

Ghallis Non Hazardous Landfill Closure Plan

CONTENTS

1.0	INTRODUCTION.....	1
1.1	Background.....	1
1.2	Report Context.....	1
1.3	Definition of Closure.....	2
1.4	Site Details	2
2.0	MANAGEMENT SYSTEM.....	6
2.1	Environmental Management System (EMS).....	6
2.2	Environmental Management System Overview	6
3.0	THE SITE	8
3.1	Site Infrastructure	8
3.2	Waste Accepted in the Landfill	10
4.0	LEACHATE MANAGEMENT/MONITORING	11
4.1	Leachate Collection/Monitoring.....	11
4.2	Control Levels and Contingency Action Plan.....	14
5.0	GROUNDWATER MANAGEMENT.....	16
5.1	Groundwater Control.....	16
5.2	Location, Design and Construction of Monitoring Points	17
5.3	Groundwater Monitoring	17
5.4	Control Levels/Compliance Limits and Contingency Action Plan	19
6.0	SURFACE WATER MANAGEMENT	21
6.1	Surface Water Collection.....	21
6.2	Surface Water Treatment and Disposal.....	23
6.3	Maintenance of Surface Water Control System	23
6.4	Surface Water Monitoring	24
7.0	LANDFILL GAS MANAGEMENT	25
7.1	Introduction.....	25
7.2	Landfill Gas Monitoring.....	27
7.3	Action and Compliance Limits and Contingency Action Plan Perimeter Monitoring	28
7.4	Monitoring Procedure.....	28
7.5	Data Management and Reporting Procedures.....	28
8.0	RESTORATION AND MAINTENANCE	30
8.1	Restoration Scheme	30
8.2	Site Survey	30
8.3	Site Maintenance and Repairs	30
9.0	ANTICIPATED REMAINING WASTE VOLUMES.....	32
10.0	RODENT AND NUISANCE WILDLIFE CONTROL PROCEDURES	33
10.1	Introduction.....	33
10.2	Environmental Influences	33
10.3	Birds, Flies and Other Vermin.....	33
10.4	Rodents	33
10.5	Pest Control Contractors	37
10.6	Rodenticide Code of Practice	37
10.7	Risks to Non-Target Species and Mitigation.....	38
10.8	Alternative Pest Control Measures	39
10.9	Post Treatment.....	40
10.10	Disposal of waste.....	40
11.0	CLOSURE.....	41

FIGURES

Figure 5-1 Groundwater monitoring points.....	17
Figure 9-1 Surface water monitoring points.....	23
Figure 4-1 Landfill gas monitoring points	26

TABLES

Table 7-1 Leachate Monitoring Programme Leachate Monitoring Points LCP1-11	12
Table 4-2 Leachate Level Contingency Action Plan	15
Table 5-1 Groundwater Monitoring Programme	16
Table 5-2 Groundwater Contingency Action Plan.....	20
Table 9-1 On-Site Surface Water Monitoring.....	21
Table 4-1 Landfill Gas Monitoring.....	25
Table 10.4.2b Application Methods for Rodenticide.....	34

DRAWINGS INCLUDED FROM PREVIOUS REPORTS

005A	Phase F2 Proposed Infilling Levels (Ref 5)
006	Cross Sections (Ref 5)
002	Leachate Monitoring Location Plan Layout (Ref 7)

NEW DRAWINGS INCLUDED IN THIS REPORT

001	General Site Layout
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APPENDIX A: MARCH 2017 VOID SPACE CALCULATION INFORMATION

1.0 INTRODUCTION

1.1 Background

SLR Consulting Limited (SLR) was instructed by WasteServ Malta Limited (Wasteserv) to prepare a Closure Report for the Ghallis Ta Gewwa Non Hazardous Landfill. Wasteserv has been operating the facility since 2007 and the objective of the work is to develop a draft closure and aftercare plan for the landfill.

Ghallis Ta Gewwa Landfill Site is part of a large integrated waste management facility close to the village of Maghtab approximately 2km to the north of Naxxaar and 2km east of Qawra along the northern coast of Malta (referred to by Wasteserv as the Maghtab complex). The overall site includes the following:

- The old and closed Maghtab Landfill;
- Zwejra Landfill Site; and
- Ghallis integrated waste management facility (Ghallis non-hazardous landfill, Malta North MBT facility, biological treatment plant and associated infrastructure).

For ease of reference throughout this document the site is referred to as “Ghallis” or the “site” or the “landfill”.

1.2 Report Context

1.2.1 Site Permit

The site is operated under the Integrated Pollution Prevention and Control (IPPC) Regulations in accordance with Permit No. IP 0001/06 B issued on 5th September 2007¹.

At the time of issue the permit recognises that as the site progresses Wasteserv would be required to submit a number of documents to provide further information to the Regulator. These are listed under Section 1.5 Improvement Programme. Item number 18 of this programme requests the submission of a draft closure plan and this report is produced to comply with that requirement.

It should be noted that the Maghtab site is relatively complex from a regulatory point of view given the site operates a number of facilities under different permits but with all facilities having some common and shared infrastructure.

1.2.2 Report Structure

This report is likely to be the first landfill closure plan issued in Malta under the IPPC regime. Although UK guidance and legislation does not apply in Malta, this report has been produced based on UK guidance to ensure “best practice”. This report contains multiple references to Environment Agency (Agency) guidance and/or UK legislation – these should be treated as best practice rather than statutory requirements.

The following documents are referenced as part of this report:

¹ Ghallis Non-hazardous Engineered Waste Facility, WasteServ Malta Limited, L/O Naxxaar, Naxxaar. Permit No IP/0001/06/B

1. Landfill (EPR5.02), How to comply with your environmental permit, Closing your Landfill, Version 1, Environment Agency, March 2013;
2. Landfill (EPR5.02), How to surrender your environmental permit, Closing your Landfill, Version 2, Environment Agency, December 2012;
3. IPPC Permit number IP 0001/06/B, issued by the Malta Environment and Planning Authority
4. Environmental Statement (ES) Volume 1, SLR, December 2005, 4C.585.001;
5. Landfill Phasing and Programming-Ghallis landfill, SLR, Ref: 403.00585.00026, dated September 2015
6. Landfill Optimisation of Void Space Assessment, SLR, Ref:403.00585.00026, dated April 2016
7. Ghallis Non Hazardous Landfill, Leachate Management and Disposal Options Report, SLR, Ref 403.00585.00026, dated April 2016;
8. Ghallis Non Hazardous, Gas Management Plan, SLR, Ref 403.00585.00026, dated Feb 2016
9. Adi Associates Environmental Monitoring Programme (June, 2014) for IPPC Permit IP 00001/06/B.

This Closure Report relates to the closure and restoration of the site so that it may be regarded as 'definitively closed', based on the guidance produced by the Agency in the UK. Landfill operators must submit "*such reports as may be required by the EA*", as set out within the Landfill Directive. The Agency must assess the submitted reports to ensure that measures are in place to monitor and control any potential hazards.

This submission has been prepared in accordance with the Agency's guidance on landfill closure (Ref 1 above). Additionally, account has been taken of the Agency's guidance on landfill permit surrender (Ref 2 above).

In many respects, this Closure Report knits together aspects of other reports that have been produced for the site, particularly drawings. To reduce the size of this report and make it more user friendly, applicable previous reports and/or drawings have been referenced rather than reproduced in this report.

This closure submission relates to the whole of the existing landfill area, and the boundary of the area to go into definite closure is shown on the drawing reproduced from the permit in Section 1.4.1 below. It should be noted that this report has been prepared before the landfill actually closes.

1.3 Definition of Closure

The term landfill 'closure' relates to a site that stops operating and no longer receives controlled wastes. The 'closure process' therefore establishes the measures that need to be in place, following the cessation of activities, in order to ensure the appropriate level of control and monitoring of the potential hazards and risks associated with a site. The closure process is distinctly different from 'landfill surrender', which relates to the handing back of the site permit once it can be demonstrated that the site no longer poses a risk to the environment or to human health.

1.4 Site Details

1.4.1 General

WasteServ has undertaken a phased operation of landfill cell construction and waste infilling since the site opened in 2007. The general sequence of operation is as follows:

- Excavation of limestone deposits to create the landfill void;
- Installation of a landfill lining and leachate collection system;
- Waste infilling with non-hazardous wastes;
- Installation of capping and restoration system (to be completed); and
- Installation of landfill gas extraction infrastructure (to be completed).

The process of rock excavation, cell construction and filling has been taking place since the site opened and on the basis of current projections is likely to remain operational until c. 2020. Following this the site will require installation of the capping and restoration system along with the landfill gas extraction infrastructure.

The General Site Layout of the entire Maghtab site showing the overall position of all facilities is shown on Drawing 1. An extract from the Permit (Schedule 3: Site Plan) is reproduced below showing the approved boundary of the controlled landfill.



1.4.2 Environmental Setting

Topography

The site falls from a level of c. 140mOD in the south west corner to c. 104mOD in the north east corner.

Site Setting

The site is located along the northern coastline of Malta in a semi-rural setting.

In the general vicinity of the landfill the land rises steadily from the coast to a level of around 30-50mOD. Further to the south the land rises steeply to over 100mOD along the Victoria Lines, which are located over 1km from the site. The land also rises steadily to the west, reaching a high point of around 116mOD at Gebel Ghawzara, around 2km from the site.

Surrounding Watercourses

There are no permanent surface water features within the site or adjacent surrounding areas. This reflects the small catchment size, climatic conditions, and the high hydraulic conductivity of the Lower Coralline Limestone that underlies the site and surrounding area.

Once the landfill site is fully capped and restored, there will be a need to revisit and upgrade the surface water management systems that are tied in to the overall Maghtab waste management complex.

Solid Geology

Details of the solid geology of the site are presented in Chapter 7 of the Environmental Statement (ES) Volume 1 (Ref4).

Drift Deposits

The development of soils on site is both patchy and limited. This is indicated by the shallow depth of the bedrock, ranging between 0 and 1.7m below ground level. Two distinct soil types are present, namely:

- The Xaghra Soil Series;
- The L'Inglin Complex.

Aquifer Status

Details of the aquifer status of the site are presented in Chapter 7 of the ES (Ref 4).

2.0 MANAGEMENT SYSTEM

Throughout the operational and post closure period of the landfill Wasteserv as the operator have developed a number of management techniques aimed at ensuring appropriate management controls are in place. A summary of these techniques are described below.

2.1 Environmental Management System (EMS)

Wasteserv operates a management system, a component of which is dedicated to environmental management which meets the requirements of ISO 14001. The management system governs operations at this site.

Consequently, operational procedures for the management of the site will ensure that all appropriate pollution prevention and control techniques are delivered reliably and on an integrated basis. The environmental management system assists in maintaining compliance with regulatory requirements and managing environmental impacts.

2.2 Environmental Management System Overview

2.2.1 Management Structure and Responsibilities

The Technically Competent Person (TCP) is responsible for day to day operations and compliance with the current Operating Permit and subsequent variations.

2.2.2 Technical Competence

During the aftercare phase the site will be managed by technically competent persons who will be fully conversant with the requirements of the Permit for the site.

2.2.3 Managing Documentation and Records

Controls are in place to ensure that all documents governing the environmental monitoring programme at the site are issued, revised and maintained in a consistent fashion.

2.2.4 Reporting Non-Compliance and Taking Corrective Action

Procedures ensure appropriate corrective action is taken in response to problems identified at the site. The procedures ensure that non-conformances are reported, investigated and rectified, and that failures are prevented. The following aspects are considered;

- actual or potential non-compliance;
- system failure;
- incidents, accidents, and emergencies; and
- complaints.

The action taken in response to the non-conformance may include;

- obtaining additional information on the nature and extent of the non-conformance;
- discussing and testing solutions; and
- modifying procedures and responsibilities.

2.2.5 Environmental Policy, Objectives and Targets

Wasteserv has a commitment to continual improvement, prevention of pollution and compliance with legislation.

Wasteserv's Environmental Policy incorporates the following commitments:

- Comply with IPPC permit IP 0001/06 and all applicable environmental laws and regulations that relate to our environmental aspects and impacts;
- Monitor and control the waste received on site, its handling, storage and disposal;
- Monitor and manage the activities associated with the generation of leachates;
- Monitor and manage the activities involved with the generation of gas including; extraction, collection, treatment and energy generation;
- Implement emergency preparedness measures to minimise and control the risk of fire; and
- Motivate and educate employees through training (formal and on-the-job).

2.2.6 Operational Control, Preventative Maintenance and Calibration

The environmental management system complements the environmental monitoring and maintenance procedures included in this Closure Report so as to ensure effective control of the site during the aftercare period.

3.0 THE SITE

3.1 Site Infrastructure

3.1.1 Containment Engineering

The lining and leachate collection system constructed at the base of each cell prior to waste placement (from top to bottom) consists of:

- 300mm gravel;
- Protection geotextile;
- Geomembrane;
- Geosynthetic Clay liner (GCL); and
- 500mm mineral liner.

The system is constructed on the base and side slopes of the cells, directly on top of the prepared formation surface shaped following extraction of limestone deposits.

3.1.2 Capping

The capping/restoration system (from top to bottom) is still to be fully designed and approved but will consist of the following or equivalent subject to approval:

- 1000mm thick restoration material;
- 300mm thick protection layer;
- Geocomposite Drainage Layer;
- 1.0mm thick Geomembrane; and
- 300mm stabilisation layer.

3.1.3 Leachate Management/Storage

Each hydraulically independent area of the landfills base falls to a leachate collection and monitoring well. This will continue for future cells. The leachate wells are built up from the base of each landfill cell and extend to the current site surface to allow for monitoring of leachate levels, sampling of leachate quality and pumping of excess leachate for recirculation back into the waste mass. The existing landfill site currently has 11 leachate collection wells numbered LCP1 to LCP11. More information is provided in Chapter 4 of this report.

3.1.4 Landfill Gas Management

The waste types that have been, and will continue to be, accepted at the landfill are generally biodegradable with some non-biodegradable material. Therefore it is considered that a gas management system is required.

More information is provided in Chapter 7 of this report.

3.1.5 Road Surfacing

The landfill is accessed via the recently constructed main access to the Maghtab complex off the main coast road. The Maghtab site entrance includes tarmacked roads, weighbridge and other associated infrastructure. Access to the landfill for waste deposition is via temporary site roads which are appropriately maintained.

Following closure, benches will be retained on site within the waste area for rehabilitation, monitoring, gas management and maintenance of the landfill.

3.1.6 Restoration

At the time of writing this report, none of the landfill areas have been capped or restored.

The currently proposed restoration contours are identified on Drawing 005A (Ref 5 above) .It should be noted that the possibility to amend the restoration contours is being considered, as identified in the 2016 report (Ref 6 above).

Typical cross sections through the landfill are shown on Drawing 006 (Ref 5 above).

These 2 referenced drawings from other reports have been included for completeness in this report.

3.1.7 Bunds/Fuel Storage

There are no fuel storage facilities at Ghallis. If, in the future, any fuel storage facilities were required, then these would be appropriately bunded. These facilities will be removed from the site following completion.

3.1.8 Site Offices and Parking Facilities

The site offices and weighbridge are shared with the other facilities in the Magtab complex and will therefore be retained following closure of the landfill.

3.1.9 Perimeter Fencing and Site Security

The site boundary of the Magtab complex is enclosed by a security fence and the site entrance is gated and locked outside operational hours. The fencing is inspected regularly for signs of damage and maintained.

Site security is based on the following objectives and requirements;

- to ensure that members of the general public do not become endangered by unknowingly encroaching over the landfill site boundary;
- to positively discourage fly tipping; and
- to minimise vandalism on the site, in particular to environmental monitoring and control equipment.

3.1.10 Notices and Signs

A large, clearly marked notice board of durable, weather resistant design is maintained at the entrance to the Magtab site. The notice board shows the following;

- the name of the installation;
- the name, address and telephone number of the permit holder;
- the address and telephone number of the ERA office responsible for monitoring the installation;
- an emergency out-of-hours telephone number for the operator;
- an emergency telephone number for the ERA.

The notice board is maintained in a legible condition and will be maintained as such throughout the closure phase of the site's life.

3.1.11 Surface Water Management

Existing ponds (outside the landfill permit boundary) are currently being used for surface water management to prevent direct discharge to coastal waters. Once the landfill site is fully capped and restored, there will be a need to revisit and upgrade the surface water management systems for the entire Magthab complex. Once this re-design has been completed further details would be provided.

3.2 Waste Accepted in the Landfill

The site accepts, and will continue to accept until closure, a range of non-hazardous wastes as defined in the permit.

4.0 LEACHATE MANAGEMENT/MONITORING

4.1 Leachate Collection/Monitoring

Each hydraulically independent area of the landfills base falls to a leachate collection and monitoring well. This will continue for future cells (some cells still to be constructed). The leachate wells are built up from the base of each landfill cell and extend to the current site surface to allow for monitoring of leachate levels, sampling of leachate quality and pumping of excess leachate for recirculation back into the waste mass.

In order to comply with the Permit requirement, the Operator monitors leachate at the site in accordance with the consolidated Environmental Monitoring Programme (Ref 9) for the Permitted Installation. The following leachate monitoring is required to be completed and this includes information relating to both the leachate levels and the leachate quality. Note references Table 7.1 and Figure 7.1 relate to the EMP (Ref 9) and are identified as EMP Table 7.1 and EMP Figure 7.1 to avoid confusion:

Table 7-1
Leachate Monitoring Programme
Leachate Monitoring Points LCP1-11

Determinand	Indicator Monitoring Frequency (Monthly)	Characterisation Monitoring	Control Level	Trigger Level	Detection Limit
Water Level	3		0.8m	1.0m	
Conductivity	3				±3.4 µS/cm
pH	3				0.1 pH units
TOC	3				0.1mg/L
NH ₄ N	3		260mg/L	1000mg/L	0.01mg/L
Cl ⁻	3		10000mg/L	500mg/L	0.05mg/L
Phenol Index	3				0.05mg/L
F	3				0.05mg/L
Fe		12			0.1µg/L
SO ₄		12			0.05mg/L
Na		12			0.5mg/L
K		12			0.5mg/L
Mg		12			0.05mg/L
Ca		12			0.05mg/L
As	3		0.004mg/L	0.4mg/L	0.14µg/L
Ba		12			0.1µg/L
Cd	3		0.0002mg/L	0.02mg/L	0.1µg/L
Cr	3		0.09mg/L	0.4mg/L	0.2µg/L
Cu	3		0.05mg/L	0.1mg/L	0.3µg/L
Hg		12			0.1µg/L
Mo		12			1.0µg/L
Ni	3		0.2mg/L	0.6mg/L	0.05µg/L
Pb	3		0.1mg/L	0.3mg/L	0.1µg/L
Sb		12			0.5µg/L
Se		12			0.9µg/L
Zn		12			4.1µg/L
Hydrocarbon	3				1µg/L
List 1 screen		12			

The current leachate monitoring points are shown in the “Leachate Collection Location Plan (002)” taken from the Leachate Management and Disposal Options Report (Ref 7). This drawing has been included in this report for completeness.

4.1.1 Maintenance of Leachate Monitoring System

The following aspects of the leachate monitoring system will be inspected on a quarterly basis:

- To identify any damage to protective covers;
- To identify any damage to the leachate well visible at ground surface;

- To identify any ponding water in the vicinity of the well;
- To identify any vegetation obscuring the well;
- To identify whether any identifying information (eg well reference number) is clearly visible;
- Depth of well checked using a dip meter to determine whether any silting up has occurred.

The outcome of these inspections would be recorded and the records kept on site. Any remedial action identified as part of the inspection regime would be remedied within 3 months of a maintenance requirement being identified.

4.1.2 Leachate Monitoring

The following programme for leachate monitoring, outlined in EMP Table 7.1, will be carried out moving into the post closure phase. Following further post closure assessment of monitoring information it may be possible to agree a reduction in the monitoring requirements subject to approval.

Monitoring of leachate will be carried out at each of the wells identified in EMP Table 7-1 and EMP Figure 7.1 above and any additional leachate wells added in the upcoming cells. On completion of all cells the leachate monitoring points drawing will be updated.

4.1.3 Monitoring Procedure

At each well, landfill gas monitoring would be undertaken before leachate monitoring and/or sampling was undertaken.

Monitoring will be carried out by a specialist, in accordance with the procedure outlined below:

Pre-Monitoring Checks

Prior to undertaking leachate monitoring, checks are carried out to determine;

- the number of samples and analytical requirements;
- the size, type and number of pre-labelled bottles that are required, and any fixative or preservative requirements;
- that all equipment is clean and in good working order;
- that all necessary equipment is available including keys; and
- equipment used for leachate sampling are marked 'leachate only' and will not be used for any other purpose.

Site Records

A record is made of the following;

- name of technician;
- date of sampling;
- sampling equipment and method used;
- on-site weather conditions;
- damage to manhole/headworks of leachate extraction and monitoring points;
- the specific reference number of the leachate extraction/monitoring point; and
- depth to top of leachate and depth to the base of the extraction/monitoring point.

Monitoring Procedure

The following procedures are implemented;

- an electronic dip tape or equivalent monitoring method (transducer) is used to record the depth to the top of the leachate, and the depth to the base of the extraction/monitoring point from the top of the cover;
- samples of leachate are obtained from the relevant sump or leachate monitoring point;
- where pumps are not installed samples are obtained from the well using a bailer;
- the sampling equipment is flushed out between sample locations;
- those sample bottles not containing preservative are flushed out with the sample;
- other than for bottles containing fixative, the sample bottle is filled to the brim to exclude air, the top is secured firmly; and
- all bottles are clearly pre-labelled with the location code and date, this approach avoids any confusion both in the field and in the lab.

Data Management and Reporting

The leachate level is recorded as leachate head (m). Should leachate depths be referenced against a fixed segment of leachate shaft, segments will be numbered sequentially and numbers will be recorded and checked against the previous months records.

The TCP will be informed by the monitoring technician of any results in excess of the compliance levels or any problems recorded as part of the visual inspection. All records will be held off site.

The leachate level and quality monitoring results are entered into a database off site, and the data submitted to the ERA for review at an agreed frequency.

Quality Assurance

Suitably trained, competent personnel undertake leachate monitoring. Laboratory analyses of samples are carried out at an accredited laboratory. A major ion balance is undertaken routinely and reported by the analytical laboratory as part of laboratory quality control procedures. Monitoring equipment is serviced and maintained in line with the manufacturers' recommendations.

Should any of the leachate monitoring points become damaged to such an extent that the leachate levels cannot be recorded they are either repaired or replaced if practicable. The nature and location of any replacement, as well as the methods to be used, would be agreed with the ERA prior to any works being undertaken.

4.2 Control Levels and Contingency Action Plan

Environmental monitoring is a crucial element of the risk assessment process as it;

- allows for validation of the risk assessment;
- can confirm whether risk management options are meeting their desired aims; and
- provides a warning mechanism if adverse impacts are found.

Control levels and compliance limits form the basis for assessing leachate monitoring data at landfill sites.

Control levels are specific assessment criteria relating to leachate or other relevant parameters and are used to determine whether a landfill is performing as designed. They are

levels that are intended to draw attention of site management and the ERA to the development of adverse, or unexpected, trends in the monitoring data. Such trends may result from failure of site engineering or management, or from variations between actual conditions and those assumed within the conceptual model. Control levels should be treated primarily as an early warning system to enable appropriate investigative or corrective measures to be implemented, particularly where there is potential for a compliance limit to be breached.

A well-planned EMP, agreed between the operator and the ERA, will help to protect the environment and thereby avoid breaches of compliance limit, and provide clarity and avoid ambiguity when compliance limit conditions are breached.

Control levels should therefore;

- highlight variations between the conceptual model (i.e. assumed behaviour) and observed conditions;
- identify unambiguous adverse trends which are indicative of leachate impacts;
- allow for variation in natural water quality from baseline conditions; and
- give sufficient time to take corrective or remedial action.

4.2.1 Control Levels and Compliance Limits

The provisional leachate monitoring schedule is set out in Table 7-1 above.

4.2.2 Contingency Action Plan

In the event that control levels are exceeded at the designated monitoring locations, the various actions that may be appropriate are detailed in Table 4-1 below.

Table 4-2
Leachate Level Contingency Action Plan

Appropriate Contingency Actions	Following a Breach of	
	Control Level	Compliance Limit
Monitoring technician will advise TCP	✓	✓
Confirm by repeat sampling and analysis	✓	✓
Review existing monitoring information	✓	✓
Review the assumptions incorporated into the conceptual site model		✓
Review existing control levels		✓
Review site management and operations, and implement actions, or corrective actions, to prevent future breach of control levels	✓	✓
If necessary, set in place procedures for implementing corrective measures in consultation with or required by the EA		✓

5.0 GROUNDWATER MANAGEMENT

5.1 Groundwater Control

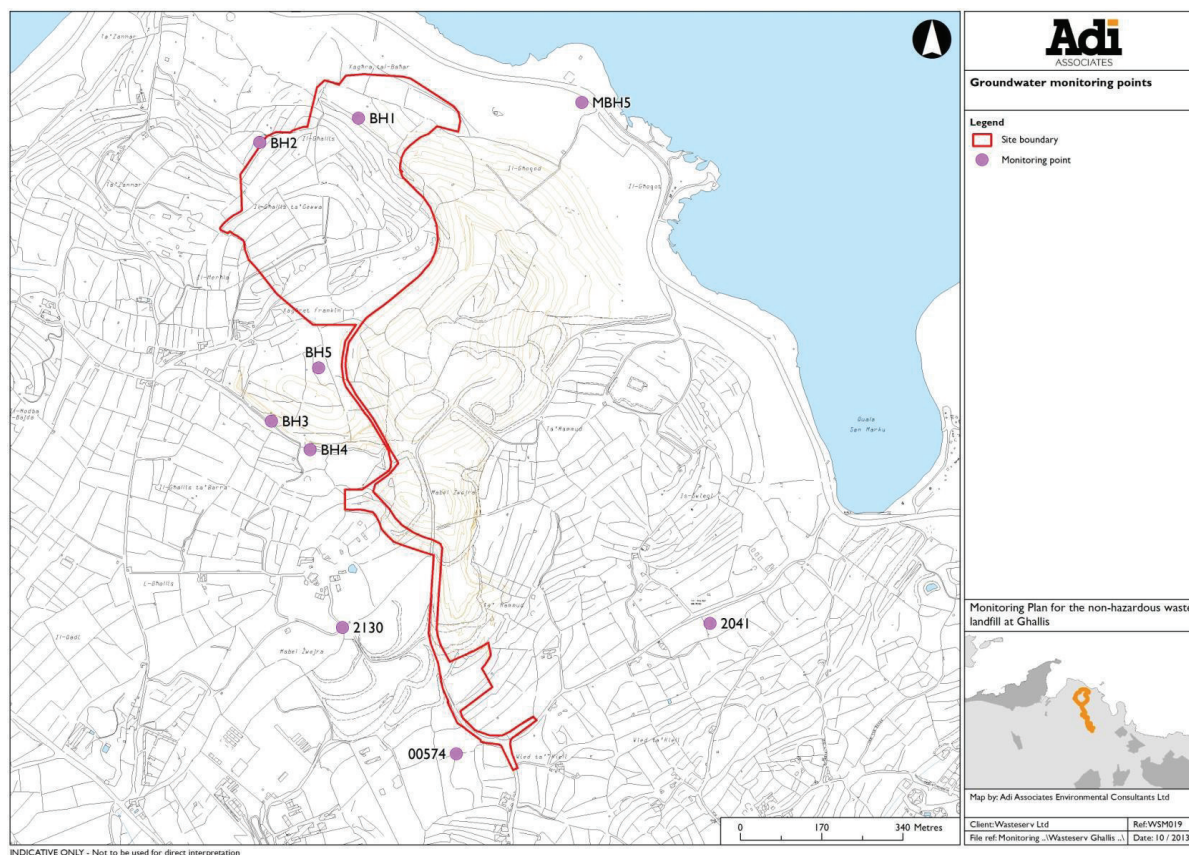
In order to comply with the Permit requirement, the Operator monitors groundwater at the site in accordance with the consolidated Environmental Monitoring Programme (Ref 9) for the Permitted Installation, the following groundwater monitoring is required to be completed. Note references Table 5.1 and Figure 5.1 relate to the EMP (Ref 9) and are identified as EMP Table 5.1 and EMP Figure 5.1 to avoid confusion:

Table 5-1
Groundwater Monitoring Programme

Determinand	Indicator Monitoring Frequency (Monthly)	Characterisation Monitoring	Control Level	Trigger Level	Detection Limit
Water Level	3				
Conductivity	3				±3.4 µS/cm
pH	3				0.1 pH units
TOC	3				0.1mg/L
NH ₄ N	3		0.195mg/L	0.39mg/L	0.01mg/L
Cl ⁻	3		N/A	N/A	0.05mg/L
F ⁻	3				0.05mg/L
Phenol Index	3				0.05mg/L
Fe		12			0.1µg/L
SO ₄		12			0.05mg/L
Na		12			0.5mg/L
K		12			0.5mg/L
Mg		12			0.05mg/L
Ca		12			0.05mg/L
As	3		0.0039mg/L	0.01mg/L	0.14µg/L
Ba		12			0.1µg/L
Cd	3		0.05mg/L	0.1mg/L	0.025µg/L
Cr	3		0.02mg/L	0.05mg/L	0.2µg/L
Cu	3		0.514mg/L	2.0mg/L	0.3µg/L
Hg		12			0.1µg/L
Mo		12			1.0µg/L
Ni	3		0.0086mg/L	0.02mg/L	0.05µg/L
Pb	3		0.005mg/L	0.01mg/L	0.1µg/L
Sb		12			0.5µg/L
Se		12			0.9µg/L
Zn		12			4.1µg/L
Hydrocarbon	3				1µg/L
List 1 screen		12			

The current groundwater monitoring points are shown in EMP Figure 5.1 below.

Figure 5-1
Groundwater monitoring points



5.2 Location, Design and Construction of Monitoring Points

Monitoring of groundwater will be carried out at each of the wells identified in EMP Table 5-1 and EMP Figure 5.1 above.

5.3 Groundwater Monitoring

The post closure groundwater monitoring schedule is presented in Table 5-1 above. The groundwater monitoring points are illustrated on Drawing EMP 5.1.

It is noted that the monitoring schedule may be amended based on the outcome of leachate analysis and the parameters may be deleted from the above schedule should they not be present within the leachate. Monitoring information will be stored at the operator's regional office and will be submitted to the ERA at agreed intervals.

The groundwater monitoring programme and results will be subject to regular review by the operator throughout the post-closure aftercare period of the site. Sampling frequencies and determinands will be modified and adjusted as appropriate.

If stable conditions are present (levels or quality) the frequency and/or number of determinands may be reduced in consultation with ERA.

5.3.1 Maintenance of Groundwater Monitoring System

The following aspects of the groundwater monitoring system will be inspected on a quarterly basis:

- To identify any damage to protective covers;
- To identify any damage to the well visible at ground surface;
- To identify any ponding water in the vicinity of the well;
- To identify any vegetation obscuring the well;
- To identify whether any identifying information (eg well reference number) is clearly visible;
- Depth of well checked using a dip meter to determine whether any silting up has occurred.

The outcome of these inspections would be recorded and the records kept on site. Any remedial action identified as part of the inspection regime would be remedied within 3 months of a maintenance requirement being identified.

5.3.2 Monitoring Procedure

Monitoring will be carried out by a technical person, in accordance with the procedure outlined below:-

Pre-Monitoring Checks

Prior to undertaking groundwater monitoring, checks are carried out to determine;

- the number of samples and analytical requirements;
- the size, type and number of pre-labelled bottles that are required, and any fixative or preservative requirements;
- that all equipment is clean and in good working order; and
- that all necessary equipment is available including keys.

Site Records

A record is made of the following;

- name of technician;
- date of sampling;
- sampling equipment and method used;
- on-site weather conditions; and
- damage to borehole headworks or caps.

Monitoring Procedure

- The borehole cap is removed and the depth to groundwater and depth to the base of the borehole from the cover level or any other agreed datum is measured using an electronic dip tape or other suitable equipment;
- the depth of the water column is calculated by subtracting the dip to the water from the dip to the base of the borehole;
- the volume of water is calculated by multiplying the depth of the water column by the borehole diameter to derive the well volume;
- a submersible pump, inertial pump or bailer is used to purge the borehole into a graduated bucket;

- the borehole is purged by 3 well volumes or until it is dry, whichever is the sooner;
- the volume of water removed is recorded;
- the borehole cap is replaced;
- those sample bottles not containing preservative is flushed out with the sample;
- the sample bottle is filled to the brim to exclude air, the top is secured firmly, and it is clearly labelled with the location code and date;
- care is taken to avoid cross contamination between samples. The pump head and hosing is kept off the ground, and the equipment is purged of any residual water, before progressing to the next sample location;
- dirty equipment will not be put down the borehole; and
- samples are transferred immediately to suitable containers, and taken to the laboratory at the earliest opportunity.

Data Management and Reporting

Comparison of monitoring data with control levels and compliance limits is carried out each time monitoring data are collected. The monitoring frequency is increased if there appears to be a trend indicating that the compliance levels may be breached, or when there is a rapidly rising trend towards this point. When an adverse trend or breach of a control level or compliance limit is indicated by the monitoring results, appropriate contingency actions are implemented.

The groundwater level and quality monitoring results are entered into a database, and the data is submitted to the ERA for review on an agreed frequency.

Construction Quality Assurance

Any further groundwater monitoring point construction works will be subject to a Construction Quality Assurance plan. Drill arising and monitoring well installation would be supervised by an appropriately qualified person.

Should any of the groundwater monitoring points become damaged to such an extent that the levels cannot be recorded or samples obtained, they will be either repaired or replaced if practicable.

Quality Assurance

Suitably trained, competent personnel will undertake groundwater monitoring. Laboratory analysis of samples will be carried out at an accredited laboratory.

Monitoring equipment is serviced and maintained in line with the manufacturers' recommendations.

5.4 Control Levels/Compliance Limits and Contingency Action Plan

5.4.1 Control Levels and Compliance Limits

Following closure it is proposed to adopt the current scheduled for control levels and compliance limits as identified in EMP Table 5-1. Based on further analysis of post closure results it may be possible to amend the requirements subject to approval.

5.4.2 Contingency Action Plan

In the event that control levels or compliance limits are exceeded in the designated monitoring boreholes, the various actions that are taken are detailed in Table 5-2 below;

Table 5-2
Groundwater Contingency Action Plan

Appropriate Contingency Actions	Following a breach of a	
	Control Level	Compliance Limit
Monitoring technician will advise TCP	✓	✓
Inform the ERA		✓
Confirm by repeat sampling and analysis	✓	✓
Review existing monitoring information	✓	✓
Notify ERA of proposed programme and period of supplementary sampling to further quantify the non-compliance event		✓
Review the assumptions incorporated into the conceptual site model		✓
Review existing hydrogeological control levels and compliance limits		✓
Review site management and operations, and implement actions, or corrective actions, to prevent future breach of control levels	✓	
If necessary, set in place procedures for implementing corrective measures in consultation with or required by the ERA		✓

6.0 SURFACE WATER MANAGEMENT

6.1 Surface Water Collection

The objective of a surface water management system is to:

- ensure that runoff is controlled at all stages and that the drainage system has sufficient capacity to safely discharge surface runoff without impairment to the stability of restored slopes;
- ensure that there is no increase in flooding risk either at the site or downstream of the site; and
- ensure that surface water discharged from the site is of a suitable quality.

The landfill lies within the wider Matghab complex and once the landfill site is fully capped and restored, there will be a need to revisit and upgrade the surface water management systems for the entire Magthab complex. Once this re-design has been completed further details would be provided.

The following surface water monitoring is currently required to be completed. Note references Table 9.1 and Figure 9.1 relate to the EMP (Ref 9) and are identified as EMP Table 9.1 and EMP Figure 9.1 to avoid confusion:

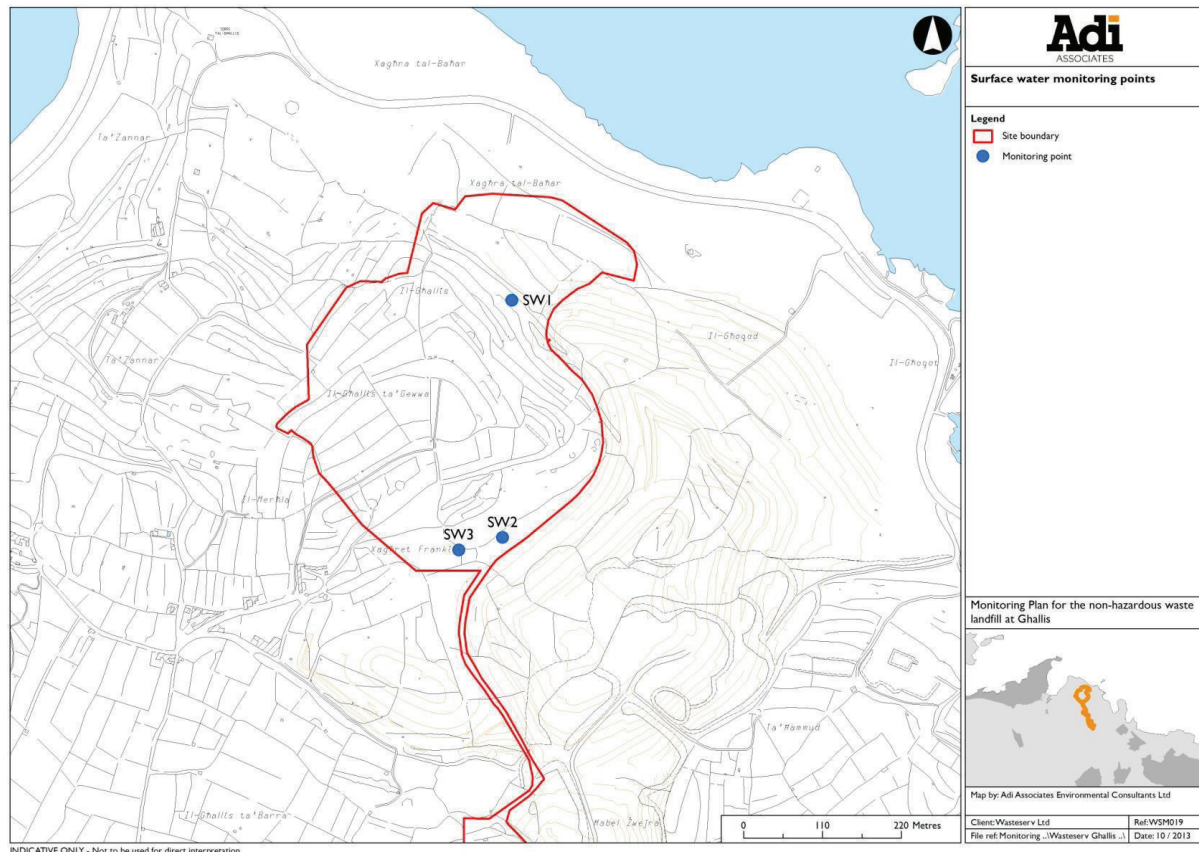
Table 9-1
On-Site Surface Water Monitoring

On-site Surface Water Monitoring Points SW1, SW2 and SW3					
Determinand	Indicator Monitoring Frequency (Monthly)	Characterisation Monitoring	Control Level	Trigger Level	Detection Limit
Water Level	3				
Conductivity	3				±3.4 µS/cm
pH	3				0.1 pH units
TOC	3				0.1mg/L
NH ₄ N	3		0.195mg/L	0.39mg/L	0.01mg/L
Cl ⁻	3		N/A	N/A	0.05mg/L
F ⁻	3				0.05mg/L
Phenol Index	3				0.05mg/L
Fe		12			0.1µg/L
SO ₄		12			0.05mg/L
Na		12			0.5mg/L
K		12			0.5mg/L
Mg		12			0.05mg/L

On-site Surface Water Monitoring Points SW1, SW2 and SW3

Determinand	Indicator Monitoring Frequency (Monthly)	Characterisation Monitoring	Control Level	Trigger Level	Detection Limit
Ca		12			0.05mg/L
As	3		0.0039mg/L	0.01mg/L	0.14µg/L
Ba		12			0.1µg/L
Cd	3		0.05mg/L	0.1mg/L	0.025µg/L
Cr	3		0.02mg/L	0.05mg/L	0.2µg/L
Cu	3		0.514mg/L	2.0mg/L	0.3µg/L
Hg		12			0.1µg/L
Mo		12			1.0µg/L
Ni	3		0.0086mg/L	0.02mg/L	0.05µg/L
Pb	3		0.005mg/L	0.01mg/L	0.1µg/L
Sb		12			0.5µg/L
Se		12			0.9µg/L
Zn		12			4.1µg/L
Hydrocarbons	3				1µg/L
List 1 screen		12			

Figure 9-1
Surface water monitoring points



6.2 Surface Water Treatment and Disposal

The surface water at the site will be subject to treatment in the form of storage in the lagoons to allow the settlement of any suspended solids. After treatment in the lagoons water will be discharged.

6.3 Maintenance of Surface Water Control System

In the absence of good site practice and appropriate maintenance, the gradual accumulation of debris within ditches etc. could reduce capacity and effectiveness. A number of operational practices are in place to ensure that the surface water drains efficiently. These include:

- good site practice, to ensure that the generation of suspended solids is minimised by the progressive vegetation of restored slopes;
- site operatives routinely monitor the efficiency of surface water drainage. The accumulation of sediment along any drainage channels will be checked and any obstructions (debris etc.) within the system removed.

Additionally, the following aspects of the surface water control system will be inspected on a quarterly basis:

- To identify any blockages;
- To identify any damage any lagoons;
- To identify any vegetation affecting the performance of the ditches or lagoon;
- To identify whether any identifying information is clearly visible.

The outcome of these inspections would be recorded and the records kept on site. Any remedial action identified as part of the inspection regime would be remedied within 3 months of a maintenance requirement being identified.

6.4 Surface Water Monitoring

Monitoring information will be stored at operator's regional offices and will be submitted to the ERA at agreed intervals.

The surface water monitoring programme and results will be subject to regular review by operator throughout the post-closure aftercare period of the installation. Sampling frequencies and determinands will be modified and adjusted as appropriate.

If stable conditions are present (levels or quality) the frequency and/or number of determinands may be reduced in consultation with the ERA.

7.0 LANDFILL GAS MANAGEMENT

7.1 Introduction

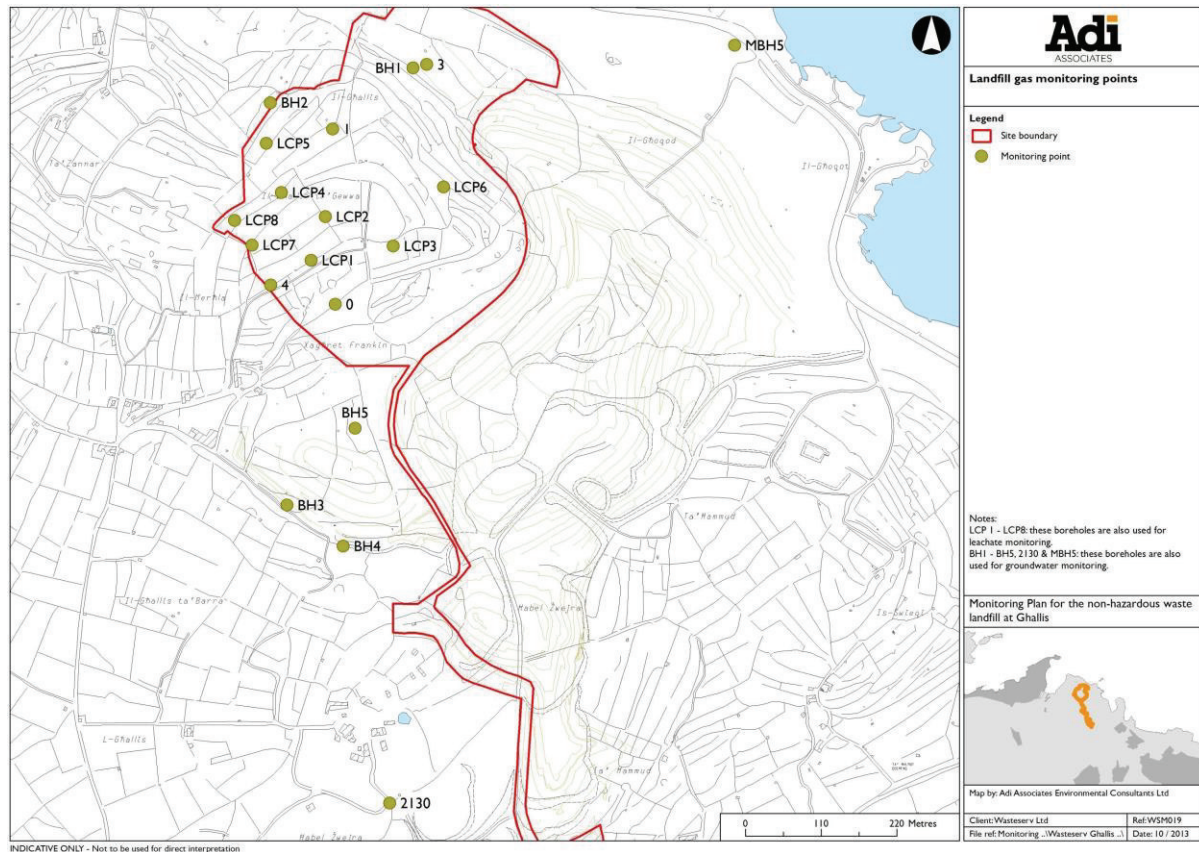
In order to comply with the Permit requirement, the Operator monitors landfill gas at the site in accordance with the consolidated Environmental Monitoring Programme (Ref 9) for the Permitted Installation, the following monitoring is required to be completed. Note references Table 4.1 and Figure 4.1 relate to the EMP (Ref 9) and are identified as EMP Table 4.1 and EMP Figure 4.1 to avoid confusion:

**Table 4-1
Landfill Gas Monitoring**

Monitoring location (Figure 4.1)	Measured Parameters	Frequency	Instrument type	Assessment levels
Landfill gas surface emission points 0, 1, 3 & 4 (Operational phase)	Methane (flammable gas vapours), methane flux, H ₂ , CO ₂ . General surface type and condition (ground description)	Monthly	Portable Flame Ionisation Detector (FID) calibrated with CH ₄	Not applicable
Landfill gas and groundwater monitoring boreholes (BH1-5, MBH5, 2130)	CH ₄ , CO ₂ , O ₂ , flux, differential pressure flow.	Quarterly	Portable Infra-Red gas analyser	1% CH ₄ , 1.5% CO ₂ above background (i)
Leachate monitoring points (LCP1-11)	CH ₄ , CO ₂ , O ₂ , H ₂ S, flow, differential pressure, flow.	Quarterly	Portable Infra-Red gas analyser	1.0% O ₂ , 0.1% CO.
Gas samples from one leachate monitoring point and one groundwater monitoring borehole	Detailed gas composition and priority trace components (ii)	Annually	Gresham Tube/Tedlar bag and laboratory GCMS for bulk gases. Solid sorbants for priority trace components (iii)	Not applicable
Capped areas	CH ₄ flux (iv)	Annually (v)	Flux box/FID	Permanently capped zone: 0.001 mg/m ² /s Temporarily capped zone: 0.1 mg/m ² /s

The current gas wells are shown in EMP Figure 4.1 below.

**Figure 4-1
Landfill gas monitoring points**



7.1.1 Maintenance of Landfill Gas Monitoring System (as per Table 4-1)

The following aspects of the landfill gas monitoring system will be inspected on a quarterly basis:

- To identify any damage to the well visible at ground surface;
- To identify any ponding water in the vicinity of the well;
- To identify any damage to the gas tap;
- To identify any vegetation obscuring the well;
- To identify whether any identifying information (eg well reference number) is clearly visible;
- Depth of well checked using a dip meter to determine whether any silting up has occurred.

The outcome of these inspections would be recorded and the records kept on site. Any remedial action identified as part of the inspection regime would be remedied within 3 months of a maintenance requirement being identified.

7.1.2 In – Waste Gas Monitoring Boreholes

The in waste landfill gas infrastructure will be developed as filling continues. Gas samples shall be taken directly from actual gas wells and no gas monitoring boreholes shall be installed).

7.1.3 Perimeter Gas Monitoring Boreholes

The external perimeter monitoring locations are shown on Figure 4.1 above.

7.2 Landfill Gas Monitoring

Gas monitoring will be undertaken by a suitable contractor or by a suitably trained operator technician.

7.2.1 Locations, Design and Construction of Monitoring Points

In Waste Boreholes

Monitoring of in-waste landfill gas concentrations will be carried out at each of the boreholes illustrated in Figure 4-1 above.

For each visit, landfill gas monitoring would be undertaken before any leachate monitoring.

Perimeter Boreholes

The aim of the external landfill gas monitoring system is to identify any landfill gas that may be migrating from the landfill. The locations of the perimeter gas boreholes that may be monitored are illustrated on EMP Figure 4-1 above.

All monitoring boreholes would be fitted with a gas tight cap that is equipped with a gas-sampling tap suitable for connection to the sampling equipment to be used at the site.

Boreholes would be secured with lockable steel headworks. The borehole number will be marked on the headworks.

7.2.2 Monitoring Measurements and Schedules

In-Waste and Perimeter Gas Monitoring

In waste monitoring of the following parameters will be undertaken on a continuous basis for the first year then quarterly for an overall period of two years. Perimeter monitoring would be undertaken quarterly.

- Methane (% by vol.);
- Carbon Dioxide (% by vol.);
- Oxygen (% by vol.);
- Atmospheric pressure;
- Differential pressure;
- Ambient temperature;
- Flow rate; and
- Meteorological conditions

Landfill gas monitoring will be carried out using a portable infra-red gas analyser, or other suitable equipment, at the monitoring locations in EMP Figure 4.1.

Observations of meteorological data (including atmospheric pressure), ground conditions, damage to boreholes along with the instrument serial number and name of personnel carrying out the monitoring will also be recorded in the field log.

If there are prolonged periods where there is no off-site gas migration, as detected in the exterior monitoring wells, the extent and frequency of the monitoring may be altered from this regime in consultation with the ERA. Conversely if perimeter monitoring suggests that off-site gas migration could potentially present a hazard, the frequency and extent will be increased proportionally.

7.3 Action and Compliance Limits and Contingency Action Plan Perimeter Monitoring

7.3.1 Action and Compliance Limits Perimeter Monitoring

The landfill gas monitoring requirements that will be routinely undertaken are described in EMP Table 4-1.

The action and compliance limits have been derived in accordance with the Industry Code of Practice (ICOP) 'Perimeter Soil Gas Emissions Criteria and Associated Management 2011'. The ICOP concludes that no compliance limits should be set for carbon dioxide because there are alternative sources in the sub-surface environment.

Methane will therefore be used as the primary compliance parameter in the context of landfill gas monitoring. Carbon dioxide concentrations will continue to be recorded to allow the conceptual model of the site to be kept under review.

These levels may be subject to revision following the collection of additional gas monitoring data. Any such revisions will be discussed and agreed with the ERA.

All monitoring results will be reviewed and assessed on an annual basis, as part of the overall monitoring review for the installation.

7.3.2 Contingency Action Plan

In the highly unlikely event of landfill gas breaching a compliance level in one of the perimeter boreholes, the borehole will be resampled immediately to ensure the integrity of the data being collected.

If resampling confirms that elevated methane concentrations are present, appropriate action will be discussed and agreed with the ERA.

7.4 Monitoring Procedure

A record is made of the following:

- name of technician;
- date of sampling;
- atmospheric pressure;
- instrument type and serial number; and
- on-site weather conditions.

7.5 Data Management and Reporting Procedures

7.5.1 Recording and Maintenance of Data

Following each landfill gas monitoring exercise the gas monitoring results are recorded. This information includes as a minimum;

- borehole identification;
- date;
- gas concentration;
- barometric pressure; and
- units.

7.5.2 *Reporting to the ERA*

Results of the perimeter landfill gas monitoring will be submitted at intervals to be agreed with the ERA.

7.5.3 *Monitoring Quality Assurance*

Suitably trained and experienced personnel will undertake gas monitoring.

The gas monitoring equipment will be calibrated, serviced and maintained in line with the manufacturer's recommendations.

The area adjacent to the boreholes will continue to be kept clear and free from any vegetation, to ensure that adequate areas for sampling or monitoring are retained.

8.0 RESTORATION AND MAINTENANCE

8.1 Restoration Scheme

The restoration scheme maximises the potential contribution that the installation can make to improving landscape quality, ecological enhancement and public access. The proposed after use and restoration does not conflict with the requirements to ensure continued access for monitoring and maintenance of environmental monitoring and management systems.

The landfill will be progressively restored in accordance with the proposed restoration plan. This provides for the creation of a sympathetic landform in keeping with the topography of the surrounding area, and minimises the visual impact of the development and vehicle movements.

The site is currently operational and will remain so up to c2020. At this time further details on the restoration system will need to be submitted for approval. The basic concepts for restoration are detailed in the Environmental Statement (ES) Volume 1, SLR, December 2005, 4C.585.001 (Ref 5).

8.2 Site Survey

Measures are taken to record the structure and composition of the landfill body as detailed below.

8.2.1 Monitoring Frequency

During the aftercare phase settlement will continue to be monitored at annual intervals. If stable conditions are present (i.e. no significant settlement is detected), then the frequency of monitoring may be reduced in consultation with the ERA.

8.2.2 Monitoring Methods

Ground control is established for each survey, and is checked as appropriate to ensure continued accuracy.

Surveys are carried out to an accuracy of +/- 20mm.

8.2.3 Data Management and Recording

All data collected during the surveys is stored electronically, and used to generate paper plans as required by the operator.

8.3 Site Maintenance and Repairs

Inspection Programme

To ensure all necessary maintenance is carried out during the aftercare period, a regular inspection programme is implemented. The scope of the inspection programme is as follows;

- inspection of fencing and gates;
- inspection of 'above ground' components of landfill including monitoring boreholes, pipework, wellheads;
- inspection of public access features, i.e. public right of way; and
- inspection of landfill topography for signs of differential settlement.

Maintenance Programme

The outcome of these inspections would be recorded and the records kept on site. Any remedial action identified as part of the inspection regime would be remedied within 3 months of a maintenance requirement being identified.

All plant and equipment utilised during the post closure period will be inspected (on a quarterly basis) and maintained in accordance with the manufacturers' requirements. The outcome of these inspections would be recorded and the records kept on site. The plant and equipment that will be subject to this maintenance is as follows:

- fencing and gates; and
- monitoring boreholes (gas, leachate, groundwater);

In addition to the planned maintenance programme, unplanned maintenance will be carried out in response to unexpected damage identified during the course of the routine inspection programme.

In addition, the restored landform will be maintained if required to remedy any differential settlement that may jeopardise the integrity of the capping or drainage system.

Some degradation of the monitoring systems (gas and leachate) is expected, which would reduce their efficacy. The extent of the degradation would increase with time and it has been assumed that all management systems become non-functional during the post-closure phase of the site.

With regards to the conditions when completion will be attained, these would be satisfied when the site no longer has the potential to cause damage to or deterioration of the environment and risk to human health i.e. it no longer poses a potential risk to the environment or human health.

9.0 ANTICIPATED REMAINING WASTE VOLUMES

This report relates to the period following closure of the landfill. Depending on the various scenarios of waste input volumes waste infilling is likely to continue until c2020. The SLR April 2016 phasing report (Ref 6) indicated a remaining nett waste volume of 1,548,200m³ with a further 3 phases of landfill cell construction.

This calculation has been updated for the purposes of this latest plan. The void model has been generated using the following base information:

- Full site topographical survey supplied by WasteServ dated March 2017 (reference 165 GH12_00 General Survey Ghallis);
- A combined model for the base of the landfill site which combines the base levels for the as built landfill cells along with the proposed levels for the remaining cells as taken from the phasing report (Ref 6);
- Pre settlement top of waste contours generated by SLR using information provided by Wasteserv on PA 964/11 Changes to Ghallis landfill boundary drawing entitled Existing and Proposed Pre-Settlement Waste Levels reference WSM Ghallis/12/06 dated 12.04.12

On the basis of the models above the remaining void space for waste input (as of March 2017) is calculated as 1,347,764m³.

The above drawings and model outputs are presented in Appendix A.

10.0 RODENT AND NUISANCE WILDLIFE CONTROL PROCEDURES

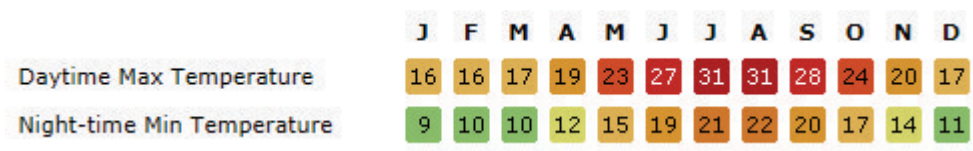
10.1 Introduction

This section describes the techniques and measures that will be used to prevent and control birds, vermin and insects. The main pests that require control at landfill installations are rats, flies and gulls, as the waste can provide ideal conditions for attracting such species.

10.2 Environmental Influences

Malta has a temperate climate and is unlikely to be affected significantly by seasonal temperature variations. Figure 10.2 below shows that annual temperatures range between 9 – 31°C, which is conducive to year round pest activity. Therefore constant pest control methods are likely to be required and pest control would need to be present upon site all year round.

Figure 10.2
Average Annual Temperature for Malta



10.3 Birds, Flies and Other Vermin

The presence of birds, flies and other vermin such as scavenging foxes as a nuisance have been considered but has been discounted due to the capping and restoration system that will be in place giving greater than 1 meter inert fill being present and preventing direct access to the underlying waste materials as a food source or harbourage. Therefore species will not be able to use the underlying waste as a source of habitat or food as it will be covered and prevent them from access.

10.4 Rodents

Rodents such as Rats and Mice are often prevalent on waste management facilities, such as landfills, due to the available food sources and availability of habitats which provide cover and shelter.

The control of rodent populations on waste management facilities is essential to prevent the spread disease and prevent damage to buildings. They can also become the source of infestation for nearby suburban areas.

10.4.1 Assessing Requirements

In making an assessment of the requirements the following will be produced by the pest controller during an onsite assessment:

The first requirement of any assessment is to establish what the extent and location of the rodent pest problem is by:

- site plan identifying

- notable areas of Rodent activity (Tracks, droppings, urine odour, gnaw marks, sightings, damage or burrowing)
- buildings and areas requiring treatment.
- layout of the site
- position of all baiting points.

10.4.2 Pest Control

The waste materials are covered with the final capping and restoration soils with a depth of greater than 1 meter of inert cover material which prevents direct access to the waste to rodent species by means of an insitu barrier.

The site currently utilises second generation anticoagulants namely Difenacoum. If resistance becomes apparent there are alternative Rodenticides that may be administered according to the approved uses by a suitably qualified pest control practitioner.

Table 10.10.2a
Rodenticide Products

Products containing the following active ingredients are currently available within Europe:

Rodenticide	Active Ingredient	Approved for use
First generation anticoagulants	warfarin, coumatetralyl	Approved for use both indoors and outdoors
Second generation anticoagulants	difenacoum, bromadiolone, brodifacoum, flocoumafen, difethialone	Approved for use 'in and around buildings'. This allows the pest controller to treat the surrounding area of the buildings in order to deal with the infestation of the building
Non-anticoagulants	aluminium phosphide, powdered corn cob	Please consult product labels prior to use

Authorised uses of rodenticides within the European Union are being currently reviewed as a result of the implementation of the Biocidal Products Regulations (528/2012) in conjunction with the 2004-L.N.294/04 and the Pesticides Control Act. Therefore only products that are approved can be used.

Please consult product labels prior to use, as this document is a generalised document and advice on product labels will supersede advice given in this document.

At present, there are three main application methods used to control rats and mice with rodenticide baits. These are:

Table 10.10.1b
Application Methods for Rodenticide

Baiting method	Application
Loose baiting:	Loose bait made inaccessible to non-target species either by using it in secure premises or, elsewhere, by placing it under tiles, in pipes or using naturally occurring materials etc.
Use of bait stations:	

Baiting method	Application
	Bait applied in purpose-built bait stations is the most commonly used method by professional pest controllers but is not one that is compulsory in all circumstances.
Hole/burrow baiting:	Loose bait applied directly into holes or burrows.

The site currently uses bait stations around the perimeter of the landfill as identified below:

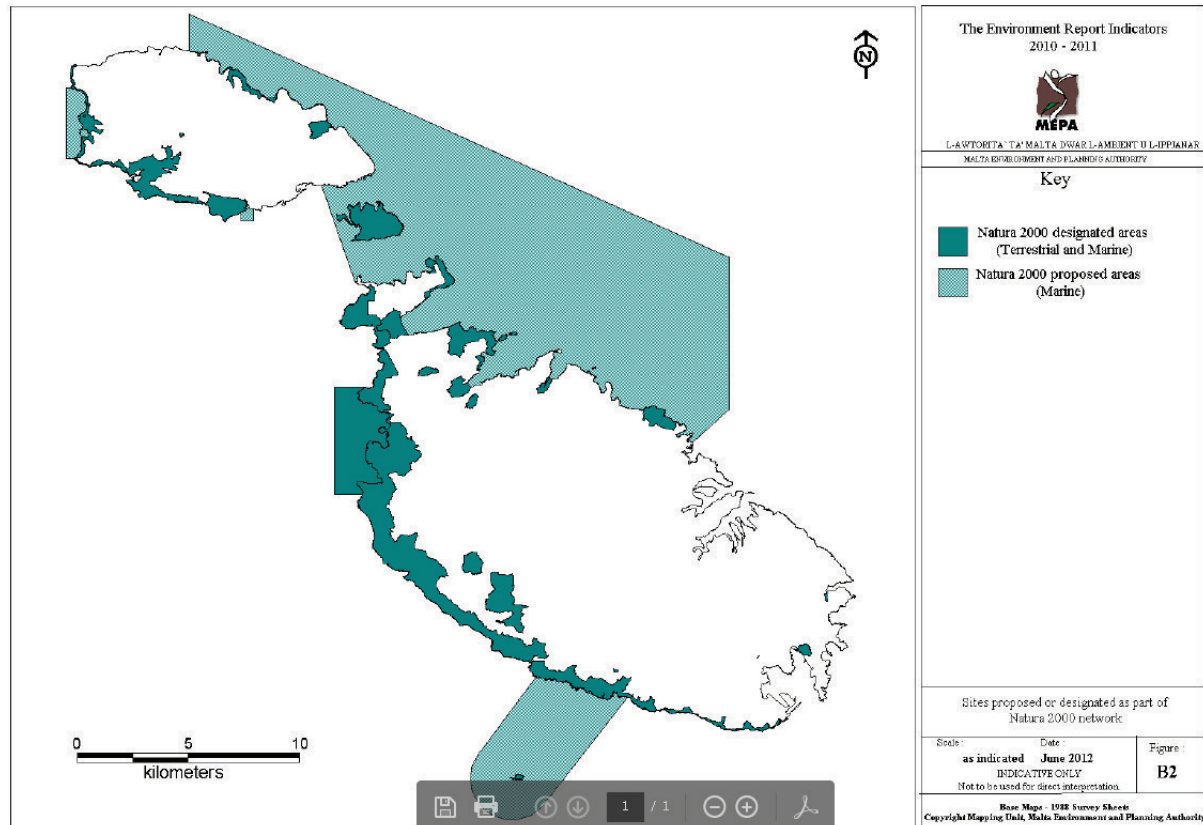


10.4.3 Assessing Impacts

As the treatment areas are established by reviewing the information as detailed in section 10.4.1 of this report it is important to establish potential sensitive receptors that could be impacted so that adequate controls can be established.

As required by the European Union Convention and transposed into Malta law Habitat protection is required via L.N. 94 of 2010 Environment Protection Act (Cap. 435) Development Planning Act (Cap. 356) - Flora, Fauna and Natural Habitats Protection (Amendment) (No. 2) Regulations 2010.

The Maltese Islands, although small in area (316 km²), host a large number of endemic species, some of which are unique and unusual. These endemic species are important to the Maltese Islands because they form part of Maltese national heritage and are topics of scientific research. As such several areas have been designated as sites of importance by the Malta Environment & Planning Authority (MEPA) see plan below for designated areas.



Some treatments may be near species or areas with a special status in law, for example ie Local Nature Reserves (LNR); or areas or species with specific designations.

Malta has the European designations: SAC, SPA.²

Maltese specific designations include, Nature Reserve, Historical trees having and Antiquarian importance, Bird Sanctuary, Protected Beaches, Area of Ecological Importance, Site of Scientific Importance and finally Area of Ecological Importance and Site of Scientific Importance

Whilst undertaking pest control close to one of these areas, it is imperative that there is no adverse impact through poisoning of protected species and these sites must be protected from any possible harmful effects resulting from using rodenticides in or near them.

² Information on designations <http://www.naturetrustmalta.org/what-we-do/natural-parks> accessed January 2017

10.5 Pest Control Contractors

Wasteserv currently outsource pest control to an external contractor Salvarti Co.Ltd-Fort Pest Control who supply and monitor all baiting stations and rodenticide.

The company or person applying the pesticide should:

- ensure the necessary notice has been given and any necessary permission received.
- Identify which protected species may be present in or near the treatment site.

Wildlife and domestic or companion animals that may be affected by a rodent treatment will include:

- raptors such as owls, kestrels, falcons, and hawks;
- mammals such as shrews, weasel and fox;
- domestic animals such as cattle, pigs and horses;
- companion animals such as cats and dogs; and
- Reptile species.

Note should also be taken of any risk to humans that may occur through rodent baiting.

Pest control contractors are regulated in relation to the available methods of entrapment and dispatch of pests/vermin via the following legislation: L.N. 167 of 2002 Environment Protection Act (Act No. XX of 2001) Capture and Killing Methods (Prohibition) Regulations, 2002³

The aim of the legislation is to ensure that the practice is carried out in a controlled humane way to prevent unnecessary suffering.

10.6 Rodenticide Code of Practice

Detailed treatment records will be kept by the contractor.

A site plan will be marked up by the pest controller detailing the locations of bait stations and inspection regime to be followed.

During regular inspection of bait stations rodent carcasses should be located and removed.

Where possible alternative environmental measures would be implemented by Wasteserv to compliment the baiting stations:

- By removing harbourages such as rubbish and discarded equipment. Cutting undergrowth around and between buildings will also help to discourage rodents;
- Proofing of buildings and maintaining them in a sound condition combined with good housekeeping will also reduce the chances of rodents entering buildings and becoming established; and
- If possible, prevent or limit access to food sources and avoid spillages.

However, with the exception of removing food that may be attractive to rodents, these measures should not be carried out before a rodenticide treatment takes place since this may spread the infestation before the treatment has had a chance to be effective.

³ <https://www.mepa.org.mt/LpDocumentDetails?syskey=443> accessed January 2017

Adopting environmental measures is always good practice but it is likely to take longer to control rodent populations through these measures alone and so if used in isolation, will not provide a quick answer to the problem if rodent infestation is present.

As the site will benefit from the capping and restoration system with a thickness greater than 1 meter of inert cover there is limited access to available food sources.

10.7 Risks to Non-Target Species and Mitigation

Wild birds and mammals, including pets, are at particular risk from pesticides in granule, pellet or bait form.

All precautions and advice on product labels should be followed to protect birds and mammals. In some situations, additional care will be needed eg if treatment is close to fresh water, then the Maltese freshwater crab (a protected species) could be at risk of poisoning..

The evidence shows that many incidents of poisoning involve companion animals (i.e. cats and dogs). Where wildlife is concerned, foxes and raptors such as buzzards, falcons and harriers are the most common species likely to be affected.

First generation anticoagulants are unlikely to secondarily poison wildlife and instances where poisoning has occurred due to these compounds are most often found in cases involving the direct exposure of companion animals and other wildlife by access and consumption of baits.

The second generation compounds can affect companion animals and wildlife by both direct consumption of baits and by the consumption of dead and dying rodents carrying residues of the rodenticides. Studies have shown evidence that contamination of some wildlife species, such as owls and kestrels, occurs mainly from predators taking non-target small mammals, such as field mice, rather than from consuming the bodies of target rats and mice.

An essential requirement in rodenticide application is to ensure that all necessary measures are used to make baits inaccessible to non-target animals.

Robust, purpose-made tamper- resistant bait stations are used. The site is supplied with Rodent tamper proof lockable boxes to prevent non target species accessing the bait. They do not protect baits from consumption by animals smaller than rodents. However, the use of tamper resistant bait stations may inhibit the uptake of bait by rodents for a time and they get used to the new object, thereby extending the length of treatments.

They may also encourage bait transfer, where rodents take unsecured baits from the stations and hide them elsewhere for later consumption.

The direct application of baits to rat burrows is a method of application that has successful results if safe to administer without risk to other non-target species. Frequent checks of baited burrows are required to clear up bait that is disturbed by rodent movement.

Rodenticide applications are generally effective within 35 days of treatment. .

Where a major infestation exists on neighbouring land and is not being controlled by the occupier, permanent baiting to protect a customer's land and buildings may be applicable.

In order to achieve control of the whole population, an attempt should be made to co-ordinate treatments on adjoining sites.

Regular collection and disposal of rodent carcasses will minimise the risk of non-target species feeding on the carcasses leading to secondary poisoning. Diligent searches for the bodies of all poisoned animals should be conducted regularly, and this should be done at least as often as the site is visited to check and replenish bait points.

10.8 Alternative Pest Control Measures

10.8.1 Trapping

Where traps are used, they must conform to current regulations. There are three types of trap currently in common use - spring traps, live catch traps and glue boards.

Spring traps

Only certain types of spring traps are considered humane and approved for killing and taking animals.

Break-back traps commonly used for the destruction of rats, mice and other small ground vermin are exempted from the requirement to be approved.

Live catch traps

There are environmental benefits to be gained from using live catch traps. In particular, rodenticides are not used and non-target species can be released provided this is permitted.

However, traps should always be visited at least once every 24 hours to prevent unnecessary suffering to captured animals, such as exposure to adverse weather conditions such as high temperatures.

Once caught, non-target species must be released as soon as possible and pest species disposed of humanely. Drowning is not an acceptable method of dispatch.

Glue boards

There are times when glue board use is required as a method of last resort, when all other methods of control have been tried unsuccessfully or are inappropriate. However, they should never be used as a routine method of control and only placed in areas where there is no risk to wildlife. It would be unlikely that this method would be used on the Zwejra Landfill.

Regular inspections are necessary to prevent unnecessary suffering and captured rodents should be dispatched as humanely and quickly as possible. The recommended methods of dispatch are: a) quick and positive dislocation of the neck; and b) the use of lethal chambers is permitted provided that the gas introduced is approved for that purpose. Once again, drowning is not an acceptable method of dispatch.

All boards must be removed at the end of the treatment and disposed of appropriately to avoid risks to non-target species.

Documentation should show clearly why glue boards have been chosen as the method of control and the location and dates of initial laying down, use and removal must be fully recorded. Keep documents for at least a three year period.

10.8.2 Gassing

Aluminium phosphide based fumigant products are approved for use against rats in outdoor burrows. However, the toxicity of these compounds and potential risks that careless or misuse may pose to humans and non-target animals must be considered.

The main considerations include that users must be trained, hold an appropriate certificate of competence and be familiar with the precautions to be taken and the procedures to follow in the case of an emergency arising during the use of the product. Burrows less than 10 metres from any building occupied by man or animals must not be treated. Flasks must be stored correctly and disposed of.

10.9 Post Treatment

On completion of the treatment, records should be updated by the pest controller to demonstrate the following;

- That the infestation has been controlled;
- That as far as reasonably practical all baits have been removed and all bait stations emptied;
- A final search has been made to locate and dispose of any rodent bodies; and
- Any proofing or other environmental changes which may prevent re-infestation have been discussed with the client (Wasteserv Malta Ltd).

10.10 Disposal of waste

10.10.1 Pesticide waste

On completion of the treatment all reasonable efforts must be made to clear up and remove uneaten or contaminated bait. This must then be disposed of properly. It is very difficult to retrieve uneaten bait in the case of hole or burrow baiting, but this should be done wherever possible and at least no bait should be left outside burrows that have been ejected from them.

Limiting the use of pesticides will reduce the amount of product and empty containers that have to be disposed of. Effective control of pesticide stocks, storage and use will help to avoid having to dispose of damaged, deteriorated, out-of-date or unapproved products.

The generation of waste can be reduced by buying and using only the quantities that are needed. However, the legal requirement to take up uneaten and contaminated bait at the end of a treatment will unavoidably create waste and so, despite good management, it may be necessary from time to time to dispose of some concentrates or ready to use rodenticides.

10.10.2 Carcasses

The bodies of vermin poisoned by routine baiting should be disposed of without delay to prevent contact with other wildlife.

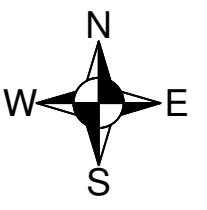
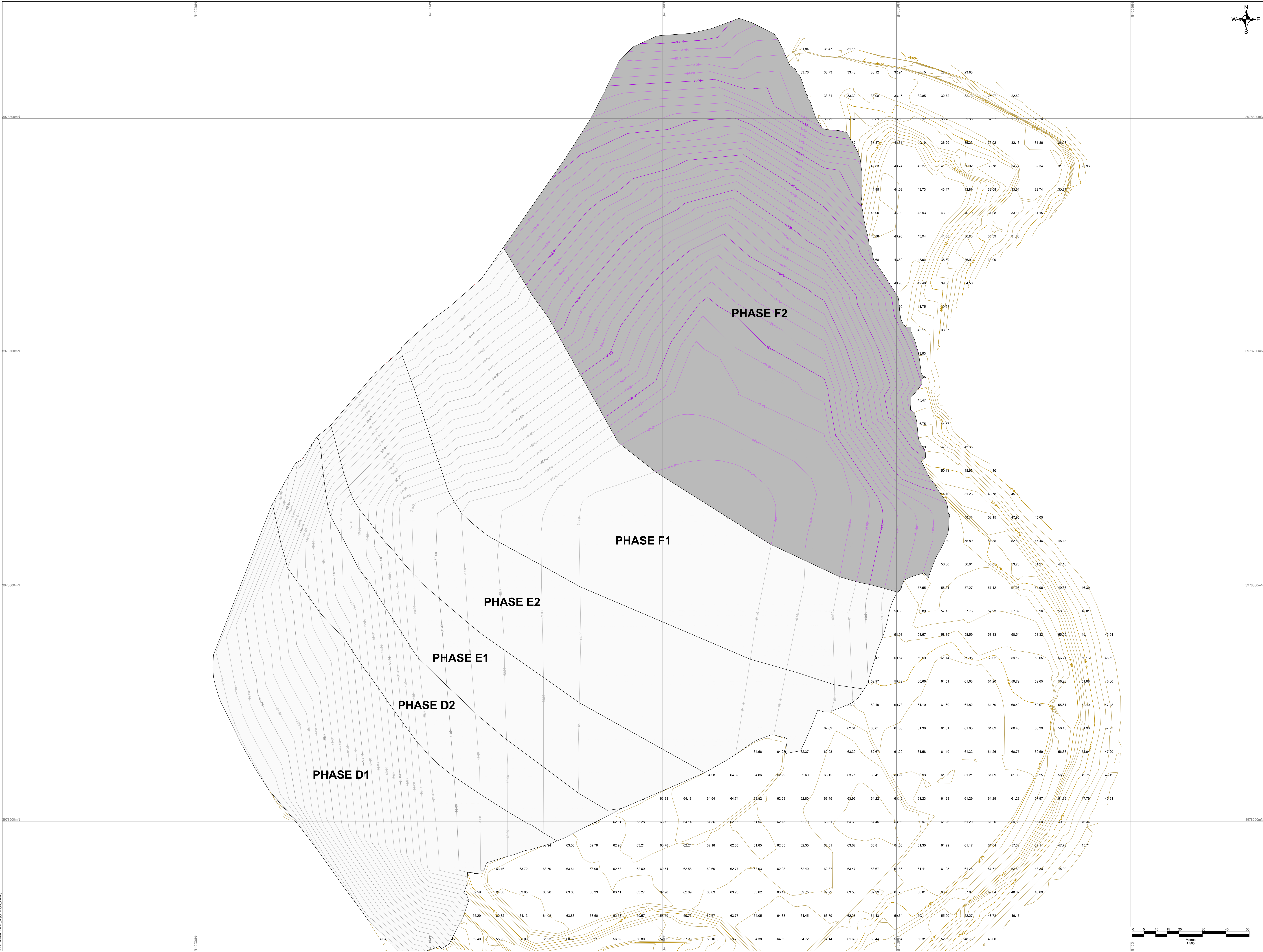
Regular collection and disposal of rodent carcasses for disposal will be required to be undertaken by the Pest control contractor. The items should be collected and placed in a sealed bag or container and labelled accordingly.

11.0 CLOSURE

This report has been prepared by SLR Consulting Limited with all reasonable skill, care and diligence, and taking account of the manpower and resources devoted to it by agreement with the client. Information reported herein is based on the interpretation of data collected and has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of Wasteserv Malta Ltd; no warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the client and others in respect of any matters outside the agreed scope of the work.

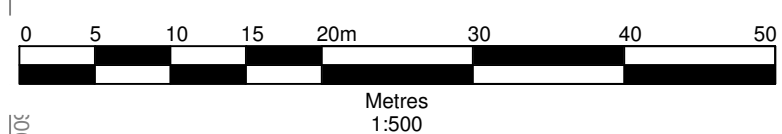


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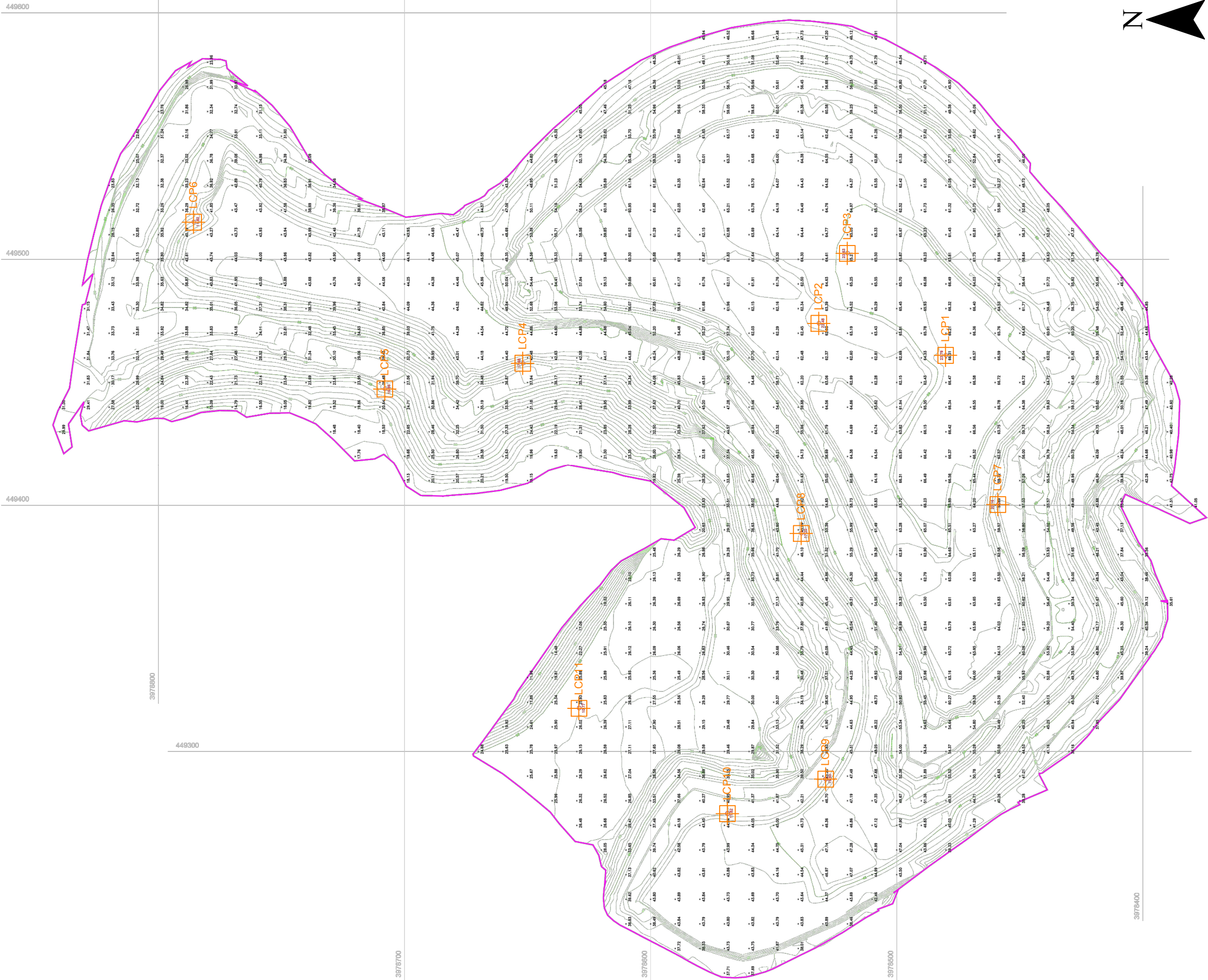
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2. ADDITIONAL INFORMATION SUPPLIED BY WASTESERV MALTA LTD. REF: DTM EXC EXIST & PROP MERGED.DWG. DATE RECEIVED: 12.05.2015.

LEGEND	
	TOPOGRAPHIC SURVEY LEVEL CONTOURS (m.AOD)
	EXCAVATION / PROPOSED FORMATION LEVEL CONTOURS (m.AOD)
	COMPLETED PRE-SETTLEMENT TOP-OF-RESTORATION LEVEL CONTOURS (m.AOD)
	PROPOSED PRE-SETTLEMENT TOP-OF-RESTORATION LEVEL CONTOURS (m.AOD)
	PHASE D
	PHASE E
	PHASE F



0	KW	SW	09/15	
Revision	By	Chk'd By	Date	Comments
ASPECT HOUSE ASPECT BUSINESS PARK BENEFIELD ROAD NOTTINGHAM NG6 4HR T: 0115 947086 F: 0115 947085 www.droonstaging.com				
Site: GħALLUS LANDFILL SITE				
Project: LANDFILL PHASING & CONSTRUCTION				
Drawing Title: PHASE F2 PROPOSED INFILLING LEVELS				
Scale: 1:500	© AG	Date: SEPTEMBER 2015	Revision: 0	
Drawing Number: 005A		Revision: 0		



NOTES

1. SURVEY SUPPLIED BY ALAN MICALLEF SURVEYING SERVICES. DRAWING NUMBER 165 GH02, REV 00.

LEGEND

	SPOT LEVEL ON WASTE
	SPOT LEVEL ON LINER OR DRAINAGE LAYER
	LEACHATE COLLECTION POINT
	CONTOUR AT 01m INTERVALS
	CONTOUR AT 05m INTERVALS
	CONTOUR AT 10m INTERVALS
	EDGE OF WASTE

0	DB	DJ	01/16	
Revision	By	Chk'd By	Date	Comments



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Site
GHALLIS LANDFILL SITE

Project
LEACHATE MANAGEMENT PLAN

Drawing Title
LEACHATE COLLECTION LOCATION PLAN

Scale
1:1500 @ A3

Date
01/16

Drawing Number

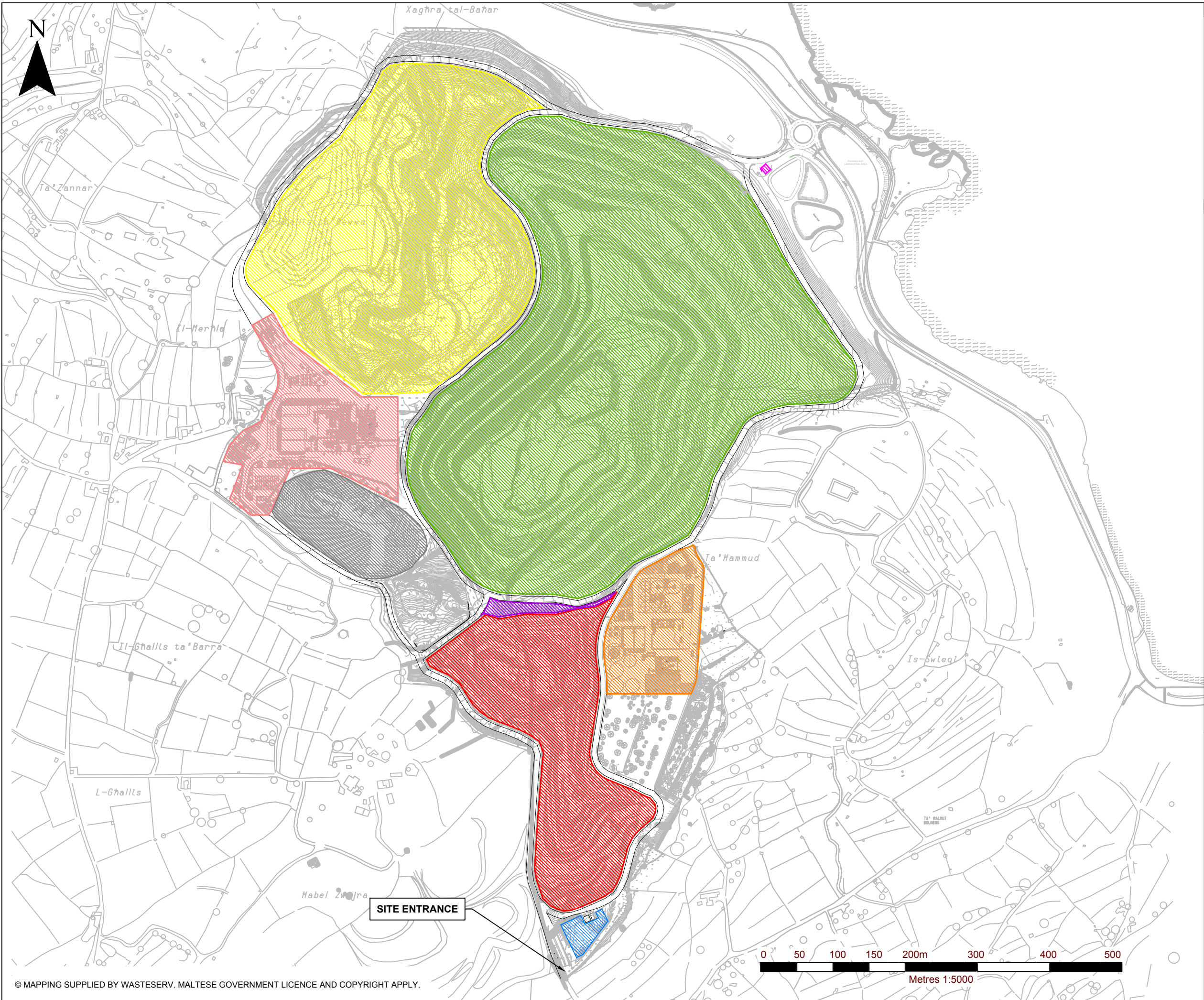
002

Revision

0

FOR INFORMATION

403.00585.00026.11.001.0 General Site Layout.dwg



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NOTES

1. SURVEY OBTAINED FROM WASTESERV
MALTA LIMITED REF: BLOCK PLAN.DWG.

LEGEND

- LEACHATE TANK
- GHALLIS LANDFILL
- MAGHTAB LANDFILL
- MECHANICAL WASTE TREATMENT PLANT
- HAZARDOUS WASTE CELL
- BIOLOGICAL TREATMENT PLANT
- ZWEJRA LANDFILL
- GAS MANAGEMENT PLANT



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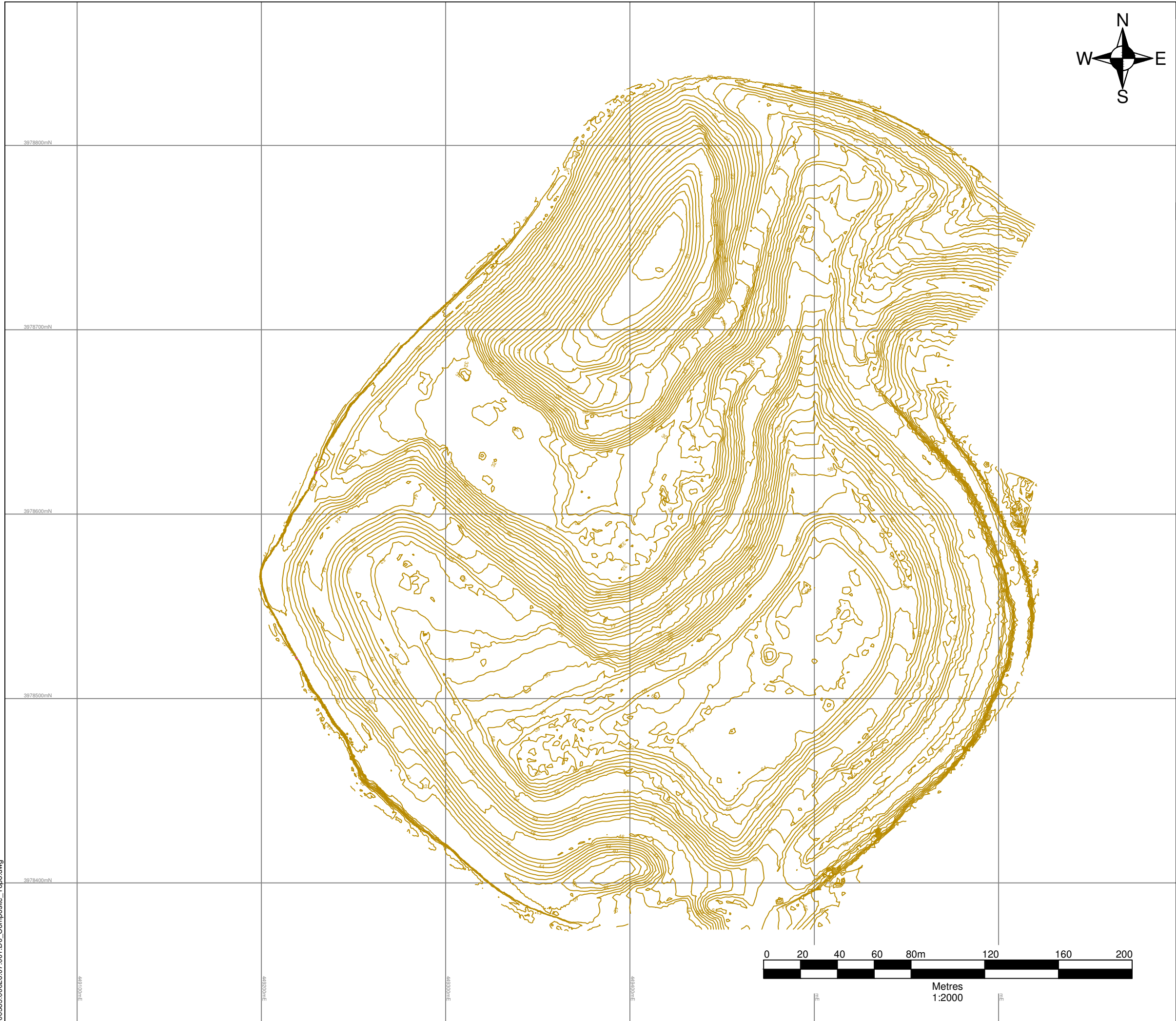
GHALLIS LANDFILL SITE
LANDFILL PHASING & CONSTRUCTION
GENERAL SITE LAYOUT

001

Scale
1:5,000 @ A3

Date
APRIL 2016

00585.00026.07.001.D0_Composite_Topo.dwg



NOTES

1. TOPOGRAPHIC SURVEY INFORMATION
SUPPLIED BY WASTESERVE MALTA LTD, REF: 165
GH12_00 General Survey Ghallis March 2017 3D,
DATE RECEIVED: MARCH 2017

LEGEND

50.00

TOPOGRAPHIC SURVEY LEVEL
CONTOURS (mAOD)

D0	AB	IR	05/17	
Revision	By	Chk'd By	Date	Comments

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Site
GHALLIS LANDFILL SITE

Project
LANDFILL PHASING & CONSTRUCTION

Drawing Title
**COMPOSITE TOPOGRAPHIC
SURVEY LEVELS**

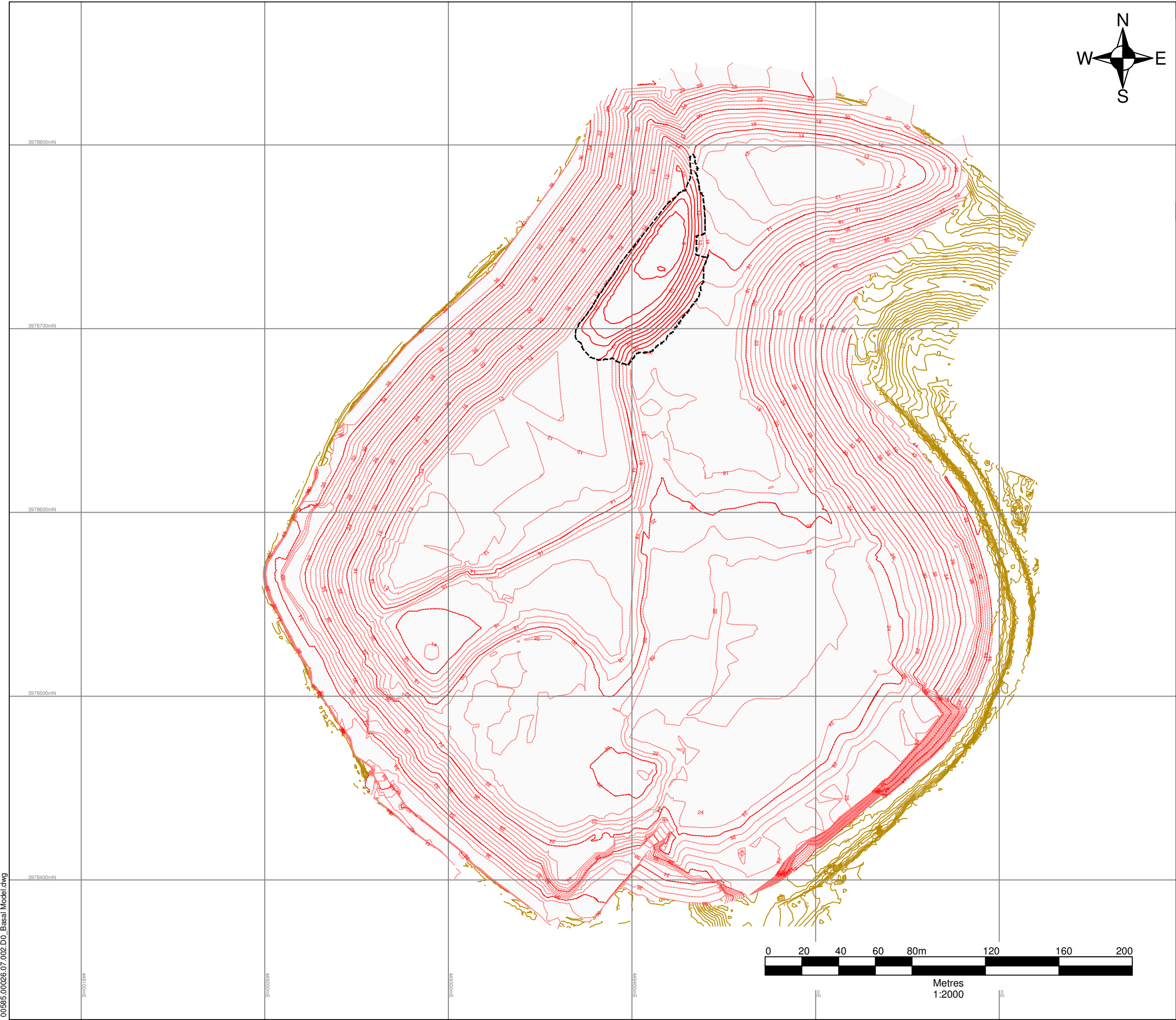
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Date
MAY 2015

Drawing Number
001

Revision
D0

DRAFT



NOTES

1. TOPOGRAPHIC SURVEY INFORMATION
SUPPLIED BY WASTESERVE MALTA LTD, REF: 165
GH12_00 General Survey Ghallis March 2017 3D,
DATE RECEIVED: MARCH 2017

LEGEND

TOPOGRAPHIC SURVEY LEVEL
CONTOURS (mAOD)

EXISTING FORMATION LEVEL
CONTOURS (mAOD)

AREA OF FORMATION
REQUIRED TO BE FILLED TO
FORMATION LEVELS

D0	AB	IR	05/17	
Revision	By	Chk'd By	Date	Comments

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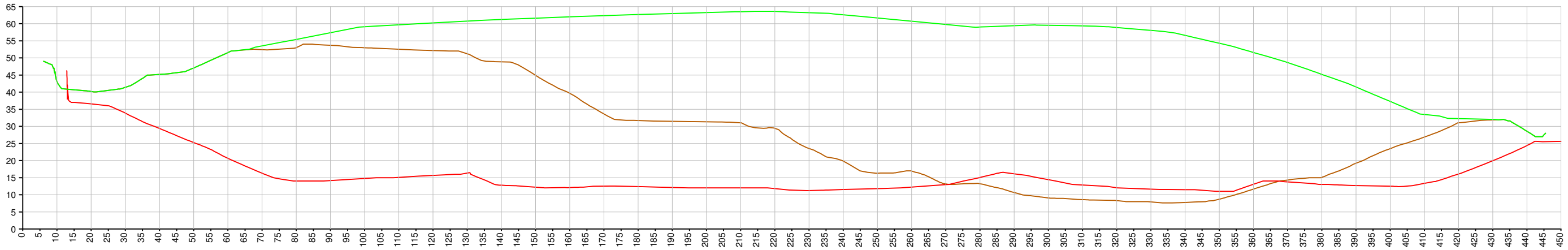
Site
GHALLIS LANDFILL SITE

Project
LANDFILL PHASING & CONSTRUCTION

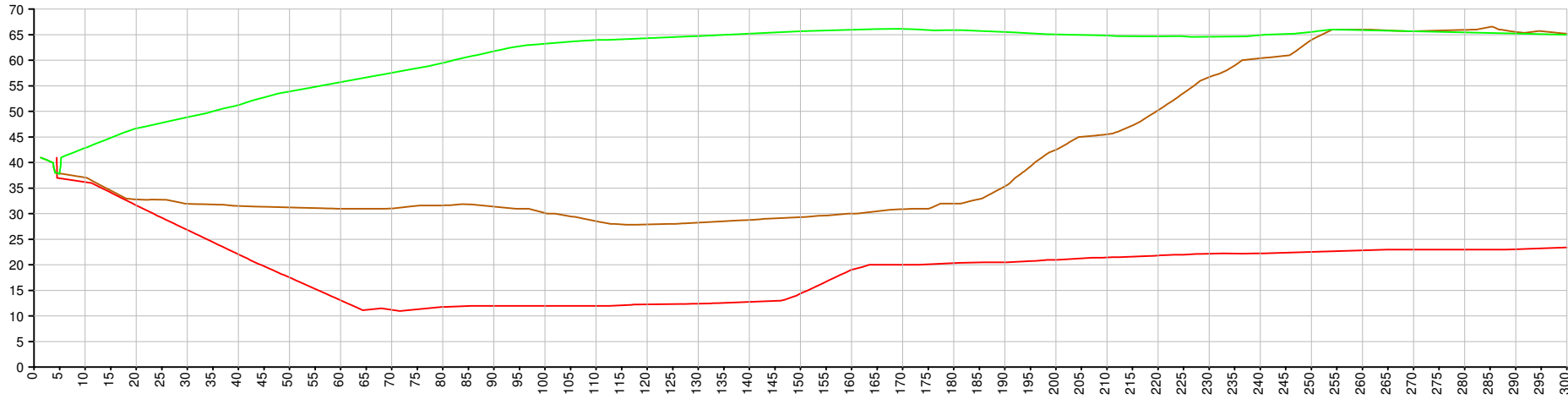
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Drawing Number 002	Revision D0
DRAFT	

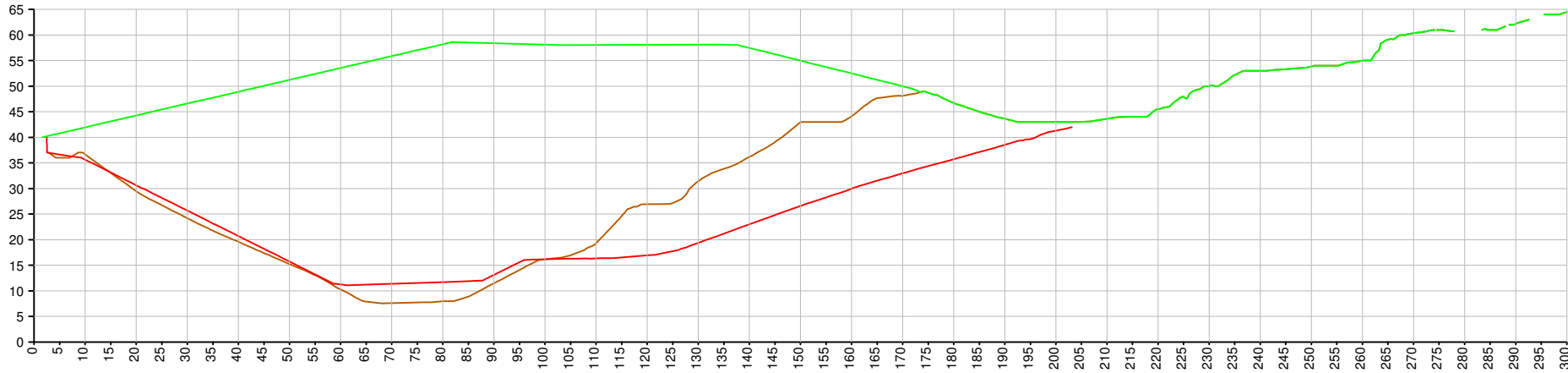
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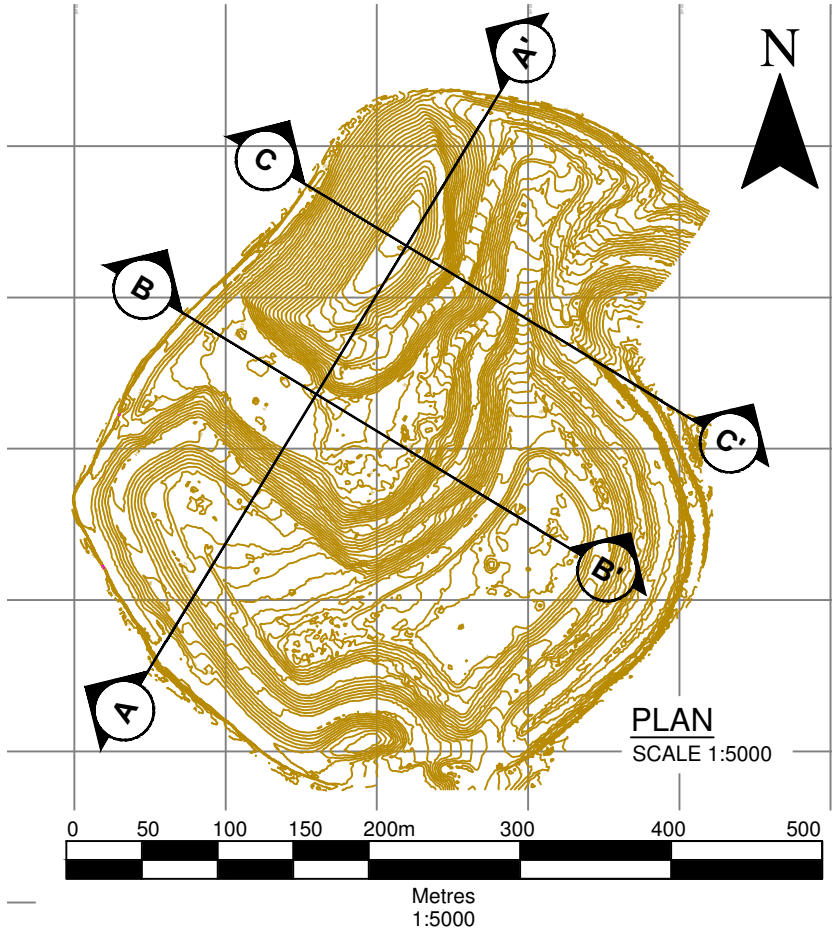
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SCALE 1:1250



SECTION B-B'
SCALE 1:1250



SECTION C-C'
SCALE 1:1250



LEGEND - PLAN

50.00 TOPOGRAPHIC SURVEY LEVEL
CONTOURS (mAOD)

LEGEND - SECTION

TOPOGRAPHIC SURVEY LEVEL
EXISTING FORMATION LEVEL
PRE SETTLEMENT TOP OF
WASTE LEVEL

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CROSS SECTIONS

005

Scale
AS SHOWN @A3

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