Before Independent Hearings Commissioners
At Wellington

Under	the Resource Management Act 1991
In the matter of	Applications for resource consents, and a Notice of Requirement for a Designation by Wellington Water Limited on behalf of Upper Hutt City Council, for the construction, operation and maintenance of the structural flood mitigation works identified as the Pinehaven Stream Improvements Project.

Statement of evidence of Claire Elaine Conwell for Wellington Water Limited (Erosion and sediment control)

Dated 20 July 2020

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Statement of evidence of Claire Conwell

1 Qualifications and experience

1.1 My full name is Claire Elaine Conwell.

1.2 I am an Associate Environmental Consultant at Jacobs (Water Resources). I have been employed at Jacobs since mid-January 2020.

1.3 I lead client projects and investigations, provide technical expert opinions regarding aspects of water quality, including field sampling methodology, data analysis and interpretation. I am also involved in all aspects of assessments for resource consent applications.

1.4 Prior to my current role at Jacobs, I was employed as a Senior Scientist with the Greater Wellington Regional Council ('**GWRC**') for 8.5 years, where I was responsible for components of the Coastal State of the Environment Programme focusing on estuarine and subtidal sediment contaminants, and I was Programme Manager for the Wellington Region's Recreational Water Quality Monitoring Programme. I provided scientific technical advice for Environmental Regulation (consents) officers across a wide range of marine and freshwater quality issues, with specific focus on wastewater and stormwater discharges. I provided technical expert evidence on stormwater provisions for the Proposed Natural Resources Plan for the Wellington region ('**PNRP**').

1.5 During January to June of 2019 I was seconded to the Ministry for the Environment's ('**MfE**') Essential Freshwater Taskforce to assist the policy advisors with specific analysis and provisions in the Essential Freshwater Reforms (announced September 2019). These were specifically for Ecosystem Health and Sediment attributes and policy. I also championed the Envirolink Tools research project 'Monitoring water quality in urban streams and stormwater: Guidance for New Zealand practitioners'[1] (NIWA 2019).

1.6 Prior to working at GWRC, I was employed as an environmental consultant for 5 years at the Cawthron Institute (Nelson), undertaking a range of Assessments of Environmental Effects ('**AEE**') for a variety of activities in near shore coastal environments around New Zealand. This commonly included assessment of contaminants in benthic sediments in urban coastal areas and port environments.

[1] J Gadd and J Milne "Monitoring water quality in urban streams and stormwater: Guidance for New Zealand practitioners" (June 2019) Envirolink <https://www.envirolink.govt.nz/assets/R13-1-Monitoring-water-quality-in-urban-streams-and-stormwater.pdf>

1.7 I hold a PhD in aquatic ecotoxicology from the University of Melbourne (Australia, 2007), and First Class Honours in aquatic ecotoxicology from the Royal Melbourne Institute of Technology University (Australia, 2000) and a Bachelor of Science from Monash University (Australia, 1999). I am a member of Water New Zealand (including membership of the Stormwater Group) and the Society of Environmental Toxicology and Chemistry (SETAC Australasia Branch).

1.8 I have authored more than 50 technical reports in environmental management, produced more than 10 conference presentations in the field of ecotoxicology and water quality, and published several peer reviewed science papers and co-authored a book chapter in marine hydrocarbon pollution.

1.9 My evidence relates to a Notice of Requirement ('**NOR**') for Designation and associated resource consent applications for the construction, operation and maintenance of the structural flood mitigation works identified as the Pinehaven Stream Improvements Project ('**the Project**'). Wellington Water Limited ('**WWL**') has lodged the resource consent applications and NOR on behalf of Upper Hutt City Council ('**UHCC**').

1.10 I am familiar with the area the Project covers and have been involved with the Project in a water quality advisory role since January 2020. I took part in expert witness conferencing of erosion and sediment control matters on 14 July 2020.

2 Code of conduct

2.1 While these applications are not before the Environment Court, I have read and am familiar with the Code of Conduct for Expert Witnesses in the current Environment Court Practice Note (2014). I have complied with the Code in the preparation of this evidence, and will follow it when presenting evidence at the hearing.

2.2 The data, information, facts and assumptions I have considered in forming my opinions are set out in my evidence to follow. The reasons for the opinions expressed are also set out in my evidence to follow.

2.3 Unless I state otherwise, my evidence is within my sphere of expertise and I have not omitted to consider material facts known to me that might alter or detract from the opinions that I express.

3 Scope of evidence

3.1 The evidence addresses the following matters:

a Sensitivity of the receiving environment to water quality effects;

b Effects on water quality;

c Recommended mitigation and methods for controlling erosion and sediment effects; and

d Response to Section 42A Report.

3.2 My evidence should be read together with the evidence of **Mr Tim Haylock** (construction methodology) and **Dr Alex James** (aquatic ecology), as it provides the link between these two subjects.

3.3 My evidence does not discuss matters raised in submissions, because none of these included concerns about the impact of the Project on water quality.

4 Executive summary

4.1 The Pinehaven Stream is highly modified, and water quality can be assumed to be typically similar to other urban streams in the Wellington Region.

4.2 The main contaminant of concern during the construction phase is the potential for sediment to be released, as suspended sediment (as particles in the water column), which in turn may contribute to down-stream deposited fine sediment.

4.3 Other contaminants of potential concern have been identified as those associated with heavy vehicle use for on-site construction works. The risk of any contaminants discharging from vehicle use is very low, and will be managed by reducing time of vehicles present on site, and mitigated by standard spill response protocols. The risk of chemical contamination associated with wet uncured cement use on site is low given the main concrete products will be pre-cast off site.

4.4 The measures of controlling sediment released into the stream are appropriately set out in the draft Erosion and Sediment Control Plan ('**ESCP**')[2] which has adopted the recommendations of construction methodology and feedback from GWRC.

4.5 The overall approach set out in the ESCP to manage and mitigate any release of sediment into the watercourse is robust, as detailed in sections 4 and 5 of the draft plan. The monitoring and adaptive management approach, as set out in

[2] Section 92 response to GWRC dated 21 February, 2020, Appendix B.

section 6, will ensure that any effects are temporary, short in duration, and overall will not significantly reduce the ecological health of the downstream receiving environment.

4.6 The overall contribution of any sediment released to the wider catchment is expected to be small, and contribution to cumulative effects from this activity will be minor in terms of the Hutt River Catchment.

5 Sensitivity of the receiving environment

5.1 The Hutt River is the single largest freshwater input into Wellington Harbour. Baseflow is around 5-6 cubic metres per second (cumecs), and following high rainfall (e.g. 24h >25mL rainfall event) flow in the main stem can peak at over 90 cumecs (e.g. as recorded on 26/5/2020[3]). High flows generally take several days to return to pre-rain baseflow conditions. On a whole of catchment scale, these high flow events deliver significant sediment loads to the Wellington Harbour receiving environment. The visible surface plume of this can extend southward as far as Evans Bay before dissipating into the marine receiving waters.

5.2 The Hutt River catchment sub-zone is described as a 56 km shallow, sometimes braided river, covering 57,419 ha. The middle and lower reaches of the catchment are increasingly urbanised, representing approximately 6% of the total catchment land use[4].

5.3 Whilst the specific contribution of the Pinehaven Stream sub-catchment to Hutt River main stem flow and overall catchment contaminant load has not been quantified, given the size of this sub-catchment (4.5 ha), the width and depth of the stream, and flashy nature of smaller urban streams in the Wellington area, the relative contribution of the freshwater flow and associated contaminant loads to the Hutt River main stem are expected to be very low.

5.4 There is limited water quality data for the 1.2 km stretch of the Pinehaven Stream subject to this development. The most recent site-specific data was reported in Warr (2007)[5], which, along with the information about urban streams in the Wellington Region, and also the Hulls Creek Catchment (which the Pinehaven Stream is a part of), allows for several generalisations about the sensitivity of the area, and effects of local water quality, to be inferred.

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[3] https://mapping.gw.govt.nz/GW/RiverLevels/

[4] http://www.gw.govt.nz/assets/Whaitua-Te-Whanganui-a-Tara/REPORT-Whaitua-Te-Whanganui-a-Tara-River-and-stream-water-quality-and-ecology.pdf

[5] Warr, S. (2007).Hulls Creek – water quality and ecology. Report for Environmental Monitoring and Investigations Department, Greater Wellington Regional Council. Report No. GW/EMI-T-07/2192007

5.5 Warr (2007) describes the lower reaches of the Hulls Creek Catchment as a moderately degraded waterway – and hence was identified in the then Greater Wellington Regional Policy Statement as a catchment requiring enhancement and restoration of poor water quality. Despite the issues identified for the catchment, the report concluded that Hulls Creek is not any more degraded than other urban streams in the Wellington region (Warr 2007).

5.6 The mid-catchment area of the Hulls Creek catchment is drained by Pinehaven Stream – this area is dominated by plantation forestry and scrub in the headwaters and urban residential areas in the middle and lower reaches.

5.7 The urban footprint of the Hulls Creek catchment is described in detail in Wellington Water's Global Stormwater Discharge Resource Consent AEE[6]. In summary, of the total 16.58 ha of the Hulls Creek sub-catchment, the stormwater catchment occupies around 43%. Overall, the total impervious area of this sub-catchment has been calculated to represent 0.23% of the total area – equivalent to 0.04 ha.

5.8 The total stream length in the Hulls Creek sub-catchment is around 25 km of mostly open stream, and is described as 'heavily modified'. Along the stretch of the proposed construction works in the Pinehaven stretch of the sub-catchment, there are numerous stormwater outlet pipes discharging to the Pinehaven Stream, as identified on the publicly available utilities map.

5.9 Pinehaven Stream itself has been modified by piping and channelization – the 300m piped section immediately before the Hulls Creek confluence has been identified as a barrier likely to be limiting fish access to higher quality habitat in the upper reaches of the Pinehaven Stream catchment.

Contaminants and water quality parameters

5.10 Warr (2007)[7] also explained that contaminated runoff from the urban areas around Pinehaven is likely to be contributing to the main source of copper and zinc contamination in the lower reaches of the Pinehaven Stream. Copper and zinc, along with suspended sediments, are ubiquitous contaminants of stormwater and urban runoff[8].

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[6] Wellington Water Ltd Stage One Global Stormwater Discharge Consent . Prepared by GHD Limited for Wellington Water Limited July 2017.
Resource Consent Application and Assessment of Environmental Effects

[7] Warr, S. (2007).Hulls Creek – water quality and ecology. Report for Environmental Monitoring and Investigations Department, Greater Wellington Regional Council. Report No. GW/EMI-T-07/2192007.

[8] https://niwa.co.nz/freshwater/management-tools/water-quality-tools/sampling-urban-streams-stormwater.

5.11 Turbidity[9] records summarised in the 2007 report also identified widespread elevated turbidity across the Hulls Creek Catchment and tributaries – but overall, median concentrations were similar to those in other urban streams in the region for the same reporting period. For the lower reaches of the Pinehaven stream, Warr (2007) reported turbidity in the range of 5.98 to 9.04 (NTU).

5.12 GWRC undertakes routine monthly sampling at 41 sites across the Wellington Region[10]. This is known as the Rivers Water Quality and Ecology Programme – also commonly referred to as State of the Environment ('**SoE**') monitoring network. This network of sites is designed to incorporate a range of catchment landuse types, and is not targeted to site specific monitoring of specific activities. Thus, GWRC Rivers SoE data can be used to describe in general terms, the current and historical state of catchment water quality in the region.

5.13 The closest SoE sites to the Pinehaven Stream are 'Hutt River Opposite Manor Park Golf Club (RS21)', 600m downstream of the Hulls Creek confluence with the Hutt River, and upstream there are SoE sites (Whakatikei River at Riverstone (RS26), Akatarawa River at Hutt Confluence (RS25), Mangaroa River at Te Marua (RS24) located several kilometres upstream of the Hull River confluence with the Hutt River. It is noted that these upstream sites are located on the smaller river/stream tributaries prior to their confluence with the Hutt River main stem, thus water quality associated with those sites are for the upper sub-catchments draining separately into those sub-catchment only and not representative of the cumulative profile of the Hutt River on their own.

5.14 A recent report prepared for the Whaitua Te Whanganui-a-Tara[11] (October 2018) collated available water quality and ecology data collected as part of the RWQE long term programme, including the sites listed in 5.13 above, and benchmarked the results against the PNRP outcomes, established guideline values from the literature and the National Policy Statement for Freshwater Management 2017 ('**NPS-FM**') attribute states. The 'current state' was assessed from data collected over a five-year period from 2012 to 2017.

5.15 Regarding the data collated for total suspended sediment (TSS) in the Hutt River Sub-catchment, the report stated "*It does not appear that TSS is affecting aquatic ecosystem health at any of the monitoring sites in the Hutt River catchment sub-zone. TSS concentrations recorded at all sites were generally well below the*

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[9] Turbidity is an index of cloudiness of water and measures how light is scattered by fine particles in waterways. Turbidity is an alternative measurement for suspended sediment and/or visual clarity and is measured in nephelometric turbidity units (NTU). Compared to black disk measurements, turbidity can be measured continuously, for example through the night (www.lawa.org.nz)

[10] https://www.gw.govt.nz/annual-monitoring-reports/2019/rivers-water-quality-and-ecology/index.html

[11] http://www.gw.govt.nz/assets/Whaitua-Te-Whanganui-a-Tara/REPORT-Whaitua-Te-Whanganui-a-Tara-River-and-stream-water-quality-and-ecology.pdf

commonly cited threshold of 25 mg/L for the onset of detrimental effects for fish".[12]

5.16 The 2018 Whaitua report comparisons of data ranges (as box-plots, collated for the period 2012-2017) indicated that median TSS for the site 'Hutt River Opposite Manor Park Golf Club (RS21)' downstream of the Hulls Creek confluence was within the range of upper catchment sites for the Hutt River sub-catchment, and median TSS concentration was well below the commonly cite threshold of 25 mg/L for the onset of detrimental effects on fish.

5.17 Temporal trend analysis of TSS data summarised in the 2018 Whaitua report[13] conducted for a ten-year period across the RWQE sites was inconclusive as to whether the TSS concentrations were improving or degrading over this period. The author of the report indicated that there was no conclusive statistical evidence to support whether the TSS was improving or degrading over this period – i.e. it remained largely unchanged, and no trends (environmentally meaningful or not) were apparent.

5.18 A review of New Zealand data regarding the relationship between impervious cover of a catchment and the impacts to freshwater quality and ecology[14] concluded that for the water quality metrics studied, almost all indicated reduced ecological integrity at very low levels of impervious cover. This study concluded that any levels of impervious cover (i.e. any cover above zero percent) can have a measurable effect on stream integrity (noting that most metrics appeared to be sensitive to changes between >0 to 20% impervious cover). The report went on to state that urbanisation of catchments, of which impervious cover is one measure, leads to 'flashier storm hydrographs, elevated nutrients, chemical contaminants and temperature, and altered channel morphology'.

5.19 An 'impervious condition model' identifies 10% impervious cover as a boundary distinguishing impacted urban streams, and predicts an exponential decrease in stream health in response to impervious cover. Low levels of impervious cover can elicit responses in stream metrics probably due to the point source nature of the impact pathways, that is stormwater inputs.

5.20 For the sub-catchments in the Hutt River catchment – such as the already urbanized sub-catchments in Pinehaven and the wider Upper Hutt City district,

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[12] http://www.gw.govt.nz/assets/Whaitua-Te-Whanganui-a-Tara/REPORT-Whaitua-Te-Whanganui-a-Tara-River-and-stream-water-quality-and-ecology.pdf at pg 62.
[13] See Table 31 on page 67 of http://www.gw.govt.nz/assets/Whaitua-Te-Whanganui-a-Tara/REPORT-Whaitua-Te-Whanganui-a-Tara-River-and-stream-water-quality-and-ecology.pdf
[14] Clapcott,, J., Collier, K., Death, R., Goodwin, E., Harding, J., Kelly, D., Leathwick, J., Young, R. (2012) Quantifying relationships between land-use gradients and structural and functional indicators of stream ecological integrity. Freshwtaer Biology 57:74-90.

there exists considerable localized areas of impervious cover which themselves contain numerous point-source stormwater discharge points that drain into the local streams, and eventually to the Hutt River. Combined with the total area of the upper catchments, however, the overall percentage of impervious cover decreases.

5.21 Separation of broader catchment cumulative effects from a localized point source effect of an intermittent sediment discharge is complex, and is beyond the scope of this current evidence. The approach would, at a minimum, need to account for wider catchment effects of urbanization, upper catchment land use changes, upper catchment hydrology, climate change, and consideration of mitigations imposed via the planning and policy framework set out in the PNRP and NPS-FM. This is generally a task of the current GWRC Whaitua process, and would require a wider assessment framework accounting for catchment scale cumulative effects than is possible under a single activity consent process.

5.22 Given catchment effects on urbanized stretches of the stream are already in place, the consideration is focused on not exacerbating these effects and to ensure that any potential adverse effects of a localized and temporary discharge of suspended sediment laden water in the Pinehaven Stream, are minimized and considered as short-term effects that can be appropriately managed via the ESCP to the extent that any such effects are no more than minor.

6 Effects on water quality

Earthworks

6.1 Adverse effects on water quality that could occur during site preparation, earthworks and construction are set out in section 10.5.1.3 of the AEE and are expanded here.

6.2 Sediment is considered the key contaminant of concern during all phases of construction. This is the key focus of control in the ESCP and the recommended framework set out in the Adaptive Monitoring Plan discussed with GWRC on 10 February 2020, and currently appended to the draft ESCP.[15]

6.3 Soil type in the catchment can affect the amount of suspended sediment. For example, streams in catchments with clay soils are likely to have naturally poorer water clarity than streams in sandy catchments. In slow-flowing lowland streams where sediment can be very fine, water clarity can be poor for long periods. This

[15] Section 92 response to GWRC dated 21 February, 2020, Appendix B.

is due to the slow rate of flushing and the fact that very fine particles are held in suspension almost indefinitely.

6.4 As erosion occurs, tiny particles of clay, silt or small organic particles are washed into waterways. These tiny particles can be supported in the water current and are termed suspended sediment. The faster the water is moving the larger the amount and size of suspended sediment particles it can carry.

6.5 Discharge of sediment into waterways can affect ecosystem health through various modes of impact which can be quantified by four environment state variables (‘**ESVs**’): suspended sediment concentration, visual water clarity, light penetration, and deposited fine sediment.[16]

6.6 There are generally two aspects of sediment-laden water discharges that need to be considered for minimising and managing adverse effects for the downstream receiving environment: suspended sediment concentrations (i.e. the sediment particles suspended in the water column itself), and deposited sediment (the particles that fall to the bottom of the stream and cover or smother the existing stream bed). These two aspects have different impacts on the receiving environment.

6.7 The current NPS-FM does not include specific provisions for managing suspended or deposited sediment. Rather, this is currently addressed by the PNRP water quality limits for clarity and sediment cover, as set out in Table 3.1 of the PNRP[17].

6.8 The proposed amendments to the NPS-FM (released September 2019) include the provision for sediment attributes in the National Objectives Framework, however these amendments are not yet operative.

6.9 Increases in suspended sediment concentration can alter ESVs by reducing light penetration, reducing clarity, and increasing deposition of fine sediment particles. Light penetration is important as it controls the amount of light in the water needed for aquatic plants to grow. Visual clarity indicates how much suspended sediment (soil) is in the water[18].

6.10 Deposited sediment alters the physical habitat by clogging interstitial spaces used as refugia by benthic invertebrates and fish, by altering food resources and by removing sites used for egg laying. As such, deposited sediment can affect the

[16] https://www.mfe.govt.nz/publications/fresh-water/sediment-attributes-stage-1
[17] Table 3.1 of the PNRP lists Primary contact recreation and Maori customary use objectives in freshwater bodies.
[18] https://www.lawa.org.nz/

diversity and composition of biotic communities. Excess suspended and deposited sediment can also affect the aesthetic appeal of rivers and streams for human recreation. Even short-term peak events which may not affect the overall median turbidity value, can still have an adverse effect on the ecological health of a stream.[19]

6.11 Other potential contaminants arising from the on-site construction activities are due to the presence of vehicles and the associated fuels, oils, grease, hydraulic fluids associated with machinery use on site, and any construction materials (cement/construction works). Proper machinery maintenance and servicing prior to site use will ensure that any potential discharge of hydrocarbon etc is minimised. Any spills incurred would be suitably managed under a spill response protocol, as required by the Construction Management Plan.[20]

6.12 The construction methodology also indicates that pre-cast concrete will be transported to the sites over the course of construction – i.e. any use of wet cement is minimised to the use in grouting. Pre-cast cement is fully cured cement – and considered an inert construction material, thus does not represent a risk of chemical discharge to the receiving environment. The minimal use of wet cement for grouting purposes (and associated contaminants) is therefore considered to be a low to very low risk to any receiving environment effects. Any wet cement products used on site would expect to be cured up to 95% within 24 hours - after which time the risk of discharge of cement related material is minimal.

6.13 The effects of contaminants are being mitigated in the overall construction methodology by adopting recommendations of GWRC to construct a dam and diversion/over-pumping construction methodology. Thus the main stream flow of the Pinehaven Stream will be piped though a diversion around the earthworks site, and any residual water is pumped to settlement tanks prior to downstream discharge. In effect, only clean stream water will be discharged to the downstream area of construction site.

6.14 This approach, combined with the off-site construction of pre-cast concrete materials reduces the period of stream bed disturbance, and the requirement for

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[19] https://www.mfe.govt.nz/sites/default/files/media/Fresh%20water/sediment-attributes-and-urban-development-literature-review.pdf
[20] See GWRC recommended condition 16(h).

additional on-site heavy machinery that may exacerbate soil disturbance and introduce additional risks of contamination of the stream.

6.15 Overall, the effects of the earthworks is expected to have a temporary minor impact on the water quality (as assessed by turbidity and SSC) in the immediate downstream vicinity of the construction site. These effects are expected to be temporary, and effectively controlled via the ESCP and Site Specific Environment Management Plan (SEMP).

Stream bed disturbance and dewatering

6.16 The adverse effects on water quality that could occur as a result of disturbance of the stream bed and discharges of dewatering water are set out in section 10.5.1.4 of the AEE and expanded here.

6.17 A recent review commissioned by MfE[21] concluded that, when implemented correctly, erosion sediment controls can be over 90% effective at reducing sediment yields from a development/construction site. The key features include implementing construction practices that reduce the area exposed at any one time, reducing slope length and protecting exposed slopes, and controlling surface water flows as well as retention of sediment laden water on site (if required) to allow sediment to settle out.

6.18 For the Pinehaven project's ESCP, the items listed in 6.21 are all features adopted in the construction methodology and set out in section 3.1 and detailed in Sections 4 to 6 of the ESCP. For example, Section 4 details the approach to specific construction controls of sediment, including reducing sediment loss to water. Section 5 of the ESCP details aspects of site stabilisation for exposed sediment surfaces, including stockpiles, and exposed stream bank slopes.[22]

6.19 Adverse effects of increases in turbidity (or suspended sediment concentration (SSC)) as a direct effect of the works are expected to be temporary, of short duration, and managed by the Adaptive Management Plan (AMP) set out in the Appendix A of the ESCP in the event that increase in turbidity/SSC is detected.[23] Whilst mitigating factors such as increased upper catchment flow following heavy rain will serve to 'flush' the residual sediment – and provide for natural attenuation, this method of mitigation is not the focus of sediment control. Rather,

[21] [21] https://www.mfe.govt.nz/sites/default/files/media/Fresh%20water/sediment-attributes-and-urban-development-literature-review.pdf
[22] Section 92 response to GWRC dated 21 February, 2020, Appendix B.
[23] Section 92 response to GWRC dated 21 February, 2020, Appendix B.

the preventative approach adopted in the construction methodology and set out in the ESCP is considered best practice.

6.20 Whilst all measures set out in the ESCP and SEMP for each development stage will ensure that the bulk of sediment will be controlled, the disturbance of the stream bed itself during construction is anticipated to generate some unavoidable release of suspended sediment when the stream is livened. This can potentially mobilise any unconsolidated sediment and generate a sediment plume – increasing the risk of deposited sediment at downstream receiving environment.

6.21 The evidence of **Dr Alex James** sets out the main ecological impacts anticipated to result from the construction methodology, in particular the effects of temporary increase in turbidity and potential increases in downstream deposited fine sediment cover.[24]

6.22 Potential downstream effects of deposited sediment can include smothering of benthic ecology, reducing habitat quality by the infilling of interstitial spaces – thus altering food resources, and affecting niche areas for egg laying and other recruitment processes for many aquatic species.[25] Increases in turbidity reduce the aesthetic quality for recreational users.

6.23 For each development stage, a SEMP is intended to be adaptable to ensure that site specific environmental needs are met – and to minimise and control the increase in downstream turbidity, and minimise and deposition of fine suspended sediment particles. The framework in the ESCP ensures that any learnings from the first stage of development, including any indication that there is a potential risk of downstream deposited sediment, then increased preventative measures can be adopted for subsequent stages of development.

6.24 In the short term – control measures adopted during the stream livening process will be an important step to reduce the release of unconsolidated fine sediments. The management approach is set out in section 4.2.1.1 of the ESCP.[26] This will likely involve allowing some flow to enter the works area following stream compaction mitigation activities, which will then be pumped out and treated by a sediment settling tank before being discharged back to the stream downstream of the works area. Following this, the dams will then be fully removed as quickly as possible to allow the flow to flush out remaining sediment within the works area.

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[24] James EIC, paras 6.12-6.15.
[25] James EIC, para 6.14.
[26] Section 92 response to GWRC dated 21 February, 2020, Appendix B.

6.25 This process ensures any release of unconsolidated fine sediment to the downstream receiving environment is minimised, and reduces the risk for any plume or deposited sediment to occur.

6.26 The overall contribution of any potential expected turbidity/sediment load increase to the cumulative load of the Hutt River is expected to be minor. As state above , the upper Hutt River Catchment drains an area of ~57,419 Ha. The relative contribution of suspended sediment from the Pinehaven Sub-catchment (4.5 sq. km) has not been quantified. Given the surrounding sub-catchments, there are numerous point source discharge points contributing to the overall cumulative impact. The stretch of the affected stream area (approx. ~1.2 km of stream length, and noting that these are largely first or second order tributaries/streams), from the overall stream in the sub-catchment is small. Thus given the control measures set out in the ESCP, the overall cumulative load is expected to be relatively minor compared to the overall catchment load.

Zone of reasonable mixing

6.27 The appropriate zone of reasonable mixing is considered to be 50m.

a The PNRP defines the zone of reasonable mixing for permitted areas for flowing water bodies as no less than 50 m.[27] In this situation where a discharge consent has been applied for, the appropriate zone of reasonable mixing must be considered in accordance with Policy P72 of the PNRP.

6.28 Policy P72 states:

> When a discharge to water requires resource consent, the **zone of reasonable mixing** shall be minimised and will be determined on a case-by-case basis. In determining the **zone of reasonable mixing**, particular regard shall be given to:
>
> (a) acute and chronic toxicity effects, and
>
> (b) adverse effects on aquatic species migration, and
>
> (c) efficient mixing of the discharge with the receiving waters, and
>
> (d) avoiding a site with significant **mana whenua** values identified in Schedule C (mana whenua), and
>
> (e) the identified values of that area of water, and

[27] Section 2.2.

(f) avoiding significant adverse effects within the **zone of reasonable mixing**.

6.29 Each item is addressed below.

a Acute and chronic toxicity effects arising from the temporary and intermittent discharge of sediment from the construction area are not expected. Sediment itself is not toxic, rather the risk to the receiving environment is incurred due to the physical disturbance it poses, rather than a chemical disturbance. This aspect of physical disturbance will be minimised where possible via the implementation of the ESCP, and mitigated by the timing of the construction during the winter period – outside the main reproductive cycles of freshwater flora and fauna species.

b Adverse effects on aquatic species migration are addressed in the evidence of **Dr Alex James**. The physical disturbance imposed by the main construction itself, and the piped water diversion, is in itself the main barrier. This is appropriately managed by the requirements of the consent on ensuring safeguarding of aquatic ecology from construction works, rather than the risk of aquatic species migration imposed by elevated SSC.

c Efficient mixing of the discharge water (pipe diversion, and discharge from sediment settling tank) with receiving environment and waters is expected to be achieved by ensuring the piped diversion upstream of the construction site remains clean and uncontaminated by construction site activities, and the discharged supernatant from the sediment settling tank also has minimal SSC. To ensure efficient mixing of the settlement tank supernatant, this point of mixing should occur immediately downstream of the piped diversion discharge point. Given both discharges are expected to be largely free of elevated SSC, then adverse effects in the zone of reasonable mixing are minimised.

d There are no Schedule C sites in the Pinehaven Stream, or in the wider Hulls Catchment downstream of the proposed works.

e The identified values for this area of water are interpreted as the ecological values – this is addressed in the evidence of **Dr Alex James**.

f Significant adverse effects within the zone of reasonable mixing, in this case defined as 50m, are expected to be minimised via the implementation of the ESCP and site-specific method statements. The key aspect of the ESCP to avoid significant adverse effects within the zone of reasonable mixing is the employment of the construction methodology to divert the clean upstream water and any clean runoff away from the construction area (including away from any non-stabilised earthworks area), and ensuring that appropriately managed perimeter controls for any surface water runoff are in place.[28] This includes any stormwater and ponding that may occur on site, and to ensure that any sediment laden water is retained in a settlement tank for a period of time to allow fine particulates to settle, and the clean supernatant to be discharged immediately downstream of the discharge point of the piped diversion stream.

6.30 In light of the items (a-f) covered above, a 50 m zone of reasonable mixing is adequate for ensuring any adverse effects of discharge are no more than minor. The main effect is potentially a conspicuous change in visual clarity of the water which is anticipated to be at times minor, and of a temporary nature. All other aspects of s107 are expected to be negligible to no more than minor.

Overall effects during construction

6.31 The overall impacts of the construction phase are potential risks of release of sediment. As outlined, the ESCP sets out effective steps to minimise this during the construction phase.[29] Effects of increased downstream turbidity are likely to be short in duration, and in the absence of upper catchment effects, are expected to quickly return to background levels.

6.32 The dam and diversion method in effect is temporarily disturbing the stream bank and stream bed floor- however when complete the diversion process will be delivering clean stream water to the downstream site – and any onsite construction processes during the operational phase are appropriately managed via the ESCP and SEMP. Thus effects during the construction phase are excepted to be both minor and temporary.

Operational phase

6.33 Positive effects on local stream water quality that are expected to result during the course of and following completion of the operational phase are set out in section 10.5.2 of the AEE.

6.34 In the short term, riparian planting can lend support to the stabilisation of stream banks disturbed during the construction phase, this will reduce further erosion of sediment into the water course. Over time as the riparian zone is established, this

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[28] Section 92 response to GWRC dated 21 February, 2020, Appendix B.
[29] Section 92 response to GWRC dated 21 February, 2020, Appendix B.

will also serve to increase filtration of overland flows of runoff into the stream from the surrounding catchment.

6.35 This is expected to result in local improvement to the Pinehaven Stream water quality, and overall to reduce the 'flashy' nature of the stream which in turn can exacerbate the transport of sediment and stormwater to downstream receiving environments.

6.36 The improvements will also enhance the aesthetic appeal and improve recreational experiences of the stream environment for public users.

6.37 Overall, there are expected to be short term effects on increased suspended sediment, and potentially downstream deposited sediment during the operational phase as riparian planting becomes established. If managed according to the construction methodology and prescribed management plans, adverse effects are minimised, considered short term, and the overall contribution to the wider catchment is considered minimal

7 Recommended mitigation

7.1 In order to achieve the best outcomes for water quality in the Pinehaven stream, I recommend the process of controls set out in the ESCP, specifically the methods set out in sections 4 and 5, supported by monitoring and reporting requirements set out in section 6, be adopted.[30]

7.2 As indicated in the s92 response, the construction procedure of 'dam and diversion' were adopted on the recommendation of GWRC as the best practicable option for minimising the overall environmental impact of the construction, the best protection for the Pinehaven Stream water quality, whilst still providing a viable means for the works to proceed. This preferred approach is set out in the ESCP,[31] and is also in accordance with the advice from GWRC[32].

7.3 GWRC experts considered that the initial proposed methodology of sheet-piling to have a higher risk associated with sediment control and overall environmental impact. In light of the concerns expressed by GWRC, the construction methodology was subsequently changed to the 'dam and diversion' approach to allow for greater management and mitigation of risks to the receiving environment.

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30 Section 92 response to GWRC dated 21 February, 2020, Appendix B.
31 Section 92 response to GWRC dated 21 February, 2020, Appendix B.
32 See Section 92 response to GWRC dated 21 February, 2020, Table 1, EH10 response.

7.4 Appendix B of the Draft ESCP sets out the 12 stages of the proposed construction, and includes the description of how the pipe diversion methodology will be implemented for each stage, and with particular regard to the different or challenging logistics of each stage.[33] For example, the terrain of the site at 50 Blue Mountains Road requires a pump and/or suction hose arrangement to be installed, rather reliance on a gravity fed diversion. This may also require a larger pump hose than is proposed for other sites, and is expected to be managed accordingly for the site specific needs, and to be detailed in the SEMP.

7.5 Proposed conditions 18-21 under *Erosion and Sediment Control*[34] comprehensively cover the controls imposed for minimising the release of sediment into the Pinehaven stream. This includes the requirement for the ESCP to be finalised in accordance with the draft ESCP, and to follow through with the development of SEMP for final approval of GWRC.

7.6 A supporting assessment and monitoring framework sets out an adaptive management approach to ensure that downstream water quality during the construction phase is managed within trigger levels – this requires continuous assessment with possible mitigation steps included in the event that water quality is demonstrably deteriorating during the construction period[35].

7.7 In addition to the AMP, the conditions include the requirement for downstream monitoring for fine deposited sediment using the SAM2 method of assessment.[36] The methods are consistent with that currently adopted in GWRC's RWQE programme, and in accordance with the method set out in the draft recommendations to the NPS-FM sediment monitoring updates.

7.8 Overall, the detailed draft management plans, in particular the ESCP[37], give a level of confidence to all parties that the construction methodology is overall robust, can be tailored for the site specific requirements, and will be appropriately monitored and reported with any identifiable mitigations implemented and amendments to the AMP for successive stages incorporated.

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[33] Section 92 response to GWRC dated 21 February, 2020, Appendix B.
[34] As discussed with from Helen Anderson, 4 June 2020, GWRC Section 42A Report.
[35] See Section 92 response to GWRC dated 21 February, 2020, Table 1, EH04 response
[36] GWRC Section 42A Report, Appendix 2, condition 54.
[37] Section 92 response to GWRC dated 21 February, 2020, Appendix B.

8 Response to section 42A report

8.1 I have read the GWRC Section 42A Report, and would like to comment on issues relating to Section 10.3 Effects on water quality, with specific regard to section 10.3.1 Sediment discharges (pages 49-51).

8.2 Overall the description concerning the potential effects on water quality set out in Section 10.3 are an accurate description of the potential effects of sediment on the downstream water quality in the Pinehaven Stream catchment. The description of the difference between dry weather and wet weather water quality (in relation to sediment) provides an accurate understanding of the key issues discussed in this evidence, and that I have also discussed with Helen Anderson, Tim Haylock, and Gregor Mclean.

8.3 Regarding the proposed condition to limit the downstream SSC to 50 mg/L SSC at all times during the construction works (discussed on p 49 and 50 of the 42A report), I consider this tentatively appropriate for the purpose of meeting the requirement of no conspicuous change under s107 of the RMA. My opinion is based on my assessment of the Hutt River SoE monitoring data for the site immediately downstream of the Hulls Creek discharge to the Hutt River main stem (corresponding to site 'Hutt River Opposite Manor Park Golf Club' (RS21), sourced from the GWRC Rivers Water Quality and Ecology long term monitoring programme.

8.4 I assessed the available data for the period 1 July 2017 to 16 March 2020, for the parameters of clarity (as measured by the Black Disc method), turbidity, and SSC.

8.5 In accordance with the definition of conspicuous change, as described in the MfE 1994 Report[38], as well as in the 2013 Report for GWRC[39], a conspicuous change in water clarity can be described as a 33 to 50% reduction in visual clarity measurements. The 2013 water quality limits recommended for rivers and streams in the Wellington Region (for waters where there are no other significant natural features), state that a 33% reduction is considered an appropriate measure of conspicuous change in visual clarity.

8.6 On the basis of the comparisons between the water clarity data, compared with the SSC and turbidity data for the Hutt River site RS21, reductions in water clarity

[38] MfE (1994). Water Quality Guidelines No2: Guidelines for the Management of Water colour and Clarity. *Published by the Ministry for the Environment, Wellington, New Zealand. ISBN 0-477-05891-4.*
[39] Ausseil, O. (2013). Recommended water quality limits for rivers and streams managed for Aquatic Ecosystem Health in the Wellington Region. Report Prepared for Greater Wellington Regional Council. Report prepared by Aquanet Consulting Ltd. June 2013.

are consistent with significant increases in both turbidity and SCC, usually as the result of heavy rainfall events. The data for this site indicates for an instream concentration of 50 mg/L SSC, this would most likely meet the definition of a conspicuous change of water clarity by 33%, compared with ambient baseflow or upstream water quality state (in dry conditions). This assessment is with the caveat that the data summarised was for the Hutt River main stem flow; the general nature of urban streams in the Wellington region are that they are 'flashier', whereby water levels and thus water quality measures rapidly change in response to moderate to high rainfall events. The assessment is also with the caveat that the 'workability' of the limit of 50 mg/L SSC remains largely untested in a small urban stream environment. Thus the ability for the trigger level to be appropriately adapted and managed via the AMP will be central to the mitigation controls imposed for subsequent stages of construction.

8.7 Regarding the proposed Winter works condition, whilst I am in agreement with the intent of this approach to manage the works in a higher risk period, I consider that this is already appropriately catered for in the CMP framework, and the requirement for an additional step for approval is unnecessary, as all the same best practice controls and mitigation steps, as well as the AMP, are already set out.

8.8 The issues set out in 10.3.2 Other contaminants also accurately represent my own understanding of the issues associated with those listed. I agree that the effects of other contaminants are appropriately managed by the mitigation controls set out in the CMP.

9 Conclusions

9.1 The main contaminant of concern during the construction phase is the potential for sediment to be released, either as suspended sediment (as particles in the water column), which in turn may contribute to down-stream deposited fine sediment.

9.2 The best outcomes for water quality in the Pinehaven stream can be achieved with the implementation of the process of controls set out in the ESCP, specifically the methods set out in sections 4 and 5, supported by monitoring and reporting requirements set out in section 6.[40]

9.3 The overall approach set out in the ESCP to manage and mitigate any release of sediment into the watercourse is robust, and the adaptive management approach

[40] Section 92 response to GWRC dated 21 February, 2020, Appendix B.

will ensure that any effects are temporary, short in duration, and overall will not significantly reduce the ecological health of the downstream receiving environment.

9.4 The overall contribution of any sediment released to the wider catchment is expected to be small, and contribution to cumulative effects from this activity will be minor in terms of the Hutt River Catchment.

Claire Elaine Conwell
20 July 2020