

Appendix H Lining System Memo

Memorandum

Subject: ARL Project - Lining System Memorandum

Reference No: 1101798

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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 Mm³ 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)¹, 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 preliminary lining system design 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

¹ 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

The proposed landfill lining system for ARL is a composite system designed to provide long-term containment of waste and its by-products, including leachate and landfill gas. The system is intended to isolate the waste mass from the surrounding environment for the duration that containment is required and has been developed in accordance with the recommendations in the WasteMINZ Technical Guidelines, which represent established landfill design practice in New Zealand and reflect international experience.

Two lining system configurations are provided for within the design: a Type 1 lining system and a Type 2 lining system. Both configurations are recognised in the WasteMINZ Technical Guidelines as providing equivalent containment performance when properly designed and constructed, and their inclusion provides appropriate flexibility over the life of the landfill. The lining system incorporates an integrated leachate collection system designed to limit leachate head above the liner and thereby minimises the potential for leakage. Lining system performance has been assessed using conservative modelling assumptions, including sensitivity scenarios, and the assessment indicates low potential leakage rates under both typical and conservative conditions.

The anticipated service life of the high-density polyethylene (HDPE) geomembrane has been assessed with reference to internationally published durability research and long-term performance data. The geomembrane is expected to retain its containment function for several hundred years, with published estimates indicating a service life of at least 400 years and potentially in excess of 750 years, subject to appropriate design and construction quality assurance. The lining system geometry and material selection provide for stable performance under seismic loading, and construction quality assurance is fundamental to system performance and is addressed through defined material requirements, controlled installation procedures, inspection and testing, and independent review.

3 Assessment methodology

The preliminary lining system design builds on the assessment outlined in the Landfill Engineering Assessment and has been informed by a comprehensive review of available site information and includes:

- Collection of all relevant existing data related to the site.
- Selection of a suitable landfill profile to provide a suitable foundation for the lining system.
- Assessment of overall requirements for the operation of the landfill over its expected life and the implications on the lining system design.
- Assessment of the proposed designs against the recommendations set out in the WasteMINZ Technical Guidelines and international good practice for landfill lining system design.
- Consideration of construction quality control and assurance requirements.

4 Lining system design and performance

4.1 Proposed lining system overview

The proposed lining system for ARL is a composite system designed to provide long-term containment of waste and its by-products, including leachate and landfill gas. The role of the lining system is to isolate the waste mass from the surrounding environment for as long as containment is required.

The lining system design has been developed with reference to the WasteMINZ Technical Guidelines. These guidelines represent established practice for landfill design in New Zealand and reflect international experience in engineered landfill containment systems.

Two lining system configurations are proposed for use over the life of the landfill, depending on the quality of site-won soils available at the time of construction, namely:

- **Type 1 lining system**, comprising a 1.5 mm HDPE geomembrane placed directly over a 600 mm thick compacted low permeability mineral soil layer ($k \leq 1 \times 10^{-9}$ m/s).
- **Type 2 lining system**, comprising a 1.5 mm HDPE geomembrane placed over a geosynthetic clay liner (GCL) and a 600 mm thick compacted low permeability mineral soil layer ($k \leq 1 \times 10^{-8}$ m/s).

Both lining system types are recognised in the WasteMINZ Technical Guidelines as providing equivalent containment performance when properly designed and constructed.

4.2 Basegrade geometry and foundation preparation

The lining system will be constructed on a prepared basegrade formed through earthworks within the landfill valley. The basegrade geometry has been deliberately configured to provide regular and consistent surfaces suitable for liner installation and staged landfill development.

Side slopes are predominantly no steeper than 1 vertical to 3 horizontal (1V:3H), with limited areas of steeper slopes required to accommodate the natural valley geometry. Benches are incorporated at regular vertical intervals. These benches define construction stages, facilitate liner installation, and provide control of surface water during landfill development.

Where fractured rock is encountered close to the underside of the lining system, foundation treatment will be undertaken to maintain containment performance. This includes sub excavation and replacement with compacted site soils to ensure that an adequate thickness of low permeability material is present beneath the lining system, consistent with the requirements of the WasteMINZ Technical Guidelines.

4.3 Lining system configuration

From top to bottom, the lining system comprises:

- leachate drainage layer incorporating drainage aggregate and collection pipework
- protection geotextile
- 1.5 mm HDPE geomembrane
- compacted low-permeability mineral soil layer, with a GCL incorporated where required
- prepared foundation soils.

The HDPE geomembrane forms the primary containment barrier. The underlying mineral soil layer, and, where present, the GCL, restricts seepage and provides chemical attenuation of contaminants within any potential seepage through the primary barrier. The geomembrane is installed in direct

contact with the low permeability layer, which limits lateral transmission of leachate should a defect occur.

Additional containment measures are provided at the leachate sump area, where localised increases in leachate depth may occur. These measures include supplementary geomembrane and GCL layers to further reduce the potential for leakage at this location.

4.4 Leachate collection and management

Leachate generated within the waste mass will be collected by a drainage aggregate layer placed directly above the lining system. Leachate will drain through this layer to a network of collection pipes, which convey leachate to sumps located at the toe of the landfill.

The leachate collection system has been designed to limit leachate head above the lining system to less than 300 mm across the majority of the landfill footprint. Higher leachate depths will be confined to small areas at sump locations.

Leachate will be actively extracted throughout landfill operation. During the early stages of landfill development, leachate will be removed from site for authorised disposal. As landfill gas generation increases, leachate management will incorporate onsite treatment using landfill gas fuelled systems.

4.5 Lining system performance

4.5.1 Leachate containment performance

The potential for leachate leakage through the lining system has been evaluated using the Hydrologic Evaluation of Landfill Performance (HELP) model. The assessment adopts conservative assumptions for geomembrane manufacturing and installation defects and includes sensitivity scenarios involving increased leachate head and poorer installation conditions.

The modelling demonstrates low leakage rates under both typical and conservative scenarios. These leakage estimates have been adopted by other specialists as inputs to their assessments of potential effects.

More details on the HELP modelling are provided in the Landfill Engineering Memorandum².

4.5.2 Durability and longevity

The anticipated service life of the HDPE geomembrane has been assessed with reference to internationally published durability research and long term performance data. The assessment considers the conditions expected at ARL, including waste characteristics, leachate temperature, operational practices, and construction quality.

Based on this assessment, the geomembrane is expected to retain its containment function for several hundred years. Published estimates indicate a service life of at least 400 years and potentially in excess of 750 years, provided that design specifications and construction quality assurance requirements are met.

The lining system design incorporates specific measures to limit tensile strain in the geomembrane, including controlled foundation geometry, avoidance of abrupt changes in slope or geometry, and careful placement of drainage materials and initial waste layers.

4.5.3 Seismic performance

A site-specific seismic hazard assessment (SSHA) has been undertaken for the Project. Slope stability analyses indicate a factor of safety greater than one for an ultimate limit state earthquake event.

Given the low risk seismic setting of the site and the proposed lining system geometry, the lining system is not expected to sustain damage from seismic shaking. Post event inspection procedures are proposed to confirm liner integrity following significant seismic events.

More details on the SSHA are provided in the Geotechnical Memorandum.

4.6 Construction quality assurance

Construction quality assurance is fundamental to the performance of the lining system. Quality assurance measures include verification of geomembrane manufacturing quality, inspection and testing of geomembrane welds, supervision of liner installation, protection of installed liner components, and documentation of construction and as-built conditions. In addition, in line with good practice, independent review of lining system installation is an essential element of the quality assurance process.

5 Conclusions

The design of the proposed lining system for ARL is technically robust and is consistent with or exceeds the recommendations set out in the WasteMINZ Technical Guidelines and international best practice.

The lining system, together with the collection systems (leachate and LFG) are considered to be appropriate and will provide for the safe, long-term containment of waste and its by-products while minimising environmental effects.

6 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 report 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 report for the purpose of assessing that application.

Tonkin & Taylor Ltd

Lead Author:

Authorised for Tonkin & Taylor Ltd by:

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Simonne Eldridge
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Simonne Eldridge
Project Director