IN THE MATTER of the Resource Management Act 1991

AND

IN THE MATTER of applications by Waka Kotahi NZ Transport Agency (Waka Kotahi) to Manawatū-Whanganui Regional Council and Greater Wellington Regional Council for resource consents to enable the construction, operation and maintenance of new state highway, shared use path and associated infrastructure, between Taylors Road (to the north of Ōtaki) and Stage Highway 1 north of Levin.

SECTION 87F REPORT OF KERRY PEARCE – EROSION AND SEDIMENT CONTROL

MANAWATŪ-WHANGANUI REGIONAL COUNCIL AND GREATER WELLINGTON REGIONAL COUNCIL

28 April 2023

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A. OUTLINE OF REPORT

1. This report, required by section 87F of the Resource Management Act 1991 ("**RMA**"), addresses erosion and sediment control methodology, practices and effects arising from resource consent applications lodged with the Manawatū-Whanganui Regional Council ("**Horizons**") and Greater Wellington Regional Council ("**GWRC**") for the Ōtaki to North of Level Highway Project (the "**Ō2NL Project**").

2. The resource consents applied for, by Waka Kotahi NZ Transport Agency ("**Waka Kotahi**"), are required to authorise the construction, operation and maintenance and improvement of a new state highway, shared use path and associated infrastructure, between Taylors Road (to the north of Ōtaki) and State Highway 1 north of Levin.

3. In addition, Waka Kotahi separately lodged Notices of Requirement ("**NoRs**") relating to the Ō2NL Project with Horowhenua District Council and Kāpiti Coast District Council (the "**District Councils**"), respectively. Matters relating to the NoRs are outside the scope of this report, and are being addressed by technical advisors for the District Councils.

4. In preparing this report, I have relied on the expert advice from the following experts advising Horizons and GWRC:

   (a) Logan Brown for Horizons and GWRC on Water Quality;

   (b) Stuart Farrant for Horizons and GWRC on Operational Stormwater; and

   (c) Justine Bennett for the District Councils on Water Quality.

5. While this report is pursuant to section 87F of the RMA, I have in accordance with section 42A(1A) and (1B) attempted to minimise the repetition of information included in the application and where I have considered it appropriate, adopt that information.

B. QUALIFICATIONS / EXPERIENCE

6. My name is Kerry Stewart Pearce. I am Director of Environmental Land Management Limited, which is subcontracted to Bryant Environmental Solutions Limited. I have been in that position since May 2005.

7. My role involves providing technical advice on earthworks and erosion and sediment control components of resource consent applications for Waikato Regional Council, Auckland Council, and Horizons, along with monitoring the erosion and sediment control components of land use resource consents for those regional councils.

8. I hold the Bachelor of Applied Science (Agriculture) degree from Massey University. I am a member of the New Zealand Association of Resource Management.

9. I have specific experience in both preparing technical assessments to support RMA processes, as well as on-site monitoring experience with a number of large projects including:

   (a) Mighty River Power Puketoi Wind Farm;

   (b) New Zealand Steel Managed Landfill;

   (c) Waka Kotahi Upper Harbour Corridor;

   (d) Contact Energy Limited Te Mihi Power Station;

   (e) Waka Kotahi Atiamuri Bridge Replacement;

   (f) Mighty River Power Ngatamariki Power Station;

   (g) Transpower Wairakei to Whakamaru “C” Transmission Line; and

   (h) Mercury Turitea Wind Farm.

10. I am familiar with site and surrounding area. I visited the site along with other Horizons and GWRC experts and Waka Kotahi experts on 7 September 2022.

C. CODE OF CONDUCT

11. I confirm that I have read and agree to comply with the Code of Conduct for Expert Witnesses contained in the Environment Court Practice Note 2023. I confirm that I have stated the reasons for my opinions I express in this report, and considered all the material facts that I am aware of that might alter or detract from those opinions.

12. Statements expressed in this report are made within the scope of my expertise, except where I rely on the technical advice, I have referred to in paragraph 4 of this report.

13. I have all the information necessary to assess the application within the scope of my expertise and am not aware of any gaps in the information or my knowledge.

D. EXECUTIVE SUMMARY

14. In summary:

    (a) GD05 provides 'best practice' erosion and sediment control tools for earthworks sites and any deviation from these guidelines requires sound technical justification. In my opinion, use of the Waka Kotahi Guidelines has not been sufficiently justified when having regard to the impact of soil compaction and soil pore blockage during construction or contingency measures should Waka Kotahi Guideline devices not meet performance standards. If the Waka Kotahi Guidelines are to be utilised (which I do not support presently) then, at a minimum, there must be robust and regular monitoring of device performance. Further, there also needs to be contingency measures in place for poorly performing ESCP devices. These measures would, at a minimum, ensure the performance achieved the standard expected from GD05 compliant devices.

    (b) I support the imposition of performance standards for the end of pipe sediment load from sediment control devices. This performance standard will ensure Waka Kotahi and Regional Councils obtain a more accurate indication of the sediment

discharge from the site. This will also ensure the effects are consistent with those assessed as part of the application. I rely on Mr Brown's recommendations with regard to the appropriate standards to apply in particular catchments.

(c) The management and monitoring system proposed for the Ō2NL Project covers a range of matters and is intended to ensure that measures have been designed, installed, and managed in accordance with consent conditions and guidance documents. There are a number of performance outcomes, standards and reporting requirements proposed for management plans, which should, in my view, be reflected in conditions of consent.

E. SCOPE OF REPORT

15. This report addresses issues related to the earthworks and erosion and sediment control methodology and practices associated with the construction of the Ō2NL Project. It covers the following specific topics:

(a) A description and understanding of the receiving environment as it is relevant to the erosion and sediment control components of the construction;

(b) The erosion and sediment control methods, practices and standards proposed to be implemented during construction in order to avoid, remedy or minimise potential effects during construction of the Project;

(c) The potential estimated sediment yields calculated by Waka Kotahi, and an assessment of the sediment yield determining factors;

(d) Submissions relating to issues concerning erosion and sediment control; and

(e) Proposed mitigation and management of effects (Conditions).

16. In preparing my report I have considered the following information:

(a) Otaki to North of Levin Highway Project Volume II – Notices of Requirement for a Designation and Application for Resource Consents: Supporting Information and Assessment of Effects on the Environment 1 November 2022 ("**AEE**");

(b) Otaki to North of Levin Highway Project Design and Construction Report Prepared for Waka Kotahi NZ Transport Agency July 2022 ("**DCR**");

(c) Appendix 4.3 Erosion and Sediment Control Technical Assessment Report ("**ESCP Report**");

(d) Appendix 4.3.A – Te Ahu a Turanga Trigger Response Form;

(e) Appendix 4.3.B – USLE;

(f) Otaki to North of Levin Highway Project (O2NL) Appendix 4.3.3: Erosion and Sediment Control Plan ("**ESCP**");

(g) Otaki to North of Levin Highway Project (O2NL) Appendix 4.3.3.1: Chemical Treatment Management Plan ("**CTMP**");

(h) Otaki to North of Levin Highway Project (O2NL) Appendix 4.3.3.2: Erosion and Sediment Control Monitoring Plan ("**ESMP**");

(i) Appendix 4.3.3.3 – Dewatering Management Procedure;

(j) Appendix 4.3.3.4 – Emergency Spill Response Procedure;

(k) Appendix 4.3.3.5 – Stream Works Procedure;

(l) Appendix 4.3.3.6 – Hazardous Substances Procedure;

(m) Otaki to North of Levin Highway Project Technical Assessment H: Water Quality;

(n) Concept Erosion and Sediment Control Drawings; and

(o) Example Site Specific Erosion and Sediment Control Plans (SSESCPs).

F. BACKGROUND

17. The Ō2NL Project is described in detail in Waka Kotahi's application,[1] and I adopt that description for the purpose of my report. Relevantly, the proposed construction footprint area is approximately 364 ha[2] with approximately 4–5 million cubic meters of cut material, including cut to fill, borrow to fill, and cut to waste.[3]

18. The topography of the alignment is described in the ESCP Report[4] as follows:

> The alignment starts in the north at the proposed SH1 (State Highway 1) intersection approximately 1.5km north of Levin. From here, the corridor extends south-east, passing over the NMIT railway and across rural and residential land with moderately sloping gullies for approximately 3km to the existing SH57. Then the alignment turns south-west and runs parallel to the existing SH57 over relatively flat farmland plains, crossing McDonald Road, Waihou Rd, Queen Street, Tararua Road and Kimberley Road. Past SH57 the corridor is positioned to the East of the current SH1 until it terminates at the Waitohu Stream, just north of Ōtaki. This section is the main stretch of the Ō2NL corridor, and it is characterised by alluvial plains to the east of the Tararua Ranges. The alignment crosses many streams and rivers through this section, including the Waikawa Stream, Kuku Stream and Ohau River, which have shaped the local topography. Near the southern end, the corridor crosses some large gullies between SH1 and the Tararua Ranges.

19. The geomorphological setting and soils of the alignment are described as:[5]

> The project area is predominately characterised by alluvial deposits transported from the Tararua ranges during the late

[1] Assessment of Environmental Effects at 1.0
[2] Assessment of Environmental Effects at 50.2.1. There may be a discrepancy in how these volumes are described when you compare the volume set out at page 35 of the Design and Construction Report.
[3] Assessment of Environmental Effects at 14.4.1.
[4] At paragraph 30.
[5] At paragraphs 31 to 33.

> Pleistocene and Holocene interglacial periods. A large alluvial basin has been formed, which extends along the middle part of the project area from the eastern plains and towards the coast and has overlain or incised older shoreline and dune sand deposits. The alluvial deposits form localised fans and terraces around the existing and historical waterways, such as the Ōhau River and Waikawa River.
>
> Late Pleistocene shoreline deposits consisting of beach and aeolian deposits are exposed to the north and south near Levin and Ōtaki at the surface, as elevated sandy hills capped with loess. Through the middle of the project area these materials are found at depth, underlying the late Pleistocene and Holocene alluvium. Older, middle Pleistocene alluvium has been encountered below the shoreline deposits in some areas.
>
> Wellington Greywacke is the basement rock in the area and is generally expected to be at depths exceeding 40 – 50 m along the alignment. Greywacke was encountered at depths of approximately 20 – 30m near the Ōhau River and Tararua Ranges, close to the existing quarry.

20. The existing freshwater receiving environments are described in Technical Assessment K and Technical Assessment H.[6] The ESCP Report[7] describes the water quality along the proposed alignment as:

> ...variable, and largely dependent upon upstream land use, ranging from generally high (in the Ōhau River and Waikawa Stream) to poor (in the Koputaroa Stream and tributaries of the Waitohu Stream).

G. EFFECTS OF EROSION AND SEDIMENTATION

21. The ESCP Report details the erosion and sedimentation process and how erosion and sediment control can manage resultant effects on the receiving environment.[8] I agree with the overview provided in this part of the ESCP Report.

[6] The freshwater receiving environments are summarised in the ESCP report, at paragraphs 34-39.
[7] At paragraphs 37.
[8] At paragraphs 41 to 48.

22. To summarise, the environmental effects associated with the discharge of sediment into watercourses are well documented and accepted, and can include adverse effects on the aquatic flora and fauna of an area. These effects can extend substantial distances downstream from the works area and range from the smothering of aquatic life, the injury to the mouths and gills of aquatic animals, and the destruction of spawning grounds. An increase in turbidity within a stream can also stop animals feeding due to poor visibility, can increase heat absorption and stop light penetrating the water reducing photosynthetic activity. The deposition of sediment from earthworks can also result in a disruption to stream hydraulics, which may result in an increase in extent and/or frequency of flooding and changes to in-stream habitat.

23. Significant quantities of sediment may be discharged from bare/disturbed earth surfaces where appropriate erosion and sediment control measures are not implemented. Undertaking works within watercourses also has a very high potential for erosion and discharge of sediment. This is because these works are undertaken in, or near, flowing water which is the major cause of erosion. Flowing water causes on-going scour and provides the transport mechanism to allow sediment to be dispersed downstream of the works and ultimately, into the marine environment.

24. Robust erosion and sediment control measures are therefore necessary for the Ō2NL Project. The objectives of ESC management for the Ō2NL Project are stated by Waka Kotahi as being to minimise the potential for sediment generation and discharge, in order to avoid or minimise the impacts of construction on the freshwater environment that may arise from the discharge of sediment.[9] I agree with these objectives.

Approach to erosion and sediment control

25. It is well understood that the key principles to follow when planning for and undertaking earthworks activities are:[10]

[9] Appendix 4.3 Erosion and Sediment Control Technical Assessment Report, at paragraph 4.
[10] Erosion and Sediment Control Guide for Land Disturbing Activities in the Auckland Region (Auckland Council, June 2016) ("**GD05**") at A2.0.

(a) Minimise disturbance;

(b) Stage construction;

(c) Protect slopes;

(d) Protect receiving environments;

(e) Rapidly stabilise exposed areas;

(f) Install perimeter controls and diversions;

(g) Employ sediment detention devices;

(h) Get trained and develop experience;

(i) Adjust the ESC Plan as needed; and

(j) Assess and adjust your ESC measures.

26. Waka Kotahi has proposed the following management plan structure to manage the adverse effects associated with the Ō2NL Project:

(a) A Construction Environmental Management Plan ("**CEMP**") which is, in summary, an umbrella environmental management document. The CEMP is described in the AEE[11] as *"an overarching document that is prepared to assist in achieving compliance with designation and resource conditions, and to also meet Waka Kotahi's obligations under, relevant legislation; national, regional, and local policy; and Waka Kotahi environmental and social policies."* The CEMP will also specify areas of responsibility for the construction phase of the Ō2NL Project;

(b) An ESCP to guide the overall principles and methodologies for erosion and sediment control for the Ō2Nl Project. The ESCP documents a framework for the management, mitigation, and monitoring measures to be implemented on site; and

[11] At section 59.2.1.

(c) The SSESCPs which will be developed in line with the resource consent conditions, ESCP and Auckland Council Guidance Document 05 *"Erosion and Sediment Control Guide for Land Disturbing Activities in the Auckland Region Guidance Document 2016/005 Incorporating Amendment 1"* ("**GD05**") and "*Waka Kotahi Erosion and Sediment Control Guidelines for State Highway Infrastructure, September 2014"* ("**Waka Kotahi Guidelines**"), and will focus on the management of specific sites and activities throughout the Ō2NL Project.

27. GD05 provides technical guidance for the selection, design and use of erosion and sediment control practices and measures for a range of land disturbing activities. GD05's ultimate goal is *"to minimise erosion, sediment discharge and sedimentation that occurs as a consequence of land disturbance".*[12]

28. The Waka Kotahi Guidelines are intended to provide the minimum requirement for erosion and sediment control that state highway construction projects shall comply with. The Waka Kotahi Guidelines were:[13]

> prepared with the intention that it will meet or exceed current local erosion and sediment control guidelines so that compliance with it will minimise consenting related issues. If a local standard is amended and becomes more stringent than this Standard, the more stringent requirements shall be met if required by resource consent.

29. The ESCP Report details the Ō2NL Project's approach to ESC design and implementation. It provides that all ESC measures will be designed, constructed and maintained in accordance with GD05 and the Waka Kotahi Guidelines. The Waka Kotahi Guidelines are stated in the application documents to be used solely for the sizing of sediment

[12] For completeness, I note that GD05 is a two-part document. Part 1 – Principles - contains the overarching principles of ESC, erosion and sedimentation and a process for selecting and using ESC practices; while Part 2 – Practices - contains specific practices including a range of options for ESC, along with the benefits and applicability of each practice.
[13] Waka Kotahi Guidelines, section 1.2.

retention devices where the predominant soils are gravel.[14] However, the application and technical report of Mr McLean refers to all erosion and sediment control measures being designed, constructed and maintained in accordance with the Waka Kotahi Guidelines.[15] In this sense, it appears that reference to the Waka Kotahi Guidelines is directed to GD05 and the Waka Kotahi Guidelines, jointly/collectively.[16] Despite this, I note that condition RESC1 (along with other conditions) requires compliance with GD05 only. As I discuss below, I support RESC1.

30. In my opinion, GD05 is currently regarded as industry best practice when undertaking earthworks activities and in the context referenced for the Ō2NL Project contains a higher standard than the Waka Kotahi Guidelines. Relevantly, when considering the intent of the Waka Kotahi Guidelines (described at paragraph 28 above), GD05 is more stringent than the Waka Kotahi Guidelines.

31. GD05 is well recognised throughout New Zealand, and has a proven track record in ensuring successful erosion and sediment control management for a range of projects I have been involved with. GD05 is highly regarded and well understood by industry, and contains a 'toolbox' of measures that can be employed to minimise erosion and control sediment within the earthworks site. While I can understand the reasoning for use of the Waka Kotahi Guidelines, in my opinion, these guidelines are not a direct replacement for GD05. The use of GD05 is also consistent with the One Plan.[17]

32. For these reasons I am not comfortable with the use of two separate sets of guidelines (GD05 and the Waka Kotahi Guidelines) for erosion and sediment control within the Ō2NL Project. In my opinion, this aspect of the erosion and sediment control proposal is the area that provides

[14] Appendix 4.3 Erosion and Sediment Control Technical Assessment Report, at para 57.
[15] Appendix 4.3 Erosion and Sediment Control Technical Assessment Report, at para 57-58, 60.
[16] Appendix 4.3 Erosion and Sediment Control Technical Assessment Report, see para 56.
[17] See also, the ESCP Report, paragraph 5 note 1, which provides that *"Horizons Regional Council refer to GD05 as the Guideline to be used when preparing Erosion and Sediment Control Plans."*

the greatest amount of uncertainty. This uncertainty largely arises due to differences in the sizing of the ESC devices, which are significantly smaller under the Waka Kotahi Guidelines than what would be required under GD05.

33. This difference in approach (and use of the Waka Kotahi Guidelines) is justified in the application by reference to the soils on which the Waka Kotahi Guideline devices will be utilised. That is, Waka Kotahi proposes to use the Waka Kotahi Guidelines where soils are predominantly gravel, and therefore have greater infiltration and potentially less runoff during storm events. However, as I explain below, this approach may not result in adequate long-term ESC for the proposed works. In my opinion, this approach fails to sufficiently account for site conditions that may differ from those documented in the geotechnical investigations and for the compaction of the gravel soils that will occur during construction. As earthworks are undertaken, compaction and soil pore blockage of the gravel soils will occur, reducing permeability and increasing potential runoff over the pre-existing site conditions. Construction of the erosion and sediment control devices with heavy machinery, and migration of soil particles through erosion can also decrease infiltration on site and in the control devices themselves through clogging.

34. The implications of compaction of soils are referenced in the Waka Kotahi Guidelines themselves, which state:[18]

> Where compaction occurs, the effect is a significant reduction in water infiltration into the ground. This applies across the board to all soils, but to a lesser extent for sands and gravels.

While the guidelines go on to suggest that the reduction in water infiltration occurs to a "*lesser extent for sands and gravels*", it is not quantified, and it is not the case that it does not occur at all during construction.

35. Further technical justification for the use of the Waka Kotahi Guidelines is required to demonstrate that treatment can be achieved to a similar or higher standard than industry best practice GD05. In my view, at a

[18] At Section 6.1.

minimum, further technical assessment is required to demonstrate how compaction of gravel soils will not impede the performance of the smaller devices proposed under the Waka Kotahi Guidelines, and further, how this would be monitored and managed.

36. Even then (and subject to the outcome of those investigations), should the Waka Kotahi Guidelines be implemented in soils that are predominantly gravel, in my opinion, there needs to be a robust and regular monitoring regime for these alternative ESC devices. In addition, there must be contingency measures that are able to be robustly implemented should the treatment standard of equivalent GD05 devices not be met at any given time. These measures would need to ensure the performance achieved the standard expected from GD05 compliant devices and may include reversion to GD05 compliant devices should performance not meet these standards.

37. The draft conditions provided in Appendix 5 of the AEE reflects a best practice approach of using GD05 as the design standard. I support RES1 a), which provides:

> a) Sediment losses to a natural water body arising from construction activities authorised by these resource consents must be minimised for the duration of construction activities and until the expiry of the resource consents through:
>
> > i. the establishment and maintenance of erosion and sediment control measures in accordance with 'Erosion and Sediment Control Guide for Land Disturbing Activities in the Auckland Region' June 2016 Guideline Document 2016/005 Version 2 except where a higher standard is referred to in the Erosion and Sediment Control Plan, or a certified Site-Specific Erosion and Sediment Control Plan, in which case the higher standard applies;

38. This condition requires <u>all</u> erosion and sediment control measures to meet GD05 standards. This addresses my concerns regarding use of the Waka Kotahi Guidelines. In the absence of sufficient justification for the smaller devices recommended by those guidelines, and robust monitoring of their performance including adaptive/contingency

management, an approach requiring the use of GD05 is, in my view, appropriate.

Erosion and sediment control management framework – the ESCP

39. The overarching erosion and sediment control management framework is provided in the ESCP submitted with the application. The ESCP details ESC measures that will meet GD05 and Waka Kotahi Guideline requirements. The application also contains high level erosion and sediment control drawings ("**ESC drawings**") showing how GD05 and Waka Kotahi Guidelines measures will be employed across the Ō2NL Project.

40. The ESC drawings indicate that Sediment Retention Ponds ("**SRPs"**) (primarily) and Decanting Earth Bunds ("**DEBs"**) will be utilised as the predominant sediment control devices for the Ō2NL Project. Chemically treated SRPs are considered to be the most efficient sediment control device in terms of sediment treatment efficiency, while DEBs can be less effective due to their more simplistic design. In order to achieve the highest possible sediment treatment efficiency, it is my opinion that all runoff practicable should be directed to SRPs for treatment.

41. The ESCP Report and ESCP also detail how SSESCPs will be developed in line with the ESCP, GD05, and Waka Kotahi Guidelines. These plans will focus on the management of specific sites and activities throughout the Project. The plans propose to use the detail in the ESCP, the ESC Drawings, GD05 and Waka Kotahi Guidelines, and focus on implementation and management of the erosion and sediment control devices. Use of the SSESCPs will allow for future flexibility and provide the ability to adapt appropriately to changing site conditions. I support the concept of using SSESCPs. The SSESCP structure allows the site to implement the most effective ESC solution to a changing site; effectively employing the GD05 principle of adjusting the ESCP as needed at any given time.

42. Prior to earthworks or stream works commencing at any given location, the Environmental Management Team will prepare and submit a SSESCP to Horizons for certification against the resource consent

conditions, ESCP, GD05, and Waka Kotahi Guidelines. Work will only commence in any given area once the SSESCP has been certified by Horizons. The SSESCP will take into account the specific construction activity; the area, volume and nature of the earthworks and the downstream receiving environment; methods for managing effects; the duration, the time of year and any additional specific measures required; stabilisation methods and timing; and chemical treatment. This is supported through conditions RES5 and RES6.

43. Although the ESCP Report is silent on winter works, the AEE details that there is likely to be works undertaken in winter.[19] As earthworks during winter are more susceptible to wetter weather and a resultant increase in sediment discharge risk, a seasonal restriction is considered appropriate. The proposed consent conditions indicate that SSESCPs will also be utilised to manage winter works throughout the Ō2NL Project and will be certified as winter works through the SSESCP certification process. In my view, a condition should be included requiring any winter works to be approved in advance, and in writing, by Regional Councils and this is provided for in REW2.

44. Chemical treatment (flocculation) is considered a key tool to assist in the sediment control efficiency of the SRPs and DEBs. Chemical treatment is proposed in Mr McLeans report,[20] and is documented in Section F2.0 of GD05, however, it is not specifically provided for in the consent conditions.

45. The ESCP contains a CTMP which sets out a management framework that provides for ongoing bench testing and the implementation of chemical treatment for the Ō2NL Project. This includes a procedure for bench testing of site soils and the design and implementation of a flocculation treatment system. However, there has been no evidence of any preliminary bench testing that has been undertaken in preparing the consent application, so it is unknown how site soils will react to flocculation. The application is also silent as to how flocculation dosage systems will be adapted to Waka Kotahi Guideline treatment devices

[19] See section 4.7.6.
[20] Appendix 4.3 Erosion and Sediment Control Technical Assessment Report, at para 61 and 66.

(should these be utilised) and the runoff profile of the predominantly gravel soils. Given the proposed chemical treatment system is designed as rainfall activated in accordance with GD05, in my opinion, there is a risk of overdosing in soils that have a high permeability.

46. For these reasons, I am of the view that a condition should be included requiring ongoing bench testing and chemical treatment of all sediment impoundment devices. This may need to include allowance for specific chemical treatment design for soils with a high permeability.

47. The ESCP Report and the ESCP also focus on progressive and rapid stabilisation of disturbed areas using measures aligned with GD05 such as mulch, aggregate, and geotextiles. Temporary and permanent stabilisation will be key to ongoing erosion control on completed areas. In my view a condition should be included requiring progressive stabilisation of completed earthworks areas. Presently this is only indirectly provided for in REW2, which requires stabilisation in accordance with GD05.

48. The Ō2NL Project includes piling, earthworks, and stream works that will require dewatering by pumping. The ESCP contains a Dewatering Management Procedure to ensure that the required level of sediment treatment is achieved on site during dewatering operations. Pumping will either be via a sediment control device such as an SRP or DEB, or directly from the excavation or stream diversion works to the receiving environment and is managed through condition RGW1. I note the following:[21]

    (a) If dewatering is via a sediment control device such as an SRP or DEB, the decants of the device will be raised and water impounded within the SRP or DEB will be stored and batch dosed with flocculent to achieve greater than 100mm clarity and pH of 5.5 – 8.5 prior to discharge to the receiving environment.

    (b) If dewatering is to occur directly to the receiving environment, the impounded water is to have a clarity of greater than 100mm at

[21] Appendix 4.3.3.3: Dewatering Management Procedure at 4.1–4.2.

all times and the pump must be able to remove the impounded water without disturbing any sediment.

49. The Dewatering Management Procedure contains a Dewatering and Pumping Record Sheet – Permit to Pump that is to be completed and signed off by a site manager prior to any pumping. The Dewatering and Pumping Record Sheet – Permit to Pump ensures that any dewatering is undertaken in accordance with the Dewatering Management Plan. In my view, a condition should be included requiring any dewatering to be undertaken to meet a clarity standard or via a sediment treatment device provided that the device is not currently in use and can impound water to achieve the required clarity. I note the intent of RGW1(c)–(d) in this regard, and I support these conditions.

50. The proposed earthworks will generate excess unsuitable material that will be placed into spoil disposal sites. Spoil disposal sites are considered as part of the overall earthworks operation and erosion and sediment control will be maintained to the same standard as 'typical' site earthworks through consent condition REW2. Currently there is not a condition proposed that requires spoil sites to be managed to ensure that they do not lead to any uncontrolled instability or collapse affecting either the spoil site or adversely affecting watercourses. In my opinion, such a condition should be imposed.

H. SEDIMENT YIELD

51. The ESCP Report provides detail on various tools that can be used to estimate sediment yield from earthworks sites.[22] In order to determine an estimated sediment yield for the Ō2NL Project, the Universal Soil Loss Equation ("**USLE**") has been used. The USLE is a tool that has been used by regional councils throughout New Zealand to estimate the potential annual soil loss from earthwork projects using rainfall pattern, soil type, topography, vegetation cover and management practices. The equation can help identify the comparative scale of potential effects on receiving environments, and the potential risk associated with those sedimentation effects.

[22] At paragraphs 105 to 121.

52. The ESCP Report applies a USLE estimate that is reflective of the topography and soil type of given sections of earthworks within the Ō2NL Project. The USLE estimates have been applied to the footprint of earthworks within the predominant stream systems of the alignment (including sub-catchments) to derive estimates of sediment load in tonnes from the Ō2NL Project for one year, being the first year of works within each given area. The ESCP Report sets out the assumptions that form the basis of the USLE calculations.[23] I agree with the assumptions, which apply a conservative scenario for sediment generation while using industry accepted values for sediment control devices based on the implementation of industry best practice (GD05) erosion and sediment control. Having reviewed the USLE calculations, I consider them to be accurate.

53. The ESCP Report provides detail on other estimating tools such as the Groundwater Loading Effects of Agricultural Management Systems ("**GLEAMS**") and the Construction Water Assessment Report ("**CWAR**") used on the NZTA Puhoi to Warkworth project. The ESCP Report goes on to compare these tools and the USLE. It concludes that:[24]

> the USLE outputs derived specifically for this Project will not underestimate sediment yield and can be relied on by various experts to inform their assessment of likely downstream sediment-related effects of the Project.

54. I agree with the conclusion regarding ULSE outputs. The USLE is the most commonly used estimating tool when calculating estimated sediment loss from earthworks sites, and I agree that the outputs calculated for the Ō2NL Project can be considered conservative (i.e., not underestimated) in this context.

I. EROSION AND SEDIMENT CONTROL MONITORING

55. The ESCP contains an ESMP that details the erosion and sediment control management and monitoring system to be implemented for the Ō2NL Project.

[23] At paragraphs 124 to 126.
[24] At paragraph 121.

56. The ESMP covers site management structures, weather monitoring and triggers, and erosion and sediment control monitoring for sediment control performance, along with event and annual reporting procedures. The ESMP is also designed to ensure that the erosion and sediment control measures have been designed, installed, and managed in accordance with GD05 and Waka Kotahi Guidelines, the conditions of consent, and any management plan requirements.

57. I generally agree with the intent and the substance of the ESMP, with the exception of the issues that I set out below.[25]

58. The ESMP details a process for implementation of erosion and sediment control devices in accordance with the SSESCP, GD05, and the Waka Kotahi Guidelines. Once a SSESCP has been certified by the regional councils, the Construction Team and the Environmental Management Team will review the control location and requirements of the relevant SSESCP on site and oversee the construction of ESC devices. Once construction is complete, the Environmental Management Team will certify device compliance with the SSESCP and GD05/Waka Kotahi Guidelines with 'as built' certification. The 'as built' certifications must be submitted to the regional councils.

59. A condition of consent is included at RES8 requiring 'as builts' for all erosion and sediment control measures to be submitted prior to the commencement of earthworks. All 'as builts' should be in accordance with industry 'as built' requirements to ensure accurate detail that can be used to determine compliance with GD05/Waka Kotahi Guideline standards.

60. The monitoring proposed under the ESMP includes routine (at a minimum weekly) inspections by the Environmental Management Team of the site and all ESC devices. There are also daily inspections proposed to be undertaken by ESC Foremen. There will be pre rain event inspections where more than 20mm of rainfall is forecast over a 24 hour period in addition to standard pre forecast rain event inspections, and there will also be post rainfall event monitoring during

[25] I also note my earlier comments regarding reliance on GD05 and the Waka Kotahi Guidelines.

or immediately after trigger rainfall events, where an inspection will be made of all SRPs and DEBs. There will be manual clarity and pH testing (where chemical treatment is being used) of the outlet flows of all SRPs and DEBs in addition to the general inspection of ESC devices. I note that this may assist in determining compliance with a proposed discharge standard (as I discuss further below, and consistent with the recommendations of Mr Brown for Horizons and GWRC) and triggers to ensure the discharge standard can be met.

61. The ESMP also details that rainfall triggered monitoring will be prioritised to the ESC devices in catchments that have been determined as having both a high risk of sediment release from earthworks and high ecological values. However, the ESMP does not contain details around rainfall triggered monitoring in 'non-priority' catchments and how and when this will be undertaken. In my opinion, all catchments should have some form of rainfall triggered monitoring contained in the ESMP to ensure ESC performance across the site. In my opinion, if there are catchments that are considered a higher priority (which the application indicates there are), then consideration should be given to a higher standard of monitoring and discharge for these areas. As I discuss below, Mr Logan Brown's report addresses the standards required across the priority and non-priority catchments in his section 87F report.

Discharge and Monitoring Standards

62. The ESCP Report discuss parameters for monitoring the performance of ESC devices on the Ō2NL Project.[26] A more detailed discussion on specific monitoring procedures is included in the ESMP.

63. Consent condition RES1(d) also contains targets for the discharges from sediment retention devices. Mr Brown has recommended discharge standards for dewatering and erosion and sediment control devices in his report for Horizons and GWRC.[27] These standards reflect the sensitivity of the receiving environment to ensure the effects of sediment load (and related increases in sediment load) in catchments traversed

[26] At paragraphs 74 to 104.
[27] Section 87F Report, Mr Logan Brown, Water Quality and Freshwater Ecology, 28 April 2023.

by the Ō2NL Project are appropriately managed. I support this approach.

64. Turbidity, total suspended solids ("**TSS**") and clarity have all been used on various large-scale projects in recent years, with TSS having been employed as a performance standard in some cases. The significant difference between the three parameters is that turbidity and clarity can be measured on-site in real time, while TSS requires sampling and analysis in a laboratory before results can be reported.

65. The ESCP Report recommends clarity monitoring through the use of a Secchi disc or clarity tube, with a target clarity of 100mm and related pH requirements of between 5.5 and 8.5. Should the 100mm clarity target not be met, the ESMP proposes actions to be undertaken in an effort to refine ESC practices for the respective device to achieve the 100mm clarity target. These methods are seen by Waka Kotahi as the most time and cost-effective measures for monitoring ESC performance on site.

66. I understand Mr Brown supports the use of clarity as a performance standard, although the target of 100m is considered by Mr Brown to be a minimum standard, with a more stringent target clarity proposed in more sensitive receiving environments.

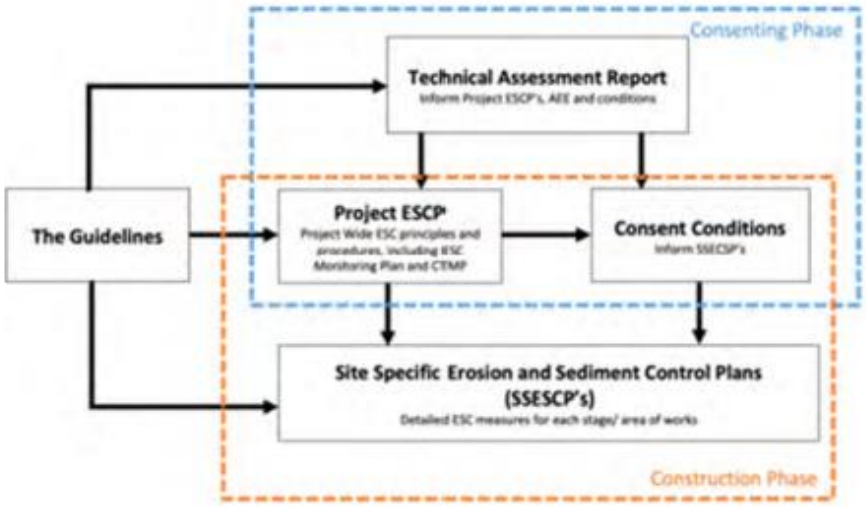
67. pH measurements will also be taken with a calibrated pH meter. pH readings will be recorded and correlated with the pH measurements from the CTMP to ensure the baseline pH is not changed beyond +/- 1 unit, and within the parameters set by resource consent conditions. In my view a condition should be included to ensure the pH does not fall outside of the range of 5.5 and 8.5 when measured at the device outlet. I consider that proposed consent conditions RGW1 and RES1 achieve this.

68. In addition to the clarity and pH monitoring, the routine and trigger event inspections will check the operational integrity of all erosion and sediment control devices. Should there be a failure or overtopping of any erosion and sediment control device that results in a visible discharge to a watercourse, remedial action will be undertaken to reinstate devices to prevent further discharges. Presently, this response and the need for

remedial action does not appear to be recorded within the conditions. It may be that it would be picked up as part of an exceedance of a discharge target, however, to avoid doubt, there would, in my view, be benefit in detailing the necessary response.

J. ASSESSENT OF CEMP, ESCP, and SSESCPs

69. As outlined earlier, the CEMP is an umbrella environmental management document. It is the ESCP that guides the overall principles and methodologies for erosion and sediment control to be adopted. The ESCP documents a framework for the management, mitigation, and monitoring measures to be implemented on site. Mr McLean's report provides factors to be considered in the development of SSESCPs.[28] These will be developed in line with the consent conditions, ESCP, and GD05/Waka Kotahi Guidelines to focus on the management of specific sites and activities throughout the Ō2NL Project. See *Figure 4.3.3. ESC management document structure* from Mr McLeans report.[29]



[28] Appendix 4.3 Erosion and Sediment Control Technical Assessment Report, at para 73.
[29] Appendix 4.3 Erosion and Sediment Control Technical Assessment Report, at para 70.

70. Paragraphs 29 to 38 of this report detail my concerns with the use of the Waka Kotahi Guidelines on the Ō2NL Project. While they set a minimum baseline for erosion and sediment control, in my opinion, GD05 is best industry practice, which is more stringent, and should be adopted for the purpose of the Ō2NL Project.[30]

71. Implementation of GD05 requires consideration of all key principles of erosion and sediment control, including non-structural approaches such as:

    (a) Minimising disturbance;

    (b) Staging construction;

    (c) Protecting steep slopes; and

    (d) Protecting watercourses (and other sensitive features).

72. Should implementation of GD05 and/or Waka Kotahi Guideline measures not achieve (based on the recommended discharge standard) the required minimisation of impacts on the receiving environment, further consideration will need to be given to non-structural approaches in any catchment where these impacts are occurring. This could require consideration of a more staged approach where parts of the catchment are rapidly stabilised, or earthworks are undertaken in stages to minimise the sediment laden flows to a treatment device.

73. As discussed by Mr Brown in his section 87F report, while a discharge standard provides certainty around the quality of the discharge, it is still possible that it may not always result in the protection of the stream values in high value waterways. In this regard, the additional in-stream monitoring proposed by Waka Kotahi is considered important by Mr Brown, so as to enable these effects to be detected in-stream. The in-stream monitoring may show that additional measures (such as those I refer to above) need to be undertaken to manage the discharge to a higher standard.

[30] Use of GD05 also aligns with the One Plan.

74. Mr McLean has set out a process where non-compliances are identified in his report.[31] A process for response and remedial action is not required under any consent condition, and in my opinion, it should be. This should include consent conditions which require improvements on-site where discharge standards are not met and/or instream effects are detected in-stream despite the erosion and sediment measures.

75. Undertaking works within watercourses has a very high potential for erosion and discharge of sediment. This is because the work is undertaken in or near flowing water which is a major cause of erosion. Flowing water causes on-going scour and provides the transport mechanism to allow sediment to be dispersed downstream of the works and ultimately, into the receiving environment. Works within watercourses can also directly impact watercourse habitat through habitat disturbance or destruction, and watercourse ecology through sediment and temperature-related effects.

76. Greater care is therefore required for works in and around watercourses to minimise actual and potential effects as much as possible. Where this work is unavoidable, specific construction methodologies and control measures are required to minimise potential adverse impacts. In order to minimise the effects of sediment mobilised during stream works, it is important to avoid working in flowing water using the dam and divert principles detailed in GD05, to minimise the disturbed areas adjacent to the stream works and to promptly stabilise all areas upon completion of the works. In my view a condition of consent should be included requiring all works in a watercourse to be undertaken only when all flows can be diverted around the works area (e.g. beds are dry) and rapid stabilisation of areas on completion of the works.

77. The application contained two SSESCPs referred to in the AEE, so as to demonstrate the level of detail that will be provided in these site specific plans. The two SSESCPs also show the detail expected when designing a SSESCP under GD05 and Waka Kotahi Guidelines. The SSESCPs are in relation to:

[31] Appendix 4.3 Erosion and Sediment Control Technical Assessment Report, at para 97-98.

(a) Earthworks and civil works between CH11600 and CH12050 designed in accordance with GD05; and

(b) Earthworks and civil works between CH23800 and CH24300 designed in accordance with Waka Kotahi Guidelines.

78. At the outset I note this approach is inconsistent with proposed condition RESC1 which requires all sediment and control devices be constructed in accordance with GD05. For the reasons I explain above, and as illustrated below, I support RESC1.

79. The SSESCP for earthworks and civil works between CH11600and CH12050 proposes that erosion and sediment control measures will be designed and constructed in accordance with GD05. It provides for two SRPs designed in accordance with the 3% criteria ($3m^3$ of storage for every $100m^2$ of contributing catchment) which will be chemically flocculated in accordance with the CTMP.

80. The SSESCP for earthworks and civil works between CH23800 and CH24300 proposes that erosion and sediment control measures will be designed and constructed in accordance with GD05, with the exception of some sediment retention devices which will be designed in accordance with the Waka Kotahi Guidelines. The geotechnical investigations for this section of earthworks shows the predominant soils are gravels, hence the proposed use of the Waka Kotahi Guidelines. For this example, a 5ha catchment is treated with a $309m^3$ sediment retention device, and a 1.5ha catchment is treated with a $93m^3$ sediment retention device.

81. If the SSESCP for earthworks and civil works between CH23800 and CH24300 proposed erosion and sediment control measures wholly designed and constructed in accordance with GD05, these sediment retention ponds would be $1,500m^3$ and $300m^3$ respectively. This shows the significant difference in sizing, and as a result capability, in the GD05 and Waka Kotahi Guideline devices. This difference illustrates the need for a strong technical case for departure from GD05, and the importance of the issues I have raised earlier in the report with the adoption of the Waka Kotahi Guidelines.

82. It is expected that a well-constructed and maintained SRP designed and built in accordance with GD05 can achieve average efficiencies of 90% to 95%, while DEBs, as I described above, are generally considered to not be as efficient, especially on steeper slopes where runoff velocities can be greater. Therefore, if DEBs are to be utilised (noting my opinion that SRPs should be preferred) careful consideration of where DEBs are to be utilised will be necessary to ensure that treatment efficiencies are not compromised.

83. Dewatering will be required throughout the Ō2NL Project. GD05 contains a best practice procedure for dewatering that will be implemented throughout the Ō2NL Project through the procedures in the Dewatering Management Procedure (which forms part of the ESCP). As a minimum,[32] 100 mm clarity (100mm clear water depth) within the water to be discharged is required to allow water to be discharged directly offsite. Otherwise, water will need to be pumped to an SRP or DEB for treatment. Subject to the volumes pumped, the outlet may need to be blocked during pumping and the SRP/DEB treated in accordance with the CTMP following pumping. This is all documented in the Dewatering Management Procedure and is considered appropriate.

84. The performance outcomes, reporting requirements, and trigger response procedures are currently in the CEMP and ESCP (through the ESMP) and are not referenced in consent conditions. While some of the detail behind these outcomes/triggers can be included in the CEMP and ESCP, in my opinion, there are a number of direct sediment related environmental effects on the receiving environment that should be addressed by way of "bottom lines" within the consent conditions. This will ensure:

    (a) The adverse effects of a proposal are avoided, remedied or mitigated through enforceable conditions and not via the content of management plans;

    (b) The consent document is a transparent reference point for compliance when undertaking consent monitoring of key

[32] Noting that Mr Brown has recommended different discharge standards depending on the receiving environment.

environmental (bottom line) outcomes, thereby avoiding having to search through management plans; and

(c) Important elements of the resource consents are not unintentionally changed through the management plan review and approval process; with conditions setting out bottom lines which are only able to change via the review condition.

K. CONDITIONS

85. I have commented on particular conditions within the earlier sections of my report, and do not repeat them again. Suffice to say, ESC is dependent on robust conditions, and management plans, and an effective pathway to respond to issues as they arise.

L. SUBMISSIONS

86. I have reviewed the submissions on the Ō2NL Project. Very few submissions raise concerns with erosion and sediment control matters. They included submissions 36, 59, 60, and 73. Generally speaking the issues raised related to dust and the potential downstream effects of sediment discharges. I note:

(a) Submission 36 predominantly relates to dust effects from the proposed earthworks, which is outside of erosion and sediment control and dealt with by other experts;

(b) Submission 59 discusses the effects of suspended sediment on stream ecosystems, and how this is going to be measured, monitored, and managed during and post construction;

(c) Submission 60 raises concerns over the impact of the works on a watercourse on the property of the submitter; and

(c) Submission 73 discusses the downstream effects of inadequate erosion and sediment control.

87. In response, I note that subject to the assessment undertaken in this section 87F report, and the recommendations of Mr Brown regarding performance standards and monitoring across catchments, the Ō2NL

Project will be implementing best practice erosion and sediment control measures, and a monitoring regime that will identify any potential impacts and response measures to minimise the potential adverse effects.

Kerry Pearce

28 April 2023