streams managed by a single authority as part of a stormwater or water race network. For example, in her statement of primary evidence Ms. O'Brien (KCDC) states that KCDC's stormwater network includes an open channel network more than 40 km long, and that in 2015-2016 alone, 16.5 km of this network was cleared. Ms. O'Brien states that most of these waterways have a baseflow, indicating that they are indeed streams. The adverse effects of clearing such a large length stream in a such a small geographic area are, undoubtedly, significant (see para. 7.1 to para. 7.7 of my statement of primary evidence for a description of the effects of drain clearing). Allowing this scale of activity under a permitted activity rule is, in my opinion, entirely inappropriate.

7.4 When drain clearance is carried out on the scale described by Ms. O'Brien, strict conditions need to be imposed to ensure that effects of the activity are managed, the frequency of drain clearing is not excessive, and that network owners actively work to reduce the need for drain clearing by managing sediment input and plant growth. In my opinion, developing the conditions that achieve these outcomes is best done on a case by case basis through global consents.

8. APPROPRIATENESS OF ALLOWING WEED REMOVAL ON THE BANKS OF DRAINS AND HIGHLY MODIFIED WATERCOURSES UNDER RULE R121

8.1 It is my understanding that Ms. Whitney (MDC and SWDC) has requested that clause (g) be amended so that the requirement to leave vegetation cover on the bank intact does not apply when that vegetation is comprised of weeds. The intent of clause (g) is to prevent the excavator scraping the bank during drain clearing, as this can lead to erosion. In principle, I have no objection to weed removal on the bank, as long as it is targeted (i.e. does not involve using an excavator to scrape the bank). Therefore, I am comfortable with Ms. Whitney's recommendation provided that the clause clearly stipulates that weed removal shall not involve the use of an excavator.

9. APPROPRIATENESS OF IMPOSING AN EXCLUSION PERIOD FOR FISH MIGRATION IN THE CLAUSES OF R121

9.1 In her statement of primary evidence Ms. Petrove (Minister of Conservation) has recommended that a clause be added to Rule R121 (and Rule R122) that prevents drain maintenance works during key fish migration periods (1 August to 31 December). In principle, I agree with Ms. Petrove that drain clearance in fish migration periods should be avoided to limit the population level impacts of the activity. However, it is my opinion that imposing such a long exclusion period as a condition of a permitted activity rule is counter-productive.

9.2 Juveniles of several species of 'whitebait', namely banded kōkopu, kōaro and inanga, are known to avoid high sediment environments (Boubée et al., 1997). Drain clearing results in the release of large amounts of sediment (Greer, 2014; Greer at al., 2017), and conducting this activity during migration periods could reduce the number of fish from these species entering the impacted stream, or, if the activity is large enough, sub-catchment (Greer, 2014). Given the ecological, recreational, commercial and cultural importance of these species, and the "at risk – declining" status of kōaro and inanga, it is my opinion that drain clearing should be avoided during their migration season.

9.3 However, while I agree with Ms. Petrove that drain clearing should be avoided during fish migrations, I do not think that can be effectively achieved through conditions in a permitted activity rule. The length of the migration period proposed by Ms. Petrove, while appropriate for the protection of fish, is overly restrictive for a permitted activity, as it effectively prevents drain clearing without a consent for half the year, including the spring period when the activity is often required.

9.4 With the current clauses in Rule R121, landowners can be certain that they can clear the highly modified rivers and streams on their property to manage flood risk whenever that risk is present. If the exclusion period proposed by Ms. Petrove was incorporated in to the rule, this certainty would disappear; to manage flood risk year-round landowners would have to apply for resource consent. This

would have the same effect as changing the activity status of the drain clearing, as most people would still require resource consent to conduct the activity in a way that achieves its desired purpose (i.e. to manage flood risk). It should be noted that the current clauses of Rule R121 already provide a level of protection to native fish, including migratory life stages, and the recommended amendments to Method M14 work to reduce the extent and frequency of drain maintenance activities over time

10. APPROPRIATENESS OF THE USE OF THE TERM "ORIGINAL GRADE OR CROSS SECTION" IN CLAUSE (F) OF R121,

10.1 I understand that submitters, namely WWL and MDC/SWDC, are concerned that the term "original grade or cross section" in clause (f) is open to interpretation. I agree that what constitutes the original grade or cross section of the bed is open to a level of interpretation, considering the highly modified nature of the water bodies in which drain clearing is conducted. However, it is my opinion that giving effect to the current clause when conducting drain clearing operations will be straight forward in most circumstances, providing that a pragmatic approach is taken and the intent, as well as the wording is considered.

10.2 The intent of clause (f) is to ensure that excavation of bed substrate is limited to the removal of unconsolidated fine sediment that is deposited on the bed between clearings. From speaking to excavator operators and watching them work on multiple occasions, it is my opinion that, in most instances, operators can easily differentiate between deposited fine sediment and the underlying "original" bed. Even in soft bottomed streams, the sediments that make up the "original" bed are generally more consolidated than those deposited on top of it. Therefore, that the term "original" is open to interpretation should not be an issue, provided that the people conducting drain clearing know to only remove deposited fine sediment. This is a matter that should also be included as part of the education programme under Method M14.

11. REPSONSE TO DR KEESING'S RECCOMENDATIONS ON THE CLAUSES OF RULE R115 (CULVERTS)

11.1 Dr Keesing states in his statement of primary evidence that the maximum culvert length allowed under rule R115 could be increased to 30 metres without impeding fish passage; I agree with all of Dr Keesing's guidance on this clause. However, it is my understanding that the maximum culvert length was not set to ensure fish passage, but rather to reduce the potential for stream piping under this rule. Therefore, although Dr Keesing's evidence is correct, it does not justify changing the clauses of Rule R115

12. SECTIONS 5.5.2 AND 5.5.4 BEDS OF LAKES AND RIVERS AND WETLANDS GENERAL CONDITIONS: APPROPRIATENESS OF PROVISION FOR TEMPORARY OBSTRUCTION OF FISH PASSAGE (5.5.2 (d) 5.5.4 (d)).

12.1 I support, Ms. Guest amendments to Section 5.5.2 (d) and 5.5.4 (d) of the proposed Plan, which allow for the temporary (48 hour) obstruction of fish passage for the construction and maintenance of structures.

12.2 In her statement of primary evidence (para. 34), Ms. Petrove (Minister for Conservation) states that permitting the temporary (48 hour) obstruction of fish passage during the installation of small structures may have a significant impact on native fish when conducted in the lower reaches of rivers during peak migration periods. Based on this advice, legal submissions from Ms. Anton (Minister for Conservation) recommended that Ms. Guest's amendments to Section 5.5.2 (d) and 5.5.4 (d) be rejected.

12.3 While the short-term obstruction of fish passage in the lower reaches of large rivers may have a significant impact on upstream fish populations when it occurs during the peak of the migration season, it is unlikely that Ms. Guest's amendments to Section 5.5.2 (d) and 5.5.4 (d) will actually allow for the restriction of fish passage in large rivers. Very rarely will the construction of channel-wide structures in large rivers take less than 48 hours. The aim of Ms. Guest's amendments is to allow for the temporary obstruction of fish passage during the construction or in-frequent maintenance of **small** structures in **small** streams. In my opinion the impact of obstructing fish passage, even during the peak migration season, is unlikely to be significant under these circumstances.

12.4 It is important to note that preventing even a very temporary restriction of fish passage will increase the amount of earthworks required to install small structures, as diversion channels will have to be created whenever they are installed. This will also have effects on migrating native fish, which may avoid the sediment released during these earthworks, or be stranded in the diversion channel once flow in the stream is restored.

13. APPROPRIATENESS OF THE TIMEFRAMES SET OUT IN CONDITION (g)(ii) (SEDIMENT) OF SECTION 5.5.4 (ACTIVITIES IN BEDS OF LAKES AND RIVERS GENERAL CONDITIONS)

13.1 In her statement of primary evidence, Ms. Wratt (WWL) opposes Ms. Guest's recommended amendments to condition (g)(ii) in Section 5.5.4 (activities in beds of lakes and rivers general conditions). Ms. Guest has recommended that the clarity and colour change standards set out in condition apply while activities are being conducted on the beds of lakes and rivers, rather than 24 hours after their completion. Ms. Wratt states that the timeframe of 24 hours after completion of the activity should be retained in the condition to ensure there is a measurable standard for minimising the generation and release of sediment to water.

13.2 I disagree with Ms. Wratt's recommendation; in my opinion the clarity and colour change standards in Section 5.5.4 (g)(ii) should apply at all times. Having the clarity and colour change standards in (g) (ii) come into force 24 hours after works have finished allows for sustained periods of elevated and potentially detrimental suspended sediment levels when activities are conducted over a long period. Furthermore, the point in time at which condition (g)(ii) applies has no bearing on how "measurable" it is, the process of assessing colour and clarity change is always the same.

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