BEFORE THE NEW PLYMOUTH DISTRICT AND TARANAKI REGIONAL COUNCILS

IN THE MATTER of the Resource Management Act 1991 ("the Act")

AND

IN THE MATTER of applications from NZTA to alter a designation and for resource consents for the Mt Messenger Bypass Project - SH 3 between Uruti and Ahititi ("the Project")

Richard Alexander Duirs

EVIDENCE ON BEHALF OF THE DIRECTOR-GENERAL OF CONSERVATION

(Erosion & Sediment Control)

Dated: 24 July 2018

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1. QUALIFICATIONS AND EXPERIENCE

1.1. My full name is Richard Alexander Duirs.

1.2. I am employed as a Senior Environmental Planner with Wainui Environmental Limited and have been contracted by the Department of Conservation (hereafter termed **DOC**) to provide advice in regard to potential erosion and sediment effects associated with the Mt Messenger Bypass construction project.

1.3. I hold a bachelors degree in Natural Resource Studies from Lincoln University. My previous employment has included working as a Planner with the Waipa District Council, a Resource Officer with Waikato Regional Council, an Environmental Consultant with an Auckland based environmental consultancy and a Senior Environmental Planner with a Waikato based civil engineering and planning consultancy. Through these roles I have gained extensive experience in erosion and sediment management on large scale earthworks sites including consenting, compliance monitoring, erosion and sediment control design and on-site erosion and sediment control management. Past projects have included a number of wind farms and a number of NZTA expressway projects through

challenging terrain along with numerous residential development projects. I have been in my current role since January 2018, which includes overseeing erosion and sediment control management on a high risk, large scale residential developments. I am also engaged by the Waikato Regional Council to undertake compliance monitoring of a number of large scale earthworks sites in the Waikato Region. Through my employment I have gained significant theoretical and practical knowledge and skills in erosion and sediment management on large scale earthworks projects in New Zealand. I have obtained the Certified Professional in Erosion and Sediment Control qualification through the International Erosion Control Association. I am an Associate Member of the New Zealand Planning Institute.

1.4. I am familiar with the proposed route of the Mt Messenger bypass generally. I attended a site visit with the applicant on 2 February, 2018.

1.5. I have read the Environment Court's Code of Conduct for Expert Witnesses, and I agree to comply with it. I confirm that the issues addressed in this brief of evidence are within my area of expertise.

1.6. I have not omitted to consider material facts known to me that might alter or detract from the opinions expressed. I have specified where my opinion is based on limited or partial information and identified any assumptions I have made in forming my opinions.

1.7. My opinions rely in part on the evidence presented by expert witnesses appearing for NZ Transport Agency, in particular the statements of evidence of Mr Ridley.

2. SCOPE OF EVIDENCE

2.1. My evidence will deal with the following issues:

- The nature of the Mt Messenger Bypass site/project;
- The proposed erosion and sediment control methods outlined in the NOR;
- The potential erosion and sediment effects of the Mt Messenger Bypass project; and

- The Applicant's proposed erosion and sediment monitoring, mitigation and proposed consent conditions.

2.2. I have assessed the Applicant's proposed erosion and sediment control methods and generally consider these to be reflective of best practice methods typically implemented for large scale earthworks projects within New Zealand. However, I have outstanding reservations regarding the ability of the proposed methods to effectively manage to the potential sediment effects of the proposed earthworks activities on downstream receiving environments. In particular, I question the ability of the Applicant to construct/implement best practice erosion and sediment control measures throughout the high risk central portion of the site due to topographical/hydraulic constraints in this area.

2.3. The NOR documents include a high level, theoretical assessment of sediment yield from the proposed earthworks incorporating best practice erosion and sediment control measures which outline increases of up to 46% in sediment loads within site watercourses. The applicant has concluded that these effects will be less than minor.

2.4. I disagree with this conclusion. Considering the high risk nature of the works in conjunction with the high quality of the aquatic receiving environments within the site, and the significant construction challenges within some areas, I consider that these activities present a high potential for adverse water quality and aquatic habitat impacts within the immediate site receiving watercourses. These effects could be significantly more than minor. The actual scale of these effects will be directly related to the scale and frequency of storm events occurring within the site catchments over the course of the Project.

2.5. The NOR includes a proposed monitoring plan to measure sediment control efficiencies, water quality effects and proposed site response measures. However, the proposed sampling methods do not present a robust method for determining peak sediment discharge effects. Nor does this plan include sufficient provision for responding to any measured adverse sediment effects in the form of ecological offset mechanisms, when adverse effects are detected within the downstream environment.

3. KEY FACTS AND OPINIONS

3.1. The exposure of earth surfaces during large scale earthworks operations is known to create a potential for adverse environmental effects through erosion and subsequent discharge of sediment to downstream waterbodies. Within aquatic receiving environments these discharges have the potential to result in adverse effects on water quality and aquatic ecology. As described in the evidence of Dr Drinan, effects may include the abrasive and smothering effects of fine sediments on aquatic organisms and habitats, and the discolouration of water affecting visual feeder species as well as aesthetic and recreational values. Operational effects can include infilling and blockage of drainage channels and culvert pipes, resulting in reduced drainage efficiencies within these systems and increased flooding effects.

3.2. The earthworks associated with the Mt Messenger Bypass project comprise large scale land disturbance activities occurring across an area of 36ha. Earthworks volumes are proposed in the vicinity of 1,000,000m^3. In addition, the project proposes numerous other land disturbance activities including vegetation clearance, access tracking, temporary and permanent culvert installations, temporary and permanent stream diversions, a large scale tunnelling operation and a large bridge installation. All of these activities present a risk for adverse erosion and sediment effects.

3.3. A significant portion of the Mt Messenger Bypass alignment passes through steep headwater catchment topography with limited/no current access and thick vegetation cover. The NOR documents describe site geology as predominantly comprising papa clay soils which are described as fine sands, silts and clays which could be expected to be susceptible to adverse erosion effects under saturated conditions and which will likely have a high level of mobility within site runoff and receiving environments.

3.4. Dr Drinan's evidence identifies the aquatic receiving environments within the site as comprising largely intact, natural state water bodies with good riparian cover from mature native forest, good to excellent water quality and habitat values and a high diversity of native fish. These include longfin eel, giant kokopu, red fin bully and inanga comprising species classified as 'At-Risk declining' under the DoC Threat Classification System.

3.5. The Project specifications outlined above are representative of a significant construction earthworks project occurring within pristine headwater catchment areas. While the scale of the Project may not be as large as a number of other NZTA Expressway Construction projects currently underway within New Zealand (e.g Transmission Gully, Huntly Bypass, Puhoi to Warkworth), there are a number of characteristics which elevate the erosion and sediment risks of the Project including:

- Site topography: steep, incised bush covered gully systems with limited to no existing access to many of the proposed works area.

- The papa clay soils which are described as fine sands, silts and clays which will be susceptible to erosion under saturated conditions.

- High rainfall within this elevated West Coast area.

- The design characteristics of the earthworks which include large scale box cuts and sidling cut/fill operations across steep slopes along with large scale/deep fill embankments extending up incised gully watercourse systems.

- Large numbers/lengths of temporary and permanent stream diversion and culvert installations within the difficult terrain.

- High ecological values associated with the site receiving watercourses.

3.5 While this Project may not be of the same scale (in terms of area/volumes) as a number of other NZTA Expressway Construction projects currently underway within New Zealand, the four year timeframe specified for completion of this Project is the same duration as the construction programme specified for most of these larger projects. This reflects the significant complexities and challenges associated with this Project.

3.6. It is primarily the works through the central part of the site (CH2000-4550) which include the infilling of significant lengths of incised, steep sided gullies along with stream diversions, culvert installations, tunnel/bridge construction and box cutting through steep slopes, presenting significant

construction challenges and a significant potential for adverse erosion and sediment discharge effects.

4. ASSESSMENT OF THE ADEQUACY OF THE APPLICANT'S PROPOSED EROSION AND SEDIMENT MANAGEMENT METHODS

4.1 The application documents outline the proposed methods for managing erosion and sediment effects during the works. These include the documents titled 'Construction Water Management Plan', 'Specific Construction Water Management Plan Template', 'Construction Water Discharges Monitoring Programme' and the drawing set titled 'Erosion and Sediment Control Conceptual Plans for Main Construction Works'. I have reviewed and assessed these documents and also attended a number of discussions with the Applicant's advisors in regard to these documents.

4.2 The NOR proposes a 'Construction Management Plan' approach to management of the potential erosion and sediment effects of the activities. This is based upon a two-stage approach as follows:

- Development of an overarching Construction Water Management Plan (CWMP) prior to commencement of earthworks outlining the key erosion and sediment management principles, devices, processes and methodologies that will be implemented over the course of the project.

- Development of individual/site Specific Construction Water Management Plans (SCWMP) for each phase/area of works within the site which outlines the specific details of the proposed erosion and sediment control methods and devices relevant to that phase of works.

This approach comprises the typical erosion and sediment management approach implemented on numerous other large-scale earthworks projects throughout New Zealand. I agree that this approach presents an appropriate management method for the Project.

4.3 The processes and practices proposed in the CWMP and SCWMP are generally based upon the methods outlined within the New Zealand Transport Agency's Erosion and Sediment Control Guideline for State Highway Infrastructure, 2014.

4.4 The proposed erosion and sediment control processes and practices are generally reflective of best practice erosion and sediment control in New Zealand and if implemented effectively will go a significant way to reducing the adverse erosion and sediment effects of the Project. A number of my previous concerns have now been addressed through discussions with the Applicant, provision of further information and updated management plan documents.

4.5 However, my key outstanding concern in regard to the proposed erosion and sediment control methods and subsequent sediment effects of the Project is the ability of the applicant to physically implement best practice erosion and sediment control measures for the works. The central part of the site (CH2000-4550) raises significant construction challenges, with its steeply incised, deep valley systems with permanent flowing watercourses. Works through these areas will involve a number of complicated operations including major stream diversions and culvert installations, tunnel/bridge construction and large scale filling and box cutting through steep slopes. The absence of any existing access into these areas (including pedestrian access) is a significant construction challenge/risk and will determine the requirement for multiple phases of enabling works to get to a point where bulk construction activities are even able to proceed within these areas.

4.12 If the Applicant is practically unable to implement best practice erosion and sediment control measures in these challenging parts of the site (e.g the ability to construct appropriately sized water impoundment devices on the side of steep slopes or within incised gully systems), there will be a lower level of sediment treatment than anticipated through the NOR.

4.13 Furthermore, the construction of erosion and sediment control devices within this terrain presents an increased risk for failure of sediment control devices both during typical work conditions, or during greater than design events. In this respect, erosion and sediment control devices comprise temporary/rudimentary engineered measures with erosion and sediment control guideline documents within New Zealand (including the NZTA guideline) excluding any specific geotechnical design or construction testing requirements to ensure the structural integrity of these structures. Hence, again factoring the steep slopes and topographical constraints within this central part of the site, I consider that a high potential for failures of erosion and sediment control measures exists. Large scale

failures of compliant/best practice sediment control measures, and subsequent adverse effects, are known to occur for large magnitude earthworks at much simpler sites to Mt Messenger during significant rainfall events. This can be a relatively common occurrence even on earthworks sites where best practice erosion and sediment control measures are implemented.

4.14 The Applicant has attempted to develop a conceptual construction methodology for how the high risk works within the central part of the site may be undertaken to confirm that the proposed construction activities through these areas are physically possible, and that the potential erosion and sediment effects can be effectively controlled. While the information does outline some possible construction/environmental management methods, the information presented is at a high/conceptual level and does not provide confidence that the potential erosion and sediment control effects of these works can be managed to prevent adverse downstream effects. The reality for these works is that they will be challenging, complex and risky. Risks include:

- Ability to physically construct the proposed sediment control devices in the design locations;
- Ability to effectively divert all cleanwater around the site;
- Management of greater than design events or unforeseen circumstances e.g culvert blockages;
- Access limitations e.g waterfalls;
- Ability to undertake the works within the timeframes suggested.

4.15 Overall, the potential for acceptance of a reduced level of erosion and sediment control through this area and the inherent risks associated with even best practice sediment controls implemented in this area are considered to maintain a significant risk for adverse sediment discharge effects over the duration of these activities.

5. POTENTIAL SEDIMENT EFFECTS OF THE MT MESSENGER BYPASS PROJECT

5.1 The potential sediment effects of the Mt Messenger Bypass Project have been assessed by the Applicant in the Construction Water Assessment Report (CWAR). The CWAR concludes that the effects of sediment runoff from the project earthworks on the downstream receiving watercourses will be less than minor. This conclusion is based upon a number of factors including:

- Implementation of best practice ESC measures for the works;
- High sediment base flows within the site receiving water bodies;
- The minor scale of the site in relation to the overall catchment areas (Tongaporutu and Mimi) and immediate upstream sub-catchments.

I disagree with this conclusion for the following reasons.

5.2 The Applicant has provided some baseline water quality data for the site catchments which do identify elevated suspended sediment levels within stream flows during large catchment rainfall events. As the subject catchments comprise stable, forested catchments I would assume these elevated levels are likely due to stream bank erosion or localised slip events. During the site visit, it was noted that the Tongaporutu River flows were significantly discoloured due to a recent rain event in the catchment. However, at the same time the smaller catchment watercourses within the site were all flowing clearly with no evidence of catchment erosion/sedimentation effects within stream flows.

5.3 The Applicant's CWAR includes a high level/theoretical assessment of potential sediment yields for the works based upon sediment yield data derived from a separate assessment undertaken during a consent process for a separate NZTA earthworks project within the Auckland Region. This assessment has applied these sediment yield figures to the subject site and to the surrounding catchment areas in an attempt to quantify the impact of site sediment runoff on broader catchment flows.

5.4 No specific details of the Auckland project runoff parameters have been provided. Hence, I am unable to confirm whether the parameters used

would be applicable to the subject site. However I understand that this data was based upon the earthworks site utilising sediment control devices operating at optimum efficiencies (in the range of 90% sediment removal) and without any account for potential greater than design events or failures that may occur.

5.5 At a basic level, even with the implementation of best practice erosion and sediment control measures operating at optimum efficiencies, the data utilised suggests a greater than 600% increase in sediment yield from the existing forested site cover to the proposed earthworks scenario i.e:

- Baseline/forested catchment sediment yield = 7.9 tonnes of sediment/ha/year;

- Earthworks catchment sediment yield - including implementation of best practice erosion and sediment control measures = 49.1 tonnes of sediment/ha/year.

5.6 The Applicant has utilised this data to assess the potential impact of the site earthworks upon sediment yields within the wider Tongaporutu and Mimi River catchments and has determined potential increases in these catchments of 0.7% and 0.5% respectively which are deemed insignificant by the Applicant.

5.7 While some contribution to the existing cumulative high sediment loads occurring within these catchments should be anticipated, I consider that it would be very difficult to attribute any adverse sediment effects detected within these broader river systems directly to the proposed earthworks activities based upon their significant catchment areas, distance downstream of the site and existing high sediment loads from multiple catchment sediment inputs.

5.8 The Applicant has also utilised this data to estimate the percentage increase in sediment yield from the earthworks activities. These results indicate a 46% increase in sediment within stream flows in the northern/Mangapepeke catchment and a 7.2% increase in sediment within stream flows within the southern/Mimi catchment.

5.9 The increase within the Mangapepeke catchment represents a significant increase in sediment yield and is at a level which I consider could give rise to adverse sedimentation effects within the catchment watercourses.

5.10 The calculated lower percentage increase in the Mimi catchment is due to the much larger upstream catchment and smaller area of earthworks proposed within this catchment, whereas at a subcatchment/tributary catchment level, these increases would be significantly greater.

5.11 The Applicant has assessed sediment yield using a basic assessment and using baseline data from an unvalidated, remote source in relation to the subject site. Nonetheless, the assessment does provide an indication of the quantum of increase in sediment yield that could be anticipated. Based upon this information and my own assessment, my key conclusions in are:

- The proposed activities, even with the implementation of best practice ESC's will result in a significant increase in sediment inputs to some of the receiving water bodies immediately below the site (46% increase estimated within the Mangapepeke Stream by the Applicant);

- The Applicant's assessment has been based upon best practice erosion and sediment control measures functioning at optimum performance levels. Based upon the challenging site terrain and constructability challenges previously outlined, I consider that this is unlikely to be achieved throughout the Project.

- Within the broader/larger catchment areas (Tongaporutu and Mimi) site discharges are unlikely to result in any significant/noticeable increase in sediment base loads (based upon the larger dilution factor and existing sediment base loads within these larger waterbodies). They will however contribute to cumulative sedimentation effects which may be occurring within the lower reaches of these catchments and marine receiving environments.

- Within the localised, smaller receiving water bodies immediately below the site, the works will result in a significant increase in sediment inputs. The effects of these inputs will likely comprise a significant increase in stream flow sediment levels during storm events, with these effects also likely extending beyond the duration of the storm event (based upon the extended time it will take for sediment control devices to drain down to dead storage levels following an event).

- While water quality within these streams will eventually recover, increased levels of benthic sedimentation and associated ecological effects may occur within downstream channels. These effects would

likely be concentrated within lower velocity channel sections and pools however I defer to the evidence of Dr Drinan in regard to these effects.

5.12 Based upon the above points, I disagree with the Applicant's assessment that the potential sediment discharge effects of the Project will be less than minor or negligible[1]. I consider that these activities present a high potential for adverse water quality and aquatic habitat impacts within the immediate site receiving watercourses which could be significantly more than minor. The actual scale of these effects will be directly related to the scale and frequency of storm events occurring within the site catchments over the course of the project.

6 ASSESSMENT OF THE ADEQUACY OF PROPOSED MONITORING AND MITIGATION

6.1 The NOR documents have included a document titled 'Construction Water Discharges Monitoring Programme' (CWDMP) which outlines water sampling and site response methods to be implemented over the duration of the earthworks with a specified purpose of ensuring that the effects of the Project are managed appropriately.

6.2 The CWDMP outlines proposed trigger rainfall events, sampling methods/locations and sediment management thresholds. The proposed sediment management thresholds refer to trigger levels beyond which management responses will be implemented by the Applicant with the trigger levels outlined as follows:

- For manual SRP sampling – less than 80% reduction in turbidity between the pond inflow and outflow;
- For stream sampling – greater than 20% increase in site stream turbidity from control sites;
- For sediment deposition monitoring – greater than 5mm sediment deposition within the Mimi Swamp Forest.

[1] Section 10 of the CWAR refers: With the implementation of the measures and methods described in this report the overall effects of construction discharges on receiving waters will be less than minor. Mr Ridley EIC at [137]: *"The potential change in water quality is minimal and the increase in sediment (as shown in Table 1) is unlikely to be detectable.'* Mr Ridley Supplementary Evidence at [37]: *"Overall, I remain of the view that …the erosion and sediment effects of the Project will be negligible"*.

6.3 Should the first two water quality/turbidity management thresholds be exceeded, the proposed response is to undertake site inspections to determine likely causes and undertake any necessary remedial works on site. Should the sediment deposition threshold for the Mimi Swamp forest be exceeded, the proposed response is to implement response actions outlined within the Freshwater Management Plan (Chapter 8 of the ELMP). I have reviewed the ELMP and note that these responses appear to be limited to further monitoring of any sedimentation within the Mimi Swamp Forest, and preparation of a report summarising the findings.

6.4 I have previously questioned the ability of the proposed monitoring regime to effectively detect and respond to any adverse sediment effects within downstream receiving environments for the following reasons:

- Proposed sediment discharge monitoring methods were limited to manual, grab sampling methods only to detect compliance with the above triggers. It is very difficult to ensure that peak sediment discharge events are captured using manual sampling methods. Storm events may occur at night or during weekend/holiday periods when site staff are not present. The isolated site location and challenging access terrain presents further constraints to ensure that the storm peaks are captured. Based upon staff being on site for 10 hours/day and for 6 days/week, they are only likely to be present for around 35% of the time that a storm event may occur. Hence, the proposed manual monitoring approach was considered to present a low level of confidence that peak storm events will be captured to determine sediment control efficiencies or downstream sediment effects. It was recommended that continuous sediment monitoring systems were implemented at upstream/downstream and SRP inlet/outlet locations within each catchment to ensure capture of all peak events;

- The proposed response to any measured period of elevated sediment discharge effects was limited to onsite remedial works only, which do not respond to any adverse sediment effects (reduced water quality/increased deposition) which may have already occurred within downstream receiving environments during the sampled storm event;

- Receiving environment sediment deposition/habitat monitoring was limited to the Mimi Swamp Forest site only, whereas the proposed

earthworks present a high risk for adverse sedimentation effects to occur within both the Mimi and Mangapepeke catchments and within both wetland and aquatic stream habitats;

- The only ecological response outlined for sediment deposition effects occurring at the lone Mimi Swamp Forest site was to undertake further monitoring and prepare a report, which does not provide any means for remedying or mitigating these adverse effects.

6.5 The Applicant has provided an updated CWDMP that addresses some of these concerns. However I have remaining concerns as follows.

Water Quality Sampling Methods

6.6 The updated CWDMP has been extended to include provision for continuous sampling at downstream locations/directly below the earthworks areas in each catchment to collect real-time monitoring data in addition to the previous manual sampling regime. The intention is that the continuous sampling units will be installed prior to commencement of the earthworks to collect baseline turbidity data which in combination with manually collected baseline data can be utilised for comparative analysis throughout the earthworks period.

6.7 I question the ability of only using two continuous monitoring units downstream of the works (with this data to be assessed against historic, baseline data) to provide an accurate and realistic method for assessing compliance with the above site performance triggers during a storm event. In particular, the ability to assess this data accurately against historic baseline data from a storm event of exactly the same magnitude, seasonal and catchment conditions.[2] I consider it is necessary to ensure that the pre-works and during-works turbidity comparison is accurate, and presents an appropriate comparison for determining compliance with the specified triggers.

6.8 Hence, I do not consider that the proposed CWDMP outlines an appropriate monitoring regime to effectively capture/quantify the actual adverse

[2] Mr Ridley's Supplementary evidence at [28(c)] states: *"There is no practical reason to install upstream continuous turbidity monitoring to understand Project related discharges. The downstream sites for the continuous monitoring will enable pre-earthworks baselines to be established and represent more accurately the catchment that will be subject to earthworks."*

sediment effects of the earthworks activities or appropriate response procedures. To ensure that peak sediment runoff effects and appropriate responses are captured and implemented, I maintain that implementation of continuous monitoring at both upstream and downstream locations within both catchments provides the most accurate means to assess compliance with the triggers. Upstream as well as downstream monitoring is required to provide certainty that peak sediment/turbidity levels during/following all peak storm events are captured.

6.9 In this respect, I support the TRC Officer's Report consent conditions (8-10) of consent number 10655-1.0 requiring provision of an updated CWDMP which includes a requirement for continuous monitoring of sediment levels within both stream channels and at least two SRPs within the Mimi and Mangapepeke catchments respectively.

6.10 The implementation of this continuous monitoring method also provides a potential opportunity for the continuous monitoring data to be made available to other stakeholder groups (e.g TRC/DOC), via website link or similar to allow these parties to observe the effectiveness of the proposed erosion and sediment control regimes. Should these recommended measures proceed, I recommend a consent condition which provides for stakeholder web access to this data to observe site performance/effects as an added means means of transparency and compliance monitoring.

6.11 In addition, the provision of both continuous upstream and downstream monitoring during the earthworks has potential to be of benefit to the Applicant. In particular, should significantly elevated sediment levels be recorded at the downstream sites, the provision of directly correlated upstream data will be able to confirm situations where elevated levels may be caused by separate, upstream sources such as catchment slips. The absence of any upstream data and reliance upon historic baseline data during these events will maintain a level of uncertainty regarding the likely source of sediment runoff contributing to these effects.

Ecological Monitoring

6.12 The updated CWDMP now refers to additional ecological monitoring of immediate aquatic receiving environments, baseline monitoring and biannual monitoring of fish and macroinvertebrate communities including directly below Fills 12 and 13 during the fill operations in these areas. The addition of this monitoring is supported in regard to identifying any direct

sediment effects of the earthworks on local aquatic communities. However, I refer to the evidence of Dr Drinan regarding the appropriateness of the proposed ecological monitoring regime including scope, frequency and methods.

Ecological Response/Mitigation

6.13 The only ecological response outlined in regard to any identified adverse sediment effects occurring due to the Project earthworks appears to relate to deposition effects within the Mimi Swamp Forest site with the response comprising further monitoring and preparation of a summary report. This response does not provide any means for remedying or mitigating these adverse effects. There is no clear direction as to what ecological offset works/measures will be undertaken to remedy or mitigate for any adverse sediment effects which may occur within the sites aquatic receiving environments.

6.14 I consider that this issue should be addressed through update of the CWDMP and ELMP documents to ensure that, should adverse ecological effects be determined within downstream receiving environments as a result of site sediment discharges (through the finalised CWDMP), a direct response is required. Dr Drinan's evidence recommends mitigation works including sediment removal processes or additional biodiversity offsets (e.g. further riparian planting). The extent of any additional enhancement works should be commensurate to the measured scope of adverse effects as determined by an appropriately qualified ecologist and should be additional to the extent of aquatic habitat enhancement proposed by the Applicant for the direct habitat loss/impacts. Dr Drinan recommends the choice of measure, quantity of mitigation and the timeframe for implementation be determined in associated with an Expert Review Panel and TRC and I support that. Currently conditions GEN24 and SED11 of the draft NZTA conditions, referencing the ELMP and CWDMP documents, are inadequate.

7 ASSESSMENT OF RECOMMENDED TRC CONDITIONS

7.1 I have reviewed the recommended consent conditions outlined within the TRC recommendation for resource consent application 17-049.1.0 and in particular consent number 10655-1.0 (discharge of stormwater and sediment). These recommended conditions provide a greater level of

confidence that the risk of adverse sediment effects occurring over the higher risk winter period will be effectively managed in accordance with best practice methods.

7.2 I support the inclusion of conditions 5–7 which outline specific requirements for erosion and sediment control device design and management. The direct reference to these items in the conditions ensures that these requirements are explicit and clear for the consent holder, the consent authority and any stake holder groups.

7.3 The recommended conditions (8–10) include provision for a more robust water quality monitoring regime to ensure that systems are in place including continuous monitoring to accurately detect the level of adverse water quality effects occurring as a result of the earthworks activities.

7.4 However, while the recommended conditions do require continuous monitoring of both SRP efficiencies and suspended sediment within receiving watercourses, this does not extend to monitoring of actual ecological effects which may occur as a result of measured elevated sediment discharges or any specific response measures occurring to remedy or mitigate for any identified adverse effects. Dr Drinan comments on that matter.

7.5 Condition 10(g) refers to the CWDMP including provision of:

> *"Specific management responses that will be undertaken in response of the water quality triggers and any other adverse sediment effects that is identified."*

7.6 As stated above, I recommend that these conditions (and the CWDMP/ELMP) include specific provision for outlining the details of ecological mitigation works that will be undertaken in the event that adverse sediment effects are identified within downstream receiving environments.

8 ASSESSMENT OF DRAFT NZTA CONDITIONS

8.1I have reviewed the draft conditions submitted by the Applicant dated 17 July, 2018. At a general level I do not consider that the NZTA draft conditions are sufficiently prescriptive in establishing specific requirements/standards that must be achieved by the consent holder for

the earthworks activities. Instead, the draft conditions refer to numerous management plan documents which will contain the various management requirements and performance standards for the site.

8.2 I consider that the consent/environmental management requirements on these type of Projects are most effective when they are explicit and referred to directly within consent conditions (rather than buried deeply within multiple layers of management plan documents). This ensures that they are clear and are not subject to misinterpretation or modification. In this instance, the NZTA draft conditions are focussed predominantly on management plan development, submittal and amendment processes and do not provide clear, measurable conditions that can be easily assessed by either the consent holder, consent authority or other stakeholder groups to determine site compliance.

8.3 I prefer the recommended TRC consent conditions as a more prescriptive and appropriate set of conditions to achieve best practice and transparent erosion and sediment management at the site.

9 REVIEW OF NZTA EVIDENCE

9.1 Mr Ridley EIC at [144] states:

> *"DOC has received a copy of the CWDMP and has confirmed acceptance of the CWDMP for monitoring construction related activities as fit for purpose. This matter has therefore been resolved."*

9.2 I was provided the opportunity to review the CWDMP document, however I have not previously provided formal comment on this document.

9.3 Mr Ridley EIC at [147] states, in relation to the proposed large scale earthworks activities within the central part of the site:

> *"DOC has accepted these methodologies but emphasised that the high risk profile of these locations remain. There is agreement that the fill sites in question are subject to SCWMPs and that the proposed staged approach enabled appropriate adaption of the methodologies. This matter has therefore been resolved."*

9.4 The Applicant has presented two conceptual/high level construction/erosion and sediment control methodologies for these areas. While the information does outline some possible construction/environmental management methods, the information presented is at a broad/conceptual level and does not provide confidence that the potential erosion and sediment control effects of these works can be managed to prevent adverse downstream effects. I maintain that even with erosion and sediment planning in-line with these processes, a high risk of adverse erosion and sediment effects remains.

9.5 Mr Ridley Supplementary Statement at [28(c)] states:

> *"There is no practical reason to install upstream continuous turbidity monitoring to understand Project related discharges. The downstream sites for the continuous monitoring will enable pre-earthworks baselines to be established and represent more accurately the catchment that will be subject to earthworks."*

9.6 I have dealt with this comment above. I consider that reliance on baseline data to form the site control water quality reference point creates a high level of uncertainty when comparing recent data against data from historic catchment storm events and catchment conditions including both climatic, hydraulic, landform and landuse changes.

9.7 Mr Ridley Supplementary evidence at [28(c)] also states:

> *"The rationale for monitoring flow and turbidity is unclear. In the absence of further sampling and establishing relationships between suspended sediment concentration and turbidity, turbidity itself does not provide any confirmation of sediment concentrations"*

9.8 I concur that turbidity does not provide a direct measure of sediment concentrations. However, in the absence of any other practical method for providing continuous/rapid data representative of water clarity conditions at the site, turbidity does comprise the most appropriate parameter for characterising sediment effects occurring due to site discharges. Considering any significant measured increase in upstream/downstream turbidity levels at the site, the potential for these to be occurring as a result of any other catchment inputs other than sediment discharges within the localised site area, is low. Furthermore, the CWDMP specifies that:

"'total suspended solids will be tested at the same time as the calibration samples to establish TSS and turbidity relationships. Turbidity records can then be more accurately converted to TSS for assisting with assessment of potential effects."

Hence, I maintain that provision of continuous upstream/downstream turbidity monitoring will comprise a useful and effective tool for characterising site sediment effects within receiving watercourses.

9.9 Mr Ridley's Supplementary evidence at [29] – [31] states:

"DOC have raised a concern related to the earthworks activities to occur in both Fill 12 and 13… To assist with the management of this risk, we have also introduced a more site focused monitoring programme for these locations… and includes specific ecological monitoring…"

The cautious construction methodologies proposed for these fill sites, the CWDMP and the fill specific monitoring programme, mean that any effects of construction related water discharges will be managed effectively with full knowledge of outcomes as the fills progress. Overall, therefore, I remain of the view that erosion and sedimentation related effects associated with these fill sites will be negligible."

9.10 The provision of additional monitoring for these high risk works is supported and will provide increased knowledge of outcomes from these activities. However, this does not provide confidence that outcomes will necessarily be positive or that the effects will be negligible. Mr Ridley has not set out what mitigation response measures will be implemented in the event that adverse sediment effects do occur, but appears to rely only on continual improvement of the erosion and sediment control measures. I maintain my position that this should be addressed within the application documents and subsequent management plans.

10 CONCLUSION

10.1 The Mt Messenger Bypass Project proposes significant construction earthworks activities through a high value ecological environment. Combined with the very steep site topography and construction complexities, these activities present a high risk for adverse erosion and sediment effects within downstream watercourses.

10.2 The Applicant has proposed erosion and sediment management processes and plans which are generally reflective of best practice methods typically implemented on earthworks sites throughout New Zealand. However, the Applicant has not provided sufficient information to confirm that the best practice erosion and sediment control methods proposed are able to physically be implemented for all parts of the project and particularly the complex, high risk works occurring through the central steep headwater catchment areas.

10.3 I disagree with the Applicant's conclusion that the potential erosion and sediment effects of the project will be less than minor or negligible. This is not reflected within the Applicants own assessment which indicates an increase in sediment yield within one of the site catchments (Mangapepeke) of 46%. I consider the risk of adverse erosion and sedimentation effects occuring, over the duration of construction, is high.

10.4 The Applicant has proposed a monitoring plan to sample sediment pond performance and water quality effects within the receiving waterbodies. While provision of continuous/automated monitoring has been added at downstream locations, a reliance on historic, baseline records to provide the control water quality data for the site is insufficient. I support the TRCs recommendations for provision of continuous/automated monitoring at both upstream and downstream locations and within sediment ponds as the most robust method for determining the actual sediment effects of the site earthworks and subsequent response measures.

10.5 I recommend that a direct response should be provided if adverse effects occur within downstream receiving environments as a result of site sediment discharges. Potential responses for such events are referred to in Dr Drinan's evidence.