

Taggarts

15047

Blue Sky Resource Recovery Ltd.

Lisbane Landfill Site Capping Works

Construction Quality Assurance Plan

Waste & Engineering

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Report

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1 Introduction

1.1 General

Taggarts have been commissioned by Blue Sky Resource Recovery Ltd. to prepare a Construction Quality Assurance (CQA) plan for the construction and engineering of the final phase of capping works at Lisbane Landfill Site. The works will mainly consist of the installation of a capping system over an area of approximately 14,260m².

This subsequent CQA Plan details all the works and testing to be carried out and has been prepared in accordance with NIEA requirements and relevant guidance documents.

1.2 Location

Lisbane Landfill Site is located on Aughlish Road, approximately 2.5km to the south-east of Tandragee and 1.8km to the north-west of Scarva, Co. Armagh, centred on Irish Grid reference J 04822 344504. The site is accessed via secured gated access while the inactive landfill site is accessed via internal hard-core roads.

1.3 Current Site

Lisbane landfill is a former non-hazardous landfill situated in a former hard rock quarry (greywacke). The site previously accepted household, commercial and industrial wastes however no waste has been infilled at the site since July 2013. The site was temporarily capped with a 150mm regulation layer of clay type material which is overlaid by Cover up 240 Geohess panels in 2014. The temporary geohess cap is anchored around the perimeter of the site by 0.5m high clay bunds.

The quarry side wall of the landfill was lined with a GCL overlain by HDPE geomembrane, protection geotextile and Geogrid (Tensar 40RE). This lining system was attached to a polystyrene faced reinforced earth wall or by a revetment system which was bolted to the walls of the quarry. The top of revetment system is visible along the perimeter of the landfill.

Although the site no longer accepts non-hazardous waste the leachate and landfill gas produced on site continues to be managed. Leachate is extracted at the base of the landfill and tankered off site for treatment at an NI Water Water Treatment Works. Landfill gas is extracted via gas wells across the landfill site and combusted in the onsite gas flare.

1.4 Project Description

The works will comprise the construction and engineering of the final phase of permanent capping works. The capping system has been designed to meet the requirements of the Landfill Regulations (Northern Ireland) 2003. The programme for capping and restoration works will be implemented in a phased manner.

A surface sealing layer will be installed over the current temporary capping layer. This cap will provide a maximum permeability of $1 \times 10^{-9} \text{m/s}$ and will comprise a 1m deep soil layer. The installed cap will prevent the escape of landfill gases produced from degradable wastes and will mitigate the infiltration of surface water in to the waste body.

A summary of the planned works is as follows:

1. The retention of the current temporary capping layers including the 150mm clay layer and the geohess liner. This will form part of the permanent cap reducing infiltration of water and the escape of landfill gas.
2. Capping of the site – The cap with a maximum permeability of $1 \times 10^{-9} \text{m/s}$, will be determined by material availability and will be a 1 meter deep layer of clay/soils compacted to achieve the required permeability.
3. Landfill gas extraction system – the current landfill gas extraction system will be maintained with all functioning gas wells appropriately extended through the restoration layers.

Table 1.1 Proposed Capping System

	Layer	Thickness (mm)	Properties	Purpose
Current temporary cap	Regulation layer of clay type material	150	Cohesive clay	Smooth surface for placement of Geohess
	Cover up 240 Geohess panels with stitched seems, 0.5m clay bunds around perimeter	0.4/500	$1.6 \times 10^{-8} \text{m/s}$	Temporary cap
Proposed final cap	Compacted Soil layer	1,000	To have permeability of $1 \times 10^{-9} \text{m/s}$	To provide a low permeability barrier to prevent infiltration of water into the landfill mass as required in the Permit conditions.

All works will be undertaken by a contractor with experience in landfill works, to be appointed by Blue Sky Resource Recovery Ltd. The works will be supervised by an independent CQA Supervisor.

2 Definitions

For clarification, the following definitions are given:

Construction Quality Assurance (CQA) - A planned and systematic pattern of all means and actions designed to provide confidence that items or services meet contractual and regulatory requirements. Construction Quality Assurance refers to means and actions employed to assure conformity of the lining system, i.e. its preparation, production and installation, to this CQA Plan, the Contract Drawings and Specifications. CQA is provided by a party independent from production and installation.

Construction Quality Control (CQC) – Actions that provide a means of measure and regulation to characteristics of an item or service to contractual requirements. CQC refers to those actions taken by Manufacturers, Installers, Contractors, or the employer to ensure materials and workmanship meet the requirements of the plans and specifications.

Contractor - means the person or persons, firm, company or other body to whom the Contract has been awarded by the employer, and includes the Contractor's personal representatives or other parties, e.g. Sub-contractors, Manufacturer. The Contractor will undertake the execution of the works under the terms of the Contract.

3 Responsibilities

The CQA Project Team will comprise of the following:

3.1 Project Manager

The project manager will be office based and will:

- Attend all progress or liaison meetings and be the key contact with regulatory officers;
- Review all designs, plans and specifications;
- Review other site-specific documentation, including proposed layout and Contractor's qualifications;
- Administer the CQA program; and
- Review all changes to the design, plans and specifications.

3.2 CQA Supervisor

The CQA supervisor will be located at the site and will:

- Manage the daily activities of the CQA regime;
- Attend all CQA related meetings (e.g. Pre-construction and Progress);
- Supervise the ongoing preparation of the as-built drawings;
- Assign locations for testing and sampling;
- Record any relevant observations in the daily report;
- Oversee the collection of all samples for laboratory testing;
- Report any unresolved deviations from this CQA Plan to the Project Manager;
- Provide all logs and relevant data to the Project Manager;
- Assist in the production of the CQA Validation Report; and
- Report to the Project Manager.

4 Engineered Cap

The engineered cap is designed to mitigate water ingress and contain landfill gas until extracted by the gas management system. The cap will constitute a barrier providing a maximum permeability of $1 \times 10^{-9} \text{m/s}$, and will consist of a 1m thick soil/clay cap.

Only material deemed fit for purpose by the CQA Supervisor shall be utilised.

The capping works will complete the final phase of capping as detailed in the NIEA approved October 2017 CQA Plan, A final validation report for the last phase of capping will be submitted to NIEA for approval. The engineered cap shall be installed directly onto the temporary geohess cap currently installed on site that will provide further mitigation against the ingress of water and the collection of landfill gas.

Details of the proposed capping system is shown on Drawing 15047-502 The properties and quality assurance measures and requirements for each of the optional capping systems are provided in the subsequent sections of this report.

5 Soil Cap

A natural material landfill cap is to be used and will be a minimum of 1 metre thick and provide a maximum permeability of 1×10^{-9} m/s.

Throughout the restoration of the landfill, the Operator may receive or import available materials suitable for use as a cap. These materials shall be stockpiled in suitable locations within the landfill and shall be subject to a quality control system. This system shall include the delivery documents including source and weight of loads. Any imported materials shall be subject to testing and soil analysis to determine its capability for use as a capping material.

5.1 Soil Testing and Requirements

Testing of soils and clays shall be carried out in accordance with Table 5.1 to determine the materials suitability for use as a soil cap. The results of all testing shall be provided within the CQA Validation Reports.

The general requirements of materials to be used as a cap may vary based on material availability and agreed use with NIEA.

Table 5.1 Soil Testing

Property		General Requirements	Lab Test Method	Minimum frequency of test
Permeability / Hydraulic conductivity		1×10^{-9} m/s	BS1377 : 1990 , Part 6 : Method 6	1 per 5,000m ³
Remoulded undrained shear strength		≥ 50 KN/m ²	BS1377 : 1990 , Part 7 : Method 8	1 per 5,000m ³
Plasticity index (I_p)		$10\% \leq I_p \leq 65\%$	BS1377 : 1990 , Part 2 : Method 4.3 and 5.3	1 per 5,000m ³
Liquid Limit		$\leq 90\%$	-	1 per 5,000m ³
Particle Size Distribution	Percentage fines <0.063 mm (63 μ m)	$\geq 20\%$	BS1377 : 1990 , Part 2 : Method 9.2, 9.5	1 per 5,000m ³
	Percentage gravel > 5mm	$\leq 30\%$		
	Maximum particle (stone) size	150mm		
Minimum Residual Friction Angle with Geohess		19°	ASTM D6243/5321	1 per site

5.2 Field Trials

Before proceeding with the installation of a soil cap, the properties and suitability of the material shall be determined by laboratory testing. A field trial of the installed material shall then be conducted to evaluate the following aspects:

- Material handling and placement requirements;
- Compaction equipment and procedures;
- Number of passes of equipment necessary to achieve the specified relative compaction; and
- Field testing procedures for compaction.

The installation and testing of trial pads shall be witnessed by the CQA Supervisor on site. Sufficient information shall be obtained to demonstrate consistency across the site.

5.3 Placement and Compaction

The material to be used within the cap shall be placed and compacted in layers until the 1m depth is achieved. The level of compaction will be based on the completed field trials that will have determined the density levels required to achieve the desired permeability.

No placement or compaction of the capping material shall take place during inclement weather to include rain, snow and/or freezing conditions. Under no circumstances shall any frozen material be employed, be that from the stockpile of in-situ material or material which has been imported; neither shall the material be placed upon frozen subgrade. Any frozen material shall be placed to one side until thawed. If any placed capping material becomes frozen adjacent to a new placement area, then either the placement of the new section of cap shall be suspended until the existing material has thawed, or the frozen cap removed and replaced with non-frozen capping material. Any laid section which is damaged (including by weather) beyond its suitability for use, shall be removed and replaced as necessary.

The Contractor shall provide adequate and acceptable measures for protecting the material at all stages of the work from all sources of potential contamination until completion of the contract.

5.4 In-situ Testing

In-situ testing of the soil cap shall be carried out in accordance with Table 5.2 in order to demonstrate the compliance of the cap.

Table 5.2 In-situ Testing

Parameter	Test Method	Frequency
Density in-situ	In-situ Nuclear Density Gauge	1 / 2,500m ³
Moisture Content in-situ	In-situ Nuclear Density Gauge	1 / 2,500m ³
Density	Core Cutter Method- BS1377: Part 9: Method 2.4	1 / 5,000m ³
Moisture Content	Core Cutter Method- BS1377: Part 2: Method 3.2	1 / 5,000m ³
Particle Size Distribution	Sieve Analysis- BS 1377: Part 2: Method 9	1 / 5,000m ³
Depth	Marker posts with indicator line at 1m depth	1 / 2,500m ²
Permeability	Soak away test- See Section 5.4.1 below	1 / 5,000m ³

5.4.1 Permeability Testing

Permeability testing of the cap shall be carried out in-situ as outlined below:

1. Scrape a smooth flat surface 50mm below the surface layer to be tested;
2. Drive a 100mm internal diameter U100 cutter and tube 15mm into the smoothed area of the geological barrier;
3. Fill the tube to a depth of 50mm with water, record the time and seal the tube to minimise evaporation;
4. After 24 hours remove the cover and measure the depth of any remaining water. The level shall be recorded along with the observations of ground conditions around the ring.

If there is no water remaining the cap is too permeable. Observations and results of all in-situ permeability testing shall be included within the CQA Validation Reports.

5.5 Construction Quality Assurance

The objective of CQA Supervision is to confirm appropriate procedures are implemented at the site and to provide assurance that only suitable materials and construction methods are used.

The CQA Engineer shall instruct and train site staff on the procedures and requirements of the CQA Plan including all record keeping. Site staff shall be instructed to separately stockpile materials thought to be suitable for use in the cap. As soon as is reasonably practicable after

the stockpiling of potential geological barrier materials, a quantity of material determined by the CQA Supervisor will be removed and labelled for conformance testing, ensuring that the material meets the relevant requirements.

The CQA Engineer shall witness and supervise all conformance testing carried out in accordance with Table 5.1 and 5.2 above and record all construction activities and results. The CQA Supervisor reserves the right to request further measurements to be made or tests carried out as necessary, to demonstrate the cap has been installed in accordance with this CQA Plan.

If any of the works inspected by the CQA Supervisor do not comply with this CQA plan, the CQA Supervisor will record this and the Contractor will make good any non-compliance. Solutions for non-compliance will be noted and included in the CQA Validation Report.

6 Ancillaries

6.1 Gas Extraction and Management

Landfill gas is currently extracted from the landfill by gas wells and managed through the on-site gas flare. The gas extraction and management system shall continue on site during and after the completion of capping and infilling of restoration materials.

The cap shall be carefully placed around the existing landfill gas wells with bentonite powder poured around the wells to offer further mitigation against escape of landfill gases and ingress of water. The placement of capping materials in the immediate vicinity to the gas wells will be carried out by hand to reduce any risk of damaging the infrastructure.

Following the installation of the cap and prior to placement of restoration materials around the gas wells, the wells shall be extended by fusion welding extensions to the HDPE pipework. The wells shall be protected using concrete manhole rings or sand bags that will be lifted and infilled or left in-situ as the restoration materials are placed around them. The extensions of the gas wells shall continue vertically in sections as required during the placement of the restoration soils.

6.2 Surface Water Drain

The falls of the site and the installation of the cap will divert all storm water from the site to the north western boundary. The existing 300mm diameter perforated HDPE pipe along the bottom of the landfill slope, and adjacent to the upper concrete yard, will be lifted and re-laid on top of the completed capping surface. This will catch surface water from the capped slope for discharge off site at the existing single outfall location. The HDPE pipe will be wrapped in geotextile and covered with a clean drainage stone berm that shall provide filtration of surface water run-off during the placing of restoration materials.

The surface water discharge point shall be monitored on a monthly basis with further means of filtration utilised if deemed necessary (i.e. stone berm appropriately increased or geotextile filter material installed within berm). Other surface water monitoring, both upstream and downstream of the landfill will continue on a monthly basis as per the Permit to assess the effect of the placement of restoration materials on the watercourse.

7 CQA Validation Report

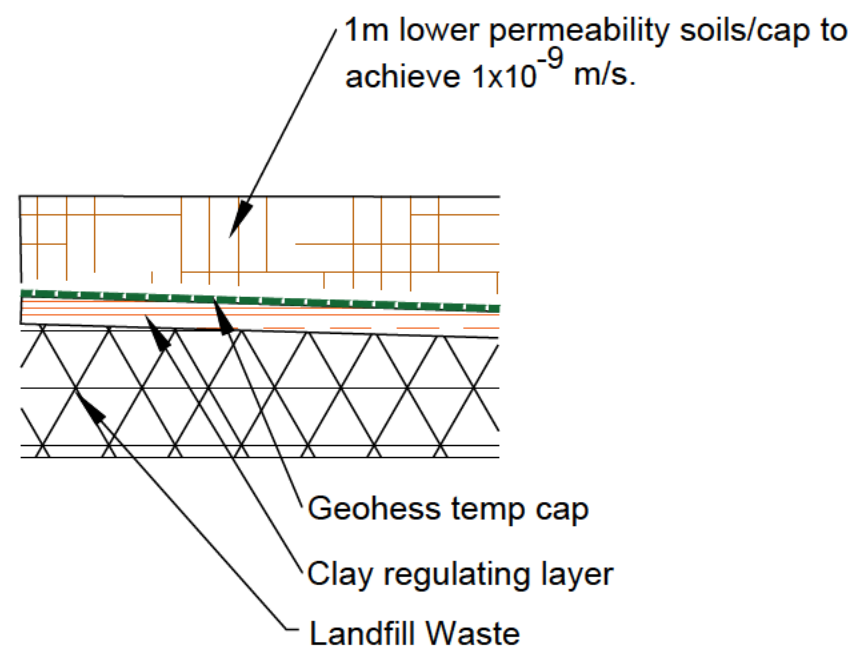
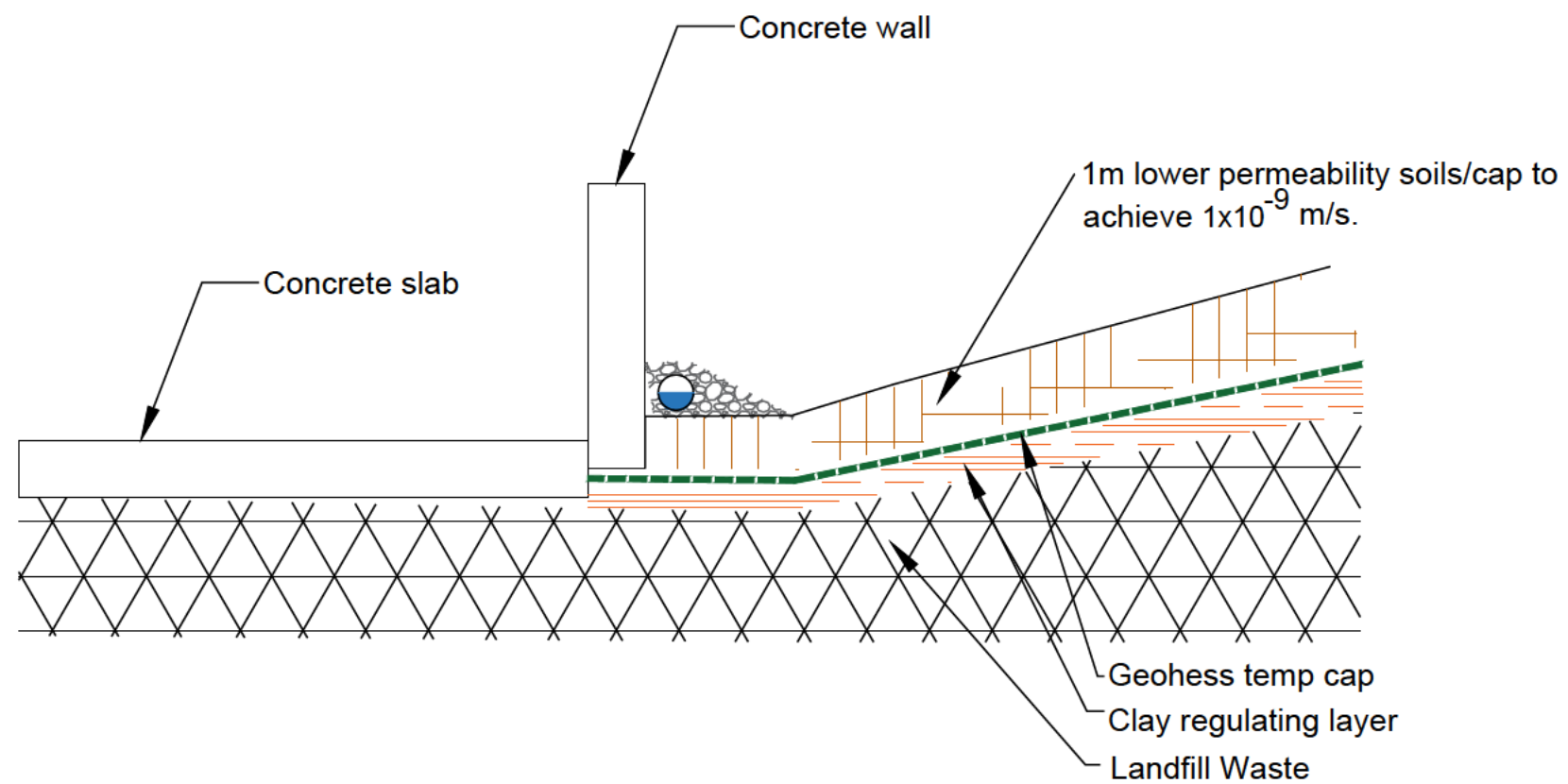
An individual CQA Validation Report shall be submitted upon the completion of each phase of cap prior to the placement of restoration materials.

The CQA Validation Report will provide the following information:

- All conformance certificates for materials used;
- The results of all field and laboratory testing to include any failed tests, details of remedial action taken and re-tests;
- Final as-built plans and surveys including engineering details of the work;
- Copies of the CQA Supervisor's daily/weekly records;
- Records of any problems or non-compliance and the solution applied;
- An appropriate selection of photographs showing progress, compliance, noncompliance and any remedial actions; and
- Validation that all aspects of works have been completed in accordance with this CQA Plan unless otherwise agreed in advance with NIEA.

Appendix A

Drawings



REV	DATE	DESCRIPTION	DRN	CKD
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INFORMATION

Taggarts

CLIENT BLUE SKY RESOURCE RECOVERY LTD

CONTRACT LISBANE LANDFILL SITE CAPPING CQA

DRAWING FINAL CAPPING PHASE

SCALE	NTS	DATE	AUG 25
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DRAWN	CHECKED
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DRG No.	15047-502	REVISION	-
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