

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 STUART FARRANT – OPERATIONAL
STORMWATER MANAGEMENT**

**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 operational stormwater management in relation to the resource consent applications lodged with the Manawatū-Whanganui Regional Council (“**Horizons**”) and Greater Wellington Regional Council (“**GWRC**”) for the Ōtaki to North of Levin Highway Project (the “**Ō2NL Project**” or “**the Project**”).
2. The resource consents applied for by Waka Kotahi NZ Transport Agency (“**Waka Kotahi**”) are required to authorise the construction, operation and maintenance 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) Peter Kinley for Horizons and GWRC on Flooding and Hydrology;
 - (c) Jonathan Williamson for Horizons and GWRC on Hydrogeology and Groundwater; and
 - (d) 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 full name is Stuart James Edgar Farrant. I am a Principal Ecological Engineer and Southern Regional Manager at Morphem Environmental Ltd and hold a Bachelor of Engineering (Natural Resources) from University of Canterbury.
7. I have over 16 years' experience working in multiple aspects of freshwater management and ecological engineering. I have worked for Morphem Environmental for 9 years, establishing the southern sector office (Wellington) in 2014. Prior to that, I worked for 5 years as an Ecological Engineer in Melbourne, Australia for AECOM and DesignFlow and prior to that worked for Tonkin & Taylor for two years in Wellington following graduation.
8. I have experience working in a range of areas relating to three waters management including design, technical review and auditing of constructed wetlands, vegetated stormwater treatment/conveyance systems, stream restoration and land application. Specifically, I have extensive experience with the design and delivery of stormwater management devices including constructed wetlands, raingardens and swales to mitigate adverse water quality effects from urban and rural runoff. I also have specific experience with natural wetland restoration projects.
9. I have contributed to and authored technical design guidelines for Councils/Utilities in New Zealand and Australia and was on the technical advisory team for the Dairy NZ Constructed Wetland Guidelines. I was awarded a 2018 Winston Churchill Fellowship to travel internationally for the purposes of researching leading practice for urban water management in Europe, Scandinavia and USA.
10. I am familiar with the site and surrounding area but have not been able to undertake site visits at this stage.

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. I have addressed the following issues in this report:
 - (a) The suitability of proposed measures to treat stormwater prior to discharge to waterways or groundwater; and
 - (b) The ability of proposed measures to provide long term functionality within realistic and practical operational parameters.
13. 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 above at paragraph 4.
14. 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

15. The key conclusions of my report include:
 - (a) The proposed operational stormwater management adopts a treatment train approach including vegetated swales, constructed wetlands and discharge via surface or groundwater. The overall philosophy and preliminary sizing is considered to be fit for purpose but a lack of detail on the functionality of devices results in uncertainty with the ability of these treatments to achieve intended outcomes.
 - (b) Specifically, there is a lack of detail on how treatment devices (particularly forebays, wetlands and soakage) will be integrated into the landform to achieve the required treatment footprint with provision for maintenance access, stable perimeter batters, etc.

- (c) There is also a lack of information on contaminated land and groundwater recharge zones which will need to be considered in the design of devices to avoid contamination.
16. Overall, I have a moderate level of confidence that the specified outcomes will be able to be achieved as the design evolves. This confidence can only be increased through provision of detailed designs for all operational stormwater management devices which are proposed to be required as a condition of consent prior to any construction works commencing.

E. SCOPE OF REPORT

17. My report focuses only on issues related to operational stormwater management. This includes consideration of stormwater discharges and design/infrastructure responses. My report covers the following topics:
- (a) Water Sensitive Design;
 - (b) Actual and potential discharges of contaminants to water; and
 - (c) Impact on receiving environment hydrology.
18. In preparing this report, I have reviewed the following information:
- (a) Ōtaki to North of Levin Highway Project Cultural and Environmental Design Framework (“**CEDF**”). Volume II, Appendix Three Consent Version;
 - (b) Waka Kotahi, Ōtaki to North of Levin Highway Project, Notice of Requirement for Designation and Application for Resource Consents: Supporting Information and Assessment of Effects on the Environment (the “**AEE**”);
 - (c) AEE Appendix 4: Design and Construction Report;
 - (d) AEE Appendix 4.2: Stormwater Management Design;
 - (e) Technical Assessment H – Water Quality;

- (f) Waka Kotahi, Ōtaki to North of Levin Highway Project – Response to request for additional information pursuant to section 92 of the Resource Management Act 1991, dated 23 December 2023 (the “**Section 92 Response**”); and
- (g) Draft Conditions (28 November 2022), including amendments following the Section 92 Response (21 March 2023).

F. BACKGROUND

- 19. The Ō2NL Project design includes significant areas of pavement and associated hardstand that will result in stormwater during small to large rainfall events. Stormwater will discharge to multiple waterways which cross the road corridor and in parts may interact with groundwater via infiltration.
- 20. Stormwater creates the potential for a range of adverse impacts to the surrounding environment, including due to vehicle-related contaminants (hydrocarbons, heavy metals and other particulates), nutrients (atmospheric N and windblown organics), changes in temperature (due to thermal mass of pavement), modified hydrology (in particular in small frequent rainfall events) and an increased risk of specific discharge events from spills or accidents. Unless appropriately managed, it is considered likely that the discharge of stormwater would have more than minor adverse impacts on freshwater receiving environments, tidal estuaries and the coastal receiving environment.
- 21. The Ō2NL Project proposes to adopt a Water Sensitive Design approach.¹ This approach is intended to capture and treat site generated stormwater, treat stormwater from an initial water quality volume and dispose of runoff through a combination of discharges to surface water and soakage to ground.
- 22. A treatment train approach is proposed with grass swales alongside the road to catch and convey stormwater runoff from impervious surfaces

¹ AEE Appendix 4: Design and Construction Report at 3.9.2.

and direct flow into constructed wetlands before discharge to land or water.²

23. The main body of each wetland is stated in the consent application to be lined to prevent drawdown in between rainfall events; however, the swales, forebays and attenuation basins are proposed to not be lined and are therefore potentially connected to groundwater.³
24. My review of the consent application has focussed on the long-term functionality of the proposed measures and the ability to support long term stormwater management.
25. Consideration has not been given to construction phase impacts, flooding, or instream ecology, which are considered by other experts.

G. STORMWATER MANAGEMENT

26. Overall, the proposed stormwater management is to be provided through a treatment train approach which comprises discharge of road runoff initially to vegetated swales (which will provide pre-treatment) prior to discharge into constructed wetlands (which incorporate separate forebay and planted wetland area) which are proposed to be integrated with flood attenuation. Wetlands will discharge to adjacent streams (via direct discharge or piped reaches) or direct to groundwater via designed soakage where downstream stormwater networks or stream discharge are not feasible.
27. Swales have been designed and sized based on conveyance requirements (to pass flows up to 1% AEP)⁴ but have not been specifically designed for water quality purposes. Swales will therefore be 'online' to all flows and will potentially offer reduced water quality function (as compared to industry standard design) due to periodic resuspension of captured particulate contaminants. Proposed swales are unlined but will largely be constructed in engineered fill or heavily compacted ground with an expectation of moderate interception and losses (through evapotranspiration and infiltration) during frequent small

² AEE Appendix 4.2: Stormwater Management Design at paragraphs 34(a) and 40–43.

³ AEE Appendix 4.2: Stormwater Management Design, Table 2.

⁴ Section 92 Response, dated 23 December 2022 at 54.

rainfall events. It is noted that any treatment function of the proposed swales has not been relied on in the sizing of constructed wetlands, which have been sized assuming no pre-treatment in the swales.

28. Constructed wetlands have been provisionally sized based on the capture and treatment of the initial water quality volume (sometimes referred to as the first flush) with the inclusion of a forebay and macrophyte (planted) zone. Calculated wetland footprints have been nominally increased by 20% to account for perimeter bunds and batters, and spatially indicated via polygons on the plan set.⁵
29. Proposed wetlands are shown on concept drawings as provisional polygons only (with 20% contingency) and do not provide details of access, batter slopes or site-specific configuration. 'Typical' wetland details are provided with the concept drawings, but these are not representative of specific localities.⁶ Preliminary details of the proposed wetlands are provided, which indicate an unlined forebay, hydraulic controls via pipe throttles, and a lined and vegetated macrophyte zone.⁷
30. In my opinion, fully functioning constructed wetlands which are designed and constructed in accordance with best practice, will provide an appropriate level of water quality treatment for the range of contaminants expected from the Ō2NL Project. However, it will be important, given the conceptual nature of the design to date, to ensure the detailed design provides for treatment proposed by the application.
31. Approximately 95% of the total Ō2NL Project area is shown to be captured and treated via proposed stormwater treatment devices. 5% of the Ō2NL Project area will therefore remain untreated. It is unclear precisely where this 5% is located. As part of the Section 92 Response, Waka Kotahi advised that the 5% is distributed across the Ō2NL Project and comprises only minor areas which are unable to drain to swales or formal collection.⁸ While I agree that the 5% represents a small overall portion of the total Ō2NL Project, there remains a risk where the untreated areas are situated in close proximity to freshwater receiving

⁵ Section 92 Response, dated 23 December 2022 at 51.

⁶ Section 92 Response, dated 23 December 2022 at 52.

⁷ AEE Appendix 4.2: Stormwater Management Design, Table 2.

⁸ Section 92 Response, dated 23 December 2022 at 50.

environments. The lack of treatment could pose long term adverse impacts through contaminants, hydrology and physical characteristics.

32. As stated above, the proposed swales are to be unlined. Given the inclusion of vegetation and expected compacted subsoils, I consider that this is appropriate from a water quality perspective. The exception is where swales cross the sensitive groundwater recharge zones to the east of Levin or where they may cross currently unidentified contaminated land areas. In these instances, conditions should require the lining of swales with a suitably impermeable liner system.
33. The use of unlined swales will also result in losses in stormwater volume through evapotranspiration and shallow infiltration. This will result in less stormwater getting through to proposed wetlands, including the potential for minimal flow to the wetlands during small frequent rainfall events. Based on current wetland sizing for the Ō2NL Project, this could result in drawdown of the wetland surface during prolonged dry/low rainfall periods which could, in turn, result in adverse impacts to biological treatment processes and require increased maintenance (to mitigate weed ingress). The inclusion of extensive unlined swales therefore increases the importance of the detailed design of wetlands to retain water (e.g. by being lined) and to cope with seasonable variability with water level etc.
34. The proposed wetland forebays are also proposed to be unlined. This will further reduce the volume and frequency of water that is able to discharge to the main wetland body and could in some cases result in contaminated stormwater discharging to underlying groundwater. I understand from the Section 92 Response that the unlined forebays were intended to mitigate the risk of drowning.⁹ It is my opinion that other industry standard measures such as safety benches and vegetated perimeters are more appropriate to manage these risks and that the potential for the unlined forebays to adversely impact the flows to the wetlands needs further consideration. In my opinion, as discussed later

⁹ Section 92 Response dated 23 December 2022 at 57.

in my report, proposed wetland forebays should include lining to support improved functionality.

35. I do not consider that the planting palette for the Constructed Wetland, as provided in the CEDF, is suitable for the water quality function. In particular, the current list includes species not naturally occurring in the local environment (*Machaerina articulata*) and others which can negatively impact the treatment function (*Raupo orientalis* and *Bolboschoenus fluviatilis*). Amended wetland species lists are required with the identified species needing to reflect the shallow and deep marsh conditions and required water quality improvement function. This information should be provided no later than the detailed design stage.
36. Horizons and GWRC have also sought confirmation that infiltration would not occur where contaminated land was present. Waka Kotahi stated that full contaminated ground investigations will be deferred, with proposed condition REW4 requiring detailed site investigations for a range of specific sites.¹⁰ As currently shown, these locations do not correlate with the location of the proposed wetlands or infiltration areas. However, I understand from Ms Newall's report that the PSI prepared for the application may not represent a full account of contaminated land over the Ō2NL Project area.¹¹ Understanding potential contaminants at the location of proposed infiltration sites will be necessary to ensure no further contamination of groundwater.
37. Information on design for maintenance of the stormwater measures is not provided with the consent application. It is especially important that the location and design of all operational stormwater management devices (including swales, wetlands and soakage) allows for regular vehicular and pedestrian access for inspections and routine (proactive and reactive) maintenance activities. Consideration should be given to specific traffic management requirements to ensure maintenance can be undertaken in an efficient and cost-effective manner when these measures are designed. I have identified minimum requirements for an operational and maintenance plan at paragraph 51 below.

¹⁰ Section 92 Response, dated 23 December 2022 at 53.

¹¹ Section 87F and 198D Report, Contamination, Ms Sarah Newall, 28 April 2023.

38. No information has been provided on design for management and containment of chemical spills or firefighting foam/water during operation. Given the risk of soil and water contamination as a result of accidental spills or vehicle fires on a high traffic road such as the Ō2NL Project, the design should include an ability to isolate and respond to events as required. It is noted that as the proportion of electric vehicles increases, and heavy haulage trucks are electrified, containment of the contaminants from firefighting will become increasingly important.

H. RECOMMENDATIONS

39. Overall, it is considered that the proposed stormwater management is fit for purpose with adequate space allocated for intended water quality treatment. However, there are a range of design-related matters which, in my view, will require further consideration to ensure that the design functions as intended and is maintainable.
40. Where swales cross the sensitive groundwater recharge zones to the east of Levin, or where they may cross currently unidentified contaminated land areas, the design will require the lining of swales with a suitably impermeable liner system.
41. The application currently provides indicative spatial locations for wetland and infiltration systems only. The shape of these does not appear to reflect any conceptual design of the proposed systems including the layout of forebays, macrophyte zones and bypass etc. Confirmation will be required that the proposed wetlands are able to be constructed within the landscape, with consideration of topography, hydraulic connections and any other constraints such as indigenous vegetation. Where topography results in a greater footprint (batters), the design must be amended in collaboration with all other design disciplines to ensure no issues arise with other technical requirements/constraints as the design progresses.
42. Further design development of wetlands will need to reflect the expected frequency and duration of infill, with consideration of any 'losses' from connected but unlined vegetated swales. This should be informed by a water balance exercise, to determine the likely influence of the

conveyance swales on the design and plant specification of the downstream wetlands more accurately.

43. As noted above, Waka Kotahi should revisit the lining of the proposed wetland forebays to ensure there is no discharge of potentially contaminated stormwater to ground and to ensure the biological processes within the wetlands are sustained.
44. Waka Kotahi must provide a more detailed summary of areas of the Ō2NL Project which are unable to discharge to the proposed treatment train, so that assessment can be made of whether these areas are likely to adversely impact on freshwater through contaminants or scour. In the instance that these locations do discharge to waterways, further measures will be required to mitigate the effects from these discharges. This could require further treatment measures such as proprietary treatment systems, or small raingardens.
45. Further information is required around how the proposed design will provide the ability to respond to unintended spills resulting from accidents. This requires an ability to isolate any spills in a responsive manner and prevent these discharging either to ground or waterways. In the instance that this results in impacts to the long-term function of stormwater treatment devices, this will need to be addressed via long term operation and maintenance plans for swales, wetlands and infiltration galleries.
46. Detailed designs for all stormwater management systems will need to be reviewed prior to construction. This is necessary given the conceptual nature of the design presently. In my opinion, there are likely opportunities to reduce complexity (through simplified hydraulic design) and rationalise footprints based on a more accurate understanding of water balance. The Regional Councils will also require confidence that the design will deliver on the outcomes anticipated by the application.
47. Planting plans and bathymetric design will need to be reviewed prior to construction to ensure that the wetlands will support the intended function through adequate plant coverage with appropriate species.

48. Where wetlands discharge to natural waterbodies the detailed design shall prevent or limit, as far as practicable, the ability of indigenous fish species to migrate into the wetlands due to the expected presence of contaminants. This can be achieved through a stepped outlet to create a fish passage barrier.

I. SUBMISSIONS

49. I have reviewed the submissions. Generally, the submissions did not directly relate to operational stormwater matters and have been responded to by other experts accordingly.
50. Submissions 41 and 50 raised concerns about the ability of the runoff from the operational road surface to be captured and appropriately treated. These concerns are considered to be appropriately addressed through my evidence and the recommendations and consent conditions intended to ensure the required water quality outcomes are achieved.

J. CONDITIONS

51. I have reviewed the conditions provided with the application and have made a number of recommendations to address the matters I raise above. These are reflected in the condition set contained within Mr St Clair's s87F Report. Specific conditions to ensure Operational Stormwater Management is fit for purpose include:
- (a) Waka Kotahi must provide detailed design plans for all operational stormwater management ("**OSM**") devices including swales, wetlands, infiltration and hydraulic connections prior to construction commencing. All OSM devices must demonstrate that they are designed in agreement with the application plans and strictly in accordance with industry standard guidelines (i.e., Wellington Water – Water Sensitive Design Guidelines) and achieve the stated treatment areas in this application as a minimum. Detailed designs must include the following;
 - (i) Confirmation of all areas subject to ground contamination and groundwater recharge and verification that OSM devices shall not either enable mobilisation of existing

contaminants or ongoing contamination of local groundwater;

- (ii) All required batters and embankments are to tie into adjacent landform;
 - (iii) Details on lining of forebays and wetlands;
 - (iv) Details on operational water levels and wetland bathymetry to support a minimum of 80% plant coverage;
 - (v) Details on level of protection for forebays and wetlands from flooding including protection from riverine floods versus localised flood attenuation storage;
 - (vi) Details on design for spill response, including areas to isolate to prevent widespread contamination;
 - (vii) Planting plans for all OSM devices to support required water quality treatment function;
 - (viii) Provision of maintenance access to all OSM devices including safe connection to road and suitable areas for turning and operational requirements;
- (b) Waka Kotahi must provide Operation and Maintenance Plans (“**OMPs**”) for all OSM devices including swales, wetlands, infiltration, and hydraulic connections for approval prior to construction commencing. OMPs must include the following:
- (i) An establishment and commissioning plan to ensure OSM devices are appropriately protected through the initial 24 month period, to ensure long term functionality;
 - (ii) Spill response protocols and planning, including procedures to isolate the immediate area downstream of any spill/fire and actions to prevent spread of contaminants, and remediation works;
 - (iii) Operational inspection frequency and focus;

- (iv) Regular scheduled maintenance activities;
- (v) Responsive inspection/maintenance activities following significant rainfall events;
- (vi) Periodic functional audits of forebays, wetlands and infiltration including detailed condition audit and monitoring of hydraulic function under actual or synthetic rainfall event;
- (vii) Programmed renewal/reset activities, including measures to determine their frequency and methodology to ensure renewal is undertaken without discharge of contaminants in immediate area or at disposal site;
- (viii) Reporting on maintenance actions undertaken since last inspection and any identified issues to be rectified following inspection.

Stuart Farrant

28 April 2023