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Mount Cooee Landfill Expansion

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CONFIDENTIAL

Design Report

wsp

150 YEARS IN AOTEAROA

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Contents

List of Figures

List of Tables

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This report ('**Report**') has been prepared by WSP exclusively for Clutha District Council ('**Client**') in relation to The development of an updated Landfill Development Plan and Resource Recovery Centre ('**Purpose**') and in accordance with the Short form Agreement with the Client dated 11 November 2021. The findings in this Report are based on and are subject to the assumptions specified in the Report and the confirming briefing notice (Task 02100) signed 8 December 2022. WSP accepts no liability whatsoever for any reliance on or use of this Report, in whole or in part, for any use or purpose other than the Purpose or any use or reliance on the Report by any third party.

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1 Overview

1.1 Introduction

The Mt Cooee Landfill in Balclutha is currently the only municipal solid waste landfill in the Clutha District, servicing a district population of 18,400, including approximately 4,000 in the immediate township of Balclutha. The site's landfill operation receives approximately 9,000 tonnes of waste per year, including waste received through Council's kerbside refuse collection service (servicing around 6,000 households) and ten public drop-off facilities/transfer stations, along with residential, commercial, and industrial customers.

The current landfill stage (referred to hence as Stage 1) has been operating for over 30 years and is operated under the classification of a "Class 1" landfill (WasteMINZ Technical Guidelines to Land 2022). However, the site would no longer be considered best practice in terms of design. Key features of Stage 1 were the construction of a sheet pile cut off wall to contain leachate, construction of stormwater ponds and a leachate pump station. The existing landfill has no base liner and relies upon the natural containment of the underlying greywacke rock and the sheet pile cut off wall blocking flow paths through the valley bottom alluvium.

Site operations are managed by a private contractor, General Waste is deposited directly to the tip face and Green waste and hardfill are deposited on an area of capped landfill. Resource Recovery facilities are provided on a cleared hardstand, with mobile 240L bins for commingled recyclables, and glass (collected separately), as well as dedicated areas for bulky materials, scrap metal (including gas bottles and car batteries), ash and paint.

Clutha District Council are now seeking the development of a new Class 1 landfill cell to replace the existing landfill area (Stage 1), as the cell nears capacity (with consents expiring in 2023). The proposed landfill expansion (Stage 2) is proposed to be located to the south and east of the existing fill and is to be designed in accordance with current guidelines, including a landfill liner, leachate capture and Landfill Gas capture and destruction.

This report describes the proposed development of the Mt Cooee Landfill, Stage 2.

1.2 Strategic Drivers – WMMP

Strategic drivers for waste management in the District are defined in the Clutha District Council's 2018 Waste Management and Minimisation Plan (WMMP), which sets out a number of targets for the District, including:

- A reduction in General Waste collected at the kerbside
- Increasing public satisfaction with kerbside services
- An increase in kerbside diversion.

Council also established an overall target of reducing the total waste received at Mt Cooee landfill from 9,500 tonnes in 2016/17 to 8,400 in 2020.

In addition the New Zealand Government has recently released an updated Waste Strategy: Te rautaki para (March 2023). This document provides high-level guidance including the establishment of minimum targets for the diversion of waste from landfill and specific requirements to provide the collection from households of a standardised set of recycling (including Glass) by 2027 and food waste by 2030. These targets and the requirements of Aotearoa New Zealand's First Emissions Reduction Plan (May 2022) will influence council's services and the resulting composition of waste requiring disposal to landfill.

1.3 Purpose

Clutha District Council seeks to establish a modern Class 1 landfill on the existing Mt Cooee Site. The Mt Cooee site is designated in the District Plan for the purpose of landfilling. The proposed landfill has been designed to accept all existing waste streams and have sufficient capacity to manage waste generated within the district across the projected facility lifespan.

The following objectives have been established in relation to the proposed landfill activity:

- To operate in compliance with the site resource consents
- To minimise discharges of contaminants to the wider environment
- To minimise nuisance effects on adjoining property
- To ensure safety of people on the site
- To make optimum use of the site capacity
- To maximise diversion of waste from the landfill
- To minimise Clutha District Council's long term liability
- To provide a friendly and helpful service to the landfill customers
- To operate in compliance with Waste Levy and Emissions Trading Scheme requirements
- To operate the site at least cost consistent with the above objectives

The landfill design and associated Landfill Operation Plan provided in section 5.2, documents how the site will be constructed, managed and operated to achieve these objectives.

1.4 Required Landfill Capacity

In addition to the strategic drivers developed through the council's WMMP and the positive impacts available through greater diversion of waste materials from landfill, it is important to establish the likely demand and required capacity across the life of the proposed landfill.

Based on population projections provided by Council, the Clutha District is generally expected to remain stable through to 2038, with a mild decline thereafter. It is estimated that over the next 30 years, Clutha District will experience:

- Growth from 18,400 people in 2021 to approx. 19,000 in 2051.
- Nearly 750 additional houses being built.
- Total rating units (dwellings in the district) increasing to around 14,320.

Based on the relatively stable population and waste minimisation opportunities expected to be implemented over the life of the landfill, a target volume of 320,000 m^3 is sought for Stage 2. Currently Clutha District dispose of approximately 9,000 tonnes per annum of mixed municipal waste. Almost all waste is sourced from Clutha District. Allowing a nominal 0.8 tonnes of waste to each 1 m^3 of void space (as should be obtainable with heavy compaction), the estimated rate of void depletion (filling) can be projected at around 11,252 m^3 per annum. Based on this estimate, the proposed Stage 2 development would service the District's needs for nearly 30 years. Any waste reduction measures and increases to waste diversion would extend this period.

1.5 Approach - Planning considerations

Resource consents (Otago Regional Council) for the site operation are held in the name of the Clutha District Council (CDC). A full copy of the resource consents is included as Appendix 1.

1.5.1 Existing Resource Consents

(a) Otago Regional Council

The following resource consents from ORC are held in relation to the landfill

Table 1-1: Regional Council Resource Consents

Consent Number	Consent Type	Issue date	Expiry date	Conditions
94509	Discharge permit - stormwater	May 1995, reissued August 2001	2023	7 Conditions, monitoring provisions
94508	Discharge permit – waste to land	May 1995	2023	8 Conditions, Management Plan
95953	Groundwater abstraction	February 1996 Note supersedes 94545	2023	4 Conditions
94511	Diversion of stream	June 1995	2023	2 Conditions No ongoing requirements
94543	Install culvert	June 1995	2023	2 Conditions No ongoing requirements
94510	Air discharge	May 1995	2023	6 Conditions
95954	Discharge leachate to ground	February 1996 Note supersedes 94512	2023	8 Conditions Groundwater monitoring
RM20.452.01	Land use consent	13 April 2021	2026	8 Conditions

Note: Frequent reference to the consent conditions are made in this text, in the form (Consent/Condition number). For example (94509/2)

(b) Clutha District Council

The entire site (Lots 1 and 2, DP 12203 and Part Sections 4 and 5, Blk XIV, North Molyneux SD) is designated (D120) in the Operative Clutha District Plan as Mt Cooee Landfill (Rural) with the Notation "Refuse Disposal". Designation D120 is not subject to any conditions.

2 Site Description

2.1 Site Location

The Mt Cooee landfill is located off the Kaitangata Highway, approximately 1.2 km from Balclutha. The landfill site encompasses 2 lots on the property DP 12203 and has a total area of approximately 12.8 hectares. The approximate location of the site is shown on Figure 1 below.

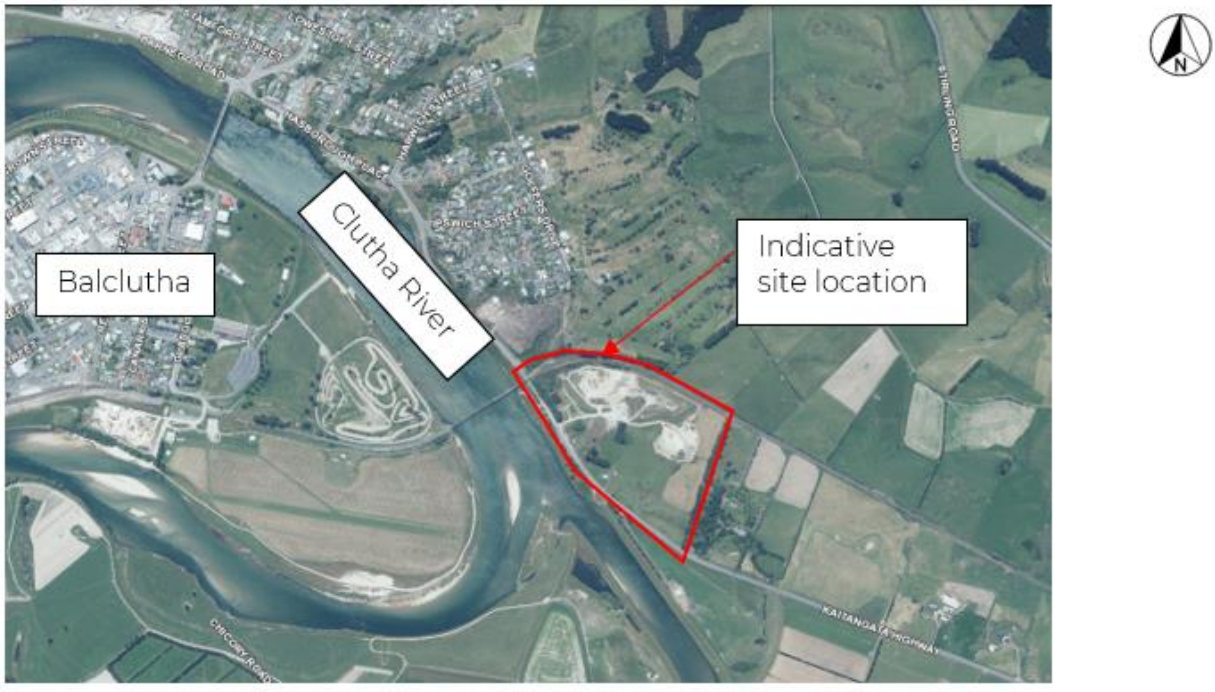

Figure 2-1: Site Location (image courtesy of DCC's Web Map)

The site is bounded by the Balclutha golf course across the railway line to the north, private farmland to the east, and across the highway, the Clutha River / Mata-Au. The railway line runs on the north boundary and the Kaitangata Highway on the south (river) side.

The landfill occupies a shallow valley sloping out to the river at the site entrance. At the current top platform level, the site is reasonably well screened by the landform and vegetation from neighbouring residences.

The closest residences are approximately 400m to the northwest (Arthur Terrace) of the existing landfill and 240m from the proposed landfill expansion to the southeast (rural residence).

2.2 Site Ownership

The land on which the site is located is owned by CDC and designated for refuse disposal purposes in the District Plan. The balance of the site not used for the landfill is currently leased for grazing.

2.3 Site Topography and underlying Geology

'The published geology maps by GNS Science indicate the site is underlain by two geological units: the Caples Terrane (Unit YTr) across the northern half of the site and the Pakihi Supergroup (Unit Q1a) across the southern end. Site-specific geotechnical investigations in the form of 10 machine boreholes were carried out across the site to inform the ground and groundwater profiles. Based on the review of investigation results, the site is generally underlain by a thin layer of topsoil overlying Caples Terrane bedrock, with the exception of the eastern section of the site where alluvial deposits of variable thickness were encountered overlying bedrock. Bedrock typically consists of highly to moderately weathered SILTSTONE/SANDSTONE (greywacke) in the upper layer, overlying slightly weathered to fresh SILTSTONE/SANDSTONE.

A quantitative assessment indicates the risk of liquefaction in alluvial deposits is low and therefore the site is not susceptible to liquefaction due to the shallow depth to bedrock. The risk of rupture of nearby faults affecting the site is also considered to be low. The preliminary global stability assessment of the proposed landfill indicate that the minimum required factors of safety under static and seismic cases are achieved. Preliminary geological mapping indicates the risk of deep-seated instability in the rock slopes is low. For the purpose of preliminary assessments, we recommend a minimum 1(V): 1.5(H) cut batters in the weathered rock and 1(V): 2.5(H) batters in alluvial deposits.

A detailed description of the site, including outcomes of geotechnical investigations is provided in the Geotechnical Interpretive Report (WSP, 2023), See Appendix 2.

2.4 Groundwater and Site Hydrology

The current understanding of the groundwater system at the Mt Cooee Landfill site is that of a groundwater system dominated by flow through the Caples Terrane bedrock of various permeabilities. Some flow also occurs through the overlying alluvial deposits, particularly in the valley floor that runs through the southwest side of the site where the alluvial sediments are generally thicker.

Groundwater level measurements in the historic and recent wells to date have not shown clear differences in groundwater levels within the bedrock and overlying alluvium. Therefore, the groundwater system is conceptualised as effectively one connected system. Groundwater is largely recharged by rainfall in the catchment and flows from the topographic highs at the north towards the southwest. Groundwater level measurements at the landfill and riverbank elevations (obtained from LiDAR) indicate that groundwater is likely connected to the Clutha River / Mata-Au and the river gains groundwater from the site.

A more detailed description of the site hydrology and potential impacts of the planned landfill development is included in the Mt Cooee Landfill Resource Consent Application: Assessment of Effects on Groundwater and Surface Water (WSP, 2023), See Appendix 3.

2.5 Climate

The site climate is relatively dry with an average rainfall of 670 mm. The dry climate limits leachate generation and would also slow waste degradation (and gas production) compared to more humid climates.

The prevailing wind is from the west blowing generally down the Clutha River / Mata-Au valley and so away from town. Winds from the south easterly quarter are less frequent but blow odour towards the main residential areas of town.

The local topography of the site influences the wind regime in the immediate vicinity. It is expected that under low general wind speed conditions, particularly during the night, when katabatic (downhill) flows of cooler air will tend to occur from the elevated areas north of the site, drifting in a southerly direction. These conditions direct airflow from the landfill across the road and out over the Clutha River / Mata-Au where any odour would dissipate well clear of any residences.

A weather station has been installed to record rainfall and wind direction. This data is useful for managing leachate flows and activities that could be potentially odorous.

2.6 Adjoining Land uses

The Mt Cooee site is bordered by the rail corridor to the north and Kaitangata Highway to the South, the property shares a boundary with the neighbouring rural property along its Eastern boundary.

Beyond the rail corridor to the North of the site, Land uses include a recreational reserve, residential housing and a golf course. The planned development will increase the distance between active landfill activities and these adjoining land uses. The location of the Stage 2 will be closer to the property's eastern boundary and the interface with the neighbouring property has therefore been considered in the assessment of effects.

2.7 Natural Hazards

A Clutha River Flood Hazard Assessment for the Mt Cooee Landfill has been prepared by GHC Consulting (March 2023). The report provides an overview of the flood hazard associated with the site concluding that the parts of the site likely to be affected by a major flooding event are limited to the berm area between the highway and landfill face, including sedimentation ponds and proposed Resource Recovery Centre locations. The report suggests the depth of inundation will vary depending on flood event but is unlikely to exceed 1.0 metres.

The report provides an approximate extent for consideration of flood risk, see Figure 2-2 below:

Figure 2-2: Flood Risk Assessment

The Otago Regional Council assessment of natural hazards on the Clutha Delta describes a number of considerations for the area of the Mt Cooee Site (Area A1), including that the area plays a crucial role in the conveyance of floodwater, and in the mitigation of flood hazard for other parts of the delta. It is the main flow path during high river flows, and modifications to this area could affect the safe and effective operation of the Lower Clutha Flood Protection Scheme.

As this flood extent affects the proposed Resource Recovery Centre, adjacent to the Kaitangata highway, a more detailed response within the civil design is included in section 6.4.6

2.8 Existing Landfill activities

The existing landfill, operational since the mid 1980's accepts domestic, commercial and limited sources of Industrial waste. Public access is provided via a staffed weighbridge with operations staff responsible for directing users to the appropriate areas of disposal.

The site currently operates 7 days per week with the following hours of operation:

- Monday – Friday 08:00am – 16:30pm
- Saturday – Sunday 10:00am – 16:30pm
- Christmas day, New Year's Day, Good Friday, Anzac morning: Closed to all vehicles.

Material collected through the Council's solid waste services (kerbside and public drop-off facilities) is transported to Mt Cooee and deposited directly into the landfill face. Kerbside recycling materials are sent out of district directly for materials recovery and processing.

As a Class 1 landfill, the site is available for the disposal of general municipal waste of a domestic/household nature or from businesses and farms. By nature this waste will contain small quantities of hazardous wastes or special wastes and this waste is accepted. Such wastes would normally constitute less than 1.0 % of the overall waste stream.

Core activities across the current site include:

- General Waste (Refuse) disposal – via tip face (public and operational vehicles)
- Green waste processing – incoming Green waste is matured on top of the existing landfill and shredded for landscaping
- Recycling – An operational area immediately after the weighbridge is provided for household recycling and scrap metal storage. Materials are then transported offsite for processing.
- Hazardous Substances, the site does not currently accept hazardous substances other than used paint and end of life gas bottles. It is expected that the new Transfer Station design (See section 6) will accommodate a more comprehensive facility for the diversion of hazardous substances from landfill.
- Ash, the existing operations include provision for the acceptance of ash via a dedicated fenced and signposted area, to ensure hot ash will not ignite refuse.
- Liquid wastes (Septage, grease trap and occasional other liquid organic wastes from food processing) have been accepted via excavation of a dedicated liquid waste pit. Such excavations occur into the already deposited refuse layer and are limited to an area of no more than 20m^2 by 2m deep, to be closed over within 2 months. It has been noted that this activity does not align with best practice landfill management and poses a number of issues including variable settlement within the landfill, contributing to onsite leachate generation and may be a significant source of odour unless managed appropriately.

2.8.1 Special wastes acceptance

Special wastes are accepted under a licensing procedure. The waste generator is required to contact CDC in advance requesting disposal. An application to CDC as set out in the Solid Waste Bylaw is required (refer Appendix 6 attached). The application is assessed in terms of the Bylaw "Schedule B: Special Waste Definition and Classification" and the waste disposal approved with conditions as appropriate. A specific permit is issued for a special waste disposal and must be produced at the kiosk. A waste manifest is kept at the kiosk that records the waste type and quantity and also provides for a record of the location in the fill where the material is placed. Location of special wastes is only recorded for selected materials where future location could be relevant (e.g. asbestos waste).

2.8.2 Stage 1 Leachate management - Sheetpile cut-off wall

As part of the site investigations WSP has considered the effectiveness of the existing Stage 1 containment including efficacy of Leachate management via the installed Sheet-pile cut off wall. While the integrity of the structure is considered likely to be acceptable, some uncertainty with the watertightness of the pipe penetration of the stormwater pipe through the sheetpile wall has been identified, for more information see Appendix 8: Mt Cooee Landfill Development Plan - Sheet Pile Cut-off Wall Review Report (WSP 2023). The Applicant recognises this as an issue that needs to be

addressed in the context of ensuring the overall water tightness of the sheetpile wall. In the next few months excavation will take place adjacent to the stormwater pipe to construct the replacement leachate pumpstation. At that point the pipe will be exposed, the condition of the seal assessed and any necessary remedial measures actioned.

3 Landfill Design

3.1 Guidelines

3.1.1 WasteMINZ 2022

The Technical Guidelines for the Disposal to Land (V3) published in October 2022 by the Waste Management Institute of New Zealand (WasteMINZ), provides the current best practice landfill design in New Zealand. The guideline provides technical advice on landfill siting, design, operation and monitoring of landfill(s) based on New Zealand and international experience. The document replaces previous documents:

- Centre for Advanced Engineering (CAE) Landfill Guidelines (2000); and
- A Guide to the Management of Cleanfills (Ministry for the Environment [MfE] 2002a).

The guideline establishes five classes of landfill in New Zealand, including that of a Class 1 Landfill as proposed for the site. A Class 1 Landfill is designed to accept municipal solid waste and requires:

- a rigorous assessment of siting constraints, considering all factors, but with achieving a high level of containment as a key aim
- engineered environmental protection by way of a liner and leachate collection system, and an appropriate cap, all with appropriate redundancy; and
- landfill gas management

3.1.2 Site designation

The entire site (Lots 1 and 2, DP 12203 and Part Sections 4 and 5, Blk XIV, North Molyneux SD) is designated (D120) in the Operative Clutha District Plan as Mt Cooee Landfill (Rural) with the Notation “Refuse Disposal”. Designation D120 is not subject to any conditions.

3.2 Design Objectives

3.2.1 Waste Volumes

The Mt Cooee Landfill receives around 9,500 tonnes of waste per year, including Green waste and Glass (which are reused onsite), equating to approximately 185 tonnes per week. The composition of this waste is documented in the most recent Waste Assessment (2017), which includes the following breakdown of materials by source:

Table 3-1 Summary of Incoming Materials - Mt Cooee Landfill

Incoming Materials	Source	Tonnes/Week	Composition
General Waste to Landfill	Kerbside Waste Collection	59	31.68%
	Rural Transfer Stations	1	0.54%
	Special Waste	3	1.61%
	Construction & Demolition Waste	15	8.05%
	Landscaping & Earthworks	7	3.76%
	Industrial/Commercial/Institutional	79	42.42%

	Residential Self-haul	6	3.22%
Diverted Materials	Glass	0.23	0.12%
	Green waste	16	8.59%
Total		186.23	100.00%

As part of the 2017 Waste Assessment, council has identified opportunities to divert up to 66 percent of its kerbside waste volumes, including:

- Recycling: 21.7% or 12.8 tonnes/week
- Organics – Food waste: 20.5% or 12 tonnes/week
- Organics – Green waste: 24.0% or 14.1 tonnes/week

Of the approximate 60 tonnes of kerbside waste disposed of weekly, the amount able to be diverted will depend to a large extent on the degree of change implemented by Council (i.e. a new kerbside collection system could yield greater diversion of kerbside waste from landfill). Any potential change in kerbside systems is likely to depend on the outcomes of the recently consulted upon plan by Central Government to standardise kerbside recycling and the direction set in Council's next Waste Minimisation and Management Plan.

For the purposes of preliminary landfill cell design and staging a tonnage of 9,000 tonnes per year has been used.

3.2.2 Waste Acceptance Criteria

Waste Acceptance criteria for the site are intended to align with the Class 1 acceptance criteria developed in the WasteMINZ Guidelines for the Disposal to Land (2022), i.e. include the following materials;

- Municipal Solid Waste (including mixed waste from residential, commercial and industrial sources)
- Special Waste with potentially hazardous leachable contaminants as defined by maximum chemical contaminant limits – See Class 1 Landfill Waste Acceptance Criteria (WasteMINZ), Appendix 5.

3.2.3 Waste handling

The proposed landfill development will be complemented by a Transfer Station and Resource Recovery Centre, see Section 6. These facilities will be established to support the safe management of incoming waste streams and reduce the overall volume of waste to be deposited within the landfill. The receipt of all public and uncompacted waste at a dedicated Refuse Transfer Station facility, will have multiple benefits including:

- Reducing health and safety concerns associated with having public access to an active refuse tip face and interaction with operational equipment and the public.
- Increasing opportunities to recover materials from the refuse waste stream (and divert those materials from landfill).
- Maximise efficiencies for placing waste within the landfill cell, either in a compacted state or by controlling the placement of all materials.
- Minimise the required area of tip face open at any time.
- Reduce litter and related impacts such as birds associated with having a large an accessible public tipping face.

3.3 Site Suitability- Geotechnical Features

The Mt Cooee site has the following geotechnical features that have determined the landfill design:

(i) The valley under the old landfill cell is infilled with up to 8m of alluvium deposits. These thin at the valley sides to leave a 1-2m veneer of weathered greywacke overlain with thin deposits of alluvial materials and topsoil.

(ii) Stage 2 does not involve construction over the alluvium. All of Stage 2 will be founded on excavated greywacke, either weathered or fresh. The greywacke is competent rock which requires ripping to excavate (once the initial 1-2m of weathered material is passed).

(iii) There is no liquefaction risk to the Stage 2 fill foundation.

(iv) Groundwater will be greater than 1m below the landfill liner base layer (more generally 2-3m)

(v) There is little clay or silt materials on the site which can be utilised for either landfill liner materials or for landfill cover and capping soils. There is only a thin veneer of silt over the weathered greywacke. Having no clay on site is a major factor determining the liner system.

(vi) While there is no clay on site, suitable deposits of liner grade clay/silt are expected to be available within a short haul distance

(vii) Rock excavated to form the landfill floor will be granular material and will be permeable to water and gas if utilised for landfill cover.

(viii) It is understood there is currently no economic use for the rock to be excavated and it is therefore all assumed to be either used within the site works, across Council operations, or cut to waste.

3.4 Landfill Capacity and Staging

The planned expansion will encompass a total footprint area of 3.23 hectares across 5 landfill cell stages. The total available airspace across the landfill expansion is 320,400m3, which allows for an estimated 30 years of waste disposal.

Landfill cells will be developed sequentially, with three base cells (Stages 1-3) developed against the existing landfill footprint (in a clockwise order), with two further cells (Stages 4, 5) then developed on top of the landfill base, up to a final height of 36.0mRL.

3.4.1 General layout

It is proposed that Stage 2 be built to the south and east of Stage 1 as shown on Technical Drawing Set (Appendix 4 attached). The boundaries have been set as follows:

- An area on the existing fill and adjoining the weighbridge has been set aside for an onsite transfer station and materials recovery area. This area is over alluvial soils and unlined ground and is not considered suitable for the new fill.
- The east boundary of Stage 2 has been set 15m from the eastern property boundary
- The south boundary has been set at least 150m from the Kaitangata highway, beyond the crest of the existing hill slope. This will reduce visual impacts and avoid encroachment onto an identified wetland in the South East corner of the property adjacent to the roadway.
- The north boundary is an effective continuation of Stage 1, alongside the railway.

As Stage 2 will sit in part on top of the existing landfill (Stage 1), some of the available void space is provided by filling back over the temporary batters of Stage 1. The development of Stage 2 will include lining these batters rather than relying on the existing sheet pile cut off wall (further detail provided in Section 3.6.2.2 below).

3.4.2 Technical Drawing Set

A set of technical drawings to support the consent application have been prepared, see Appendix 4. A summary of the supplied drawings is provided in Table 3-2 below.

Table 3-2: Technical Drawings

Activity	Description	Sheet No.
Site Location	Overall Site Plan	C101
Resource Recovery Centre and Transfer Station	Transfer Station and Resource Recovery Centre Overall Site Plan	C102
	Resource Recovery Centre Plan	C103
	Transfer Station Plan	C104
	Main Access Road Plan and Profile	C105
	Resource Recovery Centre Access Road Plan and Profile	C106
	Typical Cross Sections	C107
	Main Access Road Cross Sections 10.0 – 50.0	C108
	Main Access Road Cross Sections 60.0 – 90.0	C109
	Main Access Road Cross Sections 100.0 – 130.0	C110
	Main Access Road Cross Sections 140.0 – 170.0	C111
	Main Access Road Cross Sections 180.0 – 210.0	C112
	Main Access Road Cross Sections 220.0 – 240.0	C113
	Resource Centre Access Cross Sections 10.0 – 40.0	C114
	Resource Centre Access Cross Sections 50.0 – 80.0	C115
	Resource Centre Access Cross Sections 90.0 – 110.0	C116
	Resource Centre Access Cross Sections 120.0 – 140.0	C117
Landfill Expansion	Landfill Expansion Stage 01 Floor Design	C200
	Landfill Expansion Stage 01 and Excavation Stage 02	C201
	Landfill Expansion Stage 02 and Excavation Stage 03	C202
	Landfill Expansion Stage 03	C203
	Landfill Expansion Stage 04	C204
	Landfill Expansion Stage 05	C205
	Landfill Expansion Section Layout Plan	C206
	Landfill Expansion East-West Sections 01 and 04	C207
	Landfill Expansion North-South Sections 02 and 03	C208

3.4.3 Base grades

Excavation of the existing landform will be required to develop each of the three base cells. Cells will be graded at a 1:50 slope, with a fall to the West, this will allow leachate collected from the base of the cell to be fed by gravity to the existing landfill waste water pump station and thence to the Balclutha wastewater treatment plant. Internal batters within the landfill area will be at a slope of 18 degrees (3h:1v) to support liner application and suitable drainage.

A summary of each landfill cell within the Stage 2 works, including the volume to be removed and expected airspace available is summarised in Table 3-3 below.

Table 3-3: Summary of landfill cut and fill by development Stage

Landfill Cell	Landfill Volume (m^3)	Excavated Area (Ha)	Cut Volume (m^3)	Fill Volume (m^3)
ST01	59,200	0.49	32,350	150
ST02	62,200	0.43	5,960	1,850
ST03	79,400	0.44	5,280	110
ST04	69,200	0.00	0	0
ST05	50,400	0.00	0	0
Total	320,400	1.36	43,590	2,110

3.4.4 Stockpiling activities

Due to the required volume of material to be removed (largely expected to be weathered greywacke), a yet to be determined volume of material will either be stockpiled onsite or transported off-site. It is anticipated that excavated materials will be utilised by Council operations or if unsatisfactory for these purposes, cut to waste, with up to 32,200m^3 generated in the initial stage of works.

3.4.5 Landfill Airspace/Volume

Landfill airspace has been calculated based on an expected 9,000 tonnes of incoming waste annually, this estimate has been generated on existing volumes and is therefore considered conservative, noting that dependant on the degree of diversion and waste minimisation activities this volume could reduce to as little as 4,800m3 annually.

Estimated landfill airspace, per landfill cell, is described in Table 3-4 below.

Table 3-4: Landfill Volume by development Stage

Landfill Cell	Landfill Volume (m^3)	Max Elevation (by stage (mRL)	Annual tonnage (estimated)	Annual converted Volume (m^3)	Approximate Cell capacity (years)
ST01	59,200	27.5	9,000	11,250	5.25
ST02	62,200	27.5	9,000	11,250	6
ST03	79,400	27.5	9,000	11,250	7
ST04	69,200	31.0	9,000	11,250	6
ST05	50,400	36.0	9,000	11,250	4.5
Total	320,400	36.0			28.5

3.4.6 Landfill staging and operations

Landfill staging is planned across five landfill cells planned for the development, each cell will be graded to drain to the west of the site, with a landfill liner installed on all newly excavated areas and singular point of leachate discharge.

The cell arrangement has been designed to support integration with existing landfill and allow a continuation of the existing landform and screening of operational activities.

The staging is indicative only and may be amended to better suit cash flow and waste volumes in future as appropriate.

The Staging sequence is clockwise, commencing with the cell at the north alongside the railway. This was at the request of Clutha District Council. This sequencing has two consequences:

(a) There is a large volume of material to be excavated as part of the development works (32,000 m3 of weathered and fresh greywacke). This material will require storage or transport offsite in the early years of the development. With a counter clockwise development this material could be extracted more gradually possibly allowing more use on the site or possible sale.

(b) Drainage of leachate from the initial cells is into the future cells. While not insurmountable, this is generally undesirable as it is a lot easier to joint new liners to the upslope edge.

Figure 3-1 below shows the landfill staging, across site preparation and five landfill cells, with final landform and access shown.

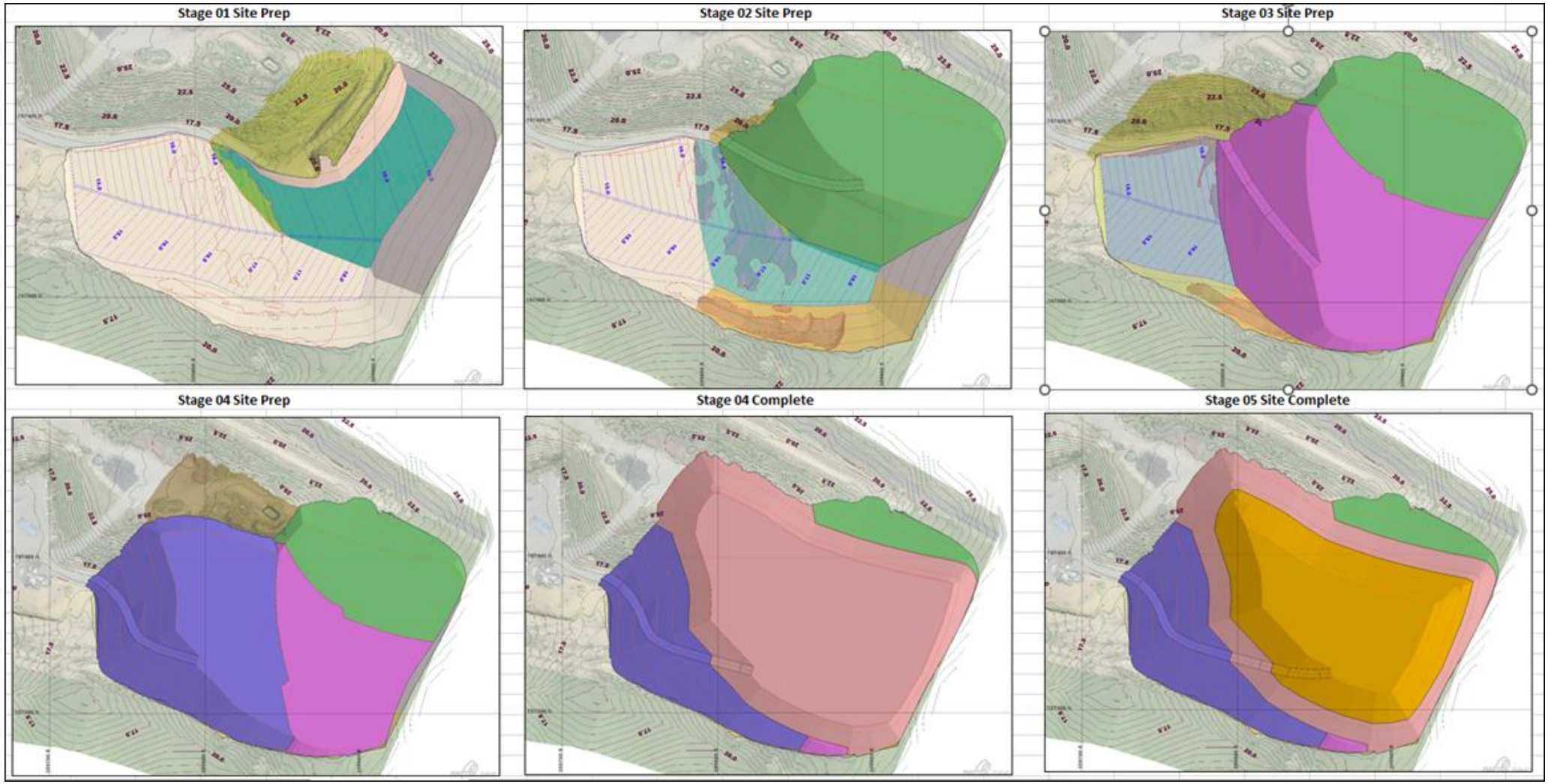

Figure 3-1: Landfill development by Stage

3.5 Geotechnical Design

3.5.1.1 Investigations specific to Stage 2

The Geotechnical conditions are described in WSP report *"Mt Cooee Landfill Extension: Preliminary Geotechnical Assessment"*. This describes the area to be excavated by the proposed extension into Stage 2 and provides recommendations on batter angles.

Groundwater is typically 2-3m below the surface and will not be encountered in the excavation for the landfill floor. For more detail please see Mt Cooee Landfill Resource Consent Application: Assessment of Effects on Groundwater and Surface Water (WSP, 2023).

3.5.1.2 Slope stability

No issues are identified in regards to slope stability for the temporary cut batters or the final landfill surface. Refer the Preliminary Geotechnical Report.

3.5.1.3 Settlement due to landfilling

Expected settlements of the landfill foundation under the applied refuse load are predicted to be negligible.

Proof rolling of the landfill foundation will be carried out as part of the construction sequence to identify any soft areas where fill has to be placed to bring the floor to design grade.

3.6 Landfill Liner

As a Class 1 Landfill, the design of landfill liner and leachate abstraction have been developed in accordance with the WasteMINZ Disposal to Land Guidelines (2022)

3.6.1.1 Base liners

The landfill expansion area will be progressively developed in accordance with the landfill staging plan with a Class 1-Type 2 liner applied to each cell prior to the placement of waste (and discharge of any leachate). The minimum requirements for the Class 1 – Type 2 liner are described in Figure 3-2 below, noting that dependant on soil permeability, a shallower 300mm layer of compacted cohesive soil ($K<10^{-9}$ m/s) would provide equivalent performance.

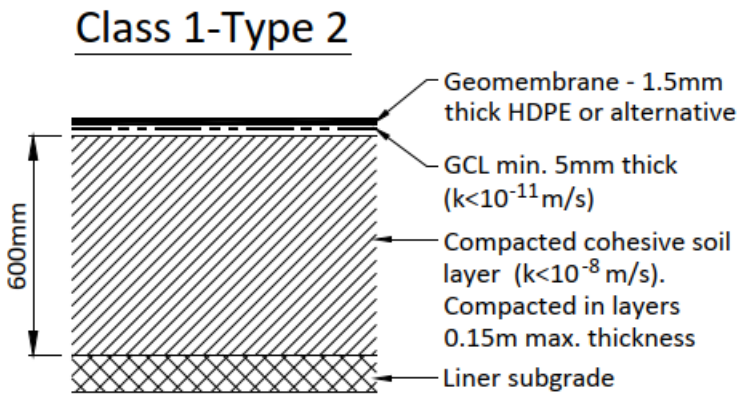

Figure 3-2: Class 1 - Type 2 Landfill Liner

In accordance with the performance requirements identified in the WasteMINZ Guideline (2022), the following minimum requirements are established for the Mt Cooee Landfill expansion, Stage 2 (from landfill layer (top) to base of landfill excavation):

- 300mm thick granular drainage layer,
- geomembrane protection layer of non-woven geotextile,

- 1.5mm HDPE Geomembrane
- 5.0mm Geosynthetic Clay Liner ($k<10^{-11}$m/s)
- 300mm Compacted cohesive soil ($K<10^{-9}$ m/s)

Note that the soil for the compacted soil layer beneath the GCL is assumed to be imported to site and therefore, at final design stage when the borrow area for the Compacted cohesive soil layer is confirmed, the thickness and specification of the base soil layer will be confirmed. An alternative approach should highly cohesive soils be un-economic to import would be to use 600mm of soil at permeability 1 x 10^{-8} m/s (as per Figure 3.2 above). The lower permeability soil has been used as the basis for the design, noting this option is preferred as it will reduce quantities of liner soil having to be imported to site.

The liner protection layer geofabric will be specified for compatibility with the selected drainage aggregate.

3.6.2 Liner placement

The placement of landfill liner will be completed following excavation of the landfill footprint, with base contours in accordance with the Landfill staging drawings (Stage 01 Site Prep) in Figure 3.1 above)

Following placement of a suitable liner subgrade (e.g. crushed rock), the placement of cohesive soils will occur in 150mm lifts as required with compaction testing completed prior to installing next compacted soil layer.

Overtop of the completed soils layer, a Geosynthetic Clay Liner (GCL) will be placed.

Overtop of the GCL an HDPE Geomembrane layer will be installed.

Prior to placement of waste a heavy weight geofabric, weight appropriate to the drainage aggregate, will be placed.

3.6.2.1 Liner on batters (new ground)

It is proposed to construct the batters in new ground (east and a section of south edge) at 3h:1V. This will allow a conventional lining using compacted soil, GCL (reinforced for side slopes) and HDPE as per the floor.

The greywacke is able to stand at steep angles without stability issues. However it is not considered that the additional expense of lining on the steep cut face is warranted for the small void space gained. This decision can always be reviewed in future and consents sought should allow for this. A lining of polyurea over shotcrete would be an alternative (albeit expensive).

3.6.2.2 Liner on batters (Interface with existing landfill)

Development of the proposed Class 1 landfill will overlap the existing landfill area at the eastern boundary (existing landfill with final capping applied). The existing landfill has been capped as follows (from top to bottom):

- Maintained grass cover
- 150 - 200 mm topsoil and /or Green waste mulch or other supplement
- Undefined depth of subsoil layer
- 500 mm of compacted silt or quarry strippings – permeability range 10-6 – 10-8 m/s.
- 200 mm final cover over refuse

In developing Stage 2, two design options have been considered for the treatment of the existing landfill batters:

(i) Place no lining and utilise the existing containment provided by the sheet pile cutoff wall for any leachate from the new fill that percolates into the Stage 1 fill, or:

(ii) Place a liner on the existing refuse fill and capture as much leachate as possible for direction into the Stage 2 leachate collection system.

In order to minimise reliance on the Stage 1 controls, it is recommended that the design incorporate the lining of the Stage 1 batters. The approach will minimise the reliance that Stage 2 fill places on the sheet pile cut off wall, noting however that placing the liner on the refuse batter is not ideal, as settlement within Stage 1 will lead to uneven stresses on the Stage 2 liner. The side liner system proposed on top of the existing landfill cell would be (top to bottom):

- Gravel drainage layer
- Liner protection layer
- 1.5mm HDPE
- GCL (reinforced as appropriate to slope)
- 600mm of compacted soil to permeability of 1×10^{-8} m/s
- 300mm compacted intermediate cover to the existing refuse

Settlement of the existing refuse will occur through degradation of the existing refuse and also from the applied load of the new fill. Generally this settlement will place the liner on the batter under a compressive stress, rather than a tensile stress. As such a rupture of the liner or separation of the batter liner from the landfill floor is unlikely. In the event that uneven settlement within the Stage 1 fill does damage the side liner this is considered acceptable in the context of the Stage 1 fill adjacent, and the containment provided by the sheet pile cutoff wall.

Stages 4 and 5 will involve placement of fill over the top platform of the existing Stage 1 fill. This is estimated to be some 20 years away at current fill rates. Specific design of the “piggyback” liner will be required at that stage as the flatter surface of the top platform will be more susceptible to settlement damaging the liners. It is proposed that settlement monitoring pins be placed on this area to provide good information upon which to base the future design.

The placement of fill against the existing landfill batter, will include good drainage so that leachate is captured at the base of the new cells. Any percolation through the existing cap will be captured via the existing leachate controls including landfill cut-off wall and connection to the leachate pump station. This connection between existing and future cells is unlikely to result in any additional discharge from the site as all leachate continues to be managed and transferred via the Leachate pump station.

3.7 Leachate Management

3.7.1 Landfill Floor Gradient

The landfill floor will be constructed to a minimum gradient of 2% (1v:50h)

3.7.2 Underdrainage

As the groundwater level is well below the proposed floor level of the landfill no underdrainage is proposed beneath the base layer of the landfill liner.

3.7.3 Pipe layout

The leachate drainage for Stage 2 will be:

(i) Lateral collectors running across the slope back to the perimeter batters at 80 m spacing. These to be terminated against the access road (permanent access point) or left for later extension into the final cells.

(ii) Main centre drain.

3.7.4 Pipe specification

HDPE pipe specified as DN 160 SDR 13.6 PE 80C has been specified for all the leachate pipes. This provides adequate factor of safety up to 24 m of refuse fill with quality embedment of the surrounding drainage metal. Compaction of the bedding has been specified up to 90% of standard dry density. The design refuse fill height is 36.0m including capping.

3.7.5 Pipe spacing

Leachate drains have been positioned to provide a maximum horizontal flow path of 90 m. This is calculated to keep leachate depth on the liner between drains at less than 300 mm.

3.7.6 Drainage metal

Stage 2 will use a crushed or river run gravel for the drainage metal. The specified grading is:

Table 3-5: Drainage Material Grading

Sieve size	% passing
37.5mm	100%
9.5 mm	< 15%
0.3 mm	< 5%
75 micron	< 3%

After being subject to light compaction (as measured by ¼ of NZ Standard Compaction) the percentage of material passing the 1.18mm sieve shall not have increased by greater than 2%.

The liner protection fabric will be specified accordingly

3.7.7 Access for cleaning of leachate lines

Leachate lines have been sized at 160 mm diameter as this is an optimum size for cleaning. Access is available from inlet chambers (capped) at the upstream end of laterals. The central collector is accessible from both upstream and downstream ends.

3.8 Landfill Cover

3.8.1 Daily Cover

Daily cover will be applied across the working tip face at close of each day, the placement of daily cover is intended to minimise unwanted effects including; windblown litter, odour and attraction of vermin and or birds. Daily cover material will depend on availability of suitable materials onsite but due to lack of topsoil may include:

- Soil or clays imported
- Inert wastes received at the site and suitable for stockpiling and use as daily cover
- Shredded Green waste, sawdust or mulch
- Contaminated soils (compliant with site Waste Acceptance Criteria)
- Ash, or

- Stabilised biosolids

3.8.2 Intermediate Cover

Intermediate cover will be applied as cells are completed and remain in place prior to development of a new overlying cell (e.g. at the completion of Cells 1-3 and 4). Intermediary cover will be designed to limit water ingress and prevent odour and therefore will need to have low permeability to water and landfill gas. In accordance with the WasteMINZ Guidelines (2022), this cover will also be grassed where it remains exposed for a period of more than three months.

3.8.3 Final Cover – Landfill Cap

Final cover (Landfill capping) will be developed in accordance with the WasteMINZ Guidelines (2022) and consist of an engineered cap, with the following profile (from top to waste layer):

- Maintained grass cover/plantings
- 150mm Topsoil
- 300mm subsoil (Growth) Layer
- 200mm Drainage Layer
- 300mm of Compacted Soil (K<10-7m/s)
- GCL
- 500mm combination of intermediate soil cover and gas dispersion layers
- waste layer and daily cover layer

Should it be required an alternative cap design which provides equivalent performance may be substituted for the above.

3.8.4 Maximum elevation

The final elevation proposed for the Stage 2 fill is RL 36m. This is some 14m above the general ridge line. Implications of this are discussed in Section x below.

Fill to this level is necessary to achieve the target void space.

3.9 Landfill Gas

The Stage 2 landfill is assumed to require landfill gas abstraction as per the Emissions Reduction Plan (2022). This will involve:

- A fully enclosed flare
- Gas wells constructed as the fill is placed
- Reticulation to the flare

Landfill gas abstraction adds a substantial measure of complexity to the historical operations on site and will involve considerable on going operational expenditure.

Our current interpretation of the Emissions Reduction Plan (ERP) is that gas collection will be required at all Class 1 landfills accepting municipal waste by 2026 (Action 15.5.1). This is signalled to be implemented by way of an amendment to the NES Air Quality 2004. The Action 15.5.1 does include a caveat of “where feasible” however what this may mean in practice is not defined at this stage. Accordingly we recommend that requirements for gas collection be kept under review and further advice be sought from MfE prior to committing to the Stage 2 development. The prudent financial course at this stage in our opinion is to assume that the Mt Cooee site will require landfill gas collection and destruction as per 15.5.1 of the ERP.

3.10 Stormwater Management

Stormwater Management for the development site is addressed in the Stormwater Design Memo (WSP, 2023), See Appendix 7 attached. The Memo describes the site as an undulating area with approximately ~20m of height variation with a natural fall towards the Southwest and Clutha River / Mata-Au, with a smaller area to the North of the site that falls northwards towards the railway line to an open drain.

Existing Stormwater on site is managed by two stormwater retention ponds with a combined volume of 1,600m^3 , both Ponds are designed, once capacity is exceeded, to discharge via a culvert to the Clutha River / Mata-Au. Upgradient surface water is captured at the boundary between the golf course and railway line on the northwestern side of the site and also discharges to the river, upstream of the railway bridge (and site boundary).

As part of the landfill cell development across Stage 2, a temporary flap on the landfill liner will be used to divide sub cells and allow clean stormwater to be diverted away from the leachate system.

To support effective management of stormwater from operational areas of the landfill expansion a new sediment retention pond will be created upgradient of the transfer station area. This facility will capture all stormwater from the landfill development area (approximately 3.23ha), allowing suspended sediment to settle out within the pond. Also aiding in the attenuation of flow and therefore limiting the effect downstream in large rainfall events. All operational landfill stages (i.e. filling of waste) will be captured separately via the site leachate management system.

3.11 Landscaping and Amenity

Following closure of landfill stages, final capping and landscaping of surfaces will be undertaken in accordance with landfill the site Landscape Mitigation Concept and Effects Assessment Report, see Appendix 9.

4 Consideration of Alternatives

4.1 Planning

The Fourth Schedule of the RMA requires an assessment of any possible alternative locations or methods for undertaking the landfill activity, where it is likely that an activity will result in any significant adverse effects on the environment. Although it is considered that the Mt Cooee Landfill proposal will result in effects that are minor, or less than minor, particularly due to the mitigation methods proposed, an assessment of alternative options has still been undertaken as part of the design stage of the project. Alternative Sites

An evaluation of the opportunities to dispose of waste from the Clutha District is being developed for Clutha District Council as part of the business case for the development of Stage 2. The analysis finds that two sites, each located within 150km of Mt Cooee, could be considered viable alternatives. Both sites are Class 1 facilities, albeit at a much larger scale than the planned development.

4.1.1 AB Lime - Winton, Southland

AB Lime operate a Class 1 Landfill just outside the township of Winton, approximately 120kms from the Mt Cooee Site. AB Lime have confirmed that they are prepared to accept Clutha District waste. This site has the capacity to accept Clutha districts waste volume and has Resource Consents in place through to 2046 The AB Lime site has an extensive and efficient landfill gas collection system in place and operates at a relatively low UEF (Unique Emissions Factor).

4.1.2 Smooth Hill, south of Dunedin

Dunedin City Council are currently involved in a Resource Consenting process for the approval of a landfill located approximately 55kms North along the state highway from Balclutha, in an area known as Smooth Hill (accessed from McLaren Gully Road). Should this facility go ahead, the close proximity to population centres in both Balclutha and Milton could be advantageous to the Clutha District Council.

Currently the status of the Dunedin sites is unclear. Initial discussions with DCC staff have indicated that the current Green Island site would not be available for CDC. Currently all incoming waste to the proposed Smooth Hill site would be via the transfer station at Green Island, so the proximity of Smooth Hill to Balclutha may not be of use.

4.1.3 Summary

For the purpose of economic comparison there is greater certainty around the AB Lime site as the site is already operational and with capacity to accept CDC waste as opposed to the less certain access to Dunedin City Council facilities. The AB Lime site is therefore considered as the most likely viable alternative.

4.2 Alternative Technologies

The limited availability of alternative approaches to landfill in New Zealand have led to a focus on waste minimisation and diversion rather than investment in alternative technologies. The recent release of an updated NZ Waste Strategy: Te rautaki para (2023), further defines the shift towards a more circular economy with disposal as the last step in an annotated waste hierarchy, see Figure 4-1 below.

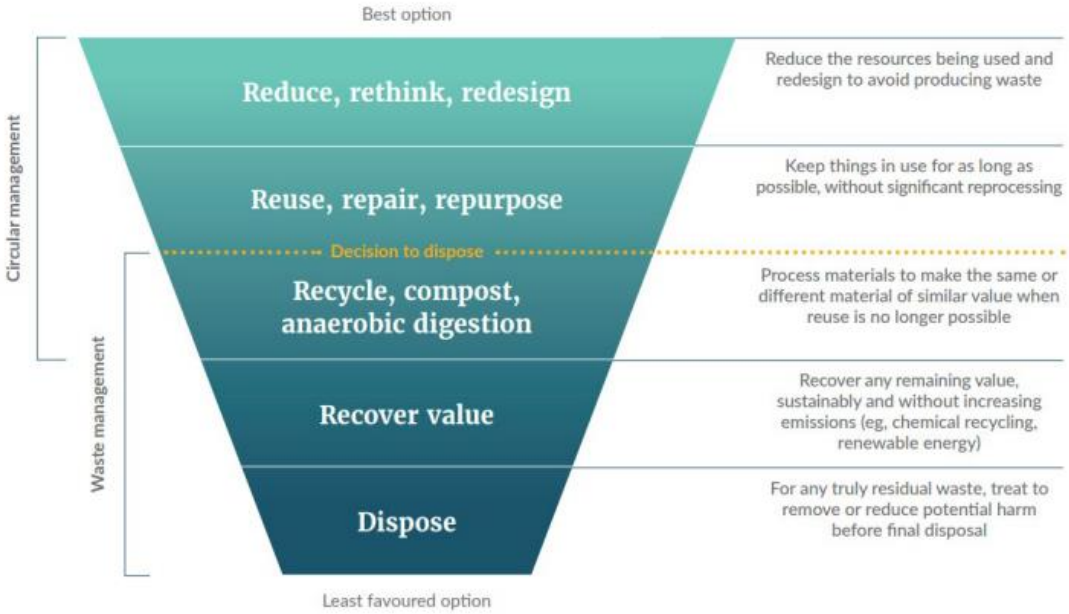

Figure 4-1: NZ Waste Hierarchy (MfE, 2023)

Notably, te rautaki para (2023), describes the waste management phases of the waste hierarchy in order of preference which establishes a preference for recycling and processing waste where re-use is not possible, prior to recovering any remaining value (without increasing emissions) and finally by disposing of waste (to landfill). This means that rather than seek alternative technologies for processing of the current waste stream, better separation, re-use and recovery of value within the waste stream should be prioritised over investment in alternative technologies including the potential waste incineration plant (Project Kea) in Waimate.

5 Landfill Construction, Operation and Closure

5.1 Construction phase approvals

5.1.1 Construction phase stormwater

In order to manage any construction phase discharges, the following methodology has been developed to address erosion sediment control across the site.

Erosion and Sediment Control

All practicable measures will be undertaken to prevent sediment from entering water including, but not limited to:

1 Establishing sediment controls prior to the onset of works and maintaining them in place until disturbed areas are stabilised;
2 Stabilisation of disturbed areas as soon as practicable following the works;
3 No washing down of equipment may occur where sediment may enter any waterbodies.

Erosion, sediment, and dust control will need to be provided throughout the duration of the construction works particularly around the Clutha River / Mata-Au, to ensure protection of the receiving environment. A site-specific Erosion, Sediment and Dust Control Plan (ESDCMP) will be developed by the Contractor once appointed and developed for the various stages of the project.

The key approaches for managing erosion and sediment risks are:

(i) Minimise disturbance – Only work those areas required for the construction to take place;
(ii) Stage construction – Plan works to minimise area of disturbance at any one time;
(iii) Protect steep slopes – Use cut of drains, bund armouring and use of flumes as appropriate;
(iv) Protect watercourses – Plan works to prevent sediment laden flows from entering watercourse without treatment;
(v) Develop methodologies and sequences for works in close proximity to the Clutha River / Mata-Au and any other waterways nearby;
(vi) Stabilise exposed areas rapidly – Stabilise areas using a mixture of gravel, mulch and hydro seeding as appropriate;
(vii) Install perimeter controls – Divert clean water away from areas of disturbance and divert sediment laden flows to control devices;
(viii) Employ detention devices – Treat runoff by methods that allow the sediment to settle out;
(ix) Cover, stabilise and bund/silt fence stockpiles;
(x) Update Site-Specific ESCPs – As construction the plan needs to be modified to reflect the changing conditions of the site; and
(xi) Assess and adjust – Inspect, monitor, and maintain control measures.

5.2 Landfill Operation Plan

A detailed Landfill operations plan will be developed in accordance with the proposed consent conditions, with an approved plan to be circulated within 6 months of landfill operations commencing.

The operations plan will address Operations and environmental monitoring regime, noting that in terms of business continuity the prevalence of alternative sites (Smooth Hill and AB Lime), the Clutha District is well placed should disposal at Mt Cooee be interrupted for any reason

5.2.1 Waste placement

Refuse filling is envisaged to commence at the north end of the new cell (ST01) against the railway.

Care needs to be taken as refuse is placed not to extend filling too close to the top of the edge bunds. Ideally a trench should be left with refuse finishing at the level of the liner anchor trench. This will provide a channel in which runoff from the fill can collect in heavy rain and soak back to the lined fill without risk of spilling over the bund outside of the liners.

Soft refuse (eg bagged refuse) is to be placed against the side batters to minimum of 500 mm thickness as refuse is placed. This is important to ensure protection of the liners and to provide a drainage path down to the leachate drainage layer.

The location of the Stage 2 fill will lead to operational complexity in the later years as the fill height increases and rises 14m above the surrounding country. This will make control of offsite nuisances of odour, noise and litter more difficult. It is expected that increased operational expenditure on litter fencing and landfill cover will be required.

5.2.2 Waste Acceptance: Liquid Wastes

The receipt of liquid wastes should be considered as special waste for the purpose of Waste Acceptance Criteria, with maximum moisture content for incoming materials established. While septage and other liquid waste have traditionally been accepted at the landfill site (stage 1), it is recommended that only dewatered materials be accepted for disposal in the new landfill cells (stage 2). Waste Acceptance shall be limited to 'spadable sludge', i.e. waste with a moisture content of 15-20 percent solids. Should liquid waste be received at the landfill site, then appropriate dewatering should be completed (with all dewatered liquid treated) prior to waste being deposited into the landfill cell.

5.3 Transport Assessment

As part of the consideration for operations under the planned Design, a Transport Assessment has been prepared See Appendix 10.

Overall, it is expected that the transportation effects of the Mt Cooee Landfill development can suitably be managed with the following improvements and mitigations, to address any adverse effects;

- Upgrade the intersection of the Kaitangata Highway with the existing site access to limit the conflict with turning movements, in line with a Safe System approach.
- Construction Traffic Management Plan to be submitted before the construction starts to ensure the construction activities are appropriately managed so that any generated traffic effects are acceptable.

5.4 Closure and Landfill Aftercare

A detailed landfill aftercare plan will be developed at least 6 months prior to the completion of the Stage 2 activities, Aftercare will include all ongoing maintenance, monitoring activities and outline ongoing use/site access, with a preference to make the site available once landfilling is completed as a public recreation area.

6 Transfer Station and Resource Recovery Centre Design

As part of the planned expansion Clutha District council is also planning to expand its current public waste receival facilities, including the development of a front-end Resource Recovery Centre and enhanced Transfer Station operations. The development of these facilities will support Council's strategic objectives to minimise waste and manage waste and recovered materials in a safe facility which prioritises diversion from landfill.

6.1 Regulatory Requirements

An outline plan for the landfill expansion works located within the Mt Cooee Landfill designation will be submitted to Clutha District Council under section 176A of the Resource Management Act 1991 (RMA). The outline plan will detail the proposed resource recovery centre and education centre, including the proposed traffic layout.

The following regulatory requirements will be addressed as part of the detailed design:

- Operational Stormwater
- Building consent
- Materials storage and reporting requirements are covered by the Waste Minimisation (Information Requirements) Regulations 2021. With the following required by an operator of a transfer station, the operator must measure:

  (a) in accordance with regulation 11, the tonnage of waste or diverted material that enters the facility (gross tonnage); and

  (b) in accordance with regulation 12, the tonnage of waste or diverted material that is reused or recycled at the facility, or is removed from the facility (other than as described in paragraph (c)) (diverted tonnage); and

  (c) the tonnage of waste (if any) that is sent from the facility to a disposal facility for disposal or elsewhere for further processing.

6.2 Design Objectives

A review of the existing facilities at the Mount Cooee Landfill have identified a number of areas for improvement, including;

- Separation of operational and public access.
- Safe areas/facilities for the collection of Residual Waste and Garden Waste – currently deposited at the landfill face and on top of the capped landfill respectively.
- Enhanced management of hazardous materials, including provision of a hazardous substances collection point.
- Enhanced management and recovery of bulk recoverable materials and diversion from landfill of Construction and Demolition Waste.
- Management of product stewardship materials, e.g. Agricultural plastics and tyres.
- prioritisation of a 'free' recycling drop-off (and Resource Recovery Centre) prior to crossing the weighbridge.

- Development of a re-use shop where recovered materials can be made accessible to the community.
- Development of a dedicated education space to support environmental training and waste minimisation education activities

6.3 Site Arrangement

Vehicle access to the site will be provided by the existing entrance located on Kaitangata highway.

The arrangement of Resource Recovery Centre Facilities has been designed around a number of requirements, including a preference to allow a separate one-way circulation for public drop-off of recycling and other free to dispose of materials, with the addition of a resource recovery shop and education centre and associated carparking. These activities occur prior to the public weighbridge.

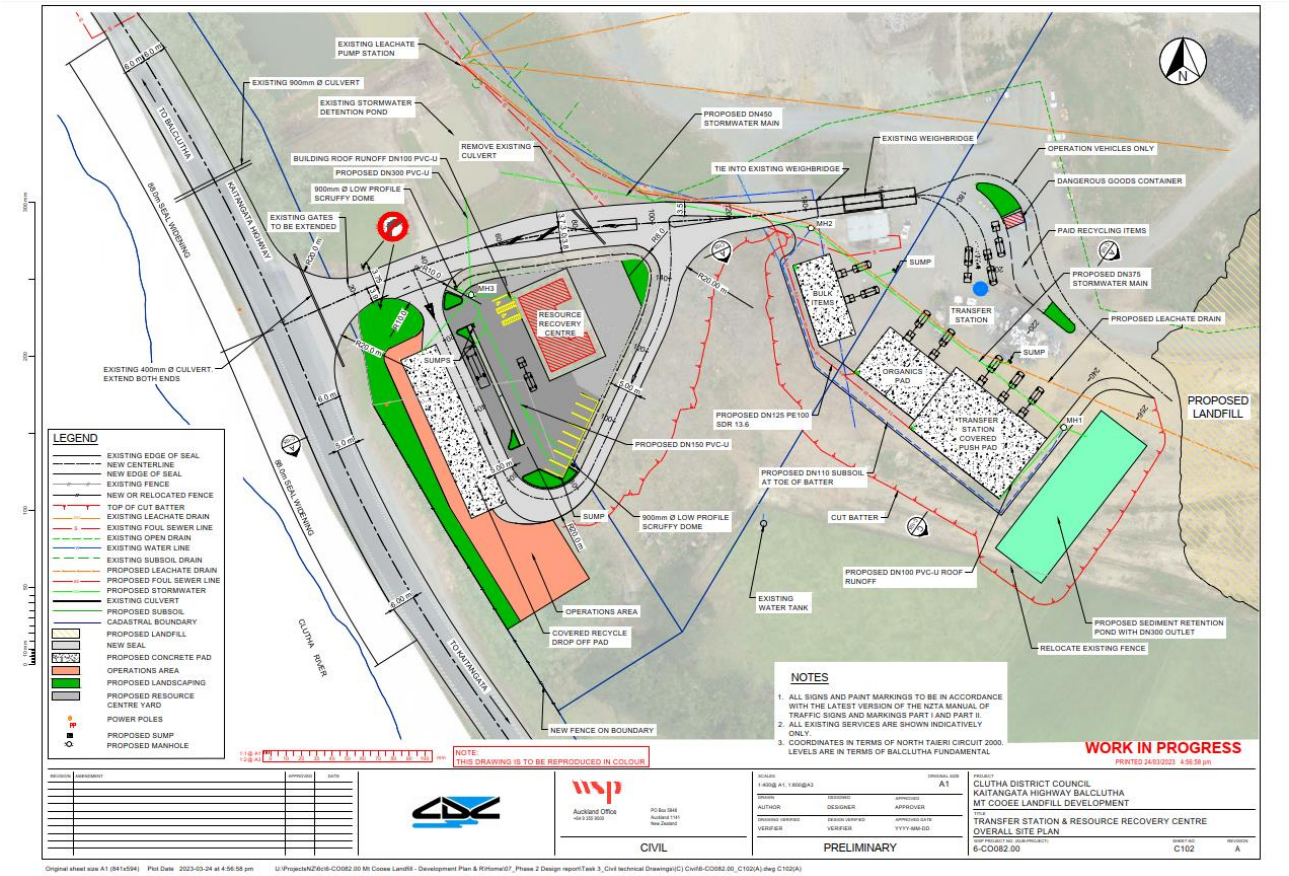

Figure 6-1: Mt Cooee RRC and Transfer Station arrangement

6.3.1 Resource Recovery Centre

Public traffic will be directed around the Resource Recovery Centre (RRC) and re-use shop/education centre on a one-way loop. The RRC will provide a free drop-off facility for household recycling and divertible materials, with all received waste contained in mobile containers/skips. The recycling drop-off will be covered by a roof structure to ensure unloading and storage of recyclables can occur without being exposed to the elements.

Full recycling containers will be stored in the back of house areas as required, prior to being transferred to a separate collection area for transfer offsite. Recovered materials will be assessed

by operations staff and transferred to the re-use shop and education area as required, it is expected that these materials will change over time dependant on recovery processes available.

The education space and re-use shop will be developed with a dedicated carparking area which vehicles enter from the RRC circulation. Vehicle will re-enter this circulation to either then exit the site or travel on to the weighbridge as required.

The planned structure for the education centre/re-use shop is still to be defined but is intended to be a relocatable structure on a permanent base foundation. This approach will provide Council with higher degree of flexibility should the structure need to be moved in future.

6.3.1 Transfer Station

Post weighbridge the site arrangement has been designed to separate public and operational traffic once vehicles exit the single (existing) weighbridge.

Public traffic enters the Transfer Station area with options to unload hazardous materials prior to progressing to a dedicated refuse tipping floor, the tipping floor is an at-grade covered waste receival pad, which allows vehicles to reverse trailers to a vehicle stop and unload directly onto the tipping floor. Operational vehicles working beyond the physical barrier then consolidate materials for transfer to landfill or as recovered materials.

Public vehicles also have an option to deposit Green waste on one of two organics pads. The drive-on nature of the two pads will allows vehicles with trailers to easily unload Garden Waste materials. Operations can close off each pad to move materials as required.

Public vehicles also have an option to deposit bulky materials (e.g. bricks and rubble, scrap metal) directly into materials bunkers adjacent to the organics area. This concrete pad will be partitioned with moveable concrete blocks, providing flexibility for the operations team to manage varying material volumes.

Once public users of the Transfer Station have deposited waste in the appropriate areas, vehicles will follow an exit loop to cross the weighbridge and exit the site via the direct access to Kaitangata Highway. An entry lane will allow vehicles to enter the RRC area and visit the facilities including re-use shop as required.

Operational traffic follows an external circulation that accesses the rear of public facilities, including a connection through to the existing and planned landfill area.

6.3.1 Cut and fill requirements

Due to the shape of the existing landform, which includes an area of previous quarrying activity, it is recommended that further excavation and contouring be undertaken to provide the required levels and ensure safe batters around the site.

Earthworks will include the cut and removal of approximately 15,000m^3 of weathered bed rock (greywacke), across the development area, with around 4,000m^3 of granular fill required to construct the appropriate gradient and building platforms for the Resource Recovery Centre and Transfer Station activities and traffic circulation. It is expected that this could result in approximately 11,000m^3 of excavated rock being available for other uses or transfer offsite. Noting that in addition to the granular fill, intended to be sourced from within the development, suitable basecourse and subbase would likely need to be imported to prepare the final surfaces.

6.4 Resource Recovery Centre Design elements

6.4.1 Entranceway widening and grading of access road.

To accommodate the new Resource Recovery Centre the existing access road will be widened and recontoured, with a separate right turn lane for incoming vehicles wishing to access the Resource Recovery Centre.

6.4.2 Resource Recovery Centre access

Access to the Resource Recovery Centre will be via a one-way traffic circulation with vehicles either entering from the access road (incoming traffic) or after crossing the weighbridge (outgoing traffic), vehicles will follow a clockwise circulation, with options to pull into a recycling drop off area (under cover), or continue through to the carpark entry of the re-use shop/education centre, or continue out to the main access road, where traffic will be controlled by a giveway. Vehicles exiting the carpark will re-enter the Resource Recovery Centre circulation and also exit via the main access road.

6.4.3 Drive-through recycling drop-off

A dedicated drop-off area will be provided for unloading of household recycling and reusable materials, the area will be covered by a roof to protect users from the weather and be orientated to the North. Materials will be deposited into nominated recycling containers, with the ability for Council to change materials streams as required. Immediately behind the public drop-off area an operations only area will provide storage for materials and loadout access.

6.4.4 Re-use shop and education centre

The re-use shop and education centre will be developed with a dedicated carparking area which includes a bus parking bay. The building platform and sealed yard are arranged to allow shop materials to be stored in and outdoors as required. The initial design is based around a relocatable structure, with a 400m^2 platform established, noting the actual foundation will depend on final building arrangement.

6.4.5 Carparking and traffic circulation

All access and carparking prior to the weighbridge is intended to be sealed, with the added benefit of managing all surface water across the site and allowing clear road marking and site navigation.

6.4.6 Flood Hazard considerations

Considering information from the Flood Hazard Assessment (GHC, 2023), the site layout has been developed to accommodate flood levels of up to 1.0m above the Kaitangata Highway centreline. The RRC area to be constructed on an elevated building platform, with all drainage managed via the stormwater system (which drains to the Clutha River / Mata-Au.

The elevated RRC platform is shown in Figure 6-2 below, with the original flood from the GHC Report shown by the blue dashed line. Noting that by increasing the height in the RRC, the flood overlay (blue polygon) has been amended to reflect areas up to the level of 1.0m.

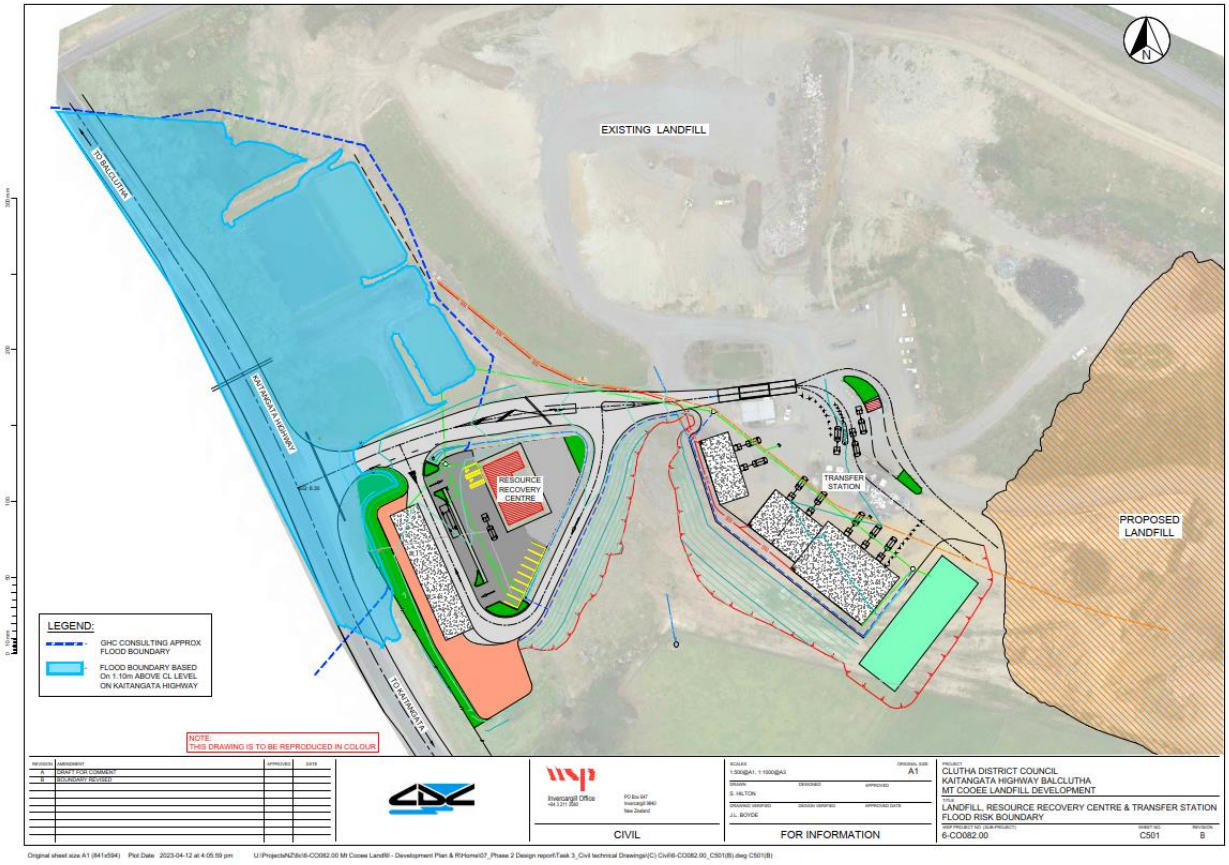

Figure 6-2: Annotated Flood Hazard Diagram

6.5 Transfer Station Design elements

6.5.1 Weighbridge access

The existing site weighbridge and kiosk will be retained, with all incoming/outgoing vehicles required to cross for the purpose of measuring waste volumes received. The design allows space for placement of a second weighbridge to the North if later required.

6.5.2 Hazardous substances and paid recyclables

Hazardous substance storage will be provided in a bunded shipping container, the volume of materials expected at the site are low so a small unit with segregated storage (including secondary containers) is recommended. In addition vehicles exiting the weighbridge will have the opportunity to unload certain materials, e.g. gas bottles, fire extinguishers, tyres in dedicated collection areas, prior to progressing around the site.

6.5.3 Construction and Demolition materials and General Waste drop-off

A dedicated flat floor facility will provide a multiuse facility for General Waste and recoverable Construction and Demolition materials. Vehicles will unload directly onto the tipping floor (at grade) and operations vehicles will then separate into waste or recovered materials. The facility will be constructed as a semi-enclosed facility, with a roof and two walls enclosed. The floor will be reinforced concrete capable carrying of heavy machinery associated with operations. Within the operational area vehicles will be able to use push walls to transfer waste into transport units.

All run-off from this facility, including any washdown, will be transferred by sewer line to the leachate pump station. Roof water will be captured and separated from stormwater either for onsite irrigation or otherwise diverted from operational activities.

6.5.4 *Organics drop off facilities*

Two 10mx10m organics pads will be constructed from reinforced concrete, for the receival of organic materials (Green waste). Drainage from the organics area will be connected via sewer line to the leachate pump station. Under current operations Green waste is shredded onsite with outputs used for landscaping across closed areas of the landfill. The facility could also accommodate future consolidation of kerbside organics (e.g. including Foodwaste) if required.

6.5.5 *Bulk materials bunkers/storage*

A concrete pad will be installed for bulky recoverable materials including scrap metal and building materials. This pad measuring 20mx6m will be separated into bunkers using moveable concrete blocks, providing operations staff with the flexibility to manage received material streams and fluctuating volumes.

6.6 Resource Recovery and Transfer Station Operations

Public and operations vehicles entering the site will continue past the RRC circulation and travel up the slope to the site weighbridge. All incoming vehicles will need to be weighed in, noting that under the existing site operations, certain approved vehicles are able to bypass the weighbridge on exit.

Once Public vehicles exited the weighbridge they will be directed around the Transfer Station area by means of signage and directions from Operations staff. Vehicles will undertake a clockwise circulation with opportunities to unload hazardous materials via dedicated waste receival area, before re-joining the general Transfer Station circulation.

Vehicles with General Waste (refuse) to unload will follow signage around the Transfer Station circulation, before reversing into dedicated drop-off bays for the refuse drop-off facility. Materials will be unloaded at grade, with vehicle stops and a solid edge, providing a physical barrier between public and operations vehicles.

Vehicles with Garden Waste to unload will follow signage around the Transfer Station circulation past the refuse drop-off area, before reversing onto a dedicated drop-off pad for garden waste. Materials will be unloaded at grade, with vehicles able to unload directly onto the receiving pad and drive away as a means of supporting unloading. The Garden Waste pad will be split into two area so that operations can close each area off, as required, to clear accumulated materials. All water will be collected from the Garden waste pad via a dedicated sump, prior to being discharged to the wastewater network.

Operations vehicles will travel a separate circulation around the public Transfer Station circulation, the Operations circulation will be separated from the public by means of physical barrier to ensure site safety and segregation of two activities.

Compacted waste will be transferred directly to the landfill, while non compacted waste will be deposited onto the refuse tipping pad by a separate operational vehicle only access.

6.7 Waste diversion opportunities and volume projections

Based on information supplied in the most recent Waste Assessment and population statistics for the region, it is expected unlikely that overall waste volumes will change significantly in the lifetime of the facility. The divertible volume of waste will largely rely on social behaviours and decisions around materials reprocessing which are yet to be determined. However, based on the supplied transfer station and resource recovery centre preliminary design, the following opportunities should decrease the overall volume of waste requiring disposal:

- Free drop-off for recyclable materials via dedicated resource recovery centre (RRC). Noting accepted materials may change overtime, the development of this facility will enable Council to offer a free disposal option and therefore incentivise the diversion of readily recoverable materials from landfill.
- The inclusion of a waste education space and re-use shop as part of the RRC development will support re-use markets for recovered materials, both through education and makers spaces and by providing a direct retail output for recovered materials.
- At the weighbridge it is anticipated that customers will be able to identify whether they have recoverable materials or General Waste with different fees for each. This further encourages diversion with the costs of disposal to landfill higher than for diverted materials.
- After crossing the weighbridge, customers will have a dedicated area for the safe management of hazardous materials (including gas bottles and household chemicals), the provision of this facility will reduce the overall volume of waste received in the General Waste disposal area and reduce contamination and associated hazards at the landfill itself.
- A dedicated Refuse Transfer Station (RTS will be developed to include a covered area where vehicles can un-load General Waste at grade, with operations staff able to separate recoverable materials and transfer General Waste into transport units for disposal. Provision of a flat floor facility reduces health and safety concerns associated with other RTS arrangements and also reduces damage/mixing of recoverable materials, allowing greater opportunities for diversion.
- A dedicated Green waste area will also be developed, this will enable customers to easily unload Green waste and encourage greater separation of organic materials from the General Waste stream. Recovered organics from the RTS can also be combined with materials dropped-off in the Green waste area and transferred for further processing, (either shredded and used onsite, or transported offsite for composting).
- Like Green waste a dedicated area is planned for the recovery of bulky reusable materials (e.g. building supplies and inert wastes), the provision of suitable storage and processing area onsite will ensure these materials are able to be triaged and where applicable re-sold or otherwise diverted from landfill.

Based on the above separation and facilities for diversion, it is expected that council can divert a greater portion of incoming waste that currently achieved. Numbers from the most recent Waste Assessment are provided below, noting that some elements would require additional services such as kerbside collections and offsite processing of materials (e.g. composting).

Table 6-1: Waste Diversion Potential

Material	Waste to landfill* (tonnes/annum)	Kerbside Diversion Potential (tonnes/annum)	Transfer Station Diversion Potential (tonnes/annum)	Residual waste to landfill (tonnes/annum)
Paper	778	130	182	466
Plastics	1356	67.6	296.4	992
Organics	2456	1357.2	514.8	584
Ferrous metals	301	31.2	269.8	0

Non-Ferrous metals	65	10.4	41.6	13
Glass	715	421.2	150.8	143
Textiles	483	0	156	327
Sanitary paper	419	0	0	419
Rubble	921	0	312	609
Timber	866	0	156	710
Rubber	296	0	0	296
Potentially hazardous	236	0	0	236
Total	**8892**	**2018**	**2079**	**4795**

*Data from 2017 Waste Assessment

6.8 Operational Stormwater Management

Operational stormwater management for the transfer station and resource recovery areas is addressed in the Stormwater Design Memo (WSP, 2023), with all stormwater managed to address gross pollutants and with collected stormwater discharged to the existing stormwater retention system. Ground levels and site contouring in the Transfer Station and Resource Recovery Centre areas will allow drainage of operational areas to be gravity fed.

Stormwater from the Resource Recovery Centre will be conveyed to a centralised point and transferred to the existing stormwater retention pond. Grates will be fitted with sump cages to catch any litter prior to discharging via the stormwater network. A routine maintenance task will be established to clear grates and ensure functionality of stormwater network.

Stormwater from the Transfer Station area, including water from the sediment retention pond (servicing landfill construction area) will be piped via a new stormwater main, also discharging to the existing stormwater retention pond. An existing under road culvert (access road), will be removed as part of these works.

Any liquid generated on either the Organics (Green waste) or General Waste receival areas will be captured and transferred to the Leachate pump station, via a new sewer line around the rear of the operational area. Leachate for the landfill expansion will be transferred across the centre of the operational site via a new leachate line and discharged to the leachate pump station.

7 Next steps

Subject to approval of the site Resource Consents for the landfill expansion and Resource Recovery Centre development, a more detailed Design will be developed. Detailed Design will provide Council with the necessary information to develop the site and facilities, including all structural and civil works associated with the Landfill expansion, Transfer Station and Resource Recovery Centre.

Appendices 1-10

(To be circulated separately)

1. Resource consents
2. Geotechnical Interpretive Report (WSP)
3. Assessment of Effects on Groundwater and Surface Water (WSP)
4. Technical Drawing Set (WSP)
5. Class 1 Landfill Waste Acceptance Criteria (WasteMINZ)
6. Solid Waste Bylaw, 2019 (Clutha District Council)
7. Stormwater Design Memo (WSP)
8. Sheet Pile Cut-off Wall Review Report (WSP)
9. Landscape Mitigation Concept and Effects Assessment (Mike Moore)
10. Integrated Transport Assessment (WSP)

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