
Side Slope Stability Assessment 2023

Arthurstown Landfill (W004-04)

Prepared for

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Trim, Co Meath

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1 INTRODUCTION

South Dublin County Council (SDCC) owns and operates the Arthurstown Landfill (the Site) located at Kill, Co Kildare. Landfilling at the Site commenced in October 1997 and an EPA Waste Licence was issued in December 2009 to regulate the operations. The current Waste Licence (Register number W004-04) was issued on the 21st of December 2009. The most recent Technical Amendment B for the licence was issued on the 15th of January 2013. Landfilling at the Site ceased in December 2010 and the final cap was completed in 2013. The landfill is currently in the aftercare phase.

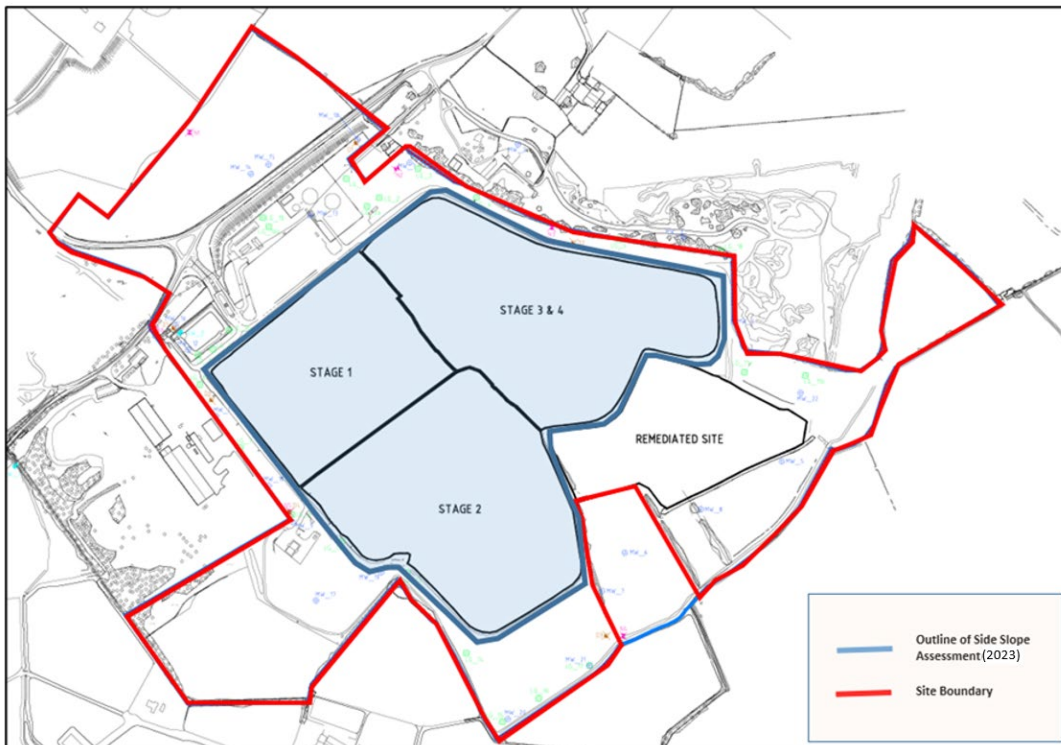
Geosyntec Consultants Ltd (Geosyntec) was requested by Odour Monitoring Ireland (OMI) to carry out a Side Slope Stability Assessment (SSSA) at the Site in compliance with Condition 8.13.1 of the Waste Licence Register number W0004-04:

“8.13.1 The Licensee shall carry out a stability assessment of the side slopes of the facility annually.”

This report presents findings of a Stability Assessment carried out at the Arthurstown Landfill on the 4th October 2023.

Refer to Figure 1 below for an outline of the licensed facility and the extent of the SSSA.

Figure 1: Extent of Side Slope Stability Assessment.



2 OBJECTIVES AND SCOPE OF WORK

The objective of the inspection was to carry out a stability assessment of the side slopes of the facility. The assessment included the waste slopes and engineered containment slopes within the footprint of the Site and was based solely on visual inspection of the slopes and as such cannot result in a definitive assessment of slope stability. For definitive assessment of slope stability and security, detailed investigations followed by slope stability analysis would have to be undertaken.

The scope of work comprised a visual walkover inspection of the slopes and environs with the aim to identify the following:

- Signs of distress - e.g. cracking.
- Signs of movement - e.g. bulging in the slope and/or depressions at the top of the slopes.
- Disturbance of or discontinuities in vegetation.
- Evidence of movement or distress to surrounding structures such as within the above ground landfill gas collection pipework and the wooden boundary fencing present throughout the Site.

Moreover, locations with landfill gas odour were noted (if observed), as such surface emission could be an early indication for localised instabilities within the permanent cap or within the landfill gas collection infrastructure.

The following documents were considered during the preparation of this report:

- Landfill Restoration and Aftercare, Landfill Manuals, EPA 1999.
- Air Guidance Note 6 (AG6), Surface VOC Emissions Monitoring on Landfill Facilities, EPA 2010.
- Topographical survey of the Site, SDCC, October 2016.
- Waste Licence Register number W0004-04.

3 SIDE SLOPE STABILITY ASSESSMENT

3.1 Background

The Site was previously a sand and gravel quarry with a history of material extraction, prior to SDCC purchasing the Site in 1992. The landfill accepted approximately 4.8 million tonnes of baled non-hazardous municipal waste.

For the purpose of the Site restoration the Site has been divided into four (4 No) Stages, i.e. Stages 1 to 4 – refer to Figure 1.

- Stage 1 – represents the oldest part of the Site followed by Stage 2; and,
- Stages 3 and 4 were completed in 2010 and received the final cap in 2013.

It is understood that wastes with high organic content (municipal wastes) were deposited within Stages 1 and 2, whereas Stages 3 and 4 have a higher percentage of plastics. Due to the higher organic content of the waste, Stages 1 and 2 are more likely to show signs of surface settlement.

3.2 General

Geosyntec's Principal Consultant Thomas Vainio-Mattila, MSc, PGeo, EurGeol visited the Site on the 4th October 2023 and undertook a site walkover, which included visual inspection of the following:

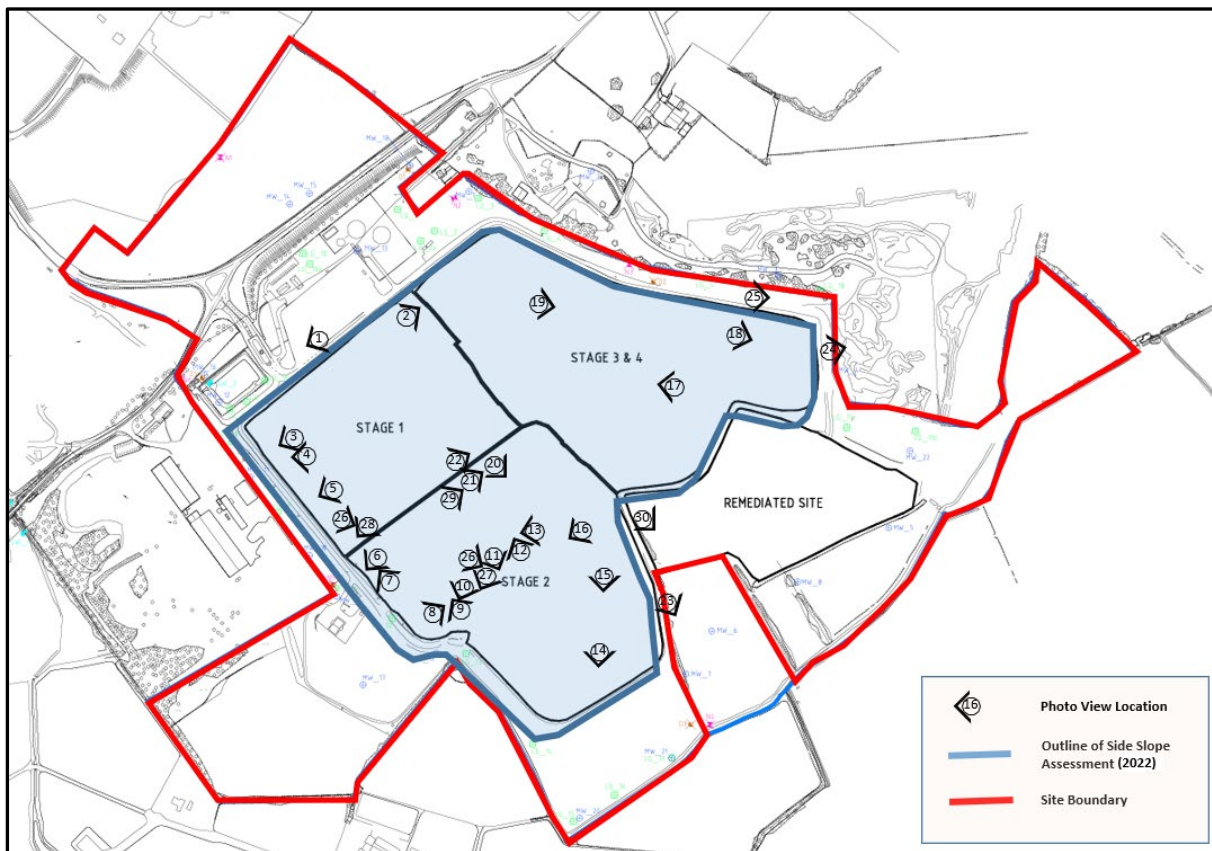
- All sloped embankments within the capped surface of the facility.
- The toe of all embankments around the perimeter of the facility.
- Perimeter fencing along field boundaries.
- Selected manholes forming part of landfill gas and leachate collection infrastructure.
- Other on-site infrastructure including access roads, foundations at landfill gas management areas and other areas of hardstanding.

Figure 2 below depicts Photo View locations 1 to 30, which are presented in Appendix A. The facility was closed with no activity observed during the Site visit.

The weather was overcast, 13C with light breeze and with good visibility. No intrusive investigations were undertaken during the assessment.

The capped surface was observed dry and firm with no standing water observed on the surface. Grazing livestock, including sheep and cattle, were observed at the Site during the walkover survey.

Figure 2: Photo View Locations.



3.3 Slope Stability

3.3.1 Visual Inspection

During the Site inspection, Geosyntec’s Principal Consultant walked the perimeter of the landfill mass, on top of the capped areas and observed for indicators of movement as outlined in Section 2.0 above.

Following observations were made during the Site walkover:

- Visually the Site conditions were observed to be similar to conditions observed during the previous annual side slope assessments undertaken by the same Consultant since 2016.
- As a general observation, signs of settlement were observed throughout the landfill surface. The settlement was observed taking place in an even manner across the entire restored surface.
- The observed settlement was not considered to be significant, i.e. no significant damage to above ground structures could be visually observed during the Site walkover and all the side slopes were observed to be in stable condition. Some signs of settlement could be observed within the above ground landfill gas collection

infrastructure and wooden fencing running along field boundaries (see Photo Views 22 and 29) for the buckled fences within the Site). The fence between Stage 2 and Stages 4 was repaired in 2022.

- **Stage 1** – signs of long-term settlement were noted but no damage could be observed on the surface or any above ground structures, such as fences, drains, ditches and landscaping (trees and hedges).
- **Stage 2** – visible signs of settlement could be observed within Stage 2, i.e. at infrastructure that form a part the landfill gas collection infrastructure, such as manholes and concrete slabs (refer to Photo Views 13, 26 and 27 for an example). It is considered likely that the observed settlement occurred in the years immediately after the cessation of landfilling activities at the Site. The degree of settlement was observed to be similar when compared to the previous visual assessments. It is recommended that these locations will be inspected to assess if any damage to the underground installations have occurred and remediated if required.
- **Stages 3 and 4** – The final capping within these stages took place in 2013. There were less signs of settlement within these areas when compared to Stages 1 and 2.
- No standing water was observed on the Site.
- No landfill has odours were noted on Site or in the vicinity of the Site during the walkover survey.

3.3.2 *Analysis of Survey*

The visual observation deemed that all of the Sites side slopes were shallower than 1(v) to 4.5(h), which is within the accepted limit of good practice. There were no indications of instability within the Site's embankments. Extensive coverage with grass and shrubs was observed throughout the Site. As well as the uniformity of the Sites slope profile, the surface appeared to be in good condition. The side slopes are therefore deemed acceptable.

A comparison of photographic records from the previous side slope assessments with the 2023 photographic records did not indicate a major change in the Site's topography.

Landfill gas odours were not observed during the Site walk over.

3.3.3 *Structures*

The structures present around the perimeter of the waste mass comprise wheel wash, weighbridges, office compound, leachate and landfill gas management areas, a temporary flare and a surface water lagoon. A visual inspection of these structures and areas indicated no evidence of movement or deterioration.

4 SUMMARY AND CONCLUSIONS

The survey undertaken by Geosyntec on the 4th October 2023 indicated that:

- The perimeter waste slopes have been constructed to an appropriate profile.
- The perimeter slopes were not showing significant signs of movement or distress.
- Standing water was not observed only within the restored parts of the Site, thereby the likelihood of the waste mass being saturated is low.
- Some issues were noted, such as minor movement within parts of the above ground landfill gas collection infrastructure, i.e. piping and concrete structures and the wooden boundary fencing. It is recommended that these are inspected regularly throughout.

The following Figures 3 to 6 show the general Site settings in an aerial view.

Figure 3: Aerial view from East to West – towards Stage 1 of the Site



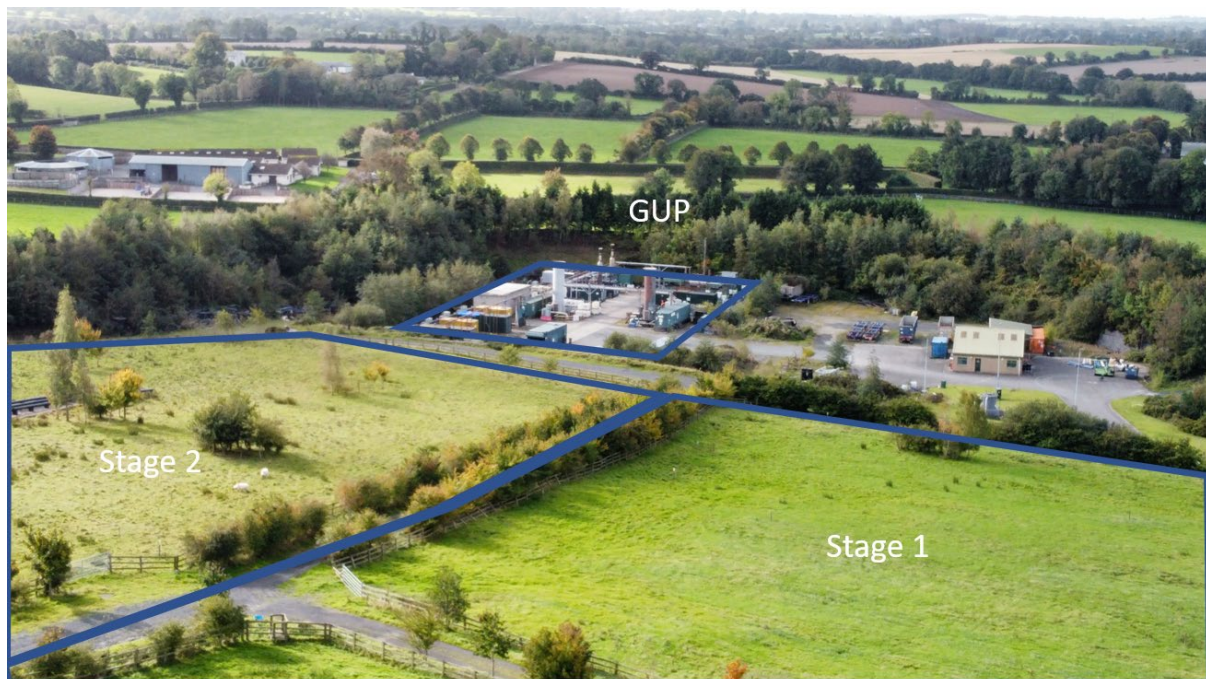
Figure 4: Aerial view from NE to SW – towards Stage 2 of the Site



Figure 5: Aerial view from NW to SE – towards Stage 3&4 of the Site.



Figure 6: Aerial view from NE to SW – towards the Gas Utilisation Compound (GUP) of the Site.



5 RECOMMENDATIONS

It is recommended that frequent Site inspections will be carried out, especially after a prolonged heavy rainfall events, to ensure that surface erosion does not become an issue within the Site and to confirm that the Site drainage infrastructure is functioning correctly, and that excess water is not being discharged to the body of waste.

The visual side slope monitoring should be continued annually in compliance with the licence requirements. Furthermore, during routine site inspections of the facility, any observations of change should be noted – e.g. signs of slopes bulging and cracks forming in slopes.


Also, it is recommended that a topographical survey is carried out at the Site and the levels compared against the previous (SDCC, 2016) topographical survey, in order to further assess the level of settlement taken place.

oOo

Geosyntec Consultants trust the information and discussion contained in this report meets all your immediate requirements. Please do not hesitate to contact the undersigned if you have any further comments or questions about any aspect of the work.

Respectfully submitted

On behalf of Geosyntec Consultants



Thomas Vainio-Mattila

Principal

Appendix A – Photo Views

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A**

GEOSYNTEC CONSULTANTS
Photographic Record

Client: Odour Monitoring Ireland

Project Number: GCU0303001

Site Name: Arthurstown Landfill

Site Location: Arthurstown, Kill, Co Kildare

Photograph 1

Date: 4 October 2023

Direction: Northeast

Comments: Northwest slopes of Stages 1 and Stages 3 & 4.



Photograph 2

Date: 4 October 2023

Direction: Southwest

Comments: Northwest slope of Stage 1.



GEOSYNTEC CONSULTANTS
Photographic Record

Client: Odour Monitoring Ireland

Project Number: GCU0303001

Site Name: Arthurstown Landfill

Site Location: Arthurstown, Kill, Co Kildare

Photograph 3

Date: 4 October 2023

Direction: Northeast

Comments: Stage 1 slopes.



Photograph 4

Date: 4 October 2023

Direction: East

Comments: Stage 1 slopes.



GEOSYNTEC CONSULTANTS
Photographic Record

Client: Odour Monitoring Ireland

Project Number: GCU0303001

Site Name: Arthurstown Landfill

Site Location: Arthurstown, Kill, Co Kildare

Photograph 5

Date: 4 October 2023

Direction: Northeast

Comments: Stage 1 slopes.



Photograph 6

Date: 4 October 2023

Direction: Northeast

Comments: Stage 2 slopes.



GEOSYNTEC CONSULTANTS
Photographic Record

Client: Odour Monitoring Ireland

Project Number: GCU0303001

Site Name: Arthurstown Landfill

Site Location: Arthurstown, Kill, Co Kildare

Photograph 7

Date: 4 October 2023

Direction: Southeast

Comments: Southern boundary of Stage 2.



Photograph 8

Date: 4 October 2023

Direction: Southwest

Comments: Gas Utilisation Compound (GUP).



GEOSYNTEC CONSULTANTS
Photographic Record

Client: Odour Monitoring Ireland

Project Number: GCU0303001

Site Name: Arthurstown Landfill

Site Location: Arthurstown, Kill, Co Kildare

Photograph 9

Date: 4 October 2023

Direction: Southeast

Comments: Stage 2 slopes.



Photograph 10

Date: 4 October 2023

Direction: North

Comments: LFG manifold within Stage 2.



GEOSYNTEC CONSULTANTS
Photographic Record

Client: Odour Monitoring Ireland

Project Number: GCU0303001

Site Name: Arthurstown Landfill

Site Location: Arthurstown, Kill, Co Kildare

Photograph 11

Date: 4 October 2023

Direction: Northwest

Comments: LFG
Collection pipework –
visible settlement within
Stage 2.



Photograph 12

Date: 4 October 2023

Direction: Southeast

Comments: Stage 2
slopes



GEOSYNTEC CONSULTANTS
Photographic Record

Client: Odour Monitoring Ireland

Project Number: GCU0303001

Site Name: Arthurstown Landfill

Site Location: Arthurstown, Kill, Co Kildare

Photograph 13

Date: 4 October 2023

Direction: East

Comments: Localised settlement within Stage 2.



Photograph 14

Date: 4 October 2023

Direction: North

Comments: Stage 2 – view towards Stage 3&4.



GEOSYNTEC CONSULTANTS
Photographic Record

Client: Odour Monitoring Ireland

Project Number: GCU0303001

Site Name: Arthurstown Landfill

Site Location: Arthurstown, Kill, Co Kildare

Photograph 15

Date: 4 October 2023

Direction: North

Comments: Eastern boundary slopes of Stage 2 and 3&4.



Photograph 16

Date: 4 October 2023

Direction: Northeast

Comments: Eastern boundary slopes of Stage 2 and 3&4.



GEOSYNTEC CONSULTANTS
Photographic Record

Client: Odour Monitoring Ireland

Project Number: GCU0303001

Site Name: Arthurstown Landfill

Site Location: Arthurstown, Kill, Co Kildare

Photograph 17

Date: 4 October 2023

Direction: East

Comments: Stage 3&4 – temporary flare and Surface Water holding lagoon.



Photograph 18

Date: 4 October 2023

Direction: West

Comments: Stages 3&4 – northern slopes.



GEOSYNTEC CONSULTANTS
Photographic Record

Client: Odour Monitoring Ireland

Project Number: GCU0303001

Site Name: Arthurstown Landfill

Site Location: Arthurstown, Kill, Co Kildare

Photograph 19

Date: 4 October 2023

Direction: West

Comments: Stage 3&4 – view towards site office and leachate compound.



Photograph 20

Date: 4 October 2023

Direction: Northwest

Comments: Minor settlement visible during previous site assessments. Covered by heavy vegetation.



GEOSYNTEC CONSULTANTS
Photographic Record

Client: Odour Monitoring Ireland

Project Number: GCU0303001

Site Name: Arthurstown Landfill

Site Location: Arthurstown, Kill, Co Kildare

Photograph 21

Date: 4 October 2023

Direction: Southwest

Comments: Stage 2 slopes.



Photograph 22

Date: 4 October 2023

Direction: Southwest

Comments: Stage 1 slopes.



GEOSYNTEC CONSULTANTS
Photographic Record

Client: Odour Monitoring Ireland

Project Number: GCU0303001

Site Name: Arthurstown Landfill

Site Location: Arthurstown, Kill, Co Kildare

Photograph 23

Date: 4 October 2023

Direction: North

Comments: Eastern slope of Stage 2 – minor slope instability within boundary embankment.



Photograph 24

Date: 4 October 2023

Direction: West

Comments: Stage 3 and 4 slopes.



GEOSYNTEC CONSULTANTS
Photographic Record

Client: Odour Monitoring Ireland

Project Number: GCU0303001

Site Name: Arthurstown Landfill

Site Location: Arthurstown, Kill, Co Kildare

Photograph 25

Date: 4 October 2023

Direction: West

Comments: Northern boundary slope of Stage 3&4.



Photograph 26

Date: 4 October 2023

Direction: West

Comments: Close view of Landfill gas collection pipework within Stage 2.



GEOSYNTEC CONSULTANTS
Photographic Record

Client: Odour Monitoring Ireland

Project Number: GCU0303001

Site Name: Arthurstown Landfill

Site Location: Arthurstown, Kill, Co Kildare

Photograph 27

Date: 4 October 2023

Direction: North

Comments: Landfill gas collection pipework within Stage 2.



Photograph 28

Date: 4 October 2023

Direction: Northeast

Comments: Slightly buckled fence at Stage 1 and 2 boundary.



GEOSYNTEC CONSULTANTS
Photographic Record

Client: Odour Monitoring Ireland

Project Number: GCU0303001

Site Name: Arthurstown Landfill

Site Location: Arthurstown, Kill, Co Kildare

Photograph 29

Date: 4 October 2023

Direction: Southwest

Comments: Buckled fence at Stage 1 and 2 boundary.



Photograph 30

Date: 4 October 2023

Direction: Northwest

Comments: Repaired fence between Stage 2 and Stages 3&4.

