Appendix 5: Draft Construction and Operations Management Plans

A: Draft Construction Environmental Management Plan

B: Erosion and Sediment Control Plan

C: Green Island Resource Recovery Precinct Draft Contaminated Land Management Plan

D: Draft Site Environmental Management Plan

E: Draft Stormwater Management Operation and Maintenance Plan

F: Draft Composting Facility Management Plan

Green Island – Resource Recovery Park Precinct

DRAFT Construction and Operations Management Plans

→ The Power of Commitment

Project name	
Document title	Green Island – Resource Recovery Park Precinct | DRAFT Construction and Operations Management Plans
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GHD Limited
Level 3 138 Victoria Street,
Christchurch 8141,
New Zealand

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1. Introduction

1.1 Background

1.1.1 Waste Futures Programme

As part of Dunedin's wider commitment to reducing carbon emissions and reducing waste going to landfill, the Dunedin City Council (DCC) has embarked on the Waste Futures Programme to develop an improved comprehensive waste management and diverted material system for Ōtepoti Dunedin. The programme aligns with DCC's responsibility under the Waste Minimisation Act 2008 to *'promote effective and efficient waste management and minimisation within its district'.*

Improving Dunedin's whole waste system includes enhancing collection services for reuse and recycling, and safe disposal of residual waste to landfill.

The Waste Futures Programme includes provision of an enhanced kerbside recycling and waste collection service for Dunedin from July 2024. The new kerbside collection service will include collection of food and green (organic) waste.

To support the implementation of the new kerbside collection service, the DCC is planning to make changes to the use of Green Island Landfill Site (Figure 1) in coming years including:

- Developing an improved Resource Recovery Park Precinct (RRPP) for food and green waste and to process recycling
- Providing new waste transfer facilities to enable the safe disposal of any residual waste to landfill.

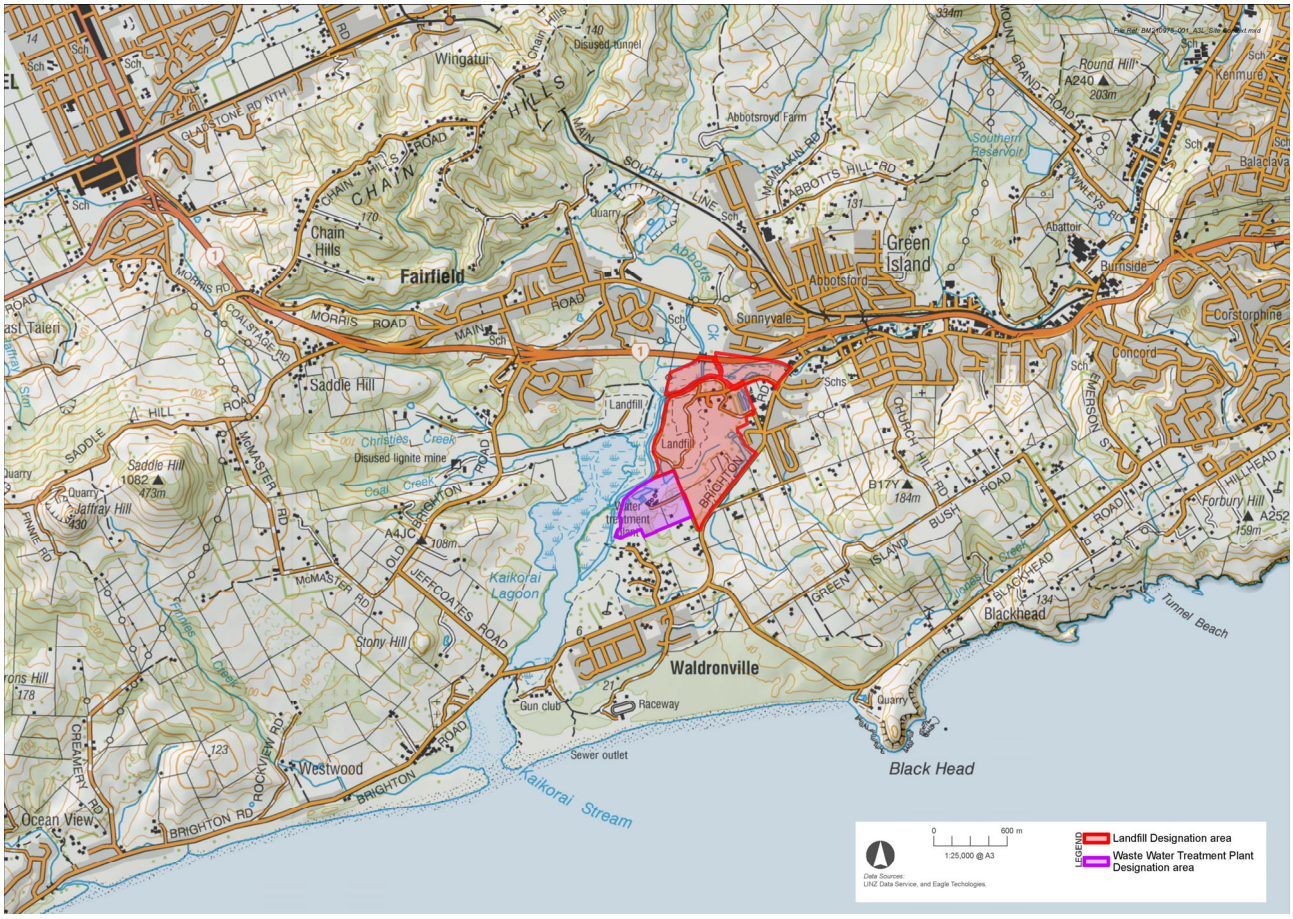

Figure 1 ***Green Island Landfill and Resource Recovery Park Precinct Site (Designation D658).***

In addition, DCC is planning for the ongoing operation and closure of the Green Island landfill, which is coming to the end of its operational life. The existing Otago Regional Council (ORC) resource consents, required to operate a landfill at Green Island, expired in October 2023. In March 2023, DCC applied to ORC for replacement resource consents to continue to use the landfill until it closes completely, and waste disposal can be transferred to a new landfill facility. These consent applications are in the process of being considered by ORC.

1.1.2 Green Island Resource Recovery Park Precinct (RRPP)

To meet the requirements of the new kerbside collection service the DCC is investing in improvements and expansion to the existing resource recovery area at the Green Island Landfill Site. Proposed new facilities are shown on Figure 2 and include:

- Organic receival building (ORB) and processing facilities to support the organic waste kerbside collection;
- Materials recovery facility (MRF) to sort and bale items collected from kerbside mixed recycling bins; and
- Bulk waste transfer station (BWTS) to facilitate the compaction and trucking of waste to landfill.

Additional facilities also include new glass bunkers, staff offices, parking, and breakrooms and associated access roads and truck parking areas. Several existing facilities are to be retained including the rummage shop, public drop-off areas and the education centre.

The resource consents for the development and operation of the new facilities relate to ground disturbance, and discharges to land and air. The Green Island Landfill Site is subject to an operative designation (D658) in the Proposed Second-Generation Dunedin City District Plan (2GP) for the purpose of Landfilling and Associated Refuse Processing Operations and Activities.

The RRPP will be run by EnviroNZ on behalf of DCC and will start operating in July 2024 following construction of the ORB, which is currently underway. Resource consent to operate the ORB was granted by ORC in September 2023 under the existing landfill consents.

The other new RRPP facilities are planned to start operating from mid-2025.

1.2 Purpose of this report

As part of the documentation to support the Resource Consent Application for the RRPP development at Green Island, Dunedin several DRAFT construction and operations management plans have been prepared by GHD and Enviro NZ Ltd. These draft plans are attached to this report in the following appendices:

Construction

Appendix A – DRAFT Construction Environmental Management Plan

Appendix B – DRAFT Erosion and Sediment Control Plan

Appendix C – DRAFT Contaminated Land Management Plan.

Operations

Appendix D – DRAFT Operations Management Plan

Appendix E – DRAFT Stormwater Management Operation and Maintenace Plan

Appendix F – DRAFT Green Island Composting Facility Management Plan

These draft plans have been prepared to provide information on the anticipated structure and content of each plan. These plans cannot be finalised until either the RRPP detail design has been completed or a constructor has been appointed and can provide specific inputs. Nonetheless, it is expected that the final plans will be in general accordance with the documents presented in this report.

These draft plans should be read in conjunction with the following reports.

Draft Plan	Proposed Facility
Appendix A – DRAFT Construction Environmental Management Plan	RRPP Design Report (GHD 2024A)
Appendix B – DRAFT Erosion and Sediment Control Plan	RRPP Stormwater Management Report (GHD 2024C)
Appendix C – DRAFT Contaminated Land Management Plan.	RRPP Design Report (GHD 2024A) RRPP Groundwater Report (GHD 2024B)
Appendix D – DRAFT Operations Management Plan	RRPP Design Report (GHD 2024A)
Appendix E – DRAFT Stormwater Management Operation and Maintenace Plan	RRPP Stormwater Management Report (GHD 2024C)
Appendix F – DRAFT Green Island composting Facility Management Plan	RRPP Deign Report (GHD 2024A) RRPP Air Quality Report (PDP 2024)

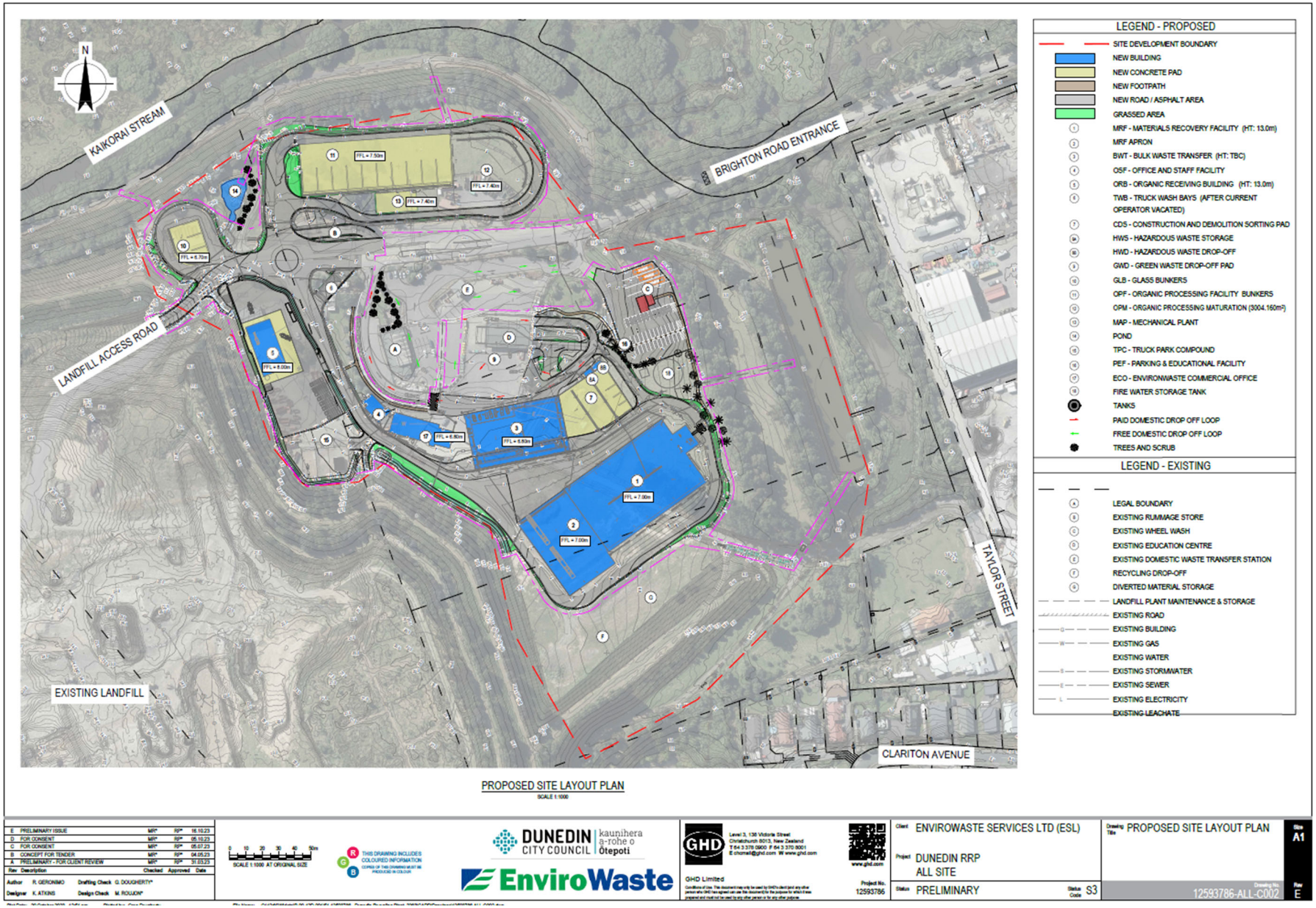

Figure 2 ***Green Island Resource Recovery Park Development Area Proposed Layout.***

2. References

– GHD, 2024A, Waste Futures – Green Island – Resource Recovery Park Precinct Design and Operations Report
– GHD, 2024B, Waste Futures – Green Island – Resource Recovery Park Precinct Groundwater Technical Report
– GHD, 2024C, Waste Futures – Green Island – Resource Recovery Park Precinct Stormwater Management and Assessment of Effects
– Pattle Delamore Partners Ltd, 2024, Green Island Resource Recovery Park Precinct – Air Quality Assessment

Limitations

This report: has been prepared by GHD for and may only be used and relied on by for the purpose agreed between GHD and as set out in section 1.1 of this report.

GHD otherwise disclaims responsibility to any person other than arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring after the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section(s) 1.3 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

Accessibility of documents

If this report is required to be accessible in any other format, this can be provided by GHD upon request and at an additional cost if necessary.

Appendices

Appendix A

DRAFT Construction Environmental Management Plan

DRAFT Construction Environmental Management Plan

Green Island Landfill Resource Recovery Park Precinct

Dunedin City Council

12 January 2024

Project name		Green Island Landfill Consenting to Closure and RRPP Consenting					
Document title		DRAFT Construction Environmental Management Plan | Green Island Landfill Resource Recovery Park Precinct					
Project number		12613624					
File name		RRPP CEMP_Draft A.docx					
Status Code	**Revision**	**Author**	**Reviewer**		**Approved for issue**		
			Name	**Signature**	**Name**	**Signature**	**Date**
S4	01 (DRAFT)	Cecilia Gately	Nick Eldred and Jack Thomas		Stephen Douglass		28/02/24
[Status code]							

GHD Limited
Contact: Cecilia Gately, Team Leader - Southern CAR | GHD
138 Victoria Street, Level 3
Christchurch Central, Canterbury 8013, New Zealand
T +64 3 378 0900 | **F** +64 3 377 8575 | **E** chcmail@ghd.com | **ghd.com**

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1. Introduction

1.1 Waste Futures Programme

As part of Dunedin's wider commitment to reducing carbon emissions and reducing waste going to landfill, the Dunedin City Council (DCC) has embarked on the Waste Futures Programme to develop an improved comprehensive waste management and diverted material system for Ōtepoti Dunedin. The programme aligns with DCC's responsibility under the Waste Minimisation Act 2008 to 'promote effective and efficient waste management and minimisation within its district'.

Improving Dunedin's whole waste system includes enhancing collection services for reuse and recycling, and safe disposal of residual waste to landfill. The Waste Futures Programme includes provision of an enhanced kerbside recycling and waste collection service for Dunedin from July 2024. The new kerbside collection service will include collection of food and green (organic) waste.

To support the implementation of the new kerbside collection service, the DCC is planning to make changes to the use of Green Island landfill site (the Landfill) in coming years including:

- Developing an improved Resource Recovery Park Precinct (RRPP) for food and green waste and to process recycling
- Providing new waste transfer facilities to enable the safe disposal of any residual waste to landfill.

The landfill is located at 20 Taylor Street, Green Island, Dunedin (the Property). A location plan for the Landfill is presented as Figure 1.

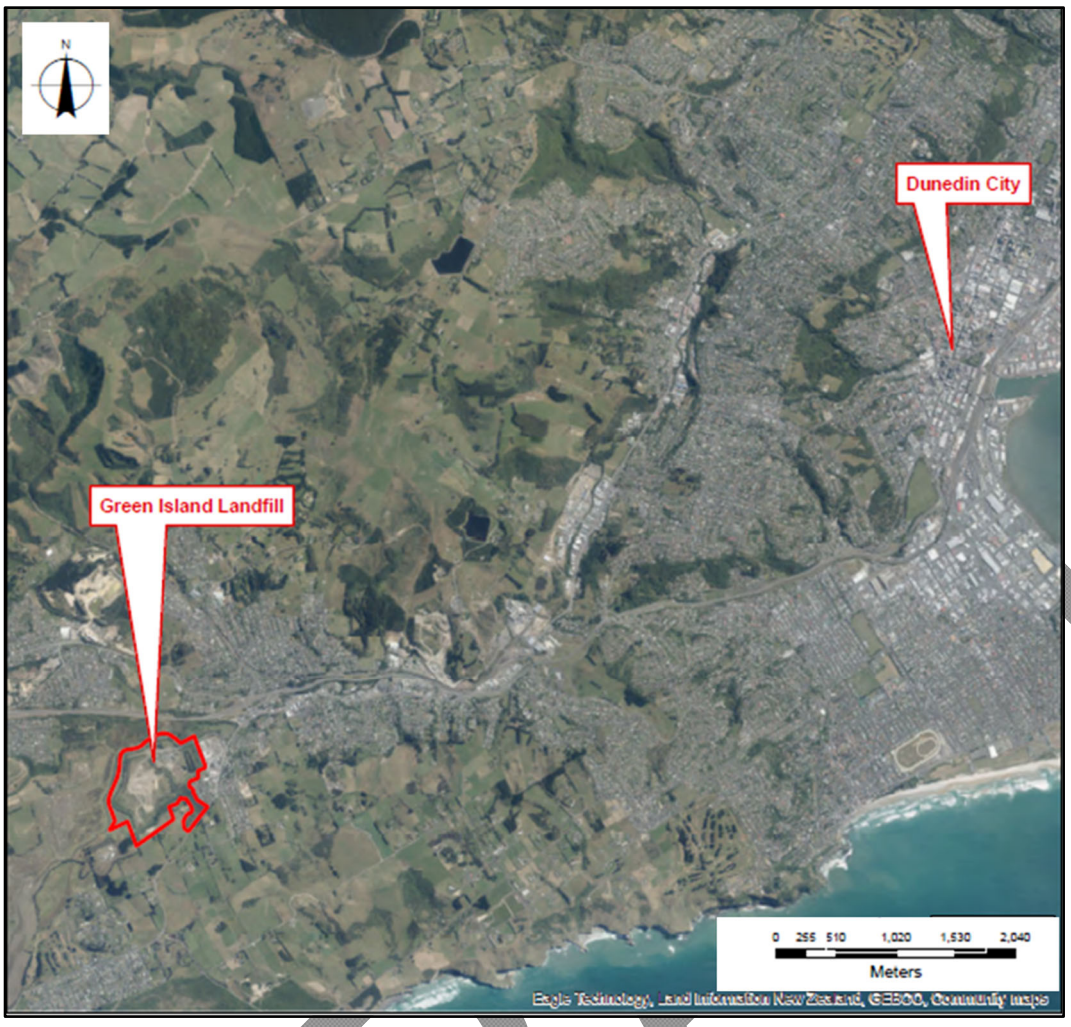

Figure 1 Green Island Landfill location plan

In addition, the DCC is planning for the ongoing operation and closure of the Green Island landfill, which is coming to the end of its operational life. The existing Otago Regional Council (ORC) resource consents, required to operate a landfill at Green Island, expired in October 2023. In March 2023, DCC applied to ORC for replacement resource consents to continue to use the landfill until it closes completely, and waste disposal can be transferred to a new landfill facility. These consent applications are in the process of being considered by ORC.

GHD Limited (GHD) have been engaged by DCC to prepare a Construction Environmental Management Plan (CEMP) for the redevelopment works proposed for the portion of the Landfill site where the RRPP is to be developed (the Project). The RRPP (red outlined area) is to be located in the northern portion of the Landfill where a transfer station and other landfill support buildings are currently situated, as can be seen in Figure 2.

Figure 2 Layout of the Landfill and location of the RRPP

1.2 Green Island Resource Recovery Park Precinct

To meet the requirements of the new kerbside collection service the DCC is investing in improvements and expansion to the existing resource recovery area at the landfill site. Proposed new facilities are shown on Figure 3 and include:

- Organic Receivables Building (ORB) and processing facilities to support the organic waste kerbside collection.
- Organic processing facility bunkers.
- Materials recovery facility (MRF) to sort and bale items collected from kerbside mixed recycling bins.
- Bulk waste transfer station (BWTS) to facilitate the compaction and trucking of waste to landfill.

Additional facilities also include new glass bunkers, staff offices, parking, and breakrooms and associated access roads and truck parking areas. Several existing facilities are to be retained including the rummage shop, public drop-off areas and the education centre.

1.3 Site setting and description

Site setting and description details are provided in Table 1 below.

Table 1 Property and Site description

Property Street Address	20 Taylor Street, Green Island, Dunedin
Property Legal Description	Lot 1 DP 20582
Property Site owner	Dunedin City Council
Property Site Area	51.36 hectares (513,600 m^2)
Project Area	~80,000 m^2
Project Area Adjoining Land Uses	North: Kaikorai Street, paddocks and motorway South: Residential properties East: Sedimentation pond, constructed wetland and industrial sites West: Operating landfill area
Project Area Topography	Flat lying
Nearby Water bodies	Sedimentation pond located 75m to the east of the Project Area Kaikorai Stream located 50m to the north of the Project Area

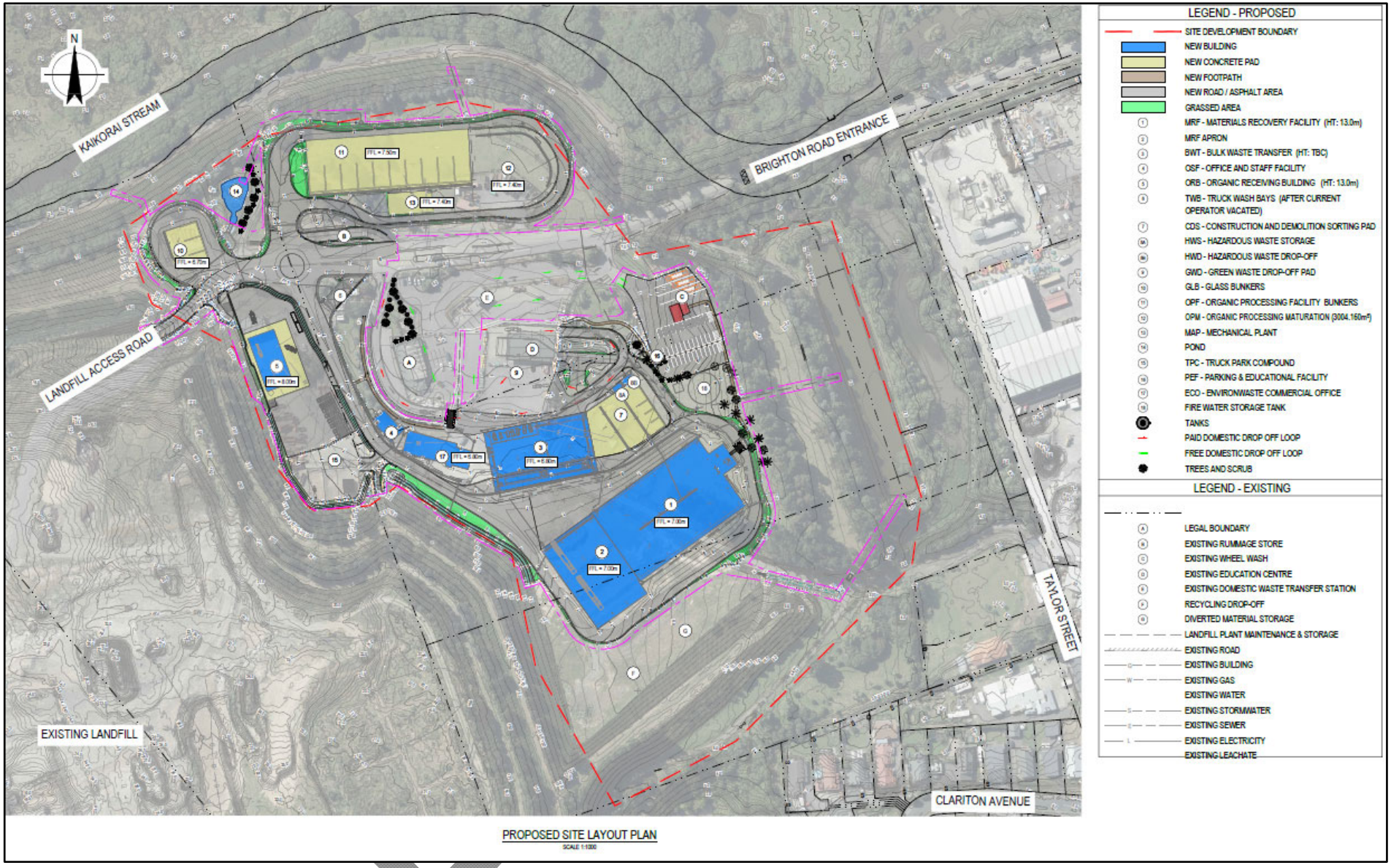

Figure 3 ***Proposed layout of the RRPP***

The resource consents for the development and operation of the new facilities relate to ground disturbance, and discharges to land and air. The Green Island landfill site is subject to an operative designation (D658) in the Proposed Second-Generation Dunedin City District Plan (2GP) for the purpose of Landfilling and Associated Refuse Processing Operations and Activities.

The RRPP will be run by EnviroNZ on behalf of the DCC and will start operating in July 2024 following construction of the ORB, which is currently underway. Resource consent to operate the ORB was granted by ORC in September 2023 under the existing landfill consents. The other new RRPP facilities are planned to start operating from mid to late 2025.

The new buildings (outlined within this report) will require resource consent from the ORC for the disturbance of contaminated soils for their construction and for the discharge of operational stormwater to the Kaikorai Stream.

In addition, resource consent for the disturbance of contaminated soils under the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 (NES-CS), and an outline plan of works approval is required from the DCC's consenting authority.

An environmental site investigation (ESA) was undertaken over the RRPP in 2021 (further details provided in section 3.1).

1.4 Purpose of this CEMP

This draft CEMP has been prepared in support of consent application for the RRPP (excluding the construction of the ORB) as requested by the ORC.

The purpose of this draft CEMP is to set out controls and procedures to manage the environmental risks posed by the proposed construction works and to meet consent requirements.

The purpose of the CEMP is to provide a framework and controls for the Project construction works to meet the conditions of applicable resource consents and designations, relevant legislation and the environmental objectives of the DCC.

This document also incorporates some of the requirements, but does not replace, the Contaminated Land Management Plan (CLMP) prepared by GHD dated February 2024 which manages the disposal of contaminated soil. This CEMP establishes the framework of management plans and protocols for implementation during the proposed construction works.

This CEMP outlines the controls and management procedures required to enable the *Main Contractor* to undertake construction works while ensuring that these works meet the appropriate environmental standards. The procedures and controls set out in the CEMP will manage the following:

- Compliance with the conditions of statutory approvals;
- Compliance with applicable legislation; and
- Environmental risks associated with the Project.

1.5 Scope

The primary objective and purpose of this CEMP is to ensure that adverse effects on the environment are adequately avoided, remedied or mitigated. To achieve this the *Main Contractor* will:

- Make environmental management a core consideration in the management process;
- Ensure a partnership approach between the DCC, the *Main Contractor*, the ORC and DCC monitoring staff;
- Ensure adequate resourcing of environmental management activities;
- Appoint suitably qualified staff responsible for environmental management aspects; and
- Undertake monitoring and auditing of the Project works to:
    a. Determine the effectiveness of the environmental management activities being undertaken;
    b. Document and report on the outcomes.

The CEMP set out the details of who, what, where, when and how environmental management and mitigation measures are to be implemented.

This CEMP may require review and amendment during the construction phase of the Project to reflect changes to activities, risks, mitigation measures, responsibilities and management processes. The ability to make changes to the CEMP is an important aspect of continually improving its effectiveness. This will be crucial to the implementation process as excavation works progress and potential landfill waste material is exposed, excavated and appropriately disposed of at the operational portion of the Landfill. All significant changes made as a result of reviews will be subject to approval by the ORC prior to implementation.

1.6 Limitations

This report is a DRAFT Document intended to provide guidance on the likely format and content of a final plan. The document will not be finalised until detail design has been completed and a contractor has been appointed who will provide input to the plan.

This report: has been prepared by GHD for Dunedin City Council and may only be used and relied on by Dunedin City Council for the purpose agreed between GHD and Dunedin City Council as set out in section 1.3 of this report.

GHD otherwise disclaims responsibility to any person other than Dunedin City Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

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The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section(s) 1.7 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

GHD has prepared this report on the basis of information provided by Dunedin City Council and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

1.7 Assumptions

The following assumptions have been made in the preparation of this CEMP:

- Information provided to GHD by the DCC and other third parties is true and accurate.
- The soil samples collected during site investigation works represent conditions at the Site.

2. Environmental Policy

Main contractor environmental policy statement

3. Roles and Responsibilities

The following principles will be maintained at all times:

- Accountability for all environmental management responsibilities ultimately rests with the Contract Manager
- The Environmental Manager's role provides a clear management structure for monitoring compliance with this CEMP.

The key management roles from each organisation in relation to environmental management during the construction of the Project are provided below:

Table 2 Key Contact Personnel

Position	Organisation	Name	Phone	Email
Engineer to Contract				
Site Manager				
Engineer's Representative				
Main Contractor Project Manager				
Main Contractor Contractors Representative				
Subcontractor Contractor Manager				
Subcontractor Contractors Representative				
Client Representative				
Contaminated Land Specialist				

Table 3 Project Emergency Contacts

Role	Name	Contact phone number
Health and Safety		
Nearest Public Hospital / Medical Centre	**Dunedin Hospital** 201 Great King Street, Dunedin **Green Island Medical Centre** 4 Howden Street, Dunedin	03 474 0999 03 488 2754
Environmental Manager		
Environmental Pollution Hotline	Otago Regional Council	0800 800 033
National Poison Centre		0800 POISON – 0800 764 766
Worksafe New Zealand		0800 030 040

3.1 Training

All staff carrying out the works, including those with site management responsibilities, will undertake a formal site induction that will identify all environmental risks and management processes described in this EMP. Anyone who

is unfamiliar with any of the control or mitigation measures, equipment, and/or incident response procedures will receive appropriate training.

Training may include (but is not limited to) such matters as contamination-specific health and safety controls, spill response and equipment, erosion and sediment control, and cultural awareness. No-one will be permitted to work on the site until they have completed the site induction process.

All staff undertaking work onsite will complete a specific site induction prior to undertaking any works onsite.

This specific induction will include the following elements:

- Spill Response;
- Sediment & Erosion Control;
- Contaminated Land Identification;

All staff that will be performing works onsite have had the relevant training and the competency register will be provided as evidence of this training.

4. Construction Methodology

4.1 Overview

The construction methodology for the RRPP (excluding the ORB) is as follows:

Contractor to complete once appointed

4.1.1 Materials Recovery Facility (MRF)

Notes for items to be considered and included in the methodologies:

- *Demolition required*
- *Excavation depth*
- *Service trenches locations and depths*
- *Excavated material handling and disposal*
- *Monitoring – construction and environmental (landfill gasses, dust etc.)*
- *Stockpiling - aggregate only*
- *Building construction details including landfill gas membrane.*
- *Dewatering / leachate management*

4.1.2 Bulk Waste Transfer (BWT)

As above

4.1.3 Organics Processing Facility Bunkers

As above

4.1.4 Offices and ancillary buildings

As above

5. Waste Management

5.1 Potential impacts

Reduction of waste is sought through the construction phase of the Project. Efficient use of resources is both environmentally and financially beneficial. In addition, the inefficient use of raw materials, waste production, litter blow, poor housekeeping and the associated presence of pests (flies, rodents and birds), and propagation of pest plant species are also significant issues to be managed. An efficiently run site is tidy and provides a good impression to the public, regulators and to the Client; it also improves the efficiency and profitability of projects and increases general site safety.

5.2 Management approach

The management of waste production and disposal within the project area from all construction activities undertaken, including provisions for recycling, will be a key focus. Site housekeeping over the duration of the project will also be given particular attention.

Procedures to encourage and facilitate material efficiency and waste minimisation will include:

Inductions, pre-starts and tailgate meetings will include instruction about the expectation that opportunities for waste reduction, re-use and site housekeeping priorities form a key plank of the programme of works.

All plant and machinery brought onto the site is to be maintained in a safe, clean and tidy condition.

Priority is to be given to the reuse or recycling of materials over disposal, wherever practicable.

All excavated material that is potentially contaminated will not be stockpiled but will be transported directly to the active tip. All loads will be prepared as detailed in the construction methodology and a record of the load will be kept in a manifest. It is not envisaged that loads will pass over the weighbridge as the material has already been accounted for and is not being introduced to site.

Weekly reviews of controls on-site will include an assessment of general site tidiness and housekeeping; where necessary, non-compliance will be rectified as soon as possible.

All site personnel will be encouraged to deal with (as a first principle) or report issues where attention is required to address waste generation and general site tidiness.

6. Environmental Risk Assessment

6.1 Methodology

Before any risks can be managed or controlled it is necessary to know the nature, likelihood, and impact of those risks. Risk Management involves the identification, assessment, control, monitoring and reporting of risks for the project. The Risk Assessment framework below consists of a Risk Assessment Matrix, and definitions for risk likelihood and Impact. The use of these in combination provides a mechanism to consistently assess risk rating. This risk process will be completed prior to finalising this CEMP.

Table 4 Risk Assessment Matrix

		Impact				
		Insignificant	Minor	Moderate	Major	Extreme
Likelihood	Almost Certain	Medium	High	High	Very High	Very High
	Likely	Medium	Medium	High	Very High	Very High
	Possible	Low	Medium	High	High	Very High
	Unlikely	Low	Low	Medium	High	High
	Very Unlikely	N/A	Low	Medium	Medium	High

Table 5 Risk Likelihood Definitions

Rating	Probability	Description
Almost Certain	> 90%	Virtually guaranteed to occur
Likely	> 70%	Will probably occur in most circumstances
Possible	> 40%	Common occurrence
Unlikely	> 10%	Could occur at some stage
Very Unlikely	< 10%	Some history of occurrence

The impact assessment must consider short, medium, and long-term impacts. Where a risk impact might encompass multiple environmental factors/effects, the highest impact must be used for the assessment.

All impacts (other than those identified as N/A) will require appropriate management and/or mitigation measures.

Table 6 ***Risk Impact Definitions***

Element	Insignificant	Minor	Moderate	Major	Extreme
Environmental		Moderate effects on biological or physical environment but little or quickly remedied impact to ecosystem. Short term reversible damage	Serious environmental effects such as displacement of species and partial impairment of ecosystem. Reversible but widespread medium-term impact/damage.	Significant impact on highly valued species or habitats. Reversible, but long-term damage. Some impact not reversible	Long term destruction of highly significant ecosystem or very significant effects on endangered species or habitat. Irreversible damage.
Legislative		Minor non-compliance with no legal / regulatory requirements.	Non-compliance with legal / regulatory requirements, or cessation of works.	Non-compliance with enforcement action, possible prosecution.	Prosecution.
Financial	Operational cost overrun up to $2%	Operational cost overrun of between $2% and $5%	Operational cost overrun of between $5% and $25%	Operational cost overrun of between $25% and $50%	Operational cost overrun greater than $50%.
Reputational / Image	No or negligible (one-off) media coverage or comment.	Minor short term media coverage with negative correlation and small/local audience	Negative media coverage with broader audience (regional and/or some national coverage) and involving more than one media agent. Short term focus (<5days).	Negative national media coverage with extended coverage (>5days) involving multiple news and media agents.	Sustained negative national and/or international media coverage, with focus investigative segments, re-occurring coverage and involving multiple news and media agents.
Customers	Negligible or isolated impact to customer(s) with no impact to normal levels of complaints	Impact to small groups of customers with some notable trend/similarity in complaints.	Community group impact with formal/justifiable complaints lodged or complaints in relation to public health.	A number of community groups affected (e.g. with some protest action)	Widespread impact to city population.

Table 7 provides a preliminary summary of risks that should be considered during the risk assessment process. This is not intended to be an exhaustive list and further consideration of the risk issues is required by the contractor and DCC prior to completing the risk assessment.

Table 7 Project Environmental Risks

Environmental Factor[1]	Environmental Effect[2]
Rivers, Lakes, Streams and Drains	Fish Passage
Groundwater and Springs	Erosion and Sediment Control
Flora and Fauna	Dewatering
Coastal Habitat and Processes	Stormwater
Protected Trees	Dust and Air Quality
Archaeology, Heritage and Cultural	Noise
Contaminated Land	Vibration
Coal Tar	Hazardous Substances
Asbestos	Rehabilitation / Landscaping
Wastewater	Property Ownership
Flowable Materials	Waste Minimisation
Additional Environmental Factor	Additional Environmental effect

Notes:

1. Generally denotes potential environmental risks that are present at the site prior to the project.
2. Generally denotes potential environmental risks that are result from the works associated with the project.

6.2 Other effects

Table 8 Other effects

Effect	Management / Control Measures
Working hours	*The Main Contractor* will work within the New Zealand Standard for construction noise NZS 6803:1999 guidelines.
Weather	*The Main Contractor* will review weather forecasts daily, – Works will not be undertaken when wind conditions are above the manageable level with regards to controlling dust. – When rain conditions may cause erosion / sediment issues (≥25mm within 24 hours) ESC will be reviewed and the working area is to be minimised to ensure that controls are not overwhelmed.
Project Scheduling	Project resources are to be put in place to achieve the intended programme
Adjacent property stakeholders	

7. Dust

7.1.1 Risk Assessment

Dust from excavation / construction activities, vehicle movements and/or stockpiles can contribute to sediment runoff as well as creating a nuisance to the public, neighbouring properties and adjoining roads. Similarly, odour and plant/vehicle fumes can be offensive to nearby sensitive receptors. Suitable controls are required to avoid offensive or objectionable effects of dust and fumes both on site and in the surrounding environment.

Dust may contain contaminants, placing increased importance on the prevention of dust generation during the proposed works.

Odours could arise from the works due to the disturbance of historical waste materials / contamination so appropriate dust controls must be in place.

The excavation / construction activities may generate dust due to plant movement, disturbed ground and stockpiles of excavated materials. Standard good practice for dust controls should include the following:

- Timing of works including prevalent wind direction.
- Minimizing need to stockpile material.
- Dampening any exposed soils during dry conditions.
- Minimising material drop heights from mobile plant.
- Considering sensitive activities or sites adjacent to the area of works.
- Descriptions of the management practices being implemented to minimise discharges.
- Management of dust from contaminated material excavation/removal.

7.1.2 Performance Standards

The discharge of dust from excavation / construction activities will comply with the Ministry for the Environment. (2016). Good Practice Guide for Assessing and Managing Dust: There shall be no noxious, dangerous, objectionable or offensive dust to the extent that it causes an adverse effect at or beyond the boundary of the site.

7.1.3 Control Measures

During excavation / construction works, the principal mitigation will be through the use of water for dust suppression, namely using a water spray to dampen the affected surface, and by avoiding earthworks during strong winds when ground conditions are dry. Discharge from water suppression will be collected for disposal to the leachate management system.

It is essential that dust generation during the works is prevented to minimise any impact to the adjacent stakeholders and the public. Therefore, as a minimum the following control systems shall be put in place:

- Minimise destabilisation of existing hardstand areas where possible;
- Frequent spraying of water over the work area, particularly any excavation, stockpiling and trafficking areas, to ensure the working surfaces remain damp;
- Wetting of excavated materials, loading, tipping and placement; and
- Works shall cease, and the Site Manager be advised if the wind conditions are too strong to continue in a safe manner. Contingency measures are presented in Section 7.2.6.

7.1.4 Monitoring

Site inspections for the generation of dust will be undertaken at least twice daily during the works and the findings and actions will be recorded in daily logs. All inspections will be made by a member of site staff that has been trained in making dust observations.

If dust is visible beyond the site boundaries then the following details will be recorded:

- Source of dust emission (i.e. confirm it originated from the stockpiled material and not from other on site or off-site activities).
- A brief description of the colour and opacity of the visible dust emission.
- The level (extent) of the visible dust emission based on the following:
- Minor (< 5 m from source).
- Moderate (<20 m from source).
- Major (>20 m from source).
- The time and general weather conditions.
- Possible causes of the discharge and preventative actions taken.

The control and mitigation measures listed in Section 7.2.3, apply at all times and are to be carried out as necessary to prevent or remedy any visible dust emissions beyond the site boundary, regardless of the assessed level. However, if the assessed level of visible dust emissions is moderate or major (as described above), the Site Manager must be notified for further action.

When notified for further action, the Site Manager will investigate the situation and take necessary measures to ensure dust levels do not give rise to adverse off-site impacts. Such actions will also be recorded in the daily log.

7.1.5 Reporting / Incident Response

Site inspections will be recorded, and inspection reports will be forwarded to the *Engineer's Representative* on a weekly basis.

Any complaints received by the *Main Contractor* shall be forwarded to the *Engineer's Representative* immediately upon receipt.

All responses to complaints will be managed by the *Engineer's Representative and / or the Client*. The *Main Contractor* will work with *Engineer's Representative and / or the Client* as required to investigate the likely cause of the complaint and identify corrective actions.

7.1.6 Contingency

Contingency measures to control dust may be required in situations when dust suppression equipment breaks down or malfunctions or when unforeseen circumstances cause visible dust to blow beyond the site boundary (e.g., highly unfavourable weather conditions). The following contingency measures are to be carried out should these events occur:

- If dust suppression equipment breaks down or malfunctions, cease operations of those activities that result in significant dust emissions immediately and only resume when the equipment or equivalent replacement is fully operational and functioning correctly.
- If significant visible dust is blowing beyond the site boundary, cease any dust generating activity until the appropriate mitigation measures are in place. If necessary dampen the material to be handled (e.g., excavated) or wait until more favourable weather conditions arise (e.g., if highly unfavourable weather conditions are causing dust mitigation measures to be less effective).

8. Contaminated Land

8.1 Contaminant Status

The Site is listed on the ORC listed land use register (LLUR) as being a known landfill and as such is categorised as HAIL activity G3 (landfill sites).

8.2 Previous Site Investigation

An Environmental Site Assessment (ESA) investigation was undertaken over the RRPP in September 2021. As the layout and design of the precinct had not been finalised at the time the investigations took place, the locations of the investigation points (test pits, boreholes and landfill gas monitoring wells) were spread across the proposed RRPP area to provide coverage of the whole area.

Thirty-four test pits were excavated across the proposed RRPP area to depths of up to 3.2 m below ground level (bgl). In addition, four boreholes, which had groundwater piezometers installed into them, and four landfill gas monitoring wells were drilled and installed. Landfill waste material, comprising brick, timber, concrete, metal, clothing, paper, asphalt etc., was encountered at all of the investigation points.

The site investigation indicated that the material placed over the waste present comprised a topsoil type material and was approximately 0.2 m to 0.3 m thick in the eastern and northern portion of the proposed RRPP area. In the composting area (southern portion of the proposed RRPP area), the capping material was between 1.0 and 1.5 m thick and in the northwestern area, there was hardfill material between 0.3 m and 1.2 m thick present at surface. The borehole logs indicated that the material placed over the waste was between 0.65 m and 1.2 m thick.

Logs for the boreholes indicate that the landfill waste is between 5.0 m and 9.3 m thick and overlies estuarine sediments associated with the Kaikorai Estuary onto which waste was placed in this area between the 1950s and 1970s.

The water levels recorded in the boreholes were between 2.5 and 3.8 m below the top of casing on 2nd November 2021. As groundwater is associated with the underlying waste materials it has been classified as leachate with respect to water management at the landfill.

Methane gas was found to be present in all of the landfill gas monitoring wells (at each of the five monitoring events), with the higher concentrations recorded at monitoring wells WS01 (composting area), ranging between 6.1% and 80.5% of methane, and WS02 (south eastern corner of the Site) with concentrations ranging between 3.5% and 61.5% of methane. This range reflects the highly variable nature of waste and the generation of methane gas that is typical of waste materials.

Hydrogen sulphide (H_2S) was recorded as present at only one of five monitoring events in monitoring well WS04, at a concentration of 3.0 ppm, located in the northern portion of the Site. Low concentrations of oxygen were also recorded in all wells with concentrations recorded at each monitoring event ranging between 0.0 and 5.6 ppm with the exception of WS01 (October 2021) and WS02 (November 2021) which during discrete events recorded concentrations of 15.5 and 13.3 ppm, respectively.

Heavy metals and polycyclic aromatic hydrocarbons (PAHs) in soil were reported present at concentrations above the adopted background values at all sample location points. However, none of the reported concentrations were above the human health NESCS[1] Commercial / Industrial soil contaminant standard (SCS) criteria values or adopted guideline values. Selected soil samples were also analysed for total petroleum hydrocarbon (TPH), semi-volatile organic compounds (SVOCs) and asbestos. There were reported concentrations of these contaminants at values above either adopted background values (where available) or above the laboratory limit of reporting (LOR). However, none of the concentrations for these contaminants were reported at values exceeding the adopted human health NESCS Commercial / Industrial SCS criteria values or adopted guideline values.

[1] Resource Management (National Environmental Standard for assessing and managing contaminants in soil to protect human health (NESCS)) Regulations 2011.

Asbestos fines were reported present in two of the samples analysed at concentrations less than the human health standard. The samples were collected from test pits which are located in the northern and southeastern portions of the Site.

Comparison of reported laboratory analytical results to the ANZECC (2000)[2] ISQG High and Low trigger values and the ANZG (2018)[3] GV High and Default Guideline Values (DGV) indicated that heavy metals, PAHs and SVOCs were present at concentrations above these guideline values.

8.3 Contaminants of Concern

On the basis of the HAIL activity identified (landfill operations) and the findings of the ESA, the primary contaminants of potential concern are considered to include:

- Heavy metals
- PAHs
- TPHs
- SVOCs
- Asbestos
- Ground gases (landfill gas)

8.4 Risk Assessment

It is certain that contaminated soil and historical waste material will be encountered during the excavation works phase of the Project and, if inappropriately managed, may result in onsite and offsite contamination, human and environmental health and safety effects and increased waste disposal costs.

8.5 Performance Standards

Works are to be undertaken in accordance with the following:

- Applicable consent conditions;
- The Contaminated Land Management Plan (CLMP) for the works; and
- Erosion and Sediment Control Plan.

8.6 Control Measures

As described in Section 8,2 the site has been “capped” with a soil like layer up to 1.2m thick. While not necessarily contaminated, this material will be transported to the active landfill for disposal.

Contaminated material (landfill waste) will be encountered beneath this overlying soil layer. , Once encountered works must cease in the immediate area and *the Subcontractor* Project Engineer and *the Subcontractor* Environmental Manager consulted on the appropriate excavation methodology. The site of the waste materials will be demarcated and protected, and no further earth disturbing activities shall occur until a determination of the material type is made and decision on the appropriate management response has been formulated. Unless unexpected materials are encountered (see Section 8.8) the likely management method may include (but is not limited to):

- Material is not to be re-used onsite. It is to be disposed of within the active Green Island landfill.
- Load the unsuitable materials cleared for disposal off-site directly onto trucks, minimising the generation of dust.
- All loads shall have their loads covered with tarpaulins during transport of material to the facility.

[2] Australian and New Zealand Environment and Conservation Council (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Interim Sediment Quality Guidelines (ISQG) trigger values.
[3] Australian and New Zealand Guidelines for fresh and marine water quality (2018) Default Guideline Values (DGV) and Guideline Values (GV).

- All trucks leaving the construction zone shall have their wheels either swept down or washed before they leave the site (Project Area).
- Each truck load is to be accompanied by a waste transfer manifest and to be weighed via the Green Island weighbridge). Records of disposal of contaminated material are to be retained.
- No excavated materials will be stockpiled onsite and all topsoil, capping and refuse will be transported directly to the active tip face.
- Stockpiling of imported clean aggregate may occur and will be placed in an area where it can easily be determined where the bottom of the stockpile is so that minimal insitu ground is disturbed.

8.7 Monitoring

Monitoring to be undertaken during periods of soil disturbance works, and when there are open excavations and / or trenches present.

Unexpected discovery protocols to be in place.

8.8 Unexpected Discovery Protocol

In the event that the *Main Subcontractor / Main Contractor* or any other site workers encounter any contamination of unknown origin or gross contamination, including but not limited to underground storage tanks, waste fuel or chemical drums, asbestos containing material (ACM) in large volumes, buried wastes differing to what is typically found at the Site, or soil containing contamination (odours or staining) differing to what is normally found at the Site, the area should be evacuated and secured immediately with no further access allowed to that portion of the Site until appropriate response and control measures can be implemented as follows:

- If it appears that there is an immediate risk to staff and/or the environment (for example leaking containers, strong odours or any observed health effects), emergency services should be contacted and a HAZMAT response requested; and
- If the contamination does not appear to present an immediate risk to staff and/or the environment, the client should be informed of the discovery so that an appropriate assessment can be undertaken by a SQEP (Contaminated Land Specialist).
- An example flowchart of the procedures to be followed is provided as Figure 4.

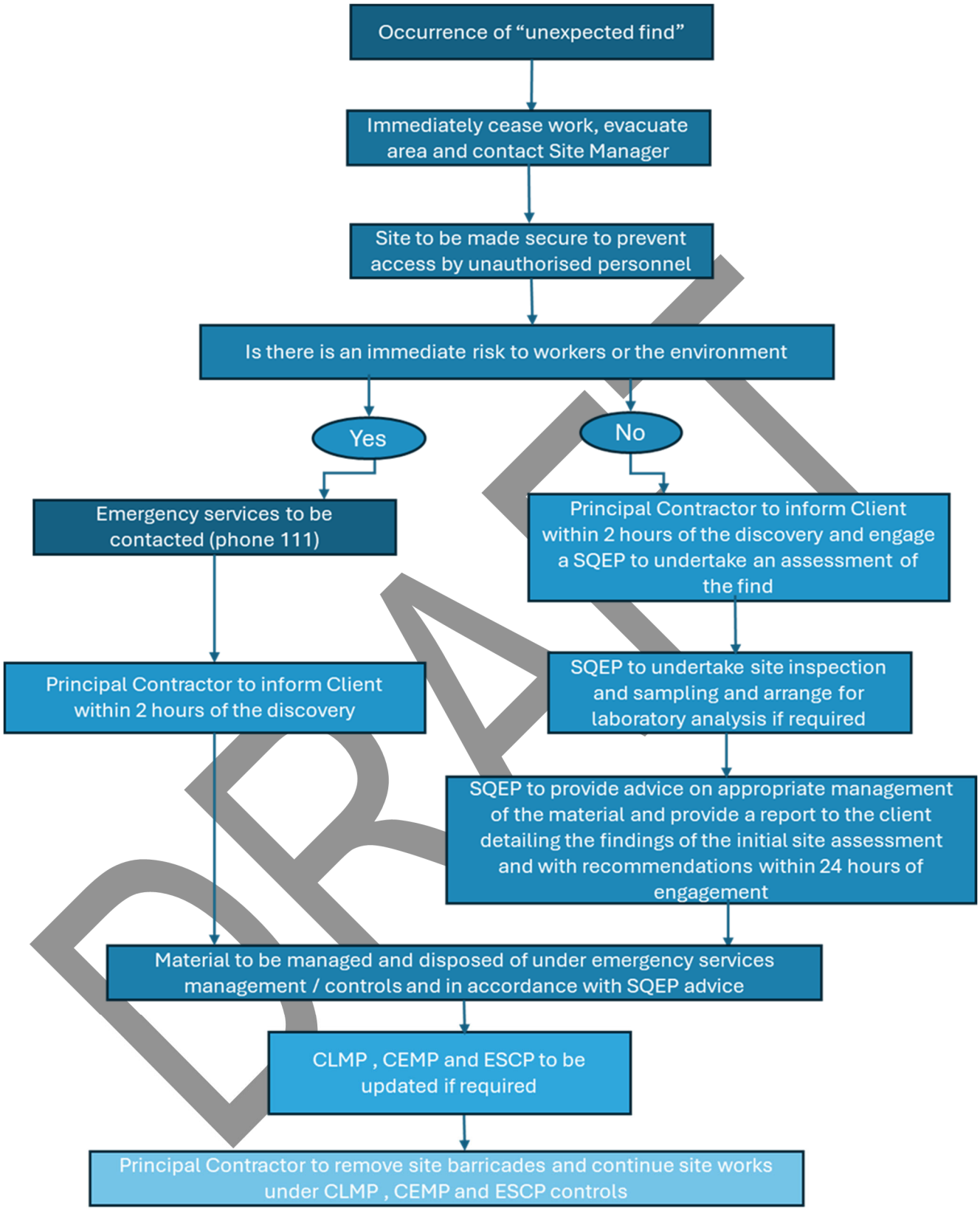


Figure 4 Proposed unexpected finds protocol

8.9 Reporting

Site reports to be prepared.

8.10 Contingency / Incident Response

All Unexpected discovery reports are to be provided to the *Main Contractor* Engineers Representative and the Client.

9. Landfill Gasses

9.1 Risk Assessment

Methane (CH_4) gas was found to be present in all of the landfill gas monitoring wells located within the RRPP Project Area at the monitoring events undertaken in 2021. The highest concentrations were recorded at monitoring wells WS01 (composting area), ranging between 6.1% and 80.5% of CH_4, and WS02 (south eastern corner of the Project Area) with concentrations ranging between 3.5% and 61.5% of CH_4. This range reflects the highly variable nature of waste and the generation of methane gas that is typical of waste materials.

Hydrogen sulphide (H_2S) was recorded as present at only one of the monitoring events in monitoring well WS04, located in the northern portion of the Site, at a concentration of 3.0 ppm. Low concentrations of oxygen (O_2) were also recorded in all wells with concentrations recorded at each monitoring event ranging between 0.0 and 5.6 ppm with the exception of WS01 (October 2021) and WS02 (November 2021) which during discrete events recorded concentrations of 15.5 and 13.3 ppm, respectively.

9.2 Performance Standards

The LFG monitoring is to be carried out in accordance with procedures that meet EPA guidance given by the:

- EPA (2016) Environmental Guidelines: Solid Waste Landfills; and
- EPA (2020) Assessment and management of hazardous ground gases.
- These procedures will include, but not be limited to:
- A suitable LFG meter that measures oxygen (%v/v), mCH_4(in %v/v), carbon dioxide (CO_2) (%v/v), carbon monoxide (CO) (ppm), H_2S (ppm) and LEL (%) with suitable detection limits against the action levels;
- For subsurface monitoring (landfill gas monitoring wells), the LFG meter is also to measure flow rates;
- Other parameters to be measured are relative pressure and barometric pressure;
- All gas monitoring devices will be calibrated as per the manufacturer's specification; and
- Monitoring will be undertaken by trained personnel who have experience with the equipment and who are able to assess the risks associated with hazardous atmospheres.

The photo-ionisation detector (PID) monitoring is to be carried out in accordance with procedures that meet EPA guidance given by the:

• EPA (2020) Assessment and management of hazardous ground gases;

• NEPM (2013) Schedule B2 guidelines; and

• EPA (2014) Technical Note: Investigation of Service Station Sites.

9.3 Control Measures

For the purposes of this CEMP, a work zone is defined as the portion of the Project Area where ground disturbance work is planned or being undertaken such as excavation or any hot-work (such as welding or cutting steel).

Hazardous or potentially explosive atmospheres are to be monitored using a landfill gas (LFG) meter (GA5000 or similar) and a photo-ionisation detector (PID with 10.6eV lamp), with the following parameters:

- LFG parameters: CH_4 (including lower explosive limit (LEL)), O_2, CO_2, CO, H_2S
- PID parameter: volatile organic compounds (VOC)

Proposed monitoring locations are summarised in Table 9

Table 9 Work Zone monitoring

Actions	LFG and PID Monitoring Locations
Excavation	At the surface of the excavation progressively through the entire bulk excavation process.
Other minor ground disturbance	At the ground surface and at breathing zone, or where applicable.

Table 10 Ground Gas monitoring action levels

Gas Parameter	Accumulation in Enclosed structures	Work Zone and Breathing zone (open atmospheres)	Work Zone and Breathing zone (Confined space)	Surface Emissions
Methane	0.25% v/v (i.e 2,500 ppm or 5% LEL)	0.25% v/v (i.e 2,500 ppm or 5% LEL)	0.25% v/v (i.e 2,500 ppm or 5% LEL)	500ppm (i.e. 0.05%v/v or 1% LEL)
Carbon dioxide	0.25 % v/v (i.e. 500 ppm)	0.5 % v/v (i.e. 5,000 ppm)	0.25 % v/v (i.e. 500 ppm)	-
Carbon monoxide	15 ppm	30 ppm	15 ppm	-
Hydrogen sulfide	5 ppm	10 ppm	5 ppm	-
Oxygen	19.5% to 23.5%	19.5% to 23.5%	19.5% to 23.5%	-
Petroleum volatiles	10 ppm	10 ppm	10 ppm	-

9.4 Monitoring

Monitoring at a work zone will be undertaken prior to the commencement of work at the work zone and at least three times per day (at the start, after lunch and mid-afternoon) to ensure ground gases are not creating a hazardous or potentially explosive atmosphere within the work zone.

Experience has shown that hazardous or potentially explosive atmospheres can develop even when volatile contaminant concentrations in soils are low, due to the heat that can be generated by various construction activities.

Monitoring to be undertaken during periods of soil disturbance works, when there are open excavations and / or trenches present.

9.5 Reporting

The results of daily monitoring will be recorded and reports will be forwarded to the *Engineer's Representative* on a weekly basis.

9.6 Contingency / Incidents

Contingency and corrective actions for LFG and other types of ground gas hazards detailed in Table 11 are to be implemented where exceedances are identified during routine monitoring. All exceedances (including one off exceedances) are to be assessed in the context of the exceedance in relation to potential immediate receptors.

Table 11 Triggers and corrective actions

Gas Concentration Trigger	Corrective Action / Contingency Plan
Action Level exceeded in enclosed structure	Evacuate building immediately and erect warning signs. If an unoccupied structure (e.g. pit), isolate area, erect barricade and erect warning signs. Contact emergency services if fire/ explosive conditions are developed and ignition sources cannot be switched off. Continue monitoring until gas levels fall below the Action Level. Further investigate incident to establish cause. Implement daily monitoring to confirm Action Levels not exceeded for next two weeks.
Action Level exceeded in work zone	Stop work, make area safe, move to an alternative location or allow additional time for ventilation. Contact emergency services if fire/ explosive conditions are developed and ignition sources cannot be switched off. Continue monitoring until gas levels fall below the Action Level. Recommence work only when there is a low risk of gas levels exceeding Action Level at which point standard monitoring frequencies can be adopted
Action Level exceeded in surface emission	Stop work, make area safe and barricade the area for further investigation by an environmental consultant for review of further corrective actions (e.g. increase ventilation, install cap and LFG control measures)

All incidents are to be recorded and investigated.

10. Odours

10.1 Risk Assessment

As it is likely that historical waste material or leachate will be exposed during the excavation works, nuisance odours may be released and migrate beyond the boundaries of the Project Area.

10.2 Performance Standards

Odour monitoring will be undertaken by trained personnel, based on the Ministry for the Environment: Good Practice Guide for Assessing and Managing Odour All survey personnel will be screened for individual sensory capability.

10.3 Control Measures

The size of the open excavation is to be minimised when waste materials have been identified as being present, to reduce the area exposed to the air and minimise the generation of odours.

Excavated material (containing waste) is to be directly loaded into trucks and transported to the working face of the landfill for disposal and covering as soon as is practicable. Excavated material is to be kept dampened to minimise the generation of dust. This may also assist in managing odour although it is not likely to be a significant control measure.

10.4 Monitoring

Odour impact from the project is largely dependent on the meteorological conditions such as wind speed, wind direction, temperature and other parameters. Furthermore, it is important to consider the downwind stakeholders that may be impacted by the works.

Boundary odour monitoring will be carried out at a designated monitoring point(s) along the southern and eastern boundary of the Project Area.

Monitoring will be undertaken:

- Each work day of construction during bulk earthworks if odour is detected at the source; and
- In response to receiving an odour complaint/s. Monitoring locations will include the site of the complaint (as close as practicable to the complainant's location) and at intermediary, publicly available locations between the worksite and location of complaint (spaced linearly at approximately 50m). Boundary odour monitoring will also be triggered (unless already undertaken within previous 2 hours).

Monitoring parameters include:

- Date;
- Start and finish times;
- Temperature at start;
- Wind direction at start;
- Wind speed at start;
- Comments on construction activities;
- Comments on any implemented mitigation methods;
- Name of assessor/s; and
- The location of complaint/s (if triggered by complaint).
- Data will be recorded into the data sheet at each monitoring location including:
- Location (identifier at nominated site boundary, nearest address if complaint triggered);
- Odour intensity unit (0 to 6);

- Odour character (descriptive);
- Hedonic tone (-4 to +4);
- Mitigation measures undertaken; and
- Comments.

10.5 Reporting

The results of any monitoring undertaken will be recorded and reports will be forwarded to the *Engineer's Representative* on a weekly basis.

Any complaints received by the *Main Contractor* shall be forwarded to the *Engineer's Representative* immediately upon receipt.

All responses to complaints will be managed by the *Engineer's Representative and / or the Client*. The *Main Contractor* will work with *Engineer's Representative and / or the Client* as required to investigate the likely cause of the complaint and identify corrective actions.

10.6 Contingency

If the observed landfill odour is found to be construction related and has a negative hedonic tone with an odour intensity unit exceeding 2 at any location, mitigation measures will be re-assessed and applied where required. This will include an investigation of odour source and if the odour is related to construction activities, further corrective action must be undertaken to prevent the odour and/or to mitigate the impacts.

If a stronger unpleasant odour is detected, which has a hedonic tone below -2 accompanied by an odour intensity exceeding 3 at any monitoring location, offsite monitoring will be undertaken immediately (where practicable) beyond the location of the detection, starting at the nearest potential receptor and moving linearly towards the potential source of odour at approximately 50 m increments . At the sensitive receptor, if the odour related to construction activities remains strong (intensity exceeding 3) and moderately unpleasant (hedonic tone below -2), *the Engineer's Representative and the Client* will be notified immediately.

Investigation, corrective actions and additional monitoring will continue until odour has subsided and an incident report will be prepared in accordance with the CEMP.

Correction actions will depend on the nature of the odour issue, and may include (but are not limited to):

- General immediate action – the application of odour suppressant or deodorisers/odour cannon;
- If the odour relates to exposed waste/leachate in excavations – localised controls including covering leachate or odorous material; and/or amendment to excavation or dewatering procedures;
- If the odour relates to the presence of unexpected leachate finds – removal and disposal of leachate seepage;
- If the odour relates to the presence of odorous stockpiles (noting that stockpiling of waste materials is not allowed) – immediately relocate or dispose of odorous material;
- Use of odour cannons; and
- Closure of correction action – additional monitoring to confirm odour has been adequately managed.

11. Erosion and Sediment Control

11.1 Risk Assessment

Construction related activities exacerbate soil erosion rates significantly. This is because disturbed soils are more easily detached from the ground surface via wind, rain or water action. Consequently, if best practice controls are not established to mitigate this increase in erosion, significant adverse environmental effects may occur in the receiving environment.

The underwriting principle of erosion and sediment control is to reduce the potential effects of erosion and sedimentation. Following the paradigm that prevention is better than cure, measures to avoid or reduce erosion are far more effective at minimising adverse effects than sedimentation controls.

Because of the presence of known ground contamination (soil and waste materials) and leachate at the site, erosion and sediment control will be a significant issue to monitor and manage. Separation of stormwater from contaminated materials is a key aspect of construction planning as this will minimise the amount of contaminated water that will require treatment as leachate.

Any erosion at and around the Project Area will be monitored and any issues rectified to reduce scouring and sedimentation of the surrounding area. During early stages of construction, most works will create excavations below the surrounding natural ground level; these excavations may act as containment and attenuation areas for any sediment that may be mobilized during rainfall events (should runoff be directed into them). Specific control, detention and treatment will be required for all sediment entrained in stormwater runoff. Erosion and Sediment Control (ESC) measures will be deployed and decommissioned progressively across the site as works advance.

11.2 Performance Standards

Compliance with the applicable resource consents and approved Erosion and Sediment Control Plan (ESCP), a draft copy of which is included in Appendix B of the RRPP Management Plan volume (GHD 2024).

ESC principles to be adopted are:

- Protection of sensitive areas (avoidance);
- Diversion of “clean” water (erosion control);
- Minimising the area of exposed earth surfaces (erosion control);
- Staging works, wherever possible (erosion control);
- Collection and treatment of sediment-laden water (sediment control);
- Maintenance and inspection of sediment control measures;
- The use of an adaptive management approach for ESC measures (including review of effectiveness and the merits of amending the CEMP to incorporate new/amended instructions).

11.3 Control Measures

As recommended by ORC, ESC measures shall be constructed and implemented in accordance with Auckland Council’s Erosion and Sediment Control Guide for Land Disturbing Activities in the Auckland Region Guidelines Document 2016/005 (GD05), which provides for erosion and sediment control best practice. The ESC measures are to be maintained in accordance with these guidelines to the satisfaction of a monitoring planner from the regional council. A DRAFT ESC Plan has been developed and is included in Appendix A2. This DRAFT plan will require further review and updating as construction planning progresses.

Erosion and sediment control measures shall include:

- Stormwater diversions will be put in place (silt socks, bunding, or diversion drains) to ensure:

a. the potential for sediment entrained in surface water to discharge from the site is minimised;
b. stormwater run-on is diverted around stockpiles (imported cleanfill); and

c. the potential for contaminated sediment or soil run off is minimised.

- Phase in ESC measures as the site is opened up. Where required, construct low temporary diversion bunds or cuts to capture and direct stormwater to the onsite existing control systems. Diversion bunds will also be used to divert clean water, and prevent it from entering the excavation reducing the volume of water entering the excavation which would become contaminated and drain through the landfill picking up potential contaminants. This measure will also reduce the volume of water reporting to the leachate drains.
- Daily inspections of erosion and sediment controls will be conducted (and documented) when works are being undertaken and are the responsibility of the *Main Contractor*. Additional inspections will also be conducted prior to, during, and following high rainfall events. If damage is noted, the system will be repaired immediately;
- Sediment collection devices will be cleaned out regularly and prior to reaching 50% capacity to ensure sediment does not become resuspended and/or bypass collection devices;
- Erosion and sediment control measures shall be upgraded, modified and maintained as necessary;
- Ensure all access roads are kept clean and tidy, and that a stabilised site entrance and exit is present. Road and access cleanliness must be monitored frequently to ensure off-site sediment dispersal is not occurring.
  a. Tyre wash stations, or wheel wash bays may be implemented as an additional mitigation to ensure sediments are not tracked off site;
  b. If soil is tracked off site to sealed surfaces, it will be removed from the roadway using a street sweeper or similar.
  c. When working within the sealed roading corridor, protect stormwater outlets using a combination of bidim cloth over sumps, and sediment logs to detain and attenuate sediment before discharge from site.
- All areas of exposed soil will be stabilised as soon as possible following soil disturbance to reduce risk of sediment run-off.
- Maintain all ESC measures until the site has been rehabilitated or stabilised to the stage where these measures are no longer required.
- Should dry and/or windy conditions prevail, the following controls will be put in place to minimise dust generation and off-site dust discharges:
- Weather forecasting will be used to determine potential for dusty conditions. High temperatures and strong winds will be used as indicators;
- Visible dust shall be adopted as a means of determining when dust suppression is required; and
- Dust will be minimised by maintaining damp conditions of the material using a water spray during the loading of the material from the excavation.

11.4 Monitoring

The inspection of ESC measures and monitoring of discharge points are required on a regular basis and either side of rainfall events to ensure they continue to work and that performance standards are not breached. Frequency of inspections and monitoring are outlined in the table below.

Work Phase	Frequency	Monitoring Actions
Surface is exposed and site is changing frequently.	– Daily – Before expected rainfall event – After rainfall event greater than 20 mm/24 hr	– Inspect all structures (sediment curtain and sump protection are secured in place). – Check discharge points meet performance standards. – Once a week – fill in inspection sheet.
Surface is exposed but not changing.	– Daily – Before expected rainfall event – After rainfall event greater than 20 mm/24 hr	– Inspect all structures and fill in inspection sheet. (Culverts clear of debris, structural integrity of control measures is sound, all-weather access to measures is maintained). – Check discharge points meet performance standards.

Once a week the inspection sheet must be completed and provided to the *Engineers Representative*. Once a month the *Engineers Representative* should accompany the on-site staff during the site inspection. The purpose of the inspection is to ensure compliance with the CEMP and identify areas where improvements can be made, or repairs and maintenance are needed. It is also to follow up on previous actions/ improvements. A regular meeting will be held on site to discuss the results of the weekly inspections.

Where inspections identify areas of non-compliance or improvement the onsite staff will advise (either verbally or in writing) the *Engineers Representative*.

11.5 Reporting

The *Main Contractor* will provide a copy of the completed inspection / monitoring checklist to the *Engineers Representative* on a weekly basis.

11.6 Decommissioning of Controls

Removal of ESCs will only occur once the disturbed area has been adequately stabilised to minimise erosion. “Stabilised” is defined as inherently resistant to erosion or rendered resistant, such as by using indurated rock or by the application of base course, colluvium, grassing, mulch, or another method. Where hydroseeding or grassing is used on a surface that is not otherwise resistant to erosion, the surface is considered stabilised once 80% vegetative cover has been established.

11.7 Contingency

Contingency measures to control erosion and sediment may be required in situations when controls are damaged, degrades, malfunctions or when unforeseen circumstances cause runoff to be able to be released beyond the site boundary (e.g., highly unfavourable weather conditions). The following contingency measures are to be carried out should these events occur:

- If controls are damaged or malfunction, cease operations of those activities that can result in erosion or sediment release and only resume when the controls or equivalent replacement are fully operational and functioning correctly; and
- If significant weather is likely to cause significant runoff, cease any sediment generating activity until the appropriate mitigation measures are in place. If necessary, wait until more favourable weather conditions arise (e.g., if highly unfavourable weather conditions are causing erosion and sediment mitigation measures to be less effective).

12. Noise and Vibration

12.1 Risk Assessment

Construction projects may require the use of large static and/or mobile mechanical equipment and processes. These types of machinery are likely to generate elevated levels of noise for extended durations that may be considered offensive or objectionable by surrounding sensitive receptors. Conversely, remote location of noisy activities and/or greater distances to sensitive receptors will minimise potential risks associated with noise nuisance.

The immediate surrounding land use is predominantly rural or commercial-industrial in nature, with the exception of the residential properties located approximately 75 m to the south of the Project Area.

The construction works may require the use of mobile drum and wheeled rollers, which may generate a degree of vibration and noise at nearby residences. Vehicles, such as excavators and trucks can also be noisy when operating under load or during quiet background noise conditions. The location of many of the noisy activities and distances to nearest dwellings will minimise potential for noise and vibration nuisance. Due to the potentially soft substrates (landfill) and potential high water table due to pore pressure within the landfill sitting above the building foundation, this vibration should cause minimal damage.

12.2 Performance Standards

Current activities on the Green Island site are designated under Designation D658 with only one condition, which is noise related:

1. Noise generated by any activity on the site shall comply with the following standards at the boundary of this site: 55Dt/40Nt dBA (NB These levels are subject to an adjustment of minus 5 dBA for noise emissions having special audible characteristics).

It is important to note:

- Special audible characteristics such as tonality, low frequency noise, impulsive or intermittent noise events, have the potential to make the sound more annoying than another sound of the same decibel level. This is referred to as a Special Audible Characteristic (SAC) adjustment;
- The nomenclature under the condition does not define the metric for the noise levels shown. GHD Acoustics (GHD Assessment of Acoustic Effects 2024B) considers it reasonable to adopt $L_{Aeq(15min)}$;
- Daytime is assumed to be from 7:00 am – 10:00 pm and Night-time is assumed to be 10:00 pm – 7:00 am based on the EIA 1992; and
- No distinction is made under the designation condition between operational noise and construction noise, therefore limits are applicable to both activities.

Note that an assessment of noise compliance at the site during construction has been completed (GHD 2024B). The assessment assumed a range of expected construction activities and concluded that the designation condition can be complied with. However, this needs to be monitored during construction to ensure compliance.

12.3 Control Measures

The most effective way to control construction noise and vibration is through good on-site management, with general and specific mitigation measures to mitigate effects of construction noise and vibration.

Control measures to be implemented include the following:

- Limit hours of operation to avoid sensitive times for neighbouring residents/businesses or provide periods of respite. Therefore hours of operation should be limited to:
  a. Monday to Saturday: 7am to 6pm; and
  b. At no time on Sundays or Public Holidays;
- Use of equipment and construction techniques in accordance with manufacturer's instructions/ site protocols (method statements);
- Early stakeholder engagement prior to any works;
- Silence/enclose plant where it is practicable to do so;
- Maintain complaints register and respond to any enquiries or concerns raised promptly to resolve all issues raised regarding noise and/or vibration. Record all complaints though the complaints register system;
- Use only modern plant fitted with approved exhaust mufflers and soundproofing. Shut down plant when not required for immediate use;
- Wherever practicable, program noisy works to occur during daytime hours (between 8.00am and 5.00pm).
- Locate any fixed items of motorized plant in positions where they are removed as far as practicable from sensitive receivers, with exhausts either screened and/or facing away from these areas;
- Keep construction time near noise-sensitive areas to a minimum, and avoid unnecessary noise (e.g. loose tailgates, idling, horns, tonal reverse alarms);
- Reduce the size of vibratory plant to the smallest size capable of producing the required quality of construction, and increase the vibration frequency, where possible; and
- Reduce the speed of road trucks on access roads and maintain running surfaces to improve rideability and limit vertical movement.

12.4 Monitoring

Monitoring will be undertaken firstly as a response to complaints. Where complaints of noise are received noise monitoring should be performed in accordance with NZS 6801:2008 acoustics – Measurement of environmental sound by appropriately trained staff. This will provide the basis of what further controls will be required.

Monitoring is also to be undertaken on a daily basis with timings spread to collect readings when various activities are being undertaken. The monitoring data collected is to be recorded in the daily monitoring sheet.

12.5 Reporting

Records of any noise-related incidents of complaints to be provided to the *Engineer's Representative*.

12.6 Contingency / Incident Response

During works, there will always be a delegated person available (*Site Manager*) to discuss noise issues with the *Engineer's Representative* and to take immediate action if directed.

13. Hazardous Substances

13.1 Risk Assessment

The project will only require use of a small range of hazardous substances, and in small quantities. Key hazardous substances risks are associated with refuelling of plant and equipment. Mobile hydrocarbon containers with built in safety features will be used. The risk levels associated with temporary hazardous substance storage and use is low provided they are securely stored away from the stormwater system.

The careful management of all hazardous substances is a key factor, as unintentional discharges can have a significant adverse effect on land and water resources. It is essential that measures are in place to avoid, remedy, or mitigate unintentional discharges of hazardous substances to the environment. Areas of particular risk for spills include during the refuelling of plant on-site, from burst or damaged hydraulic oil or fuel supply lines, from insecure portable fuel storage containers, and as a result of tampering or acts of vandalism. There is also the possibility that fluids may be encountered during excavations of the landfills and leachate systems. These liquids will all be treated as contaminated with nothing leaving site.

13.2 Performance Standards

All hazardous substances shall be stored and used in compliance with the Health and Safety at Work (Hazardous Substances) Regulations 2017 and related Hazardous Substances and New Organisms Act 1996 (HSNO)

codes of practice for hazardous substances.

13.3 Control Measures

Procedures to manage the risk of, and respond to, unintended discharges of hazardous substances include:

- As a minimum comply with the statutory requirements for the storage, use and disposal of hazardous substances under the Resource Management Act 1991 (RMA) and HSNO, HSNO regulations, and gazette notices;
- Hazardous substances are transported to and from site in accordance with the requirements of the Land Transport Management Act 2003;
- Storage facilities and equipment that hold significant quantities of hazardous substances are appropriately designed and operated to prevent/reduce the potential for any accidental spillage or leak of a hazardous substance from the facility;
- Containers, facilities and equipment containing or storing hazardous substances are appropriately labelled and signed to identify the potential hazards;
- Emergency Response Plans are in place which in the event of an incident/accident involving hazardous substances will be used to minimise the effect of the event on the environment;
- Staff and sub-contractors at the site are trained how to handle, use and store hazardous substances in a safe manner and how to respond in the event of an emergency incident;
- No spills and leaks to soil or water will occur from the storage or use of hazardous substances;
- No spills and leaks to soil or water will occur from the maintenance of any on-site equipment;
- No storage of hazardous substances shall occur within 50 metres of water bodies;
- Thorough and comprehensive pre-start checks are completed on all plant and machinery on a daily basis. Any identified defects or leaks are to be immediately fixed before the plant is operated on-site. All equipment that is used onsite will be as new as possible to ensure that there is no wear, abrasion or degradation in pumps and pipes that cannot be detected visually. This is applicable for all equipment from excavators through to hydraulic hand tooling as well as pipes and pumps;
- Refuelling on-site is to be undertaken by a trained operator. Refuelling is to be attended at all times, and appropriate spill management materials must be on-hand throughout refuelling operations;

- Wherever practicable, refuelling should occur off-site at an appropriate facility. Where on-site refuelling occurs, this is to be undertaken at a location where spills cannot flow into waterways or drainage systems;
- Portable refuelling tankers are to be stored in a secure area as far as reasonably possible from waterways or drainage systems, and at a location to minimise the risk of collision with other machinery. Portable tankers are to be removed from the worksite to a secure yard overnight;
- Spill kits are to be held on-site for the duration of works. Where spill kits have been used, these are to be replenished as soon as practical;
- Basic spill kits should be carried in all utility vehicles;
- Any liquids that are identified as potential leachate will be disposed of to the leachate drainage system, or directed back into the excavations where it will drain into the refuse. If liquids or a high water table are encountered during excavation, vehicles and machinery leaving site will be passed over the wheel wash where the water is captured and treated via the seepage system so as not to further contaminate the surrounding land.
- **All spills are to be responded to immediately**. Spills are to be dealt with in accordance with the *Main Subcontractor / Main Contractor* Spill Checklist (spill response procedure, appended). Key principles include:
    a. stop the source (if safe to do so),
    b. contain the spill,
    c. clean everything up,
    d. dispose of contaminated wastes appropriately,
    e. report the spill and
    f. restock the spill kit;
- A monitoring regime will be in place for weekly inspections of all equipment, storage facilities, spill containment equipment; and
- Where spills occur that are more than minor (i.e. >5l and/or into water or drainage system), report the spill immediately to the *Main Contractor* Environmental Manager, so that this can be reported appropriately. An incident report is to be generated for all spills.

13.4 Monitoring

Weekly Inspections will be completed.

13.5 Reporting

The *Main Contractor* will provide a copy of the completed inspection / monitoring checklist to the Engineers Representative on a weekly basis.

13.6 Contingency / Incident Response

It is important that construction workers are trained in the management of chemical spills and that the procedures are regularly tested. The basis of the spill response plan is that any spills will be contained within the site boundary, and there will be no discharge of contaminants to the wider receiving environment. To ensure the response to any spills is effective, there needs to be provision of all equipment required to manage a spill and training of staff.

In the event of a chemical spill the following immediate actions are required to be taken:

- Check any persons involved;
- Contact emergency services if injuries are serious and administer first aid (if possible).
- Identify the source and stop source if safe to do so;
- Isolate the spill (if safe to do so). Protect stormwater – confine the spill and block off access to the stormwater system through drain covers;
- Contact the Site Manager and the Environmental Manager for high-risk spill;

- Site manager to notify the ORC 24-hour emergency response service in the event of a spill that results in contamination to stormwater system, waterbody or onto land;
- Gather any information possible, i.e., identify the material and quantity, gather relevant SDS and assess any immediate risks;
- Clean up; and
- Document the incident through the completion of an Opportunity for Improvement (OFI) form and review findings of the incident investigation.

14. Archaeology and Heritage Management

14.1 Risk Assessment

There are no recorded archaeological or heritage sites on the DCC online 2GP map (viewed 10 January 2024).

It is unlikely but possible that items of archaeological, cultural or heritage value may be discovered within the portion of the Property being excavated associated with the disposal of waste from the 1950s though to the 1970s. It is important that, should suspected material of this nature be encountered, works cease immediately in the area until the origin, nature and significance of the find is clarified. Under the Heritage New Zealand Pouhere Taonga Act 2014, it is an offence to disturb or destroy heritage material. All suspected finds shall be treated as heritage material until determined otherwise. There is potential that finds may be accidentally encountered. Without due care, destruction or damage to finds may result.

14.2 Performance Standards

Archaeological sites are protected by the RMA, the Heritage New Zealand Pouhere Taonga Act 2014, and the Protected Objects Act 1975, as well as other regulations, such as the Coroners Act 1988 depending on the nature of the discovery. Any development or construction activity on an archaeological site requires an Archaeological Authority to be issued by Heritage New Zealand, and the Contractor must not recommence work until all statutory and cultural requirements have been met, including the mandatory stand-down period associated with an Archaeological Authority.

Relevant Legislation:

- Resource Management Act (1991)
- Local Government Act (2002)
- Heritage New Zealand Pouhere Taonga Act (2014)
- Protected Objects Act (1975), including Part 2 Ngā Taonga Tuturu ownership
- Burial and Cremation Act (1964)
- Coroners Act (2006)

Article 2, Treaty of Waitangi is also a relevant consideration.

14.3 Control Measures

The *Main Contractor* has an accidental discovery protocol in place that sets out the procedures required should any artefact or human bones be discovered during excavation and construction works. The Accidental Discovery Protocol requires the notification of nominated parties in the event of the suspected discovery of material.

Any trace of bones in particular will cause works to cease while being investigated. If it is suspected that these are human remains, the police and Tangata whenua will be contacted immediately.

14.4 Monitoring and Reporting

If an accidental discovery is made the *Main Contractor* will notify the archaeologist immediately in accordance with the accidental discovery protocol and works will be ceased until such time as approval is given to recommence. If required, the archaeologist will provide an on-site briefing about the archaeological work required and how to identify archaeological sites during works.

14.5 Contingency

Key procedures to be followed in the event of an accidental discovery or suspected find of heritage or cultural material include:

- Stop all work within a 10 metre radius of the suspected find site;

- Secure the area;
- Contact the *Main Subcontractor / Main Contractor* Project Engineer and/or *Main Contractor* Environmental Manager immediately to advise of the find. These people will contact the appropriate parties to ensure that statutory and protocol requirements are followed;
- The archaeological site will be recorded and excavated in accordance with standard archaeological practice;
- IAny found artifact is to remain in the location until Kai Tahu Otakau Runanga has made a decision on its future. Kai Tahu Otakau Runanga will decide if it is to be moved, and to where;
- Should a major taonga be discovered or rediscovered, work will cease within 100 meters of the find. An archaeologist will be called in to assess the find;
- Upon discovery of kōiwi (human bones) work will cease immediately and the site will become an archaeological site and Heritage New Zealand will be contacted for advice on how to proceed. Until the nature of the remains have been verified by an appropriate expert the following will apply. Those contacted will be:
    a. The New Zealand Police.
    b. Ministry of Health
    c. Heritage New Zealand Pouhere Taonga (HNZ)
    d. Archaeologist
    e. Kaumātua representative/s of Kai Tahu Otakau Runanga

Kōiwi

- If human bones are verified no work in the vicinity shall commence until:

A decision from the Hapū has been made as to the future of the kōiwi

A suitable buffer zone has been agreed to around the remains before continuing investigations

If the bones are non-human the decision as to their disposal will be the responsibility of the Main Contractor.

In the event a discovery is made, work will not recommence on the site nor will the rahui status be lifted until Kai Tahu Otakau Runanga, the archaeologist and HNZ are satisfied that the appropriate measures have been taken to nullify concerns.

Kai Tahu Otakau Runanga ensures that, should there be archaeological discoveries, they will work closely with the Main Contractor, the archaeologist, New Zealand Police and HNZ and use their best endeavours to minimise work delays.

15. Traffic Management

15.1 Risk Assessment

Traffic effects during excavation and construction works include an increase in heavy vehicles on local roads and temporary traffic management associated with detours and diversions required for the construction of the project.

15.2 Control Measures

The potential issues identified include:

- the need to minimise disruption on roads as far as is practicable and maintain existing flows and travel times. This will predominantly be within the active landfill area which needs to be kept open and accessible for daily operations;
- the desirability of minimising the number of construction vehicle trips and their effects on local roads and an aim to avoid residential areas where practicable;
- the need to minimise the effects of construction vehicle parking;
- the importance of providing for effective communication and the gathering of feedback from key affected parties; and
- providing a safe environment for the general public and construction staff during the construction works.

Methods for managing the effects associated with construction traffic will be assessed and detailed in a site **Traffic Management Plan** if required. This will provide details of the traffic management necessary for the project.

16. Landscape and Rehabilitation

16.1 Risk Assessment

Temporary and permanent landscape and visual effects may result from the Project. Soil exposed by earthworks can have visual effects depending on the length of time it is exposed. The structures and altered landform also have visual effects until rehabilitation and landscaping is complete.

16.2 Control Measures

All areas disturbed by excavation and construction works shall be rehabilitated (land surface, topsoil, drainage and vegetation) to achieve the following objectives:

- To reinstate vegetation cover and landforms as specified in the RRPP Landscape Assessment (Boffa Miskell 2024);
- To visually integrate finished structures, landforms and vegetation into the surrounding landscape so that, as far as practicable, they appear to be integrated features or features which are already present in the immediate area;
- To ensure short and long term stability of disturbed land areas and their surrounding areas; and
- To minimise the loss of existing vegetation where practicable and/or specified in the RRPP Landscape Assessment (Boffa Miskell 2024).

17. Communication

17.1 Stakeholder Engagement

Engagement with nearby stakeholders and the wider community should be undertaken prior to the works commencing.

In addition, community engagement processes related to these works will include:

- A communication plan is to be developed so that immediate digital updates can be provided should there be an odour or dust emission or other environmental emission affecting the community; and
- Drop-in sessions/forums to inform the community of potential risks and to address relevant community concerns.

17.2 Complaints Procedure

In the absence of any project specific Communication Plan, the following procedure shall be followed for all complaints:

- All complaints should be immediately directed to the person listed in Section 3 Roles and Responsibilities *Site Manager;*
- It is important that any interaction with the complainant is polite and does not belittle their concern;
- As soon as the complaint is received it will be recorded on the project complaints register and include the following details:
    a. Time and type of complaint, including details of the incident, e.g. duration, any effects noted;
    b. Name, address and contact phone number of the complainant (if provided);
    c. Location from which the complaint arose;
    d. The weather conditions and wind direction at the time of any dust or noise complaint;
    e. The likely cause of the complaint;
    f. The response made by the consent holder including any corrective action undertaken by the consent holder in response to the complaint; and
    g. Future actions proposed as a result of the complaint;
- An initial response will be made and recorded. Depending on the nature of the complaint the initial response could be to immediately cease the type of work pending investigation, replace an item of equipment, apply additional control (e.g. water sprayer for dust), or reinstate a damaged control device. However, in some cases it might not be practicable to provide immediate relief. EnviroNZ and the complainant will be informed of actions taken;
- Where the initial response does not address the complaint, the *Site Manager* will be informed and will undertake (either themselves or delegated to the Contractor) further investigation, corrective action and follow-up monitoring as appropriate. The complainant will be advised of the outcome of this process; and
- All actions will be recorded on the project complaints register and the complaint will then be closed.

18. Documentation

All paper/electronic files relating to this CEMP will be kept in the Site Office. This will include:

- A copy of this CEMP and all Appendices;
- Consultation and complaints registers;
- Monitoring/auditing reports; and
- Signed training/induction records which show that people inducted onto site understand what is required of them under this CEMP.

18.1 Updating the CEMP

This CEMP is a live document and may be updated at any time, with the necessary approval of the Contract Manager, throughout the course of the project. This CEMP must be amended if any of the following occur:

- The scope of works or methodology is going to change;
- The mitigation measures are not working sufficiently;
- Responsible parties change;
- The environmental conditions change;
- The area of works increases or changes;
- Improvements to the process or mitigation measures have been identified;
- The authorisations relevant to the project change; and
- Anything else changes that alters the effectiveness of this CEMP to manage the (potential) environmental effects of your works.

Any amendments shall only be for the purpose of improving the effectiveness of the CEMP. Reasons for making changes to the CEMP will be documented.

19. References

- GHD, 2024A, Waste Futures – Green Island – Resource Recovery Park Precinct DRAFT Construction and Operations Management Plans – Appendix B
- GHD, 2024B, Waste Futures – Green Island – Resource Recovery Park Precinct Acoustic Assessment
- Pattle Delamore Partners Ltd, 2024, Green Island Resource Recovery Park Precinct – Air Quality Assessment

Appendices

Appendix A

Training and Competency Register (to be added in final document)

Appendix B

Daily Monitoring Record (to be added in final document)

Appendix C

Complaints Register (to be added in final document)

ghd.com

The Power of Commitment

Appendix B

DRAFT Erosion and Sediment Control Plan

Report

14 February 2024

To	Dunedin City Council	**Contact No.**	027 746 7752
Copy to		**Email**	Nick.Eldred@ghd.com
From	Nick Eldred, GHD NZ Ltd	**Project No.**	12613624
Project Name	Green Island Resource Recovery Park Precinct		
Subject	DRAFT Erosion and Sediment Control Plan		

1. Introduction

1.1 Background

1.1.1 Waste Futures Programme

As part of Dunedin's wider commitment to reducing carbon emissions and reducing waste going to landfill, the Dunedin City Council (DCC) has embarked on the Waste Futures Programme to develop an improved comprehensive waste management and diverted material system for Ōtepoti Dunedin. The programme aligns with DCC's responsibility under the Waste Minimisation Act 2008 to *'promote effective and efficient waste management and minimisation within its district'.*

Improving Dunedin's whole waste system includes enhancing collection services for reuse and recycling, and safe disposal of residual waste to landfill.

The Waste Futures Programme includes provision of an enhanced kerbside recycling and waste collection service for Dunedin from July 2024. The new kerbside collection service will include collection of food and green (organic) waste.

To support the implementation of the new kerbside collection service, the DCC is planning to make changes to the use of Green Island Landfill Site (Figure 1) in coming years including:

– Developing an improved Resource Recovery Park Precinct (RRPP) for food and green waste and to process recycling
– Providing new waste transfer facilities to enable the safe disposal of any residual waste to landfill.

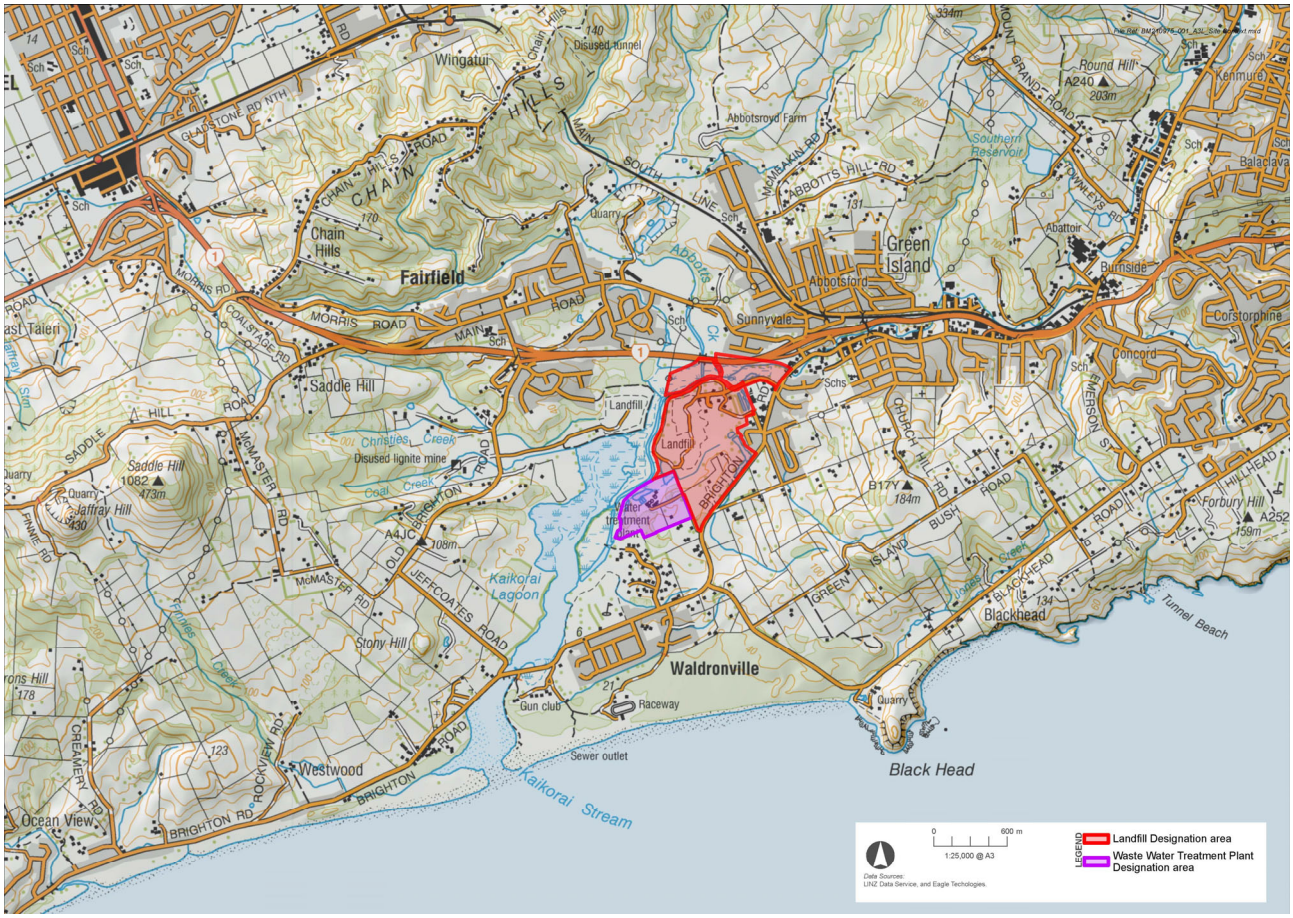


Figure 1 *Green Island Landfill and Resource Recovery Park Precinct Site (Designation D658).*

In addition, DCC is planning for the ongoing operation and closure of the Green Island landfill, which is coming to the end of its operational life. The existing Otago Regional Council (ORC) resource consents, required to operate a landfill at Green Island, expired in October 2023. In March 2023, DCC applied to ORC for replacement resource consents to continue to use the landfill until it closes completely, and waste disposal can be transferred to a new landfill facility. These consent applications are in the process of being considered by ORC.

1.1.2 Green Island Resource Recovery Park Precinct (RRPP)

To meet the requirements of the new kerbside collection service the DCC is investing in improvements and expansion to the existing resource recovery area at the Green Island Landfill Site. Proposed new facilities are shown on Figure 2 and include:

– Organic receival building (ORB) and processing facilities to support the organic waste kerbside collection;
– Materials recovery facility (MRF) to sort and bale items collected from kerbside mixed recycling bins; and
– Bulk waste transfer station (BWTS) to facilitate the compaction and trucking of waste to landfill.

Additional facilities also include new glass bunkers, staff offices, parking, and breakrooms and associated access roads and truck parking areas. Several existing facilities are to be retained including the rummage shop, public drop-off areas and the education centre.

The resource consents for the development and operation of the new facilities relate to ground disturbance, and discharges to land and air. The Green Island Landfill Site is subject to an operative designation (D658) in the Proposed Second-Generation Dunedin City District Plan (2GP) for the purpose of Landfilling and Associated Refuse Processing Operations and Activities.

The RRPP will be run by EnviroNZ on behalf of DCC and will start operating in July 2024 following construction of the ORB, which is currently underway. Resource consent to operate the ORB was granted by ORC in September 2023 under the existing landfill consents.

The other new RRPP facilities are planned to start operating from mid-2025.

1.2 Purpose of this report

1.2.1 Management of Stormwater During Construction

The construction of the RRPP will need to be undertaken in a manner that will manage the risks to the environment because of short-duration site activities. The proposed approach is documented in Contaminated Land Management Plan and the Construction Environment Management Plan (GHD 2024A).

These documents:

- Provides guidance to DCC, their agents and contractors with regards to safe and appropriate management of the contaminants identified within the soils at the Site during the proposed construction works.
- Provides measures to reduce health and safety risks associated with contaminants to workers and wider community by informing DCC's Principal Contractor of hazards associated with contamination that have been identified.
- Provides measures to reduce risk to the environment based upon the known contamination hazards at the Site.
- Assists DCC with achieving compliance with relevant environmental and health and safety legislation.

This document presents a DRAFT Erosion and Sediment Control Plan which is an important part of the construction management process. This has been aligned with the Contaminated Land Management Plan (particularly the requirements of Section 6).

In terms of erosion and sediment control management the guiding principles as per the Auckland Erosion and Sediment Control Guidelines (ORC adopted Guidelines) are:

- Existing runoff from areas outside the works area will continue to be directed around the works area.
- Management of the exposed earth surfaces using staged works areas as well as progressive stabilisation where practicable.
- All stormwater flow generated from exposed surfaces within the works area during construction is considered leachate.
- Silt fences will provide the main initial treatment for the site runoff during construction earthworks.
- Perimeter and internal bunds to be used to retain flows within the Site and it is anticipated that any significant water build-up will be disposed as quickly as practicable via sucker truck (for smaller areas) and disposed of at the landfill or discharged into the leachate collection system.
- To protect the leachate system from excessive sediment loads, then silt fences will be used upstream of the bunds to remove sediment before being pumped to the leachate system.
- In the event of forecast significant rainfall, the Contractor will reduce exposed surfaces and stabilise the Site as much as practicable and may need to review and increase the height of bunds to provide additional storage capacity.
- Stockpiling is not to take place during the construction works. Material is not to be excavated if it cannot be disposed of immediately to an approved facility.
- Soil must be wetted prior to transport in trucks, any loose contaminated material on the side of the trucks or on the wheels shall be removed before the truck leaves the Site; and
- Every truck in the waste cartage fleet must use sealed tailgates, capable of preventing any loss of materials or liquids from all loads, or otherwise be sealed with "Densotape" (or similar) to prevent loss of liquids during transport.

The DRAFT erosion and sediment control plan (ESCP) for the Site is provided as Figure 3. It is anticipated that the Contractor undertaking the physical works will review this plan and update to align with their construction sequencing, methodology and any consent conditions that relate to the physical works.

Therefore, this DRAFT ESCP has been prepared to provide information on the anticipated structure and content of the plan. This plan cannot be finalised until a contractor has been appointed and can provide specific inputs. Nonetheless, it is expected that the final plan will be in general accordance with the documents presented in this report.

This draft plans should be read in conjunction with the RRPP Stormwater Management Report (GHD 2024B).

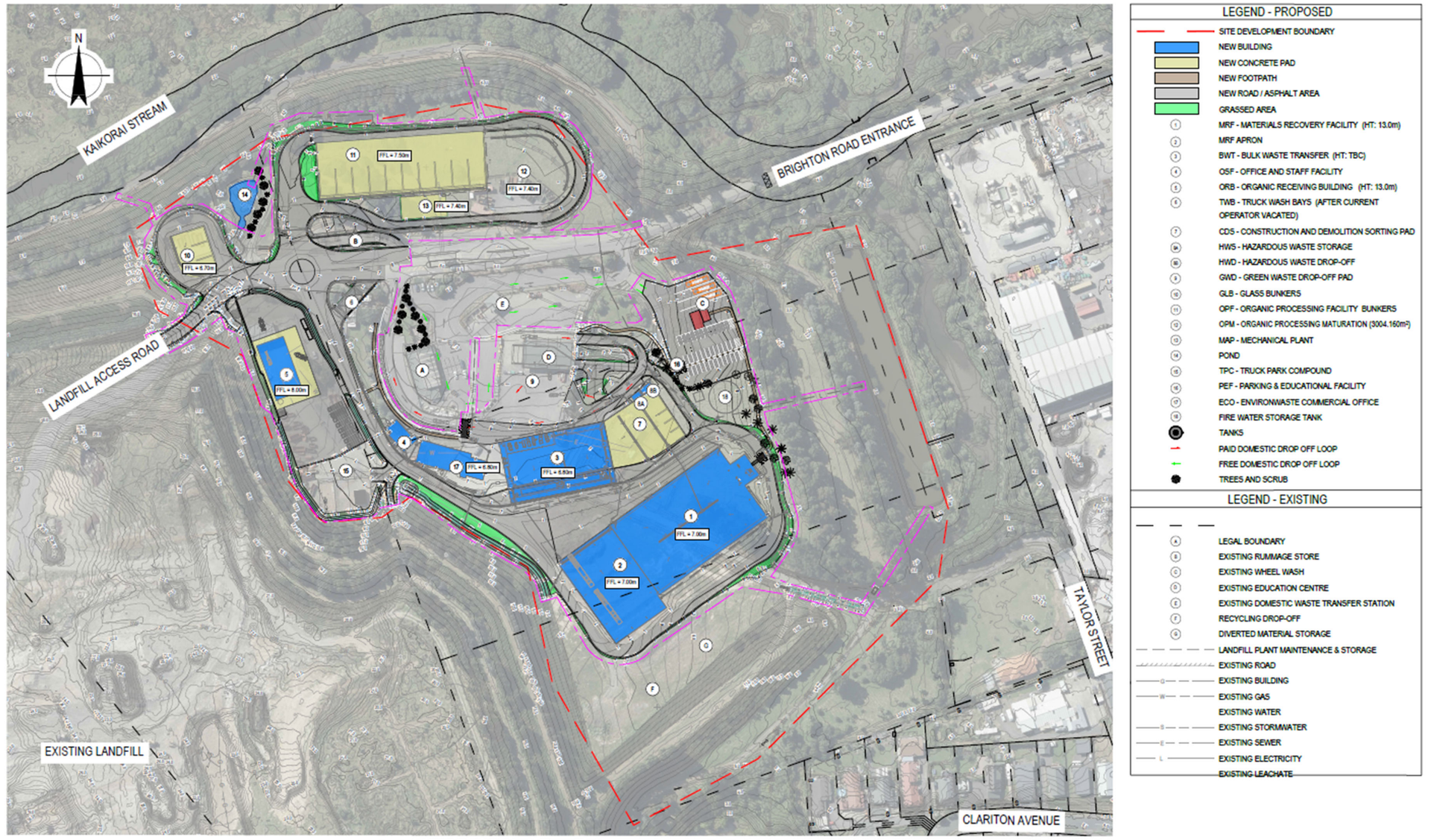
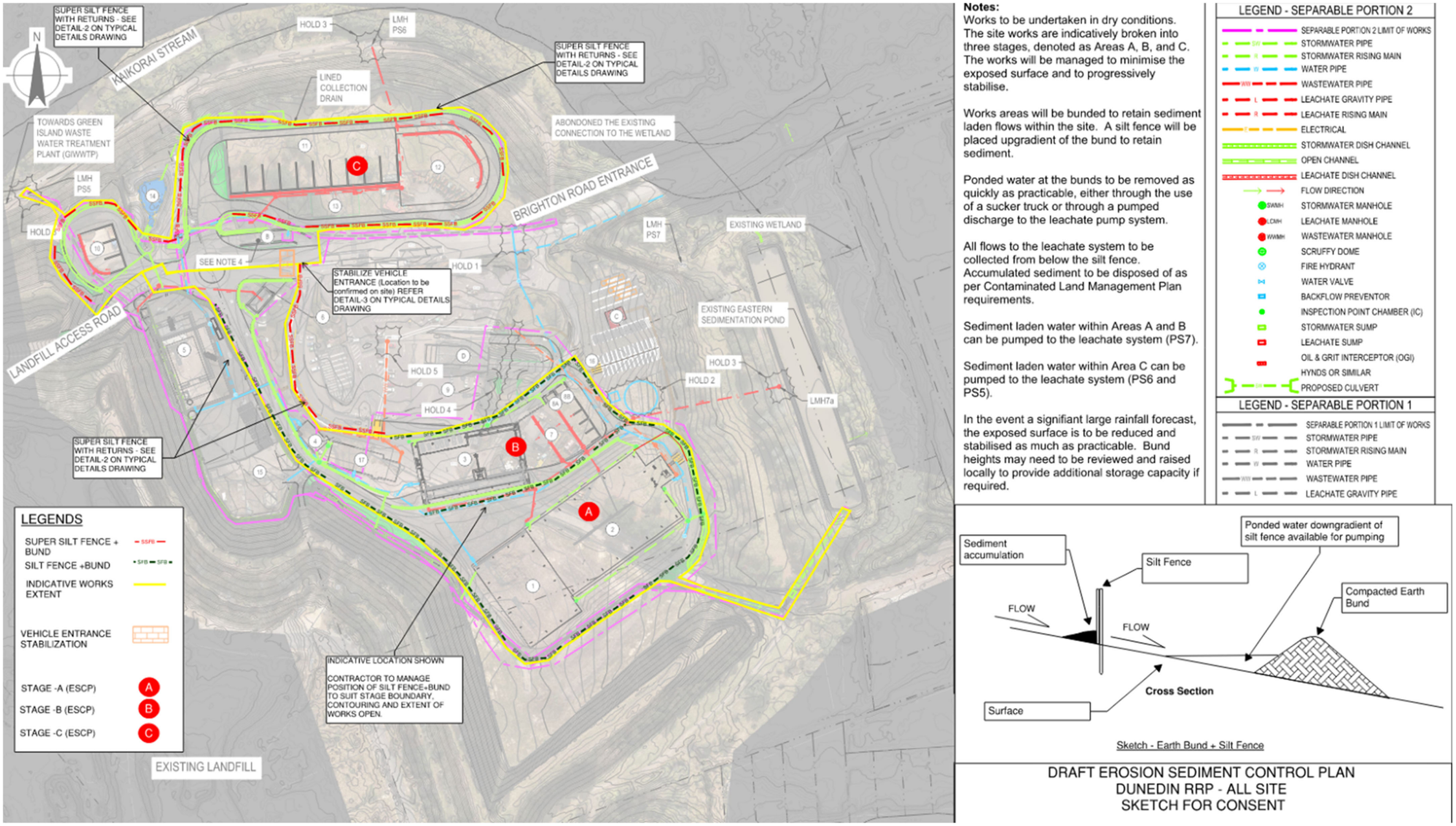


Figure 2 *Green Island Resource Recovery Park Development Area Proposed Layout.*



Notes:
Works to be undertaken in dry conditions.
The site works are indicatively broken into three stages, denoted as Areas A, B, and C. The works will be managed to minimise the exposed surface and to progressively stabilise.

Works areas will be bunded to retain sediment laden flows within the site. A silt fence will be placed upgradient of the bund to retain sediment.

Ponded water at the bunds to be removed as quickly as practicable, either through the use of a sucker truck or through a pumped discharge to the leachate pump system.

All flows to the leachate system to be collected from below the silt fence. Accumulated sediment to be disposed of as per Contaminated Land Management Plan requirements.

Sediment laden water within Areas A and B can be pumped to the leachate system (PS7).

Sediment laden water within Area C can be pumped to the leachate system (PS6 and PS5).

In the event a signifiant large rainfall forecast, the exposed surface is to be reduced and stabilised as much as practicable. Bund heights may need to be reviewed and raised locally to provide additional storage capacity if required.

LEGEND - SEPARABLE PORTION 2

- SEPARABLE PORTION 2 LIMIT OF WORKS
- STORMWATER PIPE
- STORMWATER RISING MAIN
- WATER PIPE
- WASTEWATER PIPE
- LEACHATE GRAVITY PIPE
- LEACHATE RISING MAIN
- ELECTRICAL
- STORMWATER DISH CHANNEL
- OPEN CHANNEL
- LEACHATE DISH CHANNEL
- FLOW DIRECTION
- STORMWATER MANHOLE
- LEACHATE MANHOLE
- WASTEWATER MANHOLE
- SCRUFFY DOME
- FIRE HYDRANT
- WATER VALVE
- BACKFLOW PREVENTOR
- INSPECTION POINT CHAMBER (IC)
- STORMWATER SUMP
- LEACHATE SUMP
- OIL & GRIT INTERCEPTOR (OGI)
- HYNDS OR SIMILAR
- PROPOSED CULVERT

LEGEND - SEPARABLE PORTION 1

- SEPARABLE PORTION 1 LIMIT OF WORKS
- STORMWATER PIPE
- STORMWATER RISING MAIN
- WATER PIPE
- WASTEWATER PIPE
- LEACHATE GRAVITY PIPE

Sketch - Earth Bund + Silt Fence

DRAFT EROSION SEDIMENT CONTROL PLAN
DUNEDIN RRP - ALL SITE
SKETCH FOR CONSENT

Figure 3 DRAFT Erosion and Sediment Control Plan.

2. References

– GHD, 2024A, Waste Futures – Green Island – Resource Recovery Park Precinct DRAFT Construction and Operations Management Plans – Appendix A and C
– GHD, 2024B, Waste Futures – Green Island – Resource Recovery Park Precinct Stormwater Management and Assessment of Effects

3. Limitations

This report is a DRAFT Document intended to provide guidance on the likely format and content of a final plan. The document will not be finalised until a contractor has been appointed who will provide input to the plan.

This report: has been prepared by GHD for Dunedin City Council and may only be used and relied on by Dunedin City Council for the purpose agreed between GHD and Dunedin City Council as set out in section 1.3 of this report.

GHD otherwise disclaims responsibility to any person other than Dunedin City Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

Project name		Green Island Resource Recovery Park Precinct					
Document title		Report | DRAFT Erosion and Sediment Control Plan					
Project number		12613624					
File name		Document2					
Status Code	Revision	Author			Approved for issue		
			Name	Signature	Name	Signature	Date
S4	01	Mary Wood	Nick Eldred		Stephen Douglass		28/02/24

GHD NZ LTD
Contact: Nick Eldred, Project Director |
Level 3, 138 Victoria Street
Christchurch, 8141, New Zealand
T 027 746 7752 | **E** nick.eldred@ghd.com |

Appendix C

DRAFT Contaminated Land Management Plan

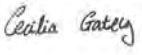
Green Island – Resource Recovery Park Precinct

DRAFT Contaminated Land Management Plan

Dunedin City Council

16 February 2024

→ **The Power of Commitment**

Project name		Green Island Landfill Consenting to Closure and RRPP Consenting					
Document title		Green Island – Resource Recovery Park Precinct | DRAFT Contaminated Land Management Plan					
Project number		12613624					
File name		12613624 Green Island RRPP CLMP Report_RV_D_231004_Review .docx					
Status Code	Revision	Author	Reviewer		Approved for issue		
			Name	Signature	Name	Signature	Date
S3	C	Hayden Erasmus	Cecilia Gately Mark Ballard		Stephen Douglass		05/10/23
S3	D	Cecilia Gately	Cecilia Gately		Stephen Douglass		16/02/24

GHD Limited

Level 1, Bing Harris Building, 286 Princess Street

Dunedin, Otago 9016, New Zealand

T +64 3 378 0991 | **E** dunedinmail@ghd.com | **ghd.com**

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1. Introduction

1.1 Waste Futures Programme

As part of Dunedin's wider commitment to reducing carbon emissions and reducing waste going to landfill, the Dunedin City Council (DCC) has embarked on the Waste Futures Programme to develop an improved comprehensive waste management and diverted material system for Ōtepoti Dunedin. The programme aligns with DCC's responsibility under the Waste Minimisation Act 2008 to *'promote effective and efficient waste management and minimisation within its district'.*

Improving Dunedin's whole waste system includes enhancing collection services for reuse and recycling, and safe disposal of residual waste to landfill.

The Waste Futures Programme includes provision of an enhanced kerbside recycling and waste collection service for Dunedin from July 2024. The new kerbside collection service will include collection of food and green (organic) waste.

To support the implementation of the new kerbside collection service, the DCC is planning to make changes to the use of Green Island landfill site (Figure 1) in coming years including:

– Developing an improved Resource Recovery Park Precinct (RRPP) for food and green waste and to process recycling
– Providing new waste transfer facilities to enable the safe disposal of any residual waste to landfill.

Figure 1 *Green Island Landfill and Resource Recovery Park Precinct Site (Designation D658).*

In addition, DCC is planning for the ongoing operation and closure of the Green Island landfill, which is coming to the end of its operational life. The existing Otago Regional Council (ORC) resource consents, required to operate a landfill at Green Island, expired in October 2023. In March 2023, DCC applied to ORC for replacement resource consents to continue to use the landfill until it closes completely, and waste disposal can be transferred to a new landfill facility. These consent applications are in the process of being considered by ORC.

1.2 Green Island Resource Recovery Park Precinct (RRPP)

To meet the requirements of the new kerbside collection service the DCC is investing in improvements and expansion to the existing resource recovery area at Green Island landfill site. Proposed new facilities are shown on Figure 2 and include:

– organic receivals building (ORB) and processing facilities to support the organic waste kerbside collection
– materials recovery facility (MRF) to sort and bale items collected from kerbside mixed recycling bins
– bulk waste transfer station (BWTS) to facilitate the compaction and trucking of waste to landfill.

Additional facilities also include new glass bunkers, staff offices, parking, and breakrooms and associated access roads and truck parking areas. Several existing facilities are to be retained including the Rummage shop, public drop-off areas and the education centre.

The resource consents for the development and operation of the new facilities relate to ground disturbance, and discharges to land and air. The Green Island landfill site is subject to an operative designation (D658) in the Proposed Second-Generation Dunedin City District Plan (2GP) for the purpose of Landfilling and Associated Refuse Processing Operations and Activities.

The RRPP will be run by EnviroNZ on behalf of DCC and will start operating in July 2024 following construction of the ORB, which is currently underway. Resource consent to operate the ORB was granted by ORC in September 2023 under the existing landfill consents.

The other new RRPP facilities are planned to start operating from mid to late 2025.

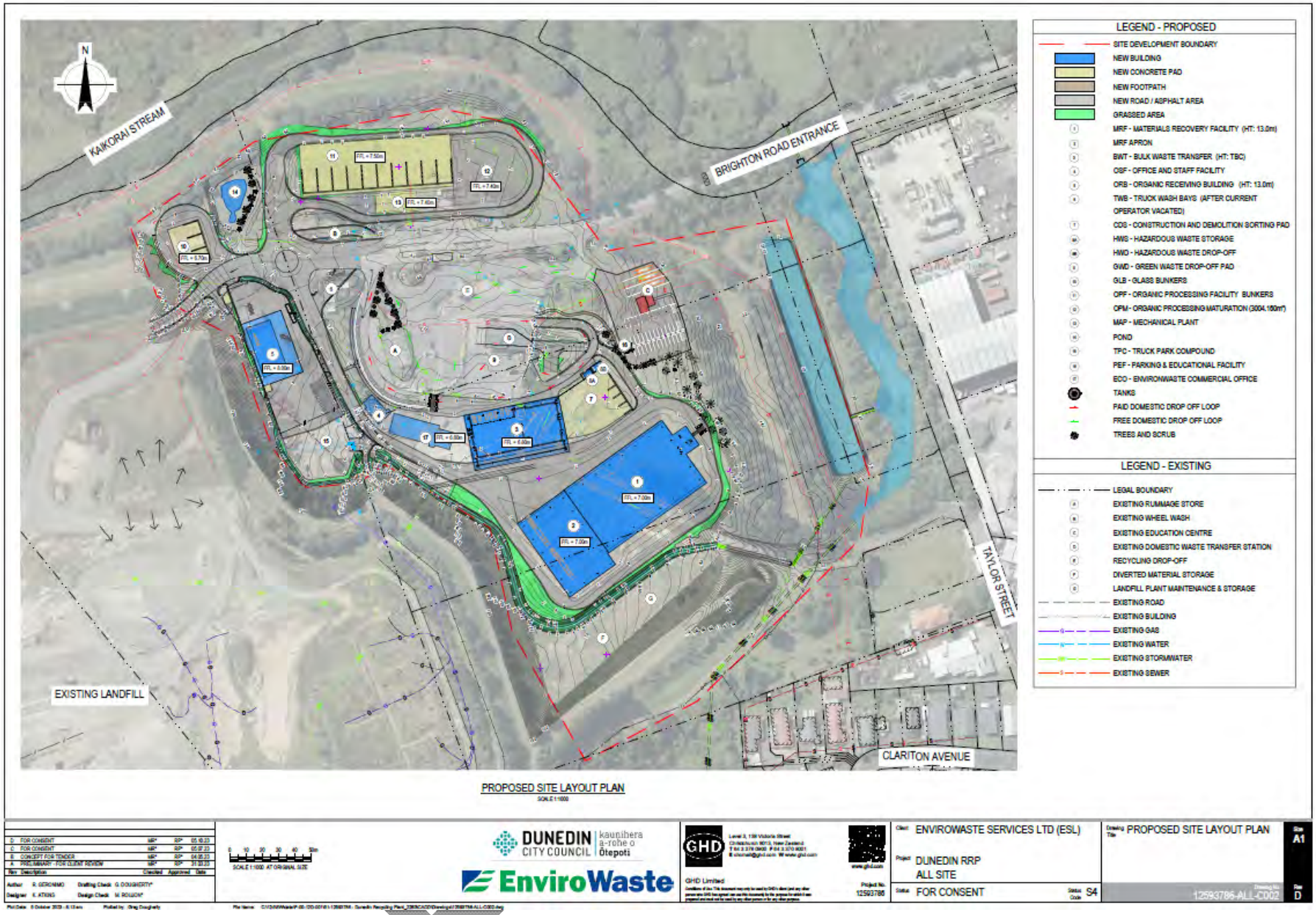

Figure 2 ***Green Island Resource Recovery Park Development Area Proposed Layout.***

The new buildings (outlined within this report) will require resource consent from the ORC for the disturbance of contaminated soils for their construction and for the discharge of operational stormwater to the Kaikorai Stream.

In addition, resource consent for the disturbance of contaminated soils under the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 (NES-CS), and an outline plan of works approval is required from the DCC's consenting authority.

An environmental site investigation (ESA) was undertaken over the RRPP in 2021 (further details provided in section 2.1). It should be noted that this ESA does not constitute a detailed site investigation (DSI) as the number of sampling locations was less than required by the current contaminated land management guidelines (CIRIA665). However, the number of locations was considered adequate to characterise the area due to the understanding that the underlying materials consisted of landfill material and compliance with the DSI requirements for sample locations would not materially add additional information to the highly variable nature of the landfill waste beneath the Site area.

1.3 Purpose of this report

GHD Limited (GHD) have been engaged by DCC to prepare this Contaminated Land Management Plan (CLMP) in support of the construction of the new structures associated with the RRPP, on a portion of the Green Island Landfill located at 9 Brighton Road, Green Island, Dunedin (the Property).

The proposed Site location in the context of the Green Island Landfill is shown in Figure 3. As can be seen from Figure 3, it is proposed to locate the new RRPP buildings and associated structures within and around the existing resource recovery area (red dashed line). The approximate landfill operational boundary is shown by a red solid line, with the tip face (where excavated waste will be disposed), labelled on the figure.

This CLMP has been prepared to assist in managing the excavation, handling and disposal of contaminated material which will likely be encountered during the earthworks (soil disturbance) associated with the proposed construction works. This CLMP provides the DCC with a mechanism to manage health, safety and environmental risks associated with the management of contaminated soil at the Site to protect onsite construction workers and other site users.

It is understood that the preparation of this CLMP is required to fulfil requirements of both the ORC Waste Plan and the DCC consenting for soil disturbance on a contaminated site under the National Environmental Standard.

As part of the preliminary investigations for the RRPP, an environmental site assessment (ESA) was undertaken[1] over the wider proposed RRPP area in November 2021 (Attachment 1), to gain a general understanding of the vertical and lateral extent of the landfill material and the contaminant status of this material. The findings of the ESA investigation are summarised in Section 2 of this report.

[1] Green Island Landfill - Resource Recovery and Processing Precinct, Environmental Site Investigation Factual Report, November 2021

1,399,000

4,913,000

Waste transfer station and recycling

Approximate tip face location

1,399,000

Legend

RRPP Site Development Boundary

Property Boundary

NOTE: Tip face location changes over time.
Aerial Photograph taken in November 2023.

Paper Size A3

0 15 30 60 90 120

Metres

Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator

N

GHD

Dunedin City Council

Green Island Landfill
Contamianted Land Management Plan

Resource Recovery Park Precinct Site Location

Job Number 12613624
Revision A
Date 19 Feb 2024

Figure 3

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Level 1 Bing Harris Building 268 Princes Street Dunedin 9016 New Zealand **T** 64 3 378 0900 **F** 64 3 377 8575 **E** chcmail@ghd.com **W** www.ghd.com

Data source:Service Layer Credits: Eagle Technology, Land Information New Zealand, GEBCO, Community maps contributorsCreated by:herasmus

1.4 Property and site identification

The Site is located within a commercial and industrial area, the Property and Site details are presented in Table 1.

Table 1: Property and Site details.

Property and Site Details	
Property and Site Address	9 Brighton Road, Green Island, Dunedin
Legal description	Pt Secs 44 and 45 Green Island Bush SD Secs 54-55, 63, 65 Block VII Section 119 Block VII Dunedin and East Taieri SD
RRPP Site area (ha)	~9.87 (98,740 m^2)
NES CS permitted soil disturbance volumes: **Soil disturbance (m^3)** **Soil removal (m^3)**	 4,937 987
Proposed volume of material to be disturbed (m^3)	~21,100
Territorial Authority	Dunedin City Council
Regional Authority	Otago Regional Council
Current Property use **Future Property use**	Landfill facility – Commercial / Industrial land use RRPP – Commercial / Industrial land use
Site Topography	Generally flat topography
Closest surface water bodies	Kaikorai Stream - ~50 m north of the Site (glass bunkers) Kaikorai Stream - ~55 m north of the Site (OPF bunkers)
Contaminants identified above *the National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health* 2011 (NESCS) soil contaminant standards (SCS) for Commercial / Industrial land use	While no contaminants were identified at concentrations above the NESCS SCS commercial / industrial land use criteria during the ESA investigation, there is the potential for higher concentrations of contaminants to be encountered during the proposed soil disturbance works.

1.5 Purpose of this CLMP

The purpose of this CLMP is to:

– Provide guidance to DCC, their agents and contractors with regards to safe and appropriate management of the contaminants identified within the soils at the Site during the proposed construction works;
– Provide measures to reduce health and safety risks associated with contaminants to workers and wider community by informing DCC's Principal Contractor of hazards associated with contamination that have been identified;
– Provide measures to reduce risk to the environment based upon the known contamination hazards at the Site;
– Assist DCC with achieving compliance with relevant environmental and health and safety legislation; and,

In preparing this CLMP, the following project aspects have been considered:

– Environmental and human health protection matters related to the Site;

– Extent and duration of the activities; and
– Requirements for incorporation of environmental management into practical day-to-day construction operations.

This CLMP is intended to supplement and not replace normal excavation and health and safety management procedures, hence the requirements of this CLMP are in addition to, and not in replacement of those procedures. A construction management plan will be prepared by the Principal Contractor appointed to undertake site works, taking account of the health and safety and environmental policies and requirements of DCC.

1.6 Scope

This CLMP is intended to provide guidance on managing risks associated with contamination that is present within the RRPP Site boundary and is not intended for use on other contaminated sites outside of this area.

This CLMP is intended to provide guidance on:

– Managing risk associated with soil contamination that is present onsite; and
– The excavation of soil and/or the removal of soil from the Site.

Any activities that are not included in the above list will need to be given further consideration to assess whether there is any additional risk associated with those activities.

1.7 Assumptions

The following assumptions have been made developing this management plan:

– The general design plans for the new RRPP buildings and the general approach to construction methodology of the buildings are assumed to be generally representative of what will be constructed at the Site. Should these change, the CLMP may need to be updated; and
– The observations made during the ESA investigation are representative of the underground conditions and the contaminant concentrations present throughout the Site.

2. Site setting

The Site is listed on the ORC listed land use register (LLUR) as being a known landfill and as such is categorised as HAIL activity G3 (landfill sites).

2.1 Environmental site assessment investigation summary

An ESA investigation was undertaken over a portion of the Green Island Landfill where it is proposed to construct the RRPP (Attachment 1). As the layout and design of the precinct had not been finalised at the time the investigations took place, the locations of the investigation points (test pits, boreholes and landfill gas monitoring wells) were spread across the proposed RRPP area to provide coverage of the whole area (Figure 4).

Thirty-four test pits were excavated across the proposed RRPP area to depths of up to 3.2 m below ground level (bgl). In addition, four boreholes, which had piezometers installed into them, and four landfill gas monitoring wells were drilled and installed. Landfill waste material, comprising brick, timber, concrete, metal, clothing, paper, asphalt etc., was encountered at all of the investigation points.

The logs for the test pits identified that in the eastern and northern portion of the proposed RRPP area, the material placed over the waste present comprised a topsoil type material and was approximately 0.2 m to 0.3 m thick. In the composting area (southern portion of the proposed RRPP area), the capping material was between 1.0 and 1.5 m thick and in the northwestern area, there was hardfill material between 0.3 m and 1.2 m thick present at surface. The borehole logs indicated that the material placed over the waste was between 0.65 m (RRPP BH02) and 1.2 m (RRPP BH01) thick.

Logs for the boreholes indicate that the landfill waste is between 5.0 (RRPP BH03) and 9.3 m (RRPP BH01) thick and overlies estuarine sediments associated with the Kaikorai Estuary onto which waste was placed in this area between the 1950s and 1970s.

The water levels recorded in the boreholes were between 2.5 and 3.8 m below the top of casing on 2nd November 2021. As groundwater is associated with the underlying waste materials it has been classified as leachate with respect to water management at the landfill.

Methane gas was found to be present in all of the landfill gas monitoring wells (at each of the five monitoring events), with the higher concentrations recorded at monitoring wells WS01 (composting area), ranging between 6.1% and 80.5% of methane, and WS02 (south eastern corner of the Site) with concentrations ranging between 3.5% and 61.5% of methane. This range reflects the highly variable nature of waste and the generation of methane gas that is typical of waste materials.

Hydrogen sulphide (H2S) was recorded as present in only one of five occasions in monitoring well WS04, at a concentration of 3.0 ppm, located in the northern portion of the Site. Low concentrations of oxygen were also recorded in all wells with concentrations recorded at each monitoring event ranging between 0.0 and 5.6 ppm with the exception of WS01 (October 2021) and WS02 (November 2021) which during discrete events recorded concentrations of 15.5 and 13.3 ppm, respectively.

Heavy metals and polycyclic aromatic hydrocarbons (PAHs) were reported present at concentrations above the adopted background values at all sample location points. However, none of the reported concentrations were above the human health NESCS[2] Commercial / Industrial SCS criteria values or adopted guideline values. Samples analysed for total petroleum hydrocarbon (TPH), semi-volatile organic compounds (SVOCs) and asbestos, which do not have associated background values, were also reported as having concentrations which did not exceed the human health NES CS Commercial / Industrial SCS criteria values or adopted guideline values.

Asbestos fines were reported present in two of the samples analysed at concentrations less than the human health standard. The samples were collected from test pits RRPP_TP03 and RRPP_TP28 which are located in the northern and southeastern portions of the Site, respectively.

[2] Resource Management (National Environmental Standard for assessing and managing contaminants in soil to protect human health (NES CS)) Regulations 2011.

Comparison of reported laboratory analytical results to the ANZECC[3] (2000) ISQG High and Low trigger values and the ANZG[4] (2018) GV High and Default Guideline Values (DGV) indicated that heavy metals, PAHs and SVOCs were present at concentrations above these guideline values.

[3] Australian and New Zealand Environment and Conservation Council (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Interim Sediment Quality Guidelines (ISQG) trigger values.
[4] Australian and New Zealand Guidelines for fresh and marine water quality (2018) Default Guideline Values (DGV) and Guideline Values (GV).

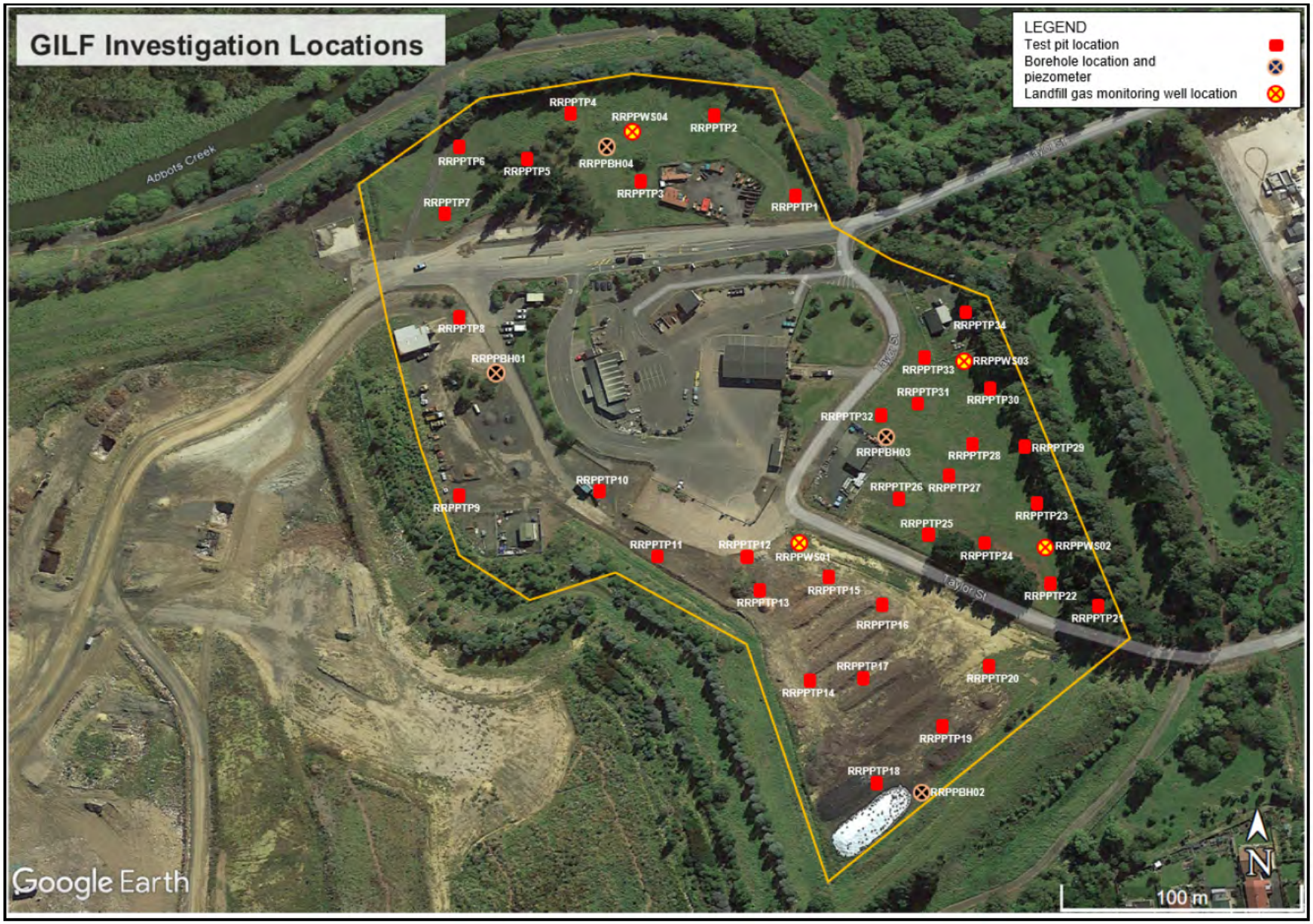

Figure 4 *ESA RRPP investigation points location plan*

2.2 Contaminants of concern

On the basis of the HAIL activity identified (landfill operations) and the previous Site investigation, the primary contaminants of potential concern are considered to include:

– Heavy metals
– PAHs
– TPHs
– SVOCs
– Asbestos
– Ground gases (landfill gas)

3. Proposed works

The proposed work sites have been split into the following groups:

– Buildings
– Concrete pads
– Bunkers
– Existing structures

A description of each building / structure has been detailed below (Sections 3.1.1 to 3.1.6) with the Site layout plan for the proposed phase 2 works presented as Figure 5.

The materials underlying the Site are a mixture of waste and overlying soils and fill. Although likely to be at lower concentrations, there is a risk that the overlying fill may have been contaminated with waste. Therefore, all materials that are excavated from the Site will be treated as being contaminated and disposed of within the operational portion of the Green Island landfill, within the Property.

The base of all service infrastructure trenches within the Site will be excavated to a depth of no greater than one meter below ground level. Excavated material associated with service trenches will be treated as contaminated waste and will be disposed of within the operational portion of the Green Island Landfill. The proposed layout of the stormwater infrastructure is shown in the Stormwater Management Report (GHD 2024) alongside further details of the proposed stormwater infrastructure.

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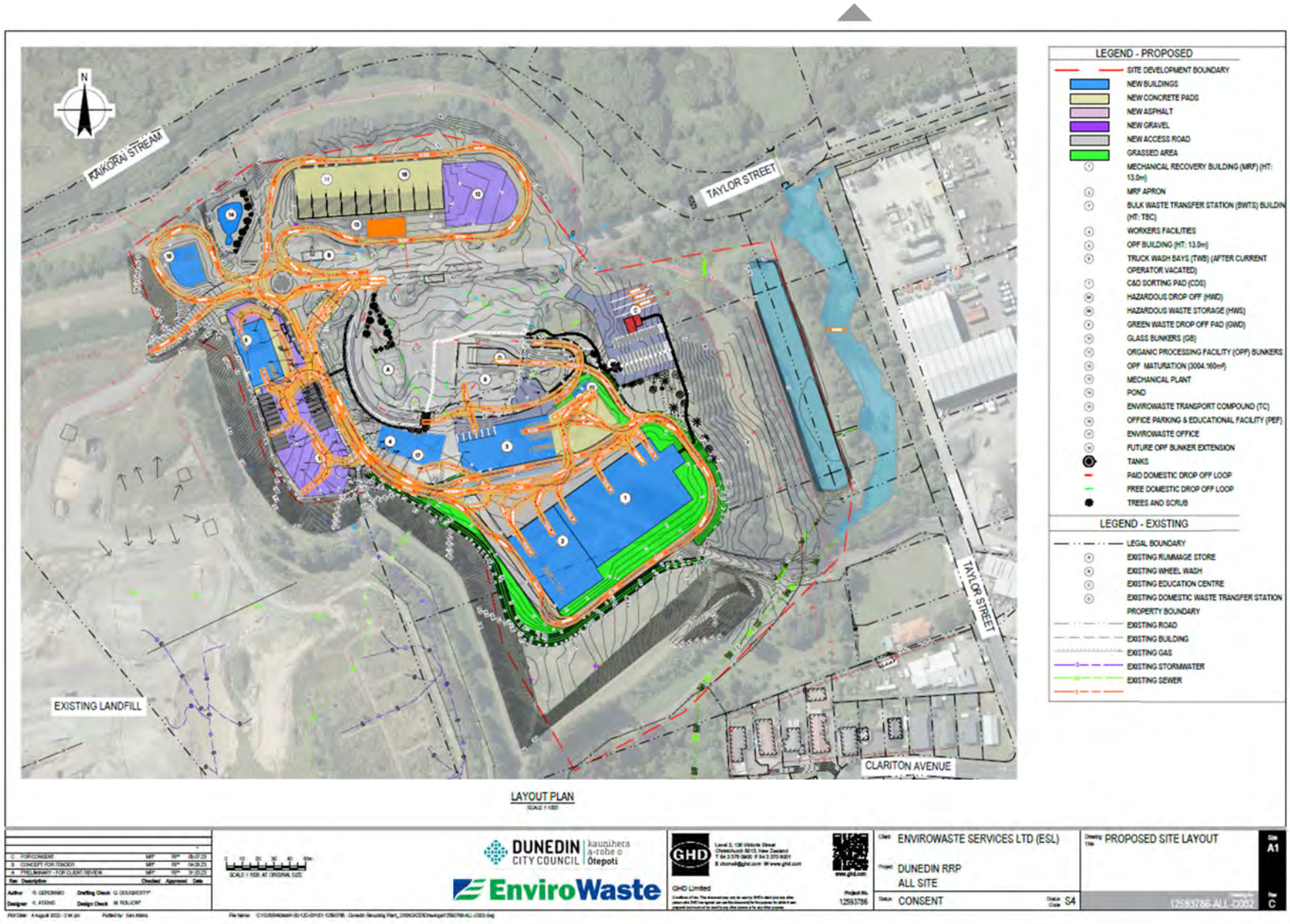

Figure 5 ***Proposed RRPP Site layout plan.***

3.1 Buildings

3.1.1 Materials Recovery Facility (MRF) and apron

The proposed MRF (#1 on the layout plan) is an industrial building intended to be used for the purpose of receiving, processing and packaging recyclable material within the building. The MRF structure footprint will cover an area measuring approximately 3,000 m^2 (Appendix C, Green Island Design and Operations Report) with an internal clearance height of 10 m.

The building is to be constructed of a steel portal design positioned and fixed to an engineered concrete slab and foundation system. The building includes an engineered geotechnical sub-floor design including membranes designed to help control landfill gases from entering the building. The concrete slab includes falls to drainage channels intended to collect and control all internal washed down liquids (e.g. from residual liquids in the received waste stream). It will be supported by concrete foundations (at a depth of 0.50 m) and using geotechnical ground improvements (compacted gravel raft) to a maximum depth of 2.5 m bgl. Based on the current design parameters, the volume of material disturbance for the MRF is estimated at 7,550 m^3.

Precast concrete walls will be used as 'push' walls inside the structure and the building is to be roofed and clad (both internally and externally) in prefinished profiled metal cladding fixed to galvanised girts and purlins.

Large commercial motorised roller doors will allow the movement of vehicles and recyclable materials in and out of the building as well as hinged pedestrian doors for day to day and emergency use. It is anticipated that the south and east façades of the MRF will not have any openings with the intake and off-take through the north and western façades.

The MRF plant inside the building will be designed, supplied, and installed by a third party. It is anticipated that the MRF will require a 500kVa transformer for power supply.

The MRF apron, an adjoining canopy (#2 on the layout plan) has a proposed footprint which will cover an area measuring approximately 1,550 m^2 (Appendix C, Green Island Design and Operations Report) with an internal height clearance of 9 to 10 m and will be utilised as a storage and loading zone. The apron will have concrete foundations at a depth of 0.50 m bgl and be supported by a compacted gravel raft to a depth of 2.5 m bgl. Based on the current design parameters, the volume of material disturbance for the MRF apron is estimated up to 3,900 m^3.

A one-way ring road around the MRF and MRF apron will be built for access to both intake and off-take traffic.

3.1.2 Bulk Waste Transfer Station (BWTS)

The proposed BWTS (#3 on the layout plan) is an industrial building intended to be used for the purpose of receiving and packaging general waste. The BWTS footprint will cover an area measuring approximately 1,550 m^2 (Appendix C, Green Island Design and Operations Report) with an internal clearance height of 12 m.

The building is to be constructed of a steel portal design positioned and fixed to an engineered concrete slab and foundation system. The building includes an engineered geotechnical sub floor design including membranes designed to help prevent landfill gases from entering the building. The concrete slab includes falls to drainage channels intended to collect and control all internal washed-down residual liquid from the incoming waste. It will be supported by concrete foundations (at a depth of 0.50 m) and be supported by a compacted gravel raft to a maximum depth of 2.5 m bgl. Based on the current design parameters, the volume of material disturbance for the BWTS is estimated up to 3,800 m^3.

Precast concrete walls will be used as 'push' walls inside the structure and the building is to be roofed and clad (both internally and externally) in prefinished profiled metal cladding fixed to galvanised girts and purlins.

Large commercial motorised roller doors will allow for the movement of vehicles and waste materials in and out of the building as well as hinged pedestrian doors for day to day and emergency use.

The northern façade will be utilised for domestic drop off (car and trailers) and the east façade with two doors to allow commercial drop off (trucks) to enter the building to offload inside. There is a drive through lane on the east

side for loading and off-take (semi-trailers). Inside the building a handling machine will load the waste for the piles inside onto off-take trucks. The off-take lane joins back with the MRF ring road to exit the Site.

3.1.3 Worker facilities

The workers facility building (#4 on the layout plan) includes change rooms, lunchroom, showers, and toilets for staff and contractors working within the Site. The footprint of the building covers an area measuring approximately 160 m^2 and based on the current design parameters, the volume of material disturbance for the workers facilities is estimated up to 400 m^3.

The structure will be constructed largely of timber, fixed to an engineered concrete slab and foundation system. The building includes an engineered geotechnical sub-floor design including membranes designed to help prevent landfill gases from entering the building. It will be supported by concrete foundations (at a depth of 0.50 m) and a compacted gravel raft to a maximum depth of 2.5 m bgl.

Selected light weight cladding will be used over the external walls of the treated timber frame. The roofing materials will consist of prefinished profiled metal sheets connected to steel/timber purlins.

Insulation will be present in the roof, walls and floors, and the windows and doors will be double glazed with thermally broken powder coated aluminium. Commercial vinyl flooring and carpet will cover the plywood flooring.

Car parking spaces will be created along the exiting road tracking west of the existing rummage store (#A on the layout plan), it is noted that the rummage store will not be altered as part of this project.

3.1.4 Organics Receival Building (ORB)

A separate CLMP[5] was prepared for the construction works associated with the ORB (#5 on the layout plan), which was consented in September 2023 as part of the Phase I works. The construction of this building is currently underway. As such, this building and construction works associated with it will not be discussed further in this document.

3.1.5 Hazardous waste drop off and storage

The hazardous waste building is separated into two areas, the public facing zone (#8A on the layout plan) which provides for waste drop off, and a 'staff only' zone (#8B on the layout plan) for sorting and storing of hazardous waste. A few car parking spots are to be created off the road adjacent to the public 'drop off' area.

The footprint of the two areas will be approximately 50 m^2 and will be a steel framed building with prefinished profiled metal cladding and roofing. The structure will be situated on a reinforced concrete slab and compacted gravel raft to a maximum depth of 2.5 m bgl which will include membranes designed to help prevent landfill gases from entering the building. The building will be supported by concrete foundations at a depth of 0.50 m bgl. Based on the current design parameters, the volume of material disturbance for the hazardous drop off and storage area is estimated up to 120 m^3.

3.1.6 EnviroNZ Services Limited (ESL) Offices

The ESL building (#17 on the layout plan) includes offices, a meeting room and staff amenities.

The footprint of the building is approximately 200 m^2 and the structure will be constructed largely of timber which will be fixed to an engineered concrete slab and foundation system. The building includes an engineered geotechnical sub-floor design including membranes designed to help prevent landfill gases from entering the building. It will be supported by concrete foundations (at a depth of 0.50 m) and a compacted gravel raft to a maximum depth of 2.5 m bgl. Based on the current design parameters, the volume of material disturbance for the ESL offices is estimated up to 500 m^3.

Selected light weight cladding will be used over the external walls of the treated timber frame. The roofing materials will consist of prefinished profiled metal sheets connected to steel/timber purlins.

[5] Green Island Landfill – Organics Receival Building and Transport Compound, Contaminated Site Management Plan, June 2023

Insulation will be present in the roof, walls and floors, and the windows and doors will be double glazed with thermally broken powder coated aluminium. Commercial vinyl flooring and carpet will cover the plywood flooring.

Car parking spaces will be created for staff and visitors (#16 on the layout plan), it is noted that the existing educational facility building (#C on the layout plan) is not proposed to be altered as part of this project.

3.2 Concrete pads

3.2.1 Truck wash bays and transport yard

Two truck wash bays will be constructed (#6 on the layout plan) with concrete pads with falls to the leachate collection system. The footprint of the wash bays is over an estimated 150 m^2 and will be supported by concrete foundations (to a depth of 0.50 m bgl) and a compacted gravel raft to a maximum depth of 1 m bgl. Based on the current design parameters, the volume of material disturbance for the wash bay is estimated at 150 m^3. The wash bays will have both a power and water supply.

The phase 1 transport compound area (TCA)[5] will be extended to the south (#15 on the layout plan) to create an additional 21 truck parking spots. The ground surface will remain consistent with what was constructed in phase 1 (AP65 material as subbase with an AP40 basecourse above as wearing course) with an estimated 85 m^3 of material to be disturbed.

3.2.2 Construction and demolition (C&D) sorting pad

The C & D pad is a concrete slab adjoining the BWTS (#7 on the layout plan). The footprint of the C & D pad is approximately 1,200 m^2 and will be supported by concrete foundations to a depth of 0.50 m bgl and a compacted gravel raft to a maximum depth of 1 m bgl. Based on the current design parameters, the volume of material disturbance for the C & D pad is estimated at 1,200 m^3.

Materials from construction skips will be dropped off at the pad and sorted. Any remaining waste that cannot be recycled or reused will be pushed into the BWTS.

The northern side of the C & D pad will be fenced so there will be no public access.

3.3 Bunkers

3.3.1 Glass bunkers

Three glass bunkers will be located to the southwest of the northern leachate pond (#10 on the layout plan). The concrete bunkers will have a footprint measuring an area of approximately 400 m^2 and have walls approximately 3 m in height. Based on the current design parameters, the volume of material disturbance for the glass bunkers is estimated at 400 m^3. The glass bunkers will be situated on an existing concrete pad with a one-way ring road to be created around the bunkers. A retaining wall (up to approximately 2 m high), cut into the existing landfill bund (to be treated as contaminated material), will be created along the 'back' (western elevation) of the bunkers.

3.3.2 Organic Processing Facility (OPF) bunkers and maturation area

The OPF bunkers (#11 on the layout plan) are designed to receive shredded organic waste coming from the ORB and a mechanical ventilation system (#13 on the layout plan) will accelerate the composting process. The mechanical system design, supply and installation is outside of the scope of this project.

As part of this phase of construction the OPF will have six bunkers, with a total approximate footprint area of 1,800 m^2. The bunkers will be built on a concrete slab with the organic waste being contained within three concrete walls (push walls) (each approximately 3 m in height). The concrete slab will be supported by concrete foundations to a depth of 0.50 m bgl and a compacted gravel raft to a maximum depth of 1.0 m bgl. Based on the current design parameters, the volume of material disturbance for the OPF bunkers is estimated at 1,800 m^3. The bunkers will be open to the north, with accesses included in the south wall for the mechanical ventilation system. A concrete apron

(approximately 14 m in width) levelled with the floor of the bunkers will be constructed as a 'manoeuvring' zone for the heavy machinery (loader) which will fill and remove waste from the bunkers.

There is a provisional area for four additional bunkers (#18 on the layout plan) should demand exist. This is not included in the scope of works for this project.

Once the organic waste is 'ready', it is moved by loader, from the bunker to the maturation area (#12 on the layout plan) and spread into piles ready for off-take. The ring road around the OFP bunkers and maturation area will allow for semi-trailers to load compost and exit the Site. Based on the current design parameters, the volume of material disturbance for the maturation area is estimated at 1,200 m^3.

All 'run-off' water from the bunkers and the maturation area will be collected and connected to the landfill's existing leachate collection system and discharged into Pump Station 6. A water supply will also be created near the bunkers.

3.4 Existing structures

3.4.1 Green waste drop off

The new garden waste drop-off area will be created by re-using and upgrading the existing waste transfer pit (#9 and #D on the layout plan). Public cars and trailers will reverse onto the south side of the building and drop garden waste into hook bins located in the pit, once full, the bins will be collected and the materials transferred into the ORB.

3.5 Contaminant status of excavated material

A review of the site conditions observations and soil analytical data collected during the ESA in 2021 was undertaken to assess the contaminant status of the soil / landfill material that will likely be excavated as part of the proposed Site redevelopment works. This review included evaluation of the thickness of cap material, fill material and depth at which landfill material was first encountered.

As part of the ESA, the analytical data was compared against the adopted background values, the NES CS soil contaminant standards (SCS) for a Commercial / Industrial land use site, the applicable Oil Industry Guidelines and BRANZ asbestos guidelines. The analytical data was not compared against soil disposal assessment or acceptance criteria as it was planned that the material would be excavated from one part of the Green Island landfill property and disposed of in another (the operational portion of the landfill). This remains the case and therefore no new contaminated materials are being received at the Site.

However, for completeness, the data has now been compared to the Green Island landfill screening waste acceptance criteria, which are the same as the MfE Class A landfill waste acceptance criteria for the most part. No toxicity characteristic leaching procedure (TCLP) analysis was undertaken on the soil samples collected during the ESA in 2021. As such, no comparison against Class B landfill leachate concentration values, which DCC have adopted for use at this landfill, was undertaken.

A summary of this review is presented in Table 2, overleaf.

Table 2 Contaminant status of excavated material

Building Name	Excavation depth (below ground level (bgl))	Contamination Present	Landfill Cap Thickness and Depth to Landfill Waste
Material Recovery Facility and Apron	2.5	Heavy metals (Copper, lead and zinc) and total petroleum hydrocarbons (TPH) reported present at concentrations above background values and the Green Island landfill screening waste acceptance criteria (Green Island Landfill WAC).	Landfill cap generally 0.2m thick, but up to 1.4m thick at one location. Landfill material encountered at depths of between 0.5-1.5m bgl within building footprint. Therefore, it is likely that landfill materials will be encountered in this excavation.
Bulk Waste Transfer Station	2.5	Limited analytical data available – Zinc reported present at a concentration above background and Green Island Landfill screening WAC.	Landfill cap between 0.2 to 0.9 m thick. Landfill material encountered at depths between surface and 1.5 m bgl. Therefore, it is likely that landfill materials will be encountered in this excavation.
Office and Staff Facilities	2.5	Heavy metals (Copper, lead and zinc) reported present at concentrations above background values and the Green Island Landfill screening WAC.	Landfill cap between 0.0 and 0.3 m thick. Landfill material encountered between depths of 0.3 and 0.8 m bgl. Therefore it is likely that landfill materials will be encountered in this excavation.
Construction and Demolition Waste sorting pad	1.0	Heavy metals (Copper, lead and zinc) and TPH reported present at concentrations above background values and the Green Island Landfill screening WAC.	Landfill cap between 0.2 and 0.9 m thick. Landfill material encountered between 0.2 to 1.2 m bgl. Therefore, it is likely that landfill materials will be encountered in this excavation.
Hazardous Waste Storage and Drop Off	1.0	Heavy metals (Copper, lead and zinc) and TPH reported present at concentrations above background values and the Green Island Landfill screening WAC.	Landfill cap in this area typically between 0.15 and 0.2 m thick. Landfill material encountered between 0.15 and 1.0m bgl. Therefore, it is likely that landfill materials will be encountered in this excavation.
Glass Bunkers	1.0	No test pits were located in this area. Closest test pits had reported concentrations of lead and zinc and TPH above background and Green Island Landfill screening WAC.	Landfill cap 0.3 m thick at TP07 (40 m to the east) and no cap at TP08 (60 m to the south east). Landfill waste material encountered at a depth of 0.3 m bgl at TP07 and 0.65 m bgl at TP08. Therefore, it is likely that landfill materials will be encountered in this excavation.
Organic Processing Facility	1.0	Heavy metals (lead and zinc) reported present at concentrations above background values and the Green Island Landfill screening WAC.	Landfill cap in this area was found to be between 0.2 and 1.0 m thick. Landfill material encountered at depths of between 0.4 and 1.8 m bgl. Therefore, it is likely that landfill materials will be encountered in this excavation.
Envirowaste Office	1.0	Limited data available for this location No heavy metals or PAHs reported above background concentrations.	Landfill cap in this area was found to be 0.3 m thick. Landfill material encountered at a depth of 0.3 m bgl. Therefore, it is likely that landfill materials will be encountered in this excavation.

As can be seen from Table 2, contaminants (heavy metals and heavy end TPH) are present within the soil / waste material, that is to be excavated during the Site redevelopment works, at concentrations above the Green Island adopted landfill waste acceptance criteria. However, this material has been in situ for at least 50 years and it is

considered that leachate generation has likely peaked and volumes and associated contaminant concentrations will have reduced. Therefore, while TCLP testing has not been undertaken to date and is not proposed as part of the CLMP it is expected that the mobility / leachability of the particular contaminants remaining in the material will be low.

In addition, the excavated material is to be placed into a part of the landfill which has a superior landfill capping and leachate collection and management system. As such, leachate discharges from the landfill associated with this waste will likely be improved.

Nonetheless, excavations will be monitored and should any evidence of gross contamination such as storage drums and significant quantities of asbestos containing material (ACM) be found, works will cease and the procedures as set out in Section 9 (Discovery of unexpected contamination) will be followed.

4. Roles and responsibilities under this CLMP

4.1 Roles

A suitably qualified and experienced practitioner (SQEP) as defined in the NES CS will be responsible for advising on contaminated soil management during periods of contaminated soil excavations. Table 3 identifies the likely roles required during these works. Once a primary contractor has been appointed, this table is to be populated and updated prior to site works commencing.

Table 3: Responsible parties

Role	Responsible Party	Assigned Staff Members
Principal	Dunedin City Council (DCC)	Chris Henderson – Project Manager Lincoln Coe – Landfill Engineer
DCC Project Manager	DCC	TBC
Principal Contractor	TBC	TBC
Site Supervisor	TBC	TBC
Wider Site Occupier (Landfill Operations Supervisor)	TBC	TBC
Subcontractor(s)	TBC	TBC
Site Health Safety & Environment (HSE) Manager	*Principal Contractor*	TBC
Engineer's Representative	TBC	TBC
Engineer to Contract	TBC	TBC
Contaminated Land Specialists (SQEP)	TBC	TBC
Licensed Asbestos Removal Contractor (if required)	TBC	TBC
Regional Regulatory Authority	Otago Regional Council	TBC
Local Regulatory Authority	Dunedin City Council	TBC
Landowner	Dunedin City Council	Lincoln Coe
Landfill Operations Supervisor	TBC	TBC

TBC – To be confirmed.

4.2 Management, control and implementation

4.2.1 Management and control

Under the Health & Safety at Work Act 2015 (HSWA), it is the responsibility of everyone to ensure safe working at this Site. In addition to the general requirements of the HSWA, the following specific responsibilities shall apply under this CLMP:

It is the responsibility of the **DCC's Project Manager (or their appointed representative)** to ensure that the current version of this CLMP is made available at the Site. It is the responsibility of the **Principal Contractor** to ensure that it is available to all subcontractors and all site construction personnel who may undertake, or be affected by, work to be conducted under this CLMP and that these parties are made familiar with and abide by its requirements. It will be the responsibility of the **DCC's Project Manager** to engage, or instruct engagement, of a **SQEP** in contaminated land investigations to assess any unforeseen situations, and to instruct review or revision of this CLMP in the event that an anomalous discovery is made that, in the opinion of the **DCC's Project Manager** is not representative of the findings of the GHD site Investigation report.

It is the responsibility of the **Principal Contractor (or their representative)** to read, understand and implement this CLMP in the field and;

– ensure workers comply with this CLMP and ensure that that all workers are inducted;
– ensure that that all workers wear appropriate personal protective equipment (PPE) for the protection against contaminated soil as and when appropriate;
– monitor for signs of contamination and manage the implementation of control measures and safety precautions where necessary; and
– report to DCC and/or the appropriate regulatory authorities regarding incidents relating to presence of contamination.

It is the responsibility of the **Site Health Safety & Environment (HSE) Manager** to understand the requirements of this CLMP; monitor daily compliance with this CLMP; record and manage incidents; report environmental incidents to the **Principal Contractor**; organise monitoring and sampling (if required); and record the results of the monitoring and sampling activities should that be required.

It is the responsibility of all **subcontractors** to understand and implement this CLMP; ensure that all site supervisors or foremen are made aware of the specific requirements of work at this Site, and sufficiently trained and experienced to implement the requirements of this CLMP; and to pass that information on to the site workers.

It is the responsibility of **site supervisors** to ensure that the workers under their supervision adhere to the requirements of this CLMP.

It is the responsibility of the Landfill Operations Supervisor to advise on general landfill operation matters such as scheduling or waste placement issues which may impact the construction works or disrupt the works program.

It is the responsibility of all persons working at the Site to work safely and in a manner that minimises health and safety risks to themselves, other site workers and passers-by.

Asbestos works are not considered likely, due to the concentrations identified during the ESA investigation being reported by the laboratory as less than the adopted human health criteria values in two investigation locations. However, key responsibilities have been included in case the situation changes as a result of accidental discovery of asbestos containing material.

– It is the responsibility of the **Licensed Asbestos Removal Contractor (if required)** to supervise and manage all works that require a licensed asbestos removal contractor, and to provide guidance to the **Principal Contractor** in that regard.
– It is the responsibility of the engaged **SQEP and the Licensed Asbestos Assessor** to understand this CLMP, and to observe (in a vigilant manner) any excavation and removal of asbestos containing material (ACM) debris or contaminated soil to completion in accordance with the Health & Safety at Work (Asbestos Regulations) 2016.

4.2.2 Review and update

This document should be seen as a “live” document and modified to address any specific health, safety and environmental issues that arise during the remediation and construction works. Any changes of note to this document should be confirmed in writing to DCC.

4.3 Implementation

It is the responsibility of the **Principal Contractor** as a person conducting a business or undertaking (PCBU), through the **HSE officer** as their delegate, to ensure that this CLMP is implemented as part of site-specific health, safety and environmental management procedures.

It is the responsibility of the **DCC’s Project Manager (or their appointed representative)** with the support of the **SQEP** to ensure that the excavation works are carried out as per the proposed plans (CLMP and Construction Environmental Management Plan).

4.3.1 General site health, safety and environment

The **Principal Contractor** shall instruct the **HSE Manager** to prepare and oversee the implementation of a site-specific Health & Safety and Environment Plan that acknowledges this CLMP. All work will be conducted under that plan. It will be the responsibility of the **HSE Manager** to ensure that all **Principal Contractor** staff and all **subcontractors** are familiar with and abide by the site-specific Health and Safety Plan.

It is the responsibility of all workers to maintain a high level of safe working practices while on Site. All workers have a responsibility to report any unsafe working practices both within the construction zone and the wider Site Environment. It is noted that workers operating as part of the wider Site environment (Waste Management) are also in a position to report any unsafe working practices which they observe to be taking place within the construction zone.

As excavation works will take place in a wider landfill operation environment, all workers will adhere to the procedures set out by the **Landfill Operations Supervisor** and care must be taken by all site workers to not disrupt the general operation of the landfilling activities e.g., truck or heavy machinery movements. Any activities which may disrupt the landfilling operation are to be discussed with the **Landfill Operations Supervisor** prior to implementation and similarly, any activities which may impact the progress of the construction works are to be discussed between the **Landfill Operations Supervisor** and the **Principal Contractor**.

5. Contamination risks

5.1 Risk to on-site construction workers

Soil contamination has not been identified at concentrations that exceed the NES CS Commercial / Industrial land use SCS criteria and adopted standards and guidelines, however it is noted that contamination was identified present at concentrations above adopted background levels.

Due to the inherent variable nature of the waste material beneath the Site, there is still the potential to encounter contamination at concentrations above human health criteria. Without mitigation, these contaminants have the potential to enter the body through inhalation, ingestion or skin adsorption. Because of this, contamination-specific requirements for the protection of workers during soil disturbance or excavation on the Site is required. To protect site worker health, specific details to be implemented are presented within Section 6.

Further unexpected contamination may be discovered during works. Indications of unexpected contamination include discoloured soils, and sheens or odours in soils. If unexpected contamination, such as large amounts of potential ACM or storage drums, is found during works, work should stop in the area of the discovery. In this situation, the procedure as set out in Section 9 is to be followed.

If there is deemed to be an immediate risk, the excavation shall be covered, the client should be informed of the discovery and an assessment must be undertaken by a **SQEP** prior to the recommencement of works.

There is the potential for ground gases (landfill gases), such as methane and carbon monoxide, to be present at concentrations that pose a risk to human health. A ground gas monitoring procedure is to be developed for the construction works by a **suitably qualified health and safety professional** and implemented by the **Principal Contractor**. This is further discussed, and procedures are provided in the Construction Environmental Management Plan (CEMP) – see draft CEMP in RRPP Management Plans – Appendix A1 (GHD 2024B).

5.2 Risk to future occupiers and maintenance workers

The proposed work will result in the removal of contaminated soils and waste materials to a maximum depth of 2.5 m. As part of the construction works, imported cleanfill gravels (aggregates) will be placed within the excavation in order to form a stable foundation (compacted gravel raft).

The immediate surroundings of the buildings and structures within the Site will be sealed with a concrete apron where high traffic volumes will be present. These impermeable layers will prevent future occupiers and maintenance workers from coming into contact with contaminated soils underlying the Site. In areas, such as the TCA extension (#15 on the layout plan), inert materials (AP65) will be used to construct the base of the TCA which will also prevent future occupiers and maintenance workers from coming into contact with contaminated soil material underlying the Site.

A landfill gas barrier membrane will be installed within the engineered fill to minimise the migration of landfill gas into all covered buildings. In order to mitigate against any potential gas build-up within the buildings, continuous indoor gas monitors will be installed. Ground gas management monitoring and management procedures will be developed for the operational phase of the buildings.

The closest residential properties are located approximately 130 m to the southeast of the nearest excavation area (MRF, #2 on the layout plan) which is sufficient distance to not be significantly impacted by the proposed construction works. Dust generated by the proposed works will be managed appropriately and not migrate outside of the Site boundary, further details for mitigation can be found in Section 6.9 of this CLMP.

5.3 Risk to the environment during construction works

The risks to the environment are predominantly based on the discharge of contaminants to the surrounding land, air and water. Common discharges to the environment include:

– Discharge of contaminants to surrounding land and water bodies from rainwater coming into contact with contaminated soils;

– Discharge of contaminants to surrounding land and water bodies through the generation of dust; and
– Leaching of contaminants into groundwater from contaminated soils.

Given the extent of contamination identified during the environmental site investigations, potential contamination risks to the environment, in particular groundwater and receiving environments through stormwater runoff are present.

Implementation of the controls set out in this CLMP, including appropriate dust, erosion and sediment controls during soil disturbance as detailed in Section 6.9, will minimise any potential risk to the receiving environment.

6. Site management

6.1 Work control area

All works shall be conducted in accordance with the conditions placed upon any construction phase earthworks and/or construction phase stormwater discharge consents received for the works. Where necessary each 'building area' will be treated as a separate 'construction zone' and the following controls will be put in place.

Prior to works commencing, the **Principal Contractor** shall implement (as a minimum) the following procedures:

– Additional documentation required (e.g., Health and Safety Plan and accidental discovery protocols) will be completed prior to works commencement by the **Primary Contractor** with input from the **subcontractors**, if necessary, for their portion of the site works;
– Security fencing to prevent unauthorised access into the construction zone;
– Signage, including site works information, health and safety requirements and site reporting requirements;
– Health and safety facilities such as change facilities and first aid points;
– Erosion and sediment control measures;
– Dust control systems; and
– Landfill gas monitoring and management procedures.

No unauthorised personnel shall be permitted within the construction zone during works.

6.2 Site induction

All workers, prior to accessing the Site, will be required to have completed an induction as required by the current controller of the landfill.

Following the completion of the required inductions, all workers will be instructed on the boundary and extent of the excavation works and restrictions as to who can enter the construction zone during earthworks involving potentially contaminated soil.

All workers engaged to work on the Site shall be given a hazard-specific induction by the **HSE Manager**, and shall be made aware of the nature of contamination and the ways in which contamination can be identified on-site.

The Site induction shall specifically cover:

– The nature and extent of the contamination issue;
– Health & safety;
– PPE requirements for management of potentially contaminated soil;
– Management and inspection procedures for contaminated, or potentially contaminated, soils;
– Landfill gas monitoring and management;
– Unexpected discovery protocol and emergency management;
– Construction zone entry and exit protocols;
– Vehicle protocols; and
– Reporting and escalation protocols in the event that additional or unexpected materials are discovered during earthworks.

6.3 Earthworks control

Inspections of the construction zone, and the excavation area will be conducted by the **Principal Contractor (or their representative)** at least once on each day that earthworks, including soil excavation and transfer, are underway to confirm that the requirements of this CLMP and **Principal Contractor** CEMP are being applied.

The inspections will specifically include:

– Checks that no unauthorised or untrained personnel are working within the area;
– Availability and appropriate usage of PPE;
– Implementation of ground gas monitoring and management procedures;
– Management procedures for contaminated soils;
– Vehicle management protocols;
– Confirmation that construction zone conditions are still as expected, and hence the current CLMP remains appropriate; and
– Should ACM in greater concentrations be encountered at the Site, that the CLMP has been updated to reflect this and that a **licensed asbestos removal contractor** has been engaged and an asbestos management plan (AMP) has been developed and implemented for the works.

6.3.1 Earthworks procedures

The following procedures shall be followed for excavation and transfer of soil from the excavations:

– Prestart meetings and toolbox talks shall be undertaken each day by site workers prior to working on the Site to highlight the risks and what to watch out for; and
– Excavation extents to be managed so that the size of any open excavations is minimised. No unnecessary excavation shall be undertaken.

6.3.1.1 Excavation of contaminated soils

Contaminated soils, and any material removed from excavations within the Site, shall be excavated and transported immediately to the Green Island landfill tip face for disposal. While it has been identified that contaminants are present in the soil and waste material at concentrations above the Green Island Landfill waste acceptance criteria, it is considered that the controls and measures included in this CLMP and the CEMP are sufficient to manage the risk to the environment and workers. As the material has been in place for at least 50 years and the mobility and toxicity of the identified remaining contaminants are considered to be low, pretreatment of the material prior to disposal is not considered necessary.

To minimise the potential for contamination of other areas of the Property, when possible, the **Principal Contractor** or **Subcontractor** shall load excavated soil directly onto trucks immediately adjacent to the excavation areas, and trucks shall be brushed down prior to leaving the Site to remove any loose dirt from the wheels and outer tray body of the vehicle.

Material will be placed in trucks / containers with the drop height minimised to reduce aeration of soils and prevention of airborne dust generation which may contain contamination i.e., potential asbestos fibres. Loaded trucks to be covered during transportation should the Site conditions require it.

6.3.1.2 Disposal of excavated materials

All soils and materials excavated from the Site will be taken to the tip face of the Green Island landfill for disposal (within the Property). The excavated materials are then to be co-mingled with general waste associated with the tip face operation. Alternatively, if required due to the potential high hazard nature of the excavated materials, the material could be disposed of separately in a specially located area away from the active tip face.

Disposal of material from the Site will require the following additional protocols:

– Trucks shall have their wheels swept down before they leave the Site; and
– Trucks shall have their wheels either swept down or washed (within the wheel wash) before they leave the Property in accordance with the landfill management decontamination procedures.

6.4 Stockpiling

Stockpiling of excavated materials is not to take place during the construction works. Material is not to be excavated if it cannot be disposed of immediately.

Stockpiling of imported cleanfill certified aggregate material is permitted, provided that this material is managed appropriately (e.g. dust control, erosion and sediment controls in place).

6.5 Backfill / imported material

Ground levels shall be reinstated across each construction zone as per the design specifications for the concrete pad construction. Fill material is to be imported virgin aggregate (AP40 or as required).

Any imported fill must be certified as free from contamination prior to being transported to the Site. Certification and/or analysis dockets from the cleanfill supplier will be obtained certifying that the fill meets the Ministry for the Environment's (MfE)'s definition of cleanfill, as described in MfE, A Guideline to the Management of Cleanfills, 2002 and any relevant local authority rules in relation to cleanfill material. If soil requires testing, it shall be sampled at a minimum rate of one sample per 100 m^3 by a **SQEP**.

6.6 Health and safety management

The **Principal Contractor** shall take all necessary precautions to protect the safety of the workers employed on or near the works, the public and traffic and shall comply in all respects with the HSWA.

6.6.1 Site specific health and safety plan

The **Principal Contractor** shall develop and implement a site-specific Health and Safety Plan (HASP), which shall list all known site and operational hazards and the measures taken or to be taken to eliminate or minimise them. The HASP shall also provide:

- Contractor's safety policy, safety training procedures and nominated site safety personnel;
- Procedure for recording of near-misses and accidents;
- Procedure for managing Site emergencies or evacuations;
- Procedure for monitoring health and safety performance;
- Procedures for monitoring the health of employees where they are exposed to hazards;
- Procedures for identifying and assessing hazards and for the avoidance or control of risks to the safety and health of employees and others, including:
  - Development of exclusion, decontamination and support zones (refer below);
  - Waste handling protocols and restrictions; and
  - Air quality (vapour, dust and fibre) and ground gas monitoring, trigger levels, responses to trigger levels and mitigation protocols;
- PPE requirements, appropriate to the risks employees and others may be exposed to while at work;
- Procedures for the induction of site workers and site visitors and the maintenance of site induction registers and attendance records;
- Procedures for identifying and reporting new hazards by **the Principal Contractor's** staff, and any subcontractors to DCC. Known hazards include, but are not limited to:
  - Pedestrian, vehicle and construction plant/machinery interactions;
  - Mechanical excavation activities;
  - Handling (mechanically or with hand tools) of waste materials and potentially hazardous by-products of waste, including dusts, inhalable fibres, gases and liquids;
  - Ground Gases; and
  - Noise.

6.6.2 Personal protective equipment for construction workers

In addition to normal construction PPE, onsite personnel who may be at risk from contact with contaminated soil, dust inhalation or landfill gas exposure during works involving contaminated material shall be provided with:

– Disposable coveralls;
– Disposable half-face masks respiratory protective equipment (P2; AS/NZS 1716:2012 respiratory protective device);
– Disposable Gloves; and
– Disposable ‘wet wipes’ or similar.

The **Principal Contractor** will set appropriate trigger levels to comply with occupational exposure limits and ensure that workers have appropriate PPE for any landfill gases detected on Site as noted in Section 2.1 and as set out in the CEMP.

The **Principal Contractor** will organise for their nominated health and safety personnel to undertake a construction zone walkover with a lower explosive limit (LEL) gas analyser at a frequency as specified by the HASP and CEMP to ensure ground gases (landfill gas) do not pose a risk to site personnel working within or adjacent to the excavation.

Facial hair (a beard, stubble growth or sideburns) may affect the ability for a face seal around the mask. Site personnel should be clean-shaven when wearing a half-face mask.

When work is finished for the shift (or part-shift) or shift breaks, the face and work boots will be wiped down with wet-wipes. The coveralls should then be removed and inverted (rolled into a ball such that the inner face is outward) and gloves removed and inverted for disposal. Workers’ faces should again be wiped with wet wipes before removal of the half-face mask. All waste shall be sealed in a sturdy polythene bag (min 200 µm) for appropriate disposal.

6.6.3 Decontamination

The decontamination of personnel and portable equipment shall be carried out to reduce potential environmental, health and safety risks and limit the potential migration of contaminants from the Site. Decontamination shall occur when leaving excavations within contaminated soils, and before leaving the Site.

Personnel and equipment decontamination shall include the following steps:

– Soil and dust removal from equipment parts that have come into contact with potentially contaminated soil by wiping down and/or scraping as appropriate.
– Personnel decontamination comprising the following:
  - Rinsing and/or scrubbing of all non-disposable PPE (e.g., boots) to remove dirt and dust residues;
  - Removal and disposal of all disposable PPE (e.g., gloves); and
  - Washing of hands and face with soap and water.

All personnel shall complete the personal decontamination procedures whenever they leave the work area (including leaving for meal breaks, toilet breaks, etc.) and following direct contact with potentially contaminated soil or ground (e.g., in the case of a ripped glove).

6.7 Environmental management

The **Principal Contractor** shall manage Site activities and environmental controls in accordance with all resource consents obtained and issued by DCC and ORC.

6.8 Construction Environmental Management Plan

The construction environmental management plan (CEMP) which is to be developed by the **Principal Contractor** will provide a reference for the Contractor’s employees, sub-contractors and any visitors to the Site and will be used to communicate Site environmental controls during the induction of site personnel. A draft copy of the plan is included in GHD 2024B)

The CEMP shall detail methods and procedures for the following:

– General waste handling and Site management protocols;

– Temporary stockpile protocols (imported aggregate only);
– Dust and litter controls;
– Stormwater, sediment, pollution, vegetation and contaminated water controls;
– A register of environmental hazards and Site controls; and a means for identifying and reporting new environmental hazards to the construction team and / or client; and
– Waste material transportation, including:
  - load wetting (when necessary) and spill-proof tray requirements; and
  - waste manifest and weight recording procedures. It is assumed the trucks will go through the Green Island landfill weighbridge to record the movement of waste from the RRPP area to the active landfill.

6.9 Environmental control

In order to minimise the potential for adverse effects to human health or the environment resulting from the Site works, a series of protective measures shall be put in place during any soil disturbance activities. Given that there is the potential for contamination at high concentrations to be present at the Site, the control measures discussed below are deemed necessary.

6.9.1 Dust and odour

The primary transport pathway for contaminant inhalation risks is interpreted to be from dust that may be generated by excavation activities.

Site works shall be carried out so that they do not result in any odours or airborne dust that is determined to be noxious, objectionable or offensive being deposited or observable beyond the property boundary. Generation of dust and odours shall be appropriately managed by employing the following standard dust and odour suppression techniques:

– Dampening down using water sprays;
– Managing dust suppression to ensure over-wetting, runoff or standing-water conditions are avoided;
– Placing silt sheets over the security fences which bound each construction zone in order to contain any potential dust generated from the excavation works;
– Employing any additional relevant dust mitigation measures such as those described in the Good Practice Guide for Assessing and Managing the Environmental Effects of Dust Emissions, Ministry for the Environment (2001);
– If dust is observed visually on-site, ceasing all works immediately, until appropriate additional dust control measures are put in place;
– Re-locating the odour cannon, currently located adjacent to the existing tip face, to the vicinity of the excavation works and utilising it if offensive odours are noted in and around the excavation;
– Scheduling activities that have increased potential to generate odour to days when the wind direction is away from sensitive receptors; and
– Covering open excavations with daily cover or employing alternative methods (e.g. ComposTex Compost Covers) to cover the work area at the end of each working day to minimise the generation and migration of any potential offensive odours.

Additional information regarding the dust and odour management is detailed in the Air Quality Impact Assessment[6].

6.9.1.1 On-site dust monitoring (if required)

On-site dust monitoring will be required if friable ACM or significant quantities of ACM, such as sheeting or roofing material, are identified during works and shall be undertaken by a person competent to undertake asbestos dust monitoring (e.g., a **Licensed Asbestos Assessor**).

[6] GHD (2023) Waste Futures - Green Island Landfill Closure – Air Quality Impact Assessment. Dated 1 March 2023. Project reference number. 12547621

All testing of the air monitoring samples must be completed by an independent certified laboratory.

In the event that asbestos fines are detected in air, work MUST be stopped until further assessment is undertaken by the **SQEP** and **Licensed Asbestos Assessor**, and appropriate dust controls are put in place. Further assessment may include additional soil and air sampling work to quantify the concentration of asbestos fines being disturbed.

WorkSafe has determined the acceptable level of respirable asbestos fines in the air. The more fines in the air of a size small enough to be inhaled, the greater the risk to health. The following are the acceptable levels of asbestos fines during on-site dust monitoring:

– Trace level – an average concentration over any 8-hour period of less than 0.01 respirable asbestos fines per millilitre of air (0.01 f/mL). If the proposed work is likely to exceed the acceptable trace level, the work is subject to licensed work controls as per the Asbestos Regulations; and
– Workplace exposure standard – an average concentration over any 8-hour period of 0.1 respirable fines per millilitre of air (0.1 f/mL)[7].

6.9.2 Sediment and erosion

Earthworks shall be undertaken in accordance with the ORC Regional Plan for Water, Rules 14.5.1.1 and 14.5.2.1 and the2GP. Should the requirements of these rules not be met, then a resource consent may be required, although this is not currently expected to be necessary. DCC have also developed a guide on “Silt and Sediment Control for smaller sites”[8] which outlines a range of measures to reduce erosion and sediment discharges to waterways from construction sites. Compliance with this document and the applicable district and regional council rules should be sufficient to manage the risks from sediment and erosion during the excavation works. The following control measures will be undertaken:

– Effort shall be made to undertake the excavation works in a period of dry weather to minimise the risks of stormwater entering the excavations or contaminated water escaping from the excavations;
– Erosion and sediment controls shall be put in place around the excavations as necessary to inhibit potentially contaminated soil/sediment from being transported away from the area;
– The erosion and sediment control measures will primarily include battering and/or bunding of the excavations to ensure surface run-off falling onto potentially contaminated soil is retained within the excavations;
– Any significant stormwater build-up within any excavation during the works will be treated as leachate. It is anticipated that significant water build-up in excavations will be disposed of via sucker truck, and disposed of at the landfill, either into a sludge pit or discharged into the leachate collection system;
– Stockpiling of contaminated soil / material is not to take place during the construction works. Material is not to be excavated if it cannot be disposed of immediately;
– Soil must be wetted prior to transport in trucks, if not already sufficiently wet, any loose contaminated material on the side of the trucks or on the wheels shall be removed before the truck leaves the Site; and
– Every truck in the waste cartage fleet must use:
    - sealed tailgates, capable of preventing any loss of materials or liquids from all loads, or otherwise be sealed with “Densotape” (or similar) to prevent loss of liquids during transport.

6.9.3 Groundwater

The Site is located over an unconfined / semi-confined aquifer and for the purpose of these site works, due to the presence of waste beneath the whole Site area, all groundwater encountered shall be treated as leachate. Static water levels, within the groundwater monitoring wells at the Site (RRPP BH01, RRPP BH02, RRPP BH03 and RRPP BH04), were measured as between 3.41 m (BH04) and 1.87 m (BH01) below ground level between February and July 2023[8].

[7] Workplace Exposure Standards and Biological Exposure Indices 2017 (amended January 2018) 9th edition.
[8] Dunedin City Council (2013), Silt and Sediment Control for smaller sites (https://www.dunedin.govt.nz/__data/assets/pdf_file/0005/337217/Silt-and-Sediment-August-2013.pdf).

The proposed design of the RRPP facilities involves the installation of gravel raft building foundations to a maximum depth of 2.5 m below ground level. Monitoring of the leachate levels in the waste materials underlying the RRPP area indicates that dewatering may be required during the excavation and installation of a gravel raft foundations. Modelling[9] was undertaken to estimate the required dewatering rate for the largest of the proposed excavations, the MRF building and apron, which indicated an inflow rate of up to 0.2 L/s. Due to the presence of waste materials, it is assumed that all inflows will be landfill leachate. The applicant proposes to collect all leachate inflows and direct these inflows to the leachate collection system or recirculate and discharge them to the landfill for disposal. The estimated flow rates are well within the usual operating range of the leachate system.

The perimeter leachate collection trench operates as a hydraulic barrier by drawing groundwater from both the landfill side and outside of the trench. The dewatering activities are unlikely to result in any additional groundwater drawdown outside of the landfill and RRPP footprint.

6.9.4 Noise

Construction noise and noise from associated activities shall at all times comply with the Green Island designation condition regarding noise limits at the boundary as detailed in the Design and Operations Report. Further details on noise management and monitoring is included in the CEMP (draft document – GHD 2024B).

6.9.5 Spill management and response

The **Principal Contractor** shall ensure that at least one 100-L capacity spill kit is available on-site for the duration of the works. The spill kit will be capable of deployment to contain fuel and oil spills from plant, equipment or vehicles and shall be positioned near the active works area (within the Construction Zone works area). Site inductions shall include a briefing on the location and appropriate use of spill kit contents.

6.9.6 Flooding

In the event of Site inundation (e.g., by stormwater runoff passing into the Site), stormwater is to be discharged into the leachate collection system for the landfill.

6.9.7 Adverse weather conditions

If adverse weather conditions are forecast (heavy rainfall or strong wind) such that it is unlikely the Site can be managed according to the above protocols, the Site shall be made safe and work will cease until the weather conditions improve. Adverse weather conditions include:

– Strong winds that would result in dust controls no longer effectively controlling dust; and
– Heavy rainfall that would result in runoff during soil handling.

[9] GHD (2023) Waste Futures – Green Island RRPP Groundwater Technical Assessment, Dated 31 July 2023. Project reference number: 12613624

7. General Site monitoring and recording

General monitoring within the Site shall be undertaken and include:

7.1 Daily monitoring

Daily inspections will be completed by the **Principal Contractor (or their representative**). Site specific checklists will be developed to check compliance with resource consent conditions. Issues will be recorded and actioned if they present significant environmental risks (e.g., landfill gas, noise, dust, odour, spoil management).

Checking of weather forecast and on-site weather conditions and any pre and post storm inspections as required shall be conducted by the **HSE Officer** or their representative.

Ongoing inspection of excavations and spoil for the presence of unidentified contamination and the effectiveness of this CLMP shall be conducted by a site representative nominated by the **SQEP**.

Inspections as required by environmental control procedures e.g., sediment control devices inspected daily to ensure that they are installed correctly, operating effectively and are properly maintained.

Daily monitoring is required during periods of soil disturbance, and when there are excavations and / or trenches open at the Site.

7.2 Weekly monitoring

Formal Site inspections are to be undertaken to check compliance with this CLMP. The **Principal Contractor (or their representative)** or delegate shall conduct inspections and issues will be noted.

7.3 Additional inspection triggers

Triggered inspections will be undertaken and recorded in response to the following:

– Issues – upon being informed of an issue, an inspection of the area affected or involved will be undertaken by the **HSE officer** and, when appropriate, escalated to the **Principal Contractor** for discussion with the DCC **Project Manager** or their representative e.g., high gas / vapour readings being detected during the excavation works, accidental discovery of unexpected contamination or a contaminated hot-spot;
– Extreme weather – Site control measures will be inspected by the **HSE Officer** immediately before, during and after extreme weather for any non-compliance with resource consent conditions; and
– Non-compliance – inspections will be undertaken by the **HSE officer** immediately following spills or other incidents or emergencies and after “near miss” events.

7.4 Record keeping and reporting

A Site logbook will be maintained on-site and shall contain (as a minimum) the following information:

– Weather conditions;
– Site conditions;
– Progress / problems associated with the Site work;
– Record of any maintenance to the erosion and sediment control plan measures;
– Record of landfill gas monitoring;
– Numbers of personnel on-site and use of PPE;
– Safety, health and environmental discussions and safety non-compliance issues;
– Third party complaints lodged regarding the works, as well as all corrective measures implemented to limit such complaints from reoccurring; and
– All incidents and near misses.

8. Incidents, accidents, and complaints

A register shall be maintained by the **HSE Officer** of any health and safety or environmental incidents, accidents or complaints related to work in the Site. The register will contain, for each incident, accident or complaint, as a minimum:

– The date and time;
– The nature of the issue;
– Who reported the issue (name and contact details);
– What actions were taken to address or resolve the issue;
– Whether any third party or emergency service was called; and
– The name and role of the person making the entry to the register.

9. Discovery of unexpected contamination

In the event that the **Principal Contractor** or any other site workers encounter any contamination of unknown origin, including but not limited to underground storage tanks, waste fuel or chemical drums, ACM in large volumes, buried wastes differing to what is typically found at the Site, or soil containing contamination (odours or staining) differing to what is normally found at the Site, the area should be evacuated and secured immediately with no further access allowed to that portion of the Site until appropriate response and control measures can be implemented as follows:

– If it appears that there is an immediate risk to staff and/or the environment (for example leaking containers, strong odours or any observed health effects), emergency services should be contacted, and a HAZMAT response requested; and
– If the contamination does not appear to present an immediate risk to staff and/or the environment, the client should be informed by the **Principal Contractor** within 2 hours of the discovery. If required, a **SQEP** shall be engaged to undertake an appropriate assessment.

An example flowchart of the procedures to be followed is provided as Figure 6.

Should an assessment be required by a SQEP, they shall advise on the appropriate management, sampling and disposal protocols. The management plans, including this CLMP, the CEMP and ESCP, shall be updated as required.

A report shall be provided to Council within 24 hours detailing the find and SQEP recommendations.

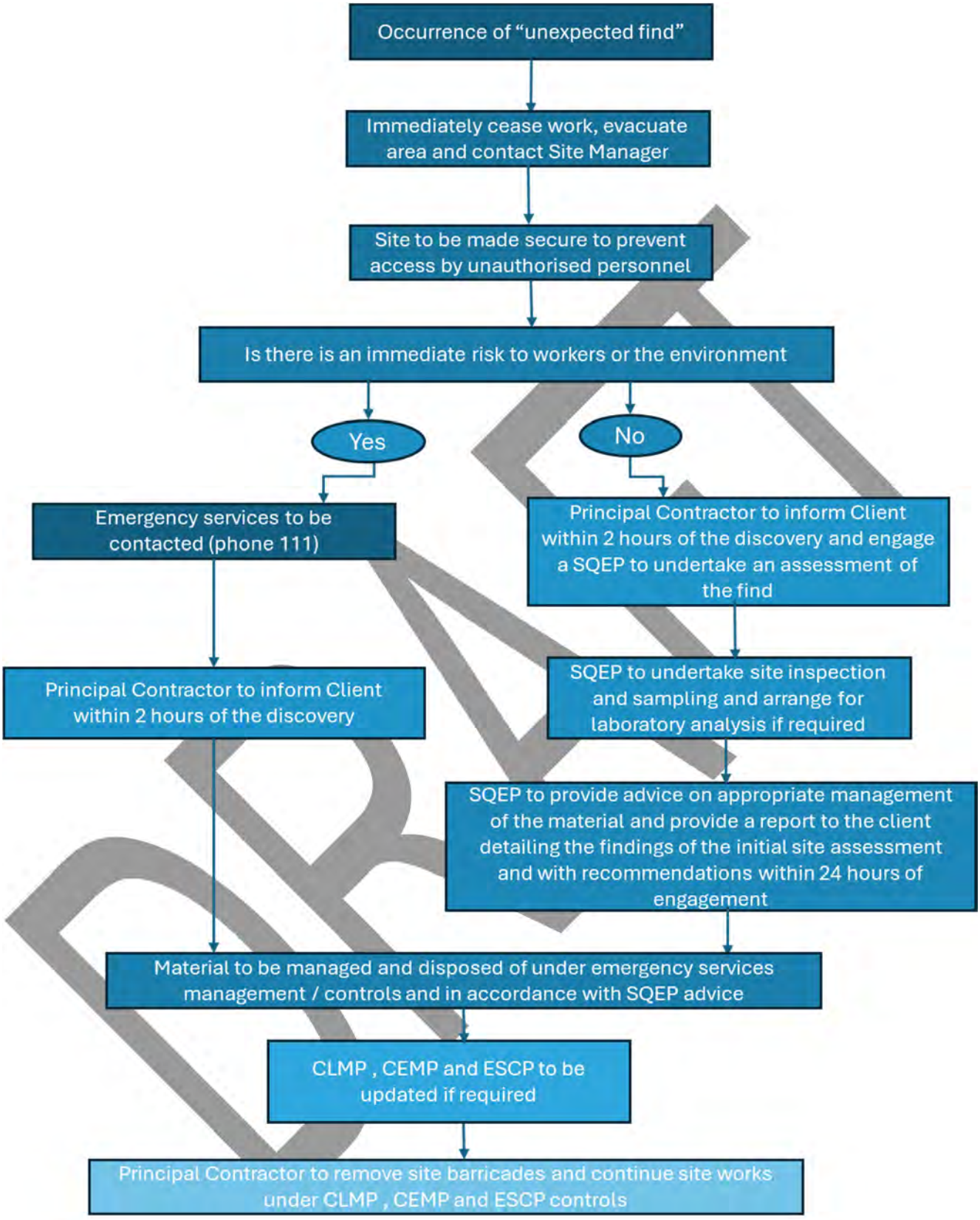

Figure 6 ***Proposed unexpected finds protocol (for contractor adaptation).***

10. Summary of works report

Following the completion of the soil disturbance works, a Site works summary report will be prepared under the supervision of, and signed off by, a **SQEP** that presents:

– A summary of the excavation activities;
– Plans showing the approximate excavation extents and depths;
– Details of any unexpected discoveries,
– A photolog of the excavations; and
– Any other reporting requirements as per the consent conditions.

Documentation relating to the importation of clean fill material shall be obtained by the **Primary Contractor** and summarised in the report.

11. Scope and limitations

This report is a DRAFT Document intended to provide guidance on the likely format and content of a final plan. The document will not be finalised until detail design has been completed and a contractor has been appointed who will provide input to the plan.

This report: has been prepared by GHD for Dunedin City Council and may only be used and relied on by Dunedin City Council for the purpose agreed between GHD and Dunedin City Council as set out in section 1.3 of this report.

GHD otherwise disclaims responsibility to any person other than Dunedin City Council Dunedin City Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section(s) 1.7 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the Site may be different from the Site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular Site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant Site features and conditions may have been identified in this report.

GHD has prepared this report on the basis of information provided by DCC Limited and others who provided information to GHD (including Government authorities)], which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

Attachment 1

Environmental Site Assessment Investigation Report

Green Island Landfill - Resource Recovery and Processing Precinct

Environmental Site Investigation Factual Report

Dunedin City Council

9 November 2021

The Power of Commitment

GHD Limited
138 Victoria Street, Level 3
Christchurch Central, Canterbury 8013, New Zealand
T +64 3 378 0900 | **F** +64 3 377 8575 | **E** chcmail@ghd.com | **ghd.com**

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1. Introduction

1.1 Background

Existing Otago Regional Council (ORC) resource consents for the operation and management of the Green Island Landfill (the Landfill), expire in October 2023. It is understood that Dunedin City Council (DCC) is considering options for disposal of waste beyond this date, as there is no alternative municipal landfill site in the Dunedin area and there is available void space that could be utilised, and eventual closure scenarios for the Landfill.

The Green Island Landfill is located south of State Highway 1 (SH1) approximately 10 km south west of Dunedin City Centre as shown on Figure 1 overleaf.

DCC has engaged GHD Limited (GHD), Boffa Miskell and Morrison Low (the Project Team), to undertake a feasibility assessment and provide advice on options for waste disposal including consenting options for the Landfill as well as costs and benefits of the future operation of the Landfill.

In addition to identifying closure scenarios for the Landfill, DCC is also seeking to develop and consent a Resource Recovery and Processing Precinct (RRPP) at the Landfill site to facilitate the sorting, transfer and recycling of waste. This is part of DCC's long term waste management strategy. It is proposed to locate the RRPP in the north eastern portion of the Landfill, at and around where the current site offices and transfer station are located (the Site). A Site layout plan is provided as Figure 2 in Section 2.1.

A GAP analysis was undertaken during the first stage of the landfill closure and consenting project. During this process, it was identified that there was little information available about the type and thickness of capping material present, the type of waste, the extent (both horizontal and vertical) of the landfilling and the concentrations of contaminants remaining in the area proposed for the construction of the RRPP. An environmental site investigation (this report) was undertaken to provide the data identified by the GAP analysis.

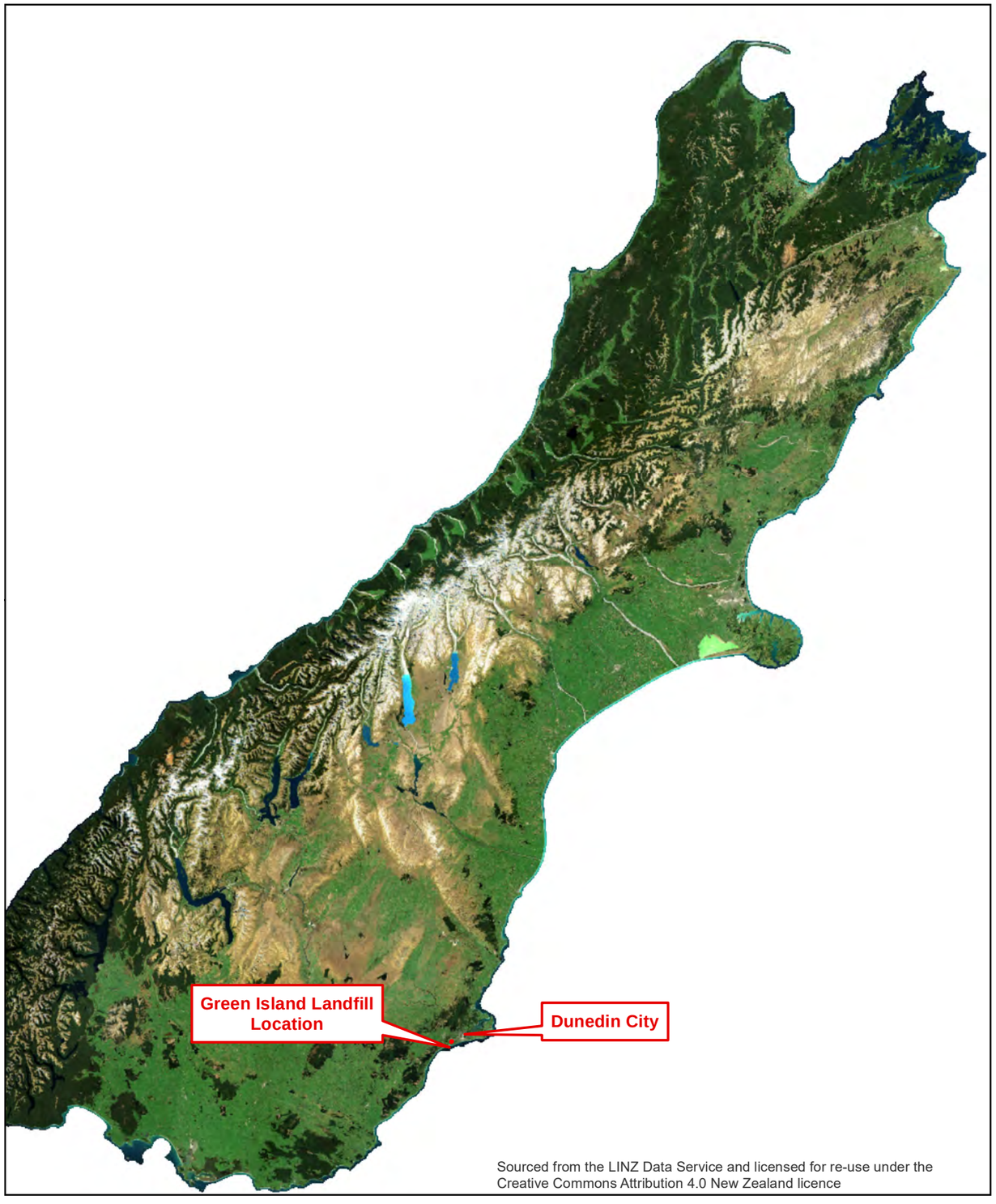
Several options for the layout and building components to be included in the RRPP are currently being considered and as such, the final layout and design of the buildings have not been finalised.

In addition to supporting potential future resource consent applications, the results of the investigation will provide factual ground information for a potential RRPP developer. Currently the final layout of the RRPP is not confirmed and therefore some further investigation may be required if layouts change.

The site investigation was designed to gain a broad understanding of the ground conditions at the Site. Sampling points (test pits, boreholes and landfill gas monitoring wells) were located where access allowed (outside of the operational areas of the Site) and where it is likely that buildings associated with the RRPP will be constructed. It may be necessary to undertake further environmental site investigations in the central portion of the Site or undertake more targeted investigations once the design of the RRPP has been finalised.

This factual report does not constitute a detailed site investigation (DSI) as defined by the Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations (NESCS, 2011) and its incorporated documents, as it does not fully document Site history and the amount of laboratory analysis undertaken was not sufficient to fully characterise the contaminated soil status of the Site. However, it does provide sufficient information to enable assessment of the optimal locations of the RRPP buildings and the risks posed by the contaminated material present.

This factual report is to be supplied to contractors as part of the tender document package for the RRPP design and construction works.



Paper Size A3

0 14,000 28,000 56,000 84,000 112,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator

N

Legend

Site Boundary

Dunedin City Council
GREEN ISLAND LANDFILL
Site Location

Job Number	12547621
Revision	A
Date	14 Oct 2021

Figure 1

G:\51\12509201\GIS\Maps\Deliverables\12509201_R001_RevA_GI_Figure1_Location.mxd

Data source: Google Earth Pro; Imagery as at April 2019, DCC; GHD_DCC_Urban_Imagery_2013, Data (GI_Site_boundaries_GHD_20180818., Roads_GILF_GHD_clip_Data_warehouse_20180818, GILF_Stream_GHD_20180818) Created by:chillman

Level 3 138 Victoria Street Christchurch 8141 New Zealand **T** 64 3 378 0900 **F** 64 3 377 8575 **E** chcmail@ghd.com **W** www.ghd.com

1.2 Purpose and Scope of this Report

The purpose of this site investigation and factual report is to provide environmental information for the assessment of layout and construction options for the RRPP. The investigation will inform the contaminant status of the soil present at the proposed RRPP Site, the extent of contamination and implications for human health and the environment.

The scope of work comprised the following:

- The excavation of 34 test pits across the site, geological logging of the material encountered and the collection of soil samples for environmental laboratory analysis.
- The drilling of four boreholes, collection of soil samples for laboratory analysis and the installation of four piezometers.
- The drilling and installation of four landfill gas monitoring wells.
- Monitoring of groundwater depths and the concentration of landfill gases.
- Preparation of a factual report detailing the site works undertaken, the presentation of the tabulated analytical results in comparison to adopted criteria and the implications of the findings of the environmental site investigation.

The site works were undertaken as a joint environmental and geotechnical investigation. The results of the geotechnical investigation are provided in a separate GHD report entitled “Resource Recovery and Processing Precinct - Green Island Landfill. Geotechnical Factual Report. Dated 18 October 2021”.

1.3 Assumptions

GHD has made the following assumptions during the preparation of this report:

- Information obtained from third parties and DCC is complete and accurate.
- That the Site will remain in commercial / industrial land use.

1.4 Limitations

This report: has been prepared by GHD for Dunedin City Council and may only be used and relied on by Dunedin City Council for the purpose agreed between GHD and Dunedin City Council as set out in section 1.2 of this report.

GHD otherwise disclaims responsibility to any person other than Dunedin City Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

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The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report (refer section(s) 1 through 6 of this report). GHD disclaims liability arising from any of the assumptions being incorrect.

The opinions, conclusions and any recommendations in this report are based on information obtained from, and testing undertaken at or in connection with, specific sample points. Site conditions at other parts of the site may be different from the site conditions found at the specific sample points.

Investigations undertaken in respect of this report are constrained by the particular site conditions, such as the location of buildings, services and vegetation. As a result, not all relevant site features and conditions may have been identified in this report.

Site conditions (including the presence of hazardous substances and/or site contamination) may change after the date of this Report. GHD does not accept responsibility arising from, or in connection with, any change to the site conditions. GHD is also not responsible for updating this report if the site conditions change.

GHD has prepared this report on the basis of information provided by Dunedin City Council and others who provided information to GHD (including Government authorities), which GHD has not independently verified or checked beyond the agreed scope of work. GHD does not accept liability in connection with such unverified information, including errors and omissions in the report which were caused by errors or omissions in that information.

2. Site Setting

2.1 Site Description

The portion of the Green Island Landfill evaluated as part of this investigation (the Site) is outlined in orange as shown in Figure 2 below.

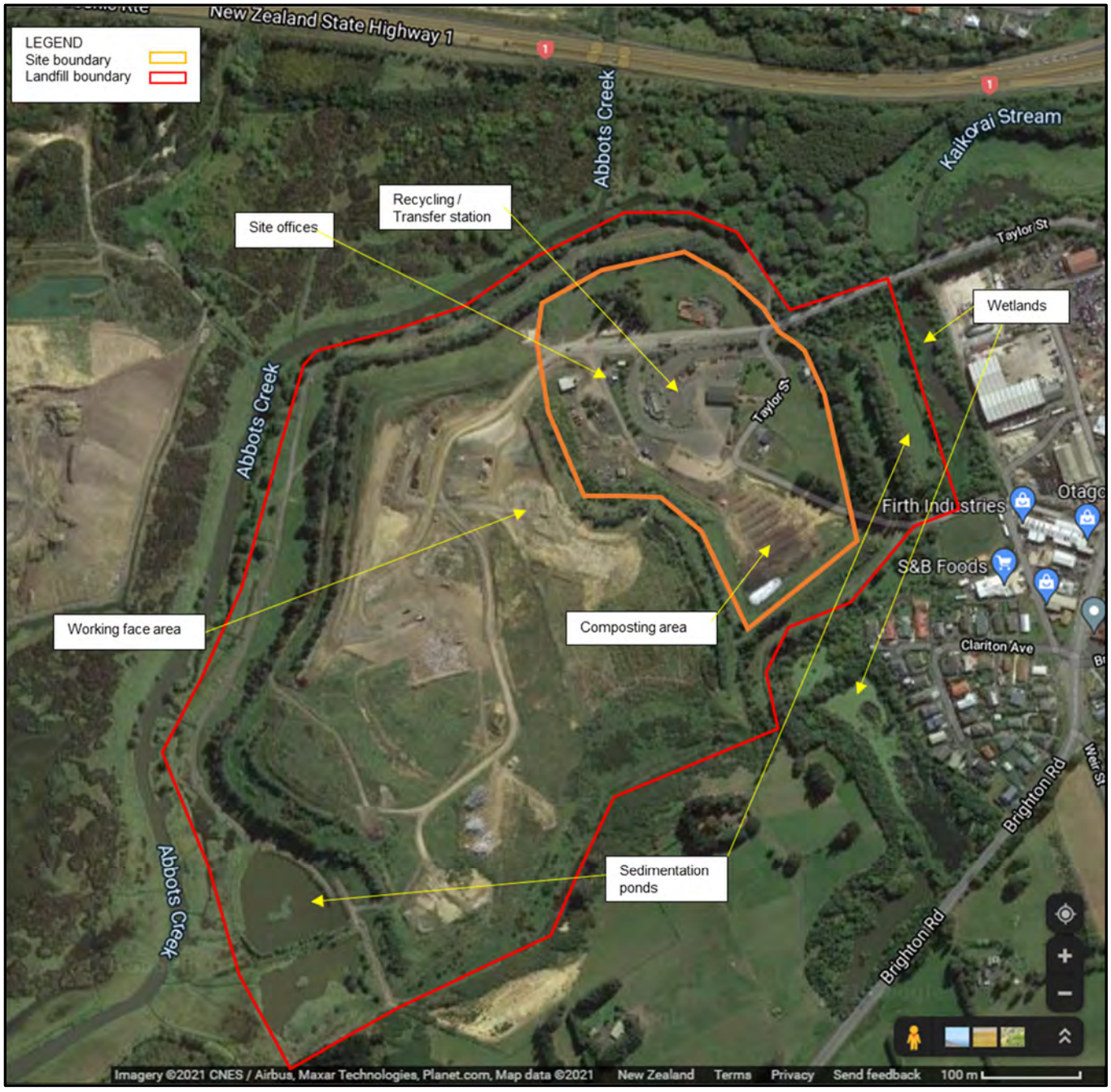


Figure 2: Green Island Landfill Layout Plan (outlined in red) highlighting the Site (outlined in orange).

The Site is bounded by the Kaikorai Stream to the north, a landfill sedimentation pond to the east, residential properties to the south east and the working tip face area to the west.

The Landfill is currently being managed and operated by Wate Management Ltd., on behalf of DCC. The Landfill is approximately 38 hectares in size and is delineated by the legal descriptions in Table 1.

Table 1: Legal Descriptions for Green Island Landfill

Legal Descriptions
Pt Secs 44 and 45 Green Island Bush SD
Secs 54-55, 63, 65 Block VII
Section 119 Block VII Dunedin and East Taieri SD

Several activities are currently being undertaken within the boundaries of the Landfill including municipal waste disposal, compost production, liquid waste and sludge disposal alongside the operation of a waste transfer station and a recycling centre (Figure 2).

As can be seen on Figure 2, the working face is currently located towards the middle of the Landfill, the composting area is situated towards the south-eastern boundary and the waste transfer station and recycling station in the north western portion of the Landfill. Landfilling is complete over the northern and north eastern portion and continues over the remainder of the Landfill.

A network of landfill gas collection wells is also installed at the Landfill. Additional wells have been installed over time with the development of the landfill. The configuration of the wells changes over time to allow for improved gas collection and collection of gas from areas of new waste. The gas is piped to the Dunedin waste water treatment plant (WWTP) for use in the generation of electricity.

Two stormwater sedimentation ponds are located on the Landfill, one on the southwestern site boundary (West Pond) and one on the north-eastern site boundary (East Pond), see Figure 1.

2.2 Site history

A landfill has been present on the eastern side of the Kaikorai Estuary since 1954. It was located in a reclaimed wetland area within the Kaikorai Estuary, which is part of the larger Kaikorai Catchment. This is a 55 km^2 area bounded by the Kaikorai Stream and Abbots Creek and the topography of Chain Hills and Saddle Hill. The Kaikorai Stream historically ran through the landfill site but was later diverted along the western boundary of the Landfill to run in a southwest and southerly direction, towards the Kaikorai Lagoon and ultimately the sea. The stream forms the northern and western limits of the landfill before flowing into the Pacific Ocean near Waldronville.

Unregulated and uncontrolled landfilling occurred at the Landfill until the 1990s, when DCC began to manage waste disposal activities through a national planning approach for the area. In 1995, a leachate interception trench and collection system was constructed. This comprised nine (9) pump stations interconnected via a gravel-filled trench with an inbuilt perforated collector drain located around the landfill toe and was retrofitted around the majority of the perimeter of the landfill.

This pump network is set up to maintain a hydraulic gradient towards the trench, minimising the amount of leachate migrating beyond the interceptor trench. There is a gap in the leachate collection trench along the south-eastern boundary of the landfill. The interception trench allows for the leachate to be collected and discharged to the Green Island WWTP, located to the southwest of the landfill.

A network of groundwater / leachate monitoring wells was installed in a series of lines crossing perpendicular to the interception trench, to monitor groundwater / leachate levels across the trench to confirm hydraulic containment of the shallow groundwater. This network consists of both shallow and deep monitoring wells and each line is located approximately halfway between each pump station.

A schematic cross section plan of the landfill and the location of the leachate collection drain and monitoring well arrangement is presented in Figure 3 below.

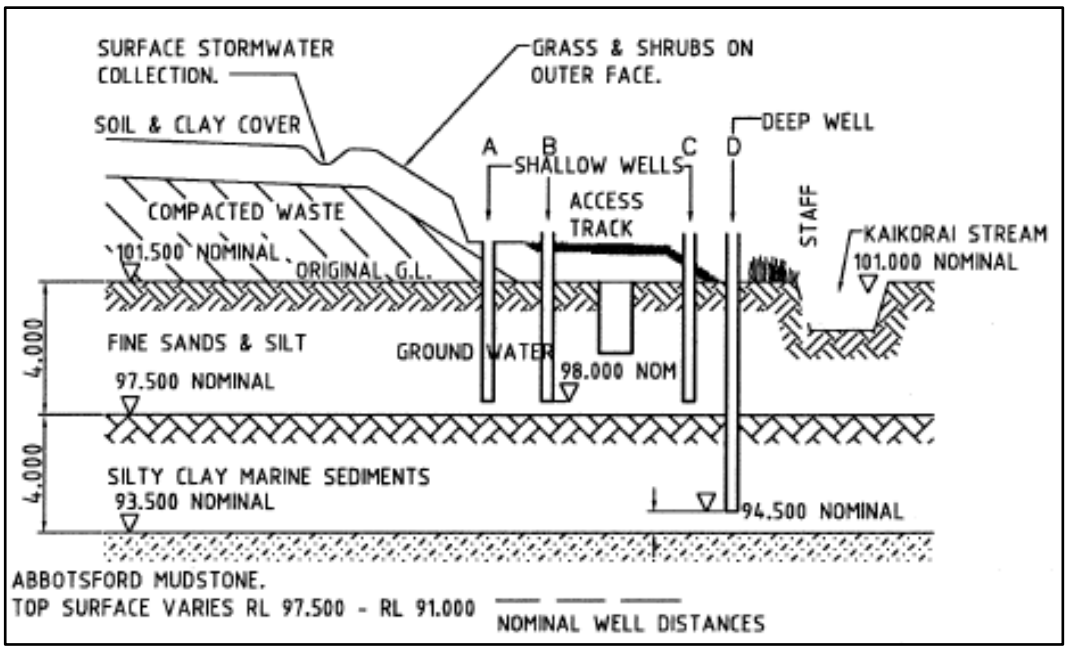


Figure 3: Schematic cross section through an example monitoring well line and the leachate collection trench (Source DCC Landfill Annual Survey Plans – July 2004 Sheet No. G11).

An HDPE liner was historically placed between the leachate interception trench and the Kaikorai Stream to minimise flow from the stream and groundwater migrating eastwards towards the landfill. During this time (HDPE liner placement), a clay bund was also installed around the site boundary to contain both the landfill and leachate.

2.3 Contaminated land (HAIL) status

The NESCS applies when a selected activity on a piece of land where an activity or industry on the Ministry for the Environment (MfE) hazardous activities and industries list (HAIL) is, has, or is more likely than not to have occurred.

The Site is known to be part of a landfill and as such is categorised as HAIL activity G3 (landfill sites).

3. Site works

All field work was carried out in compliance with the project specific Job Safety and Environmental Analysis (JSEA) plan. All site investigation staff were inducted to the Site by Waste Management. Site investigation works were undertaken between 27 September and 1 October 2021, comprising the following:

– Excavation of 34 test pits using an 8 tonne mechanical excavator (machine and operator provided by Fulton Hogan), designated as RRPP_TP01 through to RRPP_TP34, to a depth of between 1.2 and 3.2 m below ground level (bgl).
– The drilling of four boreholes, designated as RRPP_BH01 through to RRPP_BH04, using a Sonic wireline drilling rig, to depths of between 7.95 and 10.95 m bgl, and
– The drilling and installation of four landfill gas monitoring wells, designated as RRPP_WS01 through to RRPP_WS04, using a window sampler to depths of between 0.9 and 2.0 m bgl.

A site investigation points location plan is presented as Figure 4 which is included in **Appendix A** at the rear of this report. All investigation works were carried out under the supervision of a GHD Environmental Engineer.

As the Site is a known piece of contaminated land, a land use consent (to drill on a contaminated site) was required to drill and install the boreholes and landfill gas monitoring wells. Resource consent RM21.467 was granted by ORC to DCC to undertake these works on 28th September 2021. A copy of the consent document is included in **Appendix B**.

Prior to breaking ground, subsurface services clearance was undertaken by a specialist contractor (Fulton Hogan), using both a Cable Avoidance Tool (CAT) and Ground Penetrating Radar (GRP) at all test pit and borehole locations. A Ground Penetration Permit to Work was issued by an authorised GHD permitter.

Logging of the material encountered during drilling and test pitting was undertaken in accordance with NZ Geotechnical Society (2005) field description of soil and rock. Borehole, test pit and landfill gas monitoring well logs are included in **Appendix B** at the rear of this report.

3.1 Soil sampling methodology

The investigation concentrated on the areas where future development of the site is likely to occur to gain a broad understanding of the below ground conditions i.e. depth of existing landfill cap and type of material present across the Site.

Soil samples were collected from a total of 38 sampling locations (34 test pits and 4 boreholes) and at varying depths at each location to target different depths and lithologies in order to gain an understanding of the material present. Two duplicate samples were also collected during the works for quality control and assurance purposes. A Photo-ionisation detector (PID) was used to field screen soil samples for volatile contaminants at all locations.

The test pits were excavated using an 8-tonne mechanical excavator. The excavator operator was instructed to separate material into separate stockpiles upon excavation based on geological indicators.

Soil samples were collected by hand from the shallow material around the edges of the test pit (shallow samples only i.e. <0.20 m bgl) and the remaining samples >0.20 m bgl, from the distinct stockpiles created by the excavator operator. A new pair of disposable nitrile gloves were used for each separate sample collection.

Soil samples were collected in accordance with standard GHD procedures. Samples were placed directly into laboratory supplied containers and then placed in an iced chilly bin and couriered to Analytica Laboratories in Hamilton under standard GHD Chain of Custody (CoC) procedures.

A total of 30 soil samples were selected for analysis. On the basis of the historical land use, selected soil samples were analysed for the identified contaminants of concern as follows:

– Heavy metal suite (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc) x 27 samples
– Polycyclic Aromatic Hydrocarbons (PAHs) x 15
– Semi Volatile Organic Compounds (SVOCs) x 2
– Total Petroleum Hydrocarbons (TPH) x 5

– Asbestos (semi-quantitative) x 7 and potential asbestos containing material (ACM) fragment x 1
– Two duplicate samples, analysed for heavy metals (2) and TPH (1).

3.2 Field Observations

A summary of the typical material encountered, and the depths are provided in the generalised logs in Tables 2 and 3. Photographs taken during the site works are included in **Appendix B**.

Table 2: Generalised Borehole log

Depth (m bgl)	Boreholes
0.00 to 0.65 – 1.00 0.00 – 1.20	**Sandy SILT**, with some gravel and clay **Gravel hardfill** (BH01 and BH03)
0.65 to 6.1 - 9.0	**FILL** - landfill waste (metal, glass, wood, plastic, brick, timber, organics) with clay / silt layers
9.0 – 10.5	**FILL - sandy SILT** with minor waste material
10.5 – 10.95	**sandy SILT / silty SAND**

Table 3: Generalised Test pit log

Depth (m bgl)	Test Pits
0.0 to 0.2 - 0.5	**SAND** with trace gravel / sandy SILT with gravels Up to 1.0 m thick in northern area Waste encountered at surface in north western area (TP08 and TP09)
0.2 – 3.0	**FILL** – sandy SILT with waste materials (plastic, glass, concrete, brick, timber, tyres, string, paper, asphalt, wire, shoes, clothing etc.)

Hydrocarbon odours were noted in the following test pits:

RRPP_TP02 (1.2 – 2.2 m bgl)

RRPP_TP05 (0.4 – 1.2 m bgl)

RRPP_TP07 (0.3-1.2 m bgl)

Organic odours were noted in the following test pits

RRPP_TP01 (1.5-2.0 m bgl)

RRPP_TP10 (0.3-0.9 m bgl)

RRPP_TP11 (1.0-2.4 m bgl)

RRPP_TP23 (1.1 – 2.0 m bgl)

PID readings ranged between

<0.1 ppm and 62.0 ppm (RRPP_TP16)

Water was encountered at depths of between 1.0 and 2.5 m bgl in the test pits.

Water was added during the drilling of the boreholes and no water strikes were noted. Water content comments in relation to the boreholes are detailed below:

RRPP_BH01: Moist from 9.0 m bgl

RRPP_BH02: Moist from 7.5 m bgl, moist to wet from 9.5 m bgl

RRPP_BH03: Moist from 7.2 m bgl

RRPP_BH04: Moist from 7.50 m bgl

The water levels in the four boreholes were measured on 1st October 2021 and are presented below.

Borehole Name	Time	SWL (m btoc)	Bore depth (m btoc)
RRPP_BH01	1.00 pm	2.71	5.60
RRPP_BH02	1.05 pm	2.48	6.13
RRPP_BH03	1.10 pm	3.14	5.60
RRPP_BH04	1.15 pm	3.00	6.39

Notes:

SWL – Static water level

btoc- below top of casing

3.3 Landfill gas monitoring

Landfill gas monitoring well installation details are provided on the borehole logs included in **Appendix B**.

Monitoring was undertaken by Waste Management personnel on the four landfill gas monitoring wells, WS01 through to WS04, using a GA5000 portable landfill gas meter on 19th, 26th and 28th October and 2nd November 2021. Gas concentrations were measured twice on 28th October, in the morning and the afternoon. The data is presented in **Appendix C** at the rear of the report.

Discussion of the results is provided in Section 5.3.

3.4 Piezometer installations and water levels

Piezometer installation details are provided on the borehole and drillers logs included in **Appendix B**.

Groundwater (leachate) level monitoring was undertaken, by GHD and Waste Management personnel, on the four boreholes across the proposed RRPP site on 1st and 4th October and 2nd November 2021. The data is presented in **Appendix C** at the rear of the report.

Discussion of the results is provided in Section 5.4.

4. Guideline Criteria

4.1 Applicable Soil Contaminant Standards

4.1.1 The National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health

The User's Guide: National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health (MfE, 2012) [1] details Soil Contaminant Standards (SCSs) for seven inorganic substances and five organic compounds (or groups of compounds). SCSs are available for these substances and compounds when present in land used for five land use scenarios. The contaminants analysed at this site for which SCSs are available are arsenic, cadmium, chromium, copper, lead, mercury, DDT (Dichlorodiphenyltrichloroethane) and benzo(a)pyrene equivalent (BaP). The NESCS applies to a "piece of land" on which a HAIL activity has occurred or is currently occurring.

The land use category selected for the purposes of this investigation was Commercial / Industrial and is described in the NESCS User Guide as "*Commercial / Industrial site with varying degrees of exposed soil. Exposure of outdoor workers to near-surface soil during routine maintenance and gardening activities with occasional excavation as part of maintaining subsurface utilities. Also, conservatively applicable to outdoor workers on a largely unpaved site*".

This land-use exposure scenario has been adopted for screening purposes to include potential receptors including site workers during the construction works, current and future users of the Site and future ongoing maintenance / excavation workers at the site.

The intention of the NESCS is the protection of human health from contaminated land and the appropriate assessment of the risk to human health prior to construction works.

If the investigation demonstrates that the contaminants tested are at, or below, screening criteria concentrations, the regulations of the NESCS will not apply to the proposed construction works.

NESCS SCS criteria adopted for the Site are presented in Table 1, Table 2 and Table 4 contained in **Appendix D** at the rear of the report.

4.1.2 Health and Safety at Work (Asbestos) Regulations 2016

The management and/or removal of asbestos in soils is regulated under the Health and Safety at Work (Asbestos) Regulations 2016[2] (Asbestos Regulations). However, the Asbestos Regulations do not provide guidance regarding the definitions of what constitutes an asbestos contaminated site, in particular, with regard to soil. Rather, the Regulations simply states that the Asbestos Regulations apply where a competent person advises that the disturbance and/or removal of soil is likely to lead to airborne contamination at a level that exceeds trace concentrations.

The New Zealand Guidelines for Assessing and Managing Asbestos in Soil (BRANZ Guidelines 2017)

The BRANZ Guidelines 2017[3] provide a methodology to ensure that management of asbestos in soil meets regulatory requirements and an acceptable level of managed risk. This methodology is consistent with the MfE CLMG's for New Zealand and the NESCS for the assessment of asbestos in soil.

[1] Ministry for the Environment, 2012. Users Guide: National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health. Wellington: Ministry for the Environment
[2] Health and Safety at Work (Asbestos) Regulations 2016 (15 February 2016) made under sections 24(1) (m), 211, and 218 of the Health and Safety at Work Act 2015
[3] New Zealand Guidelines for Assessing and Managing Asbestos in Soil - Building Research Association of New Zealand (BRANZ), November 2017

If asbestos is detected in soils using a laboratory presence/absence test, the BRANZ Guidelines 2017 then provides an additional guidance for further soil sampling and criteria for the definition of whether the removal of such material is considered licenced asbestos removal (Class A or B), asbestos-related-works or unlicensed works under the Asbestos Regulations.

The adopted asbestos criteria are presented in Table 5 contained in **Appendix D**.

4.1.3 Other applicable Human Health Standards

For contaminants of concern that are not listed as priority contaminants, the NESCS references the Contaminated Land Management Guidelines No. 2: Hierarchy and Application in New Zealand of Environmental Guideline Values (CLMG No.2) to provide guidance.

In the absence of New Zealand risk based human health criteria for certain contaminants of concern, such as nickel and zinc, the Australian National Environment Protection Measure 2013[4] (NEPM) Recreational (C) guideline values have been adopted for this investigation.

For TPH, Tier 1 screening criteria from the MfE Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand[5] have been selected. Tier 1 soil acceptance criteria for Residential land use, All Pathways, Sand and Sandy Silt, <1.0 m depth have been used, depending on the soil type present at the sampling location.

The adopted criteria are presented in Tables 1 and 3 contained in **Appendix D**.

4.2 Background Soil Concentrations

Background soil concentrations of heavy metals for the Site were obtained from the Landcare Research (2015) report[6], Tables 13 through to Table 15. The area of the landfill is classified as fill and as such does not have background heavy metal concentrations derived. As material has been received at the Site from all over Dunedin, the highest background value from each of the dominant adjacent geological units for each metal was adopted for comparison purposes.

There are currently no published background soil concentrations for PAHs in Dunedin. As such, PAH values established for Christchurch urban soils[7] were adopted for comparative purposes only.

Background concentrations for OCP pesticides were taken from the following two documents:

- Landcare Research (2015). Background soil concentrations of selected trace elements and organic contaminants in New Zealand. Table 21.
- Ministry for the Environment (1998). Ambient concentrations of selected organochlorines in soils. Table F5.1 - mean values.

4.3 Otago Regional Council Regional Plans

The operative Regional Plan for Otago (Waste) was enacted in April 1997. Section 5 of this Plan details the policies, methods and rules regarding Contaminated Sites. A contaminated site is defined as a site at which hazardous substances occur at concentrations above background levels and where assessment indicates it poses, or is likely to pose an immediate or long term hazard to human health or the environment.

Hazardous substances are defined as follows:

[4] National Environmental Protection Council (NEPC) (2013). National Environmental Protection Measure (Assessment of Site Contamination) as amended in 2013 Schedule B1, Health Investigation Levels (HIL) for soil contaminants.
[5] Ministry for the Environment (1999, revised 2011). Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand. Module 4- Tier 1 Soil screening Criteria.
[6] Landcare Research (2015). Background soil concentrations of selected trace elements and organic contaminants in New Zealand
[7] Environment Canterbury, 2007, Background concentrations of polycyclic aromatic hydrocarbons in Christchurch urban soils. Report R07/19

Hazardous substances are substances which impair human, plant or animal health, or which may adversely affect the health or safety of any person or the environment, whether or not they are contained in or form part of any other substance or thing. These include pesticides, petrol, oil, cleaners and paint.

Rule 5.6.1 of the Plan states the following:

Rule 5.6.1 Hazardous wastes at contaminated sites (discretionary activity)

1. The disturbance of land; or
2. The discharge of hazardous waste into water; or
3. The discharge of hazardous waste onto or into land in circumstances that may result in that hazardous waste (or any other hazardous waste emanating as a result of natural processes from that hazardous waste) entering water; or
4. The deposit of any hazardous waste, in, on or under land; or
5. The discharge of hazardous waste into air at or from a contaminated site;

is a discretionary activity.

The operative Regional Plan for Otago (Water for Otago) was enacted in February 1998 and updated in June 2021. Section 7 of the Regional Plan, details policies for the discharge of stormwater and the Rules associated with these policies are contained within Section 12 (water takes, use and management). However, many of the Rules related to the discharge of stormwater within this Section have been repealed.

Rule 12.B.3 (Discharge of hazardous substances, hazardous wastes, specified contaminants, and stormwater, and discharges from industrial or trade premises and consented dams) states that the discharge of stormwater to water, or onto or into land in circumstances where it may enter water, is a restricted discretionary activity. The restrictions include the potential for soil contamination.

5. Results

5.1 Soil analytical results

Analytical results compared against the adopted standards and guidelines are presented in Tables 1 through to Table 5 included in **Appendix D** at the rear of the report. The laboratory reports are included in **Appendix E**.

In summary:

– There were no reported concentrations of contaminants of concern above the adopted commercial / industrial NESCS SCS criteria.
– Asbestos fines were reported present in two of the samples analysed at concentrations less than the human health standard. The samples were collected from test pits RRPP_TP03 and RRPP_TP28.
– One potential ACM fragment was analysed and found not to contain asbestos.
– Heavy metals, PAHs and SVOCs were reported present at concentrations above the adopted background values at all test pit locations where samples were selected for analysis.
– Heavy metals and PAHs were reported present at concentrations less than the adopted background values in four samples, two collected from the cap material in the compost area (RRPP_TP14 and RRPP_TP15) and the others collected at borehole RRPP_BH02 in the cap material and RRPP_BH03 in natural material at a depth of 6.0-7.5 m bgl.

5.2 Landfill gas monitoring

As can be seen from the landfill gas monitoring data table in **Appendix C**, methane (CH_4), a typical component of landfill gas was recorded present in each of the landfill gas monitoring wells at each of the five monitoring events. The highest recorded concentrations, ranging between 80.5 and 6.1%, were measured at monitoring well WS01 located on the northern boundary of the composting area. The lowest values, range between 1.5 and 3.5%, were recorded at monitoring well WS03, located on the north-eastern boundary of the Site.

Hydrogen sulphide (H_2S) was recorded present on only one occasion on 26th October 2021 in monitoring well WS04, at a concentration of 3.0 ppm, located in the northern portion of the Site.

Low concentrations of oxygen were recorded in all wells at each monitoring event.

5.3 Water level monitoring

As can be seen from the water level monitoring data table in **Appendix C,** groundwater (leachate) levels ranged between 2.71 and 3.14 m bgl on 1st October 2021, between 1.83 and 2.99 m bgl on 4th October 2021 and between 2.537 and 3.840 m bgl on 2nd November 2021. The shallowest levels were recorded in borehole RRPP_BH02 located at the rear of the composting area (southern portion of the Site). The deeper levels were recorded in boreholes RRPP_BH03 and RRPP_BH04, located along the eastern and northern boundaries of the Site. Groundwater (leachate) levels in these areas may be influenced by the pumping regime in the leachate collection trench.

6. Conclusions and Recommendations

An environmental site investigation was undertaken over a portion of the Green Island Landfill where it is proposed to construct a recycling and processing precinct. As the layout and design of the precinct has not yet been finalised, the locations of the investigation points (test pits, boreholes and landfill gas monitoring wells) were spread across the Site to provide coverage of the whole area. The central portion of the Site (operational recycling / transfer station area) was not accessible to this investigation. Further investigations maybe required in the future once the construction plans have been finalised.

Thirty four test pits were excavated across the Site to depths of up to 3.2 m bgl. In addition, four boreholes and four landfill gas monitoring wells were drilling and installed. Landfill waste material, comprising brick, timber, concrete, metal, clothing, paper, asphalt etc., was encountered at all of the investigation points.

In the eastern and northern portion of the Site, the cap material present comprised a topsoil type material and was approximately 0.2-0.3 m thick. In the composting area, the capping material was between 1.0 and 1.5 m thick and in the north western area of the Site, there was hardfill material between 0.3 and 1.2 m thick present at surface.

Logs for the boreholes indicate that the landfill waste is between 5.0 (RRPP_BH03) and 9.3 m (RRPP_BH01) thick.

The water levels recorded in the boreholes were between 2.5 and 3.8 m bgl on 2nd November 2021 but were noted to fluctuate as can be seen in Table 2 in **Appendix C**.

Methane gas was found to be present in all of the landfill gas monitoring wells, with the higher concentrations recorded at monitoring wells WS01 and WS02.

Heavy metals, PAHs, TPH, SVOCs and asbestos were reported present at concentrations above the adopted background values at all sample location points. However, none of the reported concentrations were above the human health NESCS commercial / industrial SCS criteria values or adopted guidelines values.

Comparison of reported laboratory analytical results to the ANZECC (2000) ISQG_High and Low trigger values and the ANZG (2018) GV_High and DVG values indicated that heavy metals, PAHs and SVOCs were present at concentrations above these guideline values.

Consideration of the findings of this investigation should be given during the design of the RRPP and the subsequent construction works.

6.1 Regulatory requirements

6.1.1 NESCS

This investigation has confirmed that HAIL activity G3 (landfill sites) has occurred on the Site and as such the requirements of the NESCS apply to the proposed redevelopment works.

Soil disturbance can be undertaken on a “piece of land” which is subject to the NESCS as long as the permitted volumes of soil disturbance and removal is not exceeded. However, it is likely that these volumes would be exceeded. On the basis of the soil sampling undertaken to date, it is likely that a controlled activity consent under Regulation 9(1) of the NESCS would be required for the development works.

6.1.2 Otago Regional Council

Based on the analytical results, it is likely that a resource consent for a discretionary activity will be required by the Otago Regional Council (ORC) for the disturbance of land (soil disturbance) required as part of the redevelopment of the Site.

In addition, a restricted discretionary consent may be required in relation to the stormwater discharges at the Site. This report should be provided to ORC so that they can advise on consenting requirements for the redevelopment works.

6.1.3 Dunedin City Council

DCC may have additional consenting requirements as part of the building consent process. This report should be provided to the planning team to seek advice on this matter and on whether a Global Stormwater Discharge Consent is in place that would permit the stormwater discharge during the works.

6.2 Landfill Gas mitigation

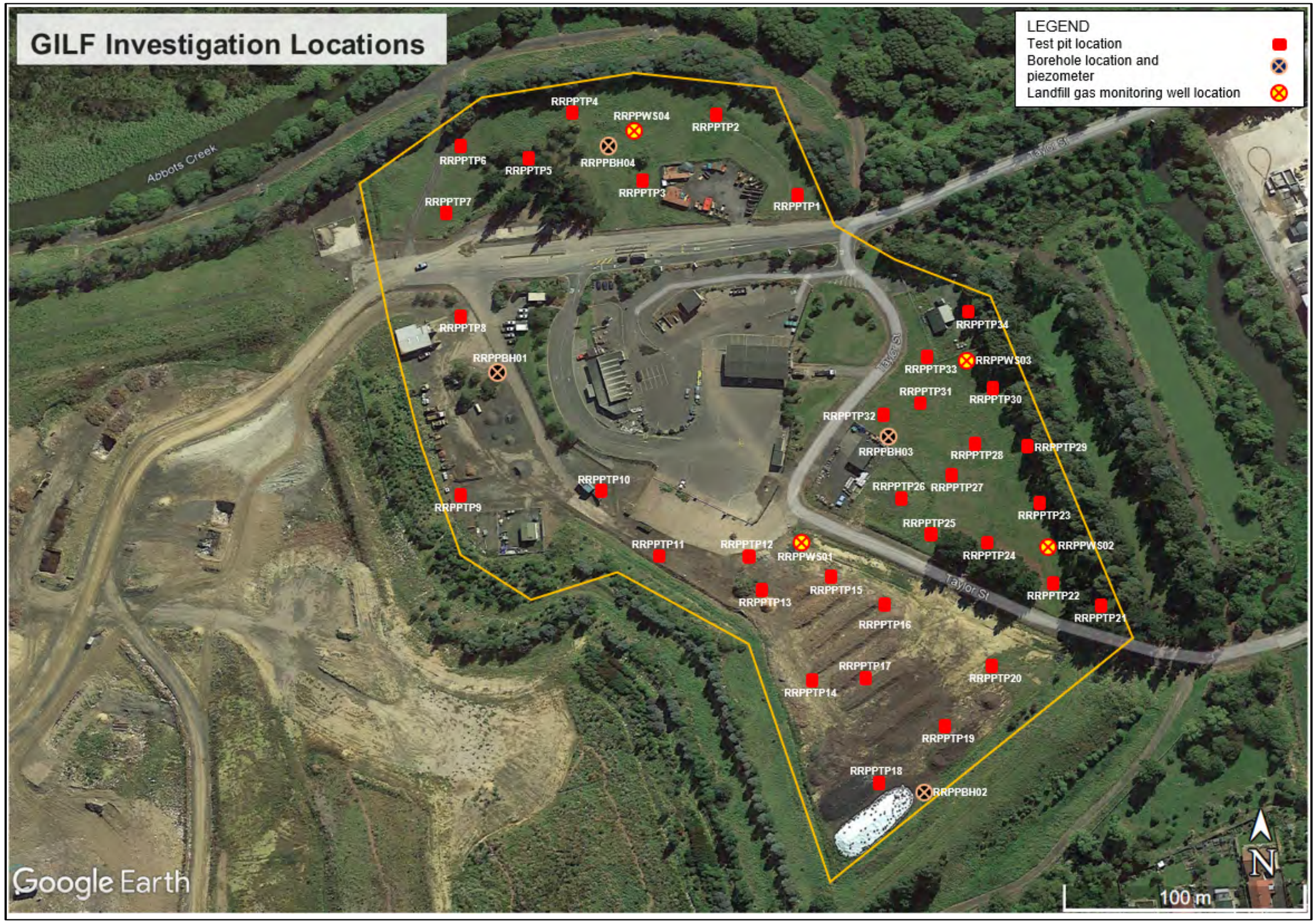
As landfill gas (methane and hydrogen sulphide) and evidence of depleted oxygen conditions have been detected as present in the landfill gas monitoring wells, it is recommended that consideration be given to the mitigation of landfill gas effects during the design and construction of the proposed RRPP site buildings.

Appendices

Appendix A

Site Investigation Locations Plan

GILF Investigation Locations



Paper Size A3

0 14,000 28,000 56,000 84,000 112,000

Metres

Map Projection: Transverse Mercator
Horizontal Datum: NZGD 2000
Grid: NZGD 2000 New Zealand Transverse Mercator

N

Legend

Site Boundary

Dunedin City Council
GREEN ISLAND LANDFILL
RRPP Investigation Points
Location Plan

Job Number	12547621
Revision	A
Date	14 Oct 2021

Figure 4

G:\51\12509201\GIS\Maps\Deliverables\12509201_R001_RevA_GI_Figure1_Location.mxd

Data source: Google Earth Pro; Imagery as at April 2019, DCC; GHD_DCC_Urban_Imagery_2013, Data (GI_Site_boundaries_GHD_20180818., Roads_GILF_GHD_clip_Data_warehouse_20180818, GILF_Stream_GHD_20180818) Created by:chillman

Level 3 138 Victoria Street Christchurch 8141 New Zealand **T** 64 3 378 0900 **F** 64 3 377 8575 **E** chcmail@ghd.com **W** www.ghd.com

Appendix B

Borehole and Test Pit Investigation Logs and Borehole Drilling Consent

Our Reference: A1534936 Consent No. RM21.467.01

LAND USE CONSENT

Pursuant to Section 104B of the Resource Management Act 1991, the Otago Regional Council grants consent to:

Name: Dunedin City Council

Address: 50 The Octagon, Dunedin, 9058

To disturb contaminated land and construct four groundwater monitoring bores and four landfill gas monitoring bores for the purpose of landfill monitoring

For a term expiring 28 September 2026

Location of consent activity: Green Island, approximately 420 metres west of the intersection of Brighton Road and Clariton Avenue

Legal description of consent location: Section 63 Block VII Dunedin & East Taieri SD, Part Section 45, 46 & 47 Green Island Bush SD.

Map Reference (NZTM 2000): Groundwater monitoring:
E1399354 N4913124
E1399548 N4913094
E1399569 N4912961
E1399440 N4913239
Gas monitoring:
E1399560 N4913144
E1399599 N4913075
E1399467 N4913044
E1399404 N4913232

Conditions

Specific

1. This consent authorisers the disturbance to a comminated site for the purpose of constructing four groundwater monitoring bores and four landfill gas monitoring bores. The activity must be carried out in accordance with the plans and the application dated 20 August 2021. All references to the bores must use the ORC-issued bore consent and/or assigned bore number. The bores must be located and constructed as detailed below:

    a) NZTM 2000 (mN) (+/- 20m):
        i. E1399354 N4913124 (Groundwater monitoring)
        ii. E1399548 N4913094 (Groundwater monitoring)
        iii. E1399569 N4912961 (Groundwater monitoring)
        iv. E1399440 N4913239 (Groundwater monitoring)
        v. E1399560 N4913144 (Gas monitoring)
        vi. E1399599 N4913075 (Gas monitoring)

vii. E1399467 N4913044 (Gas monitoring)
viii. E1399404 N4913232 (Gas monitoring)

b) Depth:
   i. 10 metres (Groundwater monitoring)
   ii. 4 metres (Gas monitoring)
c) Bore diameter : 100 millimetres
d) Address & Legal description of site: 9018/9 Brighton Road, Green Island, Dunedin 9018, Section 63 Block VII Dunedin & East Taieri SD, Part Section 45, 46 & 47 Green Island Bush SD.

2. Any bore tag provided to the Consent Holder by the Consent Authority must be attached to the monitoring bores in a visible location and be identifiable at all times. Consent holders must notify the Consent Authority at compliance@orc.govt.nz if assigned bore tag numbers are not being used (e.g. if the bore was dry or not drilled).

3. (a) The monitoring bores must be constructed, maintained, tested, and records kept (drilling log), in accordance with NZS 4411:2001 (or later version and/or any other approved and relevant standard).

(b) All works and structures relating to this resource consent must be designed and constructed to conform to best engineering practices and at all times maintained to a safe and serviceable standard.

(c) The consent holder must undertake all operations in accordance with any drawings, specifications, statements of intent and other information supplied as part of the application for this resource consent. In the event of (is) a conflict between the information supplied with the application and any consent condition(s), the condition(s) must prevail.

4. To minimise the risk of contaminants entering groundwater, the consent holder must:

a) Ensure that monitoring bores headworks are constructed and maintained to prevent any leakage and/or movement of water or contaminants between the ground surface and groundwater and must ensure that there are no openings through which contaminants might enter the bore. This must include (but not be limited to) ensuring that there are no gaps around any pipework and/or cables at the bore head.
b) The top of the bore casing must extend at least 300mm above ground level. The top of the casing must be elevated above any potential flood and/or ponding level.
c) A concrete seal (apron) is to be placed at ground level around the outside of the casing. The seal must be sufficient to prevent foreign material, surface water, spillage or other leakage entering the space between the casing and the wall of the bore. The seal must have a minimum radius of 500mm around the bore head and a minimum thickness of 100mm. The concrete apron needs to slope away from the bore in order to divert surface water away from the bore head.
d) All bores used for groundwater abstraction must have backflow prevention measures. Where there is reticulation back pressure at the bore head, a one-way valve must be fitted for maximum efficiency and in that case, the water sampling point must be on the bore pump side of the one-way valve.

e) A filter pack comprising of clean, washed sand (typically 2-4mm) must be placed around the screened interval. The filter pack must extend at least 200mm above the screened interval while allowing the condition below (i.e. bentonite seal).
f) A bentonite seal (typically bentonite pellets) must be placed above the filter to prevent ingress of water via the bore annulus. The bentonite seal must typically extend >2m above the filter pack and extend up to ground level. The concrete apron is to be located at ground level above the bentonite.

5. The construction of the bores must be completed within 30 working days of commencement of the construction.

6. The Consent Holder must take all practicable steps to ensure that penetration through any confining layer beneath shallow groundwater does not occur. If a confining layer is penetrated, the excavated area through the confining layer must be backfilled immediately with:

a) Certified non-contaminated (clean) soil in accordance with Procedure 5 of the Consent Holders "UST System Removal Scope of Work" guideline for the excavation pit; or
b) Bentonite clay for any bore holes

Performance Monitoring

7. The following information must be supplied to the Consent Authority within 10 working days of the completion of drilling of the bores:

a) Bore number (must be using the ORC-issued bore number);
b) Owner's and/or occupier's name;
c) Driller's name;
d) Date and method of drilling;
e) A photograph of the bore with a measuring device to show the bore diameter and/or installer certificate confirming bore diameter;
f) Clear photographs showing compliance with Condition 2 and 3;
g) An annotated map, or aerial photograph, that accurately and clearly shows site access, the physical location and a photograph of a GPS confirming the bore location and the bore tag;
h) Fully completed bore log forms providing description of strata encountered and depth at which encountered below ground level or other suitable datum level;
i) Level of the static water level (that is, stationary water level after the bore is fully developed and when no water has been taken or has flowed from the bore for three (3) hours or more), together with the date and time of measurement and level datum used;
j) Total Depth of bore;
k) Length, diameter, thickness, and material of casing;
l) Type, length, diameter, and mesh/slot size of screen; and
m) Any other relevant information or data as the Council may from time to time require to be kept

Unsuccessful drilling must still be notified to the Consent Authority and bore log still provided. The bore must be decommissioned according to Condition 8b. The Consent Authority should be notified that the bore tag number is not used by email to compliance@orc.govt.nz

8. a) The bore's integrity must be maintained for the lifetime of the bore until the bore is decommissioned and compliant with the decommission conditions 8b. If a bore is abandoned or no longer required, the bore must be decommissioned immediately without letting it get in disrepair, cut off, sealed or over, built over or forgotten about.

   b) The bore is to be decommissioned being appropriately sealed/grouted and backfilled, to prevent contaminants from entering the bore or drill hole at any level. Within 10 working days of completing this work, the Consent Holder must provide the Consent Authority the bore tag number and photographs showing that the bore has been sealed/grouted and backfilled. The evidence is to be supplied via email to compliance@orc.govt.nz. The email notification should state the consent and bore tag number.

9. Within 10 working days of completing the boreholes, the Consent Holder must provide the Consent Authority photographs of each completed and sealed drillhole. The photographs must include the bore tag number/s of each drillhole. Photographs must be in colour and minimally consist of 900*1600 pixels with a file size (in JPG format) between 0.5 and 1Mb.

General

10. The Consent Holder must prevent the discharge of contaminants (including sediment) to land, groundwater, or any surface waterbody arising from the exercise of this consent.

11. The drill holes must immediately be sealed/grouted and backfilled to prevent the ingress of contaminants to the bore holes, any land, groundwater, or surface water bodies.

Notes to Consent Holder

1. In accordance with Section 125(1)(a) of the Resource Management Act, this consent will lapse after a period of two years after the date of commencement unless it is given effect to or an application is made to extend the lapse period before the consent lapses.

2. The granting of this bore permit does not infer or guarantee that water will be available for abstraction once the bore is constructed.

3. This permit does not authorise access to the land where the bore is to be created. Access to the land where the bore is to be created must be arranged with the landowner/s.

4. Where information is required to be provided to the Consent Authority in conditions 7, 8 and 9, this is provided in writing to compliance@orc.govt.nz, and the email heading is to reference RM21.467 and the conditions the information relates to.

Issued at Dunedin this 28th day of September 2021.

Joanna Gilroy
Manager Consents

Photograph 1: Test Pit RRPP_TP04

Photograph 2: Test Pit RRPP_TP14

CLIENT: Dunedin City Council	PROJECT:	12547621	DESIGNED:	CG	SITE PHOTOGRAPHS
	DWG #:	NA	DRAWN:	CG	
	REVISION:		STATUS:	FINAL	
PROJECT TITLE: RRPP Site Investigation	SCALE:	NA			
	DATE:	Nov-21			Page 1 of 2

Photograph 3: Test Pit RRPP_TP22

Photograph 4: Test Pit RRPP_TP32

CLIENT: Dunedin City Council	PROJECT:	12547621	DESIGNED:	CG	SITE PHOTOGRAPHS
	DWG #:	NA	DRAWN:	CG	
	REVISION:		STATUS:	FINAL	
PROJECT TITLE: RRPP Site Investigation	SCALE:	NA			
	DATE:	Nov-21			Page 2 of 2

Project : Green Island Landfill RRPP Site Investigation
Client : Dunedin City Council
Site : Green Island Landfill
Job Number: 12547621
Commenced: 1/10/2021 Completed: 1/10/2021

Hole No. : WS01
Sheet : 1 of 1
Hole Length : 0.90m
Scale @ A4 : 1:15
Logged : JB
Processed : CH
Checked : CG

Easting: 4913048.99 Northing: 1399497.778 System: NZTM 2000
RL: Datum: Ground level

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample: Number / Type	Sample: Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
	0		Sandy CLAY; yellow, brown and grey. Very dense														
	0.3		Gravelly SAND with some clay; Black. Fill material present (glass, wood, plastic)														
	0.8		Gravelly SAND with some clay; Black. Fill material present (glass, wood, plastic)														
			End of Hole @ 0.90m,Target Depth.														
1																	
2																	

Notes and Comments:
End of Hole @ 0.90m, Target Depth.
- Gas well installation consisted of the following:
- 32mm blank pipe installed between + 0.6 m abgl - 0.25 m bgl
- 32 mm slotted pipe installed between 0.25 - 0.75 m bgl.
- The stick up of the gas well is approximately 0.6 m agl. A metal casing was installed above ground.
- Gravel pack was placed around the slotted portion of the pipe.
- Bentonite was placed above the gravel to surface level

Inclination: Vertical Orientation:
Contractor: Van Walt
Equipment: Window Sampler

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)

Project : Green Island Landfill RRPP Site Investigation
Client : Dunedin City Council
Site : Green Island Landfill
Job Number: 12547621
Commenced: 1/10/2021 Completed: 1/10/2021

Hole No. : WS02
Sheet : 1 of 1
Hole Length : 2.00m
Scale @ A4 : 1:15
Logged : JB
Processed : CH
Checked : CG

Easting: 4913251.661 Northing: 1399424.885 System: NZTM 2000
RL: Datum: Ground level

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample: Number / Type	Sample: Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
	0		Fine to coarse Silty SAND topsoil; Dark brown. Rootlets, moist														
	0.15		Medium to coarse Sandy GRAVEL; Brown, rootlets. Moist														
	0.35		FILL: Fine to medium Sandy SILT with minor gravels; Brown. Brick fragments, asphalt. Hard														
	0.6		FILL: Fine to medium Sandy SILT with minor gravels; Brown. Brick fragments, asphalt. Hard														
1	1		FILL: Fine to medium Sandy SILT with minor gravels; Brown. Brick fragments, asphalt														
	1.1		FILL: Fine to medium Sandy SILT; dark grey. Soft														
	1.2		FILL: Fine to medium Sandy SILT; brown with minor brick fragments. Grey blue mottling. Stiff; moist														
2	2		End of Hole @ 2.00m,Target Depth.														

Notes and Comments:
End of Hole @ 2.00m, Target Depth.
- Gas well installation consisted of the following:
- 32mm blank pipe installed between + 0.6 m abgl - 1.0 m bgl
- 32 mm slotted pipe installed between 1.0 - 2.0 m bgl.
- The stick up of the gas well is approximately 0.6 m agl. A metal casing was installed above ground.
- Gravel pack was placed around the slotted portion of the pipe.
- Bentonite was placed above the gravel to surface level

Inclination: Vertical Orientation:
Contractor: Van Walt
Equipment: Window Sampler

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)

Project : Green Island Landfill RRPP Site Investigation
Client : Dunedin City Council
Site : Green Island Landfill
Job Number: 12547621
Commenced: 1/10/2021 Completed: 1/10/2021

Hole No. : WS03
Sheet : 1 of 1
Hole Length : 2.00m
Scale @ A4 : 1:15
Logged : JB
Processed : CH
Checked : CG

Easting: 4913143.975 Northing: 1399580.857 System: NZTM 2000
RL: Datum: Ground level

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample: Number / Type	Sample: Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
	0		Fine to coarse Silty SAND topsoil; Dark brown. Rootlets; moist. Thin fabric membrane at 0.15 m bgl														
	0.15		Medium to coarse Sandy GRAVEL with trace silts; Brown and grey. Moist														
	0.5		Compost material comprising of bark chip and organics. Hard; plastic, dry														
	0.6		FILL: Medium to coarse Sandy GRAVEL with traces of wood; Brown. Plastic, moist														
1	1		Lost Core														
	2		End of Hole @ 2.00m,Target Depth.														

Notes and Comments:
End of Hole @ 2.00m, Target Depth.
- Gas well installation consisted of the following:
- 32mm blank pipe installed between + 0.6 m abgl - 1.0 m bgl
- 32 mm slotted pipe installed between 1.0 - 2.0 m bgl.
- The stick up of the gas well is approximately 0.6 m agl. A metal casing was installed above ground.
- Gravel pack was placed around the slotted portion of the pipe.
- Bentonite was placed above the gravel to surface level

Inclination: Vertical Orientation:
Contractor: Van Walt
Equipment: Window Sampler

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)

Project : Green Island Landfill RRPP Site Investigation
Client : Dunedin City Council
Site : Green Island Landfill
Job Number: 12547621
Commenced: 1/10/2021 Completed: 1/10/2021

Hole No. : WS04
Sheet : 1 of 1
Hole Length : 1.98m
Scale @ A4 : 1:15
Logged : JB
Processed : CH
Checked : CG

Easting: 4913064.335 Northing: 1399620.942 System: NZTM 2000
RL: Datum: Ground level

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample: Number / Type	Sample: Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
	0		Fine TOPSOIL with some sand; Brown. Moist														
	0.3		FILL: Fine to medium SAND and GRAVEL; brown. Minor traces of waste (oyster shell) found.														
	0.6		FILL: Fine to medium SAND and GRAVEL with some black fill. Fill contains plastic, wood, concrete, brick. Wet														
1	1		FILL: Fine to medium SAND and GRAVEL with some black fill. Fill contains plastic, wood, concrete, brick. Wet														
2	2		End of Hole @ 1.98m,Target Depth.														

Notes and Comments:
End of Hole @ 1.98m, Target Depth.
- Gas well installation consisted of the following:
- 32mm blank pipe installed between + 0.6 m abgl - 0.98 m b
- 32 mm slotted pipe installed between 0.98 - 1.98 m bgl.
- The stick up of the gas well is approximately 0.6 m agl. A metal casing was installed above ground.
- Gravel pack was placed around the slotted portion of the pipe.
- Bentonite was placed above the gravel to surface level

Inclination: Vertical Orientation:
Contractor: Van Walt
Equipment: Window Sampler

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)

Project : Green Island Landfill RRPP Site Investigation		Hole No.	: BH01
Client : Dunedin City Council		Sheet	: 1 of 1
Site : Green Island Landfill		Hole Length	: 10.95m
Job Number: 12547621		Scale @ A4	: 1:60
Commenced: 28/09/2021	Completed: 28/09/2021	Logged	: HE
Easting: 4913129.948	Northing: 1399359.165	Processed	: CJ
RL:	Datum: Ground level	Checked	: CG

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample: Number / Type	Sample: Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
	0		Fill: GRAVEL, trace fine sand; dark grey, moist.						100mm								
	1.2		Fill: Waste including metal, glass, wood, plastic fragments. Occasional layers of clay/silt.							SNC							
	9		Fill: Sandy SILT; brown to grey. Soft; moist. 9.00 - 10.50 Sand is fine/micaecous. Rubber fragments to 100mm.		M	S											19-10-2021
	10.5		Slightly sandy SILT, trace clay; grey. Soft; moist. 10.50 - 10.95 Sand is fine/micaceous.														
			End of Hole @ 10.95m,Target Depth.														

Notes and Comments:

End of Hole @ 10.95m, Target Depth.
Monitoring well installation consisted of the following:
- 50 mm Blank pipe being installed between + 0.6 m a bgl - 2.1 m bgl
- 50 mm Slotted pipe being installed between 2.1 - 5.1 m bgl.
- The stick up of the monitoring well is approximately 0.6 m agl. A metal casing was installed above ground.
- Gravel pack was placed around the slotted portion of the pipe.
- Bentonite was placed above the gravel to surface level

Inclination: Vertical Orientation:

Contractor: Speights Drilling

Equipment: Sonic Rig

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)
19/10/21	00:00	2.726	5.644

Project : Green Island Landfill RRPP Site Investigation
Client : Dunedin City Council
Site : Green Island Landfill
Job Number: 12547621
Commenced: 29/09/2021 Completed: 29/09/2021

Hole No. : BH02
Sheet : 1 of 1
Hole Length : 10.95m
Scale @ A4 : 1:60
Logged : HE
Processed : CJ
Checked : CG

Easting: 4912949.612 Northing: 1399553.062 System: NZTM2000
RL: Datum: Ground Level

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample: Number / Type	Sample: Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
	0		FILL: Sandy SILT; trace clay with some gravel; grey, orange brown mottling. Stiff; moist, low plasticity [LANDFILL CAP].														
	0.65		FILL: Landfill waste, plastic, timber, organics; black.														
	4.45		4.35 - 4.40 Fine to medium SAND; grey 4.40 - 4.45 Sandy SILT, trace clay; grey, orange to brown mottling. Very Stiff; dry. Sand, fine.														
	5		CORE LOSS														
	5.45		FILL: Landfill waste														
			CORE LOSS														
	6		FILL: Landfill waste														
	6.45		CORE LOSS														
	7.5		Sandy SILT, trace clay; grey, mottled brown. Stiff; moist; medium plasticity [ALLUVIUM].		M	St											
					M	St											
	9.5		Slightly silty fine SAND; pale green to grey; moist to wet [ALLUVIUM].		M-W	MD											
			End of Hole @ 10.95m,Target Depth.														

19-10-2021

Notes and Comments:

End of Hole @ 10.95m, Target Depth.
Monitoring well installation consisted of the following:
- 50 mm Blank pipe being installed between + 0.6 m a bgl - 2.9 m bgl
- 50 mm Slotted pipe being installed between 2.9 - 5.9 m bgl.
- The stick up of the monitoring well is approximately 0.6 m agl. A metal casing was installed above ground.
- Gravel pack was placed around the slotted portion of the pipe.
- Bentonite was placed above the gravel to surface level

Inclination: Vertical Orientation:
Contractor: Speights Drilling
Equipment: Sonic Rig

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)
19/10/21	00:00	2.494	10.95

Project : Green Island Landfill RRPP Site Investigation		Hole No.	: BH03
Client : Dunedin City Council		Sheet	: 1 of 1
Site : Green Island Landfill		Hole Length	: 7.95m
Job Number: 12547621		Scale @ A4	: 1:60
Commenced: 28/09/2021	Completed: 28/09/2021	Logged	: HE
Easting: 4911134.71	Northing: 1399523.518 System: NZTM2000	Processed	: CJ
RL:	Datum:	Checked	: CG

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample: Number / Type	Sample: Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
	0		FILL: Sandy fine to coarse GRAVEL, some cobbles; dark grey. Tightly packed.		D	TP											
	1		FILL: Landfill waste comprising of timber, plastics, metal.														
	3.2		FILL: Sandy CLAY, trace gravel; Fragments of plastic, metal, timber, brick. Soft; moist.		M	S											19-10-2021
	3.8		FILL: Landfill waste comprising of metal, plastics, paper														
	6.1		Slightly Sandy CLAY; grey. Mottled brown. Trace Organics. Soft; moist.		M	S											
	7.2		Sandy CLAY; brown to grey. Trace organics. Soft; moist; fibrous.														
			End of Hole @ 7.95m,Target Depth.														

Notes and Comments:

End of Hole @ 7.95m, Target Depth.
Monitoring well installation consisted of the following:
- 50 mm Blank pipe being installed between + 0.6 m a bgl - 2.0 m bgl
- 50 mm Slotted pipe being installed between 2.0 - 5.0 m bgl.
- The stick up of the monitoring well is approximately 0.6 m agl. A metal casing was installed above ground.
- Gravel pack was placed around the slotted portion of the pipe.
- Bentonite was placed above the gravel to surface level

Inclination: Vertical Orientation:

Contractor: Speights Drilling

Equipment: Sonic Rig

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)
19/10/21	00:00	3.128	5.646

Project : Green Island Landfill RRPP Site Investigation
Client : Dunedin City Council
Site : Green Island Landfill
Job Number: 12547621
Commenced: 29/09/2021 Completed: 29/09/2021

Hole No. : BH04
Sheet : 1 of 1
Hole Length : 10.95m
Scale @ A4 : 1:60
Logged : HE
Processed : CJ
Checked : CG

Easting: 4913253.964 Northing: 1399390.245 System: NZTM2000
RL: Datum: Ground Level

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample: Number / Type	Sample: Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
	0		CAP: Sandy SILT; grey. Trace rootlets.														
	1		FILL: Landfill waste comprising of plastic, wood, brick, basalt fragments. Trace gravel.														
	7.5		Sandy SILT, trace clay; blue to grey. Orange to brown mottling. Soft; moist; medium plasticity [ALLUVIUM].														
	9.6		Slightly sandy SILT, trace clay; grey to blue. Very soft; moist; medium plasticity.														
	11		End of Hole @ 10.95m,Target Depth.														

19-10-2021

Notes and Comments:

End of Hole @ 10.95m, Target Depth.
Monitoring well installation consisted of the following:
- 50 mm Blank pipe being installed between + 0.6 m a bgl - 3.0 m bgl
- 50 mm Slotted pipe being installed between 3.0 - 6.0 m bgl.
- The stick up of the monitoring well is approximately 0.6 m agl. A metal casing was installed above ground.
- Gravel pack was placed around the slotted portion of the pipe.
- Bentonite was placed above the gravel to surface level

Inclination: Vertical Orientation:
Contractor: Speights Drilling
Equipment: Sonic Rig

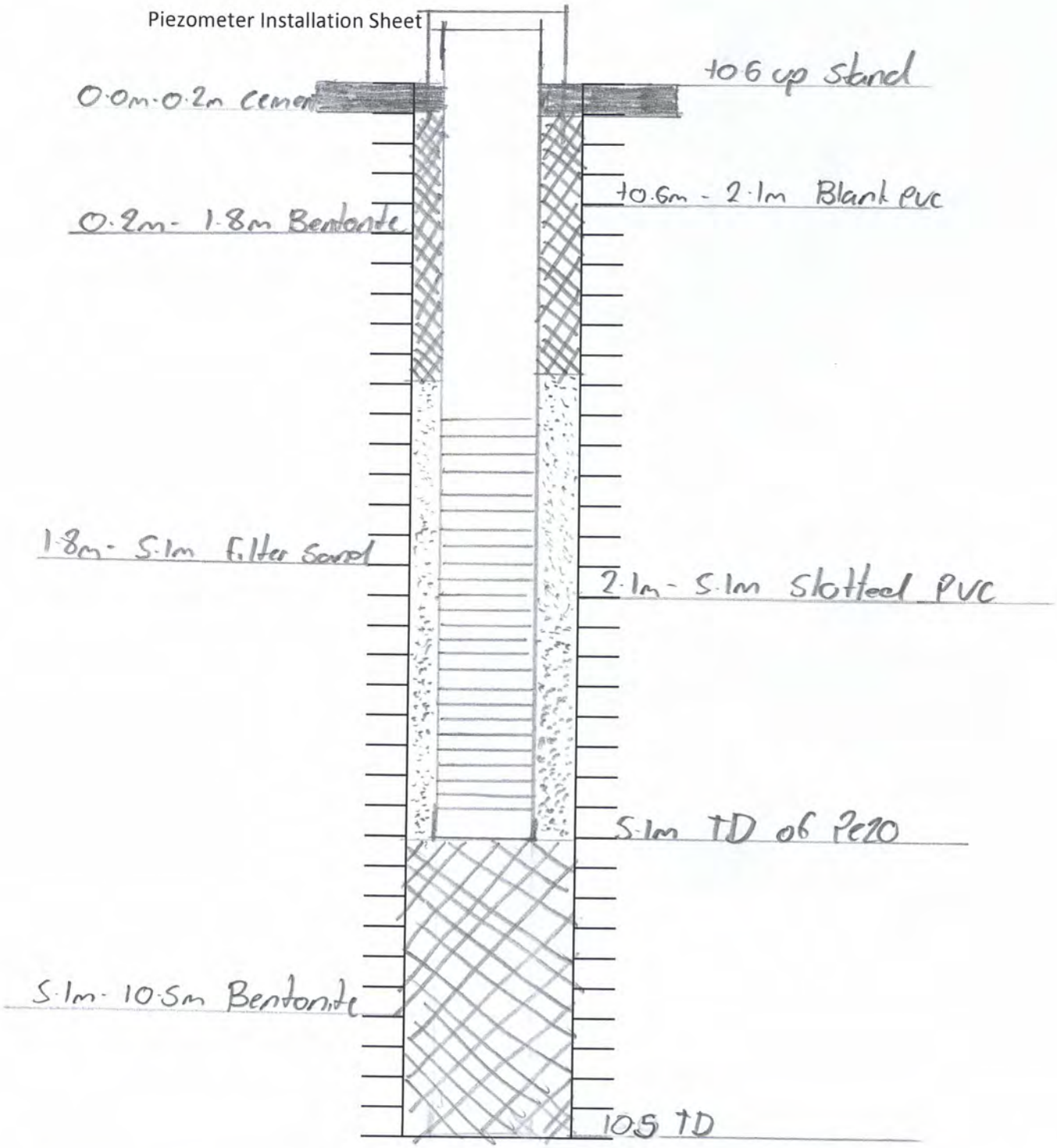
Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)
19/10/21	00:00	3.721	10.95

SPEIGHT DRILLING

Date	28-9-21
Client	GHD
Location	Green Island landfill
BH no.	BH01

Piezometer Installation Sheet

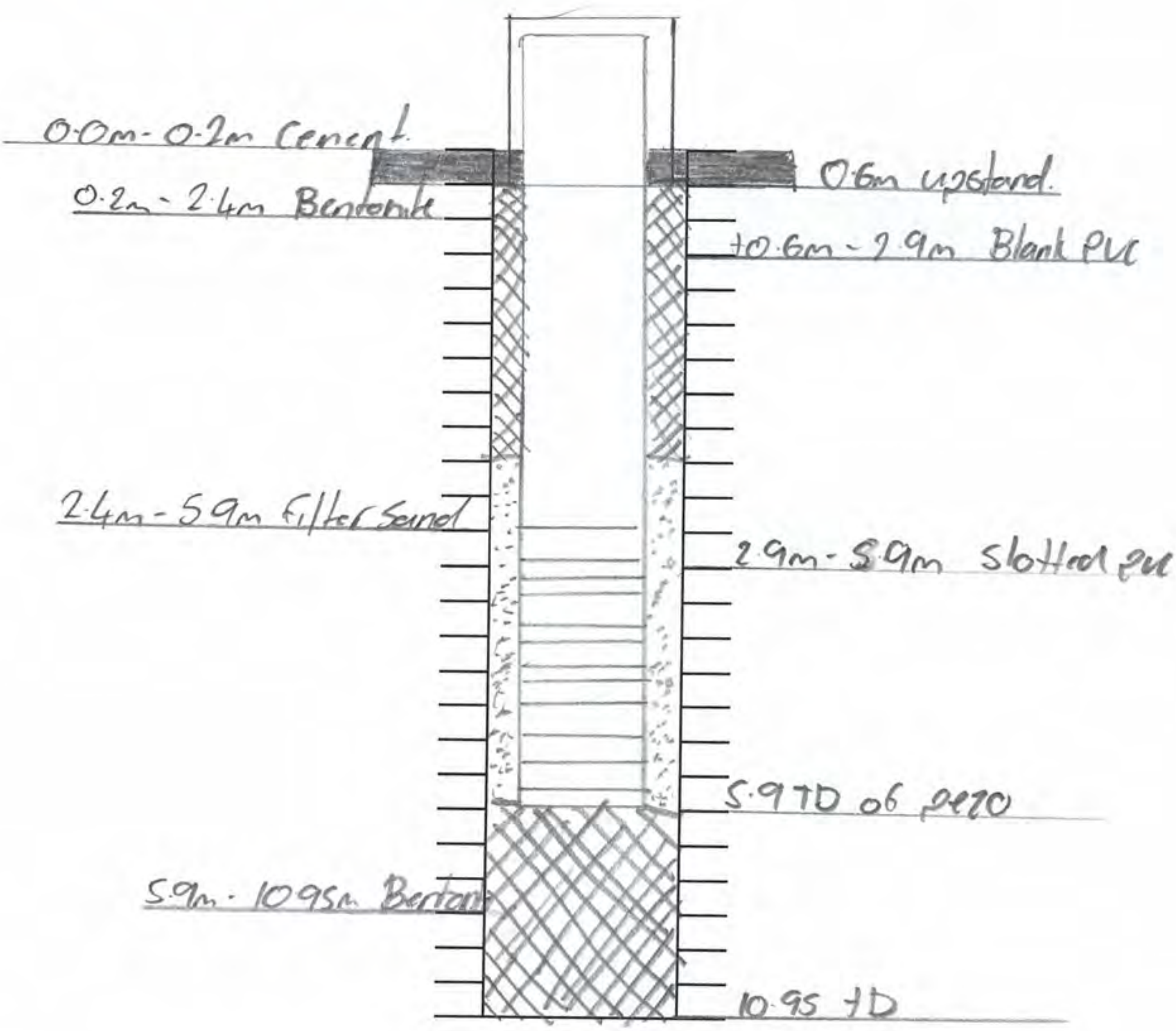


General Notes/Key Safety Points
Steel tobytop
80mm PVC

Site locations N, E, RL, Acc (NZTM)
E1399358
N4913128

Date	29.9.21
Client	GHD
Location	Green Island Landfill
BH no.	BH02

SPEIGHT DRILLING

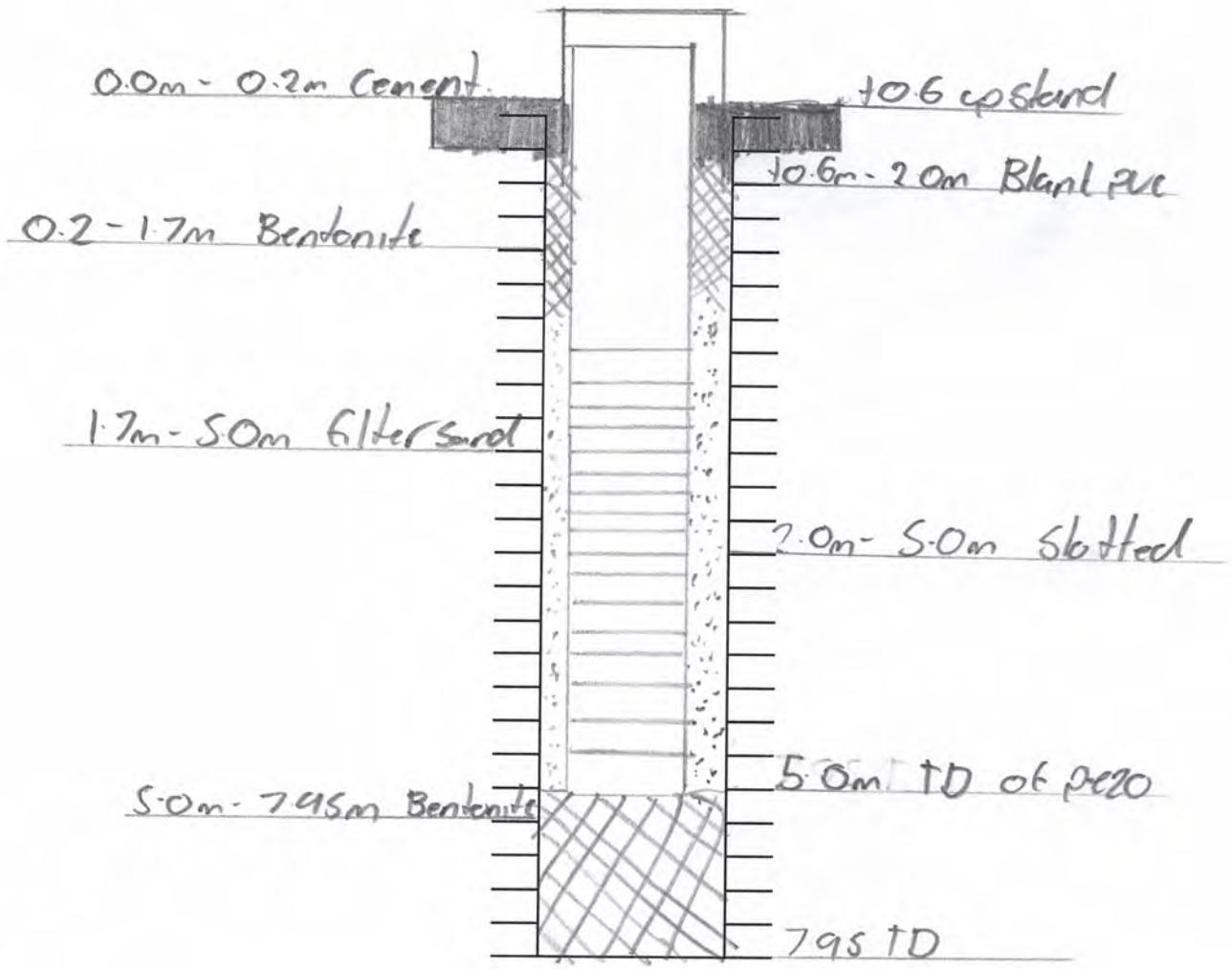


General Notes/Key Safety Points
Steel toby lid
80mm PVC

Site locations N, E, RL, Acc (NZTM format)
E 1399555
N 4912964

Date	29.9.21
Client	GHD
Location	Green Island FI
BH no.	BH03

SPEIGHT DRILLING

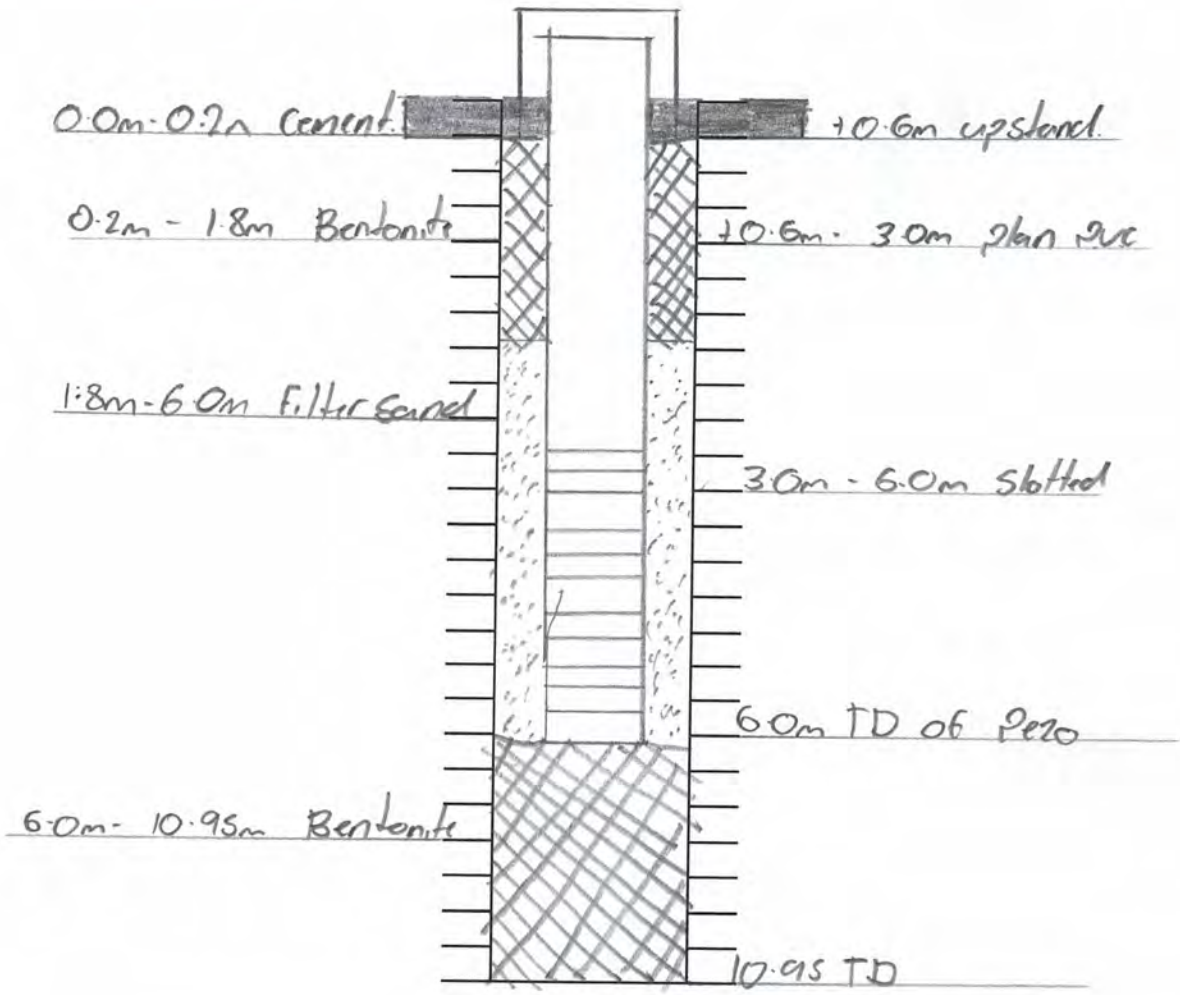


General Notes/Key Safety Points
Steel tidy lid
50mm P.V.C

Site locations N, E, RL, Acc (NZTM format)
E 1309534
N 4913104

SPEIGHT DRILLING

Date	29.9.21
Client	CHD
Location	Green Island Dunedin
BH no.	BH04



General Notes/Key Safety Points
Steel tabs lid
80mm PVC

Site locations N, E, RL, Acc (NZTM format)
E 1399410
N 4913235

Project : Green Island Landfill RRPP Site Investigation
Client : Dunedin City Council
Site : Green Island Landfill
Job Number: 12547621
Commenced: 27/09/2021 Completed: 27/09/2021

Hole No. : TP01
Sheet : 1 of 1
Hole Length : 3.20m
Scale @ A4 : 1:30
Logged : HE and JB
Processed : CJ
Checked : CG

Easting: Northing: System:
RL: Datum: Ground Level

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample Number / Type	Sample Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
	0		Silty fine to medium SAND, trace gravel; brown [CAP].			D											
	0.2		FILL: Sandy SILT; gravel. Trace clay; firm. Tightly packed; moist.		M												
1			1.10 Plastic Fragments														
	1.15		FILL: Sandy SILT, gravel; dark grey. Patches of fine to medium sand. Firm; moist. Gravel is fine to coarse basalt. Landfill waste consisting of glass, concrete, brick and timber fragments. 1.15 - 2.00 Gravel is fine to coarse basalt, angular.		M	F											
2	2		FILL: CLAY, trace gravel; grey. Trace organics. Soft, moist. 2.00 Gravel is fine to medium basalt and mudstone.			S											
3																	
			End of Hole @ 3.20m,Target Depth.														
4																	
5																	

Notes and Comments:
End of Hole @ 3.20m, Target Depth.
No groundwater encountered

Inclination: Vertical Orientation:
Contractor: Fulton Hogan
Equipment: 8 Tonne Excavator

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)

Project	: Green Island Landfill RRPP Site Investigation	Hole No.	: TP02
Client	: Dunedin City Council	Sheet	: 1 of 1
Site	: Green Island Landfill	Hole Length	: 2.20m
Job Number:	12547621	Scale @ A4	: 1:30
Commenced:	28/09/2021 Completed: 28/09/2021	Logged	: HE and JB
Easting:	Northing: System:	Processed	: CJ
RL:	Datum: Ground Level	Checked	: CG

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample: Number / Type	Sample: Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
	0		Silty SAND, trace gravels to boulders; dark brown. Trace rootlets [CAP].		D												
	0.2		FILL: Sandy GRAVEL; dark grey to blue. Landfill waste consisting of plastic, glass, concrete, waste and wood fragments.		M												
1					M												
	1.2		FILL: Sandy GRAVEL; dark grey to blue. Fragments of plastic, glass, concrete, waste, wood. Slight hydrocarbon odour.														
2																	
			End of Hole @ 2.20m,Target Depth.														
3																	
4																	
5																	

Notes and Comments:

End of Hole @ 2.20m, Target Depth.

No groundwater encountered

Inclination: Vertical Orientation:

Contractor: Fulton Hogan

Equipment: 8 Tonne Excavator

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)

Project : Green Island Landfill RRPP Site Investigation	Hole No. : TP03	
Client : Dunedin City Council	Sheet : 1 of 1	
Site : Green Island Landfill	Hole Length : 3.00m	
Job Number: 12547621	Scale @ A4 : 1:30	
Commenced: 28/09/2021 Completed: 28/09/2021	Logged : HE and JB	
Easting: Northing: System:	Processed : CJ	
RL: Datum: Ground Level	Checked : CG	

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample: Number / Type	Sample: Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
	0		Sandy SILT, trace cobbles; dark brown. Trace rootlets [TOPSOIL].		M												
	0.5		FILL: Waste materials, including brick, plastics, glass, paper, wood, string, metals, tyres.		M												
1	1		FILL: Waste materials, including brick, plastics, glass, paper, wood, string, metals, tyres.		M												
2																	
3			End of Hole @ 3.00m,Target Depth.														
4																	
5																	
6																	

Notes and Comments:

End of Hole @ 3.00m, Target Depth.

No groundwater encountered

Inclination: Vertical Orientation:

Contractor: Fulton Hogan

Equipment: 8 Tonne Excavator

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)

Project : Green Island Landfill RRPP Site Investigation
Client : Dunedin City Council
Site : Green Island Landfill
Job Number: 12547621
Commenced: 28/09/2021 Completed: 28/09/2021

Hole No. : TP04
Sheet : 1 of 1
Hole Length : 2.70m
Scale @ A4 : 1:30
Logged : HE and JB
Processed : CJ
Checked : CG

Easting: Northing: System:
RL: Datum: Ground Level

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample: Number / Type	Sample: Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
	0		Silty SAND; dark brown. Trace rootlets [CAP].		M												
	0.2		FILL: Coarse SAND and SILT; trace asphalt, brick, wire, concrete, gravels.		M												
1																	
	1.8		Fill: Landfill waste materials, plastic, concrete, wood.		M												
2																	
			End of Hole @ 2.70m,Target Depth.														
3																	
4																	
5																	
6																	

Notes and Comments:
End of Hole @ 2.70m, Target Depth.
No groundwater encountered

Inclination: Vertical Orientation:
Contractor: Fulton Hogan
Equipment: 8 Tonne Excavator

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)

Project : Green Island Landfill RRPP Site Investigation
Client : Dunedin City Council
Site : Green Island Landfill
Job Number: 12547621
Commenced: 28/09/2021 Completed: 28/09/2021

Easting: Northing: System:
RL: Datum: Ground Level

Hole No. : TP05

Sheet : 1 of 1
Hole Length : 1.20m
Scale @ A4 : 1:30
Logged : HE and JB
Processed : CJ
Checked : CG

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample: Number / Type	Sample: Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
	0		CAP: brown fine to medium grained silty SAND; dry contains gravel. No odour.		D	L					25 50 75		EW VW W MW MS VS ES		20 60 200 600 2000		
	0.4		FILL: GRAVEL; Landfill material consisting of plastic, bedsprings, clothing. Hydrocarbon odour			VL											
1			Possible Asbestos End of Hole @ 1.20m,Target Depth.														
2																	
3																	
4																	
5																	

Notes and Comments:
End of Hole @ 1.20m, Target Depth.
No groundwater encountered

Inclination: Vertical Orientation:
Contractor: Fulton Hogan
Equipment: 8 Tonne Excavator

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)

Project : Green Island Landfill RRPP Site Investigation		Hole No.	: TP06
Client : Dunedin City Council		Sheet	: 1 of 1
Site : Green Island Landfill		Hole Length	: 2.70m
Job Number: 12547621		Scale @ A4	: 1:30
Commenced: 28/09/2021	Completed: 28/09/2021	Logged	: HE and JB
Easting:	Northing: System:	Processed	: CJ
RL:	Datum: Ground Level	Checked	: CG

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample Number / Type	Sample Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
	0		CAP: Silty fine to medium SAND; brown. Trace gravel.		M												
	0.3		CAP: Sandy medium to coarse GRAVEL; light grey.		M												
	0.7		Medium to coarse silty SAND; light brown.		M												
1	1		FILL: Black; very wet. Contains building material, bricks, wood, metal plastic.		W												28-09-2021
2																	
			End of Hole @ 2.70m,Target Depth.														
3																	
4																	
5																	

Notes and Comments:
End of Hole @ 2.70m, Target Depth.

Inclination: Vertical Orientation:

Contractor: Fulton Hogan

Equipment: 8 Tonne Excavator

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)
28/09/21	00:00	2.2	

Report ID: GENERAL_LOG || Project: GREEN ISLAND.GPJ || Library: GHD - NZGD.GLB || Date: 8 November 2021

Project : Green Island Landfill RRPP Site Investigation		Hole No.	: TP07
Client : Dunedin City Council		Sheet	: 1 of 1
Site : Green Island Landfill		Hole Length	: 3.20m
Job Number: 12547621		Scale @ A4	: 1:30
Commenced: 28/09/2021	Completed: 28/09/2021	Logged	: HE and JB
Easting:	Northing: System:	Processed	: CJ
RL:	Datum: Ground Level	Checked	: CG

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample: Number / Type	Sample: Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
	0		CAP: Sandy SILT, trace gravel; brown.		D												
	0.3		FILL: Rubbish including plastic, clothing, metal, bedsprings, magazines, shoes, newspapers dated 1980. Strong Hydrocarbon odour		M												
1																	
2																	
																	28-09-2021
3																	
			End of Hole @ 3.20m,Target Depth.														
4																	
5																	

Notes and Comments:
End of Hole @ 3.20m, Target Depth.

Inclination: Vertical Orientation:

Contractor: Fulton Hogan

Equipment: 8 Tonne Excavator

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)
28/09/21	00:00	2.7	

Project : Green Island Landfill RRPP Site Investigation
Client : Dunedin City Council
Site : Green Island Landfill
Job Number: 12547621
Commenced: 28/09/2021 Completed: 28/09/2021

Hole No. : TP08
Sheet : 1 of 1
Hole Length : 2.50m
Scale @ A4 : 1:30
Logged : HE and JB
Processed : CJ
Checked : CG

Easting: Northing: System:
RL: Datum: Ground Level

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample Number / Type	Sample Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
	0		FILL: Sandy fine to coarse GRAVEL; some cobbles; grey to brown. Tightly packed; dry. Brick and concrete fragments.		D												
	0.65		FILL: Landfill waste consisting of plastics, paper, cardboard, wood, wire, timber and textiles.		M												
1																	
2					W												28-09-2021
			End of Hole @ 2.50m,Target Depth.														
3																	
4																	
5																	

Notes and Comments:
End of Hole @ 2.50m, Target Depth.

Inclination: Vertical Orientation:
Contractor: Fulton Hogan
Equipment: 8 Tonne Excavator

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)
28/09/21	00:00	2.3	

Report ID: GENERAL_LOG || Project: GREEN ISLAND.GPJ || Library: GHD - NZGD.GLB || Date: 8 November 2021

Project : Green Island Landfill RRPP Site Investigation
Client : Dunedin City Council
Site : Green Island Landfill
Job Number: 12547621
Commenced: 29/09/2021 Completed: 29/09/2021

Hole No. : TP09
Sheet : 1 of 1
Hole Length : 3.00m
Scale @ A4 : 1:30
Logged : HE and JB
Processed : CJ
Checked : CG

Easting: Northing: System:
RL: Datum: Ground Level

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample Number / Type	Sample Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
	0		FILL: Sandy medium to coarse GRAVEL, trace cobbles; grey. Tightly packed. Waste material containing plastics, fabrics, wire.		D												
	0.8		FILL: Landfill waste material consisting of plastics, paper, wire, wood, brick, glass and tree fragments.		M												
1			2.40 Seepage														29-09-2021
2																	
3			End of Hole @ 3.00m,Target Depth.														
4																	
5																	
6																	

Notes and Comments:
End of Hole @ 3.00m, Target Depth.

Inclination: Vertical Orientation:
Contractor: Fulton Hogan
Equipment: 8 Tonne Excavator

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)
29/09/21	00:00	2.4	

Project : Green Island Landfill RRPP Site Investigation
Client : Dunedin City Council
Site : Green Island Landfill
Job Number: 12547621
Commenced: 29/09/2021 Completed: 29/09/2021

Hole No. : TP10
Sheet : 1 of 1
Hole Length : 2.40m
Scale @ A4 : 1:30
Logged : HE and JB
Processed : CJ
Checked : CG

Easting: Northing: System:
RL: Datum: Ground Level

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample: Number / Type	Sample: Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
	0		CAP: SILT with some gravel and sand; brown.		M	L											
	0.3		FILL: Landfill waste consisting of plastics, paper, concrete, brick fragments. Water leaking from this layer. Slight organic odour		M	L											
1					W												
	1.3		FILL: Clay; grey to orange; very dense. Contains some waste, consiting of plastics, concrete and brick fragments.		W	D											
2																	
			End of Hole @ 2.40m,Target Depth.														
3																	
4																	
5																	
6																	

Notes and Comments:
End of Hole @ 2.40m, Target Depth.
No groundwater encountered

Inclination: Vertical Orientation:
Contractor: Fulton Hogan
Equipment: 8 Tonne Excavator

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)

Project : Green Island Landfill RRPP Site Investigation
Client : Dunedin City Council
Site : Green Island Landfill
Job Number: 12547621
Commenced: 29/09/2021 Completed: 29/09/2021

Hole No. : TP11
Sheet : 1 of 1
Hole Length : 2.40m
Scale @ A4 : 1:30
Logged : HE and JB
Processed : CJ
Checked : CG

Easting: Northing: System:
RL: Datum: Ground Level

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample Number / Type	Sample Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
	0		CAP: SILT; dark brown with some gravel and sand. 0.00 - 0.30 No Odour		M	MD											
	0.3		FILL: Medium sized GRAVEL; black. Landfill material consisting of plastics, hedge clippings and paper.		W	L											
1	1		FILL: Medium GRAVEL; black. Landfill material consisting of plastics, hedge clippings and paper. Waste material including clothing, rope. 1.00 - 2.40 Strong Odour.		W	L											
2																	
			End of Hole @ 2.40m,Target Depth.														29-09-2021
3																	
4																	
5																	

Notes and Comments:
End of Hole @ 2.40m, Target Depth.

Inclination: Vertical Orientation:
Contractor: Fulton Hogan
Equipment: 8 Tonne Excavator

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)
29/09/21	00:00	2.4	

Project : Green Island Landfill RRPP Site Investigation
Client : Dunedin City Council
Site : Green Island Landfill
Job Number: 12547621
Commenced: 29/09/2021 Completed: 29/09/2021

Hole No. : TP12
Sheet : 1 of 1
Hole Length : 2.80m
Scale @ A4 : 1:30
Logged : HE and JB
Processed : CJ
Checked : CG

Easting: Northing: System:
RL: Datum: Ground Level

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample Number / Type	Sample Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
	0		FILL: Landfill material consisting of concrete, bricks, metals.		M	L											
	0.7		FILL: Waste material consisting of plastics, paper, wood, wire, hedge clippings. Small water volume present at bottom of pit.		W	MD											
	1.7		FILL: Black; very wet. Landfill material consisting of wood, plastic, metal fragments.		W	D											
			End of Hole @ 2.80m,Target Depth.														

Notes and Comments:
End of Hole @ 2.80m, Target Depth.
No groundwater encountered

Inclination: Vertical Orientation:
Contractor: Fulton Hogan
Equipment: 8 Tonne Excavator

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)

Project : Green Island Landfill RRPP Site Investigation
Client : Dunedin City Council
Site : Green Island Landfill
Job Number: 12547621
Commenced: 29/09/2021 Completed: 29/09/2021

Hole No. : TP13
Sheet : 1 of 1
Hole Length : 1.25m
Scale @ A4 : 1:30
Logged : HE and JB
Processed : CJ
Checked : CG

Easting: Northing: System:
RL: Datum: Ground Level

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample Number / Type	Sample Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
	0		CAP: Compacted sandy GRAVEL; black.		M	L											
	0.6		FILL: Landfill waste consisting of plastic, timber, metal and brick fragments.		W	VL-L											29-09-2021
1			End of Hole @ 1.25m,Target Depth.														
2																	
3																	
4																	
5																	

Notes and Comments:
End of Hole @ 1.25m, Target Depth.

Inclination: Vertical Orientation:
Contractor: Fulton Hogan
Equipment: 8 Tonne Excavator

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)
29/09/21	00:00	0.8	

Report ID: GENERAL_LOG || Project: GREEN ISLAND.GPJ || Library: GHD - NZGD.GLB || Date: 8 November 2021

Project : Green Island Landfill RRPP Site Investigation
Client : Dunedin City Council
Site : Green Island Landfill
Job Number: 12547621
Commenced: 29/09/2021 Completed: 29/09/2021

Easting: Northing: System:
RL: Datum: Ground Level

Hole No. : TP14

Sheet : 1 of 1
Hole Length : 2.20m
Scale @ A4 : 1:30
Logged : HE and JB
Processed : CJ
Checked : CG

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample Number / Type	Sample Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
	0		FILL: Sandy GRAVEL; light grey. Fine to coarse sand. Tightly packed. Occasional brick fragments.														
	0.3		FILL: Sandy SILT; trace clay. Mottled grey orange.														
1	1		FILL: Landfill waste consisting of cloth, paper, plastic, wood and brick fragments.														
2																	
			End of Hole @ 2.20m,Target Depth.														
3																	
4																	
5																	

Notes and Comments:
End of Hole @ 2.20m, Target Depth.
No groundwater encountered

Inclination: Vertical Orientation:
Contractor: Fulton Hogan
Equipment: 8 Tonne Excavator

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)

Project : Green Island Landfill RRPP Site Investigation
Client : Dunedin City Council
Site : Green Island Landfill
Job Number: 12547621
Commenced: 30/09/2021 Completed: 30/09/2021

Hole No. : TP15
Sheet : 1 of 1
Hole Length : 2.20m
Scale @ A4 : 1:30
Logged : HE and JB
Processed : CJ
Checked : CG

Easting: Northing: System:
RL: Datum: Ground Level

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample Number / Type	Sample Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
	0		CAP: Compost material, bark, soil, minor plastic sheeting.		M												
	0.2		Sandy SILT, trace clay; light brown. Mottled blue to orange. Soft, moist. Comprising of rare asphalt (possibly from underlying layers).														
1	0.8		Gravelly SAND; dark grey. Medium to coarse sand. Occasional basaltic gravel to cobble fragments.														
	1.5		Landfill waste consisting of clay piping, plastic wrapping, ties, fabric bags, steel rod and brick fragments.														
2			End of Hole @ 2.20m,Target Depth.														
3																	
4																	
5																	
6																	

Notes and Comments:
End of Hole @ 2.20m, Target Depth.
No groundwater encountered

Inclination: Vertical Orientation:
Contractor: Fulton Hogan
Equipment: 8 Tonne Excavator

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)

Project : Green Island Landfill RRPP Site Investigation
Client : Dunedin City Council
Site : Green Island Landfill
Job Number: 12547621
Commenced: 30/09/2021 Completed: 30/09/2021

Hole No. : TP16
Sheet : 1 of 1
Hole Length : 2.20m
Scale @ A4 : 1:30
Logged : HE and JB
Processed : CJ
Checked : CG

Easting: Northing: System:
RL: Datum: Ground Level

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample: Number / Type	Sample: Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
1	0		Sandy SILT, trace clay; light brown. Mottled orange to blue. Fine to medium sand.Stiff; moist.		M												
	0.9		Sandy GRAVEL; dark grey. Medium to coarse sand. Trace wood fragments.														
	1.2		Landfill waste consisting of fabric, brick, plastic, wood, metal and pipe fragments.														
2			End of Hole @ 2.20m,Target Depth.														30-09-2021
3																	
4																	
5																	
6																	

Notes and Comments:
End of Hole @ 2.20m, Target Depth.

Inclination: Vertical Orientation:
Contractor: Fulton Hogan
Equipment: 8 Tonne Excavator

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)
30/09/21	00:00	2.15	

Project : Green Island Landfill RRPP Site Investigation
Client : Dunedin City Council
Site : Green Island Landfill
Job Number: 12547621
Commenced: 30/09/2021 Completed: 30/09/2021

Hole No. : TP17
Sheet : 1 of 1
Hole Length : 2.00m
Scale @ A4 : 1:30
Logged : HE and JB
Processed : CJ
Checked : CG

Easting: Northing: System:
RL: Datum: Ground Level

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample: Number / Type	Sample: Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
	0		Sandy SILT, trace clay; mottled light brown, blue, orange. Moist; stiff. Fine to medium sand.		M												
	0.2		Sandy SILT, trace clay; light blue with trace brown to orange mottling. Firm; moist. Medium sand.														
1																	
	1.4		FILL: Tightly packed. Top cap (<0.10) underlain by landfill waste consisting of brick, concrete, wire, fabric and plastic fragments.														
2			End of Hole @ 2.00m,Target Depth.														
3																	
4																	
5																	

Notes and Comments:
End of Hole @ 2.00m, Target Depth.
No groundwater encountered

Inclination: Vertical Orientation:
Contractor: Fulton Hogan
Equipment: 8 Tonne Excavator

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)

Project : Green Island Landfill RRPP Site Investigation
Client : Dunedin City Council
Site : Green Island Landfill
Job Number: 12547621
Commenced: 30/09/2021 Completed: 30/09/2021

Hole No. : TP18
Sheet : 1 of 1
Hole Length : 2.10m
Scale @ A4 : 1:30
Logged : HE and JB
Processed : CJ
Checked : CG

Easting: Northing: System:
RL: Datum: Ground Level

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample: Number / Type	Sample: Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
	0		Sandy SILT; dark brown. Fine to medium sand. Trace rootlets [TOPSOIL].		M												
	0.15		Sandy SILT, trace clay; light brown. Mottled orange to grey. Stiff; moist.														
1	1		Sandy GRAVEL; dark grey. Tightly packed. Trace basaltic cobbles.														
	1.8		FILL: Landfilll waste including plastic, paper, wood, fabrics, metal fragments.														
2			End of Hole @ 2.10m,Target Depth.														
3																	
4																	
5																	
6																	

Notes and Comments:
End of Hole @ 2.10m, Target Depth.
No groundwater encountered

Inclination: Vertical Orientation:
Contractor: Fulton Hogan
Equipment: 8 Tonne Excavator

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)

Project : Green Island Landfill RRPP Site Investigation
Client : Dunedin City Council
Site : Green Island Landfill
Job Number: 12547621
Commenced: 30/09/2021 Completed: 30/09/2021

Hole No. : TP19
Sheet : 1 of 1
Hole Length : 2.00m
Scale @ A4 : 1:30
Logged : HE and JB
Processed : CJ
Checked : CG

Easting: Northing: System:
RL: Datum: Ground Level

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample Number / Type	Sample Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
	0		Sandy SILT; dark brown [TOPSOIL].		M												
	0.15		Sandy SILT, trace clay; grey. Orange to brown mottling. Stiff; moist [Landfill cap].														
	0.5		FILL: Sandy GRAVEL, trace silt; light grey. Medium to coarse sand.														
1																	
	1.5		Landfill waste consisting of brick, plastic, metal, wood and concrete fragments.														
2			End of Hole @ 2.00m,Target Depth.														30-09-2021
3																	
4																	
5																	
6																	

Notes and Comments:
End of Hole @ 2.00m, Target Depth.

Inclination: Vertical Orientation:
Contractor: Fulton Hogan
Equipment: 8 Tonne Excavator

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)
30/09/21	00:00	1.9	

Project : Green Island Landfill RRPP Site Investigation
Client : Dunedin City Council
Site : Green Island Landfill
Job Number: 12547621
Commenced: 30/09/2021 Completed: 30/09/2021

Hole No. : TP20
Sheet : 1 of 1
Hole Length : 2.00m
Scale @ A4 : 1:30
Logged : HE and JB
Processed : CJ
Checked : CG

Easting: Northing: System:
RL: Datum: Ground Level

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample: Number / Type	Sample: Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
	0		Sandy SILT, trace clay; light brown. Trace orange to brown mottling. Stiff; moist [Landfill Cap].		M												
	0.7		Sandy GRAVEL; dark grey. Plastic sheeting, brick and metal fragments.														
	1.5		Landfill waste comprising of wood, plastic, wire, concrete, paper, glass, tin and brick fragments.														
	2		End of Hole @ 2.00m,Target Depth.		W												30-09-2021

Notes and Comments:
End of Hole @ 2.00m, Target Depth.

Inclination: Vertical Orientation:
Contractor: Fulton Hogan
Equipment: 8 Tonne Excavator

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)
30/09/21	00:00	2	

Project	: Green Island Landfill RRPP Site Investigation	Hole No.	: TP21
Client	: Dunedin City Council	Sheet	: 1 of 1
Site	: Green Island Landfill	Hole Length	: 2.50m
Job Number:	12547621	Scale @ A4	: 1:30
Commenced:	30/09/2021 Completed: 30/09/2021	Logged	: HE and JB
Easting:	Northing: System:	Processed	: CJ
RL:	Datum: Ground Level	Checked	: CG

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample: Number / Type	Sample: Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
	0		Sandy SILT; brown. Trace rootlets. Fine to medium sand.		M												
	0.2		Gravelley SAND, trace basaltic gravel; light brown. Medium to coarse sand. Landfill waste consisting of string, plastic, copper and concrete fragments.														
1																	
	1.3		Landfill waste consisting of metal, wire, plastic, clay lenses, glass, timber and wood fragments.		W												30-09-2021
2																	
			End of Hole @ 2.50m,Target Depth.														
3																	
4																	
5																	

Notes and Comments:

End of Hole @ 2.50m, Target Depth.

Inclination: Vertical Orientation:

Contractor: Fulton Hogan

Equipment: 8 Tonne Excavator

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)
30/09/21	00:00	1.6	

Report ID: GENERAL_LOG || Project: GREEN ISLAND.GPJ || Library: GHD - NZGD.GLB || Date: 8 November 2021

Project : Green Island Landfill RRPP Site Investigation		Hole No.	: TP22
Client : Dunedin City Council		Sheet	: 1 of 1
Site : Green Island Landfill		Hole Length	: 1.90m
Job Number: 12547621		Scale @ A4	: 1:30
Commenced: 30/09/2021	Completed: 30/09/2021	Logged	: HE and JB
Easting:	Northing: System:	Processed	: CJ
RL:	Datum: Ground Level	Checked	: CG

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample: Number / Type	Sample: Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
	0		Sandy SILT; dark brown.Trace rootlets. Fine to coarse sand [TOPSOIL].		D-M												
	0.2		Sandy GRAVEL; brown. Occasional timber posts, concrete, brick and tin fragments. Medium to coarse sand.														
	0.5		Landfill waste consisting of metal, rubber, plastic, brick, timber, fabric and paper. Minor lenses of clay.		W												
1																	
2			End of Hole @ 1.90m,Target Depth.														
3																	
4																	
5																	

Notes and Comments:

End of Hole @ 1.90m, Target Depth.

No groundwater encountered

Inclination: Vertical Orientation:

Contractor: Fulton Hogan

Equipment: 8 Tonne Excavator

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)

Project : Green Island Landfill RRPP Site Investigation
Client : Dunedin City Council
Site : Green Island Landfill
Job Number: 12547621
Commenced: 10/01/2021 Completed: 10/01/2021

Hole No. : TP23
Sheet : 1 of 1
Hole Length : 2.20m
Scale @ A4 : 1:30
Logged : HE and JB
Processed : CJ
Checked : CG

Easting: Northing: System:
RL: Datum: Ground Level

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample Number / Type	Sample Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
0	0		Sandy SILT; brown. Fine to medium sand [TOPSOIL].		D	VL											
	0.4		Medium SILT, gravel; brown. Trace clay. Timber and brick fragments.		M	L											
1	1.1		Landfill waste consisting roots, metal, fencing, paper, plastic and timber fragments. 1.10 - 2.20 Some organic odour.		W	MD											1-10-2021
2			End of Hole @ 2.20m,Target Depth.														
3																	
4																	
5																	
6																	

Notes and Comments:
End of Hole @ 2.20m, Target Depth.

Inclination: Vertical Orientation:
Contractor: Fulton Hogan
Equipment: 8 Tonne Excavator

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)
01/10/21	00:00	2	

Report ID: GENERAL_LOG || Project: GREEN ISLAND.GPJ || Library: GHD - NZGD.GLB || Date: 8 November 2021

Project : Green Island Landfill RRPP Site Investigation		Hole No.	: TP24
Client : Dunedin City Council		Sheet	: 1 of 1
Site : Green Island Landfill		Hole Length	: 2.20m
Job Number: 12547621		Scale @ A4	: 1:30
Commenced: 30/09/2021	Completed: 30/09/2021	Logged	: HE and JB
Easting:	Northing: System:	Processed	: CJ
RL:	Datum: Ground Level	Checked	: CG

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample: Number / Type	Sample: Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
	0		Sandy SILT; brown. Trace rootlets. Fine to medium sand.		M												
	0.3		Gravelly SAND; dark brown. Basaltic gravel fragments. Medium to coarse sand. Landfill waste consisting of plastics, glass, brick, paper and metal fragments.														
	0.7		Sandy GRAVEL; grey to blue. Landfill waste consisting of tyres, plastic, wire, timber posts, bricks, fabric, rubber and metal fragments.		W												30-09-2021
1																	
2			End of Hole @ 2.20m,Target Depth.														
3																	
4																	
5																	

Notes and Comments:
End of Hole @ 2.20m, Target Depth.

Inclination: Vertical Orientation:

Contractor: Fulton Hogan

Equipment: 8 Tonne Excavator

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)
30/09/21	00:00	1.2	

Report ID: GENERAL_LOG || Project: GREEN ISLAND.GPJ || Library: GHD - NZGD.GLB || Date: 8 November 2021

Project : Green Island Landfill RRPP Site Investigation
Client : Dunedin City Council
Site : Green Island Landfill
Job Number: 12547621
Commenced: 30/09/2021 Completed: 30/09/2021

Hole No. : TP25
Sheet : 1 of 1
Hole Length : 1.80m
Scale @ A4 : 1:30
Logged : HE and JB
Processed : CJ
Checked : CG

Easting: Northing: System:
RL: Datum: Ground Level

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample Number / Type	Sample Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
	0		Sandy SILT; dark brown. Trace rootlets. Fine to coarse sand. Moist [TOPSOIL].		M												
	0.2		Sandy GRAVEL; dark grey. Medium to coarse sand . Trace basaltic gravel. Moist.														
	0.5		Landfill waste consisting of metal, brick, glass, plastic and timber fragments.														
1																	30-09-2021
			End of Hole @ 1.80m,Target Depth.														
2																	
3																	
4																	
5																	

Notes and Comments:
End of Hole @ 1.80m, Target Depth.

Inclination: Vertical Orientation:
Contractor: Fulton Hogan
Equipment: 8 Tonne Excavator

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)
30/09/21	00:00	1.7	

Project : Green Island Landfill RRPP Site Investigation
Client : Dunedin City Council
Site : Green Island Landfill
Job Number: 12547621
Commenced: 30/09/2021 Completed: 30/09/2021

Hole No. : TP26
Sheet : 1 of 1
Hole Length : 1.80m
Scale @ A4 : 1:30
Logged : HE and JB
Processed : CJ
Checked : CG

Easting: Northing: System:
RL: Datum: Ground Level

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample Number / Type	Sample Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
	0		Sandy GRAVEL; brown. Trace rootlets. Medium to coarse sand. Basaltic gravel.														
	0.2		Sandy GRAVEL; brown. Landfill material consisting of brick, wire and wood fragments. Coarse sand.														
	0.7		Landfill waste consisting of plastic, wood, piping, wire, paper, metal and timber fragments.														
1																	
			End of Hole @ 1.80m,Target Depth.														30-09-2021
2																	
3																	
4																	
5																	

Notes and Comments:
End of Hole @ 1.80m, Target Depth.

Inclination: Vertical Orientation:
Contractor: Fulton Hogan
Equipment: 8 Tonne Excavator

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)
30/09/21	00:00	1.8	

Project : Green Island Landfill RRPP Site Investigation
Client : Dunedin City Council
Site : Green Island Landfill
Job Number: 12547621
Commenced: 10/01/2021 Completed: 10/01/2021

Hole No. : TP27
Sheet : 1 of 1
Hole Length : 2.50m
Scale @ A4 : 1:30
Logged : HE and JB
Processed : CJ
Checked : CG

Easting: Northing: System:
RL: Datum: Ground Level

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample Number / Type	Sample Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
	0		Sandy SILT; dark brown. Trace rootlets [TOPSOIL].		M												
	0.25		Sandy GRAVEL. Landfill waste consisting of plastics, paper, roots. Medium to coarse sand. Basaltic gravel and cobbles.														
	0.6		Coarse SAND; silty clay. Landfill waste consisting of plastic lid containers, paper, wood, metal wire, soft plastic and timber fragments.														
1																	
2																	1-10-2021
			End of Hole @ 2.50m,Target Depth.														
3																	
4																	
5																	
6																	

Notes and Comments:
End of Hole @ 2.50m, Target Depth.

Inclination: Vertical Orientation:
Contractor: Fulton Hogan
Equipment: 8 Tonne Excavator

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)
01/10/21	00:00	2.4	

Project : Green Island Landfill RRPP Site Investigation
Client : Dunedin City Council
Site : Green Island Landfill
Job Number: 12547621
Commenced: 10/01/2021 Completed: 10/01/2021

Hole No. : TP28
Sheet : 1 of 1
Hole Length : 2.30m
Scale @ A4 : 1:30
Logged : HE and JB
Processed : CJ
Checked : CG

Easting: Northing: System:
RL: Datum: Ground Level

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample Number / Type	Sample Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
	0		Silty SAND; dark brown. Trace rootlets. Fine to medium sand [TOPSOIL].														
	0.2		Coarse SAND; trace clay. Landfill waste consisting of paper, wood, fabric, plastic, tyres, brick, metal and concrete fragments.														
1																	
2																	1-10-2021
			End of Hole @ 2.30m,Target Depth.														
3																	
4																	
5																	

Notes and Comments:
End of Hole @ 2.30m, Target Depth.

Inclination: Vertical Orientation:
Contractor: Fulton Hogan
Equipment: 8 Tonne Excavator

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)
01/10/21	00:00	2.3	

GHD	Project : Green Island Landfill RRPP Site Investigation Client : Dunedin City Council Site : Green Island Landfill Job Number: 12547621 Commenced: 10/01/2021 Completed: 10/01/2021	Hole No. : TP29 Sheet : 1 of 1 Hole Length : 2.10m Scale @ A4 : 1:30	
Easting:	Northing:	System:	Logged : HE and JB Processed : CJ Checked : CG
RL:	Datum: Ground Level		

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample: Number / Type	Sample: Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
	0		[TOPSOIL]		D	L											
	0.15		Landfill waste consisting of plastic, tyres, fabric, metal wiring, paper and concrete fragments.		M	L											
1																	
	1.5		Sludge- very wet. Small amount of landfill present.		W	D											1-10-2021
2																	
			End of Hole @ 2.10m,Target Depth.														
3																	
4																	
5																	
6																	

Notes and Comments:
End of Hole @ 2.10m, Target Depth.

Inclination: Vertical Orientation:

Contractor: Fulton Hogan

Equipment: 8 Tonne Excavator

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)
01/10/21	00:00	1.5	

Report ID: GENERAL_LOG || Project: GREEN ISLAND.GPJ || Library: GHD - NZGD.GLB || Date: 8 November 2021

Project : Green Island Landfill RRPP Site Investigation
Client : Dunedin City Council
Site : Green Island Landfill
Job Number: 12547621
Commenced: 10/01/2021 Completed: 10/01/2021

Hole No. : TP30
Sheet : 1 of 1
Hole Length : 1.50m
Scale @ A4 : 1:30
Logged : HE and JB
Processed : CJ
Checked : CG

Easting: Northing: System:
RL: Datum: Ground Level

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample: Number / Type	Sample: Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
	0		Sandy SILT; dark brown. Trace rootlets [TOPSOIL].														
	0.25		Landfill waste consisting of metal sheets, rubber, string, steel rods, plastic and timber wood fragments.														
1			1.40 Water ingress @1.4m bgl.														1-10-2021
			End of Hole @ 1.50m,Target Depth.														
2																	
3																	
4																	
5																	

Notes and Comments:
End of Hole @ 1.50m, Target Depth.

Inclination: Vertical Orientation:
Contractor: Fulton Hogan
Equipment: 8 Tonne Excavator

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)
01/10/21	00:00	1.4	

Project : Green Island Landfill RRPP Site Investigation
Client : Dunedin City Council
Site : Green Island Landfill
Job Number: 12547621
Commenced: 10/01/2021 Completed: 10/01/2021

Hole No. : TP31
Sheet : 1 of 1
Hole Length : 2.50m
Scale @ A4 : 1:30
Logged : HE and JB
Processed : CJ
Checked : CG

Easting: Northing: System:
RL: Datum: Ground Level

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample: Number / Type	Sample: Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
	0		Sandy GRAVEL; dark brown. Trace rootlets. Medium to coarse sand. Basaltic gravel.														
	0.15		Landfill waste consisting of tyres, metal wiring, plastics, fabric, paper and chip board fragments. Occasional basaltic boulders.														
1																	
2																	
			Minor water seepage at 2.5m														1-10-2021
			End of Hole @ 2.50m,Target Depth.														
3																	
4																	
5																	
6																	

Notes and Comments:
End of Hole @ 2.50m, Target Depth.

Inclination: Vertical Orientation:
Contractor: Fulton Hogan
Equipment: 8 Tonne Excavator

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)
01/10/21	00:00	2.5	

Report ID: GENERAL_LOG || Project: GREEN ISLAND.GPJ || Library: GHD - NZGD.GLB || Date: 8 November 2021

Project : Green Island Landfill RRPP Site Investigation
Client : Dunedin City Council
Site : Green Island Landfill
Job Number: 12547621
Commenced: 10/01/2021 Completed: 10/01/2021

Hole No. : TP32
Sheet : 1 of 1
Hole Length : 2.50m
Scale @ A4 : 1:30
Logged : HE and JB
Processed : CJ
Checked : CG

Easting: Northing: System:
RL: Datum: Ground Level

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample Number / Type	Sample Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
	0		Sandy SILT; dark brown. Trace rootlets. Fine to medium sand [TOPSOIL].		M												
	0.2		Sandy SILT; dark brown. Fine to coarse sand. Landfill waste consisting of brick, wood and plastic fragments.														
	0.5		Landfill waste consisting of glass bottles, paper, wire, fabric, netting, wood fragments.														
1																	
2																	1-10-2021
			End of Hole @ 2.50m,Target Depth.														
3																	
4																	
5																	

Notes and Comments:
End of Hole @ 2.50m, Target Depth.

Inclination: Vertical Orientation:
Contractor: Fulton Hogan
Equipment: 8 Tonne Excavator

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)
01/10/21	00:00	2.1	

Project : Green Island Landfill RRPP Site Investigation	Hole No. : TP33	
Client : Dunedin City Council	Sheet : 1 of 1	
Site : Green Island Landfill	Hole Length : 2.20m	
Job Number: 12547621	Scale @ A4 : 1:30	
Commenced: 10/01/2021 Completed: 10/01/2021	Logged : HE and JB	
Easting: Northing: System:	Processed : CJ	
RL: Datum: Ground Level	Checked : CG	

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample: Number / Type	Sample: Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
	0		Sandy GRAVEL; brown. Trace rootlets [TOPSOIL].		M												
	0.2		Landfill waste consisting of newspaper, timber, wood, grass clippings, plastics, tyres, sheet metal and concrete fragments. Clay lenses observed.														
1																	
2			End of Hole @ 2.20m,Target Depth.														
3																	
4																	
5																	

Notes and Comments:

End of Hole @ 2.20m, Target Depth.

No groundwater encountered

Inclination: Vertical Orientation:

Contractor: Fulton Hogan

Equipment: 8 Tonne Excavator

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)

Project : Green Island Landfill RRPP Site Investigation
Client : Dunedin City Council
Site : Green Island Landfill
Job Number: 12547621
Commenced: 10/01/2021 Completed: 10/01/2021

Hole No. : TP34
Sheet : 1 of 1
Hole Length : 2.40m
Scale @ A4 : 1:30
Logged : HE and JB
Processed : CJ
Checked : CG

Easting: Northing: System:
RL: Datum: Ground Level

RL (m)	Depth (m)	Graphic	Material Description	Geological Unit	Moisture condition	Consistancy / Relative density	Sample Number / Type	Sample Result	Casing	Method	Flush Return (%)	Weathering	Estimated Strength (MPa)	TCR SCR RQD (%)	Defect Spacing (mm)	Instrumentation Installation	Water level
	0		Sandy GRAVEL, trace silt; light brown. Trace rootlets. Medium to coarse sand. Basaltic gravel. Dry.		D												
	0.2		Sandy SILT; dark brown. Fine to medium sand, basaltic gravels. Landfill waste consisting of brick, concrete, minor plastics.		M												
	0.4		Sandy CLAY; brown. Mottled blue to grey.														
1	1		Landfill waste consisting of wood, fabric, metal sheets, wire, wood and brick fragments.														
2																	1-10-2021
			End of Hole @ 2.40m,Target Depth.														
3																	
4																	
5																	

Notes and Comments:
End of Hole @ 2.40m, Target Depth.

Inclination: Vertical Orientation:
Contractor: Fulton Hogan
Equipment: 8 Tonne Excavator

Ground Water Level

Date	Time	Reading (mbgl)	Hole depth (mbgl)
01/10/21	00:00	2	

SOIL DESCRIPTION

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This procedure involves the description of a soil in terms of its visual and tactile properties, and relates to both laboratory samples and field exposures as applicable. A detailed soil profile description, in association with local geology and experience, will facilitate the initial (and often complete) site assessment for engineering purposes.

The method involves an evaluation of each of the items listed below and is in general agreement with methods and procedures in NZ Geotechnical Society Guideline "Field Description of Soil and Rock", December 2005.

SOIL TYPE

The soil is described in terms of its estimated grain size composition and the tactile behaviour (plasticity of any fines (less than *0.06 mm)) as stated in section 2.3.2 of NZ Geotechnical Society Guideline "Field Description of Soil and Rock", December 2005. If the soil falls into the coarse group, an estimate is made of the relative proportions of its principal constitutes as described in section 2.3.3. If the clay content is sufficient to influence behaviour, proceed to section 2.3.4 to determine whether soil is a silt or a clay.

Furthermore, as most natural soils frequently are combinations of various constituents, the primary soil is described and modified by minor components. In brief, the system is as follows:-

Fraction	Term	% of Soil Mass
MAJOR	(…) [UPPER CASE]	≥50 [major constituent]
Subordinate	(…)y [lower case]	20-50
Minor	omit, or use "with trace of"	<5
	describe as "with minor" as applicable	5-12
	prefix soil as "with some" as applicable	>12

(*The 200# sieve (0.075 mm) is commonly used in practice to differentiate between fine and coarse grained soils).

COLOUR

Colour is important for correlation of data between testholes and during subsequent excavation operations. The prominent colour is noted and not that of individual constituents, followed by (mottled, banded, mixed, or speckled.) then secondary colours as applicable. Colour is usually described at as-received moisture condition, though both wet and dry colours may also be appropriate.

CONSISTENCY / DENSITY INDEX

This assessment is based on the effort required to penetrate and/or mould the soil, and is an indicator of shear strength.

Granular soils are generally described in terms of density index as listed in NZ Geotechnical Society Guideline "Field Description of Soil and Rock", December 2005. These soils are inherently difficult to assess and normally a penetration test procedure (SPT, DCP or CPT) is used in conjunction with published correlations. Alternatively, in-situ density tests can be conducted in association with minimum and maximum densities performed in the laboratory.

Term	Symbol	*Inferred Symbol	Density Index (%)	SPT "N" value (blows / 300 mm)	Dynamic Cone (blows / 100 mm)
Very Loose	VL	`VL'?	< 15	< 4	0 – 2
Loose	L	`L'?	15 - 35	4 –10	1 – 3
Medium Dense	MD	`MD'?	35 - 65	10 – 30	3 – 7
Dense	D	`D'?	65 - 85	30 – 50	7 – 17
Very Dense	VD	`VD'?	>85	> 50	> 17

NOTE) No correlation is implied between Standard Penetraion Test (SPT) and Dynamic Cone Test values
) SPT "N" values are uncorrected

*Inferred symbols are to be used in the field as approximation only, unaided by in-situ density tests.

Where no test results are available, a simple field assessment can be made using the terms ***loosely packed*** *(can be removed from exposure by hand)* and ***tightly packed*** *(requires a pick for removal).*

Cohesive soils can be assessed by direct measurement (shear vane), or estimated approximately by tactile means and/or the aid of a geological pick as given on the following table. It is emphasised that"design shear strength" must take cognisance of the mode of testing and the in-situ moisture content with the possible variations of moisture with time.

Term	Symbol	Tactile Properties	Unconfined Compressive Strength q_u (kPa)
Very Soft	VS	Easily exudes between fingers when squeezed	<12
Soft	S	Easily indented by fingers.	12-25
Firm	F	Indented by strong finger pressure and can be indented by thumb pressure.	25-50
Stiff	St	Cannot be indented by thumb pressure.	50-100
Very Stiff	VSt	Readily indented by thumb nail.	100-200
Hard	H	Difficult to indent with thumb nail.	200-500

SOIL DESCRIPTION

CLIENTS PEOPLE PERFORMANCE

MOISTURE

The moisture condition of the soil is most applicable for cohesive soils as a precursor to the assessment of consistency and workability. The moisture condition is described as:-

Dry (looks and feels dry) ***Moist*** to ***Wet*** (feels cool, darkened in colour) ***Saturated*** (feels cool, visible free water is present)

In addition, the presence of any seepage or free water is noted on the testhole logs.

SENSITIVITY

Sensitivity is defined as the ratio of the undisturbed strength to the remoulded strength. Sensitivity is described as:-

Descriptive Term	Shear Strength Ratio $\frac{\text{undisturbed}}{\text{remoulded}}$
Insensitive, normal	< 2
Moderately sensitive	2 – 4
Sensitive	4 – 8
Extra sensitive	8 – 16
Quick	> 16

PLASTICITY

The most important property of a clay or silt is its plasticity. *Highly plastic* soil can be moulded or deformed over a wide moisture content range, without cracking or showing any tendency to volume change. In the field it is necessary to remoulded the soil over a range of moisture contents. In brief:- *Highly plastic* clays will become `rock hard' when dry, while those of *low plasticity* can be crumbled in the fingers.

OTHER FEATURES

For granular soils, an assessment of grading (well, or poor), particle size (fine, medium etc.) and angularity and shape may also be given. Gravels and sands should be described as *well graded* (a good representation of all particle sizes from largest to smallest), or *poorly graded* (a limited representation of grain sizes). *Poorly graded* materials may be further divided into *uniformly graded* (most particles about the same size), and *gap graded* (absence of one or more intermediate sizes within what otherwise would be well graded material).

Unless otherwise stated, it is assumed that the particle strength of sand and gravel consist of hard, unweathered rock. If this is not the case, then information should be provided indicating the hardness of grains, and the extent of weathering. Descriptions such as *"easily broken by hand"* or *"can be easily broken by a hammer blow"* are appropriate. The particle strength and weathering of gravel, cobbles and boulders can also be described using the rock descriptive terms.

Other material such as pieces of coal, shell, or traces if oils should be described. Strong odours should also be noted. Identify minerals or parent rock types and the geological unit, if known.

Soils containing organic material can have a marked effect on plasticity and therefore on engineering properties. If organic matters is present the terms below should be used:-

Term	Description
Topsoil	Surficial organic soil layer that may contain living matter. Topsoil may occur at greater depth, having buried by geological processes or man-made fill
Organic clay, silt or sand	Contains finely divided organic matter; may have distinctive smell; may stain; may oxidise rapidly. Described as for inorganic soils.
Peat	Consists predominantly of plant remains. Can be further described according to its degree of decomposition and strength. *Firm*: Fibres already compressed together *Spongy*: Very compressible and open structure *Plastic*: can be moulded in hand and smears in fingers *Fibrous*: Plant remains recognizable and retain some strength *Amorphous*: No recognizable plant remains

Term	Description
Rootlets	Fine, partly decomposed roots, normally found in the upper part of a soil profile or in a redeposited soil (eg. colluvium or fill)
Carbonaceous	Discrete particles of hardened (carbonized) plant material.

The relative proportion of organics in a soil should be described as for inorganic soils.

ORIGIN

An attempt is made, where possible, to assess origin (transported, residual, pedogenic, or fill etc.) since this assists in the judgement of probable engineering behaviour. This assessment is generally restricted to field logging activities. An interpretation of landform is a useful guide to the origin of transported soils (e.g. colluvium, talus, slide debris, slope wash, alluvium, lacustrine, estuarine, aeolian and littoral deposits) while local geology and remnant fabric will assist identification of residual soils.

GLOSSARY OF SYMBOLS

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This standard sheet should be read in conjunction with all test hole log sheets and any idealised geological sections prepared for the investigation report.

GENERAL

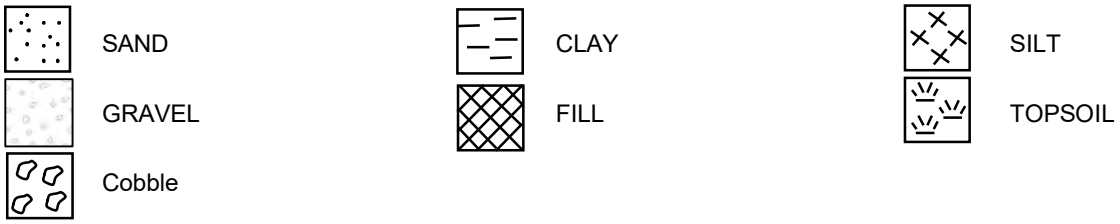
Symbol	Description
D	Disturbed Sample
U	Undisturbed Sampled (suffixed by sample size or tube diameter in mm if applicable)
C	Core Sample (suffixed by diameter in mm)
SV	Shear Vane Test (suffixed by value in kPa)
SPT	Standard Penetration Test (with blows per 75mm)
N	SPT Value
PK	Packer Test
PM	Pressuremeter Test
PP	Pocket Penetrometer (suffixed by value in kPa)
IMP	Impression Device Test
HB	SPT hammer bouncing

Symbol	Description
PZ	Piezometer Installation
R	Rising Head Permeability Test
F	Falling Head Permeability Test
PBT	Plate Bearing Test
	Water Inflow (make)
	Water Outflow (loss)
	Temporary Water Level
	Final Water Level
	Point Load Test (axial)
	Point Load Test (diametric)

SOIL SYMBOLS

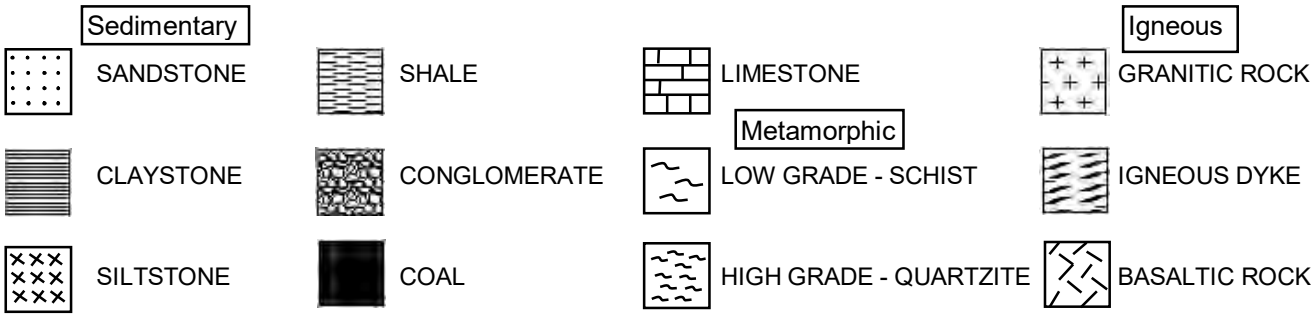
All soils are classified according to the Unified Soil Classification System (USCS) Figure 1.

Main Components



Note: Natural soils are generally a combination of constituents, e.g. sandy CLAY

ROCK SYMBOLS



Note: Additional rock symbols may be allocated for a particular project.

NATURAL FRACTURES (Coding)

Fracture Type

JT	Joint
BP	Bedding Plane
Cb	Cross Bed
SM	Seam
SF	Sheared Surface
SS	Sheared Seam
CS	Crushed Seam
SZ	Shear Zone(>250 mm)
FZ	Fractured Zone(>250 mm)
Vn	Vein

Orientation

For vertical non-oriented core ... “Dip” angle (eg. 5°) measured relative to horizontal
For inclined non-oriented core ... “Angle” measured relative to core axis.
For inclined oriented core ... “Dip” angle and “Dip Direction” angle (eg. 45°/225° mag.)

Fl	Foliation
Cl	Cleavage
VT	Vertical
HZ or 0°	Horizontal
d	degrees

Infilling or Coating

CN	Clean
X	Carbonaceous
CLAY	Clay
KT	Chlorite
CA	Calcite
Fe	Iron Oxide
MI	Micaceous
QZ	Quartz
VE	Veneer

Roughness

sl	Slickensided
r	Rough
sm	Smooth

Texture

Pl	Planar
St	Stepped
U	Undulating

Aperture

DIS	Discontinuous
TI	Tight
VN	Very Narrow
N	Narrow
MN	Moderately Narrow
MW	Moderately Wide
W	Wide
VW	Very Wide

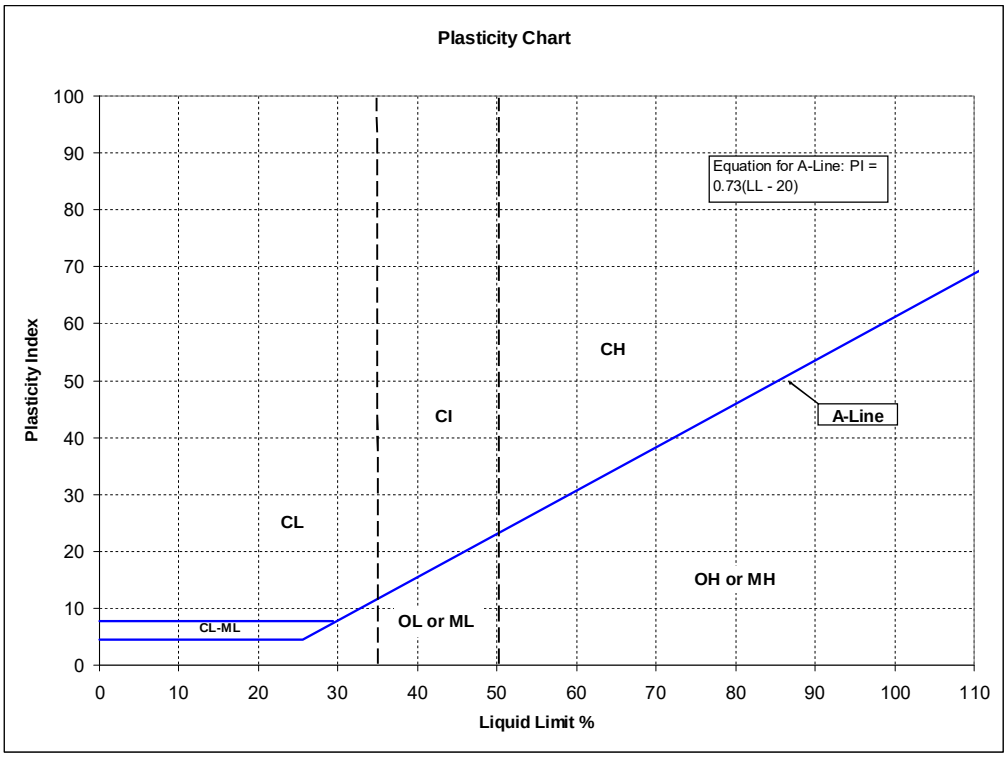
GLOSSARY OF SYMBOLS

CLIENTS | PEOPLE | PERFORMANCE

Figure 1 Unified Soil Classification System

Major divisions			Group symbol	Group name
Coarse grained soils more than 50% of material less than 63 mm is retained on a 0.075 mm sieve.	**Boulders**	200 mm		
	Cobbles	63 mm		
	Gravel > 50% of coarse fraction is retained on a 2.36 mm sieve.	Coarse Gravel >20 mm	GW	Well graded gravel, gravel-sand mixtures, little or no fines.
		Medium Gravel >4.75 mm	GP	Poorly graded gravels and gravel-sand mixtures, little or no fines, uniform gravels.
			GM	Silty gravels, gravel-sand-silt mixtures.
		Fine Gravel >2.36 mm	GC	Clayey gravels, gravel-sand-clay mixtures.
	Sand ≥ 50% of coarse fraction passes through a 2.36 mm sieve.	Coarse Sand >0.425 mm	SW	Well-graded sands, gravelly sands, little or no fines.
		Medium Sand >0.150 mm	SP	Poorly-graded sands and gravelly sands, little or no fines, uniform sands.
			SM	Silty sands, sand-silt mixtures.
		Fine Sand >0.075 mm	SC	Clayey sands, sand-clay mixtures.
Fine grained soils more than 50% of material less than 63 mm passes through a 0.075 mm sieve.	**Silt and Slay** liquid limit < 50%	Inorganic	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity.
			CL	Inorganic clay of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
		Organic	OL	Organic silts and organic silty clays of low plasticity.
	Silt and Clay liquid limit ≥ 50%	Inorganic	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts.
			CH	Inorganic clays of high plasticity, fat clays.
		Organic	OH	Organic clays of medium to high plasticity, organic silts.
	Highly organic soils		Pt	Peat and other highly organic soils.

Figure 2 A-Line Chart



Appendix C

Landfill gas monitoring and Water levels monitoring data

Gas Well	Date	Pressure	CH_4 %	CO_2 %	O_2 %	CO ppm	H_2S ppm	Balance	Air pressure (mBar)	Weather Comments	Time	Temperature (^oC)	Comments
WS01	19-10-21		26 - 6.1	6.4	15.5	1.0	0.0	72.1	1,015	Cloudy, cool, rain showers	12.30	9	Methane initially 26%, fell to 11% after 1 minute and then to 6.1% after 2 minutes
WS02	19-10-21		24.8	18.0	1.9	0.0	0.0	55.3	1,015	Cloudy, cool, rain showers	12.30	9	
WS03	19-10-21		2.1	19.8	0.3	1.0	0.0	77.8	1,015	Cloudy, cool, rain showers	12.30	9	
WS04	19-10-21		18.3	20.0	5.6	1.0	0.0	56.1	1,015	Cloudy, cool, rain showers	12.30	9	
WS01	26-10-21		70.3	26.1	0.2	3.0	0.0	3.3	1,017	Cloudy, mild	10.00	12	Morning
WS02	26-10-21		34.5	18.8	1.7	3.0	0.0	45.0	1,017	Cloudy, mild	10.05	12	Morning
WS03	26-10-21		2.5	19.6	0.8	2.0	0.0	77.1	1,017	Cloudy, mild	10.10	12	Morning
WS04	26-10-21		28.9	29.0	0.0	4.0	3.0	42.1	1,017	Cloudy, mild	9.55	12	Morning
WS01	28-10-21	5.02	80.3	27.4	0.1	0.0	0.0	0.0	1,017	Clear, mild, wet		11	Morning
WS02	28-10-21	4.98	58.0	21.2	0.3	0.0	0.0	20.5	1,017	Clear, mild, wet		11	Morning
WS03	28-10-21	4.96	3.1	21.7	0.2	0.0	0.0	74.9	1,017	Clear, mild, wet		11	Morning
WS04	28-10-21	5.05	37.7	29.9	0.8	0.0	0.0	31.6	1,017	Clear, mild, wet		11	Morning
WS01	28-10-21	4.97	80.5	27.0	0.1	2.0	0.0	0.0	1,014	Clear, warm		17	Afternoon
WS02	28-10-21	5.01	61.5	20.8	0.3	3.0	0.0	17.4	1,014	Clear, warm		17	Afternoon
WS03	28-10-21	4.96	3.5	21.7	0.2	2.0	0.0	74.7	1,014	Clear, warm		17	Afternoon
WS04	28-10-21	5.00	36.9	30.2	0.3	1.0	0.0	32.6	1,014	Clear, warm		17	Afternoon
WS01	02-11-21	0.02	45.9	25.0	0.4	1.0	0.0	28.8	1,020	Cloudy, cool	13.00	10	Gently falling atmospheric pressure
WS02	02-11-21	0.03	3.5	9.1	13.3	1.0	0.0	74.0	1,020	Cloudy, cool	13.00	10	Gently falling atmospheric pressure
WS03	02-11-21	0.03	1.5	21.5	0.2	0.0	0.0	76.8	1,020	Cloudy, cool	13.00	10	Gently falling atmospheric pressure
WS04	02-11-21	-0.03	34.2	29.9	0.0	1.0	0.0	36.0	1,020	Cloudy, cool	13.00	10	Gently falling atmospheric pressure

Note:
All measurements were collected by Waste Management

Appendix C
Table 2: RRPP- Borehole Water Level Measurements

Client: Dunedin City Council
Project Number: 12547621

Client:	DCC
Project:	Green Island Landfill RRPP Investigation
Task:	Borehole water level monitoring
Monitoring Method:	Dip Meter
Staff:	GHD / Waste Management

Bore ID	Date	Time	SWL (m btoc)	Bore depth (m btoc)	PID (ppm)	Comment
BH01	01-10-21	13.00	2.71	5.60		
BH02	01-10-21	13.05	2.48	6.13		
BH03	01-10-21	13.10	3.14	5.60		
BH04	01-10-21	13.15	3.00	6.39		
BH01	04-10-21		2.02	5.60		Slight hydrocarbon odour when bore lid opened.
BH02	04-10-21		1.83	6.13		
BH03	04-10-21		2.43	5.60		
BH04	04-10-21		2.99	6.39		
BH01	19-10-21		2.726	5.644	19.0	Strong hydrocarbon odour
BH02	19-10-21		2.494	6.104	7.3	
BH03	19-10-21		3.128	5.646	2.6	Slight hydrocarbon odour
BH04	19-10-21		3.721	6.461	19.0	
BH01	02-11-21	12.40	2.781	-		
BH02	02-11-21	12.45	2.537	-		
BH03	02-11-21	12.50	3.205	-		
BH04	02-11-21	12.55	3.840	-		

Notes:
m btoc - metres below top of casing
SWL - Static water level
PID - photoionisation detector
ppm - parts per million

Appendix D

Analytical Results Tables

Green Island Landfill RRPP
Soil Analytical Results September and October 2021
Table 1: Heavy Metals

Lab Reference		21-42090-1	21-42090-7	21-42090-8	21-42090-9	21-42090-10	21-42090-22	21-42090-24	21-42090-25	21-42090-28	21-42090-30	21-42090-32	NES SCSs for Protection of Human Health based on a Commercial/Industrial land use (mg/kg) [1 & 2]	Dunedin Background Soil Concentrations (mg/kg) [3]
Sample Depth	m bgl	0.15	1.2 - 2.2	0.15	0.2 - 0.5	0.5 - 1.5	0.3 - 1.2	0.0 - 0.65	0.65 - 1.5	0.8 - 1.8	0.0 - 0.3	1.3 - 2.4		
Test Pit		**TP1**	**TP2**	**TP3**			**TP7**	**TP8**		**TP9**	**TP10**			
Sample Name		RRPPTP01 0.15	RRPPTP02	RRPPTP03	RRPPTP03	RRPPTP03	RRPPTP07	RRPPTP08	RRPPTP08	RRPPTP09	RRPPTP10	RRPPTP10		
Sample Date		27-09-21	28-09-21	28-09-21	28-09-21	28-09-21	28-09-21	28-09-21	28-09-21	29-09-21	29-09-21	29-09-21		
Heavy Metals														
Arsenic	mg/kg	4.8	17.1	3.0	1.7	18.0	16.2	2.4	26.2	7.3	4.3	4.0	**70** [1]	11.77
Cadmium	mg/kg	0.22	1.28	0.20	0.069	0.873	2.38	0.067	1.93	0.25	0.20	0.12	**1,300** [1]	0.34
Chromium [4]	mg/kg	48.5	81.0	58.3	81.4	60.0	69.8	95.3	78.6	36.8	56.9	27.2	**6,300** [1]	80.15
Copper	mg/kg	47.3	769	47.3	40.5	92.9	71.6	10.0	307	2,150	73.8	19.9	**>10,000** [1]	60.85
Lead	mg/kg	89.9	631	95.8	9.63	557	363	16.4	922	140	48.0	60.8	**3,300** [1]	44.34
Mercury	mg/kg	0.061	0.20	0.042	<0.025	0.13	0.35	<0.025	0.39	0.085	0.063	0.035	**4,200** [1]	-
Nickel	mg/kg	47.2	58.0	59.3	90.7	80.6	53.5	72.2	46.7	36.8	60.1	18.9	**6,000** [2]	44.96
Zinc	mg/kg	189	962	120	82.2	609	982	29.8	920	233	131	112	**400,000** [2]	182.8

Lab Reference		21-42090-50	21-42090-52	21-42090-51	21-42090-70	21-42090-72	21-42090-55	21-42090-61	21-42090-89	21-42090-90	21-42090-78	21-42090-99	NES SCSs for Protection of Human Health based on a Commercial/Industrial land use (mg/kg) [1 & 2]	Dunedin Background Soil Concentrations (mg/kg) [3]
Sample Depth	m bgl	0.3 - 1.0	0.3 - 1.0	1.0 - 2.2	0.2 - 0.8	1.5 - 2.2	1.0 - 1.8	0.7 - 1.5	0.2 - 1.3	0.2 - 1.3	0.5 - 1.7	0.2 - 2.3		
Test Pit		**TP14**	**TP14-DUP**	**TP14**	**TP15**		**TP18**	**TP20**	**TP21**	**TP21-DUP**	**TP25**	**TP28**		
Sample Name		RRPPTP14	RRPPTP14	RRPPTP14	RRPPTP15	RRPPTP15	RRPPTP18	RRPPTP20	RRPPTP21	RRPPTP21	RRPPTP25	RRPPTP28		
Sample Date		29-09-21	29-09-21	29-09-21	30-09-21	30-09-21	29-09-21	30-09-21	30-09-21	30-09-21	30-09-21	01-10-21		
Heavy Metals														
Arsenic	mg/kg	7.1	6.8	5.4	6.9	3.7	9.2	7.4	4.5	4.0	19.2	7.3	**70** [1]	11.77
Cadmium	mg/kg	0.043	0.022	0.581	0.033	0.21	0.19	0.930	0.34	0.29	1.12	5.01	**1,300** [1]	0.34
Chromium [4]	mg/kg	18.3	21.0	47.2	20.6	42.5	23.3	37.1	45.5	48.2	64.7	207	**6,300** [1]	80.15
Copper	mg/kg	12.3	11.6	53.1	9.39	32.5	30.8	76.4	68.1	68.4	166	71.7	**>10,000** [1]	60.85
Lead	mg/kg	23.1	16.5	267	19.4	81.4	323	487	158	148	495	360	**3,300** [1]	44.34
Mercury	mg/kg	0.031	0.038	0.040	0.036	0.091	0.080	0.21	0.15	0.14	0.34	1.5	**4,200** [1]	-
Nickel	mg/kg	12.8	9.67	34.5	10.8	31.1	18.8	29.6	46.1	49.9	66.9	31.5	**6,000** [2]	44.96
Zinc	mg/kg	50.3	34.0	227	45.3	217	145	411	186	166	781	4,210	**400,000** [2]	182.8

Lab Reference		21-42090-109	21-42090-111	21-42090-115	21-42090-43	21-42090-44	21-42090-45	21-42090-48	NES SCSs for Protection of Human Health based on a Commercial/Industrial land use (mg/kg) [1 & 2]	Dunedin Background Soil Concentrations (mg/kg) [3]
Sample Depth	m bgl	0.25 - 1.5	0.2 - 2.2	1.0 - 2.4	5.0 - 6.0	6.0 -7.5	0.0 - 1.0	9.0 - 10.5		
Test Pit		**TP30**	**TP33**	**TP34**	**BH03**		**BH04**			
Sample Name		RRPPTP30	RRPPTP33	RRPPTP34	RRPPBH03	RRPPBH03	RRPPBH04	RRPPBH04		
Sample Date		01-10-21	01-10-21	01-10-21	29-09-21	29-09-21	29-09-21	29-09-21		
Heavy Metals										
Arsenic	mg/kg	6.0	6.7	6.3	19.2	7.2	7.5	5.4	**70** [1]	11.77
Cadmium	mg/kg	0.44	0.23	0.889	0.700	0.089	2.21	0.083	**1,300** [1]	0.34
Chromium [4]	mg/kg	92.7	48.3	54.2	63.3	26.0	61.0	23.8	**6,300** [1]	80.15
Copper	mg/kg	41.7	517	422	84.2	9.63	86.5	9.90	**>10,000** [1]	60.85
Lead	mg/kg	274	604	620	192	7.89	342	29.9	**3,300** [1]	44.34
Mercury	mg/kg	0.12	0.070	0.15	0.44	<0.025	0.14	0.026	**4,200** [1]	-
Nickel	mg/kg	52.6	31.7	68.8	44.6	14.6	50.5	14.2	**6,000** [2]	44.96
Zinc	mg/kg	251	175	680	658	45.0	313	253	**400,000** [2]	182.8

Notes:

Values shaded grey exceed the NESCS SCSs for Protection of Human Health (Commercial / Industrial land use)

Red Text exceed the adopted Dunedin Background Soil Concentrations (mg/kg)

All units are in mg/kg

m bgl - metres below ground level

References

1. Ministry for the Environment (2011). Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 (NESCS).
2. National Environment Protection Council (1999, revised 2013) National Environment Protection (Assessment of Site Contamination) Measure. Table 1A. (NEPM) Health Investigation Levels Commercial / Industrial D.
3. Landcare Research Limited (2006) PBC - Predicted Background Soil Concentrations, New Zealand - fill material (the highest value for each metal from the dominant soil groups surrounding Green Island Landfill) Dunedin , New Zealand
4. NES SCS criteria presented are for Chromium (VI)

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Table 2: Polycyclic Aromatic Hydrocarbons (PAH)

Lab Reference		21-42090-1	21-42090-10	21-42090-24	21-42090-25	21-42090-28	21-42090-30	21-42090-70	21-42090-55	NES SCSs for Commercial/Industrial land use[1]	Background Soil Concentrations, New Zealand [2]
Sample Depth	m bgl	0.15	0.5 - 1.5	0.0 - 0.65	0.65 - 1.5	0.8 - 1.8	0.0 - 0.3	0.2 - 0.8	1.0 - 1.8		
Test Pit		**TP1**	**TP3**	**TP8**		**TP9**	**TP10**	**TP15**	**TP18**		
Sample Name		RRPPTP01	RRPPTP03	RRPPTP08	RRPPTP08	RRPPTP09	RRPPTP10	RRPPTP15	RRPPTP18		
Soil Type		Silty Sand	Landfill Waste	Sandy Gravel	Landfill Waste	Landfill Waste	Sandy Gravel	Sandy Silt	Sandy Gravel	(mg/kg)	(mg/kg)
Sample Date		27-09-21	28-09-21	28-09-21	28-09-21	29-09-21	29-09-21	30-09-21	29-09-21		
Polycyclic Aromatic Hydrocarbons (PAH)											
Acenaphthene	mg/kg	<0.010	0.21	0.34	0.16	0.082	0.012	<0.010	0.045	-	0.055
Acenaphthylene	mg/kg	0.23	0.69	1.4	0.36	0.15	0.14	<0.010	0.12	-	0.069
Anthracene	mg/kg	0.23	1.7	4.1	0.99	0.25	0.11	<0.010	0.29	-	0.113
Benz[a]anthracene	mg/kg	0.96	3.0	5.1	1.8	0.58	0.45	<0.020	0.54	#	0.47
Benzo[a]pyrene	mg/kg	1.5	2.1	4.1	1.6	0.51	0.45	<0.010	0.41	#	0.595
Benzo[b]&[j] fluoranthene	mg/kg	1.3	2.5	4.5	1.9	0.59	0.59	<0.020	0.49	#	0.947
Benzo[g,h,i]perylene	mg/kg	0.75	1.1	2.6	1.1	0.36	0.39	<0.020	0.25	-	0.459
Benzo[k]fluoranthene	mg/kg	0.46	0.99	1.9	0.75	0.24	0.21	<0.010	0.19	#	0.296
Chrysene	mg/kg	0.75	2.9	4.9	1.7	0.62	0.50	<0.010	0.55	#	0.539
Dibenz(a,h)anthracene	mg/kg	0.27	0.31	0.64	0.26	0.090	0.083	<0.010	0.068	#	0.112
Fluoranthene	mg/kg	1.6	6.7	16	3.8	1.1	0.72	<0.020	1.0	#	1.345
Fluorene	mg/kg	0.033	0.52	2.7	0.57	0.13	0.029	<0.010	0.15	-	0.06
Indeno(1,2,3-cd)pyrene	mg/kg	1.1	1.3	2.9	1.2	0.37	0.39	<0.010	0.28	#	0.385
Naphthalene	mg/kg	0.037	1.1	0.18	0.95	0.29	0.15	<0.010	0.022	-	0.029
Phenanthrene	mg/kg	0.41	5.1	18	4.5	0.92	0.29	<0.010	0.76	-	0.703
Pyrene	mg/kg	1.7	5.7	13	3.4	1.0	0.73	<0.020	0.92	-	1.362
Benzo[a]pyrene TEQ [3]	mg/kg	2.2	3.3	6.4	2.4	0.80	0.71	0.030	0.64	**35**	0.922

Lab Reference		21-42090-89	21-42090-78	21-42090-99	21-42090-109	21-42090-111	21-42090-115	21-42090-79		NES SCSs for Commercial/Industrial land use [1]	Background Soil Concentrations, New Zealand [2]
Sample Depth	m bgl	0.2 - 1.3	0.5 - 1.7	0.2 - 2.3	0.25 - 1.5	0.2 - 2.2	1.0 - 2.4	0.0 - 1.0			
Test Pit		**TP21**	**TP25**	**TP28**	**TP30**	**TP33**	**TP34**	**BH02**			
Sample Name		RRPPTP21	RRPPTP25	RRPPTP28	RRPPTP30	RRPPTP33	RRPPTP34	RRPPBH02			
Soil Type		Gravelly Sand	Landfill Waste	Landfill Waste	Landfill Waste	Landfill Waste	Landfill Waste	Sandy Silt		(mg/kg)	(mg/kg)
Sample Date		30-09-21	30-09-21	01-10-21	01-10-21	01-10-21	01-10-21	30-09-21			
Polycyclic Aromatic Hydrocarbons (PAH)											
Acenaphthene	mg/kg	0.059	0.054	0.47	0.67	0.84	0.31	<0.010		-	0.055
Acenaphthylene	mg/kg	0.32	0.070	0.47	0.32	0.20	0.21	<0.010		-	0.069
Anthracene	mg/kg	0.36	0.12	2.7	1.2	1.1	0.84	<0.010		-	0.113
Benz[a]anthracene	mg/kg	1.4	0.29	5.1	1.6	1.2	1.2	<0.020		#	0.47
Benzo[a]pyrene	mg/kg	1.2	0.27	4.2	1.3	0.84	0.99	<0.010		#	0.595
Benzo[b]&[j] fluoranthene	mg/kg	1.5	0.35	4.6	1.6	1.0	1.2	<0.020		#	0.947
Benzo[g,h,i]perylene	mg/kg	0.92	0.20	2.6	0.88	0.52	0.67	<0.020		-	0.459
Benzo[k]fluoranthene	mg/kg	0.58	0.12	1.7	0.59	0.40	0.49	<0.010		#	0.296
Chrysene	mg/kg	1.4	0.36	5.2	1.6	1.1	1.2	<0.010		#	0.539
Dibenz(a,h)anthracene	mg/kg	0.21	0.050	0.65	0.21	0.13	0.16	<0.010		#	0.112
Fluoranthene	mg/kg	2.7	0.80	14	4.5	3.4	3.0	<0.020		#	1.345
Fluorene	mg/kg	0.093	0.10	1.4	1.0	0.96	0.61	<0.010		-	0.06
Indeno(1,2,3-cd)pyrene	mg/kg	0.97	0.21	2.7	0.97	0.56	0.76	<0.010		#	0.385
Naphthalene	mg/kg	0.022	0.18	0.44	0.62	1.6	0.38	<0.010		-	0.029
Phenanthrene	mg/kg	1.1	0.56	12	4.4	4.5	3.3	<0.010		-	0.703
Pyrene	mg/kg	2.5	0.61	14	3.7	2.9	2.5	<0.020		-	1.362
Benzo[a]pyrene TEQ [3]	mg/kg	1.9	0.43	6.4	2.1	1.3	1.6	0.030		**35**	0.922

Notes:

Values shaded grey exceed the NESCS SCSs for Protection of Human Health (Commercial / Industrial land use)

Red text exceed the ECan Background Concentrations of PAHs in Christchurch Urban Soils guideline values

Values shaded according according to the highest exceedance

All units are in mg/kg

m bgl - metres below ground level

A hyphen (-) indicates criterion not available or sample not anlaysed for this analyte

< - reported at a concentration less than the laboratory limit of reporting (LOR)

# indicates criteria for these compounds are addressed using the Benzo(a)pyrene equivalence calculations provided in the NES SCS (refer to Note 1 & Note 6).

References

1. Ministry for the Environment (2011). Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 (NESCS).
2. Environment Canterbury (2007). Background Concentrations of polycyclic aromatic hydrocarbons in Christchurch urban soils. Report No. R07/19. Table 9.

Green Island RRPP
Soil Analytical Results September and October 2021
Table 3: Total Petroleum Hydrocarbons (TPH)

Sample ID		21-42090-7	21-42090-22	21-42090-50	21-42090-52	21-42090-61	21-42090-94	Guidelines for Hydrocarbon Contamination - Commercial/industrial - All Pathways - Sand (<1m) (mg/kg) [1]	Guidelines for Hydrocarbon Contamination - Commercial/industrial - All Pathways - Sand (1-4m) (mg/kg) [1]	Guidelines for Hydrocarbon Contamination - Commercial/industrial - All Pathways - Sandy Silt (<1m) (mg/kg) [1]
Sample Depth	m bgl	1.2 - 2.2	0.3 - 1.2	0.3 - 1.0	0.3 - 1.0	0.7 - 1.5	1.1 - 2.2			
Test Pit		**TP2**	**TP7**	**TP14**	**TP14-DUP**	**TP20**	**TP23**			
Sample Name		RRPPTP02	RRPPTP07	RRPPTP14	RRPPTP14	RRPPTP20	RRPPTP23			
Soil Type		SAND	SAND	Sandy Silt	Sandy Silt	SAND	SAND			
Sample Date		28-09-21	28-09-21	29-09-21	29-09-21	30-09-21	01-10-21			
Total Petroleum Hydrocarbons (TPH)										
C7-C9	mg/kg	32	<10	<10	<10	<10	<10	**120** [(m)]	**120** [(m)]	**(500)** [(2, m)]
C10-C14	mg/kg	304	59	<15	<15	66	46	**(1,500)** [(2, x)]	**(1,900)** [(2,x)]	**(1,700)** [(2, x)]
C15-C36	mg/kg	2,781	1,616	197	<25	1,340	997	**NA**	**NA**	**NA**
C7-C36 (Total)	mg/kg	3,117	1,675	197	<50	1,407	1,043	-	-	-

Notes:

All units are in mg/kg

m bgl - metres below ground level

A hyphen (-) indicates criterion not available or sample not anlaysed for this analyte

< - reported at a concentration less than the laboratory limit of reporting (LOR)

Limiting pathways: (m) = Maintenance/Excavation , (2) = Brackets denote values exceed threshold likely to correspond to formation of residual separate phasehydrocarbons, (x) = PAH surrogate

NA - indicates estimated criterion exceeds 20,000 mg/kg. At 20,000 mg/kg residual separate phase is expected to have formed in soil matrix. Some aesthetic impact may be noted.

References

1. Ministry for the Environment (2011) Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand. Module 4 - Tier 1 Soil screening criteria. Table 4.14. Commercial / Industrial land use.

Green Island RRPP
Soil Analytical Results September and October 2021
Table 4: Semivolatile Organic Compounds in Soil

Lab Reference		21-42090-61	21-42090-94	NESCS SCSs[1] for Commercial/Industrial land use (mg/kg)	Background Soil Concentrations, New Zealand [4,5,6] (mg/kg)
Sample Depth	m bgl	0.7 - 1.5	1.1 - 2.2		
Test Pit		**TP20**	**TP23**		
Sample Name		RRPPTP20	RRPPTP23		
Sample Date		30-09-21	01-10-21		
Semi volatile organic compounds (SVOCs)					
Naphthalene	mg/kg	2.4	2.0	-	0.029 [5]
2-Methylnaphthalene	mg/kg	1.2	0.95	-	-
Acenaphthene	mg/kg	2.2	1.7	-	0.055 [5]
Acenaphthylene	mg/kg	0.57	0.54	-	0.069 [5]
Fluorene	mg/kg	2.7	2.1	-	0.06 [5]
Phenanthrene	mg/kg	10	8.0	-	0.703 [5]
Anthracene	mg/kg	3.8	3.0	-	0.113 [5]
Fluoranthene	mg/kg	11	9.4	#	1.345 [5]
Benzo[a]anthracene	mg/kg	4.4	4.1	#	0.47 [5]
Chrysene	mg/kg	2.9	2.8	#	0.539 [5]
Benzo[b and j]fluoranthene	mg/kg	4.3	3.9	#	0.947 [5]
Benzo[k]fluoranthene	mg/kg	1.6	1.5	#	0.296 [5]
Benzo[a]pyrene	mg/kg	3.8	3.5	#	0.595 [5]
Indeno(1,2,3-c,d)pyrene	mg/kg	2.1	2.0	#	0.385 [5]
Dibenzo[a,h]anthracene	mg/kg	0.41	0.41	#	0.112 [5]
Benzo[g,h,i]perylene	mg/kg	1.4	1.3	-	0.459 [5]
Pyrene	mg/kg	8.6	7.5	-	1.362 [5]
Benzo[a]pyrene TEQ (LOR) [2]	mg/kg	5.6	-	35 [1]	0.922 [5]
4,4'-DDD	mg/kg	<0.30	<0.30	-	0.00471 [4]
4,4'-DDE	mg/kg	<0.30	<0.30	-	0.0229 [4]
4,4'-DDT	mg/kg	<0.50	<0.50	1,000 [1]	0.0236 [6]
Bis(2-ethylhexyl) phthalate	mg/kg	0.72	0.61	-	-
Dibenzofuran	mg/kg	1.6	1.2	1,000 [3]	-

Notes:

Values shaded grey exceed the NESCS SCSs for Protection of Human Health (Commercial / Industrial land use)

Red text indicates values exceeds the adopted background concentration value

mg/kg - miligrams per kilogram

m bgl - metres below ground level

A hyphen (-) indicates criterion not available for this analyte

< - reported at a concentration less than the laboratory limit of reporting (LOR)

References:

1. Resource Management (National Environmental Standard for Assessing and Managing Contaminants in Soil to Protect Human Health) Regulations 2011 (NESCS). Soil contaminant standa
2. Benzo(a)pyrene equivalent concentration calculated as the sum of the carcinogenic PAHs in accordance with the methodology published in the NESCS.
3. US EPA Superfund EGV (June, 2013)
4. Ministry for the Environment (1998). Ambient concentrations of selected organochlorines in soils. Table F3 - mean values.
5. Environment Canterbury (2007). Background Concentrations of polycyclic aromatic hydrocarbons in Christchurch urban soils. Report No. R07/19. Table 9.
6. Landcare Research Limited (2015) Background soil concentrations of selected trace elements and organic contaminants in New Zealand . Table 21. Christchurch Soils.

Green Island RRPP
Soil Analytical Results September and October 2021
Table 5: Semi - Quantitative Asbestos Fines in Soil

Laboratory ID		21-41886-10	21-41886-25	21-41886-37	21-41886-61	21-41886-99	21-41886-79	21-41886-46	BRANZ [1] - Guideline Values Commercial / Industrial
GHD Sample Reference		RRPPTP03	RRPPTP08	RRPPTP12	RRPPTP20	RRPPTP28	RRPPBH02	RRPPBH04	
Sample Date		28-09-21	28-09-21	29-09-21	30-09-21	01-10-21	30-09-21	29-09-21	
Depth (m bgl)		0.5 - 1.5	0.65 - 1.5	0.7 - 1.7	0.7 - 1.5	0.2 - 2.3	0.0 - 1.0	3.0 - 4.0	
Sample Type		Soil	Soil	Soil	Soil	Soil	Soil	Soil	% w/w
Borehole number									
Asbestos weight (g)	>10mm fraction	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	
	2-10mm fraction	Fibre bundle	No asbestos detected	No asbestos detected	No asbestos detected	Fibre bundle	No asbestos detected	No asbestos detected	
	<2mm fraction	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	
W/W asbestos %	ACM	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		**0.05**
	AF/FA	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001		**0.001**
Asbestos type		**Chrysotile (White Asbestos)** Organic Fibres	Synthetic Mineral Fibres Organic Fibres Asbestos **NOT** Detected.	Synthetic Mineral Fibres Organic Fibres Asbestos **NOT** Detected.	Organic Fibres, Asbestos **NOT** Detected.	**Chrysotile (White Asbestos)** Organic Fibres	Organic Fibres, Asbestos **NOT** Detected.	Organic Fibres, Asbestos **NOT** Detected.	

Notes:
Peach shading indicates that asbestos was found present but at concentrations less than the guideline value
Blue shading indicates asbestos present at concentrations above the adopted BRANZ guideline values

Reference:
1. BRANZ (2017) New Zealand Guidelines for Assessing and Managing Asbestos in Soil. Table 5 - Commercial / Industrial guideline values

Appendix E

Laboratory Reports

Analytica Laboratories Limited
186 Macandrew Road
South Dunedin
sales@analytica.co.nz
www.analytica.co.nz

Certificate of Analysis

GHD Ltd
Level 1, Bing Harris Building, 286 Princess Street, Dunedin
Dunedin 9016
Attention: Cecilia Gately
Phone: 03 479 9494
Email: cecilia.gately@ghd.com

Lab Reference: 21-41886
Submitted by: Hayden Erasmus
Date Received: 05/10/2021
Testing Initiated: 6/10/2021
Date Completed: 7/10/2021
Order Number: 12547621
Reference:

Sampling Site: Green Island Landfill
Description of Work: Soils - Green Island Landfill

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.
Specific testing dates are available on request.

The <2 mm fraction for samples 37 and 46 were below the recommended weight.

Asbestos in Soil (Semi-Quantitative)

Sample Details

Laboratory ID	Client Sample ID	Sample Location	Sample Description	Date Sampled	Date Analysed
21-41886-10	RRPPTP03 0.5-1.5		Soil	28/09/2021	07/10/2021
21-41886-25	RRPPTP08 0.65-1.5		Soil	28/09/2021	07/10/2021
21-41886-37	RRPPTP12 0.7-1.7		Soil	29/09/2021	07/10/2021
21-41886-46	RRPPBH04 3-4		Soil	29/09/2021	07/10/2021
21-41886-61	RRPPTP20 0.7-1.5		Soil	30/09/2021	07/10/2021
21-41886-79	RRPPBH02 0-1		Soil	30/09/2021	07/10/2021
21-41886-99	RRPPTP28 0.2-2.3		Soil	01/10/2021	07/10/2021

Information in the above table supplied by the client: Client Sample ID, Sample Location, Date Sampled

Analysis Results (Summary)

Laboratory ID	Client Sample ID	Asbestos	Sample Weight as Received	Moisture Content	Trace Asbestos (Presence / Absence)	Asbestos (Presence / Absence)
	Units		g	%		
21-41886-10	RRPPTP03 0.5-1.5	Chrysotile (White Asbestos) Organic Fibres	578.5	22.8	Absent	Present
21-41886-25	RRPPTP08 0.65-1.5	Synthetic Mineral Fibres Organic Fibres Asbestos NOT Detected.	488.5	27.3	Absent	Absent
21-41886-37	RRPPTP12 0.7-1.7	Synthetic Mineral Fibres Organic Fibres Asbestos NOT Detected.	626.0	47.5	Absent	Absent
21-41886-46	RRPPBH04 3-4	Organic Fibres Asbestos NOT Detected.	311.5	49.6	Absent	Absent
21-41886-61	RRPPTP20 0.7-1.5	Organic Fibres Asbestos NOT Detected.	833.5	10.2	Absent	Absent

Analysis Results (Summary)

Laboratory ID	Client Sample ID	Asbestos	Sample Weight as Received	Moisture Content	Trace Asbestos (Presence / Absence)	Asbestos (Presence / Absence)
Units			g	%		
21-41886-79	RRPPBH02 0-1	Organic Fibres Asbestos NOT Detected.	626.5	19.1	Absent	Absent
21-41886-99	RRPPTP28 0.2-2.3	Chrysotile (White Asbestos) Organic Fibres	612.5	31.9	Absent	Present

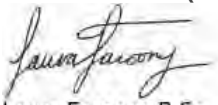
Information in the above table supplied by the client: Client Sample ID

Analysis Results (Size Fraction Breakdown)

Laboratory ID	Client Sample ID	Fraction Size	Fraction Weight*	AF/FA Weight*	ACM Weight*	ACM Content*	Asbestos Matrix	Asbestos Weight*	W/W% Asbestos*
Units *Reporting Limit*			g 0	g 0	g 0	%		g 0	
21-41886-10	RRPPTP03 0.5-1.5	>10mm	109.50	0.0000	0.0000	0	No Asbestos Detected	0.0000	<0.001 (ACM) <0.001 (AF/FA)
		2-10mm	184.00	0.0000	-	-	Fibre Bundle	0.0000	
		<2mm	153.00	0.0000	-	-	No Asbestos Detected	0.0000	
21-41886-25	RRPPTP08 0.65-1.5	>10mm	72.50	0.0000	0.0000	0	No Asbestos Detected	0.0000	<0.001 (ACM) <0.001 (AF/FA)
		2-10mm	152.00	0.0000	-	-	No Asbestos Detected	0.0000	
		<2mm	130.50	0.0000	-	-	No Asbestos Detected	0.0000	
21-41886-37	RRPPTP12 0.7-1.7	>10mm	107.00	0.0000	0.0000	0	No Asbestos Detected	0.0000	<0.001 (ACM) <0.001 (AF/FA)
		2-10mm	133.00	0.0000	-	-	No Asbestos Detected	0.0000	
		<2mm	88.50	0.0000	-	-	No Asbestos Detected	0.0000	
21-41886-46	RRPPBH04 3-4	>10mm	62.00	0.0000	0.0000	0	No Asbestos Detected	0.0000	<0.001 (ACM) <0.001 (AF/FA)
		2-10mm	60.50	0.0000	-	-	No Asbestos Detected	0.0000	
		<2mm	34.50	0.0000	-	-	No Asbestos Detected	0.0000	
21-41886-61	RRPPTP20 0.7-1.5	>10mm	115.00	0.0000	0.0000	0	No Asbestos Detected	0.0000	<0.001 (ACM) <0.001 (AF/FA)
		2-10mm	398.00	0.0000	-	-	No Asbestos Detected	0.0000	
		<2mm	235.50	0.0000	-	-	No Asbestos Detected	0.0000	
21-41886-79	RRPPBH02 0-1	>10mm	152.00	0.0000	0.0000	0	No Asbestos Detected	0.0000	<0.001 (ACM) <0.001 (AF/FA)
		2-10mm	224.00	0.0000	-	-	No Asbestos Detected	0.0000	
		<2mm	131.00	0.0000	-	-	No Asbestos Detected	0.0000	
21-41886-99	RRPPTP28 0.2-2.3	>10mm	101.00	0.0000	0.0000	0	No Asbestos Detected	0.0000	<0.001 (ACM) <0.001 (AF/FA)
		2-10mm	174.00	0.0000	-	-	Fibre Bundle	0.0000	
		<2mm	142.00	0.0000	-	-	No Asbestos Detected	0.0000	

Information in the above table supplied by the client: Client Sample ID

Asbestos in Soil (Semi-Quantitative) Approver:



Laura Facoory, B.Sc.
Laboratory Technician

Method Summary

Asbestos Fibres in Soil (Semi-Quantitative)	Sample analysis was performed using polarised light microscopy with dispersion staining in accordance with AS4964-2004 Method for the qualitative identification of asbestos in soil samples. Note 1: The reporting limit for this analysis is 0.1g/kg (0.01%) by application of polarised light microscopy, dispersion staining and trace analysis techniques. Note 2: Trace asbestos is indicative that freely liberated respirable fibres are present and dust control measures should be implemented or increased on site. This is not the sole indicator for the friable nature of the asbestos present. Note 3: If mineral fibres of unknown type are detected, by PLM and dispersion staining, these may or may not be asbestos fibres. To confirm the identity of this fibre, another independent analytical technique such as XRD analysis is advised. Note 4: The laboratory does not take responsibility for the sampling procedure or accuracy of sample location description.

Analytica Laboratories Limited
186 Macandrew Road
South Dunedin
sales@analytica.co.nz
www.analytica.co.nz

Certificate of Analysis

GHD Ltd
Level 1, Bing Harris Building, 286 Princess Street, Dunedin
Dunedin 9016
Attention: Cecilia Gately
Phone: 03 479 9494
Email: cecilia.gately@ghd.com

Lab Reference: 21-41886
Submitted by: Hayden Erasmus
Date Received: 05/10/2021
Testing Initiated: 6/10/2021
Date Completed: 7/10/2021
Order Number: 12547621
Reference:

Sampling Site: Green Island Landfill
Description of Work: Soils - Green Island Landfill

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.
Specific testing dates are available on request.

AMENDED REPORT. This report replaces in full a previous version 21-41886(17)-[R00] sent on 06/10/2021. Sample ID has been amended as requested by the client.

Asbestos Fibres in Bulk (Qualitative)

Sample Details

Laboratory ID	Client Sample ID	Sample Location	Sample Description	Date Sampled	Date Analysed
21-41886-17	RRPPTP05 1.2a		Bulk Materials (120 x 130 x 10 mm)	28/09/2021	06/10/2021

Information in the above table supplied by the client: Client Sample ID, Sample Location, Date Sampled.

Analysis Results

Laboratory ID	Client Sample ID	Sample Layers	Fibre Types	Asbestos (Present / Absent)
21-41886-17	RRPPTP05 1.2a	L1 - Surface Debris L2 - Wool	Organic Fibres Asbestos NOT Detected.	Absent

Information in the above table supplied by the client: Client Sample ID.

Asbestos Fibres in Bulk (Qualitative) Approver:

Emma Kirk, NZCS.
Dunedin Lab Coordinator

Method Summary

Asbestos Fibres in Bulk Materials (Qualitative)	Sample analysis was performed using polarised light microscopy with dispersion staining in accordance with the guidelines of AS4964-2004 Method for the qualitative identification of asbestos in bulk samples. Note 1: The reporting limit for this analysis is 0.1g/kg (0.01%) by application of polarised light microscopy, dispersion staining and trace analysis techniques. Note 2: If mineral fibres of unknown type are detected, by PLM and dispersion staining, these may or may not be asbestos fibres. To confirm the identity of this fibre, another independent analytical technique such as XRD analysis is advised. Note 3: The laboratory does not take responsibility for the sampling procedure or accuracy of sample location description.

Analytica Laboratories Limited
Ruakura Research Centre
10 Bisley Road
Hamilton 3214, New Zealand
Ph +64 (07) 974 4740
sales@analytica.co.nz
www.analytica.co.nz

Certificate of Analysis

GHD Ltd
Level 1, Bing Harris Building, 286 Princess Street, Dunedin
Dunedin 9016

Attention: Cecilia Gately
Phone: 03 479 9494
Email: hayden.erasmus@ghd.com

Sampling Site: Green Island Landfill

Lab Reference: 21-42090
Submitted by: Hayden Erasmus / Jane Butterfield
Date Received: 06/10/2021
Testing Initiated: 6/10/2021
Date Completed: 13/10/2021
Order Number:
Reference: 12547621

Report Comments

Samples were collected by yourselves (or your agent) and analysed as received at Analytica Laboratories. Samples were in acceptable condition unless otherwise noted on this report.
Specific testing dates are available on request.

Heavy Metals in Soil

			Client Sample ID	RRPPTP01 0.15	RRPPTP02 1.2-2.2	RRPPTP03 0.15	RRPPTP03 0.2-0.5	RRPPTP03 0.5-1.5
			Date Sampled	27/09/2021	28/09/2021	28/09/2021	28/09/2021	28/09/2021
Analyte	Unit	*Reporting Limit*		21-42090-1	21-42090-7	21-42090-8	21-42090-9	21-42090-10
Arsenic	mg/kg dry wt	*0.125*		4.8	17.1	3.0	1.7	18.0
Cadmium	mg/kg dry wt	*0.005*		0.22	1.28	0.20	0.069	0.873
Chromium	mg/kg dry wt	*0.125*		48.5	81.0	58.3	81.4	60.0
Copper	mg/kg dry wt	*0.075*		47.3	769	47.3	40.5	92.9
Lead	mg/kg dry wt	*0.25*		89.9	631	95.8	9.63	557
Mercury	mg/kg dry wt	*0.025*		0.061	0.20	0.042	<0.025	0.13
Nickel	mg/kg dry wt	*0.05*		47.2	58.0	59.3	90.7	80.6
Zinc	mg/kg dry wt	*0.05*		189	962	120	82.2	609

Heavy Metals in Soil

			Client Sample ID	RRPPTP07 0.3-1.2	RRPPTP08 0-0.65	RRPPTP08 0.65-1.5	RRPPTP09 0.8-1.8	RRPPTP10 0-0.3
			Date Sampled	28/09/2021	28/09/2021	28/09/2021	29/09/2021	29/09/2021
Analyte	Unit	*Reporting Limit*		21-42090-22	21-42090-24	21-42090-25	21-42090-28	21-42090-30
Arsenic	mg/kg dry wt	*0.125*		16.2	2.4	26.2	7.3	4.3
Cadmium	mg/kg dry wt	*0.005*		2.38	0.067	1.93	0.25	0.20
Chromium	mg/kg dry wt	*0.125*		69.8	95.3	78.6	36.8	56.9
Copper	mg/kg dry wt	*0.075*		71.6	10.0	307	2,150	73.8
Lead	mg/kg dry wt	*0.25*		363	16.4	922	140	48.0
Mercury	mg/kg dry wt	*0.025*		0.35	<0.025	0.39	0.085	0.063
Nickel	mg/kg dry wt	*0.05*		53.5	72.2	46.7	36.8	60.1
Zinc	mg/kg dry wt	*0.05*		982	29.8	920	233	131

Heavy Metals in Soil

		Client Sample ID	RRPPTP10 1.3-2.4	RRPPBH03 5-6	RRPPBH03 6-7.5	RRPPBH04 0-1	RRPPBH04 9-10.5
		Date Sampled	29/09/2021	29/09/2021	29/09/2021	29/09/2021	29/09/2021
Analyte	Unit	*Reporting Limit*	21-42090-32	21-42090-43	21-42090-44	21-42090-45	21-42090-48
Arsenic	mg/kg dry wt	*0.125*	4.0	19.2	7.2	7.5	5.4
Cadmium	mg/kg dry wt	*0.005*	0.12	0.700	0.089	2.21	0.083
Chromium	mg/kg dry wt	*0.125*	27.2	63.3	26.0	61.0	23.8
Copper	mg/kg dry wt	*0.075*	19.9	84.2	9.63	86.5	9.90
Lead	mg/kg dry wt	*0.25*	60.8	192	7.89	342	29.9
Mercury	mg/kg dry wt	*0.025*	0.035	0.44	<0.025	0.14	0.026
Nickel	mg/kg dry wt	*0.05*	18.9	44.6	14.6	50.5	14.2
Zinc	mg/kg dry wt	*0.05*	112	658	45.0	313	253

Heavy Metals in Soil

		Client Sample ID	RRPPTP14 0.3-1.0	RRPPTP14 1.0-1.2	RRPPTP14-DUP 0.3-1.0	RRPPTP18 1.0-1.8	RRPPTP20 0.7-1.5
		Date Sampled	29/09/2021	29/09/2021	29/09/2021	29/09/2021	30/09/2021
Analyte	Unit	*Reporting Limit*	21-42090-50	21-42090-51	21-42090-52	21-42090-55	21-42090-61
Arsenic	mg/kg dry wt	*0.125*	7.1	5.4	6.8	9.2	7.4
Cadmium	mg/kg dry wt	*0.005*	0.043	0.581	0.022	0.19	0.930
Chromium	mg/kg dry wt	*0.125*	18.3	47.2	21.0	23.3	37.1
Copper	mg/kg dry wt	*0.075*	12.3	53.1	11.6	30.8	76.4
Lead	mg/kg dry wt	*0.25*	23.1	267	16.5	323	487
Mercury	mg/kg dry wt	*0.025*	0.031	0.040	0.038	0.080	0.21
Nickel	mg/kg dry wt	*0.05*	12.8	34.5	9.67	18.8	29.6
Zinc	mg/kg dry wt	*0.05*	50.3	227	34.0	145	411

Heavy Metals in Soil

		Client Sample ID	RRPPTP15 0.2-0.8	RRPPTP15 1.5-2.2	RRPPTP25 0.5-1.7	RRPPTP21 0.2-1.3	RRPPTP21-DUP 0.2-1.3
		Date Sampled	30/09/2021	30/09/2021	30/09/2021	30/09/2021	30/09/2021
Analyte	Unit	*Reporting Limit*	21-42090-70	21-42090-72	21-42090-78	21-42090-89	21-42090-90
Arsenic	mg/kg dry wt	*0.125*	6.9	3.7	19.2	4.5	4.0
Cadmium	mg/kg dry wt	*0.005*	0.033	0.21	1.12	0.34	0.29
Chromium	mg/kg dry wt	*0.125*	20.6	42.5	64.7	45.5	48.2
Copper	mg/kg dry wt	*0.075*	9.39	32.5	166	68.1	68.4
Lead	mg/kg dry wt	*0.25*	19.4	81.4	495	158	148
Mercury	mg/kg dry wt	*0.025*	0.036	0.091	0.34	0.15	0.14
Nickel	mg/kg dry wt	*0.05*	10.8	31.1	66.9	46.1	49.9
Zinc	mg/kg dry wt	*0.05*	45.3	217	781	186	166

Heavy Metals in Soil

		Client Sample ID	RRPPTP28 0.2-2.3	RRPPTP30 0.25-1.5	RRPPTP33 0.2-2.2	RRPPTP34 1-2.4
		Date Sampled	01/10/2021	01/10/2021	01/10/2021	01/10/2021
Analyte	Unit	*Reporting Limit*	21-42090-99	21-42090-109	21-42090-111	21-42090-116
Arsenic	mg/kg dry wt	*0.125*	7.3	6.0	6.7	6.3
Cadmium	mg/kg dry wt	*0.005*	5.01	0.44	0.23	0.889
Chromium	mg/kg dry wt	*0.125*	207	92.7	48.3	54.2
Copper	mg/kg dry wt	*0.075*	71.7	41.7	517	422
Lead	mg/kg dry wt	*0.25*	360	274	604	620
Mercury	mg/kg dry wt	*0.025*	1.5	0.12	0.070	0.15

Heavy Metals in Soil

			Client Sample ID	RRPPTP28 0.2-2.3	RRPPTP30 0.25-1.5	RRPPTP33 0.2-2.2	RRPPTP34 1-2.4
			Date Sampled	01/10/2021	01/10/2021	01/10/2021	01/10/2021
Nickel	mg/kg dry wt	*0.05*		31.5	52.6	31.7	68.8
Zinc	mg/kg dry wt	*0.05*		4,210	251	175	680

Total Petroleum Hydrocarbons - Soil

		Client Sample ID	RRPPTP02 1.2-2.2	RRPPTP07 0.3-1.2	RRPPTP14 0.3-1.0	RRPPTP14-DUP 0.3-1.0	RRPPTP20 0.7-1.5
		Date Sampled	28/09/2021	28/09/2021	29/09/2021	29/09/2021	30/09/2021
Analyte	Unit	*Reporting Limit*	21-42090-7	21-42090-22	21-42090-50	21-42090-52	21-42090-61
C7-C9	mg/kg dry wt	*10*	32	<10	<10	<10	<10
C10-C14	mg/kg dry wt	*15*	304	59	<15	<15	66
C15-C36	mg/kg dry wt	*25*	2,781	1,616	197	<25	1,340
C7-C36 (Total)	mg/kg dry wt	*50*	3,117	1,675	197	<50	1,407

Total Petroleum Hydrocarbons - Soil

		Client Sample ID	RRPPTP23 1.1-2.2
		Date Sampled	01/10/2021
Analyte	Unit	*Reporting Limit*	21-42090-94
C7-C9	mg/kg dry wt	*10*	<10
C10-C14	mg/kg dry wt	*15*	46
C15-C36	mg/kg dry wt	*25*	997
C7-C36 (Total)	mg/kg dry wt	*50*	1,043

Polycyclic Aromatic Hydrocarbons - Soil

		Client Sample ID	RRPPTP01 0.15	RRPPTP03 0.5-1.5	RRPPTP08 0-0.65	RRPPTP08 0.65-1.5	RRPPTP09 0.8-1.8
		Date Sampled	27/09/2021	28/09/2021	28/09/2021	28/09/2021	29/09/2021
Analyte	Unit	*Reporting Limit*	21-42090-1	21-42090-10	21-42090-24	21-42090-25	21-42090-28
1-Methylnaphthalene	mg/kg dry wt	*0.01*	0.019	0.71	0.16	0.36	0.12
2-Methylnaphthalene	mg/kg dry wt	*0.01*	0.025	1.1	0.13	0.50	0.16
Acenaphthene	mg/kg dry wt	*0.01*	<0.010	0.21	0.34	0.16	0.082
Acenaphthylene	mg/kg dry wt	*0.01*	0.23	0.69	1.4	0.36	0.15
Anthracene	mg/kg dry wt	*0.01*	0.23	1.7	4.1	0.99	0.25
Benz[a]anthracene	mg/kg dry wt	*0.02*	0.96	3.0	5.1	1.8	0.58
Benzo[a]pyrene	mg/kg dry wt	*0.01*	1.5	2.1	4.1	1.6	0.51
Benzo[b]&[j] fluoranthene	mg/kg dry wt	*0.02*	1.3	2.5	4.5	1.9	0.59
Benzo[g,h,i]perylene	mg/kg dry wt	*0.02*	0.75	1.1	2.6	1.1	0.36
Benzo[k]fluoranthene	mg/kg dry wt	*0.01*	0.46	0.99	1.9	0.75	0.24
Chrysene	mg/kg dry wt	*0.01*	0.75	2.9	4.9	1.7	0.62
Dibenz(a,h)anthracene	mg/kg dry wt	*0.01*	0.27	0.31	0.64	0.26	0.090
Fluoranthene	mg/kg dry wt	*0.02*	1.6	6.7	16	3.8	1.1
Fluorene	mg/kg dry wt	*0.01*	0.033	0.52	2.7	0.57	0.13
Indeno(1,2,3-cd)pyrene	mg/kg dry wt	*0.01*	1.1	1.3	2.9	1.2	0.37
Naphthalene	mg/kg dry wt	*0.01*	0.037	1.1	0.18	0.95	0.29
Phenanthrene	mg/kg dry wt	*0.01*	0.41	5.1	18	4.5	0.92
Pyrene	mg/kg dry wt	*0.02*	1.7	5.7	13	3.4	1.0
Benzo[a]pyrene TEQ (LOR)	mg/kg dry wt	*0.03*	2.2	3.3	6.4	2.4	0.80
Benzo[a]pyrene TEQ (Zero)	mg/kg dry wt	*0.01*	2.2	3.3	6.4	2.4	0.80

Polycyclic Aromatic Hydrocarbons - Soil

			Client Sample ID	RRPPTP01 0.15	RRPPTP03 0.5-1.5	RRPPTP08 0-0.65	RRPPTP08 0.65-1.5	RRPPTP09 0.8-1.8
			Date Sampled	27/09/2021	28/09/2021	28/09/2021	28/09/2021	29/09/2021
Anthracene-d10 (Surrogate)	%	*1*		110	96	92	94	95

Polycyclic Aromatic Hydrocarbons - Soil

			Client Sample ID	RRPPTP10 0-0.3	RRPPTP18 1.0-1.8	RRPPTP15 0.2-0.8	RRPPTP25 0.5-1.7	RRPPBH02 0-1
			Date Sampled	29/09/2021	29/09/2021	30/09/2021	30/09/2021	30/09/2021
Analyte	Unit	*Reporting Limit*		21-42090-30	21-42090-55	21-42090-70	21-42090-78	21-42090-79
1-Methylnaphthalene	mg/kg dry wt	*0.01*		0.024	0.026	<0.010	0.083	<0.010
2-Methylnaphthalene	mg/kg dry wt	*0.01*		0.032	0.019	<0.010	0.088	<0.010
Acenaphthene	mg/kg dry wt	*0.01*		0.012	0.045	<0.010	0.054	<0.010
Acenaphthylene	mg/kg dry wt	*0.01*		0.14	0.12	<0.010	0.070	<0.010
Anthracene	mg/kg dry wt	*0.01*		0.11	0.29	<0.010	0.12	<0.010
Benz[a]anthracene	mg/kg dry wt	*0.02*		0.45	0.54	<0.020	0.29	<0.020
Benzo[a]pyrene	mg/kg dry wt	*0.01*		0.45	0.41	<0.010	0.27	<0.010
Benzo[b]&[j] fluoranthene	mg/kg dry wt	*0.02*		0.59	0.49	<0.020	0.35	<0.020
Benzo[g,h,i]perylene	mg/kg dry wt	*0.02*		0.39	0.25	<0.020	0.20	<0.020
Benzo[k]fluoranthene	mg/kg dry wt	*0.01*		0.21	0.19	<0.010	0.12	<0.010
Chrysene	mg/kg dry wt	*0.01*		0.50	0.55	<0.010	0.36	<0.010
Dibenz(a,h)anthracene	mg/kg dry wt	*0.01*		0.083	0.068	<0.010	0.050	<0.010
Fluoranthene	mg/kg dry wt	*0.02*		0.72	1.0	<0.020	0.80	<0.020
Fluorene	mg/kg dry wt	*0.01*		0.029	0.15	<0.010	0.10	<0.010
Indeno(1,2,3-cd)pyrene	mg/kg dry wt	*0.01*		0.39	0.28	<0.010	0.21	<0.010
Naphthalene	mg/kg dry wt	*0.01*		0.15	0.022	<0.010	0.18	<0.010
Phenanthrene	mg/kg dry wt	*0.01*		0.29	0.76	<0.010	0.56	<0.010
Pyrene	mg/kg dry wt	*0.02*		0.73	0.92	<0.020	0.61	<0.020
Benzo[a]pyrene TEQ (LOR)	mg/kg dry wt	*0.03*		0.71	0.64	0.030	0.43	0.030
Benzo[a]pyrene TEQ (Zero)	mg/kg dry wt	*0.01*		0.71	0.64	<0.010	0.43	<0.010
Anthracene-d10 (Surrogate)	%	*1*		100	97	110	97	110

Polycyclic Aromatic Hydrocarbons - Soil

			Client Sample ID	RRPPTP21 0.2-1.3	RRPPTP28 0.2-2.3	RRPPTP30 0.25-1.5	RRPPTP33 0.2-2.2	RRPPTP34 1-2.4
			Date Sampled	30/09/2021	01/10/2021	01/10/2021	01/10/2021	01/10/2021
Analyte	Unit	*Reporting Limit*		21-42090-89	21-42090-99	21-42090-109	21-42090-111	21-42090-116
1-Methylnaphthalene	mg/kg dry wt	*0.01*		0.013	0.23	0.33	0.48	0.23
2-Methylnaphthalene	mg/kg dry wt	*0.01*		0.013	0.20	0.24	0.58	0.25
Acenaphthene	mg/kg dry wt	*0.01*		0.059	0.47	0.67	0.84	0.31
Acenaphthylene	mg/kg dry wt	*0.01*		0.32	0.47	0.32	0.20	0.21
Anthracene	mg/kg dry wt	*0.01*		0.36	2.7	1.2	1.1	0.84
Benz[a]anthracene	mg/kg dry wt	*0.02*		1.4	5.1	1.6	1.2	1.2
Benzo[a]pyrene	mg/kg dry wt	*0.01*		1.2	4.2	1.3	0.84	0.99
Benzo[b]&[j] fluoranthene	mg/kg dry wt	*0.02*		1.5	4.6	1.6	1.0	1.2
Benzo[g,h,i]perylene	mg/kg dry wt	*0.02*		0.92	2.6	0.88	0.52	0.67
Benzo[k]fluoranthene	mg/kg dry wt	*0.01*		0.58	1.7	0.59	0.40	0.49
Chrysene	mg/kg dry wt	*0.01*		1.4	5.2	1.6	1.1	1.2
Dibenz(a,h)anthracene	mg/kg dry wt	*0.01*		0.21	0.65	0.21	0.13	0.16
Fluoranthene	mg/kg dry wt	*0.02*		2.7	14	4.5	3.4	3.0

Polycyclic Aromatic Hydrocarbons - Soil

			Client Sample ID	RRPPTP21 0.2-1.3	RRPPTP28 0.2-2.3	RRPPTP30 0.25-1.5	RRPPTP33 0.2-2.2	RRPPTP34 1-2.4
			Date Sampled	30/09/2021	01/10/2021	01/10/2021	01/10/2021	01/10/2021
Fluorene	mg/kg dry wt	*0.01*		0.093	1.4	1.0	0.96	0.61
Indeno(1,2,3-cd)pyrene	mg/kg dry wt	*0.01*		0.97	2.7	0.97	0.56	0.76
Naphthalene	mg/kg dry wt	*0.01*		0.022	0.44	0.62	1.6	0.38
Phenanthrene	mg/kg dry wt	*0.01*		1.1	12	4.4	4.5	3.3
Pyrene	mg/kg dry wt	*0.02*		2.5	14	3.7	2.9	2.5
Benzo[a]pyrene TEQ (LOR)	mg/kg dry wt	*0.03*		1.9	6.4	2.1	1.3	1.6
Benzo[a]pyrene TEQ (Zero)	mg/kg dry wt	*0.01*		1.9	6.4	2.1	1.3	1.6
Anthracene-d10 (Surrogate)	%	*1*		99	93	95	98	96

Semivolatile Organic Compounds - Soil

			Client Sample ID	RRPPTP20 0.7-1.5	RRPPTP23 1.1-2.2
			Date Sampled	30/09/2021	01/10/2021
Analyte	Unit	*Reporting Limit*		21-42090-61	21-42090-94
Phenol	mg/kg dry wt	*0.3*		<0.30	<0.30
2-Chlorophenol	mg/kg dry wt	*0.3*		<0.30	<0.30
2-Methylphenol	mg/kg dry wt	*0.3*		<0.30	<0.30
2-Nitrophenol	mg/kg dry wt	*1.0*		<1.0	<1.0
2,4-Dimethylphenol	mg/kg dry wt	*0.3*		<0.30	<0.30
2,4-Dichlorophenol	mg/kg dry wt	*0.3*		<0.30	<0.30
2,6-Dichlorophenol	mg/kg dry wt	*0.3*		<0.30	<0.30
4-Chloro-3-methylphenol	mg/kg dry wt	*0.3*		<0.30	<0.30
2,4,5-Trichlorophenol	mg/kg dry wt	*5*		<5.0	<5.0
2,4,6-Trichlorophenol	mg/kg dry wt	*5*		<5.0	<5.0
2,3,4,6-Tetrachlorophenol	mg/kg dry wt	*5*		<5.0	<5.0
4-Methylphenol	mg/kg dry wt	*0.3*		<0.30	<0.30
Naphthalene	mg/kg dry wt	*0.1*		2.4	0.13
2-Methylnaphthalene	mg/kg dry wt	*0.1*		1.2	<0.10
2-Chloronaphthalene	mg/kg dry wt	*0.3*		<0.30	<0.30
Acenaphthene	mg/kg dry wt	*0.1*		2.2	<0.10
Acenaphthylene	mg/kg dry wt	*0.1*		0.57	<0.10
Fluorene	mg/kg dry wt	*0.1*		2.7	<0.10
Phenanthrene	mg/kg dry wt	*0.1*		10	0.55
Anthracene	mg/kg dry wt	*0.1*		3.8	0.19
2-Phenylphenol	mg/kg dry wt	*0.5*		<0.50	<0.50
Fluoranthene	mg/kg dry wt	*0.1*		11	1.7
Benzo[a]anthracene	mg/kg dry wt	*0.1*		4.4	0.93
Chrysene	mg/kg dry wt	*0.1*		2.9	0.70
Bis(2-ethylhexyl) adipate	mg/kg dry wt	*0.5*		<0.50	<0.50
Benzo[b and j]fluoranthene	mg/kg dry wt	*0.1*		4.3	1.2
Benzo[k]fluoranthene	mg/kg dry wt	*0.1*		1.6	0.42
Benzo[a]pyrene	mg/kg dry wt	*0.1*		3.8	0.96
Indeno(1,2,3-c,d)pyrene	mg/kg dry wt	*0.1*		2.1	0.65
Dibenzo[a,h]anthracene	mg/kg dry wt	*0.1*		0.41	0.16
Benzo[g,h,i]perylene	mg/kg dry wt	*0.1*		1.4	0.43
Pyrene	mg/kg dry wt	*0.2*		8.6	1.6
Benzo[a]pyrene TEQ (LOR)	mg/kg dry wt	*0.2*		5.6	1.5

Semivolatile Organic Compounds - Soil

			Client Sample ID	RRPPTP20 0.7-1.5	RRPPTP23 1.1-2.2
			Date Sampled	30/09/2021	01/10/2021
Benzo[a]pyrene TEQ (Zero)	mg/kg dry wt	*0.1*		5.6	1.5
4,4'-DDD	mg/kg dry wt	*0.3*		<0.30	<0.30
4,4'-DDE	mg/kg dry wt	*0.3*		<0.30	<0.30
4,4'-DDT	mg/kg dry wt	*0.5*		<0.50	<0.50
alpha-BHC	mg/kg dry wt	*0.3*		<0.30	<0.30
beta-BHC	mg/kg dry wt	*0.3*		<0.30	<0.30
gamma-BHC (Lindane)	mg/kg dry wt	*0.3*		<0.30	<0.30
delta-BHC	mg/kg dry wt	*0.3*		<0.30	<0.30
Aldrin	mg/kg dry wt	*0.3*		<0.30	<0.30
cis-Chlordane	mg/kg dry wt	*0.3*		<0.30	<0.30
trans-Chlordane	mg/kg dry wt	*0.3*		<0.30	<0.30
Dieldrin	mg/kg dry wt	*0.5*		<0.50	<0.50
Endosulfan I	mg/kg dry wt	*0.3*		<0.30	<0.30
Endosulfan II	mg/kg dry wt	*0.5*		<0.50	<0.50
Endosulfan sulfate	mg/kg dry wt	*0.5*		<0.50	<0.50
Endrin	mg/kg dry wt	*0.5*		<0.50	<0.50
Endrin aldehyde	mg/kg dry wt	*0.5*		<0.50	<0.50
Endrin ketone	mg/kg dry wt	*0.5*		<0.50	<0.50
Hexachlorobenzene	mg/kg dry wt	*0.3*		<0.30	<0.30
Heptachlor	mg/kg dry wt	*0.3*		<0.30	<0.30
Heptachlor epoxide	mg/kg dry wt	*0.3*		<0.30	<0.30
Methoxychlor	mg/kg dry wt	*0.5*		<0.50	<0.50
Bis(2-ethylhexyl) phthalate	mg/kg dry wt	*0.5*		0.72	0.77
Butyl benzyl phthalate	mg/kg dry wt	*0.5*		<0.50	<0.50
Di-n-butyl phthalate	mg/kg dry wt	*1*		<1.0	<1.0
Di-n-octyl phthalate	mg/kg dry wt	*0.5*		<0.50	<0.50
Diethyl phthalate	mg/kg dry wt	*0.3*		<0.30	<0.30
Dimethyl phthalate	mg/kg dry wt	*0.3*		<0.30	<0.30
N-Nitrosodiphenylamine	mg/kg dry wt	*0.3*		<0.30	<0.30
N-Nitrosodi-n-propylamine	mg/kg dry wt	*0.3*		<0.30	<0.30
2,4-Dinitrotoluene	mg/kg dry wt	*0.3*		<0.30	<0.30
2,6-Dinitrotoluene	mg/kg dry wt	*0.3*		<0.30	<0.30
Azobenzene	mg/kg dry wt	*0.5*		<0.50	<0.50
Isophorone	mg/kg dry wt	*0.5*		<0.50	<0.50
Nitrobenzene	mg/kg dry wt	*0.3*		<0.30	<0.30
4-Bromophenyl phenyl ether	mg/kg dry wt	*0.3*		<0.30	<0.30
4-Chlorophenyl phenyl ether	mg/kg dry wt	*0.3*		<0.30	<0.30
Bis(2-Chloroethyl) ether	mg/kg dry wt	*0.3*		<0.30	<0.30
Bis(2-Chloro-1-methylethyl) ether	mg/kg dry wt	*0.3*		<0.30	<0.30
Bis(2-Chloroethoxy) methane	mg/kg dry wt	*0.3*		<0.30	<0.30
1,2-Dichlorobenzene	mg/kg dry wt	*0.3*		<0.30	<0.30
1,3-Dichlorobenzene	mg/kg dry wt	*0.3*		<0.30	<0.30
1,4-Dichlorobenzene	mg/kg dry wt	*0.3*		<0.30	<0.30
Hexachlorobutadiene	mg/kg dry wt	*0.3*		<0.30	<0.30
Hexachlorocylopentadiene	mg/kg dry wt	*0.3*		<0.30	<0.30
Hexachloroethane	mg/kg dry wt	*0.3*		<0.30	<0.30
4-Chloroaniline	mg/kg dry wt	*1.0*		<1.0	<1.0
2-Nitroaniline	mg/kg dry wt	*0.3*		<0.30	<0.30

Semivolatile Organic Compounds - Soil

			Client Sample ID	RRPPTP20 0.7-1.5	RRPPTP23 1.1-2.2
			Date Sampled	30/09/2021	01/10/2021
3-Nitroaniline	mg/kg dry wt	*0.5*		<0.50	<0.50
Aniline	mg/kg dry wt	*1.0*		<1.0	<1.0
3,3'-Dichlorobenzidine	mg/kg dry wt	*0.5*		<0.50	<0.50
Dibenzofuran	mg/kg dry wt	*0.3*		1.6	<0.30
Methyl methanesulfonate	mg/kg dry wt	*1.0*		<1.0	<1.0
Ethyl methanesulfonate	mg/kg dry wt	*1*		<1.0	<1.0
Benzyl alcohol	mg/kg dry wt	*1*		<1.0	<1.0
Phenol-d5 (Surrogate)	%	*1*		92	88
2-Fluorophenol (Surrogate)	%	*1*		99	91
2-Fluorobiphenyl (Surrogate)	%	*1*		93	95
2,4,6-Tribromophenol (Surrogate)	%	*1*		97	100
p-Terphenyl-d14 (Surrogate)	%	*1*		110	110
Nitrobenzene-d5 (Surrogate)	%	*1*		96	98

Moisture Content

			Client Sample ID	RRPPTP01 0.15	RRPPTP02 1.2-2.2	RRPPTP03 0.5-1.5	RRPPTP07 0.3-1.2	RRPPTP08 0-0.65
			Date Sampled	27/09/2021	28/09/2021	28/09/2021	28/09/2021	28/09/2021
Analyte	Unit	*Reporting Limit*		21-42090-1	21-42090-7	21-42090-10	21-42090-22	21-42090-24
Moisture Content	%	*1*		26	29	26	25	7

Moisture Content

			Client Sample ID	RRPPTP08 0.65-1.5	RRPPTP09 0.8-1.8	RRPPTP10 0-0.3	RRPPTP14 0.3-1.0	RRPPTP14-DUP 0.3-1.0
			Date Sampled	28/09/2021	29/09/2021	29/09/2021	29/09/2021	29/09/2021
Analyte	Unit	*Reporting Limit*		21-42090-25	21-42090-28	21-42090-30	21-42090-50	21-42090-52
Moisture Content	%	*1*		32	17	12	18	16

Moisture Content

			Client Sample ID	RRPPTP18 1.0-1.8	RRPPTP20 0.7-1.5	RRPPTP15 0.2-0.8	RRPPTP25 0.5-1.7	RRPPBH02 0-1
			Date Sampled	29/09/2021	30/09/2021	30/09/2021	30/09/2021	30/09/2021
Analyte	Unit	*Reporting Limit*		21-42090-55	21-42090-61	21-42090-70	21-42090-78	21-42090-79
Moisture Content	%	*1*		10	12	19	27	19

Moisture Content

			Client Sample ID	RRPPTP21 0.2-1.3	RRPPTP23 1.1-2.2	RRPPTP28 0.2-2.3	RRPPTP30 0.25-1.5	RRPPTP33 0.2-2.2
			Date Sampled	30/09/2021	01/10/2021	01/10/2021	01/10/2021	01/10/2021
Analyte	Unit	*Reporting Limit*		21-42090-89	21-42090-94	21-42090-99	21-42090-109	21-42090-111
Moisture Content	%	*1*		13	28	29	32	22

Moisture Content

		Client Sample ID	RRPPTP34 1-2.4
		Date Sampled	01/10/2021
Analyte	Unit	*Reporting Limit*	21-42090-116
Moisture Content	%	*1*	24

Method Summary

Elements in Soil Samples dried and passed through a 2 mm sieve followed by acid digestion and analysis by ICP-MS. In accordance with in-house procedure based on US EPA method 200.8.

TPH in Soil Solvent extraction, silica cleanup, followed by GC-FID analysis. (C7-C36). (In accordance with in-house procedure based on US EPA 8015).

PAH in Soil Solvent extraction, silica cleanup, followed by GC-MS analysis.
Benzo[a]pyrene TEQ (LOR): The most conservative TEQ estimate, where a result is reported as less than the limit of reporting (LOR) the LOR value is used to calculate the TEQ for that PAH.
Benzo[a]pyrene TEQ (Zero): The least conservative TEQ estimate, PAHs reported as less than the limit of reporting (LOR) are not included in the TEQ calculation.
Benzo[a]pyrene toxic equivalence (TEQ) is calculated according to *'Methodology for Deriving Standards for Contaminants in Soil to Protect Human Health'*. Ministry for the Environment. 2011. (In accordance with in-house procedure).

SVOC in Soil Solvent extraction, followed by GC-MS analysis.(In-house based on US EPA 8270).

Moisture Moisture content is determined gravimetrically by drying at 103 °C.

Sharelle Frank, B.Sc. (Tech)
Technologist

Rong Zhang
Technician

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Appendix D

DRAFT Operations Management Plan

SITE ENVIRONMENTAL MANAGEMENT PLAN

GREEN ISLAND RESOURCE RECOVERY PARK PRECINCT

Draft 2

February 2024

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Appendices

Appendix One Enviro NZ Commitments
Appendix Two Site Plan
Appendix Three Monitoring Procedures
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1 Introduction

Enviro NZ operates Green Island Resource Recovery Plant Precinct (Green Island RRPP) located at 20 Taylor Road, Dunedin, on behalf of the Dunedin City Council (DCC). Enviro NZ is the second-largest waste services company in New Zealand.

Enviro NZ is certified to ISO9001 Quality Management Systems, ISO45001 Occupational Health and Safety Management Systems and ISO14001 Environmental Management Systems at selected branches. Enviro NZ operates under the company's STARS (Stop, Think, Act, Remain Safe) in-house behavioural safety culture programme.

Enviro NZ takes safety, health, environmental and quality matters seriously; we pride ourselves on achieving high standards and believe we are the lead performer in the waste and recycling industry. Performance is driven at all levels from the Board, senior management, middle management, technical specialists and by employees.

The Green Island RRPP receives waste and recycling materials from domestic and business operators. Refuse materials are disposed of appropriately to a consented landfill.

1.1 Purpose of this Plan

The purpose of this document is to incorporate current best practice, the requirements of the consents and any other associated documents in a comprehensive guide for the management of the Green Island RRPP. This plan integrates the various operational and managerial aspects required to manage the transfer station into one document ensuring:

- Resource Consent requirements are met, and able to be internally audited.
- The requirements of Enviro NZ's Business Management System are met and able to be internally audited.
- Any agreed changes to operational practices are recorded and implemented.

1.2 Scope

This Green Island RRPP Site Environmental Management Plan (SEMP) describes the management, operations and responsibilities for ensuring that environmental effects of the refuse transfer station operated by Enviro NZ are controlled and minimised as far as practicable.

The plan has been prepared as a requirement of the Dunedin City Council Conditional Trade Waste Consent Permit Number: *To be inserted* and Otago Regional Council Resource Consent Permit Numbers: *To be inserted*.

1.3 Responsibility

The *Regional Manager Otago and Southland* is responsible for reviewing operations, developing and implementing management systems and providing sufficient resources to ensure compliance and training.

The *Central Otago Branch Manager* is responsible for day-to-day operations, including implementation and enforcement of Enviro NZ's health and safety programme, environmental management, compliance and complaints response.

The *Environmental Advisor* provides technical advice and assistance to the branch as and when required and is responsible for ensuring that annual environmental audits are completed.

The *Environmental Manager* provides technical advice and assistance to the branch as and when required and is responsible for assisting the site with consenting related issues.

One of the site operatives is appointed as *Site Supervisor*. This position deputises in the Branch Manager's absence.

The site will have sufficient staff at all opening times so that the measures set out in this plan can be implemented to ensure full compliance with consent conditions.

1.4 Management Systems

This plan refers to and draws on many parts of Enviro NZ's Business Management System (BMS).

For those persons without access, and who have a genuine need to access policies, procedures or forms, uncontrolled copies will be provided on request.

The BMS contains a range of policies, system and operating procedures, and forms that Enviro NZ uses to operate its business and achieve external certifications. There are four core commitments that EnviroNZ publishes and displays at its sites. These relate to:

- Safety and Health
- Environmental Sustainability
- People
- Quality and Service

A copy of these commitments is included in **Appendix One.**

1.5 Control of this Document

This Site Environmental Management Plan is a controlled document. A hardcopy is kept on site and an electronic copy on the branch's server and the corporate server.

1.6 Review of this Document

This SEMP will be reviewed at least every two years or sooner, to reflect any changes to operations, and a copy submitted to the Otago Regional Council and Dunedin City Council.

When reviewing this document, the following should be considered:

- Records of compliance with the site's resource consents, applicable legislation (refer COR-12-010 Compliance Register) and regional and district plans.

- Any changes to the regulatory environment;
- Changes to operations or processes at the site;
- Records of Management Reviews, Council Review meeting Minutes, Incident reports, Tailgates or Safety and Health Committee meetings, any monitoring results (e.g. odour monitoring, health monitoring, performance monitoring) and any complaints (e.g. service related or environmental effects); and
- Internal and external audit results (health and safety or environmental).

1.7 Compliance with Legislation and Planning Instruments

The Green Island RRPP will at all times comply with legal requirements.

Specific legislation and planning instruments of relevance to the site's operations includes:

- Resource Management Act 1991
- Litter Act 1979
- Health and Safety at Work Act 2015
- Health and Safety at Work (Hazardous Substances) Regulations 2017
- Dunedin City District Plan 2006
- Proposed Second-Generation Dunedin City District Plan (2GP; November 2018)
- Otago Regional Council (Waste Plan, Air Plan and Water Plan)
- Dunedin Trade Waste Bylaw 2020
- Dunedin Solid Waste Bylaw 2002 (Bylaw has now lapsed, no review date)

Enviro NZ's COR-12-010 Compliance Register lists a wide range of legislation, regulation, bylaws, and codes of practice and standards that need to be considered.

1.7.1 RESOURCE CONSENTS

The Operations Manager is responsible for taking such measures as are required to ensure that the site is operated in accordance with all resource consents and plan permissions held for the site at all times. These include:

- Resource Consent No: *to be inserted*, Expires *to be inserted*, Otago Regional Council
    - Discharge of contaminants to air
- Resource Consent No: *to be inserted*, Expires *to be inserted*, Otago Regional Council
    - Diversion and discharge of stormwater

1.7.2 VARIATIONS TO RESOURCE CONSENTS/OBTAINING NEW CONSENTS

Any change in operations could necessitate a variation to the existing consent or a new consent for the site.

There shall be no change in operations which could potentially result in a change in the environmental effects from the site without first consulting the Environmental Advisor or Environmental Manager.

1.7.3 SUMMARY OF EXTERNAL REPORTING REQUIREMENTS

The Green Island RRPP will report to Otago Regional Council and Dunedin City Council as required by the resource consents.

Table 1 Summary of External Reporting Requirements

Report and Regulatory Authority	Person Responsible	Frequency	Comments
Significant increase in discharge of contaminants to air ORC Regional Council	Branch Manager	Immediately	If they may result in adverse effects on the environment beyond the site boundary.
Air quality complaints ORC Regional Council	Branch Manager	Within 24 hours of a complaint	Maintain a log of complaints with detail as required under.
Stormwater ORC Regional Council	Branch Manager	Quarterly	Analysis of parameters from Condition 6.2 of Resource Consent 67401
Trade Waste Dunedin City Council	Branch Manager	Immediately	Any mishap which may alter the quality of the discharge to the extent that a breach may occur.

1.7.4 COUNCIL SITE INSPECTIONS AND ACCESS

The servants or agents of the Dunedin City Council will have access to relevant parts of the Green Island RRPP at all reasonable times. The purpose of these inspections will be to conduct surveys, investigations, tests, measurements or taking samples. Servants or agents of the Dunedin City Council are required to follow the sites health and safety procedures at all times.

1.8 Records and Record Keeping

All records, monitoring, and test results will be kept for a minimum period of 12 months from the date of each entry unless otherwise required by the resource consent.

1.9 Training and Competency

All staff on site at the Green Island RRPP will undergo training in regards to the applicable Resource Consents and this Site Environmental Management Plan.

All training will be documented in accordance with Enviro NZ's COR-10-000 Information Training and Supervision Procedure.

1.10 Review and Auditing Requirements

Enviro NZ implements a system of internal environmental audits annually. The Environmental Advisor is responsible for conducting the audits and is considered to be an independent party to the site.

The internal Enviro NZ audit measures sites performance with the company-wide Environmental Management System (EMS) and assesses conformance with company procedures, its site environmental management plan, site resource consents and other legal requirements. The audits also review any environmental risks on site and assess the appropriateness of controls.

Corrective actions and findings will be communicated with the Branch Manager and appropriate Regional Manager and followed up by the Environmental team.

2 General Operations

Site activities include:

- Receipt of commercial and domestic waste materials in a building for transfer to landfill for disposal;
- Receipt of construction and demolition waste materials for processing prior to reuse or recycling or disposal of residual waste materials;
- Public recyclables drop off and sorting;
- Receipt of green waste in a covered pit;
- Receipt of food waste in an organic receivable building;
- Acceptance and storage of household hazardous waste;
- Parking for up to 45 trucks.

Plans of the site are included in **Appendix Two**

2.1 Site Layout

Table 2 Relevant Site Facilities

Facility	Description
Green waste drop off pad	Designated space for domestic customers to drop off garden waste for proper disposal or recycling, facilitates separation and management of garden waste. Made by reusing and upgrading the existing transfer pit.
Organic Receivals Building	A 17 metres by 31 metres concrete slab and steel portal frame building with the walls e made of a 3m high concrete blocks wall and metal cladding above The South side will have a roller door which will allow a truck to enter the building and tip organic waste onto the concrete floor. The North side will have 2 roller doors for the loader access.
Organic Processing Facility (OPF) bunkers and maturation pad	Six bunkers of 140m^2 each, the south wall includes penetrations for the mechanical ventilation system. Provisional area for four additional bunkers in future. Organic waste is moved from the bunkers to the maturation area and spread out into piles ready for offtake.
Site office	Offices, meeting room and staff amenities. Approximately 200m^2
MRF building and apron	Approximately 70m x 40m for the building, and 60m x 30m for the apron, constructed from prefinished profiled metal cladding fixed to galvanised girts and purlins. Designed to facilitate effective sorting, processing, and recovery of recyclable materials from the waste stream.
Glass storage bunkers	Storage of collected glass waste until it can be processed for recycling or other treatment. Constructed using reinforced concrete, approximately 400m^2.
Household hazardous waste drop off and storage	Public zone for waste drop off and a staff only zone for sorting and storing of hazardous waste, approximately 90m^2, building

Facility	Description
	is steel framed with prefinished profiled metal cladding and roofing. The drop off area is provided to facilitate the safe and organised unloading of hazardous materials form vehicles. The building is equipped with a well-designed ventilation system to ensure removal of fumes, vapours, and other airborne contaminants that may be released by the stored hazardous materials.
Bulk Waste Transfer Station (BWTS) Building	Approximately 30m x 55m, constructed of steel portal design positioned and fixed to an engineered concrete slab. Deigned to handle receiving and loading of general waste for further transportation to appropriate disposal sites.
Construction & demolition (C&D) sorting pad	Concrete slab adjoining the BWTS building, construction skip bins to be dropped off and sorted on the pad. Approximately 1200m^2.
Workers Facilities	Change room, lunch room, showers and toiles for staff working on site. Approximately 160m^2.
Truck Wash bays	Two truck was bays with concrete pads draining to trade waste.

2.2 Operating Hours

The publicly accessible areas of the RRPP, including the public-drop off areas, will be open between 8.00 am – 5.30 pm Monday – Saturday and 9.00 am – 5.30 pm Sunday.

The non-publicly accessible (operational) areas of the RRPP will be open 8.00 am – 5.30 pm Monday – Friday and at the weekends as required by the operator. The gates at the Brighton Road access will be locked after hours.

All areas of the RRPP will be closed Easter Friday, Christmas Day, and ANZAC day until 1pm.

Some parts of the RRPP will be in operation 24/7. This will include the mechanical aeration plant of the OPF bunkers and general traffic/other activities as required by operational needs for the MRF and BWTS.

2.3 Traffic Management

A speed limit of 20 km per hour will be enforced on the site. Enviro NZ staff will restrict the number of vehicles permitted to off-load at any one time. This will be what is appropriate for the size of the vehicles and the waste stream concerned.

2.4 Plant Operation

All equipment and plant on-site will be operated and maintained by appropriately trained staff in accordance with manufacturer's instructions.

2.5 Contractors and Visitors

All visitors to the site not offloading refuse, green waste or recycling will report to the Site Office upon arrival. They will sign in and undergo an induction as per Enviro NZ procedure (SHE-13-00 Visitors to Enviro NZ Sites).

All vehicles entering the site will go over the weighbridge and will be questioned by the weighbridge operator.

Any contractors doing work on the site which could affect stormwater, trade waste, air discharges or land use consents will be provided with a copy of the relevant resource consents and appropriate training.

All Contractors will be inducted and informed of site rules before commencing any work on site

The re-fueling contractor shall be required to refuel on the rear pad located along the Southern boundary wherever practicable to avoid the potential for stormwater contamination in case of a spill.

Training of contractors in site requirements is the responsibility of the Branch Manager.

2.6 Vegetation and Landscaping

Dunedin City Council owns the site facilities at Green Island RRPP, and maintain the site paving. A portion of the site is left unsealed.

The vegetation and landscaping on site will be maintained frequently by Enviro NZ staff. Any large trees will be kept tidy to ensure that the stormwater cesspits are kept free from large amounts of leaves and debris, which could cause surface flooding.

2.7 Equipment/Vehicle Maintenance/Service

All equipment must be serviced by a suitably qualified contractor in accordance with Enviro NZ's plant maintenance procedure. Staff shall ensure that vehicles are free from oil leaks and any such leaks shall be contained and reported as soon as practicable. Where possible, all service (e.g., oil changes) will be completed inside bunding or on a concrete pad and any spills cleaned up immediately.

2.8 Vehicle washing

Any washing of Enviro NZ trucks, cars or other plant and any washing of bins will be undertaken in a designated area draining to trade waste.

2.9 Floor Wash Down

The floor of the reception buildings will be washed down regularly to minimise potential odours and dust.

3 Site Rules

The following Site Rules apply to the Green Island RRPP.

3.1 General

- All visitors must report to the Site Office and sign-in.
- All contractors must wear a minimum of Hi viz vest and safety footwear and any other PPE as required.
- Smoking is not permitted, except in designated areas.
- No hazardous or liquid waste will be accepted in the transfer station other than those household hazardous wastes allowable under Council agreement.
- Enviro NZ reserves the right to exclude persons not following site rules.

3.2 Entry

- Speed limit is 20 km per hour and all road rules apply.
- Cell phone usage is prohibited while driving or operating equipment.
- Give way to heavy plant and vehicles (maintain a minimum of 4 meters separation).
- Follow directional signage or staff instructions.
- All trucks arriving at the site must be securely covered with no loose litter, dust or liquid leaking from the vehicle.

3.3 Off Loading Area

An Enviro NZ staff member will be present at the recycling off-loading area, the greenwaste area, the BWTS building, and the C&D pad to ensure the following rules are complied with;

- Ask for assistance if required.
- Children under the age of 15 and all pets are to remain in vehicles.
- No smoking.
- No scavenging.
- No entry into unauthorised areas such as the green waste pit or C&D processing building.
- Fully enclosed footwear must be worn at all times.
- Unhooking of trailer from tow bar for tipping is prohibited.
- Do not use fire hoses to wash down vehicles.
- Give way to heavy plant and vehicles (maintain a minimum of 4 meters separation).

3.4 Emergency

- Report all accidents or injuries.
- In the event of a fuel or oil spill, or spill of any other potentially hazardous material, please contain the spill and contact site management immediately.
- If warning alarm sounds please follow staff instructions.
- If requiring first aid please contact staff.
- These rules shall be communicated to customers in writing and clearly displayed on site.

4 Waste Control Policy

The purpose of the EnviroNZ waste control policy is to advise Enviro NZ staff and customers of what can and cannot be accepted into EnviroNZ bins, trucks, transfer stations and landfills and to ensure compliance with all relevant legislation, regulations, disposal facility resource consents and other local authority requirements.

4.1 Incoming Waste

Waste accepted at the Green Island RRPP include:

- Wastes from a variety of business and commercial activities, both self-haul and from waste collection companies;
- Construction and demolition wastes;
- Domestic/household wastes, including mixed general waste and food waste, from Council collections, waste collection companies, and members of the public;
- Recyclable materials such as paper and cardboard, glass, plastic, aluminium cans, ferrous and non-ferrous metals; and
- Green waste.

All vehicles entering the site will go over the weighbridge. The weighbridge operator will question the customer as to the source and content of the waste to determine its acceptability.

Vehicles will be directed to the appropriate location for off-loading. This is to ensure that customers remain safe.

All potentially dusty loads will be dampened with water prior to unloading or during storage. The unloading of such loads will be supervised.

If waste is found to be odorous on tipping, it will be immediately covered with other waste and loaded out as soon as possible.

4.2 Management and Load Out of Waste

Management of the various waste streams will be undertaken as follows:

- Refuse – delivered into the Bulk Waste Transfer Station (BWTS) (Kerbside Collection Trucks, Commercial Collections, Car and Trailers) Loaded into Truck and Trailer Units at the rear of the BWTS using a Material Handler for landfill disposal.
- Glass – Kerbside Trucks will deliver direct to the Glass Bunkers. Public Drop off will be into Gantry bins in the recycling area that will be transferred to the bunkers vis a Gantry Truck. Glass will then be loaded from the Bunkers into the Truck and Trailer units for transport to further processing outside of the site area by the third party.

- Recycling – delivered to the MRF directly by the Kerbside Collection Trucks. Sorted and baled and then loaded into 40 Foot shipping containers for export via port Chalmers. There will be bins provided for public drop off at the Transfer Station, these will be transferred to the MRF using Gantry or FEL trucks.

- Organics – Delivered to the Organics Receival Building (ORB), Shredded and then transferred by loader or 30m3 Huka bins to the Organics Processing Facility (OPF). When processed loaded out into Truck and Trailer Units.

- Green Waste – dedicated drop off area for car and trailers, then transferred to the Organics Receival Building using Huka bins.

4.3 Storage of Waste

Any hazardous waste inadvertently deposited on site and discovered in the waste stream will be removed to the designated storage facility and collected by an approved hazardous waste operator.

Any gas bottles received must be stored outside in the caged designated area.

C&D waste is deposited in skip bins the C&D area and sorted prior to removal.

Sorted and processed materials from the MRF will be held in the MFR apron before transported to their next destination.

The floor areas, which drains to trade waste, will be washed down when required. If required food waste bins maybe sprayed with deodorant.

4.3.1 BATTERIES

Car batteries will be stored within a bund in the hazardous waste area. They will be stored in a single layer, or stacked with non-conductive material such as plastic or wood in between each layer. They will be collected by an approved collector.

Lithium ion batteries, LION, will be collected in approved containers, identified by clear signage, and segregated from the main waste stream. They will be collected by an approved collector.

4.3.2 FRIDGES AND AIR-CONDITIONING UNITS

Customers dropping of fridges, air-conditioning units, or other items that contain refrigerants will be directed to offload these items in a designated area. The items will not be handled by staff, this includes no dismantling or degassing of any items brought to the site. The items will be stored in the scrap metal area until collected or degassed by an approved operator.

4.4 Green Waste Acceptance and Management

Green waste is accepted from the public and commercial operators and deposited in the green waste pit. Green waste is checked for contaminants which, if found, are removed to the bulk waste transfer station.

Green waste is transferred to the ORB for processing prior to transfer to the OPF.

4.5 Household Hazardous Wastes

The Green Island accepts household hazardous wastes as part of agreement with Dunedin City Council. Hazardous waste is accepted and stored in a separate building adjacent to the BWTS building. The public zone allows for hazardous waste drop off, and the staff only zone is for sorting and storing of hazardous waste.

4.6 Unacceptable Wastes

Signage at the site entrance will state all materials not accepted at the Green Island RRPP.

The following wastes will not be accepted:

- Commercial types or quantities of hazardous wastes (including polychlorinated biphenyls),
- Asbestos;
- Explosives and Fireworks;
- Volatile/Liquid wastes;
- Petroleum products;
- Timber preservatives;
- Medical wastes;
- Scrap motor cars;
- Animal by-products (offal);
- Grease interceptor trap residues;
- Residues from Agriculture activities (e.g. silage, piggery wastes, poultry wastes);
- Residues from chemical manufacturing processes containing esters, acrylates, solvents, aliphatic hydrocarbons;
- Residues from tanneries;
- Herbicides / insecticides;
- Commercially derived resins, oils, paints, tars;
- Particularly dusty loads (e.g. coal ash, sawdust fines); and
- Particularly odorous loads

Staff may request the customer remove all such waste as part or whole load at the customers cost.

5 Trade Waste Management

5.1 General

Water not suitable for discharge directly to the stormwater system is diverted to trade waste. This water could potentially have adverse effects on the surrounding environment and is regulated by the Dunedin City Council Trade Waste Bylaw and Trade Waste Agreement No: *to be inserted*

5.2 Trade Waste Network

Water from the green waste pit area, projects pads (when in use) and BWTS is discharged to trade waste. The Green Island RRPP trade waste network joins into the DCC trade waste system at the Green island site.

5.2.1 INSIDE THE GREENWASTE PIT AND BWTS BUILDING

Water from this area is collected in a metal 300mm x 200mm deep steel grate drains with 21mm slotting which are located at ground level at the entrance to the pit. This water drains to trade waste via the oil/grit separator.

5.3 Vehicle and Bin Wash

Residential and commercial collection vehicles are washed in a designated area. Washing is undertaken using high pressure hot water and without detergent. Wash residue drains to the trade waste sewer via the oil/grit interceptor. The vehicles are not used to transport hazardous wastes or dangerous goods.

This area is also used to wash out commercial and residential bins, using water. The bins are not used for potentially hazardous wastes.

5.4 Household Hazardous Chemical Storage Area

Household quantities of hazardous wastes are accepted at the site under agreement with the Dunedin City Council. Wastes are stored in locked and bunded steel sheds. They are handled only by trained site staff and an appropriately certified hazardous waste contractor.

There is no drainage inside the sheds/ Rainwater falling within the bunded area drains into [describe] which is then directed to the trade waste system/ pumped out.

5.5 Vehicle and Plant Refueling

Plant must not be left unattended during refueling. The refueling contractor will be required to refuel in an area wherever practicable that is contained and drains to trade waste or an oil and grit separator to avoid the potential for stormwater contamination in case of a spill

5.6 Trade Waste System Maintenance

Trade waste drains will be checked on a regular basis. Solid materials must be cleaned out prior to performance impairment. Screens/grating over the trade waste drains provide filtration of gross contaminants.

5.7 Specific Discharge Limits

Limits specific to the Trade Waste Bylaw are indicated in Table 3. Green Island RRPP will meet all discharge limits as specified in the Trade Waste Bylaw including the controlled substances standards. The bylaw will be reviewed annually to check for updates.

Table 3 Specific discharge limits.

Parameter	**Limit**
Maximum discharge flow rate	TBD
Maximum 24-hour discharge	
pH level	
Maximum temperature	
Sulphide	
Oil & Grease	
Total Suspended Solids	
Other parameters refer to Permitted Discharge Characteristics in the Bylaw	

5.8 Trade Waste Monitoring

An effluent sample representative of a normal days discharge will be taken twice per year as an internal Enviro NZ requirement. Samples will be analysed by a laboratory holding IANZ accreditation for the required compounds.

Records of all analyses are kept on site for a period of no less than 5 years and made available for inspection on request.

All samples collected from the trade waste discharged will be transported under chain of custody protocol to a laboratory holding an IANZ accreditation for that analysis. The trade waste samples will be analysed for:

- pH
- Electrical conductivity
- Total suspended solids
- Sulphide
- Total metals (arsenic, cadmium, chromium, copper, lead, nickel, and zinc)
- Oil & grease
- Semi-Volatile Organic Compounds (SVOCs) (screen level)

Samples will be collected by appropriately trained and competent site personnel or an appropriate third party service may be contracted to perform this task. All monitoring

results will be transmitted to the Environmental Advisor upon receipt by the Branch Manager.

5.9 Risks and Controls

The likely risks present for the trade waste system at the Green Island RRPP are indicated in Table 4.

Table 4 Risks and Controls of Trade Waste System

Risk	Control
Failure of pre-treatment system	Steel grating is inspected regularly and the oil/grit interceptor is serviced quarterly.
Spill of stored hazardous substances or fuel/oil from plant or vehicles.	All chemicals are stored in an area which is isolated from the trade waste system. Spill kits are available on site and all staff are trained in the Spill Response Procedure.
Power Failure	The trade waste drains are gravity fed with no pumps in the system. Power failure has no effect on system integrity/performance. / Pumps are checked and reset after any power failure.
Inappropriate disposal of hazardous or toxic substances in waste stream.	All staff receive training on the inspection of incoming refuse. If hazardous waste is identified in the incoming waste stream it is uplifted and removed to the household hazardous goods area.

5.10 Contingency Procedures

5.10.1 INCIDENT NOTIFICATION

All staff are trained to notify the Branch Manager or supervisor if an incident occurs that will affect the discharge to the public trade waste sewer. Should an incident occur the following steps will be taken:

1. As soon as practicable or within 60 minutes of the event the most appropriately qualified staff will attend to the incident and execute the emergency spill response procedure.
2. Notify the Branch Manager and the Environmental Advisor/Manager as soon as practicable.
3. Incident will be reported and investigated (if necessary) using Enviro NZ's incident reporting procedures.

4. Incident will be debriefed and discussed at the monthly site tailgate. Remedial works as well as any changes to procedures will also be communicated at the tailgate.

The emergency spill response procedure is included within the Emergency Plan (**Appendix Four**)

5.10.2 BREACH OF DISCHARGE LIMITS

Should a result be returned that is in excess of the discharge limits set by the Trade Waste Bylaw or should a discharge to trade waste occur that may result in a breach of the limits the following steps will be taken:

1. Communicate breach to the Environmental Advisor/Manager as soon as practicable.
2. Record the event as an incident and perform an investigation, as per Enviro NZ procedure.
3. The incident will be notified to council within 30 minutes of discovery and will be followed up in writing within 3 working days.

5.10.3 SPILL RESPONSE

All Enviro NZ staff are trained in spill recognition and response. Training is carried out on an annual basis, with spill drills undertaken twice a year.

The location of spill kits on site and spill response procedure are detailed in the Emergency Plan included in **Appendix Four**.

6 Stormwater Management

6.1 Green Island RRPP Stormwater

Stormwater from the buildings will be discharged into rainwater tanks that can be used to wash down areas as required. The rainwater tank overflow will be directed either to the on-site soakage system, or to the channel alongside the entrance road which discharges to the Kaikorai Stream via the constructed wetland.

Stormwater runoff from other areas of the site consists of three main catchments:

- *Catchment A* including OPF Bunkers, OPF Maturation and its potential extension areas plus Glass Bunkers and Mechanical Plant. This catchment discharges to the northern treatment area (pond or swale wetland). From stormwater perspective, there are two different surface runoffs for this catchment. The runoff from the bunkers and maturation areas drains into the leachate system (and not into the stormwater system). The rainfall runoff from the remaining site including roads and access ways is conveyed to the stormwater system and treated as road surface with light vehicle movement.

- *Catchment B* including the workers facilities, BWTS building, C&D sorting pad, hazardous waste storage (roof runoff) only and associated drop off area, office parking, Enviro NZ office, and the existing educational facility. This catchment discharges to the existing stormwater network passing through the current RRPP site. Currently the stormwater system discharges directly to the eastern constructed wetland, and it is proposed to divert the open drain to the pond. This catchment includes a truck wash pad area. Runoff from the truck wash pad area will discharge into the leachate system due to the contaminants expected to be present in the runoff

- *Catchment C* including the MRF building and apron, OPF building and the Transport Compound Area. This catchment collects rainfall runoff from roofs, paved and compacted gravel areas into a swale along the foot of steep slope border between the capped landfill and the south-west of the site. The swale carries discharges to the eastern sedimentation pond via a swale and a pipeline. Key contaminants from this catchment are expected to be from the MRF apron and Enviro NZ transport compound

A summary of potential contaminants associated with activities onsite, their controls and inspection requirements are presented in Table 5.

Table 5 Potential Sources of Stormwater Contamination

Activity/Area	Sources of Contaminants	Potential Contaminants	Mitigation Measures for Contaminants of Concern
Building roofs	Rainwater	Heavy Metals	Monitoring
Carparks and Roads	Rainwater Vehicle movements	Suspended solids, heavy metals, hydrocarbons	Regular sweeping and inspections of paved areas. Catchpits fitted

Activity/Area	Sources of Contaminants	Potential Contaminants	Mitigation Measures for Contaminants of Concern
		(petrol/diesel/oil), gross pollutants/litter	with gross pollutant screens and 100 micron filter bags.
Buildings	Vehicle movements, recyclables, waste	Suspended solids, heavy metals, hydrocarbons (petrol/diesel/oil), gross pollutants/litter, BOD	Regular sweeping and inspections of paved areas. Catchpits fitted with gross pollutant screens and 100 micron filter bags, as appropriate.
Recycling drop off area	Rainwater Vehicle movements Recyclables	Suspended solids, heavy metals, hydrocarbons (petrol/diesel/oil), gross pollutants/litter, BOD	Regular sweeping and inspections of paved areas. Catchpits fitted with gross pollutant screens and 100 micron filter bags.
Waste drop-off areas.	Vehicle movements, refuse.	Suspended solids, heavy metals, hydrocarbons (petrol/diesel/oil), pH, BOD, nitrogen (especially ammonia), phosphorus, gross pollutants.	Regular sweeping and inspections of paved areas. Catchpits fitted with gross pollutant screens and sediment screens.
C&D waste and cleanfill drop-off area.	Vehicle movements, C&D waste.	Suspended solids, heavy metals, hydrocarbons (petrol/diesel/oil), gross pollutants, pH.	Fencing in good condition, Bund boundary lines, Contour land to slope away from boundary lines. Ground soakage
Green waste drop-off and load out areas	Vehicle movements, green waste	Suspended solids, heavy metals, hydrocarbons (petrol/diesel/oil), pH, BOD, nitrogen (especially ammonia), phosphorus, gross pollutants	Regular sweeping and inspections of paved areas. Rumble strip installed to minimize sediment run off. Catchpits fitted with gross pollutant screens and 100 micron filter bags

Notes: BOD = biochemical oxygen demand; Gross pollutants = litter, scattered refuse and green waste.

6.2 Stormwater Treatment System

All site stormwater catchpits are fitted with 100µm mesh inserts (EnviroPod LT or similar) to filter gross pollutants and sediments.

All stormwater will either go to groundwater soakage or pass through the stormwater treatment pond.

6.3 Stormwater Maintenance Requirements

Any stormwater drains will be maintained as required and kept free of litter and other potential obstructions.

Monitoring and maintenance of the storm-water system requires the following:

- All cesspits will be lined with filters.
- Visual inspections of all cesspits and filters are carried out at least weekly and after any significant storm event (25mm in 24 hours).
- Filters in the stormwater drains will be cleaned out when sediment depths reach 50mm. The frequency of the clean out will be determined by the rate of build-up of sediments within the drain.

6.4 Stormwater Monitoring and Maintenance

Resource Consent requires monitoring of the stormwater drains to be undertaken quarterly, until 8 consecutive samples results are received that fall within the trigger levels list below.

- Samples should ideally be collected within the first 30 minutes of stormwater being discharged.
- Stormwater samples are to be collected from the discharge of the stormwater treatment pond.
- In 2015 the discharge feeding SW2 was put to ground soakage by the TCC in agreement with Otago Regional Council.
- Stormwater sampling and reporting is the responsibility of the Branch Manager. Sampling must be carried out in line with Stormwater Sampling SOP ENV-50-037 (**Appendix Three**).
- Stormwater samples will be analysed for the parameters listed in Table 6. Table 6 also list the maximum discharge limits for consent compliance at SW1 and SW2.

Table 6 Maximum stormwater contamination concentrations allowed (67401 Condition 6.2).

Contaminant	**Maximum Discharge Concentration g/ m³ (grams per cubic metre)**
Total Suspended Solids (TSS)	TBD
Total Petroleum Hydrocarbons (TPH)	
Biological Oxygen Demand ($cBOD^5$)	
Total Copper (Cu)	
Total Lead (Pb)	

Contaminant	Maximum Discharge Concentration g/ m^3 (grams per cubic metre)
Total Zinc (Zn)	
pH	

[A] MfE Environmental Guidelines for Water Discharge from Petroleum Industry Sites in New Zealand
[B] ANZECC 80% Trigger values for freshwater with 5 times dilution factor.

6.5 Stormwater Contingency Plan

If an exceedance of stormwater parameters is indicated by sample analysis, additional steps must be taken:

1. The Otago Regional Council must be notified of the exceedance in writing within 5 working days of receipt of testing results.

2. Additional samples may be collected to confirm if the contamination is coming from the Green Island RRPP or from an upstream source. Investigation of any non-compliance event not traced to the Green Island RRPP will be the responsibility of Council.

3. If it is confirmed that the contamination is coming from the Green Island RRPP, Enviro NZ will undertake an investigation to find the source of the non-compliance and implement appropriate source control or treatment to correct the situation. At the conclusion of the investigation a report will be submitted to Otago Regional Council within 10 working days detailing the outcome of the investigation and any additional controls or treatment, if any, implemented as a result of the investigation.

7 Nuisance Management

The Green Island RRPP will be managed so that:

- Beyond the boundary there will be no odour, dust, particulate, ash or fume which could be considered noxious, dangerous, offensive or objectionable.
- This includes the discharge of any hazardous air pollutant, which is present in, or likely to be at a concentration detrimental to human health or the environment.

7.1 Odour Control Measures

Odorous loads will not be accepted at the site in accordance with the waste acceptance criteria. Signs specifying this will be clearly posted at the entry to the transfer station. The staff will scrutinise all incoming loads for odour content and hazardous substances. Unacceptable loads will not be permitted entry.

Refuse containing odorous material must be removed from the site as soon as practicable.

All putrescible waste will be removed from the site within [insert resource consent time frames]. If waste is to be held on site longer than [insert resource consent time frames], putrescible waste will be covered and de-odourising spray used as required to prevent off-site effects.

The floor of the building will be washed down regularly to minimise potential odours. Biodegradable deodorant chemicals will be made available and used when necessary to aid in minimising the discharge of offensive odours from the site.

All staff working at the facility will have training, which will include the requirements of resource consents, control of odorous waste, odour monitoring, housekeeping procedures and contingency measures.

Staff will undertake odour monitoring following Enviro NZ odour monitoring procedures each day of operation. This will be conducted along the site boundary using ENV-50-025 Odour and Litter Monitoring Work Instruction.

7.2 Odour Contingency Measures

In the event that odorous material is deposited, and/or odour can be detected off site, or a complaint is received, the Branch Manager will undertake the following measures as required to mitigate the odour:

a) Immediately cover the load with other waste and if necessary;

b) Apply odour suppressant chemical to the source;

c) Remove the offending waste by loading into a transfer vehicle as soon as possible; and

d) Report the odour incident using the incident reporting and investigation procedures.

7.3 Dust Control Measures

- The site access and transfer areas will be sealed/ finished with hardstand in order to minimise dust from the site.
- Vehicle speeds on site will be limited to a maximum of 20 kilometres per hour in order to minimise dust from the site. This speed limit will be clearly sign posted around the Green Island RRPP.
- All refuse off-loading must occur in the designated area.
- Particularly dusty loads will not be accepted.
- The site will be kept free from waste spills and dusty material by regularly sweeping and hosing down of clear floor areas in the building as required.
- All unused and unsealed areas of the site will be grassed or planted.
- A spray suppressant misting system, installed in the sorting shed, will be operated when required./ Site staff will wet down dusty loads with a hose.
- The refuse loading area will be swept after each transport load to prevent excess dust and tracking through the area.

7.3.1 DUST CONTINGENCY MEASURES

- If dust is being emitted during off-loading, the transfer will be temporarily stopped until the load is dampened using water, or if in the opinion of the Branch Manager the load is unacceptable, the transfer will be stopped and the load refused entry.
- Dust on the site will be monitored, especially in summer, and when necessary Enviro NZ will employ either a water truck or road sweeper to keep the site clean.

7.4 Noise

- The Branch Manager will ensure that all noise requirements under the District Plan are met.
- If required, the noise levels will be measured and assessed in accordance with the requirements of the NZS 6801:2008 "Acoustics - Measurement of environmental sound" and NZS 6802:2008 "Acoustics - Environmental noise" or their replacements.
- The noise will be measured with a sound level meter complying at least with the International Standard AS/NZS IEC 61672.1:2019 Sound Level Meters, Type 1.
- The Branch Manager is responsible for ensuring that all equipment on site is adequately muffled and maintained. All machinery will be inspected after servicing to ensure the muffling is adequate and no unacceptably noisy equipment will be used on site.

7.5 Litter

- All commercial waste carriers will be required to adequately cover their loads to avoid litter escaping from carrier vehicles.
- Most operations will take place inside a covered pit/ building, minimising nuisance litter. Perimeter fencing on site will act as an additional barrier.
- Litter checks of the property and the property boundary frontage will be undertaken by site staff as required.
- Any wind-blown litter will be recorded on the Odour and Litter Monitoring forms (found in ENV-50-025 Odour and Litter Monitoring Work Instruction) and picked up and returned to the building for recycling or disposal.
- Any complaints regarding litter nuisance will be investigated and reported internally and, if required, litter collected as soon as practicable

7.6 Pests

7.6.1 VERMIN

The best practice operational procedures of the depot aim for fast turn-around of incoming and outgoing waste streams, as well as efficient sorting of refuse. Nuisance caused by vermin (e.g. flies or rodents) is not expected.

Enviro NZ will engage an accredited pest control contractor to put in place and service a pest control program.

7.6.2 BIRDS

If control measures are required in the future they will be implemented after consultation with the Environmental Advisor or a suitably qualified consultant/contractor. Any control measures are likely to focus on excluding birds from the building, and/or any roosting and loafing sites within the property.

The MRF, BWTS, and hazardous waste buildings will be fully enclosed and internally lined to avoid perching spots for birds.

8 Complaints Handling

8.1 Complaints Handling Procedure

Complaints will be directed to the RRPP Operations Manager, or Branch Manager.

Any complaints regarding noise, litter, dust, odour, or pests received by the site will be logged and investigated in accordance with ESL's complaints handling procedure (ENV-50-030) Environmental Complaint Handling Procedure.

In addition, and acknowledging there is also a landfill operations contractor on the same Green Island site, complaints can also be directed to either the landfill contractors Operations Supervisor, or Regional Manager.

Complaints can also be directed to DCC Landfill Engineer or DCC Contracts Manager.

Whilst active landfill operations are occurring at the Green Island site, all complaints and follow-up will be shared between RRPP and the Landfill Operations Managers.

On receipt of a complaint the RRPP Operations Manager Green Island RRPP Operations Manager will note down all relevant information including:

- Type of compliant (noise, litter, dust, odour or pests)
- Date and time of complaint;
- Complainant's name, contact number and location; and
- Approximate wind direction and strength;
- Rainfall prior to complaint;
- The response and likely cause of the complaint; and
- Action taken or proposed as a result of the complaint.

The RRPP Operations Manager Operations Manager (or delegated person) will then inspect the site to determine the source of the complaint. Once identified, appropriate action will be taken to control the impacts.

If associated with the RRPP site the RRPP Operations Manage Operations Manager will then inform the complainant of actions taken to mitigate the problem and note down all actions.

On occasion complaints will be generated from the activities of others beyond the RRPP site boundary, including the adjacent landfill.

As with all environmental complaints the Enviro NZ Environmental Complaints Handling Procedure (ENV-50-030) will be followed and the cause will be reviewed by the RRPP Operations Manager to determine whether further action, (e.g. a change to procedures, further training etc.) is needed to prevent a recurrence.

8.2 Notification of Complaints

ORC and DCC will be notified of any complaints as soon as practicable, and within 24 hours for air quality complaints.

9 Emergency Management

An Emergency Plan has been developed for the Green Island RRPP, the plan is included in **Appendix Four**. The plan includes all emergencies that are likely to occur at the site e.g., spill response, fire, explosion etc. The Branch Manager is responsible for the Emergency Plan which will be reviewed through a consultation process with the site workers and updated annually. All site employees will be trained in the emergency plan contents at least annually

Relevant emergency contacts for the site are included in Emergency Plan of this document as well as within the Emergency Plan.

Appendix E

DRAFT Stormwater Management Operation and Maintenace Plan

Draft SMOMP Report

28 February 2024

To	Dunedin City Council	**Contact No.**	027 746 7752
Copy to		**Email**	Nick.Eldred@ghd.com
From	Nick Eldred, GHD NZ Ltd	**Project No.**	12613624
Project Name	Green Island Resource Recovery Park Precinct		
Subject	DRAFT Stormwater Management, Operation and Maintenace Plan		

1. Introduction

1.1 Background

1.1.1 Waste Futures Programme

As part of Dunedin's wider commitment to reducing carbon emissions and reducing waste going to landfill, the Dunedin City Council (DCC) has embarked on the Waste Futures Programme to develop an improved comprehensive waste management and diverted material system for Ōtepoti Dunedin. The programme aligns with DCC's responsibility under the Waste Minimisation Act 2008 to *'promote effective and efficient waste management and minimisation within its district'.*

Improving Dunedin's whole waste system includes enhancing collection services for reuse and recycling, and safe disposal of residual waste to landfill.

The Waste Futures Programme includes provision of an enhanced kerbside recycling and waste collection service for Dunedin from July 2024. The new kerbside collection service will include collection of food and green (organic) waste.

To support the implementation of the new kerbside collection service, the DCC is planning to make changes to the use of Green Island Landfill Site (Figure 1) in coming years including:

– Developing an improved Resource Recovery Park Precinct (RRPP) for food and green waste and to process recycling
– Providing new waste transfer facilities to enable the safe disposal of any residual waste to landfill.

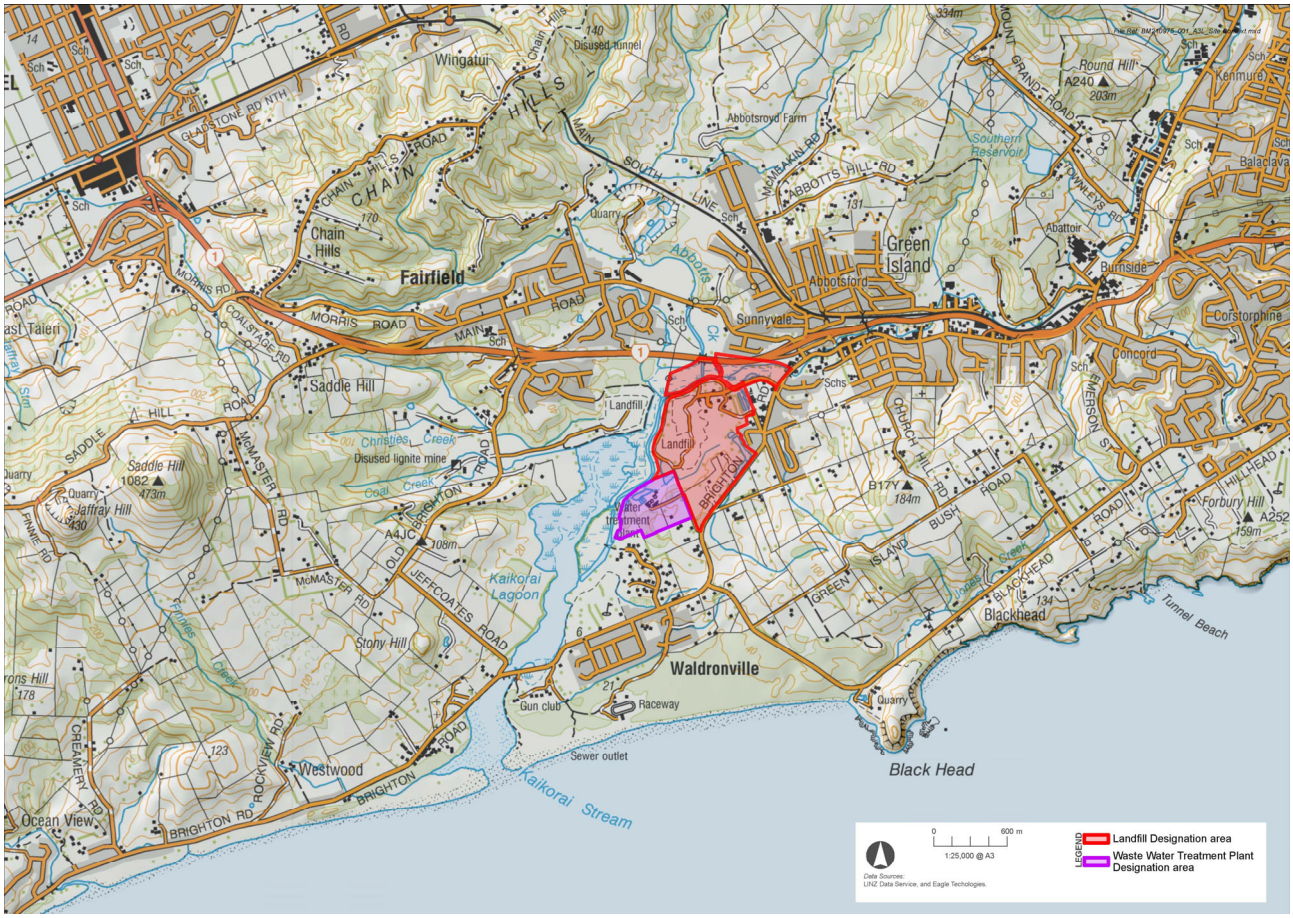


Figure 1 *Green Island Landfill and Resource Recovery Park Precinct Site (Designation D658).*

In addition, DCC is planning for the ongoing operation and closure of the Green Island landfill, which is coming to the end of its operational life. The existing Otago Regional Council (ORC) resource consents, required to operate a landfill at Green Island, expired in October 2023. In March 2023, DCC applied to ORC for replacement resource consents to continue to use the landfill until it closes completely, and waste disposal can be transferred to a new landfill facility. These consent applications are in the process of being considered by ORC.

1.1.2 Green Island Resource Recovery Park Precinct (RRPP)

To meet the requirements of the new kerbside collection service the DCC is investing in improvements and expansion to the existing resource recovery area at the Green Island Landfill Site. Proposed new facilities are shown on Figure 2 and include:

– Organic receival building (ORB) and processing facilities to support the organic waste kerbside collection;
– Materials recovery facility (MRF) to sort and bale items collected from kerbside mixed recycling bins; and
– Bulk waste transfer station (BWTS) to facilitate the compaction and trucking of waste to landfill.

Additional facilities also include new glass bunkers, staff offices, parking, and breakrooms and associated access roads and truck parking areas. Several existing facilities are to be retained including the rummage shop, public drop-off areas and the education centre.

The resource consents for the development and operation of the new facilities relate to ground disturbance, and discharges to land and air. The Green Island Landfill Site is subject to an operative designation (D658) in the Proposed Second-Generation Dunedin City District Plan (2GP) for the purpose of Landfilling and Associated Refuse Processing Operations and Activities.

The RRPP will be run by EnviroNZ on behalf of DCC and will start operating in July 2024 following construction of the ORB, which is currently underway. Resource consent to operate the ORB was granted by ORC in September 2023 under the existing landfill consents.

The other new RRPP facilities are planned to start operating from mid-2025.

2. Purpose of this report

This is a draft version of a proposed Stormwater Management, Operation and Maintenace Plan for the RRPP site. A final version will be prepared once detail design has been completed.

2.1.1 Scope

This maintenance plan sets out the maintenance requirements to:

- Provide a safe environment for the Site personnel.
- Enable maintenance is carried out in accordance with the designed operation.
- Enables protection of receiving environments from any Site discharges; and
- Enables compliance any consents held for the facility or for Regional Plan requirements.

This document is a living document and is to be reviewed periodically, and updated as required, to meet compliance and accommodate any changes/amendments in the operation of the Site.

2.1.2 Reference documents

The following documents set out the key compliance and Health and Safety requirements for the Site operation which form the basis for the maintenance procedures developed:

- Stormwater discharge consent conditions to be included
- EnviroNZ Services Ltd (ESL) H&S procedures/ plan for the facility
- Construction Environmental Management Plan
- Organics Processing Facility management plan
- Contaminated Land Management Plan
- Erosion and Sediment Control Plan

3. Operation

Stormwater conveyance systems include:

- Sumps, pipelines and lined open drains
- Vegetated swales
- Pump to the Northern Leachate Pond (NLP).
- Any pumps associated with discharging leachate to existing pump stations PS5, PS6 and PS7.

In terms of performance the following items should be noted. Pipes and drains are to be maintained free of blockages and accumulated debris. The pump and associated infrastructure will have specific maintenance requirements identified after design.

Stormwater treatment systems include:

- Enviro-pods (fine filter bags or similar) in sumps at the paved areas.
- Shallow coarse sediment forebay for TCA and ORB areas.
- A vegetated swale to provide pre-treatment for some areas on the Catchment C.
- An interception drains and pump station to pump flow within Catchment A to the NLP.

- NLP
- The Eastern Sedimentation Pond (ESP) and the constructed wetland.

In terms of performance the following should be noted:

Pre-treatment is anticipated using the Enviro-pods (or equivalent catchpit filter inserts). These form part of the treatment train and provide an opportunity to intercept contaminated material close to source and prolong the life of the downstream devices. The devices are proposed instead of construction of new forebays to the existing ponds. The benefit of these devices is that they are close to the source of potential contamination, relatively easy to access and can quickly be visually assessed by operational staff to determine if cleaning is required. Performance of these devices will require the filter inset to be cleaned periodically to maintain capacity and reduce high flow bypassing as well as the filter remaining intact.

The Eastern Sediment Pond (ESP) is already constructed. This pond should have accumulated sediment removed before the RRPP moves into operation. The primary treatment mechanism for this pond will be settling and will rely on settling length and differences in densities between incoming water and water already within the pond. While the pond configuration is not ideal with inlets from both ends, the large size of the pond and the central discharge to the downstream wetland means that the impact on treatment performance is expected to be not critical for the proposed discharges.

The NLP is already constructed. This pond should have accumulated sediment removed before being used for stormwater management. The primary treatment mechanism for this pond will be settling and will rely on settling length and differences in densities between incoming water and water already within the pond. This pond includes a surface decant system that allows water to be 'skimmed' from the top of the pond and this is located at the opposite end from the inlets.

4. Inspections and maintenance

Operational inspections / monitoring

- Visual inspection to confirm operation as normal, investigation of any unusual materials in stormwater discharges; and
- Completion of the Record Log Sheet on a weekly basis.
- Carry out monitoring in accordance with resource consent; and
- Recording and reporting and required for the consent.

Table 7 ***Sample Record / Log Sheet***

Date	**Inspection Monitoring (tick)**			**Sampling**	**Comment**	**Action**
	Paved area	Road	Swale			

The operation of the stormwater management system will require devices to be managed to maintain their capacity. Maintenance activities are discussed in the following sections.

Roads

This area consists of the roads and the Site entrance at the eastern side of the RRPP. Maintenance is required to limit sediment build up that may cause dust or polluted stormwater.
Daily Maintenance:

- Daily inspection / observation and sweeping as required to remove spilled material; and
- Watercart for dust suppression to be used, as conditions require, to prevent dust issues/ migration of material.

Weekly Maintenance:

- Inspection of channels, sumps, and catchpits for accumulation of material and litter and remove, as necessary; and
- Log maintenance activity for week in log sheet.

Monthly Inspection:

- Inspection of roads surface to check for damage and repair as required to maintain impermeable cover.

Paved Areas

This includes paved areas of parking and manoeuvring space.
Daily Maintenance

- Inspection / observation of blocks to ensure they are not dislodged / unsafe. Visual observation to check filter socks in place, particularly during or prior to forecast rain.

Weekly/Monthly Maintenance

- Inspection of paved surfaces, as operation allows, to check for damage and repair as required to maintain an impermeable surface; and
- Log maintenance activity for week in log sheet.

Interception drain, sump, and pumps

Weekly maintenance

- Inspection of drain and pump sump – removal of litter, debris and accumulated material as necessary.

Weekly/Monthly Maintenance

- Visual inspection of the drain and pump sump monthly and following large rainfall events to confirm no debris or blockage and correct operation and log level of sediment accumulation (when empty) and percentage full.

6 monthly

- Pump maintenance and inspection to be included with inspection and maintenance of other mechanical equipment within the precinct.

Ponds

Inspect inlets and outlets for evidence of scour. This should be done no less than 6-monthly and immediately following large storm events.
Dredging of sediment should occur when the build-up reduces the storage volume of the main pond to about 50% of its design volume (i.e. the depth of the sediment is half of the total depth of the water).
Litter and other floating debris need to be removed from the pond's surface and in areas where it collects.
Inspect the pond for algal blooms high nutrient or high pollutant levels in the stormwater run-off.

Swales and open drains

Weekly/Monthly Maintenance

- Visual inspection of the swale monthly and following large rainfall events to confirm no debris, scour or blockage and correct operation, and
- Check fencing/security.

Biannual Maintenance

- Biannual mowing/trimming of swale to keep the height of the grass between 50mm - 150mm.

5. Adaptive Management

In the event that monitoring indicates an increase in the level of contaminants discharging into the receiving environment from the Site then:

- Implement sweeping of hardstands during dry periods to reduce contaminant that could be entrained into stormwater.
- Confirm no runoff from high-risk areas entering stormwater network.
- Increase frequency of cleaning pre-treatment devices between rainfall events
- Review pond performance:
    - Assess accumulated sediment levels and remove as required.
    - Consider lifting the height of the decant at the NLP to provide additional retention time.
    - Shock-dosing or long-term usage of chemical dosing (to increase settling performance)
- If the source of the increase contamination can be identified within the Site, consider diversion not the leachate system (for at least the first 25mm of runoff depth).

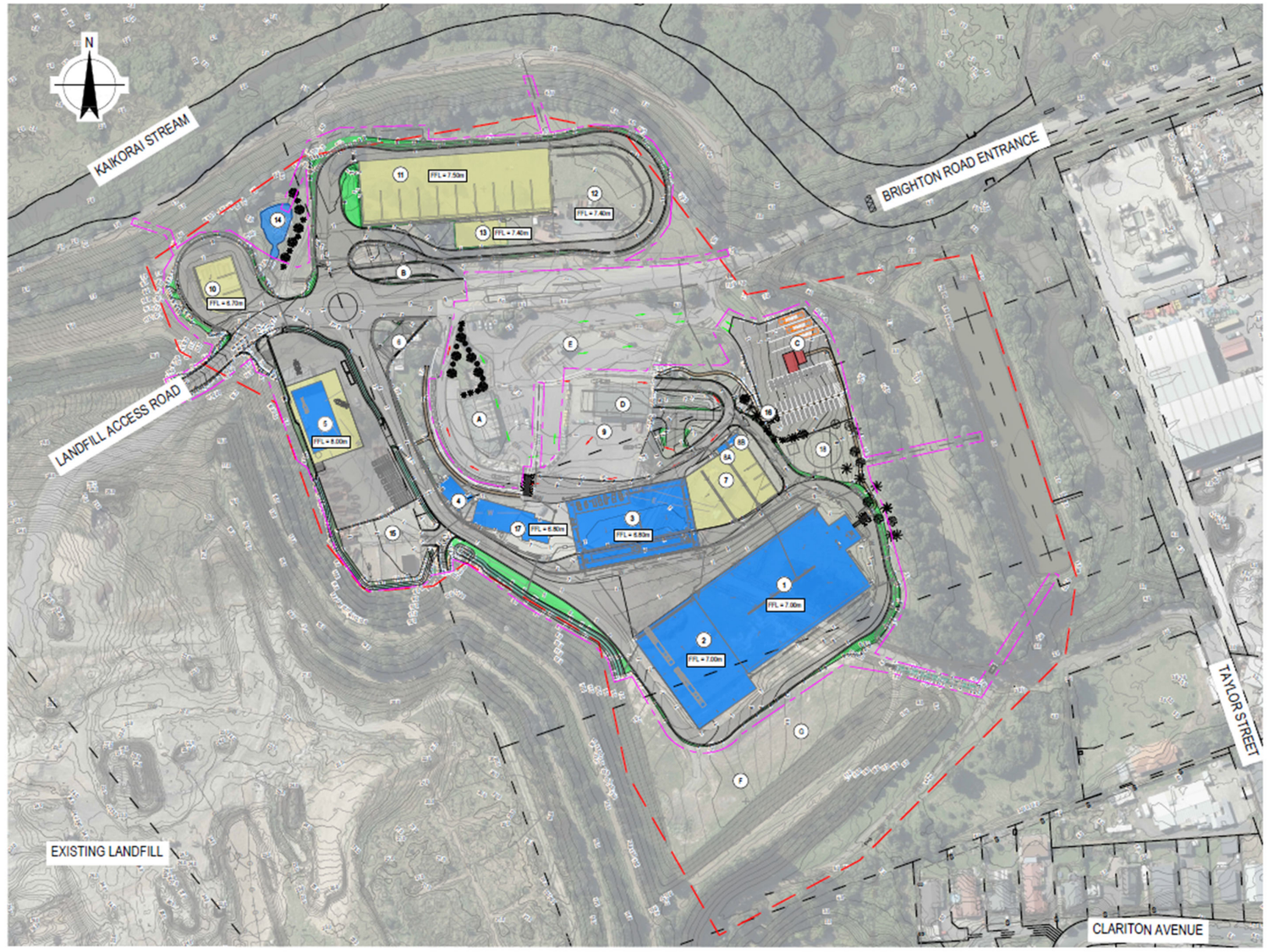
In the event of increasing trends in surface water quality in receiving environment monitoring then:

- Undertake monitoring to assess if there are increasing sources from within the Site and if so look to remedy with appropriate actions from the list above.
- If the increase is not associated with the Site activities, discuss further with the Regional Council to agree what steps, if any may be required as part of overall catchment initiatives.

In the event of unexpected performance issues with the treatment system then discharges will need to be diverted/pumped to other parts of the treatment system.

6. Related Documents

This draft plans should be read in conjunction with the RRPP Stormwater Management Report (GHD 2024A).



LEGEND - PROPOSED

- SITE DEVELOPMENT BOUNDARY
- NEW BUILDING
- NEW CONCRETE PAD
- NEW FOOTPATH
- NEW ROAD / ASPHALT AREA
- GRASSED AREA
- 1 MRF - MATERIALS RECOVERY FACILITY (HT: 13.0m)
- 2 MRF APRON
- 3 BWT - BULK WASTE TRANSFER (HT: TBC)
- 4 OSF - OFFICE AND STAFF FACILITY
- 5 ORB - ORGANIC RECEIVING BUILDING (HT: 13.0m)
- 6 TWB - TRUCK WASH BAYS (AFTER CURRENT OPERATOR VACATED)
- 7 CDS - CONSTRUCTION AND DEMOLITION SORTING PAD
- 8A HWS - HAZARDOUS WASTE STORAGE
- 8B HWD - HAZARDOUS WASTE DROP-OFF
- 9 GWD - GREEN WASTE DROP-OFF PAD
- 10 GLB - GLASS BUNKERS
- 11 OPF - ORGANIC PROCESSING FACILITY BUNKERS
- 12 OPM - ORGANIC PROCESSING MATURATION (3004.160m²)
- 13 MAP - MECHANICAL PLANT
- 14 POND
- 15 TPC - TRUCK PARK COMPOUND
- 16 PEF - PARKING & EDUCATIONAL FACILITY
- 17 ECO - ENVIRONWASTE COMMERCIAL OFFICE
- 18 FIRE WATER STORAGE TANK
- TANKS
- PAID DOMESTIC DROP OFF LOOP
- FREE DOMESTIC DROP OFF LOOP
- TREES AND SCRUB

LEGEND - EXISTING

- A LEGAL BOUNDARY
- B EXISTING RUMMAGE STORE
- C EXISTING WHEEL WASH
- D EXISTING EDUCATION CENTRE
- E EXISTING DOMESTIC WASTE TRANSFER STATION
- F RECYCLING DROP-OFF
- G DIVERTED MATERIAL STORAGE
- LANDFILL PLANT MAINTENANCE & STORAGE
- EXISTING ROAD
- EXISTING BUILDING
- EXISTING GAS
- EXISTING WATER
- EXISTING STORMWATER
- EXISTING SEWER
- EXISTING ELECTRICITY
- EXISTING LEACHATE

PROPOSED SITE LAYOUT PLAN
SCALE 1:1000

Rev	Description	Checked	Approved	Date
E	PRELIMINARY ISSUE	MR*	RP*	16.10.23
D	FOR CONSENT	MR*	RP*	05.10.23
C	FOR CONSENT	MR*	RP*	05.07.23
B	CONCEPT FOR TENDER	MR*	RP*	04.05.23
A	PRELIMINARY - FOR CLIENT REVIEW	MR*	RP*	31.03.23

Author R. GERONIMO Drafting Check G. DOUGHERTY*
Designer K. ATKINS Design Check M. ROUJON*

0 10 20 30 40 50m
SCALE 1:1000 AT ORIGINAL SIZE

THIS DRAWING INCLUDES COLOURED INFORMATION
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DUNEDIN CITY COUNCIL | kaunihera a-rohe o Ōtepoti
EnviroWaste

GHD
Level 3, 138 Victoria Street
Christchurch 8013, New Zealand
T 64 3 378 0900 F 64 3 370 8001
E chcmail@ghd.com W www.ghd.com
GHD Limited
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Project No. 12593786

Client ENVIROWASTE SERVICES LTD (ESL)
Project DUNEDIN RRP ALL SITE
Status PRELIMINARY Status Code S3
Drawing Title PROPOSED SITE LAYOUT PLAN
Size A1
Drawing No. 12593786-ALL-C002
Rev E

Figure 2 *Green Island Resource Recovery Park Development Area Proposed Layout.*

7. References

– GHD, 2024A, Waste Futures – Green Island – Resource Recovery Park Precinct Stormwater Management and Assessment of Effects

8. Limitations

This report is a DRAFT Document intended to provide guidance on the likely format and content of a final plan. The document will not be finalised until a contractor has been appointed who will provide input to the plan.

This report: has been prepared by GHD for Dunedin City Council and may only be used and relied on by Dunedin City Council for the purpose agreed between GHD and Dunedin City Council as set out in section 1.3 of this report.

GHD otherwise disclaims responsibility to any person other than Dunedin City Council arising in connection with this report. GHD also excludes implied warranties and conditions, to the extent legally permissible.

The services undertaken by GHD in connection with preparing this report were limited to those specifically detailed in the report and are subject to the scope limitations set out in the report.

The opinions, conclusions and any recommendations in this report are based on conditions encountered and information reviewed at the date of preparation of the report. GHD has no responsibility or obligation to update this report to account for events or changes occurring subsequent to the date that the report was prepared.

The opinions, conclusions and any recommendations in this report are based on assumptions made by GHD described in this report. GHD disclaims liability arising from any of the assumptions being incorrect.

Project name		Green Island Resource Recovery Park Precinct					
Document title		Draft SMOMP Report | DRAFT Erosion and Sediment Control Plan					
Project number		12613624					
File name		Document2					
Status Code	Revision	Author	Reviewer		Approved for issue		
			Name	Signature	Name	Signature	Date
S4	01 DRAFT	Mary Wood	Nick Eldred		Stephen Douglass		28/02/24

GHD NZ LTD
Contact: Nick Eldred, Project Director |
Level 3, 138 Victoria Street
Christchurch, 8141, New Zealand
T 027 746 7752 | **E** nick.eldred@ghd.com |

Appendix F

DRAFT Green Island Composting Facility Management Plan

GREEN ISLAND RRPP

DRAFT Composting Facility Management Plan

(Including Air Quality and Environmental Management Procedures)

February 2024

Enviro NZ Services Limited
Level 2, Building A, Millennium Centre
602 Great South Road, Ellerslie
Auckland 1051
Private Bag 92810, Penrose, Auckland 1642
Telephone: +64 9 636 0350

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1 Introduction

Enviro NZ Services Limited (ENZ) operates a Composting Facility located at the Green Island Resource Recovery Park Precinct, 9 Brighton Road, Green Island, Dunedin 9018. Enviro NZ Services Limited is the second-largest waste services company in New Zealand.

Enviro NZ is certified to ISO9001 Quality Management Systems, ISO45001 Occupational Health and Safety Management Systems and ISO14001 Environmental Management Systems at selected branches. Enviro NZ operates under the company's STARS (Stop, Think, Act, Remain Safe) in-house behavioural safety culture programme.

Enviro NZ takes safety, health, environmental and quality matters seriously; we pride ourselves on achieving high standards and believe we are the lead performer in the waste and recycling industry. Performance is driven from the Board, senior management, middle management, technical specialists and by employees.

The Composting Facility is in two parts as described below.

1.1 Organics Receivables Building (ORB)

This is an enclosed building with roller doors. Organic materials are delivered to the building where they are mixed and shredded. The shredded materials are loaded into hooker bins within the building for transport to the processing facility described in the next section.

1.2 Organics Processing Facility (OPF)

Composting is the process of aerobic conversion (under controlled conditions) of organic wastes by microorganisms, yielding cured soil conditioners, compost or humus. It is a natural process that can be managed and enhanced as a materials recovery tool.

The Green Island Composting Facility uses an aerated static pile (ASP) composting system as the OPF. It comprises a number of concrete bunkers with aeration channels in the floor. The ASP uses an automated aeration control and monitoring system, that measures the temperature of the pile and adjusts the airflow, from the bunker floor, to draw air into the pile (negative air flow) or out through the pile (positive air flow) to maintain aerobic conditions which minimises the generation of offsite odours. Air drawn into the pile under negative air flow is ducted via an exhaust fan to a biofilter to manage odours. When the pile is under positive pressure, the expelled air is vented via a compost cover, which acts like a biofilter to manage odours.

The Green Island RRPP Composting Facility has been designed to compost up to 20,000 tonnes per annum of input organic materials which will consist of mixed green waste and food waste from the Dunedin City residential kerbside organics collections and green waste dropped off at the transfer station.

Plans of the site are included in **Appendix One**.

1.3 Purpose of this Plan

The purpose of this document is to incorporate current best practice, the requirements of the consents and any other associated documents into a comprehensive guide for the management of the Composting Facility. This plan integrates the various operational and managerial aspects required to manage the transfer station into one document ensuring:

- Resource Consent requirements are met, and able to be internally audited;
- The requirements of Enviro NZ's Business Management System (BMS) are met and able to be internally audited; and
- Any agreed changes to operational practices are recorded and implemented.

1.4 Scope

This Composting Facility Management Plan (CFMP) describes the management, operations and responsibilities for ensuring that environmental effects of the Green Island RRPP Composting operated by Enviro NZ Services Limited (ENZ) are controlled and minimised as far as practicable.

The plan has been prepared as a requirement of the facility resource consents.

1.5 Responsibility

The *Green Island RRPP Operations Manager* is responsible for reviewing operations, developing and implementing management systems and providing sufficient resources to ensure compliance and training.

The *Compost Supervisor* is responsible for day-to-day operations, including implementation and enforcement of ENZ's health and safety programme, environmental management, compliance and complaints response.

The *Environmental Advisor* (Auckland based) provides technical advice and assistance to the branch as and when required and is responsible for ensuring that annual environmental audits are completed.

The *Environmental Manager* (Auckland based) provides technical advice and assistance to the branch as and when required and is responsible for assisting the site with consenting related issues.

The site will have sufficient staff at all operating times so that the measures set out in this plan can be implemented to ensure full compliance with consent conditions.

1.6 Site Layout

Table 1 Relevant Site Facilities

Facility	Description
Site office	Green Island RRPP site office administration building.
Organics Receival Building	Enclosed building for the receiving of food waste and mixing with green waste and high carbon material prior to shredding.
Concrete bunkers for composting	A concrete pad with 6 bunkers (expandable to 10) and aeration channels, which collect leachate, blowers to aerate the material in the bunkers and biofilter.

1.7 Management Systems

This plan refers to and draws on many parts of ENZ's BMS, under which ENZ operates. These references are hyperlinked. Hyperlinks are only available to persons with access to the EnviroNZ Intranet system.

For those persons without access, and who have a genuine need to access policies, procedures or forms, uncontrolled copies will be provided on request.

The BMS contains a range of policies, system and operating procedures, and forms that ENZ uses to operate its business and achieve external certifications. The key document is the Policy Manual which describes the rules under which ENZ operates. The procedures and forms are the 'tools' used to achieve these requirements. There are four core commitments that EnviroNZ publishes and displays at its sites. These relate to:

- Safety and Health;
- Environmental Sustainability;
- People; and
- Quality and Service.

A copy of these commitments is included in **Appendix Two**.

1.8 Control of this Document

This Site Management Plan is a controlled document and is subject to the requirements listed in COR-05-002 Document Control Policy and Procedure. It will be stored in the ENZ SharePoint system and controlled by the document controller. This will ensure that it is reviewed at the frequency required, at least annually, by the correct person, and that any holders of controlled hardcopies are also updated.

1.9 Review of this Document

This CFMP will be reviewed every two years and a copy submitted to the Otago Regional Council for approval.

When reviewing this document, the following should be considered:

- Records of compliance with the site's resource consents, applicable legislation (refer COR-12-010 Compliance Register) regional and district plans and other legislation (Refer to 1.10 Compliance and Legislation and Planning Instruments);
- Any changes to the regulatory environment;
- Records of Management Reviews, Council Review meeting Minutes, Incident reports, Tailgates or Safety and Health Committee meetings, any monitoring results (e.g. odour monitoring, health monitoring, performance monitoring) and any complaints (e.g. service related or environmental effects); and
- Internal and external audit results (health and safety or environmental).

1.10 Compliance with Legislation and Planning instruments

The Compost Facility will at all times comply with legal requirements.

Specific legislation and planning instruments of relevance to the site's operations includes:

- Resource Management Act 1991;

- Health and Safety at Work Act 2015; and
- Wider Green Island RRPP consents.

ENZ's COR-12-010 Compliance Register lists a wide range of legislation, regulation, bylaws, codes of practice and standards that need to be considered.

1.11 Resource Consents

The *Compost Supervisor* is responsible for taking such measures as are required to ensure that the site is operated in accordance with all resource consents conditions held for the site at all times. including consent conditions for the Organics Receival Building (ORB) and Resource Recovery Park Precinct (RRPP):

- Discharge Permit No: [to be inserted]
    - Discharge Contaminants to Air (odour, gasses from decomposition of refuse)

1.12 Variations to Resource Consents/Obtaining New Consents

Any change in operations could necessitate a variation to the existing consent or a new consent for the site.

There will be no change in operations which could potentially result in a change in the environmental effects from the site without first consulting the Environmental Advisor or Environmental Manager.

1.13 Summary of External Reporting Requirements

The operator of the site is required to report to both Otago Regional Council and Dunedin City Council to comply with its agreements and resource consents. A schedule of reporting is summarised in Table 2.

Table 2 Summary of External Reporting Requirements

Report	Originator	Frequency	Comments
Significant increase in discharge of contaminants to air	RRPP Operations Manager	Immediately	If they may result in adverse effects on the environment beyond the site boundary.
Air quality complaints	RRPP Operations Manager	Within 24 hours of a complaint	Maintain a log of complaints with detail as required under [consent number to be inserted].
Volume	RRPP Operations Manager	Annually	An annual report will be sent to the Otago Regional Council containing raw materials received.
Summary of air quality complaints	RRPP Operations Manager	Annually	The report will include all complaints in the year ending the month prior.

2 General Operations

All processes on site will be undertaken so that odours, noise, litter and other nuisances from the site are negligible.

2.1 Operating Hours

In terms of the movement and management of organics and compost the site will operate between the hours of 8.00am to 5.30pm Monday to Friday. No material management operations will occur on weekends, unless required to ensure efficient and effective composting processes are maintained to prevent discharges that may have adverse effects on the environment. The air blowers for the bunkers and biofilter will operate 24 hours a day, 7-days a week.

2.2 Traffic Management

A speed limit of 20 km/hr will be enforced on the site. Compost Facility staff will restrict the number of vehicles permitted to off-load at any one time. The number of allowable offloading vehicles will be what is appropriate for the size of the vehicles and the waste stream.

2.3 Plant Operation

All equipment and plant on-site will be operated and maintained by appropriately trained staff in accordance with manufacturer's instructions.

2.4 Contractors and Visitors

All visitors to the site not offloading refuse will report to the weighbridge upon arrival, this includes visitors to other areas of the site. Visitors will sign in at the weighbridge or site office and undergo an induction as per ENZ procedure (SHE-13-00).

Any contractors doing work on the site that could affect stormwater, air discharges or land use planning permissions will be provided with a copy of the relevant resource consents and appropriate training.

Contractors will be supplied with a copy of the site rules.

Training of contractors in site requirements is the responsibility of the Site Manager.

3 Process Control

3.1 Incoming Raw Materials

All raw materials will be pre-approved prior to arriving at the ORB and organics processing facility (OPF).

All vehicles entering the Green Island RRPP site will go over the weighbridge and then proceed to the organics processing facility.

The weighbridge operator may question the driver as to the source and content of the material to determine its acceptability.

3.2 Storage, Shredding and Preparation of Material

Kerbside collection food waste or mixed food and green waste materials will be received into the ORB, as indicated in **Figure 1**. The material may be stored for up to 24 hours within the ORB.

Site staff will minimise the time required for doors to be open, taking into account the efficient operation of the facility and odour potential of materials being processed

In general the doors will be kept closed except when required to be open for:

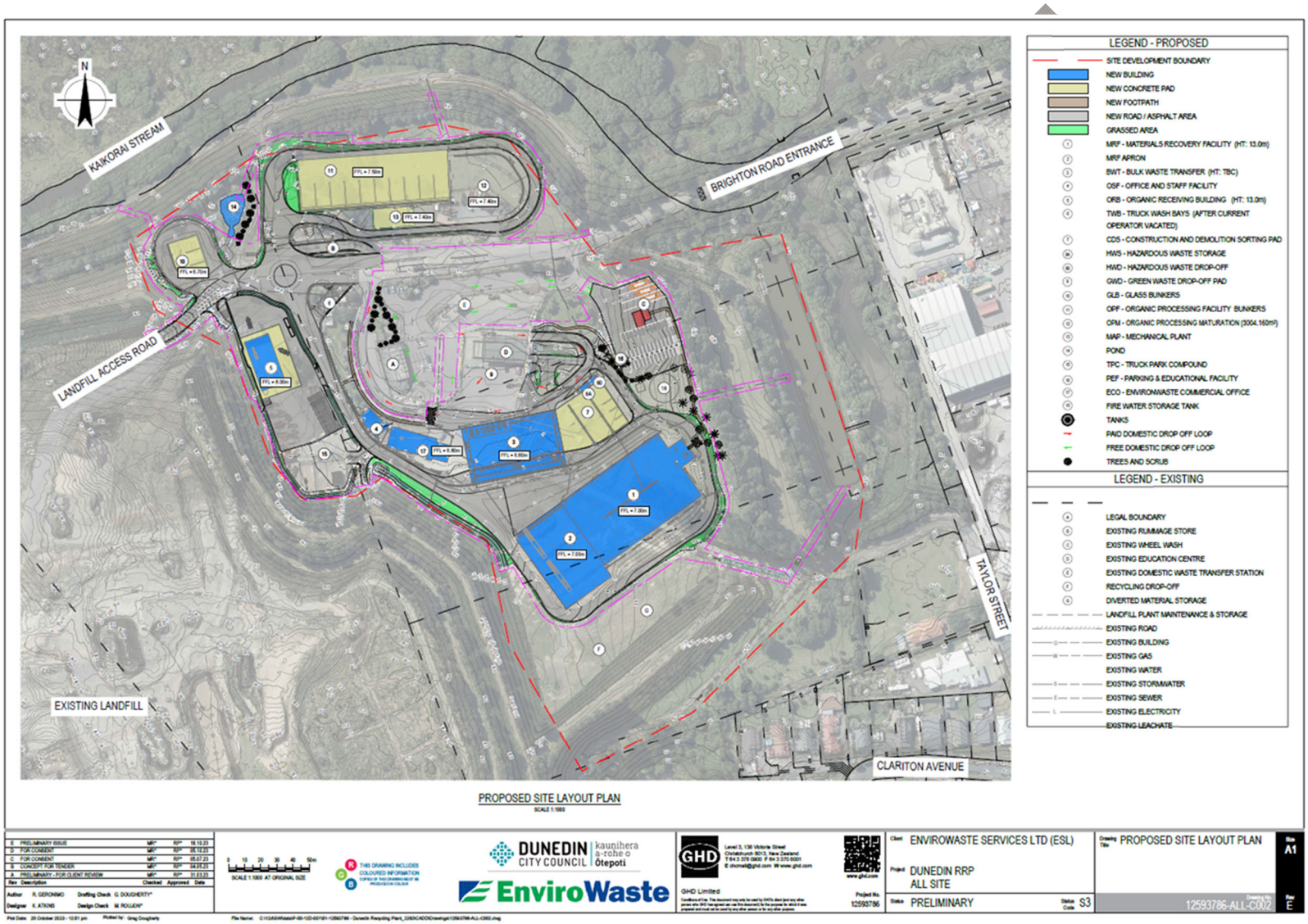
- Acceptance and removal of organic materials;
- Shredder loading;
- Shredded material acceptance;
- Removal of contaminants;
- Cleaning; and
- Maintenance.

The organics will be loaded into a shredder and the shredded material will be deposited into the shredded organics bunker.

Green waste will be received into the green waste stockpile area. Green waste will be stored unshredded on the stockpile area for up to 72 hours prior to shredding. Green waste (which will be mixed with kerbside organics) will be shredded into the shredded organics bunker.

Shredded material will be moved from the bunker into an aerated static pile bunker on a daily basis for composting.

Figure 1 Compost Facility Layout (Draft) – ORB (Location 5) and OPF (Locations11, 12 and 13)



3.3 Contaminants

Contamination is material deemed unable to be composted, or that can have a detrimental impact on the marketability of the final product. Contamination is considered to be, but not limited to:

- General refuse;
- Recyclable materials – Glass, Plastics, Metals;
- Hardfil/Cleanfill – Bricks, Concrete, Gravel, and Dirt;
- Treated timber or sawdust;
- Coal ash; and
- Chemicals/Herbicides

If material is badly contaminated with general rubbish, the bulk of the contamination will be removed for disposal, if possible, or the whole load removed for disposal. The source, date, and nature of contamination will be recorded on daily operating sheets.

If putrid waste is received, it will be redirected immediately to the landfill tipping area for disposal. Any other relevant observations (such as increases in lawn clippings or receipt of particularly odorous material) will also be recorded.

3.4 C:N Ratio

The C:N ratio of the mix at the start of composting will be 25 to 40:1 (or close to it), based on the ratio of food to green waste. **If C:N ratio is too high**, there is an excess of carbon over nitrogen and composting will proceed slowly. The C:N ratios of the compost feedstock materials used in compost mix preparation are shown in **Table 3**.

Table 3 C:N Ratio of Compost Feedstock Materials

Feedstock	C:N Ratio
Green waste (mixed)	53 - 16
Leaves	54
Grass clippings	17
Household food organics	11 - 19
Sawdust / wood shavings	442
Woodchips	560 - 641
Bark	223 - 496

(Source: Introduction to Composting Science and Management for Industry Training, Compost New Zealand, 2007)

To achieve a C:N mix ratio of 25 to 40:1 feedstocks are mixed in accordance the ratios in **Table 3**. This is generally achieved by mixing green waste with food waste at a volumetric ratio of 3 to 1. The

mix will be adjusted, using the ratios in **Table 3,** if large quantities of specific materials (for example, grass clippings) are received. Sawdust, woodchips or bark may be added to increase the carbon content in the unlikely event that green waste is not received in the required quantities.

3.5 Moisture Content

Moisture content of the mix will be managed to be between approximately 55% and 62%.

In prolonged wet weather and when much of the mix consists of fresh leafy material, it may not be necessary to add any extra water. The "squeeze test" will be used on site to determine moisture content of mixed raw materials prior to filling bunkers or forming windrows. It is conducted by taking a handful of the mixed materials and squeezing it tightly. At approximately 60% the material should feel damp to the touch and when tightly squeezed in the hand one or two drops of liquid will be released. If the clump drips water, it is too wet and requires more bulking agent. If the material falls through the fingers, it is too dry and may need water addition or more food waste.

3.6 Testing and Recording

The following monitoring and testing is undertaken for process control. This is generally undertaken for each batch of compost processed through the OPF.

- **Water content** may be tested, for by taking grab samples from the heaps and sent to an IANZ accredited laboratory, to ensure the squeeze test is being used correctly.
- **Temperature** is continuously monitored and recorded in each aerated bunker. Results can be downloaded on demand for specific batches.

In addition, samples will be taken from the mature heap to check for nutrient and herbicide content for product quality control. The samples will be sent to an IANZ accredited laboratory.

The details of each sample taken will be entered into the compost analysis register on the office laptop. A sample page is attached as **Appendix Three.**

3.7 Compost Facility Operation

Shredded organics from the ORB will be composted in the following way, depending on operational requirements.

- Initially materials will be loaded into aerated bunkers. Once each bunker is full the materials will be composted for a period of at least 21 days. During that time the composting material may be moved from one bunker to another.

Following active composting of at least 21 days (three weeks) the compost will be moved to the curing area pads and formed into windrows.

3.7.1 BUNKER LOADING

Filling of Bunkers - Bunkers will be loaded using a front-end loader. It takes from one to three days to fill an aerated bunker, depending on the rate of incoming organics.

Care should be taken by the loader operator not to overly compact the material by driving up on it or dropping in on to the floor from an excessive height. The bunker will be filled until material extends all the way out to the ends of the sidewalls at the ground to ensure the aeration floor trenches are adequately covered.

When loading a bunker with less material, the pile height will be lowered so that the material still covers the entire aeration floor and maintains a roughly uniform height.

The pile will be capped with an approximately 300mm layer of unscreened mature compost as the bunker is filled from the back to the front. This acts as a bio filter on the surface of the material.

When filling and capping the pile, the operator should aim to achieve no more than 300mm of height variation across the surface.

Initially, the system is operated manually in a positive aeration mode (air is blown up through the aeration holes and into the material) until the bunker is full. Running in positive mode during loading and unloading helps prevent the aeration holes from clogging and prevents the compost mix from becoming anaerobic.

Insertion of Temperature Probes - Once a bunker has been loaded two temperature probes are inserted into the material from the top. Each probe should be placed near the centre of the pile at a distance from the back wall where the cable is fully extended. The probe should be inserted into the material up to its full depth with some slack in the cable to account for material settling.

After the temperature probes have been inserted, the system begins automated operation, as per Section 3.9 below.

3.7.2 COMPUTER CONTROL

Once the bunker is full, the system begins automated operation, with reversing aeration mode, controlled by the computerised “Controller” aeration control and temperature monitoring system.

At the start of composting the aeration system runs in negative mode (air is drawn down through the material into the aeration holes and discharged through the biofilter) to maximise aeration and minimise odour generation. This allows the discharge gases to be treated on discharge through the engineered bio-filter.

Most odour will be generated during the first nine days of composting. Running the bunkers on negative during this time ensures minimum odour discharge.

Each bunker is controlled separately by the “Controller”, using a series of dampers to ensure each pile is composting optimally.

As the composting process progresses, the temperature probes have two sensors that monitor the top and bottom temperature of the compost piles in the bunkers. When the system detects a variance of greater than seven degrees between the top and bottom of the pile, the aeration mode reverses (switches). between positive and negative. This ensures that no part of the compost pile overheats, and that pasteurisation occurs throughout the entire pile.

The automated system ensures a homogenous environment throughout the material pile and that all parts of the pile reach a minimum temperature of 55°C for at least three days to ensure pathogen destruction.

3.8 Odour Control

The following steps will be taken to prevent odours escaping:

- The emptying of a bunker, or transferring of material between bunkers, will not be started if the prevailing wind is blowing towards an immediate receptor; and
- Composted material will be moved to the curing pad area using a wheel loader.

3.8.1 ODOUR CONTINGENCY MEASURES

If the material being composted “goes off” or becomes highly odorous or putrid, it will be removed from the composting site, using a covered vehicle, and immediately removed for landfill disposal.

3.8.2 MIXING MATERIAL

The material must be mixed during the moving process if moved between bunkers.

When under a cover, the outer layer becomes much wetter and cooler than the interior of the windrow. Compost close to the aeration channels becomes drier than material further away. Mixing during a move, turns the outer compost in, redistributes the moisture and loosens the mix (i.e. re-instates the porosity). This promotes even composting of all the material.

3.8.3 MOISTURE LEVELS

The moisture is not measured and can only be assessed by direct inspection. The compost will lose moisture during the composting process. In the aerated static pile system water is lost with the air flowing through the composting material.

High fan running time, high ambient temperature and low ambient humidity will all promote moisture loss from a composting pile windrow. Under optimal conditions, the initial water content should be sufficient to sustain the process to completion. If this is not the case, water will be added during composting in the bunkers. Regular inspection will reveal whether this is necessary.

3.9 Determining Maturity of Compost

Following a minimum of three weeks (21 days) active composting, as described in Section 3.7, the compost will be tested for maturity using the Solvita test[1]. If a batch does not meet the mature standard of 6 or higher additional aerated processing time of up to seven more calendar days may be required.

3.10 Curing of Compost

When compost maturity has been confirmed by the Solvita test compost will be cured for a minimum of 3 weeks. However, the curing period may be extended if space allows.

The minimum curing period will be decided by factors such as degradation of Clopyralid residues through testing of each batch of compost, operational routine and requirements of customers. Screening before the curing process will save on storage space and recover the carbon-rich left overs as soon as possible for re-introduction into the process.

Cured compost may also be removed from the site for curing at a customer site.

3.11 Screening

Batches of compost will be screened as required to meet end use requirements. Screening occurs outside therefore weather conditions will determine when screening can be undertaken. Screening will not be undertaken in wet or windy conditions. Screening should only be undertaken on rainless days when the prevailing wind will not take dust over neighbouring residential properties.

3.12 Preventing Contamination of Screened Material

Material is loaded into the screening plant with the front-end loader. The loader will be cleaned, as necessary, before being used to handle the cured product to prevent the contamination of the final product.

Oversize woody material that passes through the screen will be used as carboniferous bulking material in preparing feedstock for composting. While carting this over to the shredding pad, care must be taken not to contaminate the working area around the screen with raw material carried over from the shredder on the loader tyres.

3.12.1 STORAGE OF SCREENED PRODUCT

Whilst long term storage of screened product is not preferred, this will be dependent on quality testing results and end use requirements. A “screen on demand” system will avoid the need to stockpile screened product.

3.12.2 FINAL ANALYSIS & TESTING

Samples from each aggregated batch of final product (consisting of several windrows blended together) will be drawn and dispatched for analysis (Complete Compost Profile & Water Extractables B). Each sample must be recorded in the compost analysis register.

When a batch of compost is ready to be moved off the final pads, a minimum of one and a maximum of three samples will be taken.

Quality Assurance samples are taken for each batch and analysed at a laboratory for:

[1] The Solvita is an industry recognised test to determine compost maturity at the end of the composting process. It is undertaken on-site using a test kit.

1. A complete compost profile (this includes dry matter, C:N ratio, organic matter. full nutrient & heavy metals). Water extractables B profile (this includes pH, soluble salts, N profile & major soluble elements).
2. moisture determination.
3. herbicide residue (especially Clopyralid). This is the acid herbicide test which is taken periodically.

All samples are recorded in the compost analysis register when taken.

3.13 Composting End Uses

Cured compost will be transported from site to a variety of end users within 6 months of processing. Compost ill not be stored on site for longer than 6 months.

4 House Keeping and Maintenance

4.1 General Housekeeping

Cleaning of Bunker Trench Covers – Every month the aeration trench covers will be inspected for clogging.

If more than 20% of the holes are found to be clogged, they will be cleared manually with a stiff narrow brush, power washer, or an awl (nail in the end of dowel works well). The front-end loader may be used to clean the tops of the trench covers by placing a partial bucket of dry coarse wood at the outboard end of the trenches then chasing it down the length of the trench with the bucket.

Other tasks to be performed weekly are:

- All kerbs and drains must be cleaned;
- Any litter or wind-blown detritus will be picked up and disposed of; and
- The loader will be cleaned.

The Compost Supervisor, at their discretion, may undertake other housekeeping tasks they deem necessary to maintain a clean and orderly site, for example cleaning of compacted organics material from hardstand areas, as necessary.

4.2 Maintenance

4.2.1 MANUFACTURERS RECOMMENDATIONS

Inspection and maintenance of the aeration, blower and monitoring systems for the composting operating systems and the biofilter for the bunkers will be undertaken in accordance with manufacturers' recommendations.

4.3 Communication & Consultation

In the first instance, all operational issues are to be communicated with the Composting Supervisor and Green Island RRPP Site Manager. A weekly operational meeting will be held with the Green Island RRPP Site Manager, Composting Supervisor, and Compost Facility Operators to resolve operational issues.

5 Leachate Management

5.1 General

A small amount of leachate will discharge from the composting piles in the bunkers. This water could potentially have adverse effects on the surrounding environment.

All water from the bunkers drains into the aeration channels underneath each bunker. This water is considered contaminated and will be pumped to three 30,000 litre leachate storage tanks. Leachate from the tanks will be discharged to Pump Station 6 of the Leachate Collection trench that surrounds the RRPP site. Pump Station 6 directs leachate to a rising main that caries leachate to the Green Island Waste Water Treatment Plant.

5.2 Spill Response

All staff on site are trained in spill recognition and response. The location of spill kits on site, emergency contacts and the spill response procedure are detailed in the Green Island RRPP Emergency Plan.

6 Odour Management

6.1 Air Discharges

Beyond the boundary there will be no odour, dust, particulate, smoke, ash, or fumes caused by discharges from the Compost Facility, which could be considered noxious, dangerous, offensive or objectionable in the opinion of an Otago Regional Council officer . There will also be no discharges of any hazardous air pollutant, which is present in, or likely to be at a concentration that would be detrimental to human health or the environment.

6.2 Odour Control Measures

Odorous loads will not be accepted at the site in accordance with the waste acceptance criteria (section 3 Process Control).

All account customers are required to sign the Enviro NZ Waste Control Policy.

If the weighbridge operator identifies an odorous load it will not be permitted entry to the site.

Incoming compostable materials containing odorous material must be buried in the landfill.

All staff working at the facility will have training, which will include the requirements of resource consents, control of odorous materials, odour monitoring, housekeeping procedures and contingency measures.

Staff will undertake odour monitoring following ENZ odour monitoring procedures (**Appendix Four**). This will be conducted along the site boundary using ENZ odour monitoring forms [TO BE ALIGNED WITH ANY CONSENT CONDITIONS ONCE FINALISED].

The emptying of a bunker for transfer to the curing area will not be started if the prevailing wind is blowing towards an immediate receptor.

If the operation has been started and wind increases, the job will be finished as speedily as possible.

6.3 Biofilter

Odour from the negative aeration exhaust from the aerated bunkers is treated using a biofilter.

The biofilter is prepared by placing a bed of relatively coarse stable media (screened and shredded compost overs) over the biofilter pipes. The initial depth of the biofilter media will be 1.8 metres. Over time the media will compact and require topping up. At no time will the media depth be allowed to reduce to below one metre.

6.3.1 BIOFILTER MONITORING

The following monitoring of biofilter performance will be undertaken by the Composting Facilitator Manager.

- Continuous instrumental monitoring of the temperature and pressure of inlet air to the biofilter. Results will be stored and made available for download on request.
- Weekly visual and olfactory assessment of the condition of the biofilter media. A log of inspections will be maintained.
- Weekly monitoring of the biofilter media temperature. A log of temperature readings will be maintained.
- Every three months the static pressure drop across the biofilter media will be measured and recorded.
- A gravimetric determination of biofilter medium moisture content by taking a representative sample monthly for the first 6 months operation then six monthly thereafter.

- A sample of the biofilter media will be taken on a monthly basis for determination of pH. A log of results will be maintained.

Biofilter media will be changed in response to monitoring indicating degradation and loss of effectiveness. This is likely to be every 2-3 years.

6.4 Odour Contingency Measures

If the material being composted "goes off" or becomes highly odorous or putrid, it will be removed from the composting site, using covered vehicle, and immediately buried in the landfill.

In the event that odorous material is deposited, and/or odour can be detected off site, or a complaint is received, the Composting Facility Manager will undertake the following measures as required to mitigate the odour:

a) Immediately cover and remove the odorous load and if necessary; and

b) Report the odour incident using the SHE incident reporting and investigation procedures and investigate complaints in accordance with ENV-50-030, Environmental Complaint Handling Procedure (**Appendix Five**).

In the event that residence times are unavoidably extended at other times, e.g. as a result of equipment breakdown the left-over waste must be put into a covered vehicle and buried in the landfill.

6.4.1 CRITICAL SPARES AND CONTINGECY PLANS

Two spare damper actuator units for the odour control system are held on site in case of failure requiring replacement.

A critical item for the operation of the site is the shredder associated with the ORB. To ensure continued operation of the facility an alternative shredder will be identified that can be brought to hire and brought to site at short notice.

In the event that the facility cannot operate for short periods the ultimate contingency measure is to remove materials to a waste disposal facility.

7 Nuisance Management

7.1 Dust

Dust at the composting facility will be controlled by both the usual dust control measures employed at the Green Island RRPP site and the facility specific measures below:

- Vehicle speeds on site will be limited to a maximum of 20 kilometres per hour to minimise dust from the site. This speed limit will be clearly sign posted around the site.
- The surface of material in the bunkers will be watered as necessary to reduce the potential for wind erosion during high risk periods.
- Haul roads around the site will be watered as required to minimise dust.
- Bins/trucks carrying compost will be covered.
- The appropriate moisture content within the compost will be maintained (optimum moisture content is 60%).
- The existing shelter belt will help reduce wind speeds and embankments will minimise transport of dust.
- A water truck will be used to keep surfaces moist during high risk periods.

7.2 Noise

Current activities on the Green Island site are designated under Designation D658 until October 2023 with only one condition, which is noise related:

> 1. Noise generated by any activity on the site shall comply with the following standards at the boundary of this site: 55Dt/40Nt dBA (NB These levels are subject to an adjustment of minus 5 dBA for noise emissions having special audible characteristics).

An assessment has been completed by GHD (GHD 2024A, Waste Futures – Resource Recovery Park Precinct – Acoustic Assessment) regarding compliance of the RRPP operation (including the operation of the organics bunkers and all other likely equipment operations) and has demonstrated the RRPP can comply with both the `daytime and nighttime designation noise condition.

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7.3 Litter

A green waste and food composting facility is not expected to generate much in the way of litter. However, the landfill site has a number of existing controls for litter, including litter fencing and regular litter collections to manage litter from the site as a whole.

7.4 Pests

A pest control contractor is used by the landfill site to undertake vermin surveys and take action to control pests if required. The same contractor will be used to monitor for pests at the OPF.

All mixed organics will be shredded and placed in bunkers as soon as practicable, usually on the day of arrival at the facility.

8 Stormwater Management

8.1 Stormwater System

Drains on the perimeter around the composting facility divert stormwater runoff from surrounding areas to the Green Island RRPP stormwater diversion and treatment system. All leachate will be collected for separate disposal.

8.2 Stormwater Monitoring

Stormwater is monitored in ponds as part of the wider Green Island RRPP site.

9 Complaints Handling

9.1 Complaints Handling Procedure

Complaints will be directed to the RRPP Operations Manager, or Branch Manager.

Any complaints regarding noise, litter, dust, odour, or pests received by the site will be logged and investigated in accordance with ESL's complaints handling procedure (ENV-50-030) Environmental Complaint Handling Procedure.

In addition and acknowledging there is also a landfill operations contractor on the same Green Island site, complaints can also be directed to either the landfill contractors Operations Supervisor, or Regional Manager.

Complaints can also be directed to DCC Landfill Engineer or DCC Contracts Manager.

Whilst active landfill operations are occurring at the Green Island site, all complaints and follow-up will be shared between RRPP and the Landfill Operations Managers.

On receipt of a complaint the RRPP Operations Manager will note down all relevant information including:

- Type of compliant (noise, litter, dust, odour or pests)
- Date and time of complaint;
- Complainant's name, contact number and location; and
- Approximate wind direction and strength;
- Rainfall prior to complaint;
- The response and likely cause of the complaint; and
- Action taken or proposed as a result of the complaint.

The RRPP Operations Manager (or delegated person) will then inspect the site to determine the source of the complaint – this may or may not be associated with the composting facility. Once identified, appropriate action will be taken to control the impacts.

If associated with the RRPP site the RRPP Operations Manager will then inform the complainant of actions taken to mitigate the problem and note down all actions. On occasion complaints will be generated from the activities of others beyond the RRPP site boundary, including the adjacent landfill. As with all environmental complaints the Enviro NZ Environmental Complaints Handling Procedure (ENV-50-030) will be followed and the cause will be reviewed by the RRPP Operations Manager to determine whether further action, (e.g. a change to procedures, further training etc.) is needed to prevent a recurrence.

9.2 Notification of Complaints

ORC and DCC will be notified of any complaints as soon as practicable, and within 24 hours for air quality complaints.

10 Emergency Management

Emergency procedures are detailed in the Green Island RRPP Site Emergency Plan. The plan includes all emergencies that are likely to occur at the site e.g., spill response, fire, explosion etc. The Green Island RRPP Manager is responsible for the Emergency Plan and will review and update the plan annually. All employees will be trained in the Emergency Plan contents at least annually.

Relevant emergency contacts for the site are included in within the Emergency Plan.

11 Reporting and Review

11.1 Auditing Requirements

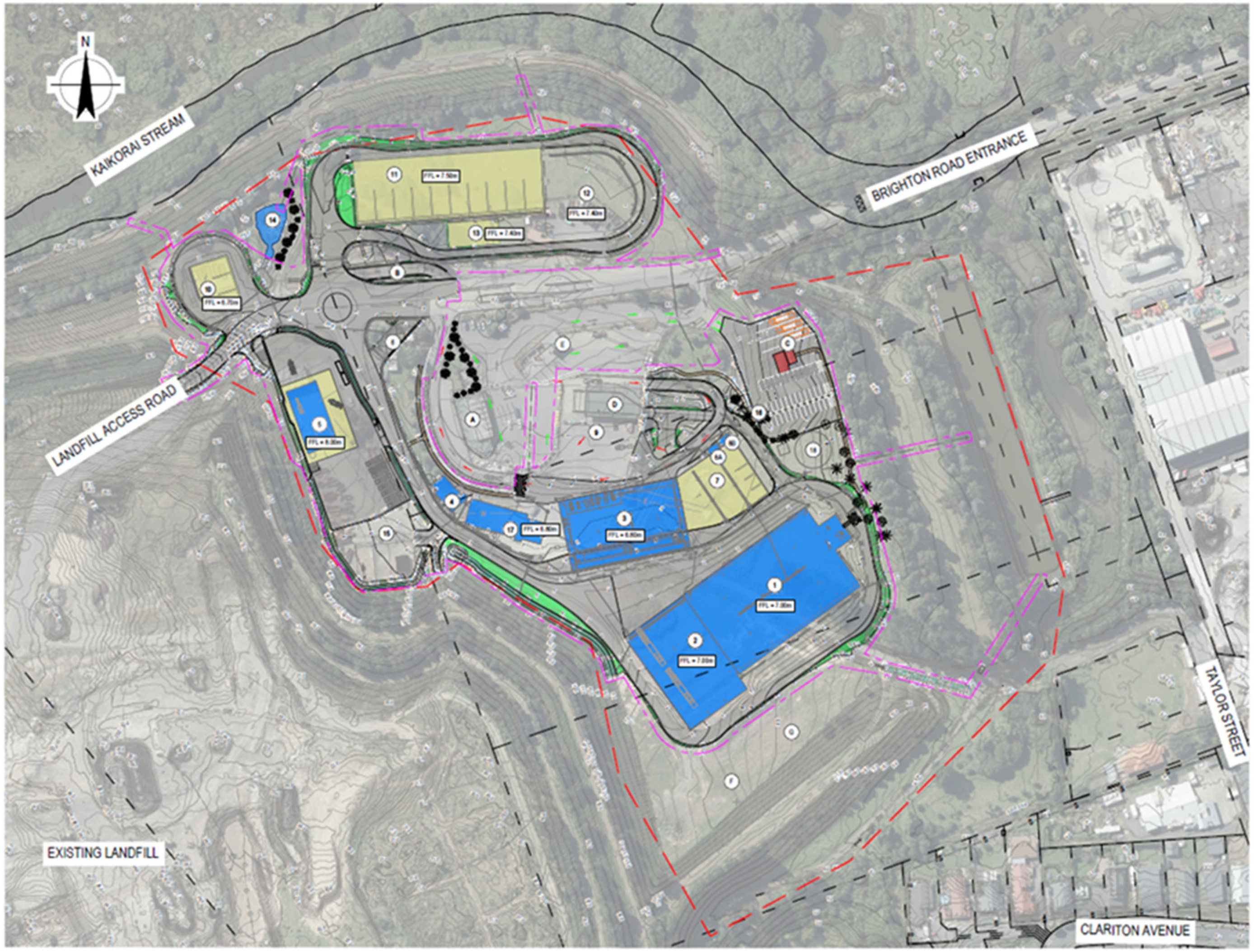
ENZ implements a system of internal environmental audits annually. The Environmental Advisor is responsible for conducting the audits and is considered to be an independent party to the site.

The internal ENZ audit measures sites' performance with the company-wide Environmental Management System (EMS) and assesses conformance with company procedures, its environmental management plan, site resource consents and other legal requirements. The audits also review any environmental risks on site and assess the appropriateness of controls.

The site will be audited annually for environmental performance and compliance with its resource consents as well as the ENZ EMS. Corrective actions will be communicated with the Composting Facility Manager and followed up by the environmental team.

Appendix One

Site Drawings



LEGEND - PROPOSED

- SITE DEVELOPMENT BOUNDARY
- NEW BUILDING
- NEW CONCRETE PAD
- NEW FOOTPATH
- NEW ROAD / ASPHALT AREA
- GRASSED AREA
- 1 MRF - MATERIALS RECOVERY FACILITY (HT: 13.0m)
- 2 MRF APRON
- 3 BWT - BULK WASTE TRANSFER (HT: TBC)
- 4 OSF - OFFICE AND STAFF FACILITY
- 5 ORB - ORGANIC RECEIVING BUILDING (HT: 13.0m)
- 6 TWB - TRUCK WASH BAYS (AFTER CURRENT OPERATOR VACATED)
- 7 CDS - CONSTRUCTION AND DEMOLITION SORTING PAD
- HWS - HAZARDOUS WASTE STORAGE
- HWD - HAZARDOUS WASTE DROP-OFF
- GWD - GREEN WASTE DROP-OFF PAD
- GLB - GLASS BUNKERS
- OPF - ORGANIC PROCESSING FACILITY BUNKERS
- OPM - ORGANIC PROCESSING MATURATION (3004.160m²)
- MAP - MECHANICAL PLANT
- POND
- TPC - TRUCK PARK COMPOUND
- PEF - PARKING & EDUCATIONAL FACILITY
- ECO - ENVIROWASTE COMMERCIAL OFFICE
- FIRE WATER STORAGE TANK
- TANKS
- PAID DOMESTIC DROP OFF LOOP
- FREE DOMESTIC DROP OFF LOOP
- TREES AND SCRUB

LEGEND - EXISTING

- LEGAL BOUNDARY
- A EXISTING RUMMAGE STORE
- B EXISTING WHEEL WASH
- C EXISTING EDUCATION CENTRE
- D EXISTING DOMESTIC WASTE TRANSFER STATION
- E RECYCLING DROP-OFF
- F DIVERTED MATERIAL STORAGE
- G LANDFILL PLANT MAINTENANCE & STORAGE
- EXISTING ROAD
- EXISTING BUILDING
- EXISTING GAS
- EXISTING WATER
- EXISTING STORMWATER
- EXISTING SEWER
- EXISTING ELECTRICITY
- EXISTING LEACHATE

PROPOSED SITE LAYOUT PLAN

SCALE 1:1000

Rev	Description	Checked	Approved	Date
E	PRELIMINARY ISSUE	MR*	RP*	18.10.23
D	FOR CONSENT	MR*	RP*	05.10.23
C	FOR CONSENT	MR*	RP*	05.07.23
B	CONCEPT FOR TENDER	MR*	RP*	04.05.23
A	PRELIMINARY - FOR CLIENT REVIEW	MR*	RP*	31.03.23

Author R. GERONIMO Drafting Check G. DOUGHERTY*
Designer K. ATKINS Design Check M. ROUJON*

0 10 20 30 40 50m
SCALE 1:1000 AT ORIGINAL SIZE

THIS DRAWING INCLUDES COLOURED INFORMATION
COPIES OF THIS DRAWING MUST BE PRODUCED IN COLOUR

DUNEDIN CITY COUNCIL | kaunihera a-rohe o Ōtepoti

EnviroWaste

GHD
Level 3, 138 Victoria Street
Christchurch 8013, New Zealand
T 64 3 378 0900 F 64 3 378 0901
E chcmail@ghd.com W www.ghd.com
www.ghd.com
GHD Limited

Project No. 12593786

Client ENVIROWASTE SERVICES LTD (ESL)

Project DUNEDIN RRP
ALL SITE

Status PRELIMINARY Status Code S3

Drawing Title PROPOSED SITE LAYOUT PLAN

Size A1

Drawing No. 12593786-ALL-C002

Rev E

Plot Date: 20 October 2023 - 12:01 pm Plotted by: Greg Dougherty File Name: C:\12\ENWaste\P-00-12D-001\01-12593786 - Dunedin Recycling Plant_3260\CADD\Drawings\12593786-ALL-C002.dwg

Appendix Two

EnviroNZ Commitments

EnviroNZ Commitments

EnviroNZ, its management and its people are committed to adhering to all applicable and required legislation and standards and operating in a lawful and compliant way at all times. In addition, EnviroNZ seeks to continuously improve its systems and performance across the business. Our commitment statements further enforce this position.

Safety & Health

We believe that maintaining the highest possible standard of safety and health is everyone's responsibility. We are committed to:

- Providing a safe and healthy workplace
- Providing effective, timely and quality training in safe procedures and practices
- Identifying, managing and where reasonably practicable eliminating hazards and reducing health and safety risks
- Consulting with workers to promote engagement and participation
- Promoting and fostering a just and fair culture of safe behaviour
- Driving continual improvements to eliminate work-related injury and illness
- Monitoring employee wellbeing, fitness and general health

Environmental Sustainability

We believe in protecting the environment and minimising the use of non-renewable resources. We are committed to:

- Promoting sustainable processes, resource recovery and waste minimisation
- Creating innovative solutions and services for environmentally unfriendly problems
- Integrating environmental matters in financial planning, business processes, services and strategic decision making
- Monitoring the sustainability of our operations in respect of local and global effects

People

We rely on our people for our success. Our people are diverse, hardworking, loyal and honest. We are committed to:

- Treating everyone with respect at all times
- Encouraging diversity and inclusion and supporting equal employment opportunity
- A culture of openness and transparency
- Fair recruitment and selection practices that encourage internal progression
- Recognising skills, experience and together with supporting personal and professional development
- Supporting our people in times of need

Quality & Service

We believe in providing high quality performance and service. We are committed to:

- Encouraging and supporting every employee to achieve their full potential and take pride in their work fostering a high performance culture
- Providing services which exceed customer expectations
- Forming enduring relationships with all stakeholders both internal and external
- Developing and providing innovative and sustainable solutions

Chris Aughton, Chief Executive Officer, EnviroNZ
March 2022

Appendix Three

Sampling Protocol and Compost Analysis Register

Enviro NZ Composting

SAMPLING PROTOCOL

The following procedure is to be used when sampling compost for analysis:

1. Using new, dry disposable gloves and a clean, dry bucket, take 10 generous grab samples of the compost to be tested from all over the heap. Each sample should consist of a large handful.
2. Dig into the heap and draw samples from the interior.
3. When drawing samples, take care to avoid a typical parts of the heap. Unusually wet or dry parts should be avoided. Take only from the material that makes up the bulk of the heap/batch. Do not take from the surface as this will tend to be wetter or drier than the material within the heap. Avoid including pieces of coarse woody material in the samples.
4. Drop the grab samples into the bucket and mix thoroughly. Without delay, and keeping it covered if raining, take the bucket to the office.
5. For laboratory analysis, draw off a 500g sample, place in a laboratory sample bag, seal, label appropriately, fill out the accompanying form and dispatch immediately by courier.
6. The following tests are to be requested:
   - At start of process of each batch – C:N Ratio and Moisture Content.
   - At end of eighth week – Complete Compost Profile + Water Extractables B.
   - When required – Acid Herbicide Screen for compost samples.
   - Acid Herbicide Screen for pre-compost samples
   - Product Stockpile - Complete Compost Profile + Water Extractables B.

COMPOST ANALYSIS REGISTER

Date Sampled	Heap No.	Sample Ref No.	Stage of Heap	Tests Required	Date Results Received	% Moisture	C:N Ratio	Comments

Enviro NZ Composting

DETERMINING MOISTURE CONTENT OF COMPOST

1. Using new, dry disposable gloves and a clean, dry bucket, take 10 generous grab samples of the compost to be tested. Each sample should consist of a large handful.
2. When drawing samples, take care to avoid atypical parts of the heap. Unusually wet or dry parts should be avoided. Take only from the material that makes up the bulk of the heap/batch. Do not take from the surface as this will tend to be wetter or drier than the material within the heap. Dig into the heap and draw samples from the interior. Avoid including pieces of coarse woody material in the samples.
3. Distribute the positions of sampling over the whole heap.
4. Drop the grab samples into the bucket and mix thoroughly.
5. Without delay (to avoid drying if warm/windy or wetting if raining) take the bucket to the weigh station and weigh off a single sample of 400g in a square aluminium lasagne tray. This is done as follows:
   - Place the empty tray on the scale and let the scale register its weight.
   - Record the weight of the empty tray.
   - Re-set the scale to zero.
   - Gently add the compost up to exactly 400 g.
6. Place the tray in the oven which has been pre-heated and set at 110º C. Leave for 12 hrs at this temperature after which the sample will be totally dry. Samples cannot be over-dried.
7. Place the tray back on the scale and measure its weight. Subtract the weight of the empty tray to determine the dry weight of the sample. Do not leave it lying around for long before weighing otherwise it will begin absorbing moisture again.
8. To calculate the percentage moisture content, use the following formula:
   (400 g – the dry weight in g, excluding the weight of the tray) = x grams

   (x grams / 400 g) X 100 = the percentage moisture content
9. To assist in this calculation, a quick calculator has been installed on the PC of the site office.
10. There are five points in the composting process where measuring and recording the moisture content is valuable – when first building a heap, when turning heaps for the first time, when turning heaps for the second time, when turning heaps for the third time and at dispatch. Monitoring moisture is essential to make sure the moisture content of the compost is within specification. While the "squeeze test" is a very good practical guide, it does not take encapsulated moisture into account. Exactly measured moisture levels enable much finer process control.
11. As a matter of course, moisture content must be determined and recorded for every batch of compost. A register for this purpose must be maintained at the composting site.

Appendix Four

Odour Monitoring Procedure

Work Instruction

Title:	Document Number:	Prepared By:
Odour and Litter Monitoring Work Instruction	ENV-50-025	Jessica Bates - Environmental Advisor
Revision Date:	**Division:**	**Document Owner:**
April 2021	Environmental	Laurence Dolan – Environmental Manager

Purpose

The purpose of this document is to provide instructions for odour and litter monitoring.

Responsibility

Department or Function (Role)	Responsible for
Quality Department	The control of this document
Environmental Department	Ensuring that this document is current and communicated to the business

Equipment and PPE

Equipment	PPE
Site specific odour and litter monitoring record (Appendix 1)	Hi Vis Vest
Beaufort scale (Appendix 2)	Steel Capped Footwear
Pen	Sunscreen (available)
	Wet Weather Gear

Instructions

Unless otherwise directed by the Environmental Advisor, Branch Managers will decide the frequency of monitoring, which will be based on the risk of odour and/or litter problems from the site.

TASK STEPS:

1. Walk slowly along the property boundary, stopping if you detect any odour.
2. Fill in an odour and litter monitoring form.
    a. Use a cross on the map to identify any location where odour is detected.
    b. Draw arrow(s) on the map to show the wind direction at the time of monitoring. If there is no wind then leave this step out.
    c. Use either the Beaufort wind scale (see Appendix 2 for details on this scale), or kph if you have an anemometer, to describe the wind speed. Be sure to identify which of these two scales are used.
    d. Fill in the allocated spaces on the odour and litter monitoring form for intensity and extent of the odour; a key to these parameters is included on the monitoring form.
    e. Describe any odour(s) detected (e.g. "smells like sewage", "rotting vegetable smell" etc.).
    f. If no odour is detected record the details including intensity 0 and extent 0, and the wind direction on the map.
    g. For litter, circle on the map any locations where litter is found and picked up.
    h. Fill in the allocated spaces on the form to describe the type of litter and the amount collected.
3. File the odour and litter monitoring form.

4. If nuisance odour is detected at the boundary, offsite monitoring downwind of the source should be carried out. Notify the manager or the Environmental Advisor.
5. If there is any odour detected at or beyond the boundary the incident needs to be reported using the SHE Incident reporting and investigation procedure. The following details the reporting requirements:
    a. If the odour intensity is "2" it can be described as a non-nuisance odour and incident report is completed.
    b. Nuisance odour has an intensity of "3" or above and an investigation must be completed, the source of the odour identified and corrective actions put in place.
6. Managers should undertake weekly or bi-weekly reviews of all monitoring forms to ensure any issues are being addressed.

Guidelines to determine the frequency of monitoring

The risk factors to take into account when determining the frequency of odour monitoring should include:

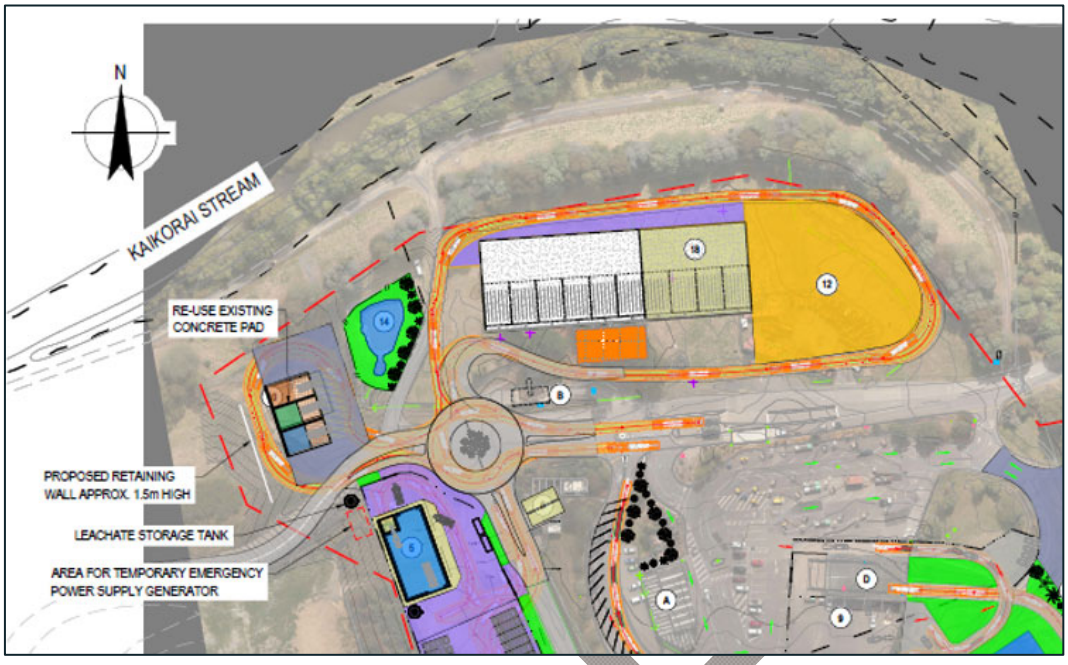
- Type of waste accepted
- Length of time waste is on site (RTS), or uncovered (Landfill)
- Surrounding land use, e.g. residential, commercial, rural
- Distance to nearest residential or recreational area
- Prevailing wind direction
- Complaint history
- Enforcement history
- Regional or district council interest in odours from the site

Associated Hazards and Controls

Hazard	Control(s)
Uneven terrain, slip/trip hazards	• Planned walking path • Pay attention to footing • Adequate lighting • Good housekeeping
Weather	• Appropriate PPE – hat, sunscreen, raincoats • In extremely hot weather, organise tasks for early morning or late afternoon • Postpone task until rains pass
Site activities/traffic (heavy and mobile equipment)	• High visibility clothing • Site awareness of your activities.
Working alone	• Inform manager or supervisor of task that you are going to complete • Carry a communications device, such as cell phone or RT

Work Instruction

Appendix 1 - Site Odour and Litter Monitoring Record



Assessment Completed by: _____

Reviewed by: _____

Key:
X – odour O – litter

Review Date: Time: _____ Date:	Approx. Wind Speed & Direction:

Litter Volume % of Wheelie bin: 100 75 50 25 0	Type of Litter:

	Odour Intensity
0	No odour
1	Indiscernible
2	Barely discernible
3	Apparent
4	Immediately apparent
5	Very strong

	Extent (assuming odour detectable, if not then 0)
0	No odour at the site boundary
1	Local & impersistent (only detected during brief periods a wind drops or blows)
2	Impersistent as above, but detected away from the site boundary
3	Persistent but fairly localised
4	Persistent and pervasive up to 50m from site boundary
5	Persistent and widespread (odour detected >50m from site boundary

Description of odour:

Additional comments:

Appendix 2 - Beaufort scale

Beaufort Force	Description	Specification on land	Speed		
			Knots	km/h	mph
0	Calm	Smoke rises vertically	Less than 1	Less than 1	Less than 1
1	Very Light	Direction of wind shown by smoke drift but not by wind vanes	1-3	1-5	1-3
2	Light breeze	Wind felt on face, leaves rustle, ordinary wind vane moved by wind	4-6	6-11	4-7
3	Gentle Breeze	Leaves and small twigs in constant motion, wind extends light flag	7-10	12-19	8-12
4	Moderate Breeze	Wind raises dust and loose paper, small branches move	11-16	20-29	13-18
5	Fresh Breeze	Small trees in leaf start to sway, crested wavelets on inland waters	17-21	30-39	19-24
6	Strong Breeze	Large branches in motion, whistling in telegraph wires, umbrellas used with difficulty	22-27	40-50	25-31
7	Near Gale	Whole trees in motion, inconvenient to walk against wind	28-33	51-61	32-38
8	Gale	Twigs break from trees, difficult to walk	34-40	62-74	39-46
9	Strong gale	Slight structural damage occurs, chimney pots and slates removed	41-47	75-87	47-54
10	Storm	Trees uprooted, considerable structural damage occurs	48-55	88-101	55-63
11	Violent Storm	Widespread damage	56-63	102-117	64-73
12	Hurricane	Widespread damage	>64	>119	>74

Appendix Five

Environmental Complaint Handling Procedure

Objective

The purpose of this procedure is to ensure that all environmental complaints are investigated and reported.

Policy

All environmental complaints are to be reported on a Complaint from External Party form in iTrak and, where applicable, investigated.

Responsibility

Department or Function (Role)	Responsible for
Branch Manager	• Ensuring that the requirements of this document are met. • Investigating all complaints regarding current site activities.

Definitions

What needs explaining	Meaning
Environmental complaint	An environmental complaint is a complaint from an external party in relation to a nuisance or pollution event caused by EnviroWaste's operations, namely odour, dust, noise, litter or a spill.

Procedure

- When a complaint is received, the following details are to be recorded:
  - Date and time of the complaint
  - Complainants name, location and phone number
  - Wind speed and direction (if it is regarding odour or dust)
  - Description of nuisance
- The complaint is to be reported as a complaint from an external party and the cause investigated.
- Examples of issues to include in the investigation include:
  - Site activities at the time of the complaint
  - Waste that was being disposed of
  - If it is odour, results of operational odour monitoring within the site or at the boundary
  - Breakdowns or equipment/operations failures that may have resulted in the nuisance
  - Any other activities that could have caused the nuisance
- The relevant Environmental Advisor shall be advised of the incident.

- Appropriate remedial actions are to be put in place to control the problem (refer to the Site Management Plan for operational controls).
  - The complainant is to be phoned and informed of the outcome of the investigation and any remedial actions to prevent further nuisance. If the cause is found to have come from another source, this is to be explained to the complainant
- The environmental complaint is to be recorded in accordance with the ESL incident reporting procedure.
- The Branch Manager is to review the incident form to determine whether further action is required (e.g. further investigation, changes to procedures or additional training).
- If Resource Consent requires, details of any complaints received must be provided to the Regulatory Authority, as soon as practicable of the receipt of the complaint, in consultation with the Environmental Advisor if feasible.
- If Resource Consent requires, a summary of all complaints received and any remedial actions taken shall be submitted to the Regulatory Authority at the frequency specified in the consent.

Records

Record Description	Storage Location	Protection	Retrieval method	Retention time	Disposition
Complaints Log	iTrak	Secure file location	From iTrak	For life of site	Secure document destruction
Paper Log of Environmental Complaint from External Party	Only for immediate collection of data prior to input into iTrak				

Appendix 1: Log of Environmental Complaint from External Party

Date:

Site Personnel:

Type of complaint	
Name, address and contact details of complainant (if available)	
Date complaint received	
Time complaint received	
Time air discharge occurred	
Location from which complaint arose	
Wind direction **Wind speed** **Rainfall (previous 6 hours)**	
Odour monitoring at time of complaint	
Site operation at time of complaint	
Other potential air discharge sources	
Likely cause of complaint	
Action taken	
Proposed further action	
Responded to complainant? include date, time and comments	

*Notify Environmental Advisor and Regulatory Authority (if applicable)

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