WM NEW ZEALAND LANDFILL

LANDFILL MANAGEMENT PLAN

Stormwater Monitoring and Contingency Plan
+
Stormwater Monitoring Programme

Document Control

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31/07/2020	Ed 3 Draft d2	BH		Council Hearing evidence
28/01/2022	Ed 4 Draft 1	BH		BH statement of evidence for Env Court
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17/03/2025	Ed 4 Draft 2	RVDM		Final draft for issue to Court.

CONTENTS

1. INTRODUCTION

1.1 Scope of this section

This section of the Landfill Management Plan (LMP) describes:

- The stormwater system.
- Stormwater monitoring.
- Contingency responses associated with discharges to the receiving environment.

This plan addresses the requirements in terms of managing surface water at the site and discharges to the receiving environment. The management of leachate at the site, along with contingency actions and monitoring undertaken prior to the discharge to the receiving environment are outlined in the Leachate Monitoring and Contingency Plan (LMCP).

This section is the Stormwater Monitoring and Contingency Plan (SWMCP), and embodies the Stormwater Monitoring Programme, required by consent condition 375[1].

Revision of this section would follow the general procedure for any revision of the LMP.

2. STORMWATER REGIME

2.1 Overview

2.1.1 Landfill Valley + Northern Block

Description:

- Pine forest in the head of Valley 1.
- Central stream and tributaries.
- Downstream to neighbours farmland near Spindler Road.
- Further downstream to the Hoteo River and beyond to the Kaipara Harbour.

Landfill activity:

- landfill footprint (where the waste will be placed – Landfill Valley).
- Internal access roads.
- Working face.
- Daily cover and intermediate cover.
- Workshops.
- Re-fueling facility.
- Wheel wash.
- Leachate treatment plant.
- Gas treatment plant and gas-to-energy plant.
- Goods storage.

[1] The current version of conditions is dated 25 February 2025, all references to conditions and the consent relate to this version.

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Other activity:

- Existing forestry operations will continue.

2.1.2 Western Block

Description:

- Farm.
- Pine forest blocks.
- Wetlands.
- Native bush blocks.
- Downstream direct into the Hoteo River.

Landfill activity:

- Soil stockpile 1.
- Ecological enhancement planting.

Other activity:

- Existing forestry operations (on part of Springhill farm) will continue.
- Off-set pine forestry replaces a limited area of bare farmland.

The Western Block will not be used for waste disposal.

2.1.3 Southern Block

Description:

- Pine forest.
- Wattle forest.
- Native bush.
- Stream.
- Downstream to NMA and Waiteraire Stream.

Landfill activity:

- Main access road.
- Bin exchange area.
- Culvert over stream.
- Bridge over Waiteraire Stream.

The Southern Block will not be used for waste disposal.

2.1.4 Waitaraire Tributary Block

Description:

- Pine forest.
- Streams.
- Downstream to SEA, Sunnybrook Reserve and Waiteraire Stream.

Landfill activity:

- None (only monitoring of baseflow).

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Other activity:

- Existing forestry operations will continue.

The Waiteraire Tributary Block will not be used for waste disposal.

2.1.5 Waiwhiu Tributary Block

Description:

- Pine forest.
- Downstream to Waiwhiu Stream.

Landfill activity:

- Cutting of walking tracks.

Other activity:

- Existing forestry operations will continue.

The Waiwhiu Stream catchment will not be used for waste disposal.

2.1.6 Hōteo River

The Hōteo River ultimately receives stormwater from all the above sources.

2.2 Baseline monitoring

Table 2.1

Location	Baseline monitoring reason	Ongoing
MC1	Water quality (as indicated by macroinvertebrate health) in NMA. Downstream from access road.	Scheduled
MC2	Supplementary to MC1. Downstream from part of access road.	As required for investigations or periodic reassessment.
MC3	Water quality (as indicated by macroinvertebrate health). Downstream from landfill.	Scheduled
MC4	Water quality (as indicated by macroinvertebrate health). Control site for landfill.	Scheduled
MC5	Water quality (as indicated by macroinvertebrate health). Downstream from Stockpile 1. Downstream from areas of land use change from farm to forestry.	Scheduled

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Location	Baseline monitoring reason	Ongoing
MC6	Water quality (as indicated by macroinvertebrate health). Downstream from area of land use change from farm to forestry.	Scheduled
SW1	Water quality (chemistry). Downstream from access road just before confluence with W Stream (downstream of access road bridge).	As required for investigations or periodic reassessment.
SW2	Water quality (chemistry). Control site upstream of access road.	As required for investigations or periodic reassessment.
SW3 Same location as SF2	Water quality (chemistry). Downstream from landfill – stream water from both Valley 1 (landfill valley) and Valley 2 (pine forest) combined.	Scheduled
SW4 Same location as SF1	Water quality (chemistry). Control site for landfill – stream water only from Valley 2 (pine forest).	Scheduled
SF3	Baseflow volume flowrate. To assess long term effect on a nearby non-landfill stream.	Scheduled
Upstream Waitaraire	Water quality (continuous).	Scheduled
Downstream Waitaraire	Water quality (continuous).	Scheduled
Hoteo River at Spindler Rd Bridge	Water quality (continuous).	Scheduled
Hoteo River at Wilson Rd Bridge	Water quality (continuous).	Scheduled
"P" prefix (ponds/dams to be constructed)	None	Scheduled

A summary of the findings of baseline monitoring to May 2019 is provided in:

Auckland Regional Landfill, Water Quality Baseline Monitoring Report, Prepared for Waste Management NZ Ltd. Prepared by Tonkin & Taylor Ltd. Date May 2019. Job Number 1005069.1170.

2.3 Risks - stormwater

Table 2.2

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Risks - landfill operations	**Mitigations**
GENERAL	REFER TO SPECIFIC CONTROLS IN THE ITAMP (supplemented by the items in this table)
Sediment Any excessively silt-laden water and sedimentation could have an effect on stream organisms. The potential sediment generating activities are the landfill operations (Eastern Block), soil stockpiles (Western Block and Waiteraire Tributary Block), and forestry (parts of all blocks) Waterways with high ecological values and ultimately the Hoteo River are downstream from all project footprint areas. The fauna in these habitats are sensitive to sediment. Some areas of NMAs, SEAs and wetlands are downstream of the project footprint (Southern Block, Western Block and Waiteraire Tributary Block), and high value reaches are downstream from the landfill footprint (Eastern Block).	Physical works described in ESCPO: • Methods for avoiding erosion. • Primary silt traps. • Permanent sediment ponds. • Riparian planting - part of the aquatic ecological mitigation and enhancement package. • Terrestrial planting - part of the ecological mitigation and enhancement package. Maintenance described in SWOMP and ESCPO: • De-silting of ponds. • Repair of fences and riparian planting. • Suck out sumps alongside access road. Tasks described in LMP sections on disposal, erosion and sediment control for landfill operations, and industrial and trade activity. • Regular inspections. • Planting of bare ground. Monitoring listed here and in SWMCP: • Suspended sediment measurements. • Aquatic fauna surveys.
Flooding Downstream neighbours on Spindler Road have been affected by log jams, and a number of properties are affected by flooding at Hoteo bridge. Climate change is thought to be exacerbating the issues. For design of stormwater ponds and channels, rainfall intensities have been taken from Auckland Council's design standards that show that the Dome forest area has very high rainfall compared to elsewhere in the Auckland region, and this is confirmed anecdotally by neighbours.	Design described in the consent application: • Permanent ponds which spread out the flow to avoid flash flooding. • Allowance for increasing rainfall intensities due to climate change. • Dams that will capture logs from upstream. • Restrictions on replanting of pines on stream banks.
Contamination - Landfill	Physical works described in LMP … ITA. Procedural controls described in the waste control section LMP …

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Risks - landfill operations	**Mitigations**
The waste and other sources pose a risk, albeit unlikely with proper care, that they might affect water quality downstream.	Tasks described in LMP sections on waste control, disposal, and industrial and trade activity. Monitoring listed here in this section LMP: • Continuous electronic measurements. • Grab sampling for chemistry tests. • Stream fauna surveys.
<u>Sediment – forestry</u> Harvest inevitably temporarily exposes the ground to more erosion and therefore more sediment.	Physical works: • Silt dams created as soon as possible after the forester has completed an area of harvest in the Landfill Valley and handed over to WM. • Restrictions on replanting on mainstream banks or in defined wetland.
<u>Contamination - Bin exchange area</u> Potential contamination from trucks, bin exchange vehicles and unsealed bins.	Design and physical works described in consent application: • Sealed pavement. • Rain garden for stormwater run-off. Tasks described in BEAMP: • Regular inspections of site. • Regular inspections of bins. Maintenance described in SOMP: • Re-conditioning of rain garden.
<u>Contamination - Access Road</u> Potential contamination related to roads generally could occur on the access road e.g. oil drips, surface wear, tyre wear, and mud dropping from truck wheels, all of which could wash off towards the nearby stream.	Design and physical works described in the consent application: • Wheel wash. • Road-side drains and spreader discharge. Tasks and scheduled maintenance described in this LMP section and ESCPO and SWOMP. Monitoring listed here in SWMCP.
<u>Sediment - Waiwhiu Stream catchment</u> Sediment could be generated by forestry at harvest time. No landfill-related activity will take place in the Waiwhiu stream catchment part of the landholdings.	The WMNZ landholding in the Waiwhiu catchment will be under the operational control of a separate forestry rights holder who will be obliged to adhere to the National Environmental Standard for Plantation Forestry.

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3. MONITORING (STORMWATER MONITORING PROGRAMME)

3.1 Monitoring parameters and schedule

The Stormwater Monitoring Programme required by Consent Condition 375 is this section of the LMP (3.22.3.1 - 3.22.3.3) and referenced appendices.

Surface water chemistry parameters are presented in a table in Appendix 6.3

Sampling locations are shown on site plans in Appendix 6.1.

Baseline monitoring in the streams has a more extensive parameter list and more frequent monitoring for a limited time as indicated in the table in Appendix 6.3.

The landfill operator may add parameters for supplementary information at its discretion.

The monitoring programme is summarised in the table below (database extract) and in the parameter lists (Appendix 6.3).

Table 3.1

Location / Event / Topic	Parameter	Frequency	TL1	TL2
Stormwater pond system OUTLET (wetland)	Surface water parameters from LMP SMCP App 6.	Fortnightly	Limits tba.	Limits tba.
Stormwater pond system OUTLET (wetland)	Conductivity and temperature	Continuous	Limits tba.	Limits tba.
Stormwater pond system OUTLET (wetland)	Turbidity (point in time)	Continuous	30 g/m3 (to be confirmed after more baseline measurements before Landfill Commencement)	Limits tba.
Stormwater pond system OUTLET (wetland)	Turbidity (rolling annual average of continuous meter readings)	Continuous	TL2 minus 1 g/m3.	30 g/m3 (to be confirmed after more baseline measurements before Landfill Commencement)
Stormwater pond system OUTLET (wetland)	Flow rate	Continuous	No limit. Monitored for information.	No limit. Monitored for information.
Stormwater pond system OUTLET (storm bypass - service spillway and emergency spillway combined)	Surface water parameters from LMP SMCP App 6.	As required	Limits tba.	Limits tba.
Stormwater pond system OUTLET (storm bypass - service spillway and emergency spillway combined)	Flow rate	As required	35.1 m3/s (to be confirmed in final design).	37.5 m3/s (to be confirmed in final design).
Stormwater pond system INFLOW	Conductivity and temperature	Continuous	Limits tba.	Limits tba.
Streams downstream from project footprint, and control sites	Surface water parameters from LMP SMCP App 6.	Quarterly	Limits tba.	Limits tba.
Soil stockpile 1 sedimentation pond outlet	Surface water parameters from LMP SMCP App 6.	Weekly	Limits tba.	Limits tba.
Soil stockpile 1 sedimentation pond outlet	Turbidity	Continuous	Limits tba.	Limits tba.
Bin exchange area stormwater run-off via rain garden	Surface water parameters from LMP SMCP App 6.	Weekly	Limits tba.	Limits tba.

3.2 Monitoring procedures

Separate detailed step-by-step procedures will be used for monitoring events (variously known as work instructions, standard operating procedures, and safe work method statements). Procedures will be provided in a separate volume. Only the key features of those procedures are highlighted here.

Table 3.2

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Procedure	Key steps
Continuous monitoring of conductivity, turbidity and pond level in the landfill valley	• Electronic measurements data logged. • Radio telemetry - web recording. • Automated notifications of trigger level exceedances. • Primary and/or secondary calibration schedule. • Weekly inspection. • Corrective action tracking. • Maintenance records. • Function check on installation design.
Grab sample for chemical analysis	• Pre-ordered bottles. • Field parameter measurements • Field preservative and handling precautions. • Avoidance of sample spoiling e.g. by floating matter. • Chain of custody documentation. • Time restrictions.
Laboratory test methods and Limits of Detection	• Listed in Appendix 6.2.
Annual Environmental Report	• Include items required by LMP … ITAMP. • Stormwater monitoring results. • Summary of contingency actions. • Objective evaluation of the site's environmental performance relating to water.

3.3 Reporting

Table 3.3

Location / Event / Topic	Report to	Method	Frequency
Environmental report	Auckland Council	Email	Annually
Environmental report copy	Community Liaison Group	Email to advise of its availability	Annually
Stormwater Monitoring and Contingency Plan to be submitted prior to Landfill Commencement Date	Auckland Council	Email or filedrop	At least 3 months before
Any spill into stormwater and TL2 exceedance.	Auckland Council	Email	Immediately
Stormwater contamination investigation	Auckland Council	Email	Within 5 days after

4. CONTINGENCY

4.1 Trigger Levels - general

4.1.1 Trigger Levels

Response limits (or trigger levels) are values for the monitoring parameters which, if exceeded, require a course of action to be taken. Upon completion of a monitoring event, the results will be checked against the pre-specified response limits. If no response limit is exceeded, the monitoring event will be routinely reported in due course. If any response limit is exceeded, action will be taken immediately as described in this contingency plan.

Response guidelines are summarised in the next section below.

The limits are set at two levels (TL1 and TL2) as follows.

4.1.2 Trigger Level 1 (Lower response limit)

Exceedance of TL1 warns of potential adverse effects, warns of potential future non-compliance with the resource consent conditions, requires investigation and reporting, and might require remedial action. For surface water, TL1 is reached if one or more individual parameters exceed the listed TL1 limits (Table 3.1 and Appendix 6.5

4.1.3 Trigger Level 2 (Upper response limit)

Exceedance of TL2 will be regarded as an indication that significant environmental harm and breaches of consent conditions either have occurred, are currently occurring, or are about to occur. The upper limits will be set either at the limits (if any) specified in the resource consent, or at limits which if exceeded indicate non-compliance. Exceedance of TL2 usually requires urgent mitigative actions, notification of authorities, calling for or reference to recent relevant independent advice, and prompt investigations and remedies. For surface water, TL2 is reached if one or more individual parameters exceed the listed TL2 limits (Table 3.1 and Appendix 6.5) at a single location.

Trigger Levels will be set by experts in that field and identified in Appendix 6.5.

4.1.4 Emergency

Extreme exceedance of TL2 might require reference to the emergency plan.

4.1.5 Definition of leachate contamination

The terms “Leachate contamination”, "contamination" and “contaminant” in the consent conditions refer to surface water, groundwater, and flows from subsoil drains. For the purposes of this LMP, wherever not otherwise defined in the consent conditions, these terms in consent conditions are taken to mean:

- TL2 has been exceeded in monitoring, and.
- There is observed or measured evidence of the presence of leachate in a watercourse or pond somewhere outside the landfill footprint, and.
- Independent specialist advice is that a significant change has occurred to the quality of surface water discharging from the site (or in ponds about to discharge from the site) due to leachate.

This definition aims to encompass leachate contamination events for which the regulator expects notification and liaison in regard to response actions. If investigation of a monitoring result or

observation subsequently reaches a different conclusion from the first call, i.e. that leachate either was or was not the cause, then the event may be re-rated retrospectively accordingly.

4.1.6 Water quality standards

The sources for the criteria and water quality standards used as a basis for setting TL2 levels tabulated in Section 3.1 above and therefore for the definition of leachate contamination are described in Appendix 6.5 and summarised as follows:

- Tba.

4.1.7 Flowchart

The procedure to be followed upon receipt of monitoring results and to determine whether leachate contamination is occurring is illustrated in Appendix 6.4 including when to notify Auckland Council.

4.2 Response guidelines

Table 4.2

Contingency triggering event	**Response guidelines**
Pond conductivity/ turbidity	Verification of readings (TL1 and TL2): • Inspect the monitoring site to check that the instrument is functioning correctly. • Inspect the monitoring site to check that there is flow (zero flow means TLs won't apply, but will still be reported with explanations in the annual environmental report). • Check the telemetric monitoring outputs for consistency across the site. • Use portable meters to repeat or take parallel readings. • If not already done, take a grab sample from the pond discharge flow and analyse it for indicator parameters - Add metals and other parameters considered likely to help identify whether or not the source is leachate. Urgent remedial and precautionary action (TL2 only): • Close the pond outlet decant valve to cease discharging from the pond, so that discharge could only be possible to occur over the service spillway after the pond is full i.e. dilution is maximised and impact if any on the stream is minimised, while other emergency treatment is activated. • Turn off (or turn on) leachate extraction pumps according to observations. • Follow emergency procedures as for a spill or a stormwater control structure failure. • Close off any water inputs to the surface water system. • Use site resources to immediately take field measurements at the monitoring site, pond outlet and upstream to find and assess the source of the TL2.

Contingency triggering event	Response guidelines
	• If the source is reasonably assessed as leachate breakout regardless of flow rate, proceed in accordance with the response guidelines in the relevant LMP sections on cover and leachate. • If the source is land management activity (examples below) and the flow rate is very low (less than approximately 2.0 litres/minute), then complete the investigations and sampling for confirmation. • Note: Very low flow rate may be combined with conductivity TL exceedance due to land management activities e.g.: spreading freshly excavated clay as cover; exposing natural ground which initially yields run-off high in soluble ions; placing topsoil; seeding and fertilising; animal grazing; spreading gravel such as limestone on road surfaces; passing of a water truck washing the adjacent road; natural vegetation die-off; stagnation of water in dry weather; groundwater drainage. • Note: The final discharge sluice valves might not be perfectly water-tight when closed. These valves may be closed with the aim of preventing discharge while pond water is being held to allow greater sedimentation to occur within the site, but there may be a residual small "trickle" discharge. If the discharge flow rate from the pond is very low i.e. a trickle, then the impact on the receiving water will likely be too small to measure. • In all cases, record findings for the regular annual report. Planned corrective and preventative action (TL1 and TL2): • Alter the pond discharge flow rate to allow for dilution into the stream before stream conductivity/turbidity reaches its TL1. • Close the decant valve to cease discharging from the pond altogether before the pond discharge conductivity/turbidity reaches its TL1 and determine or confirm whether the contamination event is due to leachate. • Open the decant valve only if or when the stream is in flood, to avoid specific environmental harm, and to provide capacity to increase detention time to reduce sediment load for cleaner discharge during sensitive low flow periods. • Isolate any identified sources of contaminated water.
Pond discharge water quality	Urgent remedial and precautionary action (TL2 only): • Close the service spillway gate valve to cease discharging from the pond altogether. • Go to the spill response plan if applicable.

Contingency triggering event	Response guidelines
	Verification of measurements and investigation (TL1 and TL2): • Follow the previous advice of the specialist adviser if a previous equivalent exceedance occurred in the past three years, otherwise re-seek advice. • Inspect catchments to identify significant contributing sources and their possible relationship with the triggered parameters e.g. freshly excavated natural ground, landfill, farmland, etc. (response actions will depend on whether the parameters relate to contaminants like leachate instead of other sources). • Take samples and/or field parameter measurements within the site as well as at the point of discharge. • Take samples downstream at the site boundary and/or further downstream before confluence with the Hōteo river, and in the Hōteo river upstream of the confluence, for the parameters which have exceeded TL1. • Expand the scope of investigation to include ecological assessment of the event's effects on any pond or stream habitat downstream from the site. Planned corrective and preventative action (TL2). If a water contamination event is confirmed, remedial actions will be tailored according to the investigation findings. Possible actions include: • Chemical treatment of contaminated water in the ponds themselves. • Aeration of the pond water by any practical means e.g. jetting into the air back over the ponds - This might suffice in some instances. • Pumping of contaminated water back to ponds at the heads of the catchments. • Treatment of contaminated water by spray irrigation back onto landfill cover or vegetated final cap. • Closure of the wheel wash. • Disposal of contaminated water back into the landfill working face, soakage pit, or leachate system. • Trucking contaminated water to a wastewater treatment plant. • Pumping of pond water to a holding pond to be formed on the existing landfill where the contaminated water will partly soak in and partly be progressively treated as leachate. • Pumping pond water out to another sedimentation pond in small amounts for assimilation.

Contingency triggering event	Response guidelines
	• Pumping of water in from another sedimentation pond for rejuvenation. • Use of contaminated water for moisture conditioning of earth materials for landfill construction. • Repairing the source of the issue e.g. leachate breakout • Continue monitoring until the contamination is remedied before re-opening the discharge valves from the pond. • Changing work procedures to manage risk of recurrence. • Afterwards, excavating contaminated pond sediment and disposing of it in the landfill.
Wheel wash holding pond water quality	Urgent remedial and precautionary action (TL2 only): • Hold water in the holding pond without discharge. Verification of measurements and investigation (TL1 and TL2): • Calculate whether discharge from the holding pond, after dilution into the on-site pond system, will cause pond water to exceed its TL1 while discharging. • Review sources of water input and nature of vehicles which have been washed. • Analyse for additional parameters. Planned corrective and preventative action (TL1): • Discharge to the pond only if calculations for dilution into the pond system are acceptable and the pond would not discharge TL1 water as a result. • Dispose of the water by irrigation onto grassed cover or landfill roads. Planned corrective and preventative action (TL2): • Chemically treat the water in the holding pond, and dispose of sludges in the landfill. • Treat the water as leachate, e.g. by injection into the landfill or by carting off-site to a proper treatment facility.
Downstream water quality	Urgent remedial and precautionary action (TL2 only): • Notify the authority. Ph (09) 301 0101 24hr or (09) 3773107 Pollution Hotline. Verification of measurements and investigation (TL1 and TL2): • Investigate whether the landfill could be the source of stream contamination, by observation, review of test results, and by additional testing if appropriate of landfill site sources. Planned corrective and preventative action (TL2): • If a leachate contamination event is confirmed, remedial actions will be tailored according to the investigation

Contingency triggering event	Response guidelines
	findings - the same as for pond discharge water quality as above. • If the source is not conclusive, assist Council as requested.

5. TASK LISTS

5.1 Tasks and scheduled maintenance

Table 5.1.

Role	Task	Frequency
Landfill Engineer	Prepare and submit the annual Environmental Report.	Annually
Monitoring Technician	Take water quality grab samples from streams.	Quarterly
Monitoring Technician	Take macroinvertebrate samples from streams.	Annually
Monitoring Technician	Review readings from fixed meters in pond inflow (coming from landfill footprint).	Daily
Monitoring Technician	Review readings from fixed meters in outflows from Ponds 1 and 2 (wetland and main sediment pond storm bypass).	Daily
Monitoring Technician	Review readings from fixed meters in outflow from soil stockpile 1.	Daily
Monitoring Technician	Take water quality grab samples in outflows from the pond system (wetland and storm by-pass).	Monthly
Monitoring Technician	Calibrate fixed meters for stormwater monitoring.	Annually
Monitoring Technician	Calibrate portable meters for stormwater monitoring.	Annually

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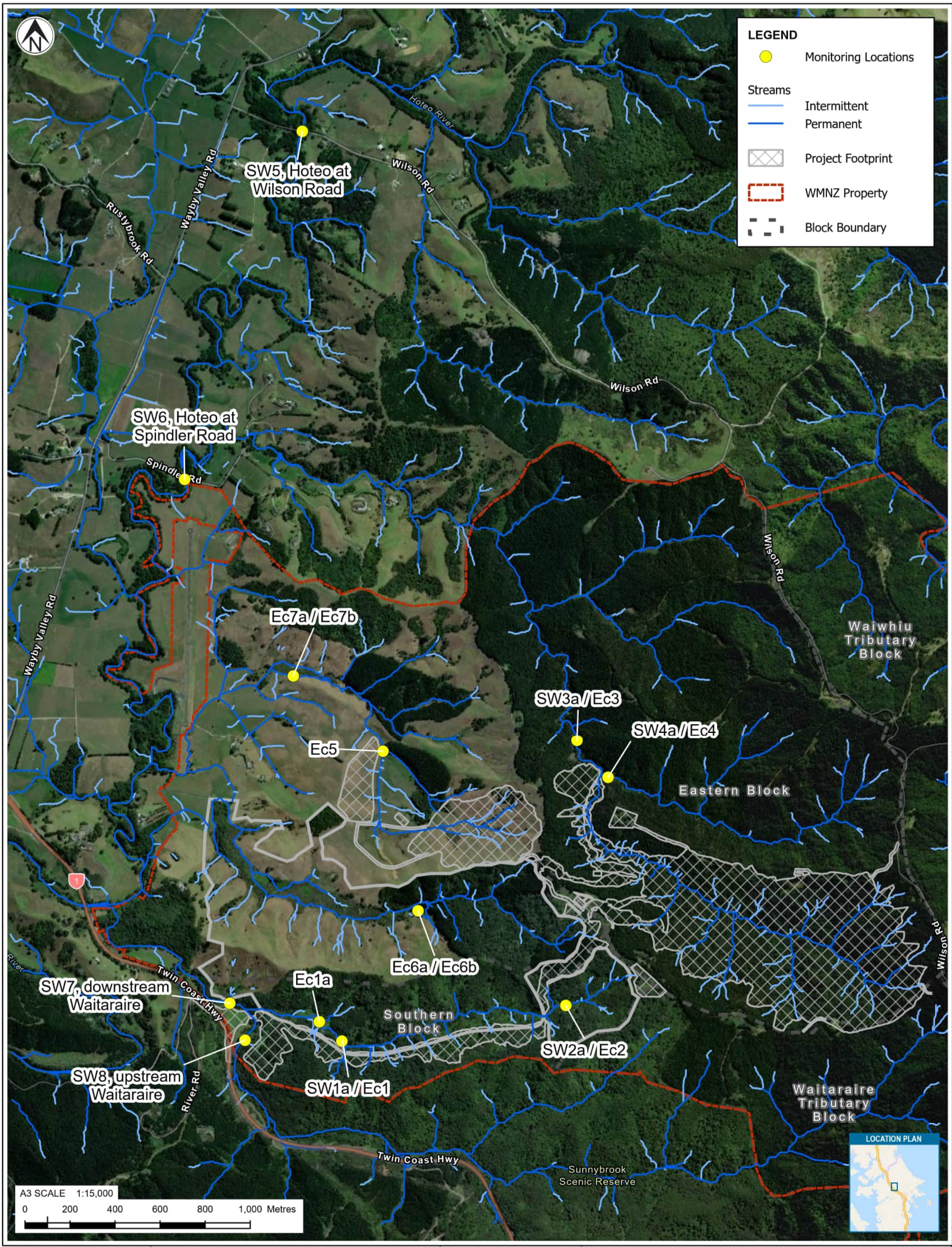
6. APPENDICES

6.1 Surface water quality monitoring site plan

(one page)



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NOTES:
1. Project footprint dated 03/05/22.
2. Streams derived from modelled, walked and predicted stream data.
3. Basemap Hybrid Reference Layer: Esri Community Maps Contributors, LINZ, Stats NZ, Esri, HERE, Garmin, Foursquare, METI/NASA, USGS. NZ Navigation Map: Eagle Technology, LINZ, StatsNZ, NIWA, Natural Earth, © OpenStreetMap contributors.. World Imagery: Maxar

REV	DESCRIPTION	GIS	CHK	DATE	APPROVED	DATE
0	First version	CHSA	RANI	08/03/23		

PROJECT No.	1017284.1000	
DESIGNED	CHSA	MAR.23
DRAWN	CHSA	MAR.23
CHECKED	RANI	MAR.23

CLIENT **WASTE MANAGEMENT NZ LTD.**
PROJECT **AUCKLAND REGIONAL LANDFILL**
TITLE PROPOSED IN-STREAM SURFACE WATER QUALITY MONITORING LOCATIONS (INDICATIVE)
SCALE (A3) 1:15,000 FIG No. FIGURE 1. REV 0

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6.2 Test methods for water quality

(representative laboratory report - 4 pages)

Hill Laboratories
TRIED, TESTED AND TRUSTED

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Certificate of Analysis

Client:	Waste Management NZ Limited	**Lab No:**	2182835	SPv1
Contact:	Hemanta Yadav	**Date Received:**	28-May-2019	
	C/- Waste Management NZ Limited	**Date Reported:**	04-Jun-2019	
	PO Box 228	**Quote No:**	84162	
	Silverdale	**Order No:**	1729530 ON 620	
	Auckland 0944	**Client Reference:**	4176	
		Add. Client Ref:	List C	
		Submitted By:	Hemanta Yadav	

Sample Type: Aqueous

Sample Name:		List C 5795 27-May-2019	List C 5796 27-May-2019	List C 5797 27-May-2019	List C 5798 27-May-2019	List C 5799 27-May-2019
Lab Number:		2182835.1	2182835.2	2182835.3	2182835.4	2182835.5
Individual Tests						
Sum of Anions	meq/L	8.8	3.4	4.5	5.7	2.6
Sum of Cations	meq/L	10.1	3.8	5.0	6.1	2.9
Turbidity	NTU	4.9	11.3	30	3.8	2.1
pH	pH Units	8.0	8.0	8.2	8.0	7.2
Total Alkalinity	g/m³ as $CaCO_3$	142	85	122	94	44
Total Hardness	g/m³ as $CaCO_3$	320	132	175	210	92
Electrical Conductivity (EC)	mS/m	93.3	36.5	45.6	58.2	30.8
Total Suspended Solids	g/m³	6	16	48	5	< 3
Dissolved Aluminium	g/m³	< 0.003	0.007	0.006	0.003	0.005
Dissolved Calcium	g/m³	99	42	56	66	27
Dissolved Iron	g/m³	< 0.02	< 0.02	< 0.02	< 0.02	0.21
Total Iron	g/m³	0.112	0.23	0.65	0.092	0.48
Dissolved Magnesium	g/m³	16.3	6.7	8.3	9.9	6.0
Dissolved Manganese	g/m³	0.055	0.0007	0.0006	0.0008	0.025
Dissolved Potassium	g/m³	9.8	5.9	6.6	5.9	2.6
Dissolved Sodium	g/m³	82	23	31	43	24
Sodium Absorption Ratio (SAR)*	$(mmol/L)^{0.5}$	2.0	0.9	1.0	1.3	1.1
Total Zinc	g/m³	0.0093	0.0028	0.0041	0.0013	0.0012
Chloride	g/m³	68	17.7	17.3	25	32
Total Ammoniacal-N	g/m³	0.091	0.040	< 0.010	< 0.010	< 0.010
Nitrite-N	g/m³	0.008	0.002	< 0.002	< 0.002	< 0.002
Nitrate-N	g/m³	0.055	0.005	< 0.002	< 0.002	0.010
Nitrate-N + Nitrite-N	g/m³	0.064	0.007	< 0.002	0.003	0.011
Total Kjeldahl Nitrogen (TKN)	g/m³	0.64	0.86	1.05	0.65	0.23
Sulphate	g/m³	193	59	76	149	42
Chemical Oxygen Demand (COD)	g O_2/m³	25	28	38	20	12
Oil and Grease	g/m³	< 2	< 2	< 2	< 2	< 2
Heavy metals, dissolved, trace As,Cd,Cr,Cu,Ni,Pb,Zn						
Dissolved Arsenic	g/m³	0.0013	< 0.0010	< 0.0010	0.0025	< 0.0010
Dissolved Cadmium	g/m³	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Dissolved Chromium	g/m³	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Dissolved Copper	g/m³	< 0.0005	< 0.0005	< 0.0005	0.0011	< 0.0005
Dissolved Lead	g/m³	< 0.00010	< 0.00010	< 0.00010	< 0.00010	< 0.00010
Dissolved Nickel	g/m³	0.0070	0.0020	0.0024	0.0039	0.0006
Dissolved Zinc	g/m³	0.0041	< 0.0010	< 0.0010	< 0.0010	< 0.0010

Sample Type: Aqueous						
Sample Name:		List C 5795 27-May-2019	List C 5796 27-May-2019	List C 5797 27-May-2019	List C 5798 27-May-2019	List C 5799 27-May-2019
Lab Number:		2182835.1	2182835.2	2182835.3	2182835.4	2182835.5
Total Petroleum Hydrocarbons in Water						
C7 - C9	g/m³	< 0.06	< 0.06	< 0.06	< 0.06	< 0.06
C10 - C14	g/m³	< 0.2	< 0.2	< 0.2	< 0.2	< 0.2
C15 - C36	g/m³	< 0.4	< 0.4	< 0.4	< 0.4	< 0.4
Total hydrocarbons (C7 - C36)	g/m³	< 0.7	< 0.7	< 0.7	< 0.7	< 0.7

Sample Name:		List C 5800 27-May-2019	List C 5801 27-May-2019			
Lab Number:		2182835.6	2182835.7			
Individual Tests						
Sum of Anions	meq/L	3.5	3.9	-	-	-
Sum of Cations	meq/L	3.9	4.5	-	-	-
Turbidity	NTU	9.3	4.3	-	-	-
pH	pH Units	7.1	7.2	-	-	-
Total Alkalinity	g/m³ as $CaCO_3$	74	98	-	-	-
Total Hardness	g/m³ as $CaCO_3$	123	144	-	-	-
Electrical Conductivity (EC)	mS/m	39.2	45.1	-	-	-
Total Suspended Solids	g/m³	9	4	-	-	-
Dissolved Aluminium	g/m³	0.008	0.007	-	-	-
Dissolved Calcium	g/m³	37	46	-	-	-
Dissolved Iron	g/m³	0.34	0.49	-	-	-
Total Iron	g/m³	1.55	1.62	-	-	-
Dissolved Magnesium	g/m³	7.5	7.3	-	-	-
Dissolved Manganese	g/m³	0.24	0.64	-	-	-
Dissolved Potassium	g/m³	3.8	4.9	-	-	-
Dissolved Sodium	g/m³	30	34	-	-	-
Sodium Absorption Ratio (SAR)*	$(mmol/L)^{0.5}$	1.2	1.2	-	-	-
Total Zinc	g/m³	0.0017	0.0013	-	-	-
Chloride	g/m³	35	37	-	-	-
Total Ammoniacal-N	g/m³	< 0.010	0.048	-	-	-
Nitrite-N	g/m³	< 0.002	< 0.002	-	-	-
Nitrate-N	g/m³	< 0.002	< 0.002	-	-	-
Nitrate-N + Nitrite-N	g/m³	< 0.002	< 0.002	-	-	-
Total Kjeldahl Nitrogen (TKN)	g/m³	0.37	0.52	-	-	-
Sulphate	g/m³	50	45	-	-	-
Chemical Oxygen Demand (COD)	g O_2/m³	21	26	-	-	-
Oil and Grease	g/m³	< 2	< 2	-	-	-
Heavy metals, dissolved, trace As,Cd,Cr,Cu,Ni,Pb,Zn						
Dissolved Arsenic	g/m³	< 0.0010	< 0.0010	-	-	-
Dissolved Cadmium	g/m³	< 0.00005	< 0.00005	-	-	-
Dissolved Chromium	g/m³	< 0.0005	< 0.0005	-	-	-
Dissolved Copper	g/m³	< 0.0005	< 0.0005	-	-	-
Dissolved Lead	g/m³	< 0.00010	< 0.00010	-	-	-
Dissolved Nickel	g/m³	0.0011	0.0014	-	-	-
Dissolved Zinc	g/m³	< 0.0010	< 0.0010	-	-	-
Total Petroleum Hydrocarbons in Water						
C7 - C9	g/m³	< 0.06	< 0.06	-	-	-
C10 - C14	g/m³	< 0.2	< 0.2	-	-	-
C15 - C36	g/m³	< 0.4	< 0.4	-	-	-
Total hydrocarbons (C7 - C36)	g/m³	< 0.7	< 0.7	-	-	-

Summary of Methods

The following table(s) gives a brief description of the methods used to conduct the analyses for this job. The detection limits given below are those attainable in a relatively clean matrix. Detection limits may be higher for individual samples should insufficient sample be available, or if the matrix requires that dilutions be performed during analysis.
Unless otherwise indicated, analyses were performed at Hill Laboratories, 28 Duke Street, Frankton, Hamilton 3204.

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Heavy metals, dissolved, trace As,Cd,Cr,Cu,Ni,Pb,Zn	0.45µm filtration, ICP-MS, trace level. APHA 3125 B 22nd ed. 2012.	0.00005 - 0.0010 g/m^3	1-7
Total Petroleum Hydrocarbons in Water	Solvent Hexane extraction, GC-FID analysis, Headspace GC-MS FS analysis US EPA 8015B/MfE Petroleum Industry Guidelines [KBIs:2803,10734;26687,3629]	0.06 - 0.7 g/m^3	1-7
Filtration, Unpreserved	Sample filtration through 0.45µm membrane filter.	-	1-7
Total Digestion	Nitric acid digestion. APHA 3030 E (modified) 23rd ed. 2017.	-	1-7
Total anions for anion/cation balance check	Calculation: sum of anions as mEquiv/L calculated from Alkalinity (bicarbonate), Chloride and Sulphate. Nitrate-N, Nitrite-N. Fluoride, Dissolved Reactive Phosphorus and Cyanide also included in calculation if available. APHA 1030 E 23rd ed. 2017.	0.07 meq/L	1-7
Total cations for anion/cation balance check	Sum of cations as mEquiv/L calculated from Sodium, Potassium, Calcium and Magnesium. Iron, Manganese, Aluminium, Zinc, Copper, Lithium, Total Ammoniacal-N and pH (H^+) also included in calculation if available. APHA 1030 E 23rd ed. 2017.	0.05 meq/L	1-7
Turbidity	Analysis using a Hach 2100N, Turbidity meter. APHA 2130 B 23rd ed. 2017.	0.05 NTU	1-7
pH	pH meter. APHA 4500-H^+ B 23rd ed. 2017. Note: It is not possible to achieve the APHA Maximum Storage Recommendation for this test (15 min) when samples are analysed upon receipt at the laboratory, and not in the field. Samples and Standards are analysed at an equivalent laboratory temperature (typically 18 to 22 °C). Temperature compensation is used.	0.1 pH Units	1-7
Total Alkalinity	Titration to pH 4.5 (M-alkalinity), autotitrator. APHA 2320 B (modified for Alkalinity <20) 23rd ed. 2017.	1.0 g/m^3 as $CaCO_3$	1-7
Total Hardness	Calculation from Calcium and Magnesium. APHA 2340 B 23rd ed. 2017.	1.0 g/m^3 as $CaCO_3$	1-7
Electrical Conductivity (EC)	Conductivity meter, 25°C. APHA 2510 B 23rd ed. 2017.	0.1 mS/m	1-7
Total Suspended Solids	Filtration using Whatman 934 AH, Advantec GC-50 or equivalent filters (nominal pore size 1.2 - 1.5µm), gravimetric determination. APHA 2540 D (modified) 23rd ed. 2017.	3 g/m^3	1-7
Filtration for dissolved metals analysis	Sample filtration through 0.45µm membrane filter and preservation with nitric acid. APHA 3030 B 23rd ed. 2017.	-	1-7
Dissolved Aluminium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.003 g/m^3	1-7
Dissolved Calcium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.05 g/m^3	1-7
Dissolved Iron	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.02 g/m^3	1-7
Total Iron	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.021 g/m^3	1-7
Dissolved Magnesium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.02 g/m^3	1-7
Dissolved Manganese	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.0005 g/m^3	1-7
Dissolved Potassium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.05 g/m^3	1-7
Dissolved Sodium	Filtered sample, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017.	0.02 g/m^3	1-7
Sodium Absorption Ratio (Dissolved)*	Calculation; from sodium, calcium and magnesium, as follows; (Na / 23) / [(Ca / 20 + Mg / 12.15)/2]$^{0.5}$ where the concentrations for these ions (Na, Ca and Mg) are expressed as g/m^3.	0.2 (mmol/L)$^{0.5}$	1-7
Total Zinc	Nitric acid digestion, ICP-MS, trace level. APHA 3125 B 23rd ed. 2017 / US EPA 200.8.	0.0011 g/m^3	1-7
Chloride	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23rd ed. 2017.	0.5 g/m^3	1-7
Total Ammoniacal-N	Phenol/hypochlorite colourimetry. Flow injection analyser. (NH_4-N = NH_4^+-N + NH_3-N). APHA 4500-NH_3 H (modified) 23rd ed. 2017.	0.010 g/m^3	1-7
Nitrite-N	Automated Azo dye colorimetry, Flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.002 g/m^3	1-7
Nitrate-N	Calculation: (Nitrate-N + Nitrite-N) - NO2N. In-House.	0.0010 g/m^3	1-7
Nitrate-N + Nitrite-N	Total oxidised nitrogen. Automated cadmium reduction, flow injection analyser. APHA 4500-NO_3^- I (modified) 23rd ed. 2017.	0.002 g/m^3	1-7

Sample Type: Aqueous			
Test	**Method Description**	**Default Detection Limit**	**Sample No**
Total Kjeldahl Nitrogen (TKN)	Total Kjeldahl digestion, phenol/hypochlorite colorimetry. Discrete Analyser. APHA 4500-N_{org} D (modified) 4500 NH_3 F (modified) 23rd ed. 2017.	0.10 g/m^3	1-7
Sulphate	Filtered sample. Ion Chromatography. APHA 4110 B (modified) 23rd ed. 2017.	0.5 g/m^3	1-7
Chemical Oxygen Demand (COD), trace level	Dichromate/sulphuric acid digestion in Hach tubes, colorimetry. Trace Level method. APHA 5220 D 23rd ed. 2017.	6 g O_2/m^3	1-7
Oil and Grease (trace level)	Sample filtration through filter aid, Soxhlet extraction, gravimetric determination of extracted Oil & Grease.	2 g/m^3	1-7
C7 - C9	Head Space, GCMS analysis.	0.06 g/m^3	1-7

These samples were collected by yourselves (or your agent) and analysed as received at the laboratory.

Samples are held at the laboratory after reporting for a length of time depending on the preservation used and the stability of the analytes being tested. Once the storage period is completed the samples are discarded unless otherwise advised by the client.

Ara Heron BSc (Tech)
Client Services Manager - Environmental

6.3 Monitoring parameter lists

AUCKLAND REGIONAL LANDFILL
WATER QUALITY ANALYSIS PARAMETER LISTS

Location >	Surfacewater Pond 1 (wetland) OUTLET	Surfacewater Pond 1 (wetland) OUTLET	Surfacewater Pond 1 (wetland) OUTLET	Surfacewater Pond 2 aux spillway (bypassing Pond 1) OUTLET	Surfacewater Pond 1 (wetland) OUTLET	Surfacewater Pond 3 INFLOW (off landfill, and from pipe from Pond 5)	Surfacewater Pond 6, 7, 9 (soil stockpile ponds) OUTLET
List >	PC	P1	P2	P3	P4	P5	P6
Frequency >	continuous	fortnightly	quarterly	continuous	If conductivity TL2 is exceeded	continuous	weekly
Consent # >	tba	tba	tba	tba	tba	tba	tba
Condition # >	C 314 318 (14/6/21 set)	C 376d (14/6/21 set)	C 376e (14/6/21 set)	C 318a (14/6/21 set)	C 319 (14/6/21 set)	C 317 (14/6/21 set)	None
Alkalinity		y	y				
Aluminium dissolved			y				
Aluminium total			y				
Ammonia N total		y	y		y		
Antimony							
Arsenic dissolved			y				
Barium							
BOD5							
Boron			y				
Cadmium dissolved			y				
Calcium			y				
Chloride		y	y		y		
Chromium dissolved			y				
COD			y		y		
Conductivity field		**	**		**		
Conductivity lab		y	y				
Conductivity continuous	y					y	
Copper dissolved			y				
Cyanide							
Hardness			y				
Iron dissolved							
Iron total			y				
Lead dissolved			y				
Magnesium soluble			**				
Magnesium total			y				
Manganese dissolved							
Mercury							
Molybdenum							
Nickel dissolved			y				
Nitrate N			**				
Nitrite N							
Oxygen dissolved field		y	y				
pH field		**	**		**		
pH lab		y	y		y		
Phosphorus total			y				
Potassium			y				
Selenium							
Silver							
Sodium			y				
Sulphate			y				
Sulphide							
Suspended solids		y	y	**			**
Temperature field		y	y		y		
Temperature continuous	y						
Turbidity field			**				
Turbidity continuous	y						**
Zinc dissolved			y				
Zinc total							
Cation/Anion balance			**				
Oil & grease			y				
Volatile Acids							
Phenols total			y				
Volatile Organic Compounds (Note 1)					y		
Semi Volatile Organic Compounds (Note 2)					y		
Total Petroleum Hydrocarbons (TPH)			y				
Polycyclic Aromatic Hydrocarbons (PAH)							
1,4-dioxane							
Poly-fluoroalkyl Substances (PFAS suite)							
Brominated flame retardants							
Macroinvertebrates							
Periphyton							
Flow rate estimate - field							
Flow rate continuous	y			y			
Water depth or level - field				**			
Results required within	½ hour	1 week	2 weeks	1 day	1 day	½ hour	1 day

"Field" = measurement by site staff either at the sample site or in the on-site laboratory.
"Dissolved" = either field-filtered by site staff or filtered by the analytical lab if the sample is delivered in a short time.
* = Measurement specifically required by conditions of consent
** = Added at site's discretion to aid interpretation of results
? = In Baseline Monitoring Report May 2019; not in draft conditions; not scheduled for regular testing.
Note 1 = VOC includes BTEX and chlorinated solvents
Note 2 = SVOC includes organochlorine pesticides and DDT compounds

AUCKLAND REGIONAL LANDFILL
WATER QUALITY ANALYSIS PARAMETER LISTS

Location >	Wheelwash pond prior to discharge	Stream water quality sites (SW1, SW3, SW4)	Stream water quality sites (SF1/SW4, SF2/SW3, SF3)	Stream water quality sites (SW1, SW3, SW4)	Stream water ecology sites (MC1-MC6)	Stream water Hoteo sites (H1-H9)
List >	WW	SB	S1	S2	SM	H
Frequency >	Per release	BASELINE monthly for 4 years	continuous	quarterly	annually for 3 yrs then two-yearly	annually
Consent # >	tba	tba	tba	tba	tba	tba
Condition # >	C 376g (14/6/21 set)	C 052 353T10 (14/6/21 set)	C 353c 353T10 (14/6/21 set)	C 353c 353T10 376e 376T11 (14/6/21 set)	C 052 376h 376T11 (14/6/21 set)	tba
Alkalinity		y		y		**
Aluminium dissolved		**		y		**
Aluminium total				y		
Ammonia N total	y	y		y		**
Antimony						
Arsenic dissolved		y		y		**
Barium						
BOD5						
Boron		y		y		**
Cadmium dissolved		**		y		**
Calcium		**		y		**
Chloride		y		y		**
Chromium dissolved		**		y		**
COD		y		y		**
Conductivity field	**	**		**		**
Conductivity lab	y	y		y		**
Conductivity continuous						
Copper dissolved		y		y		**
Cyanide						
Hardness		y		y		**
Iron dissolved		y				**
Iron total				y		
Lead dissolved		y		y		**
Magnesium soluble		y		**		**
Magnesium total				y		
Manganese dissolved		y				**
Mercury						
Molybdenum						
Nickel dissolved		y		y		**
Nitrate N		y		**		**
Nitrite N						
Oxygen dissolved field		y		y		**
pH field	**	**		**		**
pH lab	y	y		y		**
Phosphorus total		y		y		**
Potassium		y		y		**
Selenium						
Silver						
Sodium		y		y		**
Sulphate		y		y		**
Sulphide						
Suspended solids	y			y		
Temperature field	y	y		y		**
Temperature continuous						
Turbidity field		**		**		**
Turbidity continuous						
Zinc dissolved		y		y		**
Zinc total						
Cation/Anion balance		**		**		**
Oil & grease	y			y		
Volatile Acids						
Phenols total				y		
Volatile Organic Compounds (Note 1)		y				
Semi Volatile Organic Compounds (Note 2)		y				
Total Petroleum Hydrocarbons (TPH)				y		
Polycyclic Aromatic Hydrocarbons (PAH)						
1,4-dioxane						
Poly-fluoroalkyl Substances (PFAS suite)						
Brominated flame retardants						
Macroinvertebrates					y	
Periphyton					y	
Flow rate estimate - field					**	**
Flow rate continuous			y			
Water depth or level - field					**	**
Results required within	3 days	3 weeks	4 weeks	2 weeks	2 weeks	2 weeks
"Field" = measurement by site staff either at the sample site or in the on-site laboratory.						
"Dissolved" = either field-filtered by site staff or filtered by the analytical lab if the sample is delivered in a short time.						
* = Measurement specifically required by conditions of consent						
** = Added at site's discretion to aid interpretation of results						
? = In Baseline Monitoring Report May 2019; not in draft conditions; not scheduled for regular testing.						
Note 1 = VOC includes BTEX and chlorinated solvents						
Note 2 = SVOC includes organochlorine pesticides and DDT compounds						

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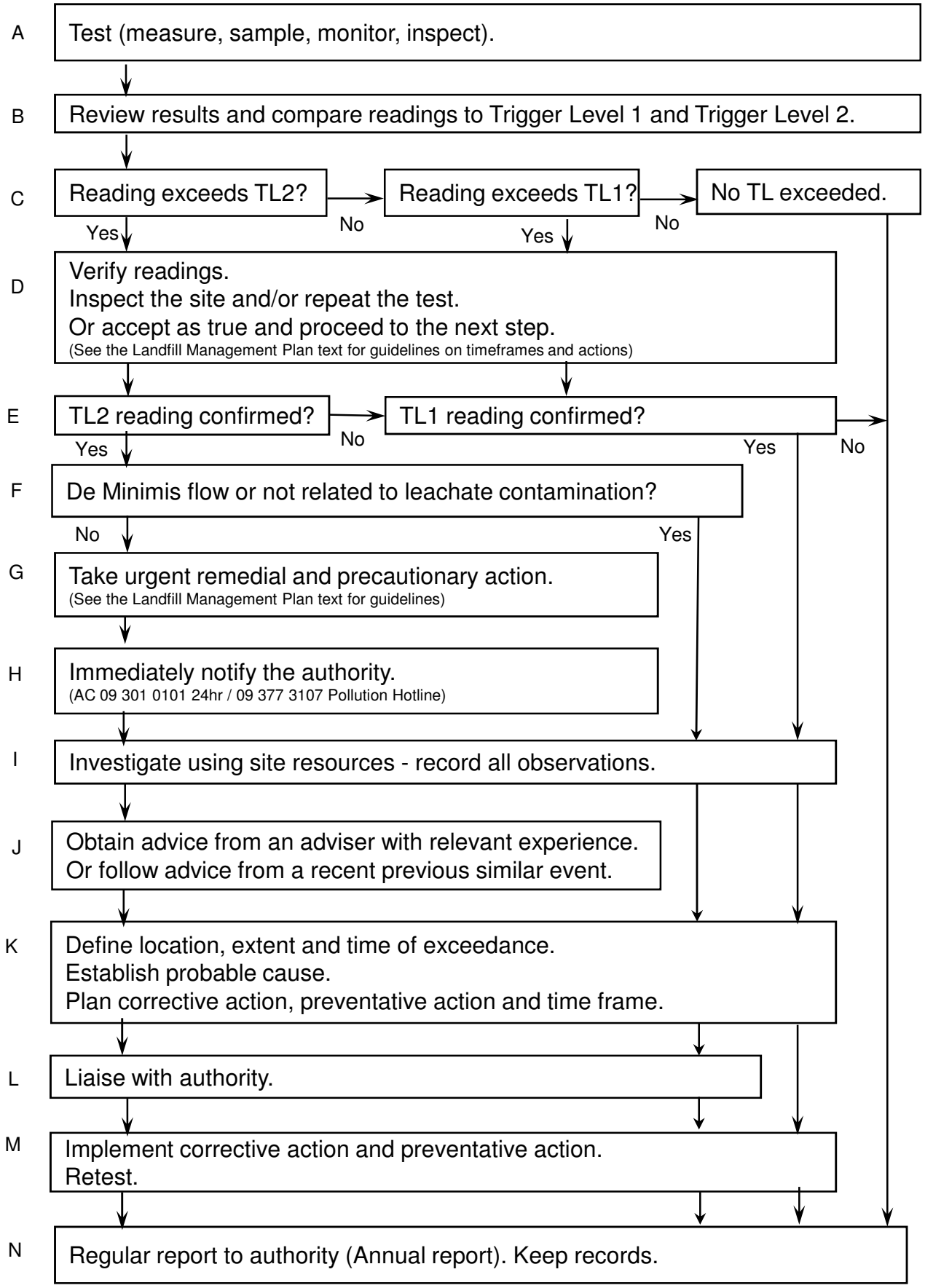
6.4 Contingency Plan Flowchart

(1 page)

AUCKLAND REGIONAL LANDFILL

Contingency Plan Flowchart

Surface Water and Ground Water



LMP Section 3.22

6.5 Trigger level report

To be prepared prior to Landfill Commencement