

## **Appendix K      Fate and Transport Memo**

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# Memorandum

**Subject:** ARL Project - Contaminant fate and transport memorandum  
**Reference No:** 1101798  
**Author:** Chris Bailey  
**Date:** 30 July 2026

## 1 Introduction

WM New Zealand (WMNZ) has engaged Tonkin & Taylor Ltd (T+T) to prepare technical memoranda for the proposed new solid waste management and disposal facility in the Wayby Valley, north of Auckland ('ARL' or 'Project').

The Project will involve constructing, operating, closing and providing aftercare for a new 24 Mm<sup>3</sup> landfill facility and associated infrastructure at Wayby Valley, Wellsford. Ngāti Manuhiri are Project partners and will work with WMNZ on the proposed management and mitigation measures. Once landfilling ceases, the land will be returned to Ngāti Manuhiri as tāngata whenua.

The new landfill will be a Class 1 landfill, as defined in the Technical Guidelines for Disposal to Land (WasteMINZ Technical Guidelines)<sup>1</sup>, accepting municipal solid waste. This includes residential and commercial waste, construction and demolition waste, some industrial wastes that meet acceptance criteria, and contaminated soils. Following waste settlement, the landfill cap surface will have a maximum height of 205 m RL.

WMNZ landholdings in the Wayby Valley area comprise a total area of 1020 ha, with the landfill footprint being approximately 60 ha. The WMNZ landholdings have been divided into five general areas; the Eastern Block, the Western Block, the Southern Block, the Waiwhiu Tributary Block and the Waiteraire Tributary Block. The proposed works will involve the following:

- **Site access and operation:** Construction of site access roads, weighbridges, and a vehicle wheel wash.
- **Landfill development:** Major earthworks and the installation of environmental management systems, including a landfill lining system and collection networks for leachate, stormwater, and landfill gas (LFG).
- **Leachate and landfill gas management:** A dedicated leachate management system and a LFG treatment facility, including a LFG flare and a LFG waste-to-energy plant.
- **Support infrastructure:** Facilities for site staff, plant maintenance, and water supply.
- **Terrestrial, freshwater and wetland biodiversity measures:** This includes native revegetation, and a weed and animal pest management programme to offset or compensate for residual adverse effects on terrestrial, freshwater and wetland ecology.

This memorandum provides an outline of the initial findings of the Hydrogeological Assessment and has been prepared for inclusion in an application for Ministerial referral of the Project under the Fast-track Approvals Act 2024 ('FTAA'). Specifically, this memorandum responds to the requirements under section 3.4 of the Fast-track Approvals Referral Application Form and section 13(4)(h) of the

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<sup>1</sup> Technical Guidelines for Disposal to Land, WasteMINZ, September 2023, Revision 3.1.

FTAA. A full description of the draft proposal is included in the accompanying information attached to the application form for the referral.

## **2 Summary of findings**

A groundwater risk assessment has been carried out for the proposed ARL site to consider the potential direct effects on groundwater quality, and indirect effects on surface water quality.

The groundwater risk assessment required development of a conceptual understanding of the site, and contaminant fate and transport modelling to evaluate the potential risk to groundwater and nearby environmental receptors. The lining system of ARL is specifically designed not to leak and no leakage is intended or sought to be authorised. Notwithstanding this, the contaminant fate and transport modelling assumes seepage of contaminants through the lining system of ARL, to enable the potential effects to be assessed in the very unlikely event such seepage was to ever occur.

The modelling has been used to inform the design of the landfill to avoid unacceptable risks. Because of the implications of leachate that may potentially seep out from the ARL, the assumptions used in the modelling of those potential effects were deliberately conservative.

Representative maximum concentrations of contaminants in leachate at WMNZ's Redvale Landfill were used as the source concentrations. Seepage of leachate was assumed to occur through the lining system and into shallow and deeper (regional) groundwater. Six potential receptors were identified, and modelling was conducted to assess risks to the receptors.

The results of the modelling indicated that contaminant concentrations would be well below relevant criteria at the assessed receptors – being the nearby stream confluence, the local farm bore, the Hōteio River and the Waiteraire Stream, the proposed groundwater supply for the landfill operations and the regional aquifer south of the landfill.

Monitoring of the landfill is proposed to ensure appropriate mitigation is implemented should a leachate release ever be detected. The monitoring consists of continuous subsoil drainage testing immediately beneath the landfill and quarterly groundwater sampling and testing at a range of locations around the landfill and further afield.

## **3 Assessment methodology**

The methodology to inform the assessment to date has been desktop based on hydrogeologic field investigations.

The following desktop-based tasks and assessment have been undertaken to inform the assessment:

- Reviewing hydrogeological data and setting.
- Developing a conceptual site model consisting of source, pathways and receptors including identifying potential downgradient receptors.
- Review of potential seepage rates through the design lining system.
- Review of leachate quality data.
- Preliminary attenuation calculations.

Field work to inform the assessment was undertaken under the supervision of Mr Pemberton and is discussed in the memorandum he has prepared<sup>2</sup>.

Modelling that has been undertaken to inform this assessment has included:

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<sup>2</sup> T+T, July 2026. ARL Project – Hydrogeology Memorandum. Ref: 1101798

- Selection of model
- Running simulations
- Comparison of results with relevant criteria protective of receptors
- Sensitivity analysis to quantify uncertainty.

#### **4 Site and project context**

A general description of the site and surrounding locality is included in the accompanying information as part of the referral application. The following elements of the site and Project are key to the contaminant fate and transport assessment:

- Hypothetical leakage rate (refer to the Hydrologic Evaluation of Landfill Performance modelling results presented in the Lining System memorandum<sup>3</sup>).
- Hydraulic conductivities and anisotropic nature of the Pakiri Formation, determined from onsite testing (refer to the Hydrogeology memorandum<sup>4</sup>), and surface water flow rates.

Conservative values were selected for these inputs.

#### **5 Assessment of potential effects**

Based on the proposal and the information available, an assessment has been undertaken of the potential effects that could arise under a highly unlikely leachate release through the lining system. That assessment is summarised below.

The review of hydrogeologic information identified potential receptors consisting of the nearby stream confluence, the local farm bore, the Hōteio River and the Waiteraire Stream, the proposed groundwater supply for the landfill operations at the borehole drilled on the southern ridgeline of the Landfill Valley ("TB01") and the regional aquifer south of the landfill.

The assessment was conducted for compounds captured within the proposed Waste Acceptance Criteria ("WAC") described in the Waste Acceptance Criteria memorandum<sup>5</sup>. Other compounds including PFAS have been added to assist with the human health risk assessment, and on the basis that PFAS is an emerging contaminant as described in the Waste Acceptance Criteria memo.

The criteria selected for comparison at the receptors were the most stringent of the NZ Drinking Water Standards, and livestock drinking water, recreational guideline and ecological protection values – sourced from Australian and New Zealand Guidelines for Fresh and Marine Water Quality published by Australian and New Zealand Environment and Conservation Council in 2000.

If in the unlikely event leachate seeps from ARL (i.e., leaks through the lining system), contaminants would enter the shallow groundwater directly beneath the landfill. WMNZ proposes to extract shallow groundwater from beneath the landfill footprint using subsoil drains during and after construction. The drains are expected to capture the vast majority of any released leachate, in the unlikely event this occurs.

However, to be conservative, the modelling was conducted assuming leachate migration with the current groundwater flow which follows topography out of the landfill valley toward the northwest. This groundwater is likely to emerge from the ground at the confluence of the landfill valley and the neighbouring valley streams. Modelling of this scenario indicates that, should contaminants reach the stream at the confluence, the concentrations would be significantly below the relevant guideline values noted above, and therefore would not be considered to pose a risk to human health or the

<sup>3</sup> T+T, July 2026. ARL Project – Lining System Assessment Memorandum. Ref: 1101798

<sup>4</sup> T+T, July 2026. ARL Project – Hydrogeology Memorandum. Ref: 1101798

<sup>5</sup> T+T, July 2026. ARL Project – Waste Acceptance Criteria Memorandum. Ref: 1101798

environment. This would be the case even prior to any further dilution or degradation of the contaminants as they move down the stream towards the Hōteio River.

Potential for leachate to transport through groundwater and reach the other assessed potential receptors, being the Hōteio River, the farm bore, the proposed landfill bore, and the regional aquifer south of the landfill or Waiterare Stream, would require vertical migration through the shallow aquifer, against the strong horizontal anisotropy present, before horizontal migration in the deeper regional aquifer. On the basis of this low likelihood, assessment of these regional groundwater receptors is considered highly conservative. Nevertheless, modelling of these scenarios indicates that should contaminants reach those regional groundwater receptors, the concentrations would be at trace levels which would not pose a risk to those receptors.

The modelling has been conducted assuming an infinite source of contaminants, i.e. assuming no decrease in magnitude over time, using representative maximum concentrations from 20 years of monitoring data of Redvale Landfill leachate. Leachate data was also sourced from other landfills for contaminants not tested at Redvale. In reality, the ARL source would be finite and leachate quality averages would be more representative of true landfill leachate conditions. Together, these assumptions mean the modelling predictions are conservative.

The results of the modelling indicated that contaminant concentrations would be well below relevant criteria at the assessed receptors.

Sensitivity analysis for the Project consisted of modifying a range of inputs including leachate release at 1000 times the hypothetical assessed rate and using the WAC toxicity characteristic leaching procedure limits as source concentrations, i.e. assuming all materials within the landfill would be contaminated at the acceptance limits, which is a very conservative assumption. Sensitivity analysis indicated that while predicted concentrations at the receptors would change when model inputs were varied within a range of feasible values, the predicted concentrations at the receptors remained below criteria.

Comprehensive monitoring of the landfill is proposed to ensure appropriate mitigation is implemented should a leachate release be detected. The monitoring consists of continuous subsoil drainage testing from beneath the landfill and quarterly groundwater sampling and testing.

## **6 Conclusions**

In conclusion, while the ARL lining system is designed not to leak, modelling of potential leachate seepage through the landfill lining system indicates that contaminant concentrations would be well below relevant criteria at all assessed receptors in the unlikely event the liner did not perform as expected.

On this basis, and taking into account the proposed monitoring and contingency measures which provide safeguards in the event of a detectable release, no unacceptable risks to aquatic life or human health are anticipated.

Accordingly, any potential seepage of leachate through the landfill lining system, in the unlikely event were to occur, is not expected to result in adverse effects on identified receptors.

## 7 Applicability

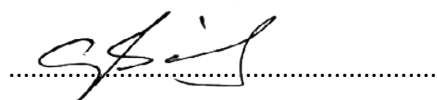
This technical memorandum has been prepared for the exclusive use of our client WMNZ, with respect to the particular brief given to us, and it may not be relied upon in other contexts or for any other purpose, or by any person other than our client, without our prior written agreement.

We understand and agree that WMNZ will submit this technical memorandum to the Environmental Protection Authority in support of a referral application under the Fast-track Approvals Act 2024 for the works described herein, and that the Environmental Protection Authority will rely on this technical memorandum for the purpose of assessing that application.

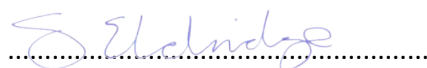
Tonkin & Taylor Ltd

Lead Author:

Authorised for Tonkin & Taylor Ltd by:

A handwritten signature in black ink, appearing to read 'C Bailey', written over a horizontal dotted line.

Chris Bailey  
Contaminant Hydrogeologist

A handwritten signature in blue ink, appearing to read 'S Eldridge', written over a horizontal dotted line.

Simonne Eldridge  
Project Director