Otago Regional Council

ORC NOTIFICATION RECOMMENDATION REPORT

File No: 1249070055-44337
Application No: RM23.185
Prepared for: Staff Consents Panel
Prepared by: Shay McDonald – Senior Consents Planner
Date: 12 November 2024

Subject: **Application RM23.185 by Dunedin City Council for various consents relating to the ongoing use, extension, closure, and aftercare of the Green Island Landfill.**

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1. Purpose

To report and make recommendations under sections 95A-G of the Resource Management Act 1991 (the Act) on the notification decision for the above application.

2. Background Information

Applicant: Dunedin City Council

Applicant's Agent: Anderson Lloyd Limited

Site address or location: Green Island Landfill, located at 9,114, 140, and 170 Brighton Road, Green Island

Legal description(s) of the site: Refer Appendix 1

Record of title number and owner: Refer Appendix 1

Map reference approximate site midpoint (NZTM2000): E1399304 N4912786

Consent(s) sought:

- RM23.185.01: Discharge Permit to discharge waste, hazardous waste and leachate onto land, in a manner that may result in contaminants entering groundwater.
- RM23.185.02: Water Permit to take and use groundwater and connected surface water from the Kaikorai Stream through a leachate collection trench and to take and use groundwater and leachate from groundwater bores, landfill gas wells and a leachate collection trench.
- RM23.185.03: Water Permit to divert surface water and stormwater from working and non-working areas of the landfill.
- RM23.185.04: Water Permit to permanently divert surface water in the Kaikorai Stream and Brighton Road Stream.
- RM23.185.05: Discharge Permit to discharge surface water and stormwater to the Kaikorai Stream.
- RM23.185.06: Discharge Permit to discharge contaminants (landfill gas, combustion emissions from landfill gas flares and engine, dust, and odour) to air.
- RM23.185.07: Land Use Consent to place a defence against water along the Kaikorai Stream for the purpose of diverting floodwaters.
- RM23.185.08: Land Use Consent to disturb a contaminated site for the purpose of undertaking capping works and installation and maintenance of landfill infrastructure.

Purpose: Operation, closure, and aftercare of the Green Island Landfill

Current consents: Refer Appendix 2

Section 124 timeframes: Application was lodged at least six months before the expiry date.

2.1 Key issues/risks

The key issues/risks with the application are:

- Adverse odour effects.
- Significant leachate head mounding within the landfill.
- Uncertainty about the magnitude of adverse water quality effects.

At this stage there are no principal issues in contention that need to be raised.

2.2 Summary

I recommend the application is processed on a publicly notified basis. This is because:

- The proposal will have more than minor adverse odour effects on the environment and persons.
- There is uncertainty about the extent to which leachate may impact the groundwater and surface water receiving environments; therefore, it cannot conclusively be said that effects are minor or less.

3. Description of Activity

3.1 General Information

Dunedin City Council (**DCC, the Applicant**) has applied for resource consents to authorise the continued operation, expansion, closure, and aftercare of the Green Island Landfill (**GIL**). The consents applied for are listed in Section 2 of this report. The application was lodged with Council on 22 March 2023. A request for further information was made in May 2023, with this further information process concluding 9 October 2024.

DCC own and operate the GIL, which is the city's current (and only) Class 1 landfill for the disposal of municipal solid waste and hazardous waste. The site also contains other waste diversion and transfer facilities for the drop off and consolidation of general waste, reusable and recyclable material, greenwaste, and household hazardous substances. The site is designated in the partially operative Second-Generation Dunedin City District Plan (**2GP**) for these purposes.

Based on current waste disposal predictions, the landfill is expected to reach full capacity in approximately April 2027. To replace the GIL, a new landfill – the Smooth Hill Landfill – will be developed at Smooth Hill, southwest of Dunedin.[1] Before waste can be received at Smooth Hill, DCC needs to undertake 36 months of baseline monitoring, complete detailed landfill design, prepare finalised management plans, and complete the initial landfill works and associated roading upgrades at that site. The earliest that the Smooth Hill Landfill could be ready to accept waste will be 2027, but there is risk of further delays.

[1] Construction and operation of the Smooth Hill Landfill are authorised by RM20.280.01-06, which were granted in May 2023.

Until the Smooth Hill Landfill is able to accept waste, there is a need for continued waste disposal at the GIL. To enable this, DCC propose to increase the height of the GIL to the west, while remaining within the current landfill footprint. This will provide capacity for the disposal of waste at the GIL until sometime between December 2029 and March 2031, depending on actual waste disposal rates.

Once Smooth Hill Landfill is able to accept waste, the GIL will be closed, and will enter a period of aftercare. With the obvious exception of waste disposal to land, which will cease upon closure, the post-closure aftercare management of the GIL is essentially the same as the operational management. That is to say, there is a long-term, ongoing requirement to manage surface water runoff, leachate, and landfill gas at the closed GIL.

New waste diversion and transfer facilities will be developed during the operational life of the GIL, and these facilities will continue operating at the site as part of the proposed Resource Recovery Park Precinct (**RRPP**) beyond the closure of the GIL. The resource consents required for the construction and operation of the RRPP have been applied for in a separate application RM24.143.[2]

In summary, the proposal includes the following key components:

- Receipt and disposal of up to 670,000 cubic metres (**m³**) of waste within the existing landfill footprint at the GIL, until closure.
- Progressive capping of the landfill, final capping, and ongoing management of capping, before and after closure.
- Management of surface water runoff at the GIL, before and after closure.
- Management of leachate, landfill gas, dust, and odour at the GIL, before and after closure.
- The operation of the existing recycling and waste diversion facilities, until such time as the RRPP development supersedes these facilities.
- The operation of the Organics Receivals Building (**ORB**).

The proposal does not include any activities relating to:

- The construction and operation of the RRPP (excluding the ORB).

The Applicant seeks a 35-year term for all consents required to authorise the proposal, except for the taking and use of groundwater, for which a six-year term is sought.

[2] Application RM24.143 was limited notified and will be heard by an Independent Commissioner on 20 and 21 November 2024.

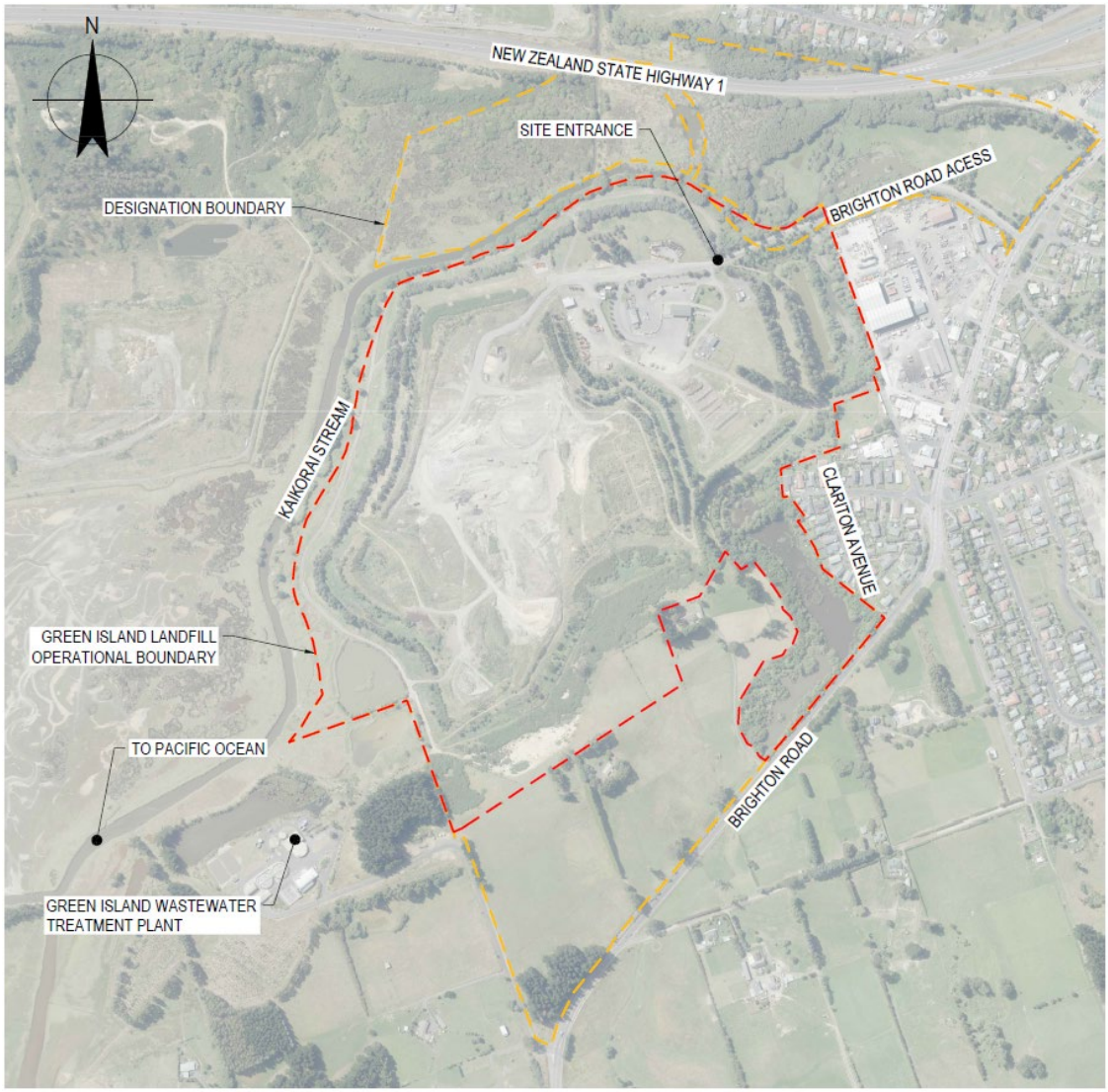

Figure 1 Locality plan, showing the location of the GIL (red line) in relation to the GIL designation boundary (yellow line) and nearby roads and features. Source: RM23.185 Design Report.

3.2 Landfilling

3.2.1 Historic landfilling

A detailed history of landfilling at the site can be found in the application documents, specifically the Groundwater Report. A brief summary, relevant to the future engineering design and closure management, is provided here:

- The pre-existing landform for the GIL was a tidal estuary.
- Landfilling commenced at the southeastern corner of the site in 1954, with waste originally end-dumped directly onto the estuarine muds and up against the southern Kaikorai Estuary edge where the pre-existing landform rises into a hillside.
- Landfilling progressed to the north until the eastern portion of the site was covered with fill by 1967. Thereafter, filling advanced to the north and west.
- Unregulated and uncontrolled landfilling occurred until the 1980s. Waste was placed without a liner or integrated leachate collection system or any landfill gas (**LFG**) collection and destruction system.

- In the mid-1990s, a leachate collection system was designed and installed around most of the perimeter of the landfill to intercept groundwater and leachate flowing from the site. This is discussed in more detail in Section 3.4 of this report.

- At approximately the same time, the eastern and western sedimentation ponds were constructed, as were the southeastern and eastern constructed wetlands.

- Historic photographs and the leachate trench construction report indicate that waste placement has likely occurred outside the leachate collection trench in certain places. The likely extent of landfilling is shown in Figure 2.

- The approximate current landfill footprint was filled by 2000.

- The eastern portion of the landfill has a relatively shallow depth of waste at around 3-6 m thickness. This area is currently used for facilities and waste transfer station operations. This area is also the proposed site of the future RRPP. Final capping has been completed and no further waste disposal will occur in this area.

- Final capping in the northern area was completed in December 2022.

- The main landfill area is located immediately to the west of the facilities area.

- Waste placement in this area has been confined over recent decades within a constructed soil bund that encircles the landfill on the eastern, northern, and western sides adjacent to the estuary. The purpose of the bund is:

    - As a buttress against which to place fill and provide a physical and hydraulic barrier from the adjacent Kaikorai Stream and estuary;
    - To provide for the installation and maintenance of the leachate collection trench and associated conveyance systems on the outside of bund base;
    - As a visual and acoustic barrier for the surrounding areas, particularly during early stages of landfill development with trees and shrubs enhancing visual screening; and
    - A wind break to reduce wind-blown debris.

- Waste placement progressed against the inside of the initial bund, with the bund progressively extended above the landfill surface elevation to provide a visual buffer for nearby residents.

- Ongoing waste placement then continued against the inside of the raised bund and eventually above the bund as a waste-to-face operation up to the design level. See Figure 3.

- In recent years landfilling has progressed north to south on the western side of the site. The southwestern half of the landfill had 6-8 m of waste placed during the 1990s. A void exists to place a further 10-15 m of waste in this area to fill up to the approved finished landfill surface.

- In July 2020, there was approximately 4.8 megatonnes (Mt) of waste in the landfill.

- The existing consents limit the extent of landfilling to a 38-hectare (**ha**) footprint and disposal of 100,000 tonnes of waste per year.

- There is no maximum height set in consent conditions, but plans provided with the 1994 application, design height of 25 m above mean sea level (**amsl**) along a central ridge running northwest to southeast.

- Subsequent revisions to those plans in 1999 were submitted to Otago Regional Council (**ORC**) and this enabled filling to an additional 2.25 m above the 25 m design height, to account for long-term settlement of waste over time.

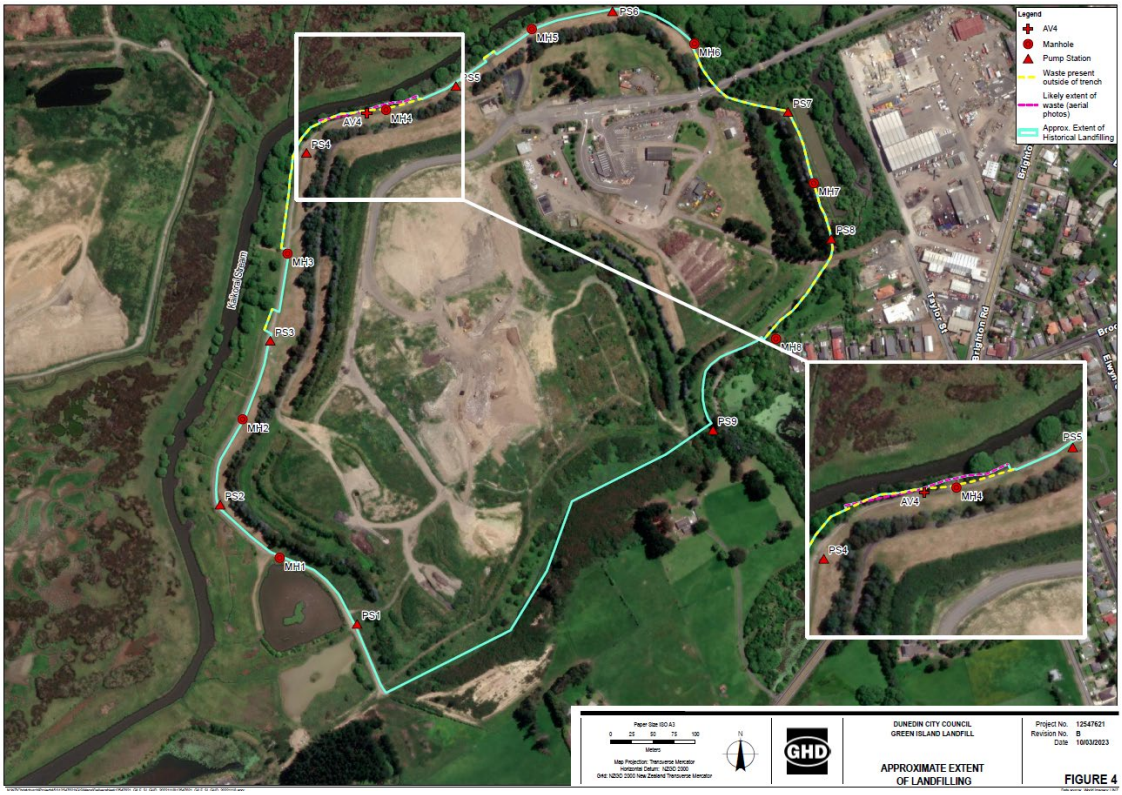

Figure 2 Approximate extent of landfilling. Yellow dashed lines indicate areas where waste is present outside the leachate collection trench. Source: RM23.185 Groundwater Report Appendix D.

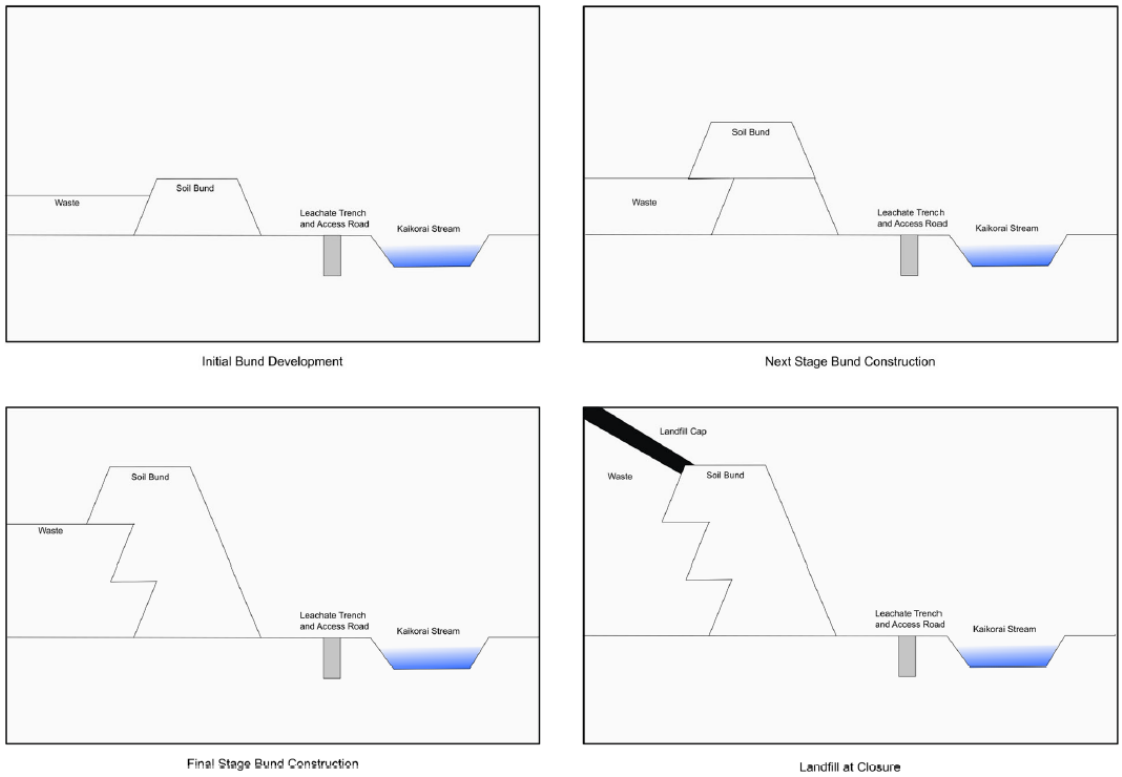

Figure 3 Schematic of bund development and waste-to-face landfilling. Source: RM23.185 Design Report.

3.2.2 Proposed landfilling

- Waste will continue to be placed in the southwestern half of the landfill.
- Around 60,000 tonnes of waste and a further 60,000 tonnes of clean and contaminated soils are currently imported to the landfill each year, with the total amount of waste and contaminated soils remaining below the 100,000-tonne annual limit imposed by the existing consent conditions.[3]
- Contaminated soils are used for daily cover, mixing with wastewater treatment plant sludges, or are placed as general waste fill, whereas the clean imported soils are stockpiled and used for both daily cover and progressive intermediate capping.
- Waste off-loaded at the tip face is spread in layers and compacted by multiple passes of the specialist waste compactor. At the end of each day's operation the waste that has been placed and compacted that day is covered with daily cover soils that are stockpiled close to the tip face.
- The size of the tip face is kept to a minimum, typically no more than 900 square metres (**m²**), with waste placement occurring over a limited operational area such that portions of the landfill are progressively completed to reach the finished design level.
- Intermediate cover is placed where waste will not be overlaid with fresh waste for more than three months. This is to minimise rainfall infiltration and LFG escape.

[3] Clean soils are not considered waste therefore the 100,000 tonne annual limit only considers the sum of municipal waste + contaminated soils.

Cover soils are mostly imported materials which are stockpiled on site, then placed in compacted layers.

- This allows final cover to be placed progressively over completed stages and reduces rainfall infiltration through the waste and ultimately into the leachate collection system.

- Sludge and biosolids from DCC's three wastewater treatment plans (**WWTP**) have been disposed of to date in specific areas at lower levels of the landfill, with waste placed over the top.

- In the future, disposal of the sludge will be integrated within layers of the normal landfill waste (i.e. co-mingled), and no (or very limited) further development and use of sludge areas are anticipated. The sludge and biosolid materials will be lime stabilised.

- Based on the past three years weighbridge records, the void required per annum to accommodate the current waste volumes is approximately 89,000 m^3 (excluding final cap volumes). This is likely to represent an upper limit as DCC aims to reduce the amount of municipal solid waste disposed to landfill by 50% by 2030, as compared with 2015 amounts.

- The value calculated (June 2022) for the remaining void available, exclusive of final cap, is 529,000 m^3. Based on likely minimum and maximum void consumption, the GIL has capacity to accept waste at least until April 2028, based on maximum void consumption, and until July 2029, based on minimum void consumption. As noted earlier in this report, there is a requirement for waste placement at the GIL until the Smooth Hill Landfill can accept waste.

- The Applicant's preferred option for extending the life of the GIL increases the landfill capacity by increasing the landfill cap height to the west, raising it approximately 8 m compared to the 2001 closure design, to reach a maximum height of 31.5 m above mean sea level (**amsl**) at the western edge of the landfill as shown in Figure 4. The capping grades generally increase as compared to the relatively low grades for the cap in the 2001 design.

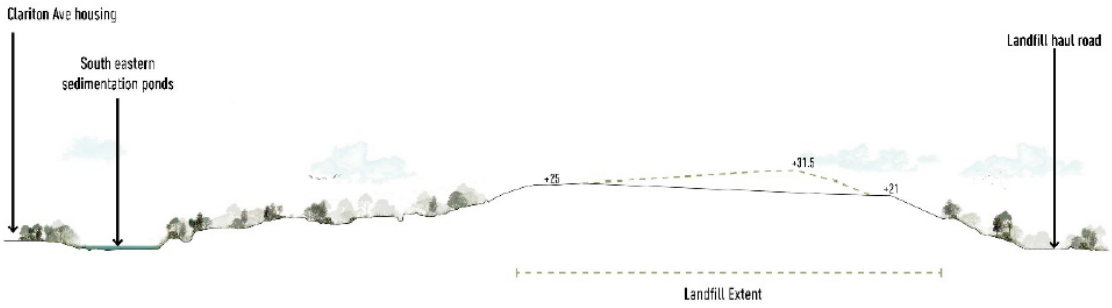

Figure 4 Cross section of proposed final landfill surface. Source: RM23.185 Assessment of Adverse Effects.

- The proposal results in no change to the landfill footprint, and the extended area is proposed to utilise the same supporting infrastructure, including the leachate collection system and stormwater management system.

- The Applicant's preferred option design results in an available void of approximately 670,000 m^3. The projected life of the GIL would then be to at least to December 2029 and potentially through until March 2031. Based on this, the Applicant has a revised target for closure (ceasing receipt of waste) of the end of 2029.

- This allows for some overlap with the opening of Smooth Hill Landfill.

- Three stages of landfilling are proposed through to closure, extending north to south. Proposed filling volumes and timeline are shown in Table 1. These are based on filling at 89,000 m^3 per year. A schematic illustration of the staging is shown in Figures 5-8.

Table 1 Proposed filling stages and estimated completion date. Source: RM23.185 application.

Stage	Landfill capacity[19] (m3)	Estimated completion date[20] (year)	Cap area (m2)
1	41,000	2023/2024	26,750
2	252,000	Mid 2025	38,000
3	377,000	Late 2026	50,500
Total	670,000	December 2029	115,250

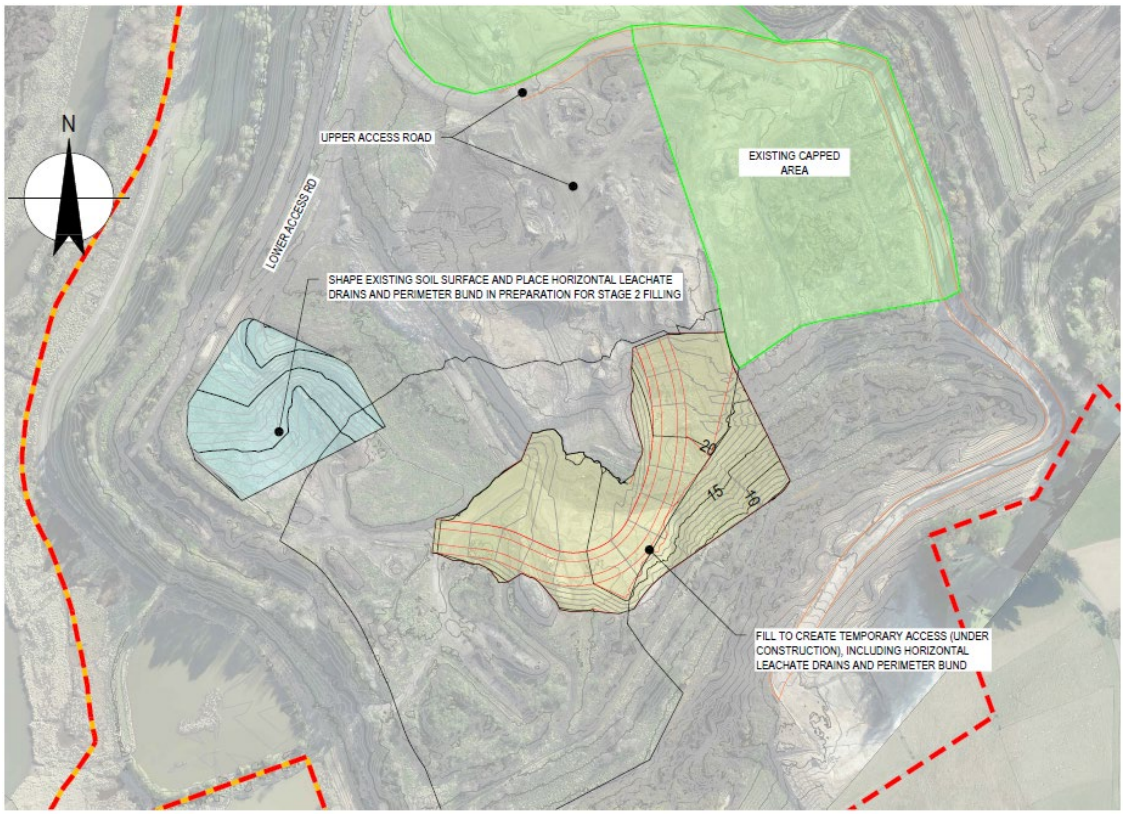

Figure 5 Stage 1 works. Source: RM23.185 Design Report.

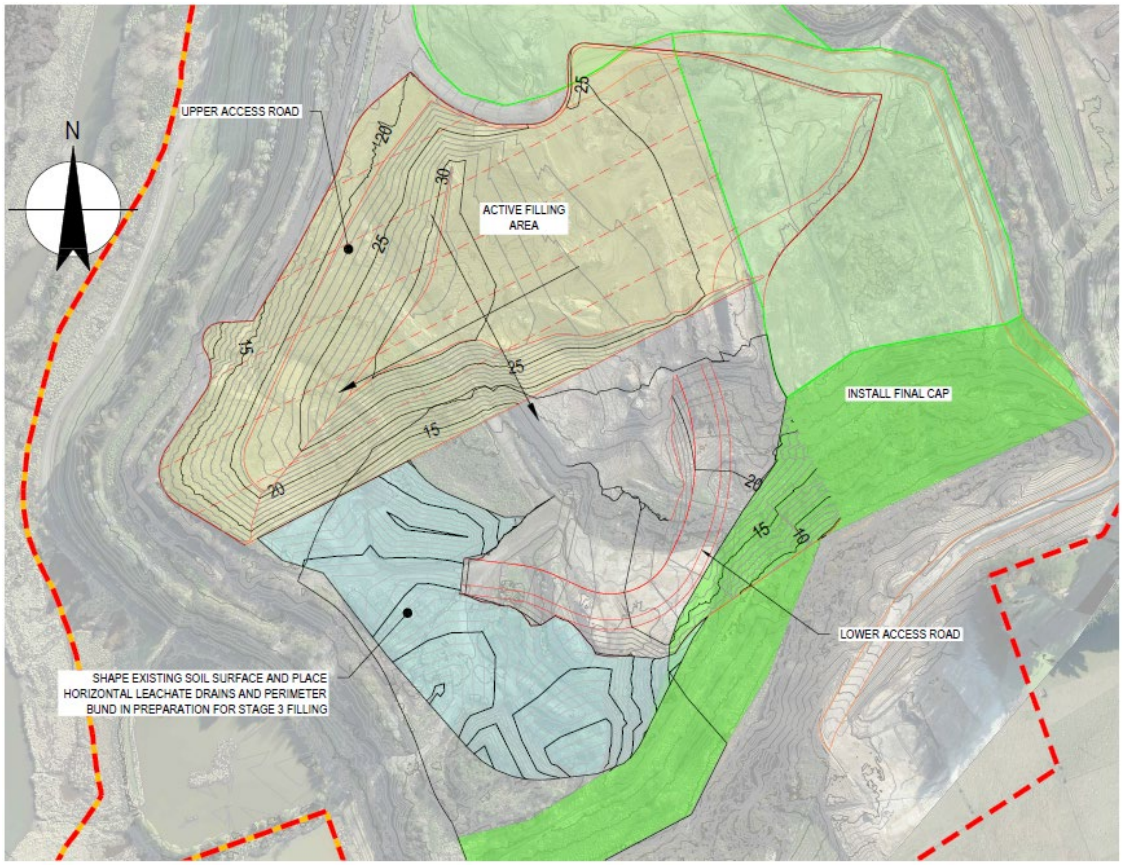

Figure 6 Stage 2 works. Source: RM23.185 Design Report.

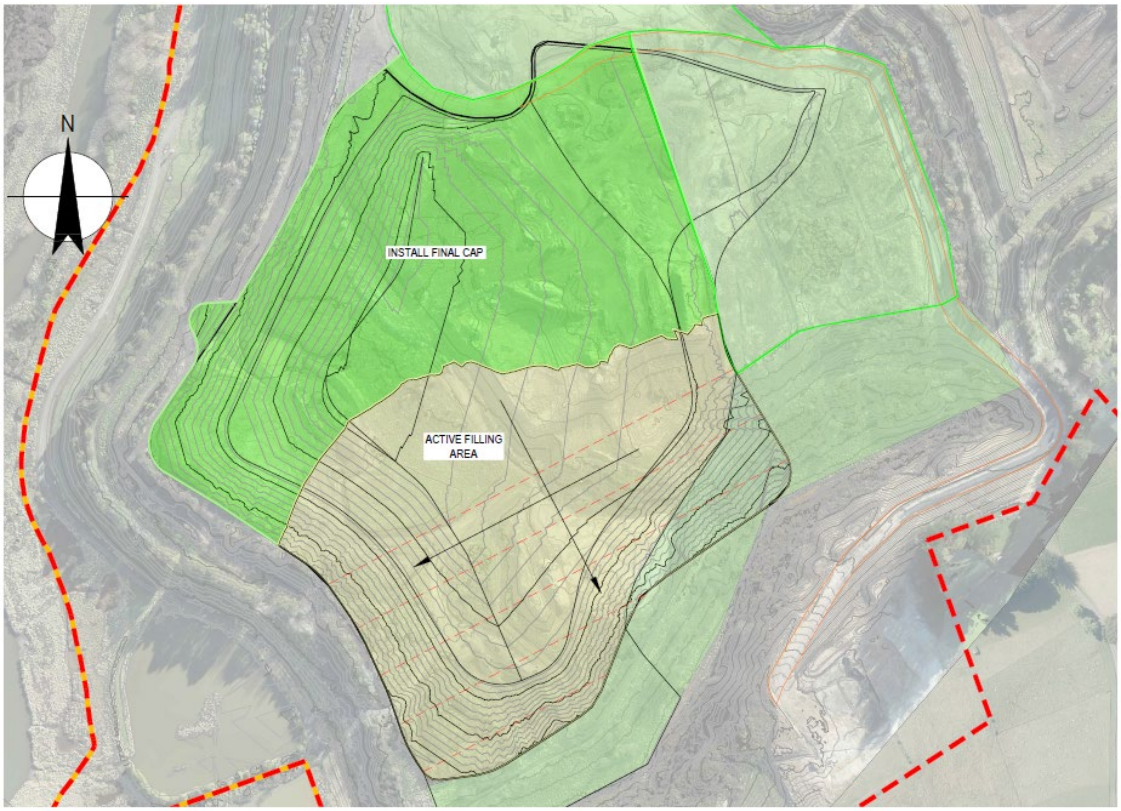

Figure 7 Stage 3 works. Source: RM23.185 Design Report.

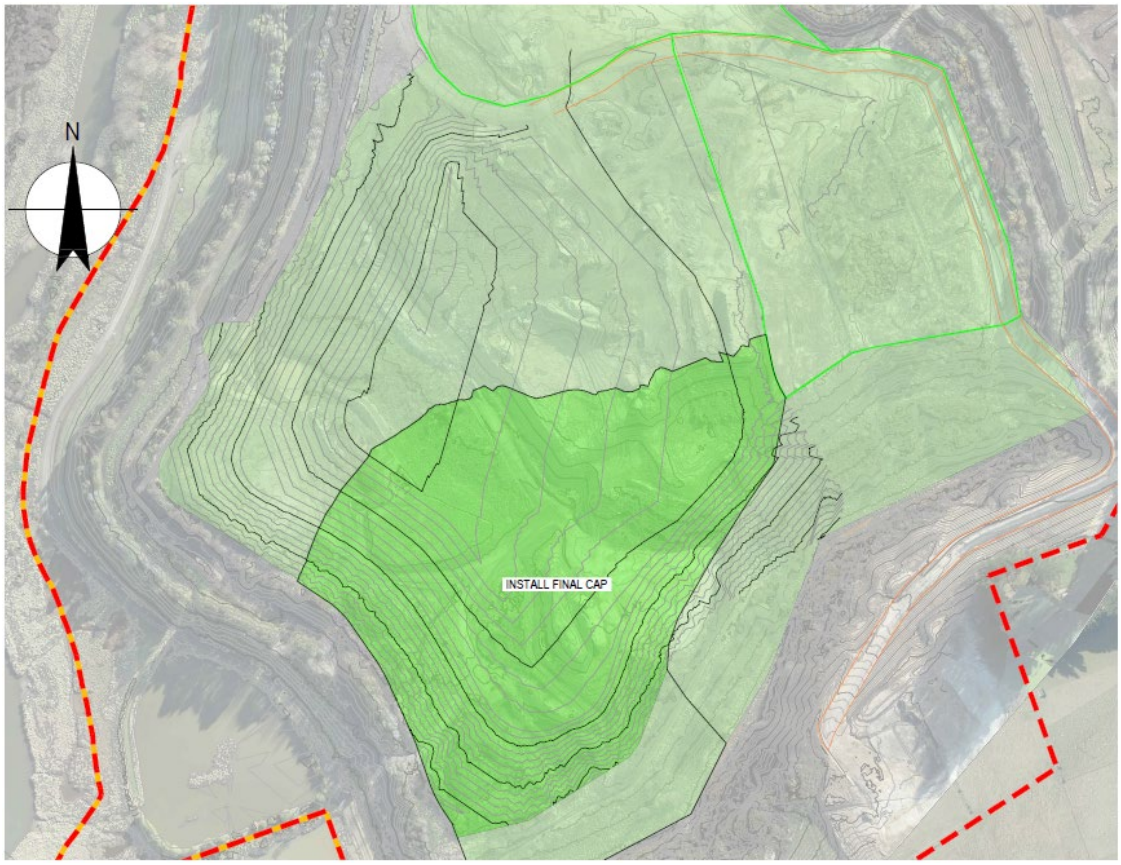

Figure 8 Closure scenario. Source: RM23.185 Design Report.

- Placement of waste is proposed to be "waste to face" with the outer face being final cap. It is not proposed to continue constructing perimeter bunds to higher elevations.

- Waste placement is proposed to be in strips to full design level plus an allowance for settlement of the waste to design level – in the order of 10% additional height. Placement will extend north to south from existing landfill access road. Three stages of filling are envisaged, as described in Section 3.2.2 of this report.

- Soils for the final cap is proposed to be obtained from the borrow area located on the hillside to the south of the landfill footprint.

3.3 Landfill Design

3.3.1 Landfill Guidelines

The current New Zealand best practice standard for sanitary landfill development is the WasteMINZ *Technical Guidelines for Disposal to Land* (2022) (**the WasteMINZ Guidelines**).[4] These guidelines recommend installation of a low-permeability synthetic liner and a leachate collection system for Class 1 landfills containing municipal solid waste. The current design does not include a low-permeability synthetic liner, but it does have a leachate collection system. This is described further in Section 3.4 of this report.

3.3.2 Landfill Cap Design

The final cap placed to date is:

[4] WasteMINZ is the Waste Management Institute of New Zealand

- 350 millimetres (**mm**) topsoil and sub-soil;
- 600 mm low permeability clay (with a permeability of <1 x 10-7 m/s); and
- 300 mm intermediate cap.

For areas of the GIL where final capping is not yet in place, the following cap profile is proposed by the Applicant, from top to bottom:

- 350 mm topsoil;
- 600 mm low permeability clay;
- 300 mm compacted intermediate cover soils;
- 200 mm soil cover.

The proposed capping requirements are generally in accordance with the WasteMINZ guidelines, sitting between the 'minimum' and 'enhanced minimum' capping profiles.

Material for the cap is obtained from a borrow area to the south of the landfill. The required volume of material from the borrow area for future capping is in the order of 73,000 m³, some of which has already been used in the 2022 capping works.[5] There is sufficient material available in the borrow area to meet this requirement, and the soils in the borrow area meet the low permeability clay layer specification (maximum permeability of 1 x 10^{-7} m/s).

The final cap surface will have maintained grass or shallow-rooted shrubs applied where the roots will not extend deeper than the 350 mm topsoil layer.

3.4 Groundwater and Leachate Management

Leachate is liquid that, in passing through waste, extracts solutes, suspended solids or any other component of the waste material through which it has passed. This includes liquid included in the waste as received and that drains as a result of waste compression, or from the ongoing breakdown of organic matter.

3.4.1 Existing Leachate Management

In the early years of landfilling there was no engineered approach to managing leachate. A perimeter leachate trench was installed in 1994 and commissioned in 1995. The purpose of the trench is to contain and collect leachate for the protection of the Kaikorai Stream and Estuary, coastal waters, and values associated with these waters. The leachate collection trench extends around the perimeter of the landfill, except for the southern side of the landfill where a shallow surface drain intercepts leachate-impacted surface water and groundwater runoff and directs it to Pump Station 1 (**PS1**) then to the main sewer line and thereafter to Green Island Wastewater Treatment Plant (**GIWWTP**). The trench was not extended around the southern edge of the landfill because at the time of design and installation there was a scenario being considered whereby waste would be placed in that southern area. This was later deemed unsuitable due to the presence of the wastewater trunk sewer.

The leachate collection system comprises the following components:

[5] The soils within the borrow area are not contaminated; therefore, no resource consents are required for the earthworks. Diversions of surface runoff water and discharges of water and silt (contaminants) are captured by the existing landfill operational consents.

- A gravel filled leachate collection trench containing a perforated 150 mm uPVC collector pipe that extends around the eastern, northern, and western sides of the landfill. A 1.5 mm HDPE liner placed on the outer face of the leachate collection trench restricts, but does not completely prevent, the influx of groundwater seepage from the adjacent Kaikorai Stream.

- Gravel drains at the base of the perimeter bund and internal horizontal leachate drains within the waste in the southern portion of the landfill and in the northern sector of waste placed in 2019 – 2022, to manage leachate levels and prevent seepage breakouts. Leachate from these drains discharges to the leachate collection trench.

- Nine pump stations (PS1 through PS9), at approximately 200 m spacings along the leachate collection trench, pump the collected leachate and groundwater to a buried 125mm rising main that discharges to the main sewer line to the GIWWTP, located to the south of the landfill.

- Manholes (MH0 through MH8) exist between the pump stations to allow inspection access and clearing of the uPVC pipe. PS9 is separated from the main leachate system by the now-buried spur of land comprising mudstone. PS9 has an associated 55 m of trench and also discharges into the main sewer line.

- Each pump station and associated pump is set to maintain the leachate level at between -0.8 m amsl and 0.2 m amsl. Leachate is normally managed via pumping from the pump stations and their nominal 200 m length of associated trench. However, the system is connected by continuous pipe and trench, so leachate can flow through to adjacent pump stations in the event that one pump should fail. This design is to ensure that a hydraulic barrier between the landfill and Kaikorai Stream can be maintained.

Prior to landfilling, groundwater within the estuarine deposits is likely to have been hydraulically connected to the Kaikorai Stream and other surface water features. Pumping of the leachate trench creates a hydraulic barrier for groundwater and leachate migration offsite. The HDPE liner aids in reducing the volume of water entering the trench from the Kaikorai Stream but does not completely prevent inflows.

Leachate generation and contaminant concentrations are highest during operation where waste is being placed. Leachate flows will be attenuated when the landfill closes, and the final cap has been installed. Contaminant concentrations will decrease as the landfill ages.

The volume of leachate within the landfill is minimised by through the following measures:

- Control of stormwater
- Placement of intermediate and final capping
- Maintenance of the leachate collection system and landfill cap.

These measures are reflected in the Landfill Development Management Plan (**LDMP**).

Despite the measures above, there is currently significant leachate head within the landfill, in some areas up to 22 m amsl. This is a significant risk, is not in line with WasteMINZ guidance to minimise leachate head, and is likely to be inhibiting the LFG collection system.

Existing consents limit the rate of take of leachate and groundwater through the collection system to 23,400 litres per hour (**L/hour**) to 72,000 L/hour. In the past five years the combined pumping rates from the leachate collection system have been between 1 and 2 litres per second (**L/s**), peaking up to 8 – 9 L/s after periods of rainfall. Numerical modelling indicates that future leachate volumes at closure are likely to be similar to the current situation (in the order of 2-3 L/s).

The Applicant proposes to reduce the authorised pumping rates to an average of 5 L/s (18,000 L/hour) and a maximum of 20 L/s (72,000 L/hour), or 432 m^3/day and 1,728 m^3/day, respectively. These rates take into account stormwater runoff flows from catchments that are conveyed to the leachate collection system as well as contingency for potentially extended periods of rainfall.

3.4.2 Proposed Improvements

The Applicant proposes the following changes to the existing leachate collection system to address potential leachate migration risks:

- Extension of the leachate collection trench along the southern side of the landfill, with three additional pump stations at spaced approximately 170 m apart. See Figure 9. This is proposed to be installed over nearly the full extent of the existing swale drain, which will be retired, shifting downslope and receiving only stormwater from the landfill, borrow area, and hillside to the south. The swale would then drain to the southwestern sedimentation ponds prior to discharge into the estuary.
    - Works to install the new section of trench and associated infrastructure will be completed within three years of consent being granted for continued operation, if consent is granted.

- Progressive installation of additional internal landfill leachate drains over the proposed waste filling area in advance of waste placement. These will discharge by gravity to the existing collection trench.

- Infrastructure to allow the use of submersible air-powered pumps in LFG wells to extract leachate if required to reduce leachate mounding in the completed sections of the landfill.

- Installation of an additional leachate rising main connecting the pump stations to the sewer and the GIWWTP above ground surface, and installation of additional power cable for the pump stations on the ground surface so they are more resistant to earthquake land deformation and so failures can be identified more quickly.
    - This will be done at least six months prior to the final acceptance of waste.

- Raise by 1 m the level of perimeter berm that extends between the adjacent Kaikorai Stream and the leachate collection trench to minimise risk of inundation of the leachate trench by floodwaters.[6]
    - This will be done at least six months prior to the final acceptance of waste.

[6] This is a defence against water.

- Raising the manholes, chambers, and electrical controls for the leachate pump stations above the predicted future flood level. These works will be completed at least 6 months prior to the final acceptance of waste.

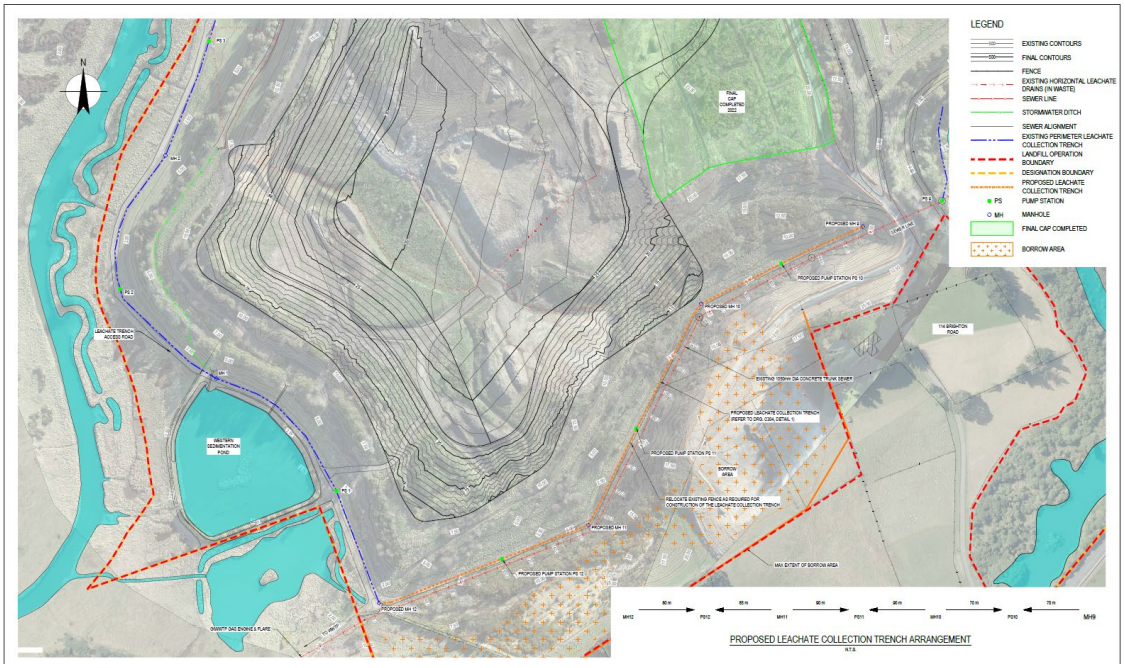

Figure 9 Proposed leachate collection trench along the southern boundary of the landfill. Source: RM23.185 Design Report.

3.4.3 Monitoring

Existing consents require groundwater level monitoring and groundwater and surface water quality monitoring. This is to confirm the effective operation of the leachate trench and to detect any leachate migration from the site. Flow rates and pumping hours are continuously recorded at the pump stations. There are eight lines of groundwater monitoring wells intersecting the leachate collection trench as shown in Figure 10. Each well line is located at the midline between two pumpstations, and each line comprises three shallow wells, except for line 7 where one is missing. Wells are named according to their location in relation to the landfill, the stream, and each other. A and B wells are located between the landfill and the leachate collection trench, with A being closest to the landfill. C and D wells are located outside the trench, with C wells being closest to the trench. A, B, and C wells are shallow wells. D wells are deep wells.

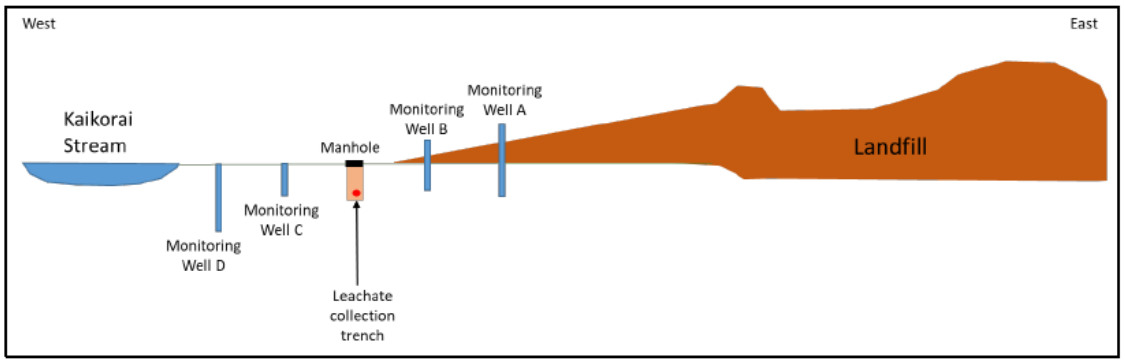

Figure 10 Schematic of typical monitoring well transect. Source: Section 4.5 of the Assessment of Environmental Effects

The same monitoring is proposed for the continued operation, closure, and aftercare, with some modifications.

3.5 Stormwater and Surface Runoff Water Management

Note on terminology for this section: The Regional Plan: Water for Otago (**RPW**) defines stormwater as the water running off from any impervious surface such as roads, carparks, roofs, and sealed runways. Therefore, stormwater in the context of the LDMP is not stormwater. However, for consistency and ease of comparison, the terms used in this report will reflect those used in the application documents and the LDMP.

The redevelopment of the site and installation of the leachate collection system combined with the constructed ponds and wetlands in the 1990s have formed the foundations of the current surface water management systems that are in operation at the site.

The LDMP separates surface waters on the site into three categories:

- Clean – non-contaminated runoff from landfill margins, completed grassed capped areas, and waste diversion and transfer facilities. Conveyed by sheet flow or by swales and pipes to perimeter drains which discharge to Kaikorai Stream by eastern and western sedimentation ponds or, in the case of the western side of the landfill, directly into the stream.
- Stormwater – runoff potentially containing elevated sediment concentrations from exposed earthworks, or areas where capping is in progress. Conveyed by grades on the landfill surface and temporary stormwater drains to the eastern and western sedimentation ponds prior to discharged into Kaikorai Stream. Some stormwater runoff is conveyed to the leachate collection system.
- Leachate – contaminated stormwater in the active filling area that has potential to encounter waste or leachate. This is left to infiltrate the landfill or is conveyed by leachate collection drains to the northern leachate pond or to the leachate collection system.

The site is split into a series of surface water catchments which employ the different water management approaches. This has varied over time as the landfill has developed. A general layout of the current catchments is shown in Figure 11. A full description of each catchment, the current water 'type' managed by that catchment, and the ultimate receiving location, can be found in the Surface Water Report.

Figure 11 Current surface water catchments on the site. Source: RM23.185 Surface Water Report.

If necessary, cleaner waters can flow or be directed to a sedimentation pond, or clean and sediment laden waters may be directed to the leachate system. Runoff from intermediate cover is treated as leachate.

The stormwater management for the proposed extension and post-closure scenarios does not represent a significant departure from the existing regime. While the on-site receiving point for some catchments may change, the underlying management philosophy for the three water types remains the same. A summary of the current surface water management and a comparison to the future management is provided in Table 5 of the Surface Water report.

The following sedimentation ponds and constructed wetlands are located on the site:

- Eastern sedimentation ponds – receive mix of clean and stormwater runoff. Constructed for design storm with clean water being discharged via culverts to

Kaikorai Stream. Can overflow into eastern constructed wetland which then discharges into Kaikorai Stream.

- Western sedimentation pond – does not currently receive any runoff unless there is an extreme weather event.
- Northern leachate pond – receives (potentially) leachate-contaminated stormwater and discharges to the leachate collection system. During prolonged high rainfall events this pond can overflow to perimeter swales and discharge to the Kaikorai Stream via a culvert.
- Borrow area sedimentation pond – receives stormwater runoff from a swale running along the base of the borrow area, from where it discharges to the leachate collection system. Upon closure this pond will be disestablished and the borrow area rehabilitated, with clean runoff being directed to the western sedimentation pond.
- Southeastern constructed wetlands – these discharge into the eastern constructed wetland via a long culvert. This culvert is currently taking in leachate; however, a repair is imminent.
- Eastern constructed wetland – discharges under the landfill access road to Kaikorai Stream. Located downstream of the eastern sedimentation pond and provides polishing of stormwater prior to discharge into stream.

3.6 Landfill Gas Management

Landfill gas (**LFG**) is generated by the degradation of biodegradable waste within a landfill. LFG primarily consists of methane, carbon dioxide, oxygen, and nitrogen, with trace amounts of reduced sulphur compounds and volatile organic compounds (**VOC**). LFG management is required to minimise risks to human health and safety, minimise potential impacts on air quality and greenhouse gas effects, minimise risk of landfill fires, control offsite migration through soils, odour control, control of hazardous volatilised components of LFG.

In the early years of operation, the landfill did not have an engineered approach to managing LFG. A LFG collection and treatment system began to be progressively installed across the site in the early to late 1990s, but this was abandoned in 1998. In 2009, LFG collection and treatment recommenced at the landfill using an engineered system. The current LFG collection and destruction system consists of the following components:

- 38 vertical LFG collection wells in capped areas of the landfill and connected to the network.
- A network of lateral connecter pipes connecting to header or ring main pipes which convey LFG to destruction systems at the GIWWTP.
- A LFG engine at GIWWTP that uses LFG as fuel to generate electricity which is fed back to the grid. This has a capacity of 600 kW and operates at a LFG flow rate of 350 m^3/hour.
- A LFG candlestick flare at the GIWWTP as a back up to the engine. This has a capacity of 450 m^3/hour.
- A mobile solar powered flare located at landfill to destroy LFG from wells close to the tip face that cannot be connected to the wider LFG network because reticulation pipework can't be installed due to vehicle movements.

This system continues to be expanded across the landfill as filling progresses. Existing consents require minimisation of the emission of LFG and all practicable steps to collect LFG from waste less than 12 years old at the time of the commencement of those consents. The Resource Management (National Environmental Standards for Air Quality) Regulations 2004

(**NES-AQ**) require collection and destruction of LFG in any landfill that will exceed 1 Mt of waste and contains more than 200,000 tonnes of waste.

The maximum measured instantaneous LFG flow rate recorded was 493 m^3/hour in January 2021. Modelled LFG generation rates indicate LFG peaking around 2030 following the closure and final capping of the site. The peak rate in 2030 is estimated at 903 m^3/hour. It is estimated that LFG extraction system will capture 80% of this flow, so the expected maximum volume collected is 722 m^3/hour in 2030.

No material changes to the LFG management approach at the GIL are proposed. Additional wells will be installed and connected to the LFG network as areas of landfilling are completed and permanently capped. This will increase the volume of LFG that is recovered and destroyed. As a replacement for the candlestick flare, an enclosed flare with a capacity of 1,000 m^3/hour is proposed to manage the predicted increase in LFG. A second mobile solar flare is also proposed to manage LFG from wells not connected to the network.

3.7 Landscape Management

The existing landfill is surrounded by extensive screening vegetation of a height and density that reduces views into the operational areas of the site. Vegetation is mostly mature exotic tree species.

The screening function of trees will reduce in importance post-closure but will continue to assist with integrating the landfill landform and RRPP activities into the surrounding landscape.[7] Cultural aspirations of Te Rūnanga o Ōtākou seek restoration of the ecological values of the Kaikorai Estuary, provision of habitat for taoka species, and rebalancing of mauri.

A long-term Vegetation Restoration and Management Plan (**VRMP**) is proposed to ensure ongoing monitoring and maintenance of vegetation, to set out long-term post-closure actions for native succession planting i.e. replacement of existing trees, and riparian planting and pest management to support cultural aspirations of Te Rūnanga o Ōtākou. The VRMP will be prepared in consultation with Te Rūnanga o Ōtākou within one year following granting of resource consents, if resource consent is granted.

It is proposed that the final landfill contours will consist of a wedge shape reaching a maximum height of 31.5 m amsl at the southwestern edge of the landfill. The landfill cap will be progressively established with pasture as each stage of landfilling is completed.

3.8 Closure and Aftercare

Ongoing aftercare of the landfill will involve continued operation and maintenance of the leachate collection, LFG collection/destruction, and stormwater infrastructure; maintenance of the landfill cap; and environmental monitoring.

Closure will occur in approximately December 2029, depending on waste disposal rates. Finalised requirements for the closure and ongoing aftercare will be detailed in a Landfill Closure Management Plan (**LCMP**) which will be developed prior to closure. Closure activities are expected to take about two years and will include:

[7] RRPP activities are not part of this application but are an activity that will be ongoing at the landfill site, in parallel with the landfill closure and aftercare activities.

- Placing the capping layer on the final stage of the landfill.
- Complete installation of the LFG wells and associated pipework.
- Establishing any final vegetation and landscape planting.
- Establishment of grass cover or other vegetation over the soil borrow area.
- Removing any site facilities and infrastructure that are not required during the aftercare period or modifying such infrastructure for the aftercare period.

Aftercare activities will include:

- Ongoing operation and maintenance of the LFG collection and destruction systems.
- Ongoing operation and maintenance of the leachate collection system.
- Maintenance of the permanent site stormwater systems.
- Maintenance of the landfill cap, including filling any areas that may have been subject to differential settlement, repair of any surface erosion, and mowing maintenance of vegetation as required.
- Maintenance of any remaining site infrastructure, including fences, and buildings not removed following closure.
- Maintenance of landscape plantings and weed management.
- Ongoing environmental monitoring, reporting, and event response, as required by the resource consents and the LCMP.

The existing waste diversion and transfer facilities will be redeveloped as part of the RRPP during the remaining operating life of the landfill, and these activities will be ongoing at the site beyond closure of the landfill.

Long-term use of the landfill site will be determined in consultation with Te Rūnanga o Ōtākou and the community. Confirmed plans will be included in the LCMP. Any use would need to ensure the protection and effective ongoing operation of the landfill cap, remaining landfill infrastructure – including the leachate and LFG collection systems, and the RRPP. Such uses may include walking and cycling tracks and picnic areas around the periphery of the closed landfill making the estuary more accessible to the public.

3.9 Landfill Management

Best-practice is for the operation, closure, and aftercare of landfills to be in accordance with a comprehensive landfill management plan. The current LDMP subsumes and cross-references the separate Landfill Operations Plan (**LOP**) which is maintained by Waste Management Limited and more specifically addresses the day-to-day operational management of the landfill. The current LDMP and LOP reflect the current approach to operating the landfill and waste diversion and transfer facilities. They have not yet been updated to align with the intended approach to the continued operation, closure, and aftercare of the landfill. However, a list of proposed amendments to the LDMP has been provided with the application.

The continued operation of the landfill and waste diversion and transfer facilities through to closure will continue to occur in accordance with the LDMP and LOP, which will be updated over the remaining life of the landfill as required to adhere to requirements set out in consent conditions, or in response to changes in waste demands, best-practice management, regulatory requirements, or any environmental changes. Prior to closure, a specific LCMP will be developed to specify the final requirements for closure and aftercare of the landfill.

3.10 Application Documents

The Applicant provided the following documents with the application:

Application as lodged:

- Green Island Landfill Closure Assessment of Environmental Effects, prepared by Boffa Miskell Limited, version 0, dated 16 March 2023, including Appendices 1-19
    - Appendix 1: Records of Title
    - Appendix 2: General Arrangement Plan
    - Appendix 3: Design Report
    - Appendix 4: Landfill Development Management Plan (LDMP)
    - Appendix 5: Groundwater Report
    - Appendix 6: Surface Water Report
    - Appendix 7: Air Quality Report
    - Appendix 8: Bird Risk Assessment Report
    - Appendix 9: Draft Southern Black Backed Gull Management Plan
    - Appendix 10: Geotechnical Investigation Report
    - Appendix 11: Liquefaction and Stability Report
    - Appendix 12: Ecological Impact Assessment Report
    - Appendix 13: Landscape, Natural Character, and Visual Effects Report
    - Appendix 14: Economic Report
    - Appendix 15: Social Impact Assessment Report
    - Appendix 16: Cultural Impact Assessment Report
    - Appendix 17: Draft Conditions of Consent
    - Appendix 18: List of Proposed Updates to Landfill Development Management Plan
    - Appendix 19: Engagement Collateral

Responses to further information requests

- Response to s92(1) request for further information, Tranche 1, received 30 June 2023
- Response to s92(1) request for further information, Tranche 1, received 31 July 2023
- Response to s92(1) request for further information, Tranche 3, received 30 August 2023
- Response to s92(1) request for further information, Tranche 4, received 29 September 2023
- Response to s92(1) request for further information, Tranche 5, received 09 October 2024.

The 5th tranche of responses included updated (final) versions of the AEE and technical reports, and new reports that were not initially provided with the application. Details as follows:

- Green Island Landfill Closure Assessment of Environmental Effects, prepared by Boffa Miskell Limited, version 2, dated 09 October 2024, including Appendices 1-21
    - Appendix 1: Records of Title
    - Appendix 2: General Arrangement Plan
    - Appendix 3: Design Report
    - Appendix 4: Landfill Development Management Plan (LDMP)
    - Appendix 5: Groundwater Report
    - Appendix 6: Surface Water Report
    - Appendix 7: Air Quality Report
    - Appendix 8: Bird Risk Assessment Report
    - Appendix 9: Draft Southern Black Backed Gull Management Plan

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- Appendix 19: Engagement Collateral
- Appendix 20: Interim Human Health and Environmental Risk Assessment
- Appendix 21: Landfill Gas Risk Assessment

4. Description of the Environment

The site and the surrounding environment are adequately described within the application and this description is not duplicated here. The description in the application is adopted for this report. The key features of the site and surrounding environment are outlined below.

4.1 Site Visit

I first visited the site on 4 April 2023. The purpose of this visit was to have a detailed walkover of the landfill site as guided by Lincoln Coe, DCC Landfill Engineer. Also present at this site visit were various representatives of the Applicant, as well as Lucia Caves, Elizabeth Morrison, Anna Lukey, and Eloise Ryan, technical experts from 4Sight Consulting who were attending on behalf of ORC.[8]

I have also visited the northeastern and southeastern sections of the landfill on 22 October and 8 November 2024, for the purpose of related application RM24.143 for the construction and operation of the RRPP.

I have a general familiarity with the environment surrounding the landfill as I have lived in the Dunedin area since 2008.

4.2 General

- The GIL is defined by the existing designation (D658) in the 2GP.
- The landfill is located in the suburb of Green Island and is approximately 8.8 kilometres (km) by road from central Dunedin.
- The landfill has a total area of 75.616 ha, being the total area of the landholding owned by DCC and designated in the 2GP. See Figure 12.
- The landfill operational area, being the area that has historically been used for waste disposal, extends across approximately 38 ha and sits within the designated area. See Figure 12.
- The GIWWTP is adjacent to the southwestern boundary of the site. See Figure 12.

[8] 4Sight Consulting is now SLR Consulting. Some of these technical experts no longer work for SLR and did not have further input to the assessment application.

- The 'site' for the purpose of this application, is defined as the landfill operational area, and the GIWWTP, because discharges to air from the LFG engine and flare occur directly from the GIWWTP and these are not separately authorised by resource consent.

- The site is identified on the ORC Hazardous Activities and Industries List (**HAIL**) as HAIL.00502.01 as category G3: Landfill Sites.

- The primary access to the site is via Brighton Road.

- The site is generally bound by State Highway 1 to the north, the Kaikorai Stream and Estuary to the west, Brighton Road to the south, and the Clariton Avenue residential area and Brighton Road industrial area to the east.

- The ORC Natural Hazard Maps indicate that the land in and around the landfill is subject to inundation risk associated with flooding from the Kaikorai Stream and from storm surge. The DCC 2GP identified the low-lying areas around the stream and estuary as being within a Hazard 2 Flood overlay at moderate risk of flooding. See Figure 13.

- The site currently includes waste diversion and transfer facilities for the drop off and consolidation of general waste, reusable and recyclable material, greenwaste, and household hazardous substances, as well as the recently constructed ORB, in which organic waste is received and shredded.

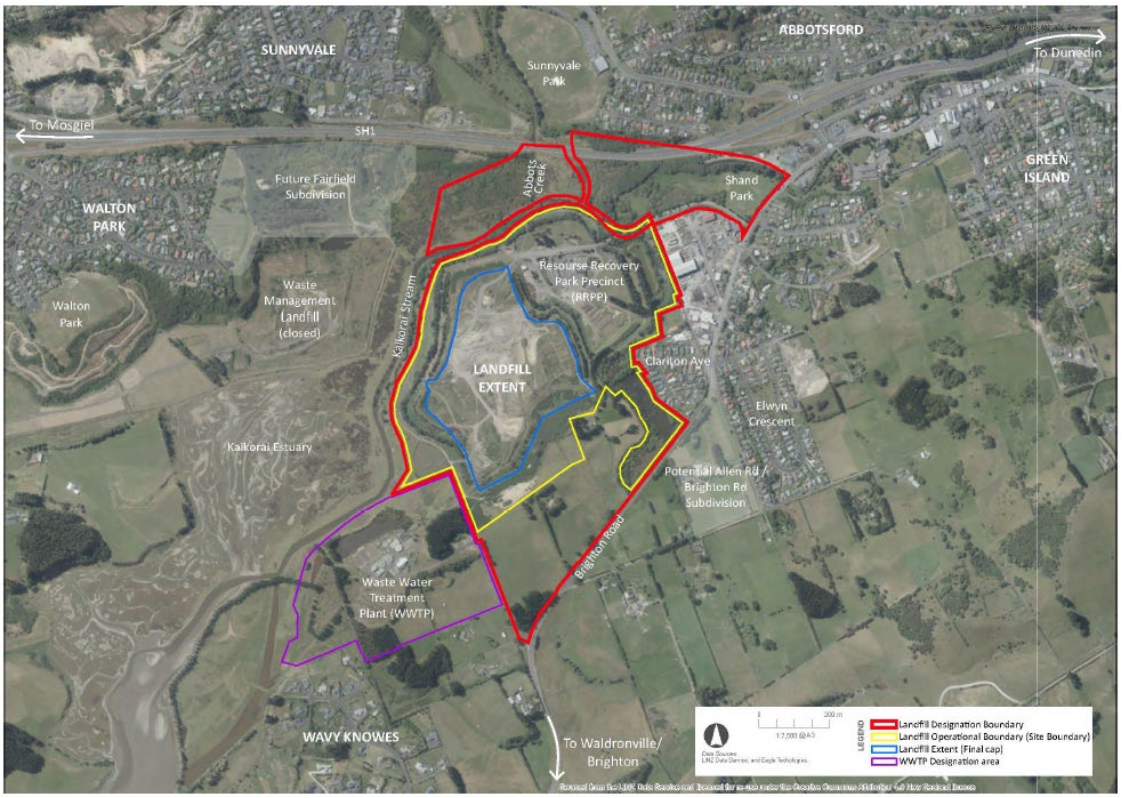

Figure 12 Landfill designation boundary (red line), operational boundary i.e. area historically used for waste placement (yellow line), landfill extent i.e. area of landfill still in operation (blue line), and GIWWTP designation area (purple line). Source: RM23.185 application.

Figure 13 Fluvial flood risk area. Source: RM23.185 Design Report.

4.3 Geology and Topography

A detailed description of the site geology and topography can be found in the application documents, specifically the Liquefaction and Stability report. A brief summary is provided below.

- Prior to landfill development, the site would have been characterised by low-lying (1-2 m amsl) estuary flats and wetlands.

- The current landfill extends to a maximum of 25 m amsl. Land surrounding the landfill is low-lying, being between 1.5 and 2.0 m amsl. Immediately to the south and east of the landfill, the land rises gently to a series of low hills.

- The geology underlying the landfill area comprises sediments of estuarine origin underlain by Abbottsford Formation mudstone.

- The estuarine sediments, characterised as Kaikorai Estuary Formation (**KEF**), are likely to be approximately 11 m thick in the landfill area.

- The KEF is divided into upper and lower layers, being the Upper Kaikorai Estuary Member (**UKEM**) and the Lower Kaikorai Estuary Member (**LKEM**), respectively.

- Geotechnical investigations at the site encountered Abbottsford mudstones beneath the estuarine sediments as a weathered mudstone or siltstone.

- The elevated land to the south of the site also consists of Abbottsford mudstone overlaid by loess soils. The loess materials sourced from the borrow area on the site are used for final capping of the landfill.

- The seismic sources within 200 km of the site have been identified. The Akatore Fault is the closest, most active fault to the site, with a preferred reoccurrence interval of 1700 years. The Green Island Fault lies offshore from the site and strikes northwest from the northern end of the Akatore Fault. This fault has a preferred reoccurrence interval of 22,000 years.

4.4 Groundwater

A detailed description of site hydrogeology and groundwater can be found in the Groundwater Report. A brief summary of key points is provided below.

- The KEF forms a shallow water-bearing strata under the landfill and surrounding area, with groundwater levels close to the ground surface.

- While investigations beneath the landfill waste were necessarily limited, the permeability of the estuarine sediments beneath the landfill footprint is likely to be reduced due to the compression of the sediments from the weight of the landfill.

- The shallower UKEM deposits exhibit a higher permeability than the lower LKEM formation.

- The underlying Abbottsford formation is inferred to be an aquitard, presenting an effectively impermeable barrier to downward seepage.

- The Kaikorai Stream historically ran through the landfill operational area but was diverted along the western boundary of the site. Former drainage channels could act as a potential pathway for leachate migration offsite.

- Rainfall that does not run off the surface of the landfill will percolate through the landfill material to the base where it accumulates as leachate. The low permeability of the underlying KEF members largely prevents downward migration of leachate into underlying sediments. Refer Figure 14.

- Leachate currently mounds within the fill to levels of between 16 and 22 m amsl.

- Prior to the landfill, groundwater within the estuarine deposits (KEF) is likely to have been hydraulically connected to Kaikorai Stream and other surface water features.

- Pumping (continuous dewatering) from the perimeter leachate collection trench creates a hydraulic barrier between surface water and the shallow aquifer underlying the landfill.

- The leachate trench does not extend to the depth of the Abbottsford mudstone.

- Leachate/groundwater levels in the leachate trench are typically maintained at -0.8 m to +0.2 m amsl. These water levels are lower than the surface water levels, with typical stream and estuary water levels of 2.0 – 2.5 m amsl.

- A high-density polyethylene (**HDPE**) liner on the outside face of the leachate trench reduces the volume of groundwater (connected surface water) entering the trench from the Kaikorai Stream.

- Leachate interacts with groundwater beneath the landfill; hence, groundwater quality within the area encircled by the leachate collection trench is poor.

- Groundwater quality outside the leachate trench is mixed, and in some areas shows influence of landfill waste on water quality, particularly where monitoring wells are present in areas where waste was historically placed outside the trench.

- Water chemistry data of water pumped from the leachate trench shows mixing of groundwater and landfill leachate, indicating that, despite the HDPE liner, some groundwater is still drawn in from areas outside the trench.

- A fundamental assumption of the hydrogeological model is that the leachate collection trench intercepts all groundwater and prevents offsite migration.

- There are no nearby (or downgradient) users of groundwater. On this basis, groundwater is not treated as a sensitive receptor.

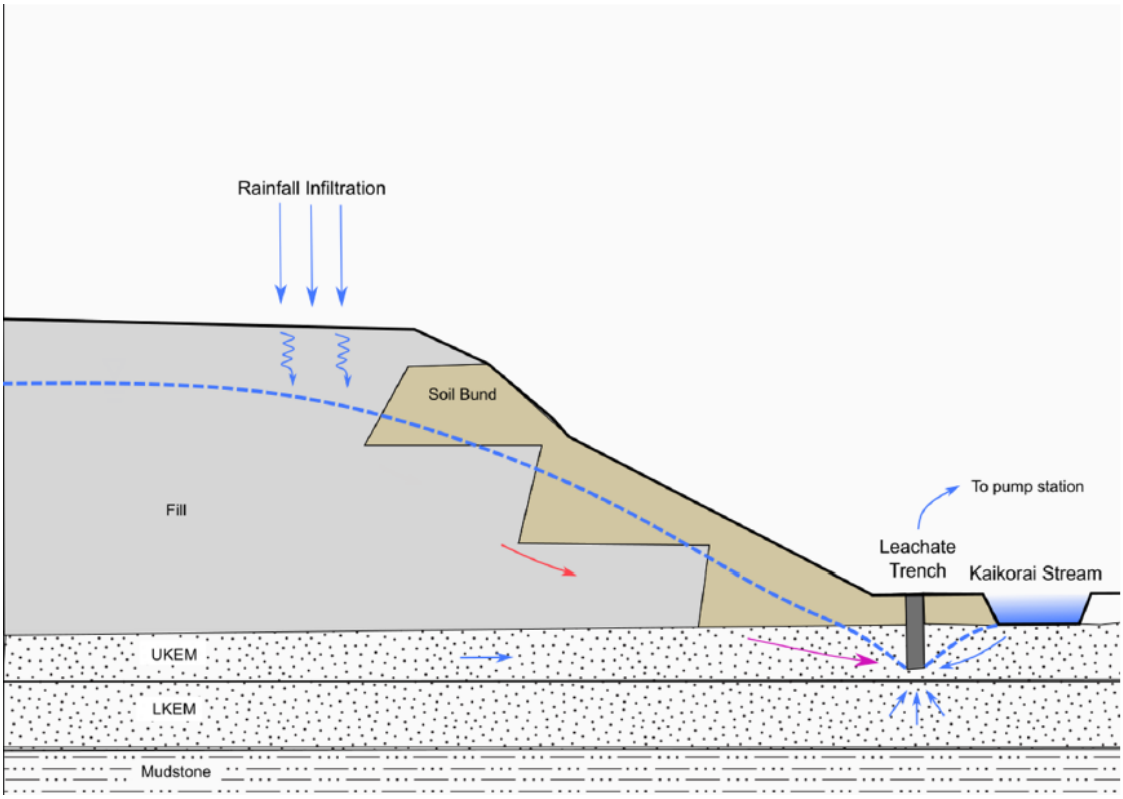

Figure 14 Schematic of leachate collection system, showing underlying geological layers, fill material, mounding of leachate within the fill, and the hydraulic gradient provided by the trench. Source: RM23.185 Groundwater Report

4.5 Surface Water

A detailed description of surface water can be found in the Surface Water Report. A brief summary of key points is provided below.

- The GIL is located within the low-lying portion of the Kaikorai Catchment, which rises from the coast to a high point of 668 m at Flagstaff hilltop.
- The Kaikorai Stream flows from the Chain Hills upstream of the landfill to the northeast, flowing through Green Island, and discharges into the Kaikorai Estuary in the general vicinity of the GIL, downstream of the confluence of Kaikorai Stream and Abbotts Creek.
- The Abbotts Creek confluence is located where the Kaikorai Stream borders the GIL to the north.
- The Kaikorai Stream historically ran through the landfill operational area but was diverted along the western boundary of the site to run in a southwest and southerly direction, towards the estuary and the sea.
- The mean flow, mean annual low flow, and average number of high flow events per year that exceed three times the median flow (**FRE3**) for segments upstream and downstream of the confluence with Abbotts Creek are shown in Table 2:

Table 2 Mean flow, mean annual low flow, and average number of high flow events per year that exceed three times the median flow. Source: RM23.185 Surface Water Report.

Location	Mean flow (L/s)	Mean annual low flow (L/s)	FRE3 (L/s)
Upstream of Abbotts Creek confluence	227	49	12.8
Downstream of Abbotts Creek confluence	368	81	12.7

- The Kaikorai Catchment has been heavily altered by residential, industrial, and agricultural development. This has impacted water quality and sediment quality in the catchment.

- Water quality data for Kaikorai Stream is categorised by LAWA as very likely degrading.

- Surface water quality is monitored (quarterly) at four sites within Abbotts Creek and Kaikorai Stream and Estuary. Results indicate that all sites – upstream, adjacent, and downstream of the GIL – exhibit dissolved metals and nutrient concentrations that are not unexpected in an impacted urban to peri-urban catchment.

- The total contributing catchment to the Kaikorai Estuary above the Brighton Road bridge is 49 km^2.

- The GIL and the Maxwell Landfill (also known as the Fairfield Landfill, located to the northwest on the opposite side of the estuary) have together reduced the estuarine area by approximately 30%.

- The Kaikorai Estuary can be categorised as a sediment sink, with the gradual infilling of the estuary occurring over geologic time scales as a result of the interaction between the upstream hydrology and geological environment combined with low energy environment of the estuary and the nearshore coastal dynamics.

- The Kaikorai Estuary is shallow (0.5 – 2 m deep) and water levels are tidally influenced. Tidal influence has an amplitude of 0.5 m between high and low tides, which can be higher when the mouth of the estuary is closed.[9]

- There are no known downstream abstractive users of water within Kaikorai Stream, Lagoon, or Estuary.

Artificial waterbodies on site

- Historical development of the GIL on the estuary deposits has resulted in changes to catchment drainage pathways for the land to the south, along Brighton Road. Surface water runoff was directed to constructed wetlands between Brighton Road and Clariton Avenue (the Southeastern Constructed Wetlands). These were connected via culvert to the Eastern Constructed Wetland.

- Figure 15 shows the artificial surface waterbodies that are located on the site:

[9] The mouth of the estuary is managed by ORC to maintain water levels at the Brighton Road bridge below 101.6 m RL.

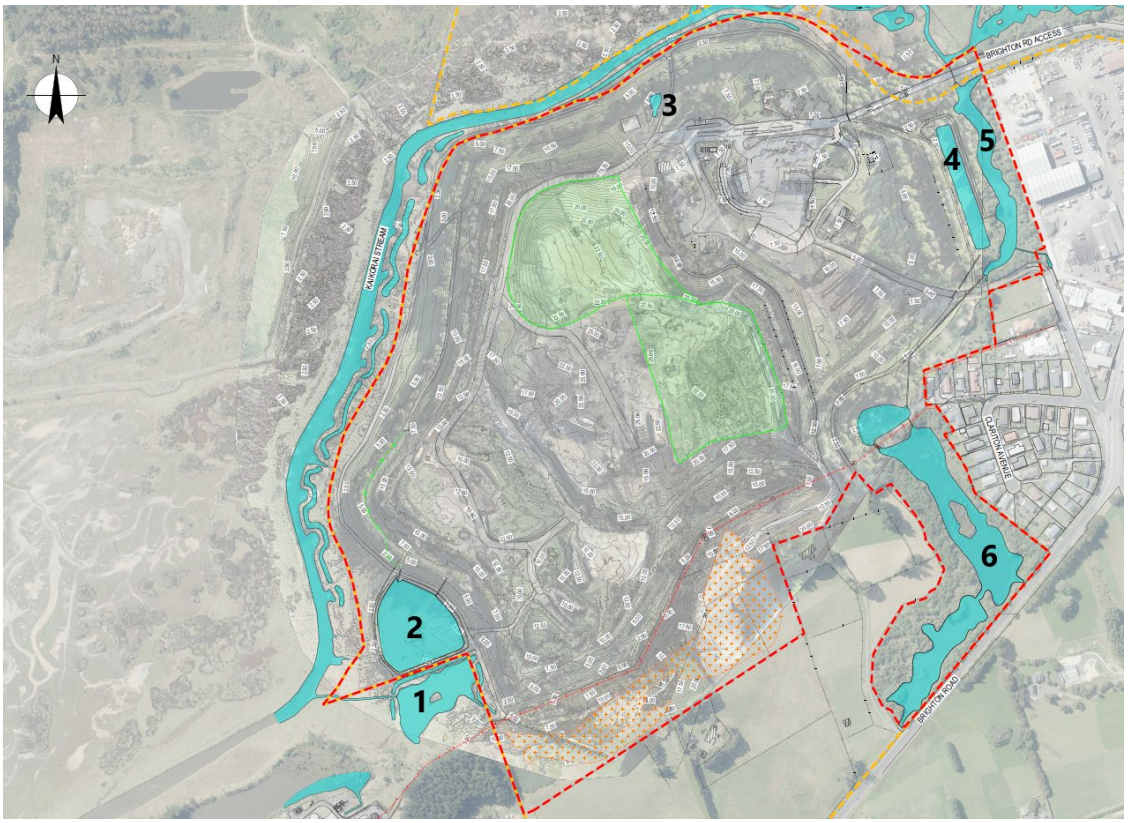

Figure 15 Artificial surface waterbodies on site. 1 & 2 western sedimentation pond including overflow; 3 northern leachate pond; 4 eastern sedimentation pond; 5 eastern constructed wetland; 6 southeastern constructed wetlands. The borrow area sedimentation pond is not shown in this view. Source: RM23.185 Design Report, with modifications (numbering) by the report writer.

4.6 Terrestrial and Aquatic Ecology

A detailed description of the ecological values of the site and surrounding area can be found in the Ecological Impact Assessment Report. A brief summary of key points is provided below.

Terrestrial Vegetation and Habitats for Fauna

- The existing working landfill extent is unlikely to support ecologically important indigenous vegetation or habitats for indigenous fauna, except for black-backed and red-billed gulls.

- Immediately surrounding the current working landfill, to the southeast within the landfill designation, areas of indigenous vegetation have been planted on previously filled and capped areas of the landfill.

- The areas of planted indigenous vegetation encompass common readily growing species which are 'not threatened', are not representative of intact vegetation types in the ecological district, are small, and have limited species diversity and habitat pattern.

- Shelterbelts planted around the landfill site and rank exotic grass and gorse shrub, in combination with the planted indigenous vegetation, provide habitat for native and exotic bird species and may also provide poor-quality habitat for lizards.

- The landfill and the surrounding residential and commercial areas may support a reasonably large population of predators (e.g. rodents) which may limit the lizard presence and population sizes.

- Overall, terrestrial vegetation is considered to have negligible ecological value and none of the areas of vegetation or habitat are identified as comprising significant indigenous vegetation of habitat under the 2GP for the purpose of section 6(c) of the RMA.

Avifauna

- No specific avifauna surveys were undertaken for this application; rather, relevant avifauna survey data collected for the Smooth Hill Landfill project was used to inform the ecological assessment.

- Habitat for avifauna populations at the project site and immediate surrounds include the landfill itself and associated infrastructure, areas of planted indigenous vegetation, shelter belts, rank exotic grass, constructed ponds and wetlands, and Kaikorai Stream and Lagoon.

- Of the 32 species that use or potentially use the GIL site and immediate surrounds, 14 have been recorded in previous surveys at Kaikorai Lagoon and the GIL. Of the 32:

    - Three are classified as 'nationally threatened' – none use the GIL, only the Kaikorai Lagoon.
    - 12 are classified as 'at risk' – some use the GIL.
    - 17 are classified as 'not threatened' – some use the GIL.

- Table 20 in the Ecological Impact Assessment Report summarises the ecological value assigned to each of the avifauna species that use or potentially use the site and immediate surrounds. In summary, these values range from low to very high and are based on their current threat values.

- Up to 9,000 southern black-backed gulls (**SBBG**), which are native but not threatened, use the landfill site itself, primarily as foraging habitat.

- Up to 450 red billed gulls have been observed on site. These gulls are classified as 'at risk'.

Aquatic Habitats and Fauna

- Kaikorai Stream is of moderate representiveness at the site, while the lower reaches have areas of significant biodiversity value. The stream has modified habitat and water quality conditions, modified and artificial banks, and highly modified riparian areas.

- Rarity and distinctiveness of species is low; diversity and pattern are moderate, with aquatic habitat typically modified and degraded due to poor water quality and surrounding land use pressures. Ecological context is low as the stream is within an urban-industrial environment. The stream forms a notable connection to the Kaikorai Lagoon.

- Overall, Kaikorai Stream is assigned a moderate ecological value.

- Abbotts Creek is of low representativeness at the site. There may be a greater range of habitat types upstream, but ecological connectivity may be compromised by road crossings. Rarity is moderate; diversity and pattern are typically modified and degraded due to poor water quality and surrounding land use pressures. Ecological context is low as the stream is within an urban-industrial environment. Ecological connectivity is limited.

- Overall, Abbotts Creek is assigned a moderate ecological value.

- Kaikorai Lagoon is of moderate representativeness as it presents a moderate degree of wetland naturalness despite habitat and water quality degradation. The Lagoon is listed as an Area of Significant Biodiversity Value and as a Wāhi Tupuna in the 2GP, and as a Regionally Significant Wetland in the RPW.[10] Rarity is high, as brackish systems with extensive swamp/marsh areas are historically reduced in the Otago Region.

- Diversity and pattern are moderate, as the lagoon presents a variety of habitat types; however, extensive habitat degradation has occurred due to replacement of native vegetation by exotic species, and surrounding land use pressures. Ecological context is high, as the lagoon provides critical habitat for the lifecycle of indigenous bird species, which are dependent on wetlands. The lagoon is also used by migratory freshwater fish, but the lagoon is not always open, which limits the ecological connectivity and habitat availability.

- Overall, Kaikorai Lagoon is assigned a high ecological value.

- Ecological value for aquatic fauna range from low (common bully, upland bully, shortfin eel, black flounder) to high (longfin eel, inanga).

4.7 Air

A detailed description of air quality can be found in the Air Quality Report. A brief summary of key points is provided below.

- There are 22 gazetted airsheds within the Otago Region. The site is located within Otago Airshed 2.

- Airshed 2 includes Mosgiel, Milton, South Dunedin, Green Island, and Palmerston.

- Where an airshed includes more than one town or region, all towns/regions within the airshed are assumed to have the air quality of the worst reading within that airshed. Monitoring for Airshed 2 is done in Mosgiel. Therefore, air quality within Airshed 2 is as per Mosgiel air quality.

- The NESAQ set ambient air quality standards for contaminants within airsheds. These regulations require Council to monitor air quality for contaminant concentrations within airsheds if it is likely that an ambient air quality standard will be breached.

[10] Consequently, they have the same status as a Significant Natural Area. Refer section 1.6 of the NPS-IB.

- Based on monitoring undertaken in Mosgiel over the last five years, Airshed 2 is deemed to be polluted.

- The Air Quality Assessment adopts the Waka Kotahi Background Air Quality default values for PM_{10} and $PM_{2.5}$, which were developed in May 2022, for the Green Island area, rather than the measured concentrations from the Mosgiel monitoring station.[11]

- Background values for sulphur dioxide (**SO_2**), carbon monoxide (**CO**), and nitrogen dioxide (**NO_2**) are sourced from the MfE Good Practice Guide for Assessing Discharges to Air from Industry (**GPG ID**) as there is no local monitoring of these pollutants.

- The Clariton Avenue residential area to the south, comprises the closest residential properties to the site, being approximately 200 m southeast of the existing transfer station facilities, and 120 m east of the current landfill footprint.

- Other residential areas are located to the east of Brighton Road, and to the north and west within Sunnyvale and Fairfield. Those residential properties are located at greater distances and separated from the landfill site by a combination of Brighton Road, the State Highway 1 corridor, the Kaikorai Stream and Lagoon, and rural and open space land.

- Undeveloped and rezoned land also exists around the Green Island landfill site which will add additional residential dwellings in future, being at 102 Walton Park Avenue on the opposite side of the lagoon, and 27 Weir Street to the south-east, Elwyn Crescent, and Trudi Place.

- The margins of the Kaikorai Stream and Estuary bordering the landfill to the north and west are identified as a Regionally Significant Wetland in the RPW and an Area of Significant Biodiversity Value, and a Wāhi Tūpuna of cultural significance to mana whenua in the 2GP. This area is therefore considered an ecological receptor.

- The nearest sensitive receptors in each direction have been identified. Where similar receptors have been grouped into clusters these are assessed at the nearest point to the site and assuming high sensitivity across the whole area (of the cluster). These are shown as receptors R0-R09 in Table 3 and Figure 16.

Table 3 Sensitive receptors. Source: RM23.185 Air Quality Report.

[11] PM_{10} and $PM_{2.5}$ means particulate matter that is less than 10 micrometres in aerodynamic diameter, or less than 2.5 micrometres in aerodynamic diameter.

ID	Receptor	Receptor type	Distance and direction from landfill footprint
R01	Green Island suburb (southeast) (nearest point along Clariton Ave)	Residential	120 m east
R02	Green Island suburb (northeast) (nearest point along Watson St)	Residential	500 m northeast
R03	Fairfield suburb (north) (nearest point along Holyport Cl)	Residential	530 m north
R04	Fairfield suburb (south) (nearest point along Blanc Ave)	Residential	650 m northwest
R05	172-176 Brighton Rd, Waldronville	Residential	440 m southwest
R06	45-51 Allen Rd South, Waldronville	Residential	420 m south
R07	Proposed residential area between Weir St and Brighton Rd	Proposed residential	280 m southeast
R08	Proposed residential area in Fairfield	Proposed residential	330 m northwest
R09	Abbotts Creek, Kaikori Stream and Estuary	Ecological	120 m west, northwest and north

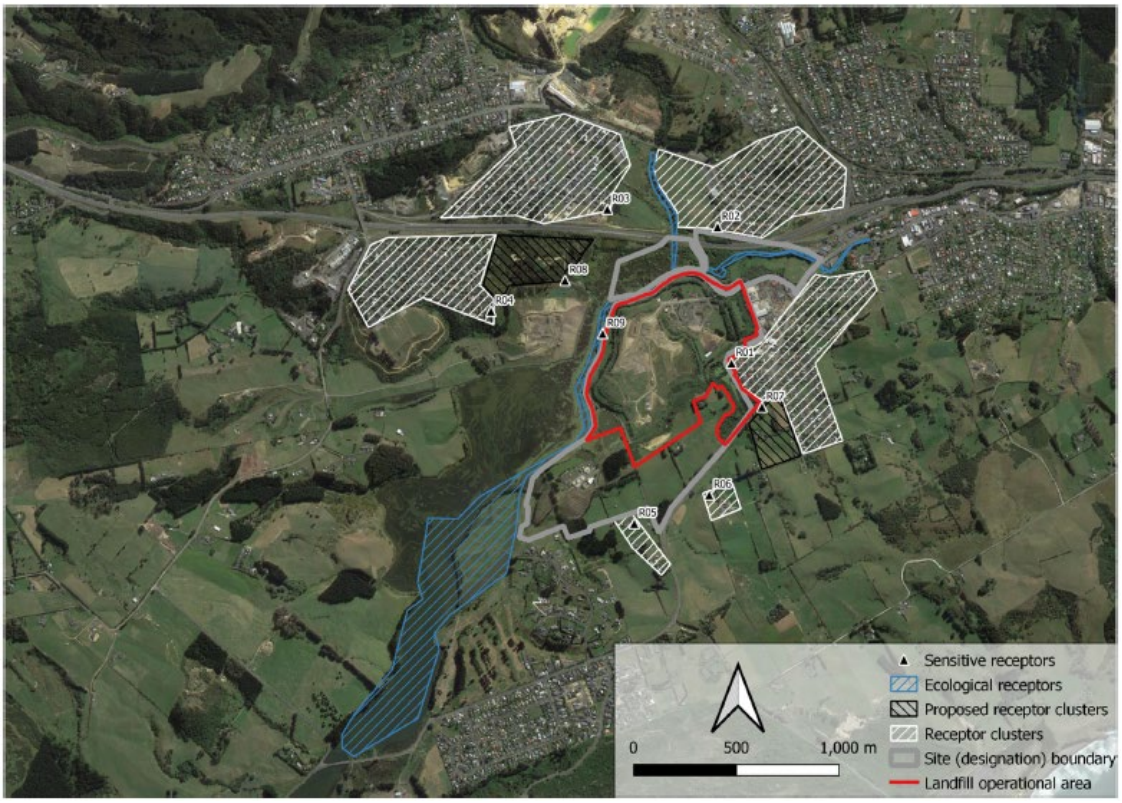

Figure 16 Sensitive receptors. Nearest receptors in cluster are shown by black triangles; residential/recreational/commercial clusters are shown by white hashing; ecological receptors by blue hashing; and proposed receptor clusters as black hashing. Source: RM23.185 Air Quality Report.

- The Green Island Landfill has its own Automatic Weather Station (**AWS**). This shows that, for the period February 2022 to January 2023:
  - The predominant wind direction is from the northeast.
  - The average wind speed measured is 2.9 metres per second (**m/s**).
  - Calm conditions (wind speeds less than 0.5 m/s) occur 1.2% of the time.
  - High wind speeds (wind speeds greater than 5 m/s) mostly occur from the northeast and southwest.

- Predicted wind patterns have also been modelled for the site. Modelling is not entirely consistent with onsite observations, with the differences put down to the

complex terrain around the site. The modelled scenario is used to indicate the worst-case on-site conditions.

- The Applicant did not take the opportunity to update the meteorological data to take into account the additional 18 months of data that have been collected between lodgement of the application and completion of the s92 process in October 2024 which would have reduced uncertainty in the model.

- A total of 145 odour complaints relating to the GIL were received from July 2017 to August 2022. Most complaints were attributed to regular or other operations, while a maximum of six complaints per year (2019) were attributed to odorous deliveries from wastewater treatment plants. 41 complaints did not have an identified source.

- Where the location that the complaint originated was known, most complaints (91 of 112) originated from the southeast of the site, with 54 from Clariton Avenue alone.

- The Applicant did not take the opportunity to update the complaints data to reflect any complaints that may have been received between August 2022 and the completion of the s92 process in October 2024.

- Other sources of air pollutants in the area include dust from Blackhead Quarries (2.6 km south) and the Fulton Hogan sand quarry (1.6 km north); motor vehicle emissions from local roads and State Highway 1; agricultural emissions including burning of vegetation, aerial spraying, and ground-based application of fertiliser; gas and dust emissions from the nearby industrial area; possible LFG emissions from the Maxwell Landfill.

4.8 Landscape and Natural Character

A detailed description of the existing landscape character of the site and surrounding area, and the natural character of rivers and wetlands can be found in the Landscape, Natural Character, and Visual Effects Report. A brief summary of key points is provided below.

- The site occupies an area that was once part of the upper reaches of the Kaikorai Estuary. Within this area, natural character and landscape values are highly modified.

- The surfaces within the site are highly modified, with low ground cover and exposed areas consistent with an operating landfill.

- The highest part of the landfill current reaches an elevation of approximate 25 m amsl.

- The site is located within the South Coast Landscape Character Area.

- The dominant character of the site is as a modified working landfill within the low-lying part of a wider basin-like landscape on the margins of Kaikorai Estuary.

- To the south, the landscape has a varied character, but is predominantly rural, characterised by open space, stands of large trees, shelterbelts, narrow gravel roads, and farm buildings, as well as larger-lot residential properties and the denser, small coastal suburb of Waldronville.

- The suburbs of Green Island, Abbottsford, and Fairfield surround the site to the northwest, north, and east, and comprise a combination of residential, commercial, and industrial development as well as recreational open space.

- The site and surrounding area are not identified in the 2GP as being in the coastal environment or part of any Outstanding Natural Feature or Landscape (**ONF/ONL**), or a Significant Natural Landscape (**SNL**) highly valued for their contribution to the amenity values or the quality of the environment.

- The Pukemakamaka/Saddle Hill landform, located 3.5 km to the west of the site, is prominent in views. This is identified as an ONF, and its upper slopes identified as an SNL in the 2GP.

- Abbotts Creek, Kaikorai Stream, and the Kaikorai Estuary are other key landscape features nearby.

- Natural character of these waterbodies is modified, but natural character values are retained particularly in regard to the birdlife that is supported and the presence of scenic qualities.

- The above natural features and landscapes are recognised as holding important values for Te Rūnanga o Ōtākou. Tangata whenua have a holistic relationship with whenua that integrates physical, associative, and perceptual dimensions of landscape.

- The site is visually well contained from close views, largely screened by the perimeter bunds and established trees.

- The hilly character of the surrounding landscape means visibility is obscured by intervening landform from some locations, but elevated views are available from others.

- Abbotts Creek and Kaikorai Estuary, the motorway and the GIWTTP provide some spatial separation between the site and residential neighbours to the south, west and north.

- Key viewing audiences include residential and light industrial properties to the east, Island Park Golf Club, and large lot residential properties to the southwest, land recently rezoned General Residential to the southeast, and residential suburbs and recreation spaces on elevated terraces to the west through to the northeast.

- Public access is not provided to the margins of the Kaikorai Stream in the vicinity of the landfill. As a result, Kaikorai Stream and Lagoon are unlikely to support important recreational values. Additionally, the poor water quality is not conducive to water-based recreational activities.

4.9 Cultural Landscapes and Mana Whenua Values

A detailed description of the cultural values which underpin the Kāi Tahu worldview and associations with the area can be found in the Cultural Impact Assessment (**CIA**) provided by Aukaha. A brief summary of key points is provided below.

Mana Whenua Values

- Whakapapa – Kāi Tahu are bound to the land, water, and all life supported by them, by whakapapa. Everything in existence is acknowledged and connected through whakapapa. Whakapapa establishes the ancestral rights which give mana whenua the mana and kaitiaki responsibilities over their takiwā.

- Mauri – is a life-giving force that flows from our living world and down through whakapapa, connecting and binding together all aspects of our world. Mauri is an observable measure of environmental health and wellbeing. Waterbodies with an intact and strong mauri sustain healthy ecosystems and support mahika kai and other cultural values. The primary resource management principle of Kāi Tahu is the protection of mauri.

- Mana – often loosely translated to mean the 'authority' or 'prestige' that mana whenua hold over their takiwā. Through the recognition of mana, mana whenua have the 'authority' to make decisions over the whenua and waterways, both wai māori (freshwater) and wai tai (coastal water).

- Rakatirataka and kaitiakitaka – rakatirataka refers to the exercise of mana in order to give effect to Kāi Tahu culture and traditions. In the management of the natural world, rakatirataka is underpinned by the obligations placed on mana whenua as kaitiaki. Kaitiakitaka is an expression of rakatirataka. Wai māori is a taoka that is governed under the domain or rakatirataka. The whakapapa connection with te taiao (the natural environment) imposes a kaitiakitaka obligation on mana whenua to protect wai and all the life it supports, in accordance with customs, knowledge, and mātauraka developed over many generations. The focus of kaitiakitaka is to ensure environmental sustainability for future generations, as expressed in the whakataukī (proverb) mō tatou, ā, mō kā uri a muri ake nei.

- Tapu – provides an element of safety and direction when there are restrictions. The Māori world is guided completely by tapu and noa.

- Mātauraka – the body of Māori knowledge and understanding which encompasses (among other things) the Māori world view and perspectives, traditional knowledge, and practices.

- Tikaka – behaviour or design outcomes that are culturally appropriate. Mana whenua engagement will allow mana whenua to guide culturally appropriate actions at the correct times.

- Utu – is in this context about an intent to redress historical and current imbalances in ecological and built forms through design.

- Maumaharataka – historical events regarding Māori are often excluded from the public narrative, or not fairly or correctly recorded. Maumaharataka emphasises the importance of upholding memories of the past and communicating Kāi Tahu

pūrākau of place, including place names, cultural heritage, and narratives. This strengthens intergenerational knowledge, community, and place-based identity.

- Tapatapa – is a manifestation of mana through the naming of landscapes by tūpuna. Placenames are important as they are from the earliest migrations and people. Tapatapa provides opportunities for strengthening intergenerational memory, and cultural and place-based identity.

- Oraka – represents the act of resting or an area of rest.

- Taoka – indigenous species are values as taoka by Kāi Tahu, as are the habitats through which taoka species survive and thrive. The ecosystems provided by wai māori, in lakes, rivers, wetlands, estuaries, and at the coast offer lifegiving habitats for indigenous species.

Mana Whenua Associations with the Kaikarae Estuary

- Wāhi Tūpuna are interconnected ancestral places, landscapes, and taoka that reflect the histories and traditions of mana whenua. The Kaikarae Estuary is part of an integrated cultural landscape (wāhi tupuna) for mana whenua, as shown in Table 4.

- Traditional travel routes through the interior and along the coast connected Kāi Tahu to places of importance for gathering and harvesting mahika kai and connected sites of permanent and seasonal occupation. Old tracks followed “along the western hill-tops, the line of Kaikorai Valley, and the seacoast”. Other Kāi Tahu trails proceeded from Kaikārae over Whakaari or Whānaupaki (Flagstaff), to Waikōuaiti.

- Mahika kai practices underpin the Kāi Tahu relationship with Otago’s rivers, lakes, wetlands, and estuaries. The coastal estuaries, lakes and wetlands of the Otago region once supported rich and healthy mahika kai resources, including a range of shellfish, sea fishing, eeling and harvest of other freshwater fish in lagoons, wetlands and rivers, waterfowl, sea bird egg gathering, forest birds, and a variety of plant resources including harakeke, fern and tī kōuka root.

- For mahika kai to be sustained, populations of species must be present across all life stages and must be plentiful enough for long term sustainable harvest. Safe access to mahika kai sites must be available, kai must be safe to gather, safe to harvest and safe to eat and management and harvesting practices must be able to be carried out in accordance with tikaka.

- The transmission of mātauraka necessitates whānau being able to access healthy mahika kai to carry out customary practices. The restoration of the mauri of Kaikārae estuary to provide healthy habitat for mahika kai and taoka species is a long-term vision for Ōtākou whānau.

Table 4 Mana whenua associations with Kaikarae Estuary. Source: Aukaha CIA.

Ikoa Māori	Location/Ikoa Pākehā	Description
Pakaru	Kaikarae Lagoon	Pakaru is the traditional Māori name for the Kaikarae Lagoon, near the mouth of the Kaikarae stream. Along with Kaikarae, Pakaru was an important kāika mahinga kai for local Kāi Tahu. During the 1879 Smith-Nairn Royal Commission of Inquiry into the Ngāi Tahu land claims, local Ngāi Tahu kaumātua recorded Pakaru as a kāika mahika kai where tuna and pātiki were gathered.
Kaikarae	Kaikarae Lagoon and Stream	Kaikarae is associated with the Waitaha explorer Rākaihautū. Upon arriving at Whakatū in the Uruao waka, Rākaihautū divided his people into two groups. His son, Rakihouia, took one party to explore the coastline, and Rākaihautū led the other party through the interior of Te Waipounamu and down to Murihiku, using his kō named Tūwhakaroria to dig out most of the fresh-water lakes of Te Waipounamu. While travelling back up the island, Rākaihautū and his party stopped at the mouth of a stream to eat, and their food was a seabird known as karae. This particular location and stream was named Kaikarae.
Pukemakamaka	Saddle Hill	Matamata was the kaitiaki of Kāti Māmoe chief Te Rakitauneke and is attributed to carving out the Ōtākou harbour and the Taiari river in search of his lost master when they became separated. The taniwha finally resting where Saddle Hill is now, becoming the peaks Turi-makamaka and Pukemakamaka.

5. Status of the Application

5.1 Resource Consents Required

Resource consents are required under the following planning instruments:

- Regional Plan: Water for Otago (**RPW**)
- Regional Plan: Waste for Otago (**RPWaste**)
- Regional Plan: Air for Otago (**RPA**)
- Resource Management (National Environmental Standards for Freshwater Regulations) 2020 (**NES-F**)

Activity	Planning Instrument and Rule	Activity Status	Notes
Discharge waste, hazardous waste, and leachate to land, in circumstances	RPWaste 7.6.1(1) and (2)	Discretionary	Contaminants are directly discharged to land and thereafter (in the case of leachate) to groundwater.

which may result in contaminants entering groundwater. *To replace resource consents 94262-V1, 94693-V1, 3839A-V1.*	RPwaste 6.6.1(1) and (2)	Discretionary	Contaminants (from the small amounts of hazardous wastes that are acceptable in a Class 1 landfill) are directly discharged to land and thereafter (in the case of leachate) to groundwater.
	RPW 12.B.4.1	Discretionary	Landfills are an industrial or trade premises. Contaminants are discharged to land.
	RPW 12.B.4.2	Discretionary	Landfills are an industrial or trade premises. Hazardous substances (as acceptable in Class 1 landfills) are discharged to land.
Take groundwater and connected surface water through the leachate collection trench, and take groundwater from groundwater bores, landfill gas wells. *To replace resource consents 4139-V1 and 3839-V1.*	RPW 12.2.4.1	Discretionary	Groundwater is taken from bores and LFG wells that are more than 100 m from a connected perennial surface waterbody and this water is not allocated as surface water or part surface water under policy 6.4.1A(a)-(c). Chapter 12 rules apply.
	RPW 10A.3.1.1	Controlled	The water permit being replaced expires before 31 December 2025, and the groundwater is taken from the leachate collection trench, and potentially bores and LFG wells, that are within 100 m of a connected perennial surface waterbody and this water is therefore allocated as surface water under policy 6.4.1A. The rules in Chapter 10A apply.

			All relevant entry conditions of this rule can be met.
	NES-F 45B(4)	Discretionary	The taking and use of groundwater will occur within 100m of the natural inland wetlands along the Kaikorai Stream, and there is a hydrological connection between the take and the wetlands, and the take is likely to change the water level range or hydrological function of the wetlands.
Divert surface water and stormwater from working and non-working areas of the landfill, and from the defence against water *To replace resource consents 3839C-V1 and 3840A-V1*	RPW 12.3.4.1	Discretionary	Cannot meet provisions (a) or (f) of permitted activity rule 12.3.2.1 and is not otherwise provided for in the RPW.
	NES-F 45B(4)	Discretionary	The diversion of surface water and stormwater will occur within 100 m of the natural wetlands along the Kaikorai Stream and may potentially change the water level range or hydrological function of the wetlands.
Permanent diversion of surface water in the Kaikorai Stream and Brighton Road Stream. *To replace resource consents 4140 and 4185.*	RPW 12.3.4.1	Discretionary	The diversion is historic, is not otherwise provided for by the RPW, and requires ongoing authorisation.
	NES-F 45B(4)	Discretionary	The diversion, although historic, is within 100 m of natural inland wetlands along the Kaikorai Stream and is likely to change the hydrological function of those natural inland wetlands.

Discharge of surface water and stormwater to the Kaikorai Stream for the purpose of the operation and closure of a Class 1 landfill *To replace resource consent 3840C-V1.*	NES-F 45B(5)	Discretionary	The discharge meets all requirements of regulation 45B(5)(a)-(d) and is therefore a discretionary activity.
	RPW 12.B.3.1	Discretionary	The discharge of stormwater to water is not otherwise provided for by permitted or controlled activity rules.
	RPW 12.B.4.1	Discretionary	The discharge of surface water, that is not defined as stormwater in the RPW, from an industrial or trade premises, requires resource consent.
Discharge of landfill gas, combustion emissions from landfill gas flares and engines, dust, and odour into air, including from the ORB and from the GIWWTP, and including from truck movements within the site. *To replace 94524-V1*	RPWaste 7.6.1(3)	Discretionary	The discharge of contaminants (LFG, products of combustion, dust, odour) to air from operating landfills is a discretionary activity. This rule applies to discharges from the GIL site only.
	RPA 16.3.5.9	Discretionary	The discharge of odour from the ORB and products of combustion from the LFG engine and flare located at the GIWWTP (industrial or trade processes) are not covered by the RPWaste because they are not landfilling and they are instead discretionary activities under the RPA.
	RPA 16.3.15.5	Discretionary	Discharges of PM_{10} occurring after 31 August 2013 are discretionary activities. This rule applies to the

			discharge of PM_{10} at the GIWWTP.
Placement of a defence against water between the landfill and Kaikorai Stream for the purpose of diverting floodwaters.	NES-F 45B(1) and (2)	Discretionary	Vegetation clearance and earthworks for construction of the perimeter road will in some cases be closer than 10 m from natural inland wetlands along the Kaikorai Stream.
	RPW 14.3.2.1	Discretionary	The raising of the perimeter road is for the purpose of flood mitigation; therefore, the road bund is a defence against water.
Disturbance of land at a contaminated site for undertaking capping works and installation and maintenance of landfill infrastructure, including the drilling of land to install monitoring wells and LFG wells. *To replace resource consent RM21.474.01.*	RPWaste 5.6.1(1) and (5)	Discretionary	The GIL is a contaminated site. Disturbing land on such a site is a discretionary activity. Any discharges of dust or other contaminants to air that occur during the disturbance are also discretionary activities.

5.2 Overall Activity Status

Applications involving a number of different activity statuses can be bundled together, so that the most restrictive activity classification is applied to the overall proposal. The bundling approach developed from case law is to enable appropriate consideration of the effects of an activity, or group of activities.

While the RMA does not require the bundling of applications, the concept of bundling is well-established by case law. There are, however, some limited circumstances in which bundling of applications may not be considered appropriate, as identified in *South Park Corp Ltd v Auckland City Council* [2001] NZRMA 350 (EnvC):

a) One of the consents sought is classified as a controlled activity or restricted discretionary activity; and
b) The scope of the consent authority's discretionary judgment in respect of that consent is relatively restricted or confined, rather than covering a broad range of factors; and
c) The effects of exercising the consents would not overlap or have consequential or flow on effects on matters to be considered on the other application(s) but are distinct.

Other case law provides guidance on when bundling may be appropriate:

Waipapa Bay Protection Society Inc v Ariki Tahi Sugarloaf Wharf Ltd [2023] NZHC 3379 at [39] discusses the practice of "bundling" and states, citing *Day v Manawatu-Wanganui Regional Council* [2012] NZEnvC 182, that "the question as to whether or not to bundle is discretionary and turns on the degree of overlap between the effects of the relevant activity."

In *Protect Aotea v Auckland Council* [2021] NZENvC 140, the court found that the assessment of the effects of the activity should be considered together in order to provide a properly holistic assessment of them but, consent for a controlled activity must be granted under ss87A(2) and 104A of the RMA and the rules of the plan which apply to that activity.

It further states that while holistic assessment of the related elements of a proposal is required no matter what combination of activity classes may be involved, "bundling" in its specific sense of treating the overall class of the proposal as being the most restrictive is not automatic and requires care to ensure that the statutory limits in relation to the different classes of activity are observed. In particular, bundling cannot override the statutory provisions of ss9,104A and 104C.

In this situation, I consider the taking of groundwater and the taking of groundwater allocated as connected surface water relate to the same subject matter, and I consider that the effects of the consents will overlap and will have consequential flow on effects on matters to be considered on the other applications, so that they should be considered together. This is because the operation of the leachate collection trench is an activity that cannot be physically separated into the two activities that are contemplated by rules 10A.3.1.1 and 12.2.4.1. Therefore, I consider that it is more appropriate to bundle all of the activities rather than to separate them and consider the application as a "hybrid" activity. However, for completeness, I note they should not be treated as having the same activity class or status for the purpose of making a substantive decision on the application, and cannot be bundled for that purpose as to do so would be contrary to the statutory limitations applicable to making decisions on applications for controlled activities, despite any practical effects this may have on the carrying out of the proposal.

Overall, the proposal has a **discretionary** activity status.

6. Assessment of Adverse Environmental Effects

6.1 Permitted Baseline

The Consent Authority may disregard an adverse effect if a rule in a plan or national environmental standard permits an activity with that effect. In this case:

There is no permitted activity rule for the discharge of contaminants to land, water, or air that occurs as a result of the operation of a landfill. While there is a permitted activity rule that allows for the discharge of contaminants for the creation of a cleanfill landfill, this is not a reasonable comparison to draw, and I do not consider that the environmental effects of a cleanfill landfill provide an appropriate permitted baseline against which to assess the effects of a Class 1 landfill. The adverse effects associated with the discharge of contaminants to land, water, and air from a Class 1 landfill are significantly different to those associated with a cleanfill landfill.

There is no permitted activity rule within the RPW or the NES-F that provides for the taking of groundwater from within 100 m of a wetland where the taking of water could change the hydrological functioning or water level range in the wetland.

There is no permitted activity rule for the diversion of water where that diversion would affect the hydrological function of a Regionally Significant Wetland, nor is there any rule permitting the discharge of stormwater from a reticulated system into such a wetland. Further, the NES-F does not provide a permitted activity pathway for diversions and discharges water associated with landfill operations which occur in proximity to natural inland wetlands.

There are no permitted activity rules within the RPWaste that provide for the disturbance of a contaminated site or the discharge of hazardous waste to air on a contaminated site, nor is there any permitted activity rule within the RPA for the discharge of contaminants to air from trade and industrial premisses such as the GIWWTP or the ORB.

For the reasons outlined above, the permitted baseline is not considered relevant to this proposal and is not given further consideration in the below assessment of adverse environmental effects.

6.2 Receiving environment

The receiving environment is the environment upon which a proposed activity may have effects. The receiving environment includes the current and reasonably foreseeable future state of the environment as it may be modified by permitted activities and by the implementation of resource consents that have been granted at the time the application is being considered. It does not include the environment as it might be modified by the implementation of future resource consents yet to be granted, nor does it include unlawful activities, even if these are already occurring.

In this case, the receiving environment is the wider landfill site, including its designation and implemented resource consents, but not those activities occurring under s124; groundwater; surface water, including artificial and natural watercourses and wetlands as well as their natural, physical, and cultural values; ambient air quality beyond the site and the receptors beyond the site that are sensitive to changes in ambient air quality. The receiving environment does not include the RRPP functions as these resource consents have not yet been determined.

6.3 General comments

Given the volume of information presented in the application, the requests for further information, and the multiple rounds of technical audits (peer-reviews), the assessment of adverse effects presented below is necessarily a summary of the findings of the application process to date.

I note that, following the response (received 9 October 2024) to the second s92(1) request for further information, a final round of technical audits was undertaken after which the s92 process was duly concluded. No further questions or concerns have been put to the Applicant for consideration, and any residual uncertainty as to adverse effects is accepted and incorporated into the assessment below to inform my notification recommendation. This was to avoid unreasonable delay in the processing of this application, which was lodged in March 2023.

In general, the sections below are set out as follows:

- Summary of the Applicant's assessment.
- Where applicable, a summary of technical audit findings, including identification of points of agreement, disagreement, and residual uncertainty.
- Overall conclusions.

Variations to the above layout occur where the Applicant hasn't provided a standalone assessment for a particular matter or where a technical audit was not deemed necessary.

The following technical experts were engaged by ORC to audit the application:

From SLR Consulting:

- James Elliot, Technical Director – Land Quality and Remediation
- Matthew Adamson, Associate Geotechnical Engineer, Geotechnics & Mine Waste Engineering
- Tim Baker, Technical Discipline Manager – Hydrology and Hydrogeology
- Claire Conwell, Principal Consultant – Ecology and Marine Science
- Elizabeth Morrison, Principal Ecologist
- Rachael Annan, Technical Director – Landscape Planning

From Jacobs New Zealand Limited:

- Tracy Freeman, Principal Air Quality Specialist

At the time of writing this report, the recommendations of the various technical experts have not been adopted by the Applicant. As such, they are not considered to be mitigation measures, and the conclusions of this notification report are based only on what the Applicant has provided.

6.4 Landfill Design

The Design Report (GHD), and relevant sections of other technical reports, were audited by James Elliot, Technical Director – Land Quality and Remediation, at SLR Consulting (**SLR**). Full comments can be found in the following memoranda:

- Technical Memorandum dated 5 December 2023
- Technical Memorandum dated 24 October 2024

A summary of the audit comments is provided below. Where recommendations are made, these are shown in *italicised* text below the relevant comment.

Surface Water Management

- Further information was requested with respect to the classification and fate of runoff from the intermediate cap. The Applicant clarified that surface water runoff from intermediate cover is currently treated as leachate and directed to the leachate collection system. Mr Elliot considers that this is appropriate, should continue, but notes that the LDMP and the design report contain contradictory comments.

  Mr Elliot recommends that the LDMP and Design Report are updated to reflect current practice.

- The direction of higher quality water types (clean or stormwater) to the leachate collection system is appropriate provided the leachate collection system has the

capacity to receive these waters. The Applicant has demonstrated that there are no issues with capacity.

Mr Elliot recommends that efforts are made to avoid runoff water from upstream of the tip face entering the tip face to minimise contribution to leachate head. Water treated as leachate should be directed to the GIWWTP by the quickest means possible, rather than be allowed to seep into the waste mass.

Leachate Management

- Further information was requested with respect to the frequency and associated impacts to the environment of leachate overflowing from the northern leachate pond in prolonged rainfall events. The Applicant has clarified that such discharges are expected to occur less than once every five years, that the water overflowing from the pond would be at or approaching 'clean' or 'stormwater' quality, and that any contaminants would be diluted due to the higher-than-average stream flow due to increased rainfall. Mr Elliot notes that dilution is not a justification for discharging contaminants to the environment, and that water levels in the northern leachate pond should be managed to prevent the likelihood of overflow. However, given the expected discharge quality and low frequency of such events, the offsite discharge may be acceptable.
- Some parts of the landfill have leachate head of more than 20 m. This is considered to be a significant risk and is not consistent with WasteMINZ Guidelines objective to *"minimise head of leachate above the liner"* noting that in this case the landfill does not have a liner.
- Modelled LFG generation and capture rates are much higher than recent actual capture rates. This indicates the system is performing poorly.
- Leachate level in the waste mass is likely to be inhibiting the generation of LFG and also would be reducing the effectiveness of the LFG wells where the leachate is present above the base of the well. A reduction in leachate levels would be expected to increase LFG generation rates and may improve LFG collection efficiency.
- The proposed horizontal leachate collection drains in the waste mass are appropriate and should be used wherever possible to reduce leachate head.

  Mr Elliot recommends that additional actions are implemented to reduce leachate head, such as active pumping of leachate from existing LFG wells.

  Mr Elliot also recommends that lowering of the leachate head be a condition of consent and should be based on a target leachate head derived by the Applicant for consideration by ORC.

- Remedial action to address leachate seepage into the culvert connecting the southeastern and eastern construction wetlands should be implemented at the earliest opportunity. The Applicant has stated these works will be completed by March 2025. This is acceptable.
- The extension of the leachate collection trench along the southern boundary is considered appropriate to further reduce the potential for leachate migration offsite.

  Mr Elliot recommends that this be subject to detailed design.

- As a general recommendation as to leachate management, taking into account the findings of other auditors:

Mr Elliot recommends that further assessment of the potential for leachate to impact groundwater and surface water should be undertaken to assess the effectiveness of the leachate collection trench in preventing impacts to the environment, and to inform if additional measures to manage leachate are required.

Landfill Gas Management

- LFG utilisation and treatment systems (engine and flare) have significant downtime. Further, the predicted LFG collection rate exceeds the capacity of the existing flare and engine. The Applicant has proposed a new enclosed flare with a capacity of 1,000 m^3/hour. Mr Elliot considers that this is appropriate, provided it is fully functional and does not have significant downtime, and provided the candlestick flare operates as a contingency, noting that if the enclosed flare is down, and LFG capture rates approach modelled rates, the engine and candlestick flare will not be sufficient, even if operating at full capacity.
- The existing LFG wells in areas where waste is to be placed will be extended over time to the top of final waste height. This is supported.
- The limitations of horizontal gas wells in this type of landfill are acknowledged, but Mr Elliot considers that these may still provide some collection capacity in areas where LFG may remain uncollected for a significant period of time while the waste mass reaches full height.
- The LFG management system (wells, lines, and ring main) will be extended across the proposed future filling area. With respect to the timing of any installation of new LFG wells, Mr Elliot recommends that:

  The period of time where areas of waste are without LFG extraction capability be minimised, and that more detailed timing of LFG well installation compared to waste placement in each area is provided.

- A Landfill Gas Risk Assessment (**LFGRS**) concludes that the risk of lateral migration (of landfill gas) impacting current adjacent site users is negligible to low risk. Mr Elliot agrees that shallow groundwater and low permeability natural soil will limit lateral migration but considers that additional data and assessment is required to support the 'negligible to low' risk conclusion. Nonetheless, Mr Elliot agrees that the LFGRA does not indicate the need to change any onsite management of LFG beyond the existing controls and associated improvements detailed in the resource consent application, and Mr Elliot's other recommendations.

  Mr Elliot recommends that a consent condition be included to require an update of the LFGRA with a more robust data set, conceptual site model and assessment of risk.

Landfill Cap and Profile

- Further information was requested, and subsequently provided, about the appropriateness of a piggyback liner. On balance, Mr Elliot agrees that a piggyback liner is not warranted at this site.
- The initially proposed landfill final cap profile did not appear to meet the minimum final cover requirements as set out in the WasteMINZ Guidelines. A revised landfill cap profile, consistent with guidelines, was proposed by the Applicant. This cap profile is considered to be acceptable.
- Sections of the landfill cap will have a grade of only 2% rather than the WasteMINZ Guidelines recommendation of 5%. The Applicant justified this lower grade on the

basis of landscape constraints, the small (2.5 ha) area proposed to have this grade, and the proposed maintenance measures.

Mr Elliot does not consider these justifications to be sufficient and recommends that a 5% grade is adopted. Additionally, regular maintenance to prevent flat spots and ponding water on the cap are recommended regardless of cap grade.

- A flexible membrane liner or geosynthetic clay liner in the cap profile is not considered necessary, subject to Mr Elliot's other recommendations in relation to landfill cap grade and long-term management of leachate at the site being adopted.

Landfill Fire

- The application contained a Fire Management Plan (**FMP**). Mr Elliot found that the mitigation, monitoring, and management requirements in this plan were generally acceptable, but made a series of recommendations relating to battery fires, regular reviews of the FMP, monitoring, thermal imagery camera, and methods to extinguish fires. The Applicant stated that a Fire Risk Assessment has been prepared, but this could not be located in the series of documents provided for review in October 2024.

Conclusions

Based on the comments from Mr Elliot, it is considered that the technical information provided in support of the application is generally robust, and clear about the uncertainties and assumptions. To the extent that they are applicable to a landfill of this age, the design of the landfill is partially consistent with industry best practice guidelines, the exception being the significant leachate head, which is a risk for leachate leakage, is not consistent with guidance, and is likely impeding the performance of the LFG collection system. There are a limited number of matters for which Mr Elliot recommends changes, or consent conditions. These are detailed above, but primarily relate to reducing leachate head, and undertaking further investigations to confirm the effectiveness of the leachate collection trench at preventing discharges to the environment and to inform the requirement for any additional management measures.

The way in which the risks outlined above contribute to adverse environmental effects is detailed in the sections below.

6.5 Stability effects

Potential land stability effects from the continued operation, expansion, closure, and aftercare of the GIL include liquefaction, slope deformation, and lateral spreading resulting from seismic events; or elevated leachate/groundwater levels within the landfill leading to a loss of stability.

Applicant Assessment

A series of geotechnical assessments have been carried out to estimate the performance of the GIL for the proposed final landform under both static and seismic conditions. This includes liquefaction, slope stability, and lateral spreading assessment. The key finding is that under the ultimate limit state (**ULS**) seismic event, portions of the land will deform by differing amounts. The predicted deformations are shown in Table 5 for the six cross sections that were modelled.

Table 5 Summary of total expected seismic deformations for the ULS event (excluding liquefaction settlement). Source: RM23.185 Liquefaction and Stability Assessment

Description	Section 1	Section 2	Section 3	Section 4	Section 5	Section 6
Anticipated slope displacement (mm)	680	630	270	205 – 325	35 – 75	930

The majority of the natural soils underlying the GIL are not liquefiable under the serviceability limit state (**SLS**) or ULS seismic events. However, some layers in the UKEM that exhibit sand-like behaviour are likely to undergo liquefaction under ULS seismic event. No free field settlement is anticipated under SLS; up to 35 mm free field settlement is likely under ULS. Differential settlements of drains and other infrastructure within the site may occur, particularly where the liquefied layers are located within the foundation zone of influence. The impact on the landfill and other infrastructure at the site is likely to be minimal.

Six cross sections for the proposed final landform have been analysed. Based on the slope stability assessment, all six cross sections meet the factor of safety (**FoS**) stability criteria for all static load cases. For seismic SLS load case, only three sections meet the FoS requirements. None of the sections met the FoS requirements under the design ULS seismic event. Post seismic flow failure is not anticipated.

Where the seismic FoS is less than 1.0 displacement analysis was carried out. During a SLS seismic event, the landfill is expected to remain stable with negligible deformation i.e. less than 5 mm. During an ULS seismic event, the landfill is likely to variably deform around the landfill perimeter. The magnitude of the slope deformation is dependent on various factors, with the two major factors being underlying ground conditions and the presence of internal perimeter bunding. The geology of the site is variable, and no liquefaction or lateral spreading is anticipated along the sections where there is no UKEM sand layer. Total seismic induced slope displacement is likely to be in the order of 35-325 mm in these areas where there is no liquefiable layer present.

In areas where liquefaction is expected to occur under ULS seismic event, lateral spreading is anticipated. The total seismic induced slope displacement is likely to be in the order of 270 to 930 mm when a liquefiable layer is present. The zone between a free face e.g. Kaikorai Stream, a sedimentation pond, etc., and up to 200 m from the free face could experience ground distortion as a result of lateral spreading.

During an ULS equivalent seismic event, the northern, western, and southwestern perimeter of the landfill are likely to move towards the nearest free face i.e. Kaikorai Stream or the western sedimentation pond to the order of 270 – 930 mm, as a result of lateral spreading. It is likely that multiple cracks will form near riverbanks, at the toe of the landfill, and the cap. Damage to the existing leachate trench is likely and will vary along its length. Such deformation could include failure of the pipe joints and between the pipe connections to the pump stations. Height has a strong influence on the predicted deformations; the higher the landfill the greater the deformations. Around the southern perimeter, approximately 930 mm of lateral displacement is predicted, with ground distortion in the form of cracks and local slumping. Liquefaction and lateral spreading is not anticipated around the eastern perimeter due to the absence of the liquefiable unit.

In conclusion, the landfill is likely to undergo deformation under ULS seismic event due to liquefaction, lateral spreading, and slope movement. To reduce the severity of the impact, remedial work is proposed. This is outlined in the design report and is summarised below.

The planned approach to increasing the earthquake performance of the landfill and infrastructure is to increase the resilience of existing infrastructure to the extent practicable and plan for post-event remediation. The alternative option of strengthening the landfill to resist ground movement was not considered practicable on the basis of increased environmental effects associated with works, high cost, and residual seismic risk.

The proposed remedial actions to be completed in advance of any event are listed in the Design Report and can be summarised as:

- Maintaining leachate levels at near 12 m amsl;
- Moving underground leachate infrastructure to the surface, or providing redundancy measures on the surface, to increase resilience to ground movement and increase the ease of repair; and
- Maintaining critical backup equipment on site.

The proposed remedial actions to be completed after any event are also listed in the Design Report, and essentially set out how interim leachate management will be established to avoid or minimise the release of leachate to the environment while repairs on the leachate system are undertaken. Damage to the landfill cap and LFG collection system may occur. Long term remedial works will be required to fix this. The immediate priority will be to minimise odour issues by placing intermediate cover on areas of exposed waste or cracks. Stockpiles of intermediate cover and capping material to a minimum of 5,000 m^3 will be retained on site to enable this. If the GIWWTP is unavailable, accessible offtakes from the header pipe will be installed to allow leachate to be pumped to tankers.

The proposed concept design for the extension of the leachate collection trench along the southern boundary has also taken into consideration configuration, materials, and long-term structural integrity. Reduced spacing between manhole and pumpstations (70-90 m) will allow for suitable staging of construction and minimise the potential disturbed area should the landfill mass shift during a seismic event. The proposed materials for trench construction were chosen to minimise liquefaction and brittle failure. The rising main connection to the proposed pump stations and power supply should be above ground so as to provide for easy inspection/repair post a seismic event.

Technical Audit

The Geotechnical Investigation Report (GHD) and the Liquefaction and Stability Assessment (GHD) as well as relevant sections of other technical reports, were audited by Matthew Adamson, Associate Geotechnical Engineer, Geotechnics & Mine Waste Engineering, at SLR. Full comments can be found in the following memorandum:

- Technical Memorandum dated 8 November 2023

A summary of the audit comments is provided below. Where recommendations are made, these are shown in *italicised* text below the relevant comment(s).

- The methodology used to perform the slope stability assessment is considered reasonable. The interpretations of the geotechnical parameters based on in-situ field testing and lab results are considered reasonable, with any review comments on the parameters deemed not critical to the overall findings of the slope stability and liquefaction assessment.

- The application contains sufficient geological and geotechnical information to understand the site and the land stability effects associated with the continued operation, closure, and aftercare of the GIL.
- The natural soils were assessed for their liquefaction potential and their behaviour post-earthquake considered in the slope stability assessments. Where the required slope stability factors of safety were not achieved, seismic slope displacement and lateral spreading analysis was performed. Based on the assessment and findings, proposed remedial measures were discussed. Expected differential settlements due to liquefaction were calculated to be reasonably small and anticipated impact on infrastructure was considered to be minimal.
- The slope stability assessment methodology and the cross-sections selected to represent the full range of conditions across the site are considered acceptable. The required factors of safety were met for the static, long-term load cases for all cross-sections. Under SLS seismic, non-liquefaction conditions cross-sections 1, 2 and 6 did not meet the target FoS; however, the anticipated slope displacements were below the allowable limits.
- Under ULS seismic, non-liquefaction conditions, all cross-sections did not meet the target FoS; however, the anticipated slope displacements were below the allowable limits. Lateral spreading was calculated for the ULS seismic, liquified load case with the slope displacements below the allowable limits.
- Localised damage to infrastructure (e.g., pipe work, capping) was identified during and post a ULS seismic event. For the section of the landfill that will experience the largest lateral deformation (but within the tolerable limits), the leachate trench has not been installed.

  Mr Adamson recommends that the proposed new section of leachate collection trench be designed with resilience to these deformations.

- For the remaining sections of the landfill where leachate trenches already exist, differential settlements are expected to be minimal with redundancy measures put in place should a seismic event occur.
- Where the leachate pipes discharge into a buried header pipe and sewer system, remedial actions are proposed in which existing buried sewer systems are replaced with surface pipes which can accommodate ground displacement and movement. These measures are considered reasonable to mitigate the effects of a ULS seismic event.
- The slope stability and liquefaction assessment have provided an understanding of the associated risks and anticipated ground displacements and movements. All cross-sections satisfy the target slope factors of safety together with the displacement tolerance limits for all SLS and ULS load cases considered. Remedial measures have been recommended (by the Applicant) which minimise the level of adverse effects on people and the environment. No additional consent conditions are recommended.

Conclusions

Mr Adamson concludes that:

"No adverse effects are expected due to non-seismic stability conditions. Any differential settlements experienced by subsurface drainage due to liquefaction are expected to be minimal. Lateral spreading and ground movement due to a ULS seismic event can be designed for (for new sections of subsurface drainage) or mitigation and monitoring procedures can be

put in place for existing subsurface drainage infrastructure to limit adverse effects on persons and the environment to within acceptable tolerance levels."

I accept this expert opinion and adopt it for this assessment. Accordingly, adverse geotechnical effects associated with the continued operation, closure, and aftercare of the landfill will be less than minor.

6.6 Flooding and Sea Level Rise Effects

Adverse effects relating to flooding and sea level rise include:

- Surface water flooding in the Kaikorai Stream affecting the operation of the leachate collection trench.
- Higher water levels in the Kaikorai Stream as a result of climate change induced sea level rise increasing inflows to the leachate collection trench.

Applicant Assessment

Low-lying areas adjacent to the GIL site are at risk of flooding from the Kaikorai Stream from the Kaikorai Estuary. ORC hazard mapping indicates the raised main landfill footprint is outside the areas at risk from flooding, but low-lying areas some around the perimeter of the landfill containing the access site road, leachate collection trench and the western sedimentation pond are within this zone.

Flood flows are conservatively expected to increase by approximately 9% by 2050, which is expected to increase flood levels at and around the landfill by 60-100 mm. Given the Kaikorai Stream channel and the estuary in the vicinity of the landfill are low energy environments, this risk of channel scour and erosion impacting the landfill are considered very low. There will be an increased frequency of inundation of the landfill perimeter, which could potentially affect the operation of the leachate collection trench.

ORC hazard mapping also indicates that areas of the estuary and Kaikorai Stream are at risk of storm surge, which is indicative of areas expected to be affected by a long-term sea level risk of up to 0.5 m. This may result in a general increase in water levels within the estuary and Kaikorai Stream and result in an increase in water entering the leachate collection trench.

Modelling results presented in the Groundwater Report suggest slightly higher inflows – in the order of 0.6 L/s – to the leachate collection trench as a result of future 0.5 m rise in sea level rise. This is well within the operating range of the leachate system.

A perimeter road berm extends around the landfill between Kaikorai Stream and the leachate collection trench. The Applicant proposes to raise the level of this perimeter road by approximately 1 m, to form a defence against water and minimise the risk of the leachate collection trench being inundated by floodwaters. It is also proposed to raise the manholes, chambers, and electrical controls for the leachate pump stations above the predicated future flood level. These works will be completed at least six months prior to the final acceptance of waste at the GIL.

This forming of a defence against water will reduce the width of the floodplain over which floodwaters can spread resulting in an increase in flood levels. Assessment shows that for the 1% (1-100 year) annual exceedance probability (**AEP**) event, the loss of flood channel capacity will be minor, and the increase in flood level would be approximately 35 mm downstream of the Kaikorai Stream/Abbotts Creek confluence, and approximately 40 mm

upstream of the confluence. The estimated increase of 35 – 40 mm in peak flood levels is considered very small and is within the limits of accuracy for hydraulic modelling. There would be no anticipated increase in flood risk to residential dwellings as a result of these works.

Overall, the risk posed by flooding and sea level rise will be low, and adverse effects on the environment and persons no more than minor.

Technical Audit
The Groundwater Report (GHD) and Design Report (GHD) as well as relevant sections of other technical reports, were audited by Tim Baker, Technical Discipline Manager – Hydrology and Hydrogeology, at SLR. Full comments can be found in the following memorandum:

- Technical Memorandum, prepared by Tim Baker, dated 10 November 2023.

A summary of the audit comments is provided below.

- It is agreed that the expected increase of flood levels by between 60-100 mm will not significantly impact either the flooding extent in the area of the landfill or the day-to-day operations.
- Raising the perimeter road may reduce the cross-sectional area of the floodplain and result in higher flood levels as the same (or greater with climate change) amount of water must flow through a smaller area.
- The Applicant provided an assessment of the change in flood levels because of the increased height of the perimeter road. This assessment used a simple analytical approach rather than a model and found that the change in flood height would be in the order of 3 to 4 cm. Mr Baker agreed that this was negligible.

Conclusions
The conclusions of the Applicant with respect to the risk posed by flood hazard are supported by the technical audit. Any increase in inflows to the leachate collection trench as a result of increased flows in the Kaikorai Stream are small and well within the operating capacity of the leachate collection system. The change in local flood levels that could result from the increase in the height of the perimeter road will be negligible. In my opinion, adverse effects relating to flooding and sea level rise will be less than minor.

6.7 Effects on groundwater

The proposed continued and extended landfilling at the GIL has the potential to affect groundwater quality and quantity, both in the short term and throughout the closure and aftercare phases. Groundwater quality is influenced by leachate, which migrates down through waste and outwards toward the edge of the landfill. Groundwater quality is also influenced by historic waste deposition; waste was historically deposited onto the estuary sediments, below groundwater level. This includes areas outside the leachate collection trench. The primary mechanism by which offsite adverse groundwater quality effects are minimised is the continuous abstraction (pumping) of combined groundwater/leachate from the leachate collection trench. In doing so, groundwater quantity is affected.

Groundwater is hydraulically connected to surface water in the Kaikorai Stream; therefore, groundwater effects are likely to manifest as adverse surface water effects. Because the Kaikorai Stream, Lagoon, and Estuary have extremely poor water quality already, it is important that leachate is effectively contained to prevent discharges into surface water.

Despite the relationship between ground and surface waters, these assessments are presented separately in this report.

Applicant Assessment

The fundamental assumption in the groundwater report is that the leachate collection trench intercepts all groundwater and prevents offsite migration. The trench intercepts any leachate flowing from the landfill but also draws groundwater from the area outside of the trench. Modelling indicates that approximately 30% of the water pumped from the trench is derived from groundwater on the outside of the trench, in areas where the trench is close to Kaikorai Stream. This volume is estimated to be <0.5 L/s for the entire trench length.

Leachate volumes for current and proposed landfill scenarios were modelled. The model estimated a flow rate to the trench of approximately 1 L/s which is in line with the current recorded flows. The modelled leachate head was similar to measured levels, although the very high leachate head in the centre of the landfill could not be simulated. Numerical modelling indicates that future leachate volumes at closure are likely to be similar (in order of 2-3 L/s).

The volume of pumped leachate, groundwater, and stormwater from the leachate collection system over the 2021 – 2022 monitoring year was 1.6 L/s or 5,780 L/hour. In the past five years the combined pumping rates from the leachate collection system have been between 1 – 2 L/s, peaking up to 8 – 9 L/s after periods of rainfall.

Groundwater quality within the landfill site is impacted by leachate, as evidenced by monitoring from the wells located inside the leachate collection trench (A and B wells). In some areas, historic waste is present outside the leachate collection trench, and this groundwater is similarly impacted by leachate. The impacts of the waste located outside the leachate collection trench are managed through the operation of the leachate collection system, which pulls groundwater/leachate from both sides of the trench. Water chemistry data from water pumped from the trench shows a mixing of leachate and groundwater.

The collection trench is not embedded into the underlying Abbottsford Formation mudstone. Therefore, although the leachate collection trench creates a hydraulic barrier to offsite leachate migration, it does not preclude offsite leachate migration if there is a pathway for leachate to migrate into the LKEM and move under the trench. However, the underlying artesian groundwater conditions combined with the low permeability of the LKEM and Abbottsford Mudstone help impede any bypass of the trench. There is no evidence of groundwater flow occurring to the southeast, under the landfill and towards the coast. A mudstone ridge prevents such flow.

If the leachate pumps were to fail for a prolonged period of time (weeks) the modelling shows that leachate flows would reverse, and flow into Kaikorai Stream at an estimated rate of 0.5-0.8 L/s (0.2% of the mean flow of the Kaikorai Stream). This scenario is very unlikely as there would be a time lag of several weeks for leachate levels to rise in the trench before the modelled flow rate was achieved. Furthermore, redundancy in the pump system allows leachate to bypass a shutdown pump station and be collected by other pump stations. It is unlikely that all pump stations would be out of action for an extended period of time.

The leachate collection trench does not extend around the southern perimeter, and a surface leachate drain intercepts leachate-impacted surface runoff and groundwater and conveys it

to PS1. The surface drain may not capture all leachate and is less effective at lowering leachate levels in the landfill. There is also potential for leachate in the drain to contaminate the nearby surface water drain via the bedding material of the adjacent main sewer line.
Impacts on groundwater quality from leachate, and related impacts on groundwater quantity associated with pumping, are minimised through the management of surface waters on the site, as described in Section 3.5 of this report. Essentially, by diverting surface runoff from areas of previously placed waste, the infiltration of water into waste, and the subsequent generation of leachate, is minimised.

The proposal includes the installation of a leachate collection trench in the southern valley; this will intercept leachate flowing from the southern side of the landfill. However, there will still be a gap in the leachate trench between MH8 and PS9. This area of the landfill sits directly on a ridge of Abbotsford Mudstone Formation. The mudstone forms an effectively impermeable barrier to flow, therefore leachate migration off site is unlikely.

Other proposed improvements include installation of additional internal landfill leachate drains, submersible pumps in LFG wells to pump leachate, repair of the damaged culvert that is currently allowing leachate to seep in and be discharged into the eastern constructed wetland, and fitting of shut off valves in the eastern and western sedimentation ponds to enable the containment of any contaminants that may enter these ponds.

The Applicant has proposed conditions of consent relating to improvements of the leachate collection system, remediation of known faults, separation of water types, management of spills and weather events, and monitoring of groundwater. Proposed monitoring, summarised in Section 8.3.6 of the Applicant's AEE, is similar to existing monitoring, with some changes suggested. An additional deep well (located to the southwest, downgradient, in the estuarine sediments) has been added to the monitoring schedule.

The underlying KEF and Abbottsford Formation are not used for groundwater supply. There are no known users of groundwater close to or downgradient of the site. Therefore, any localised reduction in groundwater levels, or changes to groundwater quality around the landfill perimeter will not affect any groundwater users. With respect to the use of the site after closure, there is no proposal to reuse or apply groundwater to land i.e. via irrigation so there will be no impacts on any future users of the site.

In summary, the leachate collection trench operates by drawing down water levels in areas immediately adjacent to the trench. This intercepts any leachate flowing from the landfill but also draws groundwater from the area outside of the trench. Several proposed improvements to the leachate collection and management system are proposed, the most significant of which is the extension of the leachate trench around the southern perimeter of the site. Effects on groundwater quantity and quality are expected to manifest in surface water if they are occurring. The Applicant finds that the effect on connected surface water flows from groundwater abstraction will be negligible and no discernible effect on surface water quality from leachate and other contaminants is expected. Accordingly, adverse effects on the environment and any persons are expected to be low and no more than minor.

Technical Audit
The Groundwater Report (GHD) as well as relevant sections of other technical reports, were audited by Anna Lukey, Technical Director – Environment, and Tim Baker, Technical Discipline Manager – Hydrology and Hydrogeology, at SLR Consulting (**SLR**). Full comments can be found in the following memoranda:

- Technical Memorandum, prepared by Anna Lukey, dated 10 November 2023.
- Technical Memorandum, prepared by Tim Baker, dated 10 November 2023.
- Technical Memorandum, prepared by Tim Baker, dated 24 October 2024.

A summary of the audit comments is provided below. Where recommendations are made, these are shown in *italicised* text below the relevant comment.

- The fundamental assumption in the Groundwater Report is that the leachate trench intercepts all groundwater and prevents offsite migration. Ms Lukey and Mr Baker hold the opinion that there is insufficient offsite groundwater quality and level data to be confident in this conclusion and believe there is potential for leachate to be moving in groundwater beneath the leachate trench.
- There is potential for former drainage channels to be acting as preferential pathways for offsite leachate migration.
- Leachate indicators zinc, boron, and ammoniacal-nitrogen have been observed in GIL C and D wells (i.e. outside the leachate trench). The Applicant attributes these to reduced conditions in organic estuarine sediments.
- In contrast, the Human Health and Environmental Risk Assessment (**HHERA**) notes that zinc and PFAS were detected in groundwater samples at concentrations above ambient levels, which suggests that groundwater is a source of these chemicals.
- Mr Baker is familiar with the closed Fairfield Landfill, located on the opposite side of the Kaikorai Lagoon, where zinc, boron, and ammoniacal-nitrogen present in monitoring wells outside that landfill's leachate trench are attributed to leachate from the landfill. Leachate is suspected to travel up to 1.2 km through estuarine sediments.
- Taking these points into account, Mr Baker recommends:

  Further investigation as to the source of these contaminants (leachate indicators zinc boron, and ammoniacal-nitrogen).

- The Applicant proposes to continue the groundwater (quality) monitoring in line with current consent conditions, with some exceptions. These exceptions are valid. The monitoring parameters are generally consistent with the WasteMINZ Guidelines, with the exception of copper.

  Mr Baker recommends that copper be added to the monitoring programme.

- The 2023 audit recommended that a Groundwater Monitoring and Contingency Plan be developed to provide more information about the potential for offsite migration of leachate. In response, the Applicant updated the proposed consent conditions. In general, this provides a good framework for management of groundwater at the site. In addition to this monitoring, Mr Baker recommends:

  That further deep wells are added to the monitoring programme; at a minimum, a deep well should be added to both monitoring lines 1 and 3.

  That a further set of monitoring wells covering the three main geological units (including the Abbottsford Formation) in the southwest corner of the property to provide more information on the potential for offsite migration of leachate and is

aligned with the historic estuarine channel locations, which may form preferential flow paths.

That all wells are surveyed, and information is collected on well construction, where this is available.

- The addition of deep well MW103 to the monitoring programme is supported.
- With respect to modelling, Mr Baker has minor reservations about whether the HELP modelling has considered the predicted 10% increase in rainfall for the Otago Region and whether the assumptions around hydraulic gradients across the main geological unit are valid. However, on balance, he finds that the application of the HELP model and the SEEP/W model are appropriate, and the models appear to be a fair representation of the long-term leachate/seepage process.
- The SEEP/W modelling considers the effects of sea level rise on to inflows into the leachate trench and finds negligible change in inflows across all scenarios.
- The assessment of the stream depletion effects resulting from the groundwater take have been assessed using the results of the SEEP/W model which predicts leachate flow into the collection trench. The modelling results align relatively well with the observed leachate pumping records. Mr Baker agrees that the modelled 0.5 L/s sourced from the stream side of the trench is insignificant in relation to the mean flow and mean annual low flow of the Kaikorai Stream.

  Mr Baker recommends that the modelling outputs and inherent uncertainty are validated through a robust long-term monitoring programme of groundwater levels and leachate trench outflow rates.

- Any localised reduction in groundwater levels, or changes to groundwater quality around the landfill perimeter, will not affect any groundwater users, because the groundwater in this area is not used for abstractive purposes.
- With respect to groundwater abstraction, there are no adverse cumulative effects to consider because the long-term abstraction volumes are very small compared to surface flows, the tidal influence on estuary levels, and likely regional groundwater flows.
- With respect to groundwater quality, cumulative effects have not specifically been assessed in the application.
- With respect to the use of the site after closure, leachate breakout remains a risk to future land users. This risk could be reduced through management of leachate head.

Conclusions

Based on the comments from Mr Baker, the Applicant's assessment appears to cover the broad matters of relevance. The application of the models is appropriate and are a good representation of the long-term leachate flows. The proposed groundwater monitoring parameters are generally in line with best practice.

However, there remain three important areas of concern:

- Whether the conceptual site model, which is based on the leachate collection trench intercepting all leachate before it migrates of site, is valid.
- Whether the current and proposed monitoring well network sufficiently covers the areas of highest risk to groundwater, being the areas down gradient of the landfill, and adjacent to the area of high leachate head and historic stream diversions.

- Whether the elevated levels of ammoniacal-nitrogen, boron, and zinc (all leachate indicators) are attributable to natural estuarine conditions, or another source.

Mr Baker remains of the opinion there is not enough site-specific downgradient groundwater data to determine the level of adverse effect on groundwater. Further data in the form of downgradient monitoring wells screened within the three geologic units is required to assess the impact to groundwater at these different depths.

I am therefore unable to support the Applicant's conclusion that there will be no more than minor adverse effects.

6.8 Effects on surface water

Potential adverse effects on surface water from the continued operation, expansion, closure, and aftercare of the GIL include changes to water level in the Kaikorai Stream, which is hydraulically connected to the leachate collection trench, and effects on surface water quality from leachate and from stormwater discharges.

Applicant Assessment

The conclusions in the surface water report are predicated on the fundamental assumption that the leachate collection trench captures all leachate. Only the effects associated with stormwater discharges and works on the landfill that could affect stormwater quality are discussed. Effects relating to the potential loss of leachate to the environment are discussed in the groundwater report.

The receiving environment with respect to surface water is the Kaikorai Stream and Estuary. Surface runoff water from the landfill is discharged to the Kaikorai Stream and Estuary, either directly, in the case of clean water, or indirectly via sedimentation ponds and constructed wetlands, in the case of stormwater. Leachate is not intentionally discharged to surface water.

Surface water monitoring is undertaken in sedimentation ponds on a quarterly basis. The quality of the water in the ponds is assumed to be indicative of the quality of the discharge that will occur to the Kaikorai Stream. This is a conservative assumption because the sampling location is the outlet into the ponds prior to any settlement of sediment or adsorptions of contaminants onto sediment. Sampling is for a range of parameters, including metals, pH, and nutrients.

The historical data set for dissolved metals in the eastern and western sedimentation ponds does not indicate persistent and significant levels of contamination of pond waters, with results from the last year all below the relevant trigger levels set in consent conditions. This also applies to nutrient concentrations. When compared to the ANZG (2018) default guideline values for 80% species protection, some analytes exceed the guideline values. This is not unexpected as these guidelines are not intended to be used for unnatural systems such as stormwater treatment ponds. PFAS is present in all onsite artificial waterbodies at similar concentrations, and all below the PFAS National Environmental Management Plan version 2.0 95% species protection guidelines.

Water in the northern leachate pond is conservatively treated as leachate and is discharged to the leachate collection trench via the outlet pipe. During prolonged high rainfalls, this pond may overflow into swales and thereafter into Kaikorai Stream. These overflows are infrequent, occur only during times of high rainfall when Kaikorai Stream has high flows, and

the quality of the water in the pond is approaching clean water. Effects on the receiving environment are considered less than minor. Following closure of the landfill when there is no longer a need to treat the pond's catchment as a leachate catchment, this will be converted to a sedimentation pond. Adverse effects associated with any discharge from this pond will reduce further.

The eastern constructed wetland is currently impacted by leachate, which appears to be entering this wetland via the damaged culvert from the southeastern constructed wetlands. Surface water monitoring in Kaikorai Stream downstream of the discharge from this wetland shows no discernible impact on water quality. Regardless, remedial works to repair the damaged culvert will be completed by March 2025.

Surface water monitoring is also undertaken in the receiving environment, at locations upstream, adjacent to, and downstream of the GIL. Data indicate that all sites exhibited the influence of an impacted urban to peri-urban catchment, with upstream sites exhibiting dissolved metal concentrations that would be expected in these types of land use settings. Samples from locations adjacent to and downstream of the landfill do not exhibit any significant changes in dissolved metal concentrations that would be a strong indicator of leachate discharge to the environment. There are some exceedances of the ANZG (2018) default guideline values for 80% species protection. Variability in conductivity readings for adjacent and downstream sites are reflective of the estuarine environment and the tidal influence at these locations. The nutrient suite similarly indicates a lack of direct and significant water quality impacts from the landfill. Cyanide has been recorded on occasion at all sites. PFAS was recorded both up and downstream, with downstream concentrations being slightly elevated with respect to upstream, noting that the dataset was limited. All PFAS concentrations were below the 95% species protection guidelines.

Based on sampling results, the Applicant considers that there are no demonstrable adverse effects on surface water quality within the Kaikorai Stream associated with the surface water discharges from the site, noting that the catchment is a heavily modified catchment.

The interim HHERA evaluates whether contamination originating from the landfill may represent a risk to human users or the environment of the catchment. A Tier 1 risk assessment was undertaken, whereby the concentrations of chemicals measured onsite and within the receiving environment were compared with conservative screening levels provided by National or International Guidelines and the chemical concentrations measured upstream of the landfill. This assessment identified that the chemical concentrations measured in surface water samples collected downstream of the landfill have generally been consistent with those measured upstream and/or below the relevant Tier 1 screening criteria. On this basis, it was concluded that discharges from the site into the receiving environment of the Kaikorai Stream generally represent a low risk to human users of the waterway and the aquatic environment. A number of chemicals, including nitrate, zinc and PFAS were identified at concentrations above the Tier 1 screening criteria, in samples collected both upstream and downstream from the landfill, suggesting contributions from across the catchment.

The conclusions of the HHERA are based on limited data and may not adequately capture situations where pulses of surface water flow from the artificial waterbodies on the landfill to the Kaikorai Stream. Nonetheless, the Applicant concludes that the available monitoring data does not indicate a discernible impact on surface water quality from the landfill.

The proposed ongoing filling of the GIL and subsequent closure activities will be undertaken in accordance with the current site procedures, including maintenance of the existing site controls such as the sedimentation ponds. No additional adverse effects are expected from the ongoing filling and closure activities.

The Applicant proposes a monitoring programme, linked with the proposed groundwater monitoring, which considers a suite of parameters and includes quarterly and annual sampling, with comparison of results to a series of relevant guidelines.

In conclusion, the Applicant considers that the landfill is having no discernible impact on surface water quality in the receiving environment. Linking surface water quantity effects to the groundwater assessment (refer Section 6.7 of this report) the Applicant considers the effect on connected surface water flows from the abstraction of groundwater from the leachate trench will be negligible. Adverse effects on the environment and any persons are expected to be low and no more than minor.

Technical Audit

The Surface Water Report (GHD) and Human Health and Environment Risk Assessment, as well as relevant sections of other technical reports, were audited by Claire Conwell, Principal Consultant – Ecology and Marine Science, at SLR. Full comments can be found in the following memoranda:

- Technical Memorandum dated 9 November 2023.
- Technical Memorandum dated 24 October 2024.

A summary of the audit comments is provided below. Where recommendations are made, these are shown in *italicised* text below the relevant comment.

<u>General Comments</u>

- The application identifies all relevant sensitive areas and receptors but does not fully describe the attributes of the sensitive areas.
- Dr Conwell reiterates that the key assumption applied to the Surface Water Report is that all of the leachate generated on site is collected via the leachate collection trench.
- In this regard, Dr Conwell's memorandum carries over the following key uncertainties from Mr Baker's 2024 groundwater memorandum:
    - That there remains potential for groundwater flows beneath the leachate collection trench; and
    - There is insufficient offsite groundwater quality and level data to be conclusively demonstrate that the leachate collection trench intercepts all leachate.
- Water quality results have been benchmarked against appropriate guidelines; however, it is not correct to assume that no exceedance of guideline values equates to no discharge of leachate.
- The improvements to the leachate collection system, and the additional mitigations measures to repair the damaged culvert linking the wetlands, respond to climate change, and install shut-off valves for emergency stormwater management, should be effective in improving the quality of water discharged to the surface water receiving environment.

<u>Effects and Assessment Methods</u>

- Any adverse effects on surface water are likely to be cumulative effects, rather than acute toxicological effects from the landfill. This is supported by the available water chemistry data which notes very few exceedances of default guideline values or national bottom-line criteria.
- Low level and diffuse discharges of leachate contaminants via groundwater to the surface water environment would result in chronic, long-term cumulative impacts.
- The assessment is confounded to an extent by the influence of activities in the upper catchment which are contributing contaminants to the downstream receiving environment, and by the limited integration of the surface water quality data into the ecological impact assessment.
- These have not been adequately addressed in the Surface Water Report or the HHERA. An integrated assessment across ecological, surface water, and HHERA is required to appropriately assess any cumulative effects.

  Further assessment of ecological effects, including ecotoxicological reviews, is recommended.

- In 2023, Dr Conwell recommended that an adaptive management plan be developed, to apply to all receiving environment monitoring, but particularly surface water. In response, the Applicant volunteered a consent condition requiring that the HHERA be reviewed and updated after a further three years of monitoring, acknowledging that this may drive the need for adaptation of the monitoring programme.
- The goal of the HHERA to provide an integrated assessment of risks to human health and ecological receptors is supported. However, the framework currently presented in the HHERA falls short of fully integrating the nuanced ecological values and sensitivities, including mahinga kai.
- Dr Conwell agrees that there is some uncertainty with the available dataset and that the sampling undertaken to date may not adequately capture situations where pulses of surface water from the landfill ponds flow into the Kaikorai Stream.
- Dr Conwell does not agree that the 'no discernible impact' conclusion in the HHERA has been robustly supported, nor have the risks to human health and the environment from PFAS, metal contaminants, and nutrients (ammoniacal-nitrogen and nitrate) been robustly assessed.
- Results for dissolved zinc concentrations are not available for review. Surface water quality monitoring for zinc is presented in the HHERA but it is not clear what the source of this data is.
- Dr Conwell recommends that future updates of the HHERA integrate the following three approaches:

  - *Risk management – Guidelines AS ISO 31000:2018; (Standards Australia 2018); and*
  - *EIANZ Ecological Impact Assessment Guidelines (EcIA) (Roper-Lindsay et al., 2018); and*
  - *An assessment of risk quotients.*

- The surface water quality assessment does not include any further statistical analyses beyond summary statistics. Doing so would assist to confirm the conclusion that there are no discernible effects on offsite stormwater quality from the landfill from stormwater or leachate. This was a recommendation of the 2023 memorandum. The Applicant did not undertake any additional assessment in response to this recommendation. As such, this recommendation remains:

Dr Conwell recommends that statistical summaries and time trends analyses be undertaken to inform the integrated assessment of effects with respect to cumulative effects and inform the HHERA.

- The framework and thresholds adopted in the HHERA are incomplete, and the conclusions cannot be supported by the current assessment provided.

Monitoring

- The Applicant has proposed appropriate monitoring locations with respect to surface water.
- The Applicant has proposed mostly appropriate monitoring parameters that are generally consistent with the WasteMINZ guidance. The following recommendations are made:

  Total hardness should be included in the major ions suite.

  Dissolved organic carbon should be included to enable default guideline values for select metals to be adjusted according to local conditions.

  Copper should be included in the metal suite.

- The conditions of consent proposed by the Applicant reduce the surface water quality monitoring for key metal contaminants to an annual schedule. This means that the data set used to inform any update to the HHERA will be significantly compromised and will not be adequate to inform any requirements for action or to undertake adaptive management responses.
- The proposed monitoring will not adequately compensate for the data gaps identified in the HHERA.
- The proposed monitoring schedule is not adequate to robustly inform any assessment of adverse effects on water quality or to inform any updated HHERA assessments, particularly while the landfill continues to receive waste, and for the immediate period following closure. It is recommended that:

  The quarterly monitoring schedule retains the analysis of dissolved metals and includes both zinc and copper along with the other analytes.

  A consent condition explicitly requires further ecological assessments.

  Ongoing periodic reviews of the HHERA are undertaken for the duration of the consent.

Conclusions

- A rationale for the ability to assess, based on the proposed monitoring, whether contaminants are being discharged offsite, has not been provided by the Applicant.
- The assessment of no adverse effects to water quality, in particular in regard to the assessment of cumulative effects, has not been supported on the basis of the currently available data. The data requires further interrogation, including assessment of long-term median, 95th percentile, and seasonal time trends analyses, to support the conclusions set out in the 2024 SW report and HHERA.

Conclusions

The Applicant concludes that there are no discernible impacts on surface water quality attributable to the landfill. Dr Conwell considers that sufficient information has not been provided to support this conclusion. The fact that default guideline values are generally not exceeded does not suggest, without further evidence, that there is no discharge of leachate into the receiving environment, especially in this heavily impacted catchment, nor does it mean that there are no adverse effects occurring. Several recommendations are made in relation to future monitoring and assessment methods, which would assist in supporting or refuting the assertions of the applicant, but these have not been adopted by the Applicant. Without these, there is insufficient data to have confidence about the level of adverse effect on surface water, and the proposed monitoring is not sufficient to enable ongoing identification of any effects, nor enable these to be managed adaptively.

I am therefore unable to support the Applicant's conclusion that there will be no more than minor adverse effects.

6.9 Ecological effects

Potential ecological effects from the continued operation, expansion, closure, and aftercare of the GIL include clearance of vegetation which may provide habitat for indigenous fauna; toxicity effects on the aquatic environment and fauna from leachate migration into groundwater and surface water, or from sediment discharges; or effects on avifauna from loss of landfill food supply, disturbance, and impacts on foraging ability.

Applicant Assessment

Terrestrial Ecology

No clearance of vegetation is required outside of the landfill footprint. Vegetation clearance within the landfill footprint is unlikely to be of ecological concern, as any vegetation that may be cleared comprises mostly exotic species and will result in a very low level of ecological effect.

Aquatic Ecology

Stream depletion could pose a risk to aquatic habitat within the stream. Groundwater modelling indicates that approximately 30% of the water pumped from the leachate collection trench is derived from groundwater/connected surface water on the outside of the trench. This translates to approximately 0.5 L/s for the entire trench length. This is insignificant in relation to the mean flow and mean annual low flow of the Kaikorai Stream. Stream depletion will have a very low level of ecological effect on the stream.

Earthworks associated with ongoing landfilling and the construction of the final landfill cap could result in sediment discharges. Sediment deposition in Kaikorai Stream or Kaikorai Estuary could adversely affect habitat and increase mud content within the estuary. Sampling indicates that mud content is not high in the estuary, at approximately 26.2%, with sand being the dominant substrate type. The management of stormwater, which can entrain sediment, on the landfill site involves sedimentation ponds and constructed wetlands which avoid or minimise the discharge of sediment to the receiving environment. Additionally, an erosion and sediment control plan will be implemented for the construction of the final cap. This management is proposed to continue and to be effective, resulting in a very low level of ecological effect.

The Applicant maintains that there is no substantive evidence that leachate is entering the receiving environment, However, if leachate were to enter Kaikorai Stream or Estuary, it

could impact aquatic fauna through changes in water quality. The Ecological Impact Assessment Report relies on the Groundwater and Surface Water Reports, in addition to ecological data collected for the impact assessment. The ecological data indicates that stream health is compromised in sites both upstream and downstream of the GIL. An ecotoxicology study indicates the potential presence of organic contaminants in the surface water of Kaikorai Stream; however, extracts taken from ground and surface water showed no or low toxicity in the ecotoxicological test on blue mussel embryos. A greater toxicity effect from surface water much further downstream, which is interpreted as suggesting that there are likely additional downstream stressors not directly associated with landfill leachate. Overall, a very low level of ecological effect is expected.

Birds

The recent implementation of the kerbside collection programme in Dunedin has reduced the amount of putrescible waste entering the landfill, and as a result has reduced the food supply available for the significant population of SBBG. Eventual closure of the GIL will further reduce this food supply. Other actions to limit food supply and prevent the breeding success of the SBBG will also be undertaken in accordance with the SBBG Management Plan, which is required by the Smooth Hill Landfill consent conditions to be implemented. While the magnitude of effect on the SBBG population will be high, their ecological value is rated as low; therefore, the level of ecological effect will be very low.

Avifauna foraging and roosting behaviours can be disturbed during landfill construction works, and also during regular landfill operations. Disturbance work is generally temporary and associated with infrastructure maintenance or improvements on site. This is unlikely to change from the current level. Operational activities will significantly reduce after closure. These activities will have a very low ecological effect on birds.

The discharge of leachate into surface water, if this were to occur, could impact upon the amount and quality of the food supply for avifauna, particularly taking into account the impacted water quality in the catchment. Based on the findings of the Surface Water Report, that there will be no discernible adverse effects on water quality either during continued operation, closure, or aftercare of the landfill, the level of ecological effect is rated very low to low.

The discharge of sediment to the estuary could impact on the foraging behaviour of birds. Sediment is expected to be adequately managed through sediment retention ponds and erosion and sediment control measures for the continued operation of the landfill. During and after closure, sediment discharges are expected to reduce, noting that they are not considered to be high currently, so a discernible reduction is not expected, and the foraging behaviour of birds is not likely to change. The level of ecological effect is rated very low to low.

Red billed gulls roost on the roofs of some buildings. Some of these buildings will be removed as part of closure activities, but others will remain. Additionally, there are ample alternative structures, roofs, and natural habitat nearby and in the wider area. Therefore, the level of ecological effect on red billed gulls is very low.

Technical Audit

The Ecological Impact Assessment, Bird Risk Assessment Report, and Draft Southern Black Backed Gull Management Plan, as well as relevant sections of other technical reports, were

audited by Elizabeth Morrison, Principal Ecologist, at SLR. Full comments can be found in the following memoranda:

- Technical Memorandum dated 9 November 2023, and updated 23 October 2024.

A summary of the audit comments is provided below. Where recommendations are made, these are shown in *italicised* text below the relevant comment.

- The ecological assessment clearly indicates the methods used, data sources, and data analysis methods.
- The assessment focuses mostly on the receiving environment upstream and downstream of the landfill, with minimal discussion on the onsite constructed ponds and wetlands.
- The scope and scale of the assessment is considered appropriate.
- Revegetation and restoration at the site alongside closure will provide a significant ecological benefit to the receiving environment.
- A comprehensive assessment has been undertaken on the potential effect on birds and the anticipated level of effect is agreed.
- The ecological conditions proposed in relation to the revegetation plan and updated bird management plan are supported. The following recommendations are made by Ms Morrison:

  *The Vegetation Management and Restoration Plan (**VMRP**) should be in accordance with the draft framework and should be available for certification by a suitably qualified expert. This plan should be referenced in the Landfill Closure Management Plan.*

  A condition requiring implementation of the VMRP within a timeframe should be imposed.

- Consent conditions recommended in other SLR memoranda are supported by Ms Morrison, in particular those of the Surface Water Memorandum of Dr Conwell. No other ecological conditions are recommended.
- The description of the sensitive receiving environment identifies key features and is considered appropriate, although the attributes of the sensitive areas surrounding the site are only discussed very broadly, and other potentially sensitive areas are not described.
- Aquatic ecology was assessed as part of field assessments and instream sampling, in addition to a desktop assessment. This provided an appropriate assessment of the macroinvertebrate community, instream habitat and native fish communities of the Kaikorai Stream in the vicinity of the landfill, and at up and downstream monitoring sites, with those present found to be tolerant (able to tolerate some level of pollution) freshwater communities.
- Freshwater ecological values have been described through comparing to upstream monitoring sites which are not directly comparable given the saline influenced waters adjacent the site.
- The ecological assessment only describes the natural character of the watercourse and wetland at a very broad scale. Further detail was sought on the actual extent of wetland habitats including updating plans to show associated tributaries and channels, but this was not provided. Regardless, the information provided is considered sufficient to describe the natural character of this area.

- Cumulative effects have not been discussed in the ecological assessment and there is a lack of integration between the surface water and ecology assessments. Continued monitoring is recommended as set out in Dr Conwell's memorandum.
- Ms Morrison agrees that the groundwater drawdown will have a negligible effect on the aquatic environment.
- There are indicators of some unaccounted-for leachate loss to the receiving environment. Ecotoxicity tests recorded increased toxicity downstream of the landfill. The ecological assessment assigned the cause of this to other ecological stressors not associated with the landfill. This conclusion is likely to be incorrect as old stream channels beneath the landfill, in conjunction with the leachate trench location, may provide pathways for unrecognised leachate loss.

Conclusions

In conclusion, the Applicant finds that adverse ecological effects are expected to be low to very low. Based on the comments from Ms Morrison, while there are areas of the proposal where further detail of the existing site would have been desirable, the information provided is generally sufficient to describe terrestrial and aquatic ecological values of the site and the impacts of the landfill operations on these, and Ms Morrison in generally in agreement with the Applicant's adverse effects assessment. Reservations are held about the ecotoxicology effects, but these are primarily addressed in the Surface Water Memorandum rather than by Ms Morrison. Ongoing monitoring is recommended in accordance with the Groundwater and Surface Water memoranda.

Taking into account the findings of the groundwater and surface water audits, I consider that there remains a degree of uncertainty about the level of aquatic ecological effect on Kaikorai Stream and Lagoon. Other ecological effects are expected to be no more than minor.

6.10 Effects relating to Bird Hazards and Pests

Landfills represent a source of food for pest animals, which may include birds and vermin.

Applicant Assessment

Birds

Putrescible waste is attractive as a food source for several bird species. Landfills that provide access to putrescible wastes can significantly influence local bird populations, by increasing breeding activity, population size, and resulting in behaviours that are increasingly urbanised. When this occurs close to airports, it can result in the increase in bird strike risk, compromising aviation safety.

The New Zealand Aviation Authority (**CAA**) and International Civil Aviation Authority (**ICAO**) guidance recommends that landfills be located no closer than 13km from an airport, such as Dunedin International Airport. GIL is located approximately 16km from Dunedin and is therefore consistent with this guidance. However, Dunedin airport has a high bird strike risk, and any land use changes should aim to ensure that risk is not exacerbated.

By far the most significant hazard to aviation in New Zealand are gulls, particularly the SBBG. The GIL supports a SBBG population in the thousands and red-billed gulls in the low hundreds. The recent commencement of the kerbside food and organic collection service in Dunedin has removed most of the putrescible waste from the waste stream. This and the eventual closure of the landfill will result in this food source being lost to birds. In the short-medium term as populations readjust to the reduced availability of food, birds are likely to

search for alternative food sources nearby, potentially bringing them into aircraft flight paths and presenting an aviation hazard. In the long-term, bird populations reliant on the landfill are likely to stabilise at lower levels, and any resultant bird strike hazard will reduce.

To address the medium probability of an increased bird strike hazard arising from SBBG dispersing after the removal of most of the putrescible waste, and ultimate closure of the landfill, it is proposed to implement a comprehensive SGGB Management Plan. The development of this plan is already a requirement of condition 52 of the Discharge Permit RM20.280.01 for the Smooth Hill Landfill.

This plan has been developed in consultation with Te Rūnanga o Ōtākou, the Department of Conservation (**DoC**), and Dunedin International Airport Limited (**DIAL**). As this plan already specifically considers the impact of the closure of the GIL, including any adverse bird hazard effects associated with closure, I do not consider that it is appropriate to reassess this here.

Consent conditions proposed by the Applicant require the Applicant to implement the SBBG Management Plan, or any subsequent updates to this plan, during the operation of the landfill.

Pests

Vermin such as rats, mice, and feral cats can be attracted to the landfill food source or be brought to site within waste. Vermin can spread disease, cause property destruction, and contaminate food. Flies may become a problem over summer months and are capable of transmitting salmonella and other food-borne diseases. As for birds, the implementation of the kerbside food and organic collection service in Dunedin has removed most of the putrescible waste from the waste stream and reduced the source of food and attraction for pests.

The LDMP includes various measures for controlling pests and flies. These include implementing good housekeeping practices; thorough compaction of waste and application of daily and intermediate cover; and regular inspection by pest control contractors and setting of bait stations, or use of insecticide sprays for flies. Consent conditions proposed by the Applicant require mammalian pests (including rodents, mustelids, and feral cats) within the landfill operational area to be eradicated as far as possible and require the LDMP to contain practices and procedures for pest management including eradication methods and pest monitoring.

Conclusions

Adverse effects relating to bird hazard will be addressed via the SBBG Management Plan to ensure there is no increased risk to aviation hazard associated with the continued operation and closure of the GIL. As this plan already specifically considers the impact of the closure of the GIL, including any adverse bird hazard effects associated with closure, I do not consider that it is appropriate to reassess this here. Adverse effects relating to other pest species will be managed by the LDMP and by professional pest control operators. I consider that these measures are reasonable. I therefore agree with the Applicant's assessment that bird hazard and pest effects will be appropriately managed to ensure that they are low and no more than minor upon the environment or persons.

6.11 Effects on air quality

Potential air quality effects from the continued operation, expansion, closure, and aftercare of the GIL include odour, dust, combustion emissions, and lateral migration of LFG from the landfill.

Applicant Assessment

Sensitive receptors include any person, location, or system that may be susceptible to changes in 'abiotic' factors as a consequence of odours and emissions of dust from landfill operations, and emissions from combustion of LFG by engine or flare. The nearest sensitive receptors in each direction have been reviewed and are identified in Table 3 and Figure 15.

Odour

The complaint history for the landfill indicates that odour from the existing operations is leading to impacts at the nearby sensitive receptors. Between July 2017 and August 2022, 145 complaints were received, the majority of which (91 out of the 112 complaints that provided a location) came from the southeast of the site. Receptor cluster R01, located 120 m from the landfill footprint, was the source of the most complaints, with 54 complaints from Clariton Avenue, 16 from Brighton Road, 17 from Allen Road, and 4 from other streets. The Air Quality Report states that it is important to recognise that any odour impact which leads to a complaint is generally considered 'offensive'.

An assessment of odour effects has involved a review of the existing operation and compliance history, followed by a qualitative assessment of the odour impact using the FIDOL (frequency, intensity, duration, effectiveness, and location) factors. The outcomes of the FIDOL assessment were:

- Frequency – Light winds with speeds < 3 m/s have the greatest potential to cause odour impacts off-site. One of the sensitive receptor clusters (R05) located southwest of the landfill is in an area where low winds occur a moderate (2 – 6%) amount of the time. The nearest receptor cluster R01 and ecological receptor R09 are expected to receive light winds from the site for a low (2%) amount of the year.

- Intensity – Based on complaint data odour intensity is causing impacts at the nearby sensitive receptors. Most of the odour complaints are due to impacts at the nearest residential cluster, Green Island suburb (southeast) (R01), which is approximately 120 m east of the site.

- Duration – Based on the complaint data the duration of odour impacts ranged from less than an hour to more extended periods; however, more than half of the complaints where duration was specified were due to odours which lasted for 1 day or less. Where the specified duration was 1 week or more, this was believed to be due to intermittent odour impacts.

- Offensiveness – Generally any odour impact which leads to a complaint is considered offensive; however, based on the comments provided with each complaint a range of odour offensiveness was observed.

- Location – The most impacted area based on complaint data was the Green Island suburb (southeast) residential cluster likely due to the close proximity of these receptors.

Based on the findings of the FIDOL assessment, a range of management and mitigation measures were proposed by the applicant. These are described in detail in the Air Quality Report and in Table 21 of the AEE. These mitigation measures are based on existing operational practices and amended where necessary to reflect best practice adopted at other New Zealand landfills. Mitigations are proposed for the LFG flare and engine; odorous deliveries including from wastewater treatment plants; sludges; the tip face; irregular activities; unfavourable meteorological conditions; and general odour emission sources.

The proposed site layout and operations were also assessed to understand the possible changes to air quality impacts at sensitive receptors. The FIDOL assessment was then repeated taking these mitigations and site changes into account.

- The *frequency* of low winds will remain unchanged. While sensitive receptors (R05) and R09 are at a location where low winds (<3 m/s) occur a moderate amount of time, these wind conditions would have to coincide with significant odour being generated by the landfill for adverse effects to occur.

- Continued site operations are expected to result in a low *intensity* of odour impacts from general operations, and be mitigated by maintaining good housekeeping standards onsite, having cover available in case of unexpected odorous deliveries, and minimising activities where possible on days with unfavourable meteorological conditions.

- The *duration* of impacts will be reduced by procedures which identify odour sources as soon as possible and application of mitigation measures such as cover to minimise emissions. For odorous deliveries including those from wastewater treatment plants, planning for receival and prioritising the processing of odorous wastes will reduce the duration of emissions. Establishing maintenance agreements and replacing the existing candlestick flare with an enclosed flare as a backup will minimise the duration of interruption to LFG flare and engine operation which will reduce the duration of impacts.

- *Offensiveness* of impacts from odorous deliveries will be mitigated by requiring loads to be treated prior to delivery (for example by requiring the wastewater biosolids to be stabilised with lime). Where offensive emissions are unavoidable, implementing an odour cannon upwind of the odour source to minimise impacts at receptors will aid in minimising impacts.

- Regarding *location*, the Green Island residential area, particularly Clariton Avenue, is expected to be the most likely receptor cluster to encounter odour. A range of contingency measures have been recommended should odour be observed in this area, including minimising truck waiting times outside the site and operation of an odour cannon during low wind speed conditions. In addition, the location of the tip face under the remaining landfill staging will progress further west than previously and will therefore be further from this receptor cluster.

The volume of organic waste received at the landfill has reduced since July 2024 as a result of the introduction of the kerbside food and organic waste collection service. Organic waste will be received and consolidated in the ORB and then transported offsite by enclosed

truck.[12] The odour from the ORB is largely contained within the building which greatly reduces the odour intensity when compared to the composting of green waste in the open.

Based on the implementation of the proposed management and mitigation measures and proposed changes to the site, odour discharges are expected to reduce in terms of both intensity, frequency, and duration. While odours may still be detectable on occasions at or near the site boundary, providing the proposed mitigation measures are rigorously implemented, the likelihood of off-site odours being considered offensive and objectionable is low, and unlikely to cause a more than minor adverse effect.

Dust

Dust generating activities (sources of dust) are identified as disturbance of dry soils; earthworks; receiving, placing, and compacting dry material during windy conditions; and vehicles in dry conditions. Dust discharges are primarily expected to consist of coarse particles.

The assessment of dust effects has involved a qualitative assessment of dust impacts from the site using the FIDOL factors, taking into account proposed management and mitigation measures and proposed changes to the site layout and operations.

The greatest potential for nuisance dust is from the acceptance of dusty waste and from vehicle movements on unpaved roads, particularly the perimeter road. MfE states that nuisance dust effects are generally only experienced within 300 m of unmitigated dust sources. Assuming that the strict onsite protocols for containing dust are followed, dust may travel up to 100 m from the source. As the nearest receptor (where sensitivity to dust is increased) is greater than 100 m from the landfill, it is not expected that there will be any significant dust deposited at these locations.

Based on the operational activities of the landfill, impacts from the existing site, and considering the FIDOL factors, it is unlikely that operational dust emissions will cause any adverse effects beyond the site boundary.

The Applicant is not aware of any historic complaints in relation to dust at the GIL.

Landfill Gas

Combustion Effects

The emission rate and chemical composition of LFG varies depending on many factors including waste type, time, moisture content, temperature, etc. LFG consists primarily of methane, carbon dioxide, oxygen, and nitrogen with trace amounts of reduced sulphur compounds and volatile organic compounds. LFG can cause health, safety, amenity, and environmental impacts due to the gases it contains.

The timescale for the evolution of significant quantities of LFG typically varies from 3 to 12 months following waste deposition and can continue for well over 30 years following the termination of waste landfilling activities. Modelling indicates that LFG emission rates will peak in 2030 at 903 m^3/hour and steadily decrease each year thereafter. LFG collection rate at the site will peak in 2030 at 722 m^3/hour based on an assumed collection rate of 80%.

[12] Offsite transport will occur until the operation of the RRPP commences. At the time of writing this report, resource consents have not yet been granted for the RRPP, and it is therefore not considered in this assessment of air quality effects.

At the GIL, LFG is collected and destroyed as required by the NES-AQ. Modelling indicates that active LFG management using flares and/or engines will be required at the site for many decades. The flare at GIWWTP does not meet the requirements for a principal flare set out in NES-AQ Regulation 27(2). However, as the gas is primarily used as a fuel for generating electricity (26(2)(b)(ii)), Regulation 27(2) does not apply. The flare at GIWWTP is used as a backup for the destruction of gas using the LFG engine and meets the requirements of Regulation 27(3).

The principal air pollutants from the combustion of LFG in the engine and flares are NO_x, CO, SO_2, PM_{10}, and $PM_{2.5}$, and small amounts of volatile organic compounds (**VOC**). Combustion emissions from the existing engine and flare have been estimated using AERMOD atmospheric dispersion modelling to determine the potential air quality effects associated with their operation. The outputs of the model were compared with the relevant health-effect based air quality criteria. Results of modelling showed:

- Predicted 1 and 24-hour average NO_2 concentrations, including background, are predicted to be well below the relevant health-effect based assessment criteria at all off site locations. The maximum off-site annual average NO_2 concentration, including background, was 19 µg/m^3 which is less than the ecological guideline of 30 µg/m^3.
- Predicted 1 and 8-hour average CO concentrations, including background, are predicted to be well below the relevant health-effect based assessment criteria at all off-site locations.
- Predicted 24-hour and annual average PM_{10} concentrations, including background, are predicted to be well below the relevant health-effect based assessment criteria at all offsite locations.
- Predicted 24-hour and annual average $PM_{2.5}$ concentrations, including background, are predicted to be well below the relevant health-effect based assessment criteria at all offsite locations.
- Predicted 1 and 24-hour average SO_2 concentrations, including background, are predicted to be well below the relevant health-effect based assessment criteria at all offsite locations. The maximum off-site annual average SO_2 concentration (including background) was 5.3 µg/m^3 which is less than the most stringent ecological guideline of 10 µg/m^3.
- The modelling of PM_{10} concentrations outside of the site boundary are below 2.5 µg/m^3 and therefore the site complies with Regulation 17 of the NES-AQ.

Based on the results of the modelling, the potential for adverse health or ecological effects from the flare and engine emissions are expected to be very low.

Offsite Migration

The potential risks associated with the subsurface migration of LFG are assessed in the Landfill Gas Risk Assessment. Existing consent conditions require monitoring of gas concentrations in the ground adjacent to Clariton Avenue. Three LFG monitoring wells are located in this area, approximately 70 m from the edge of the landfill. These were installed in 2020, are approximately 2 m deep, and are installed within shallow fill materials and into the underlying clayey silt loess deposits. Around 40 rounds of monitoring have been carried out in these locations. The results show no significant methane concentrations, and carbon dioxide concentrations that are typically low. Higher carbon dioxide concentrations of up to 12.2% have been recorded on some occasions, with approximately half the monitoring results exceeding 5.0% at well G4.

The assessment concludes that there is a negligible to low risk of lateral migration of LFG impacting adjacent site users due mainly to the low permeability of the natural materials underlying and surrounding the landfill, and the shallow groundwater level which limit the ability for LFG to migrate beyond the boundary.

Technical Audit

The Air Quality Report (GHD) as well as relevant sections of other technical reports, were audited by Tracy Freeman, Principal Air Quality Specialist, at Jacobs New Zealand Limited (**Jacobs**). Full comments can be found in the following memorandum:

- Technical Memorandum dated 8 November 2023, and updated 30 October 2024.

A summary of the audit comments is provided below. Where recommendations are made, these are shown in italicised text below the relevant comment.

<u>Odour</u>

- The Air Quality Report appropriately identifies sources of odour.
- The odour assessment methodology focused on a risk assessment approach, considering the FIDOL factors to identify receptors at highest risk of odour impacts, both for the existing environment, and with a range of mitigation measures assumed. This is considered appropriate.
- The FIDOL assessment approach is qualitative and identifies relative risk rather than absolute risk of occurrence of offensive or objectionable odours.
- The 2024 updates to the Air Quality Report presented an opportunity for the Applicant to include an additional 18 months of onsite meteorological data and two years of complaints data, but this was not included. This would have provided further confidence in the statistics used to inform the FIDOL assessment.
- The frequency analysis in the Air Quality Report implies a "low" likelihood of receptors around the Receptor 1 cluster (Clariton Avenue) being impacted by odour; however, this area does report a high annoyance to odour impacts as evidenced by the 2022 community odour survey.
- In addition, the frequency analysis does not account for meandering winds under low wind speeds due to the variable terrain around the landfill and offsite to the east of the landfill, which may increase the effective frequency of exposure to odour from the landfill for receptors to the east. This meandering wind was observed by Jacobs during the site visit with pockets of stronger odour being observed near the eastern boundary of the landfill under light wind speeds.
- The intensity, duration, offensiveness and location parts of the FIDOL assessment are appropriate.
- The proposed new mitigation measures are appropriate and should be implemented on site as soon as possible to reduce odour emissions.

  Ms Freeman recommends monitoring of odour at the site boundary and at sensitive receptors by odour scouts, both by independent contractors and site staff, with adaptive management of onsite operations and mitigations measures in response to outcomes.

  Ms Freeman recommends walk-over inspections of the landfill cap/cover on a weekly basis until closure, and then monthly after closure.

Ms Freeman recommends that a restriction on the size of the working face be imposed in a consent condition.

- It is agreed that as a result of the implementation of the proposed mitigation measures, odour discharges will reduce in terms of intensity, frequency and duration.
- Ms Freeman states that evidence has not been provided to demonstrate that off-site odour impacts will reduce to the extent that there is no offensive or objectionable odour effect due to landfill activities. Due to the nature of landfill activities at the site, it is unlikely that such evidence could be provided.
- Ms Freeman does not agree that that the impacts of odour emissions after implementation of the recommended mitigation measures are unlikely to cause a more than minor effect.

Dust

- Sources of dust emissions at the landfill have been appropriately identified.
- Given the absence of existing impacts, as evidenced by the lack of historic dust complaints, and taking into account the dust assessment in the Air Quality Report, and the proposed mitigation measures, Ms Freeman agrees that it is unlikely that dust emissions will cause any adverse effects beyond the site boundary.

Landfill Gas

- The methodology for assessment of combustion gases relies on the use of atmospheric dispersion modelling to assess downwind ground level concentrations of discharged pollutants.
- There is a degree of uncertainty in the model because the wind speed and direction are based on Dunedin airport measurements, rather than the onsite data.
- The Applicant did not take the opportunity to update the meteorological data to take into account the additional 18 months of data that have been collected between lodgement of the application and completion of the s92 process in October 2024 which may have reduced uncertainty in the model.
- There are uncertainties in the predicted model results because of the limitations in the meteorology used in the model (as described above), the assumed H_2S composition of the LFG, the use of assumed background concentrations, and the use of AERMOD in complex terrain. Jacobs considers that the sensitivity of the model results to these uncertainties is unlikely to result in predictions of ground-level cumulative concentrations exceeding either the WHO or NZAAQG/NES-AQ assessment criteria; however, some control on the concentration of H_2S in the biogas burned in the engine and flare is appropriate.

  Ms Freeman recommends that the concentration of sulphides (expressed as H_2S) in the blended gas burned in the engine and flare be limited to 500 ppm as a consent condition. This would include mixtures of biogas combining LFG from the landfill and digester gas from the GIWWTP.

  Monitoring of gas flow rates to the engine and flare(s) should be conducted continuously, including separate monitoring of LFG and biogas from the GIWWTP.

  Monitoring of the stack discharges from the engine.

- Ms Freeman agrees with the conclusion in the AQ Report Rev02 that there is limited potential for adverse effects on the environment due to NO_x emissions.

- Ms Freeman agrees that the potential for adverse heath effects associated with CO emissions is expected to be low.
- Ms Freeman agrees that the potential for adverse health effects associated with PM_{10} or $PM_{2.5}$ emissions is expected to be low.
- NES-AQ regulation 17 has been correctly assessed.
- NES-AQ regulation 26 has not been directly assessed. The Air Quality Report recommends instantaneous surface monitoring (**ISM**) until closure but is inconsistent with the recommended frequency; both quarterly and monthly ISM are recommended in the report.

  Ms Freeman recommends monthly ISM monitoring on the basis that many other landfills conduct monthly monitoring, and this monitoring can also detect fugitive odour emissions and such monitoring would allow these to be remedied in a timely manner.

- The Applicant has not assessed the cumulative effects associated with the combustion of biogas generated at the GIWWTP in addition to the combustion of LFG at the GIWWTP.
- Emissions of CO, NO_X, PM_{10}, and $PM_{2.5}$ from the biogas boilers are likely to be much smaller than the emissions from the LFG engine due to the type of combustion device and are unlikely to change the assessment conclusions.
- Emissions of SO_2 from the boilers is unknown because the H_2S content of the biogas is not known. In addition, discharges from the boilers are likely to be of lower temperature than the emissions from the flare and engine and therefore may have different dispersion behaviour. Therefore, Jacobs considers that the cumulative effects of SO_2 emissions from the GIWWTP energy centre have not been appropriately assessed. A condition, already described above, limiting the concentration of sulphides to 500 ppm in the combined biogas feed to the engine and flare is recommended.

The risk associated with subsurface migration of LFG was addressed by Mr Elliot in his landfill design audit. To summarise here, Mr Elliot considered that further information in the form of an updated LFGRA would be needed to support the conclusion of low to negligible risk. Regardless, Mr Elliot did not consider that any change to onsite management of LFG was required beyond the existing controls and associated improvements detailed in the application.

Conclusions

There is agreement that the primary impact to air quality from the operation of the landfill is from odour. The Applicant considers that with the proposed mitigation measures, the odour impacts will reduce in terms of intensity, frequency, and duration. This is also agreed by Ms Freeman. However, where the Applicant considers that with rigorous implementation of the mitigation measures the risk of offensive or objectionable odours beyond the site boundary is low, and effects would be no more than minor, Ms Freeman disagrees and considers that the Applicant has not demonstrated that offsite odour impacts will reduce to the extent that there is no offensive or objectionable odour due to landfill activities. Accordingly, there is potential for more than minor adverse odour effects beyond the site boundary. These effects are most likely to be experienced in areas to the southeast of the site but could be experienced at any of the sensitive receptors identified in the Air Quality Report.

There is agreement that adverse effects relating to dust are not likely to occur beyond the site boundary, and adverse health and ecological effects from combustion emissions will be very low.

In conclusion, based on Mr Freeman's review, I find that adverse odour effects may be more than minor. Adverse dust and landfill gas effects will be less than minor.

6.12 Landscape, Natural Character, and Visual Effects

Potential adverse effects on landscape and natural character values and visual amenity from the continued operation, expansion, closure, and aftercare of the GIL include modification of the character and quality of the landscape, and visual amenity effects manifesting from these changes, as well as changes to the natural elements, patterns, and experiential qualities or naturalness of an area.

Applicant Assessment

Landscape

Landscape character is derived from the distinct and recognisable pattern of elements that occur consistently in a particular landscape. It reflects combinations of geology, landform, soils, vegetation, land use and features of human settlement. It creates the unique sense of place defining different areas of the landscape.

The proposed closure design involves an increase in the height of the final landfill surface to the west, with the high side being approximately 31.5 amsl. The continued operation will be staged, as previously described in Section 3.2.2 of this report. At completion, the landfill will take a wedge shape, the landform will be fully capped and grassed, and the exposed slopes of the borrow area will also be grassed.

The existing character of the site is a modified working landfill within the low-lying part of a wider basin-like landscape. The character of the surrounding area is mixed. The site has formed part of this varied landscape since it opened, so while its appearance will continually change as the landfill progresses, this change is already part of the landscape. The existing perimeter vegetation will be maintained and replaced to continue integrating the site into the rural backdrop. The landfill form will not compromise the landscape values associated with the Saddle hill Outstanding Natural Feature (**ONF**), including views of its iconic shape.

Overall, the landfill will not appear prominent within views or uncharacteristic within the receiving landscape. Landscape character effects will be adverse and low-moderate during operation, and adverse low after closure. These correspond to minor adverse effects.

Natural character

Natural character is the term used to describe the degree of naturalness in an area, and includes the natural elements, patterns, processes, and experiential qualities attributes of an environment.

The existing level of natural character at the site is highly modified. The long history of reclamation, drainage and waste disposal has considerably altered biotic and abiotic systems. Natural character of the adjacent Kaikorai Stream and Estuary is higher, particularly in regard to the birdlife it supports and scenic qualities present but are also modified.

The proposed increase in volume and height of the landfill will not further reduce the abiotic or biotic aspects of natural character on site or within the context of adjoining waterbodies.

As the additional development remains within the existing landfill footprint, neither the active bed nor river margins will be impacted. Experiential aspects of natural character may be adversely changed by a very small degree due to the extension in the operating life and height from that currently anticipated.

Overall, natural character effects are assessed as very low. This corresponds to a less than minor adverse effect.

Visual effects

Visual amenity effects are influenced by several factors including the nature of the proposal, the landscape absorption capability, and the character of the site and the surrounding area. Visual amenity effects are also dependent on distance between the viewer and the proposal, the complexity of the intervening landscape and the nature of the view. A change in view does not, of itself, constitute an adverse visual effect. Landscape is dynamic and is constantly changing over time so that any change in view must be assessed within the context of the landscape in which such change occurs.

Visual effects were assessed from several viewing catchments (A-K, details in Figure 9 of the Graphic Supplement to the landscape assessment), capturing elevated areas. Additionally, the shape of the landfill was modelled, and visual simulations were prepared. The site is in a basin but is largely screened from close views by earth bunds and established trees around the site perimeter. The hilly character of the surrounding landscape means visibility is obscured by intervening landform from some locations, but elevated views are available from others. Views from elevated areas around the site also include potential views to the sea, the estuary, and surrounding hills and these will not be impacted. There will be no effect on views from the Clariton Ave residential area to Pukemakamaka/Saddle Hill's cone.

From all viewing catchments, the level of visual effects during operation are assessed as either very low, or low–moderate (less than minor to minor). The level of visual effects at closure from all viewing catchments, are assessed as very low or low (less than minor to minor). A summary of all visual impacts upon specific viewing areas is shown in Table 6.

Table 6 Summary of visual impacts from viewing areas A-K. Source: RM23.185 Landscape Assessment.

Viewing Area	Rep. Site Context Photo / Vis. Sim.	Approx. Distance	Approx. Elevation (m.a.s.l)	Angle/Nature of view	Level of Effect: Operation Stages	Level of Effect/: Closure
A	VS3	350m	5-15	West/ none to very small glimpses/ does not break skyline	Low	Very low
B	VS2	640m	8-30	West/ none to very small glimpses/ does not break skyline	Low	Very low
C	NA	1100m	60	West/ partial to open/ does not break skyline	Low	Very low
D	NA	430m	30	North/ none to very small glimpses/ does not break skyline	Very low	Very low
E	NA	700m	10	North/ none to partial/ does not break skyline	Low-Moderate	Very low
F	VS1	600m	5-30	Northwest/ partial/ does not break skyline	Low-Moderate	Very low
G	VPD	1400m	130	Northwest/ open	Low	Very low
H	VP F/G	1000-2000m	10-120	East/ Northeast/ none to open/ does not break skyline	Low	Very Low
I	VS6 / VPH	300-1030m	5-40	East/ Southeast/ partial to open/ does not break skyline	Low / Moderate (Potential for up to Moderate from undeveloped Residential Land)	Low
J	VS5	750m	15-25	Southeast/ glimpses/ does not break skyline	Low	Very low
K	VS4	840m	20-50	Southwest/ open/ does not break skyline	Low-Moderate	Low

Technical Audit

The Landscape, Natural Character, and Visual Effects Assessment as well as relevant sections of other technical reports, were audited by Rachael Annan, Technical Director – Landscape Planning, at SLR. Full comments can be found in the following memorandum:

- Technical Memorandum dated 20 November 2023, and updated 21 October 2024.

A summary of the audit comments is provided below. Where recommendations are made, these are shown in italicised text below the relevant comment.

- The assessment generally follows best practice guidelines for landscape assessments, which are *Te Tangi a te Manu: Aotearoa New Zealand Landscape Assessment Guidelines*.
- The description that the site's character is highly modified is agreed. Ms Annan does note that the assessment has overtly focussed on the level of modification of the adjacent estuary and stream areas, and this ca imply a lowering of landscape sensitivity to the proposal as a way of setting out capacity for the development.
- The approach of basing the development area's form and location on protecting lower adjacent Clariton Avenue neighbours' views towards Pukemakamaka/Saddle Hill is understood.
- The sense of separation between the development area and the adjacent highly valued areas is understood and appropriate with regards to this application.
- The overall landscape findings support for the project is supported.
- The assessment relies on the Vegetation Management and Restoration Plan as a mitigation strategy, a draft version of which has been provided.
- The VMRP has two roles: to provide vegetative mitigation and respond to cultural values. There is tension in this, as cultural values need to be effectively documented and achieved, but effective landscape mitigation, including visual amenity outcomes, need to be provided for.
- The VMRP contains limited reference to CIA findings, but the final VMRP will be developed in consultation with Te Rūnanga o Ōtākou.
- Ms Annan recommends the following conditions are imposed:

  Technical review of the final VMRP should confirm the effectiveness of the management plan in relation to ecological restoration and habitat health; alignment with mana whenua outcomes; an effective approach to landscape character and visual amenity outcomes for surrounding residents, including review of planting plans and schedules.

  Planting implementation to be signed off by a landscape architect, arborist, or other suitably quality expert, with subsequent monitoring of vegetation health, and any replacement required.

Conclusions

Overall, there is a good level of agreement between the Applicant and Ms Annan. I consider that Ms Annan's comments support the findings of the Applicant's assessment as to adverse effects. These are:

- Adverse effects on landscape character will be minor during operation and closure.
- Adverse effects on natural character will be less than minor.
- Adverse visual effects will range from less than minor to minor, depending on the viewing and audience, for both operation and closure.

6.13 Effects on human health

Adverse effects on human health could stem from interactions with contaminated land, water, or air. These effects have generally been discussed in Sections 6.4 to 6.11 of this report. However, a summary assessment is presented here.

HHERA

- The application was updated to include an interim HHERA, the purpose of which is to assess whether contamination from the landfill could present a risk to human health or the environment. This found that:

  - A number of chemicals, including nitrate, zinc and PFAS were identified in samples collected both upstream and downstream from the landfill, suggesting contributions from across the catchment.
  - The monitoring data does not indicate a discernible impact to surface water quality from the landfill.
  - There is some uncertainty associated with the available dataset, as the sampling undertaken to date may not adequately capture situations where pulses of surface water from the landfill ponds flow into the Kaikorai Stream.
- *Technical audit of the HHERA was undertaken by Claire Conwell as part of the wider surface water audit. Dr Conwell agreed that the integrated assessment of risks to human health and environmental receptors was appropriate. Dr Conwell considers that the risks to human health and the environment, with particular regard to PFAS, but also in regard to metal contaminants, and nutrients (ammoniacal nitrogen and nitrate), have not been robustly assessed. Refining the framework, endpoints, and risk assessment steps are required to improve the scientific justifications to support the conclusions reached in the HHERA.*

Air Quality

- Poor air quality and the discharge of contaminants to air can adversely affect human health. The Air Quality Report modelled the dispersion of contaminants of combustion and compared the results to health-effects based assessment criteria. The report also qualitatively assessed the impacts of dust.
- The Air Quality Report found that there is low potential for human health effects associated with the discharge of combustion gases.
- Dust is expected to have nuisance effect, rather than a health effect. Regardless, adverse dust effects are not expected beyond the site boundary.
- *Technical audit by Tracy Freeman of Jacobs agrees with these findings.*

Disposal of Waste

- Human health effects resulting from the disposal of waste to land and from the disturbance of contaminated soils on the site will be controlled through waste acceptance criteria, operational management as set out in the LDMP, and through erosion and sediment control measures. Health and safety in the workplace is regulated through other legislation.
- *Independent review of contaminated land disturbance activities was not undertaken. The measures proposed to avoid or minimise adverse effects on human health are in line with best practice.*

Landfill Fires

- Landfill fires can result in people being exposed to pollutant emissions from burning waste smoke. Landfill fires can occur on the surface in areas of recently placed or exposed waste, or in the subsurface.
- The source of fires can include batteries, hot waste materials, vehicle engines, spontaneous combustion, air ingress, arson, over extraction of LFG, poorly maintained wiring in equipment, and LFG fuel ignition.
- Eleven fires have occurred at the GIL since April 2016 caused by batteries, hot waste materials, chemical reaction from a hydrated lime delivery, and machinery. All fires were rapidly extinguished by on site staff, except for two fires where FENZ assistance was called.
- Historically, no landfill fire has spread off-site via vegetation internal or external to the site, and the highly modified and fragmented nature of vegetation cover within

and surrounding the site ensures a relatively low risk of any landfill fire spreading from the site.

- *Technical audit of landfill fire risk was undertaken by James Elliot as part of the wider landfill design audit. Mr Elliot found that the mitigation, monitoring, and management detailed in the Fire Management Plan is generally acceptable. Mr Elliot recommends that a fire risk assessment be completed to address several risks that he has identified. These recommendations are aimed at identifying fire risks and occurrences of fires. No specific risks to human health were noted.*

Conclusions

Risks to human health and the environment exist during operation, closure, and aftercare of the GIL. In some areas, the risk to human health is low particularly in relation to dust and landfill fires. However, some uncertainty remains about the conclusions of the HHERA in relation to the 'no discernible impact on water quality' on the basis that there is insufficient data to enable a robust assessment. I am therefore unable to support the Applicant's conclusion that there will be no more than minor adverse effects in human health.

6.14 Effects on Mana Whenua Values

The CIA prepared by Aukaha on behalf of Te Rūnanga o Ōtākou assessed the cultural impacts of the continued operation, closure, and aftercare of the landfill against the cultural values identified by mana whenua, which were summarised in Section 4.9 of this report. The findings of the CIA are summarised here.

The Kaikarae Estuary and its associated waterways hold great significance for mana whenua. Mana whenua have longstanding concerns over the degradation of the estuary due to past and current land uses which include landfilling and industrial discharges. The ongoing landfilling until 2029 and closure requires careful management to mitigate potential adverse effects on wai māori, taoka species, and indigenous biodiversity. The long-term aspiration of mana whenua is to restore the Kaikarae Estuary and surrounding waterways to their traditional state as abundant mahika kai sources and a place where taoka species thrive, and to reflect mana whenua values and pūrākau associated with Kaikarae Estuary in a tangible way through a co-design process.

<u>Wai Māori</u>

Wai māori – impacts on mana, mauri, whakapapa, rakatirataka and kaitiakitaka, tapu, utu, taoka.

To Kai Tahu, wai is a taoka under their mana and rakatirataka. Mana whenua seek to restore the estuary and its associated waterways to their traditional state. Embarking on a journey of restoration is embodied by the mana whenua value, utu. This starts with ensuring leachate and contaminants are not able to enter the waterways. The landfill in combination with other industrial discharges, has degraded the mauri of the Kaikarae Stream and surrounding area and has made the area tapu, so that it cannot be used for mahika kai.

Issues raised in the CIA relating to Wai Māori are:

- Abstraction of water from the leachate collection trench will result in up to 0.5 L/s groundwater/connected surface water being drawn in from outside the trench. Mauri and whakapapa are integrally connected to the natural behaviour of waterways. Any change to natural hydrology, even if this is small, is one of the many factors that affect mauri and the whakapapa of the waterway.

- Contaminants from leachate or sediment entering groundwater or surface water would further degrade the mauri of the stream and surrounding area, hindering the restoration efforts of both mana whenua and Council. This includes negative impacts on the water quality, ecosystems, avifauna, aquatic fish, invertebrates, vegetation, and riparian vegetation.
- Low-lying areas adjacent to the landfill site are at risk of flooding and storm surge from the Kaikarae Stream and Estuary. These risks will be further exacerbated by climate change and sea level rise. Monitoring and providing for the impacts of climate change are a key focus for mana whenua. It is vital that there are robust mitigation and monitoring measures in place to ensure that the landfill does not become inundated, causing leachate and other contaminants to flow in the Kaikarae Stream and surrounding waterways.
- Mana whenua understand that DCC is confident that the leachate collection trench is fit for purpose; is effective at creating a barrier and intercepting leachate from the landfill and drawing in contaminated groundwater from historic waste located outside the trench; and is able to withstand predicted leachate flows as well as forecasted seal level rise and climate change impacts. If contaminants from leachate or sediment were to enter groundwater or surface water this would further degrade waterways which are already in poor health. It is the aspiration and duty of mana whenua to enhance the health and wellbeing of water as kaitiaki.

The recommendations of both the Groundwater Report, Surface Water Report and EcIA Report, and those set out in the Applicant's Assessment of Environmental Effects and the LDMP are supported by mana whenua. Recognising the above issues, the CIA makes the following recommendations regarding Wai Māori:

- That all practicable measures are taken to prevent discharges entering water, including preventing, where possible, leachate from entering groundwater and surface water.
- That effects on mauri and whakapapa from alteration of the existing hydrology and contaminants entering water are offset by mitigation measures, including riparian planting and pest management. Proposed offsetting or mitigation management plans need to be provided to mana whenua for review and consultation prior to implementation. While these measures do not directly address the adverse effects on mauri, they will contribute to enhancement of the mauri of the area.

<u>Mahika Kai and Biodiversity Values</u>

Prior to European settlement, the Kaikarae Stream catchment would have supported large wetland areas surrounding several defined streams, with hillslopes and elevated areas supporting mixed podocarp hardwood forest, with mataī, tōtara, rimu, māhoe and narrow-leaved houhere dominant on coastal hills. In the lower catchment, freshwater wetland and forest areas would have graded to intertidal / saltmarsh areas.

Much of the former indigenous vegetation such as the succulent herb swamp has been replaced by weedy exotic species. Six native fish species were observed during sampling across all sites. Mana whenua consider opportunities should be provided for riparian ecological enhancement and a more natural sequence of indigenous vegetation types in the area, enhancing ecological connectivity. A transition to eco-sourced native tree species within the existing screen planting around the perimeter of the landfill and ecological enhancement of the borrow area is recommended following closure of the landfill.

The recommendations of both the Ecological Impact Assessment and the Landscape and Visual Assessment are supported by mana whenua. The CIA makes the following recommendation in relation to mahika kai and biodiversity values:

- The protection of habitats and the wider needs of mahika kai and taoka species is sought by mana whenua, including:
    - Indigenous plant and animal communities and the ecological processes that ensure their survival are recognised and protected to restore and improve indigenous biodiversity.
    - Creating networks of linked ecosystems.
    - Protecting and enhancing wetlands.
    - Requiring the management of hazardous operations to avoid impacts on mahika kai values.
- A Vegetation and Restoration Management Plan is developed in partnership with mana whenua to restore the ecological values of the Kaikarae Estuary, provide habitat for taoka species, and rebalance mauri.

Wāhi Tūpuna

When the landfill closes there will be opportunities for public recreational use around the perimeter of the site and environmental enhancements, which could include planting restoration projects and new walking and biking tracks beside the Kaikarae Estuary. The aspiration of Te Rūnanga o Ōtākou is to incorporate mana whenua values and pūrākau associated with the Kaikarae Estuary in a tangible way and to restore the values of this wāhi tūpuna.

The following recommendations are made by mana whenua in relation to wāhi tūpuna:

- The protection of the values of wāhi tūpuna is sought by mana whenua, including:
    - Protecting the full range of landscape features of significance.
    - Ensuring that the interpretation of Kāi Tahu histories associated with the Kaikarae Estuary and Pukemakamaka is undertaken by Te Rūnanga o Ōtākou.
    - Encouraging the use of traditional place names.
    - Requiring site rehabilitation plans for land contaminated by landfills.
- That a co-design process is undertaken with mana whenua to incorporate mana whenua values and pūrākau associated with the Kaikarae Estuary following closure of the GIL, as discussed in Appendix 3 (to the CIA).

Conclusions

Mana whenua support the recommendations contained within the various technical reports that support the application. Additional recommendations are set out in the CIA and the Applicant has proposed conditions of consent that address these. On this basis, I consider that adverse effects on mana whenua values will not be more than minor.

However, for completeness, I note that technical audit of the application suggests that there is some uncertainty as to the effectiveness of the leachate collection trench, significant mounding of leachate within the landfill, and insufficient data to support some of the Applicant's conclusions as to water quality effects. I would therefore defer to the position of mana whenua with respect to adverse effects on cultural values, should any aspects of the CIA be revised in light of these uncertainties. I would also note that Te Rūnanga o Ōtākou have not provided a written approval to the application.

6.15 Other Community Effects

The application contains a Social Impact Assessment Report (**SIA**) that provides an assessment of the potential social impacts on persons and communities of the continued operation and eventual closure of the GIL. RMA sections 5(2), and 7(b), 7(c), and 7(f) as well as objectives and policies within Otago regional policy statements provide statutory context for this assessment.

The SIA considers:

- Health and wellbeing – Changes in the surrounding environment as a result of the proposal could have an impact on the health and wellbeing of the surrounding population.
- Economy, businesses and employment – Impacts on the local and regional economy. Consideration is also given to value of surrounding properties.
- Amenity and character – Changes to amenity can impact people's way of life, and what people value about their community including their fear and aspirations for its future.
- Fears and aspirations – The community's perceptions about their safety, their fears about the future of their community, and their aspirations for their future and the future of their children.

The SIA Report considers that there will be some negative impacts associated with the increase in capacity and continued operation of GIL, such as continued odour emissions, noise and vibration, and visual amenity impacts. However, as GIL has been operating since 1954 and is part of the community which has grown since the landfill was established, the adverse social impacts during construction and ongoing operation are expected to be minor.

Following closure, adverse effects are expected to reduce significantly.

Conclusions

To the extent that they are relevant and are consequences of the resource consents applied for, adverse social impacts are expected to be minor for the duration of landfilling. Beyond closure, adverse effects will be negligible, if they are adverse at all.

7. Notification and Written Approvals

7.1 Section 95A Public Notification

Step 1: Is public notification mandatory as per questions (a) – (c) below?

(a) Has the applicant requested that the application be publicly notified? **No**

(b) Is public notification required by Section 95C? **No**
Has further information been requested and not provided within the deadline set by Council? **No**
Has the applicant refused to provide further information? **No**
Has the Council notified the applicant that it wants to commission a report, but the applicant does not respond before the deadline to Council's request? **No**
Has the applicant refused to agree to the Council commissioning a report? **No**

(c) Has the application been made jointly with an application to exchange recreation reserve land under section 15AA of the Reserves Act 1977? **No**

Step 2: Is public notification precluded as per questions (a) – (b) below?

Step 2 requires that I determine whether the application meets either of the criteria set out

in subsection (5) and if the answer is yes then go to step 4 (step 3 does not apply) and if the answer is no go to step 3.
Subsection (5) states:

(a) The application is for a resource consent for 1 or more activities, and **each** activity is subject to a rule or national environmental standard that precludes public notification. **No – 10A.3.1.1 precludes public notification but the other rules do not.**

(b) The application is for one or more of the following activities but no other activities**:**

- **(i)** A controlled activity? **No – the application is for other activities in addition to the controlled activity.**
- ***(ii)*** *[repealed]*
- **(iia)** A restricted discretionary, discretionary or non-complying activity but only if the activity is a boundary activity? **No**
- ***(iii)*** *[repealed]*

Neither of the criteria set out in subsection (5) of step 2 apply. Therefore, I must consider Step 3.

Step 3: Does the application meet either of the criteria in (a) or (b) below?
Step 3 states that public notification is required if either of the criteria set out in subsection (8) apply.
Subsection (8) says:

(a) The application is for a resource consent for one or more activities, and any of those activities is subject to a rule or national environmental standard that requires public notification? **No – none of the rules or national environmental standards require public notification.**

(b) Will the activity have or be likely to have adverse effects on the environment that are more than minor in accordance with Section 95D? **Yes – adverse odour effects will be more than minor upon the environment.** Additionally, there is uncertainty as to the level of adverse effect upon groundwater, surface water, and aquatic ecology which means that the Applicant's conclusion that there will be 'no more than minor' adverse effect cannot be supported. This uncertainty may also influence the effects on mana whenua values.

The answer to Step 3 is yes – public notification is required.

Step 4: Do special circumstances exist in relation to the application that warrant the application being publicly notified? No – public notification is warranted on the basis of more than minor adverse effects.

As required by Regulation 10 of the Resource Management (Forms, Fees, and Procedure) Regulations 2003, the direct notice will be served upon the following persons:

- Aukaha on behalf of mana whenua
- The Department of Conservation
- Otago Fish and Game Council
- Public Health South

I have considered whether any direct notifications to any other affected individuals is appropriate. Based on the information available, I am not able to delineate an effects 'radius' within which effects are definitively more than minor, or minor, upon specific persons but not upon others. This is because of the diffuse nature of odour effects, and uncertainty about

the level of other effects and who may or may not be affected by these. In my opinion, it would not be appropriate to arbitrarily define such a radius when this isn't supported by the available technical information. Therefore, no direct notifications to individuals will be made. However, a site notice will be placed at or near the entrance to the Green Island Landfill to increase the awareness of the public notification and capture any potential submitters who may not otherwise see the notice in the Otago Daily Times.

7. NOTIFICATION RECOMMENDATION:

In accordance with the notification steps set out above, it is recommended that the application proceed on a publicly notified basis.

Shay McDonald
Senior Consents Planner
12 November 2024

Otago Regional Council

Decision on Notification

Sections 95A to 95G of the Resource Management Act 1991

Date: **12 November 2024**

Application No: **RM23.185**

Subject: ***Decision on notification of resource consent application under delegated authority***

Decision under Delegated Authority

The Otago Regional Council decides that this resource consent application is to be processed on a **publicly notified / limited notified / non-notified**[13] basis in accordance with sections 95A to 95G of the Resource Management Act 1991.

The above decision adopts the recommendations and reasons outlined in the Notification Recommendation Report above in relation to this application. I have considered the information provided, reasons and recommendations in the above report. I agree with those reasons and adopt them.

This decision is made under delegated authority by:

Alexandra King
Manager Consents
12 November 2024

[13] Once all identified affected parties have provided their unconditional written approval to the application. If these approvals are not provided then the application will proceed by limited notification.

Otago Regional Council

Appendix 1. Site details (Source: Application)

Green Island Landfill Site (as defined by the existing designation in the Proposed Second Generation Dunedin City District Plan)

Site	Legal Description	Record of Title	Area	Owner
9 Brighton Road	Part Section 45-47 Green Island Bush Survey District and Section 54 and 63 Block VII and Section 119 Block VII Dunedin & East Taieri Survey District	OT11B/1241	41.8120 hectares	Dunedin City Council
9 Brighton Road	Part Section 45-47 Green Island Bush Survey District	OT368/19	1.0841 hectares	
9 Brighton Road	Section 1 Survey Office Plan 24047	OT15C/1016	4718 square metres	
9 Brighton Road	Lot 6-7 Deposited Plan 572543 and Section 1 Survey Office Plan 24040	1040235	4464 square metres	
9 Brighton Road	Part Section 120 Dunedin & East Taieri Survey District and Part Section 53 Block VII Dunedin & East Taieri Survey District and Closed Road intersecting Sections 86,87,98,102 and 103 Block V Lower Kaikorai Survey District	OT16D/1193	4.0211 hectares	

9 Brighton Road	Section 103 Block V Lower Kaikorai Survey District and Part Section 85-87, 98 Block V and Part Section 99-101 Block V and Part Section 102 Block V Lower Kaikorai Survey District	OT16D/1194	5.5726 hectares	
9 Brighton Road	Lot 2, 4 Deposited Plan 572543 and Lot 1 Deposited Plan 20826	1040233	1837 square metres	
114 Brighton Road	Part Section 38-40, Part Section 44 and Part Section 156 Green Island Bush Survey District	OT7C/934	8.2303 hectares	
140 Brighton Road	Part Lot 4 Deposited Plan 4550	OT12C/261	10.4655 hectares	
170 Brighton Road	Lot 1 Deposited Plan 20582	OT12C/262	4.2766 hectares	
170 Brighton Road	Section 81 Block VII Dunedin & East Taieri Survey District	OT15A/266	4401 square metres	
Total Area			75.6164 hectares	

Green Island Wastewater Treatment Plan Site (location of LFG engine and flare):

Site	Legal Description	Record of Title	Size of entire property	Owner
9 Brighton Road	Section 55 and 65 Block VII Dunedin & East Taieri Survey District	OT11B/1241	7.2122 hectares	Dunedin City Council
9 Brighton Road	Lot 30 Deposited Plan 24758	OT16C/1083	3.7127 hectares	
174 Brighton Road	Part Section 48 Deposited Plan 2323	OT166/158	2.1102 hectares	
174 Brighton Road	Lot 1 Deposited Plan 22230	OT14C/1027	7.1854 hectares	
Total Area			20.2205 hectares	

Otago Regional Council

Appendix 2. Existing Green Island Resource Consents (Source: Application)

Consent Type	Consent Reference	Description
Discharge to land	94262 V1	Discharge up to 270 cubic metres per day of municipal, domestic, hazardous, industrial waste and organic waste to land. For the purpose of operating a sanitary landfill and composting operation.
Discharge to water	94693 V1	Discharge up to 270 cubic metres per day of municipal, domestic, hazardous and industrial waste, including a composting operation, to land in circumstances which may result in contaminants entering natural water. For the purpose of operating a sanitary landfill.
Discharge to water	3839A V1	Discharge landfill and composting leachate to land in a manner that may enter water. For the purpose of sanitary landfil and composting operation.
Water permit	3839B V1	Take groundwater and leachate from groundwater bores and from a leachate collection drain located at and around the Green Island Sanitary Landfill. For the purpose of managing a sanitary landfill and composting facility leachate discharge from the Green Island Landfill.
Water permit	4139 V1	Take groundwater (originating from the Kaikorai Stream) through a leachate collection drain. For the purpose of maintaining groundwater levels within the surrounding ground at the Green Island Landfill.
Water permit	3839C V1	Divert stormwater at a landfill and composting facility within a 38-hectare area bounded by a leachate collection drain. For the purpose of control of landfill and composting leachate at the Green Island Landfil.
Water permit	3839D V1	Take stormwater from a landfill and composting facility within a 38-hectare area bounded by a leachate collection drain. For the purpose of control of landfill and composting facility leachate at the Green Island Landfill.
Water permit	3840A V1	Divert stormwater from the non-working areas of a landfill. For the purpose of intercepting clean stormwater and silt control of stormwater at the Green Island Landfill.
Water permit	3840B V1	Take diverted stormwater from the non-working areas of a landfill. For the purpose of silt control of stormwater at the Green Island Landfill.
Water permit	4140	Divert the Kaikorai Stream for the purpose of realignment of this natural watercourse to allow for the installation of the Green Island Landfill leachate collection drain and sumps.
Water permit	4185	Divert the existing Brighton Road Stream for the purpose of realignment of this watercourse to allow for the installation of the Green Island Landfill leachate collection drain and sumps.
Discharge to water	3840C V1	Discharge stormwater to the Kaikorai Stream. For the purpose of disposal of stormwater from a landfill facility, after treatment in silt retention ponds at the Green Island Sanitary Landfill.
Discharge to air	94524 V1	Discharge to air landfill gas, dust and odour generated from landfilling up to 100,000 cubic metres a year of compacted municipal, domestic, hazardous and industrial waste and including a composting operation. For the purpose of operating a sanitary landfill.
General/structure land use consent	RM21.474.01	Land use consent for the disturbance of land at a contaminated for the purpose of undertaking capping works at the Green Island Landfill Green Island.