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LANDFILL PLAN

EASTERN CREEK RECYCLING ECOLOGY PARK (& LANDFILL)

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LANDFILL PLAN

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VERSION CONTROL

Date	Doc Version	Authorised by
18/12/2020	A	Ros Dent – Environmental Manager
22/04/2021	B	Ros Dent – Environmental Manager
24/05/2021	C	Ros Dent – Environmental Manager
24/05/2021	1	Ros Dent – Environmental Manager
06/07/2021	2	Ros Dent – Environmental Manager
18/10/2021	3	Ros Dent – Environmental Manager
21/01/2022	4	Ros Dent – Environmental Manager

THIS REVISION

Date	Revision #	Section / Paragraph	Description of Change	Authorised by
18/12/2020	A	Whole Document	Draft	Ros Dent
04/05/2021	B	Whole Document	Draft updated with MOD8 requirements	Ros Dent
24/05/2021	C	Whole Document	Draft updated with Bingo comments	Ros Dent
24/05/2021	1	Whole Document	Prepared for submission to DPIE	Ros Dent
06/07/2021	2	Section 1.6	Updated to address DPIE comments	Ros Dent
26/10/2021	3	Section 3.3. Section 5.1	Updated to include the landfilling plan	Ros Dent
21/01/2022	4	New Appendix D	Updated to include the approved landfilling plan in Appendix D	Ros Dent

ACRONYMS AND DEFINITIONS

Acronym / Term	Meaning
ADC	Alternative daily cover
Bingo	Bingo Industries Limited
C&D	Construction and Demolition
C&I	Commercial and Industrial
DADEC	Dial-a-Dump (EC) Pty Ltd
Daily Cell	The waste placed and compacted each day, bounded by the in-situ waste and covered on other surfaces by daily cover.
Daily Cover	Material applied on the tipping face of the landfill upon close of business each day to reduce environmental and amenity impacts.
EHC Act	Environmentally Hazardous Chemicals Act 1985 (NSW)
EMS	Environmental Management Strategy
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPA	Environment Protection Agency
EPL	Environment Protection Licence
Landfill Filling Plan	An operational plan updated annually to show access to a minimum of 2 years airspace, planned filling sequence and required infrastructure works necessary to support landfilling operations. This is required as Condition O5.12 of the current landfill EPL.
Leachate	The liquid that passes through, or is released by waste. It arises from the inherent moisture content of the waste and from rainwater (and sometimes groundwater) percolating through or contacting the waste mass.
Landfill Gas (LFG)	The gaseous emissions from the anaerobic decomposition of organic waste materials placed in a landfill
LFGMP	Landfill Gas Management Plan
MOD	Modification
OSD	Onsite detention basin.
POEO Act	*Protection of the Environment Operations Act 1997*
POEO Regulations	Protection of the Environment Operations (Waste) Regulation 2014.
SEQ	Safety, Environment and Quality
SSD	State Significant Development
SW Act	Sydney Water Act 1994
SWLMP	Soil, Water and Leachate Management Plan
The Facility	Eastern Creek Recycling Ecology Park (& Landfill)
TPA	Tonnes per annum

Acronym / Term	Meaning
VENM	virgin excavated natural materials.
WARR Act	Waste Avoidance and Resource Recovery Act 2001 (NSW)
WCMR	Waste Contribution Monthly Report
WM Act	Water Management Act 2000 (NSW).
WRRP	Waste and Resource Reporting Portal

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1 INTRODUCTION

1.1 Background

Bingo Industries Limited (Bingo) acquired the Eastern Creek Recycling Ecology Park (& Landfill) (the Facility) in February 2019 and took over the management of the Eastern Creek site in April 2019. The site was previously known as the Genesis Facility.

The Facility is located at Honeycomb Drive, Eastern Creek in the central western suburbs of Sydney NSW, approximately 36 km west of the Sydney CBD, 18 km west of Parramatta and 12 km east of Penrith. The site is located wholly within the Local Government Area (LGA) of Blacktown, situated in the area known as the M7 Business Hub. The operational area is approximately 54 hectares (ha) and was a former breccia quarry that closed when it ceased extraction activities.

The existing Facility, including recycling centre/s and landfill were granted approval by the then Minister for Planning under Section 75J of the *Environmental Planning and Assessment (EP&A) Act 1979* on 22 November 2009 (MP 06_0139) and commenced operation in June 2012.

The Facility operates under two Environment Protection Licences (EPL) issued by the Environment Protection Authority (EPA); EPL 20121 focusses on resource recovery and EPL 13426 covers landfill operations. The Facility has approval to:

- Accept up to two million tonnes per annum (Mtpa) of C&D (construction and demolition) and C&I (commercial and industrial) waste and landfilling of the quarry void of up to 1 million tpa of non-putrescible waste (including asbestos and other non-recyclable waste), excluding residual chute waste from the material processing centre;
- Crushing, grinding and separating works to process waste masonry material located in an area earmarked as the Segregated Materials Area (SMA);
- Stockpile up to 50 tonnes of waste tyres; and
- Stockpile up to 20,000 tonnes of green waste.

The Facility is operated by Dial-a-Dump (EC) Pty Ltd Industries (DADEC), a fully owned subsidiary of Bingo Industries Pty Ltd.

1.2 Purpose and Application

This **Landfill Plan** has been prepared to address the Schedule 3 Condition 8 of the Project Approval (MP 06_0139). The purpose of the Landfill Plan is to outline the waste disposal methodology which will support achievement of optimum levels of compaction and how this will be managed and monitored throughout the life of the facility.

The Landfill Plan has considered the following:

- The Project Approval as modified (MP 06_0139); and
- EPL 13426.

1.3 Supporting Environmental Management Plans

The following environmental management plans have been developed in support of this Landfill Plan. These plans are provided as Appendices to this EMS:

- Soil Water and Leachate Management Plan (SWLMP); and
- Air Quality, Odour and Greenhouse Gas Management Plan (AQMP).

A Landfill Gas Management Plan (LFGMP) is an operational management plan that has been prepared for the site and is a requirement under EPL 13426.

1.4 Objectives and Targets

Table 1-1 below outlines the objectives and targets set out for the Facility to manage the disposal of material into the void to ensure that a suitable level of compaction occurs.

Table 1-1: Objectives and Targets

Objective	Target	Timeframe	Accountability
Landfill Plan review	Landfill plan is revised, reviewed and updated every three years for the life of the operation	Every 3 years	Environmental Manager NSW Site Operations Manager
Landfill Closure Plan	Landfill Closure Plan is approved 12 months prior to the final year of landfill operation.	12 months before closure of the landfill	Environmental Manager NSW Site Operations Manager
Filling Plan	Filling Plan is updated regularly as landfill operations progress.	Annually	Site Operations Manager
Compaction (Airspace Utilisation)	Optimum compaction is achieved for the waste and operational conditions based on benchmarks established on-site.	Ongoing	Site Operations Manager
Monitor compaction and settlement	Compaction and settlement rates are monitored to establish operational compaction target and long-term settlement forecast.	Ongoing	Site Operations Manager
Ongoing monitoring and maintenance	Comply with the requirements of: • MP 06_0139 • EPL 13426 • *Protection of the Environment Operations Act (POEO) 1997* • *POEO (Clean Air) Regulation* 2010	Ongoing	Site Operations Manager Site Environmental Officer
Landfill stability	Unacceptable stability risks managed in a program of ongoing monitoring and control measures.	Ongoing	Site Operations Manager
Landfill capacity	No more than 1,000,000 tonnes of non-putrescible waste is placed in the landfill each calendar year	Ongoing	Site Operations Manager
Waste exposure	No previously filled and compacted waste is exposed or exhumed without written approval from the EPA	Ongoing	Site Operations Manager
Asbestos waste	Asbestos waste is managed in accordance with the Asbestos Management Plan and asbestos management procedures	Ongoing	Site Operations Manager

1.5 Consultation and Approval

The **Landfill Plan** does not require consultation with any stakeholders; however Schedule 3 Condition 8(a) of the Project Approval requires that the Landfill Plan is prepared to the satisfaction of the Secretary.

The approved Landfill Plan will be implemented during the life of the Facility and is retained at the site office. The Landfill Plan will be made available for inspection.

1.6 Authors Details

Schedule 3 Condition 8(e) of the Project Approval requires the Landfill Plan to be prepared by a suitably qualified, experienced, and independent engineer (or other relevant expert) whose appointment has been endorsed by the Secretary.

The endorsement for the author has been provided in **Appendix A.**

The Landfill Plan has been prepared by the following authors:

Author Details	Qualifications and Experience
Paul Lightbody	**Bachelor of Engineering (Civil) (SAIT, Master of Engineering Science (Waste Management) (UNSW), Chartered Professional Engineer (NER) and Registered Professional Engineer Qld (RPEQ)** Paul has extensive experience in the Waste Management, Water and Contaminated Land sectors, specialising in the provision of technical, due diligence and advisory services. Paul is familiar with most project delivery methods and their appropriate use with public and private clients, having fulfilled executive and technical leadership roles in the planning, development, procurement and delivery of waste infrastructure, services and site remediation projects. A critical and innovative thinker, Paul seeks workable solutions for project challenges based on sound scientific principles. He has initiated research into recovered materials product specifications, landfill gas behaviour, landfill closure and phytocapping that have translated innovation into tangible project success. His strong technical skills are complimented by financial, systems and project management experience. Paul was the main author for the plan and wrote the specific chapters relating to landfill controls and practices (Chapter 4) and provided the technical expertise to support Landfilling Operations (Chapter 5). Paul also provided input to Chapter 6 to provide the requirements related to monitoring of the landfill methodology and compaction rates and operational reporting requirements. All revisions of the Landfill Plan were technically reviewed by Paul.
Heather Tilley	**B Sc (Biological Life Sciences), B Sc Hons (Physical Geography)** Heather has over 30 years' experience in environmental impact assessment, post approvals, on-site construction environmental management, including waste management, environmental auditing and compliance monitoring on large infrastructure projects. Heather authored Chapters 1, 2, 3 and provided input to Chapter 6.

2 SITE DESCRIPTION

2.1 Facility Overview

The Facility covers an operational area of 54 hectares (ha) (including the surface area of the quarry) at Lot 1 DP 1145808; and Lot 2 DP 1247691, within an area being developed for commercial and industrial use under the *State Environmental Planning Policy (Western Sydney Employment Area) 2009 (the SEPP 2009*).

The Facility is accessed via Kangaroo Avenue located to the east and north-east of the site. The site is located within the Eastern Creek industrial precinct/M7 business hub and is bounded by the Western Motorway (M4) to the north, Kangaroo Avenue to the east and Honeycomb Drive to the south. The Archbold Road extension will run parallel to the western boundary of the site (Transport for NSW (TfNSW), 2019). The Eastern Creek REP is bounded by commercial and industrial buildings to the immediate north, east and south of the site. The closest residential receivers are located approximately 400 metres (m) to the north in the suburb of Minchinbury and approximately 1.2 kilometres (km) west in the suburb of Erskine Park. To the east of the Eastern Creek REP site is a 29-ha unoccupied site owned by DPIE

The Facility as managed under the Environmental Management Strategy (EMS) and the Landfill Plan includes the following approved infrastructure:

- Site entrance and weighbridge;
- Site offices and amenities;
- Parking for light vehicles, trucks, staff and visitors;
- Materials processing centre with equipment comprising:
  - screening areas with overhead gantry crane, screener and conveyors;
  - storage bays; and
  - load out area.
- Segregated Materials Area (crushing);
- General solid (non-putrescible) landfill; and
- Wheel wash bay.

Mounds of overburden material (amenity berms) which act as impervious barriers and visual screens are located on all sides of the Facility operational area. A Conservation Area is also located at the north-western corner of the operations area which is fenced and maintained as part of the operations of the Facility.

Figure 2-1 shows the extent of the EPL boundaries for the Facility and **Appendix B** shows the layout of the Facility.

Licensed operational area

Figure 2-1: Facility Location

2.1.1 Operating Hours

Table 2-1 details the operating hours as approved under *Schedule 3 Condition 39* of MP 06_0139 Modification 6.

Table 2-1: MP 06_0139 as Modified Approved Operating Hours

Activity	Day	Time
Construction	Monday to Friday	7:00am to 6:00pm
	Saturday	8:00am to 4:00pm
	Sunday and Public Holidays	Nil
Material Processing Centre (MPC1 and MPC2): Operation, waste receival, chute use and maintenance	Monday to Friday	24 hours
	Saturday	24 hours
	Sunday and Public Holidays	24 hours
Segregated Material Area (SMA): Crushing and screening	Monday to Friday	6:00am to 6:00pm
	Saturday	8:00am to 4:00pm
	Sunday and Public Holidays	8:00am to 4:00pm
Segregated Material Area (SMA): Receipt of segregated material	Monday to Friday	24 hours
	Saturday	8:00am to 4:00pm
	Sunday and Public Holidays	8:00am to 4:00pm
Landfill: Truck deliveries	Monday to Friday	5:00am to 9:00pm
	Saturday	5:00am to 9:00pm
	Sunday and Public Holidays	5:00am to 9:00pm

3 STATUTORY REQUIREMENTS

3.1 Legal and Other Obligations

The legislation, planning instruments and guidelines considered during development of this plan are listed below with specific details provided in the Legislation Register within Appendix B of the Environmental Management Strategy (EMS).

- *Environmental Planning and Assessment Act (EP&A) 1979;*
- *Protection of the Environment Operations Act 1997;*
- *POEO (Clean Air) Regulation* 2010;
- *POEO (Waste) Regulation 2014.*

Guidelines

- Environmental Guidelines: Solid Waste Landfills second edition June 2016;
- Waste Classification Guidelines – Part 1 (including Addendum): Classifying Waste, EPA, November 2014:
  - General Solid Waste (Non-putrescible) in Tables 1 and 2 of the Waste Classification Guidelines, Part 1: Classifying Waste.

3.2 Project Approval

3.2.1 EP&A Act Approval

The original Project Approval for the site was granted by the Minister for Planning in 2009 (MP 06_0139) under Section 75J of the NSW EP&A Act. Seven modifications have been approved since 2009, with the most recent modification (MOD8) approved on 3 March 2021.

The Project Approval include requirements to be addressed in this plan and to be delivered during operation of the Facility. These requirements, and how they are addressed in the plan are provided in **Table 3-1**.

Table 3-1: Relevant Conditions of MP 06_0139 as Modified

#	Requirement	Document Reference
Schedule 3 – Landfill construction and operation		
8	The Applicant shall prepare and implement a **Landfill Plan** for the Project to manage the disposal of material into the void to ensure a suitable level of compaction occurs. The Plan must:	This Landfill Plan
a)	be to the satisfaction of the Secretary;	Section 1.5
b)	be submitted within 12 months of commencing operations;	Section 6.3
c)	be submitted every 3 years during the life of the operation (coinciding with the independent environmental audit required at Schedule 4, Condition 4); and	Section 6.3
d)	be submitted 12 months prior to the closure of the landfill;	Section 6.3
e)	be conducted by a suitably qualified, experienced, and independent engineer (or other relevant expert) whose appointment has been endorsed by the Director-General;	Section 1.6 Appendix A

#	Requirement	Document Reference
f)	detail the proposed disposal methodology to achieve a suitable level of compaction;	Section 5.2
g)	include a criteria or level of compaction target for the landfill, with the view to types of uses post-land filling of the void;	Section 5.4 Section 6.1 Landfill Filling Plan Appendix D
h)	outline a process to monitor the performance of the disposal methodology, compaction and settling rates; and	Section 6.1 Landfill Filling Plan Appendix D
i)	contingency measures should the rates not be achieved; and	Section 5.4 Landfill Filling Plan Appendix D
j)	procedures for reporting the components of this Plan.	Section 6.3 Landfill Filling Plan Appendix D

3.3 Environment Protection Licence Conditions

The most recent EPLs associated with the Facility were issued by NSW EPA on 25 June 2020 (EPL 20121) and 25 June 2020 (EPL 13426). **Figure 2-1** shows the extent of the EPL boundaries for the Facility.

EPL 13426 contains conditions which relate to landfill management. This requires that the licensee submit and maintain a filling plan for the disposal of waste sequentially in each landfill cell(s) and this Filling plan must be updated at intervals of no greater than 12 months. This requirement has been addressed in **Section 5.1**.

A standalone **Landfill Filling Plan** (LFP) has been prepared to provide a basis for the management, control and monitoring of filling at the site to demonstrate how the various outcomes relating to compaction, gas management, surface water management and leachate management are considered and will be achieved. This is also discussed in more detail in **Section 5.1.** The **Landfill Filling Plan** is also provided in **Appendix D.**

It is anticipated that the rate of filling, episodic project related filling and weather conditions may result in deviations from the plan which maintain the plans intent. This plan is subject to a 12 monthly review frequency to ensure it is updated to reflect minor deviations from the plan.

3.4 Roles and Responsibilities

Key roles and responsibilities applicable to this Landfill Plan are presented in **Table 3-2**.

Table 3-2: Roles and Responsibilities

Roles	Responsibilities
General Manager Resource Recovery NSW	• Ensuring a Landfill Plan is developed and implemented • Ensuring appropriate resources are available to implement all aspects of the Landfill Plan and maintain necessary records
Environmental Manager NSW	• Advise the General Manager Resource Recovery NSW on environmental issues • Undertaking reporting and internal audit annually

Roles	Responsibilities
	• Review, maintain and assist implementation of the Environmental Management System
Safety and Quality Manager NSW	• Provide support for the Site Operations Manager and Site Environmental Officer • Participate in investigations of accidents on site • Take action to resolve non-conformances, non-compliances and incidents
Site Environmental Officer	• Ensuring compliance with Project Approval conditions and any regulatory or other requirements • Identifying environmental risks associated with landfilling operations undertaken on site • Developing and implementing procedures and measures to minimise or eliminate any risks identified • Ensuring that all personnel undertaking work at the site receive adequate training and education in the environmental measures developed to mitigate or minimise risks associated with landfilling activities • Implement appropriate monitoring to ensure that the management measures adopted in this plan are effective • Undertaking regular reporting and undertaking an annual internal audit
Site Operations Manager	• Effectively implement environmental controls on-site in accordance with environmental obligations • Report environmental non-conformances, incidents and potential incidents to the Environment Manager NSW and General Manager Resource Recovery NSW • Manage and direct works in a manner that minimises potential for environmental impacts or stop works if there is a risk of environmental harm • Develop and update the Landfill Filling Plan, including development activities to allow access to permitted airspace • Manage and direct works (or service providers) to provide: – lining systems, leachate and LFG control systems – construction of access and surface water controls – access to sufficient cover and other materials • Monitor filling activities, efficiency and compaction
Landfill Site Supervisors	• Effectively implement environmental controls at the landfill in accordance with environmental obligations • Present and participate in toolbox talks and meetings as required • Report environmental non-conformances, incidents and potential incidents to the Site Operations Manager and/or Site Environmental Officer • Manage and direct works in a manner that minimises potential for environmental impacts or stop works if there is a risk of environmental harm • Managing on-site response to incidents where safe to do so • Undertake daily site inspections of work area • Ensure criteria or level of compaction target for the landfill are achieved • Ensure all exposed landfilled waste is appropriately covered with VENM (or a suitable alternative) every day
Contractors	• Completing the site induction • Being aware of and following onsite instructions and procedures implemented to minimise or eliminate environmental risks

3.5 Training and Competence

3.5.1 General environmental awareness training

All personnel undertaking work at the Facility will undergo general environmental awareness training and training relevant to their responsibilities under the Facility **EMS**.

Records of the Facility environmental induction and other environmental training will be maintained and readily accessible. Details of training is provided in Section 4.4 of the EMS.

4 LANDFILL CONTROLS

4.1 Waste Sources

The Facility is licensed to landfill up to 1,000,000 tonnes of non-putrescible waste per calendar year (excluding any residual waste from the Materials Processing Centres). Section 2 of the **EMS** and the **Waste Monitoring Plan** describe what wastes are permitted and prohibited to be placed in the landfill.

In summary

- Only waste streams complying with acceptable waste for general solid waste (non-putrescible) facilities and assessed to be inert waste or solid waste following the technical assessment procedure outlined in Part 1 of the Waste Classification Guidelines (NSW EPA, 2014) are permitted to be landfilled.
- All outputs produced from the waste processing and/or resource recovery Facility will be disposed to the landfill, with the exception of the following material:
  a) Recyclables extracted and delivered off-site for resource recovery purposes;
  b) Putrescible waste extracted from the input waste stream and lawfully disposed of off-site;
  c) Restricted waste and hazardous waste extracted from the input waste stream and lawfully disposed of off-site; and
  d) Output waste derived materials approved for use under the Protection of the Environment Operations Act, 1997 and Regulation.

4.2 Landfill Setting

4.2.1 Hydrogeological Setting

This is summarised by IGGC (2009) site investigations and re-assessment of the detailed hydrogeological setting of the site to confirm the accuracy of the understanding and conceptual model developed previously and to modify these as necessary. This assessment included field investigations, fracture mapping, and drilling at two sites with deep (cored) and intermediate (air hammer) constructed wells to further develop the sites conceptual model. This assessment summarised its findings as follows:

> *Consideration of the detailed hydrogeological cross-section and of the other available data indicates that the conceptual model developed previously is broadly correct and that the hydrogeological setting can be summarised as follows:*
>
> - *The hydrogeological setting comprises a layered aquifer system including a perched aquifer in the upper weathered profile and a series of aquifers in the more transmissive horizons of the underlying bedrock;*
> - *The upper weathered profile shows low to moderate hydraulic conductivity. Groundwater levels are around 67 mAHD and the hydraulic connection between the shallow aquifer and the quarry appears limited;*
> - *The intermediate Wianamatta Group aquifer layers (i.e. the upper to middle zones in the bedrock, c.30 m to 100 m depth) show generally negligible or very low hydraulic conductivities with occasional zones of higher values of up to 0.04 m/d. Stabilised groundwater levels are around 55 mAHD; natural levels would be expected to be slightly below those of the shallow groundwater zone and this shows the effect of depressurisation caused by pumping of groundwater from the quarry;*
> - *The deep Wianamatta Group aquifer layers (c.100 m to 150 m depth) show generally negligible or very low hydraulic conductivity values with occasional zones of higher values of up to 0.01 m/d. Stabilised groundwater levels are around 31 mAHD showing the effect of*

depressurisation although this is less than appeared the case from the results of previous investigation;

- *The Hawkesbury Sandstone occurs beneath the Wianamatta Shale Group strata at an elevation of around - 72 mAHD, around six metres below the deepest parts of the quarry. Hydraulic conductivity is low (0.003 m/d) and groundwater levels are similar to those is the overlying deep Wianamatta Group strata;*
- *The quarry exploits volcanic breccia of the Minchinbury Diatreme and these strata form the walls of the quarry beneath the first one or two benches. Observational data of the extent of fracturing and seepage within the quarry indicate that these strata are of very low hydraulic conductivity.*
- *Pumping of groundwater from the quarry has results in a steep inward hydraulic gradient in the bedrock strata. Effects appear limited in the shallow weathered profile indicating limited hydraulic connection between these strata and the quarry. Despite the steep gradients seepage rates into the quarry are low (c.30 m^3/day) reflecting the very limited occurrence of fracturing and therefore very low hydraulic conductivity values of the bedrock strata;*
- *Under natural conditions a low, downward hydraulic gradient would be expected to occur. This has been increased as a result of depressurisation resulting in relatively high downward gradients;*
- *The regional groundwater system is fed by low levels of rainfall recharge with groundwater flow controlled by discharge to creeks to the east and west of the site and to the Hawkesbury-Nepean system to the north.*

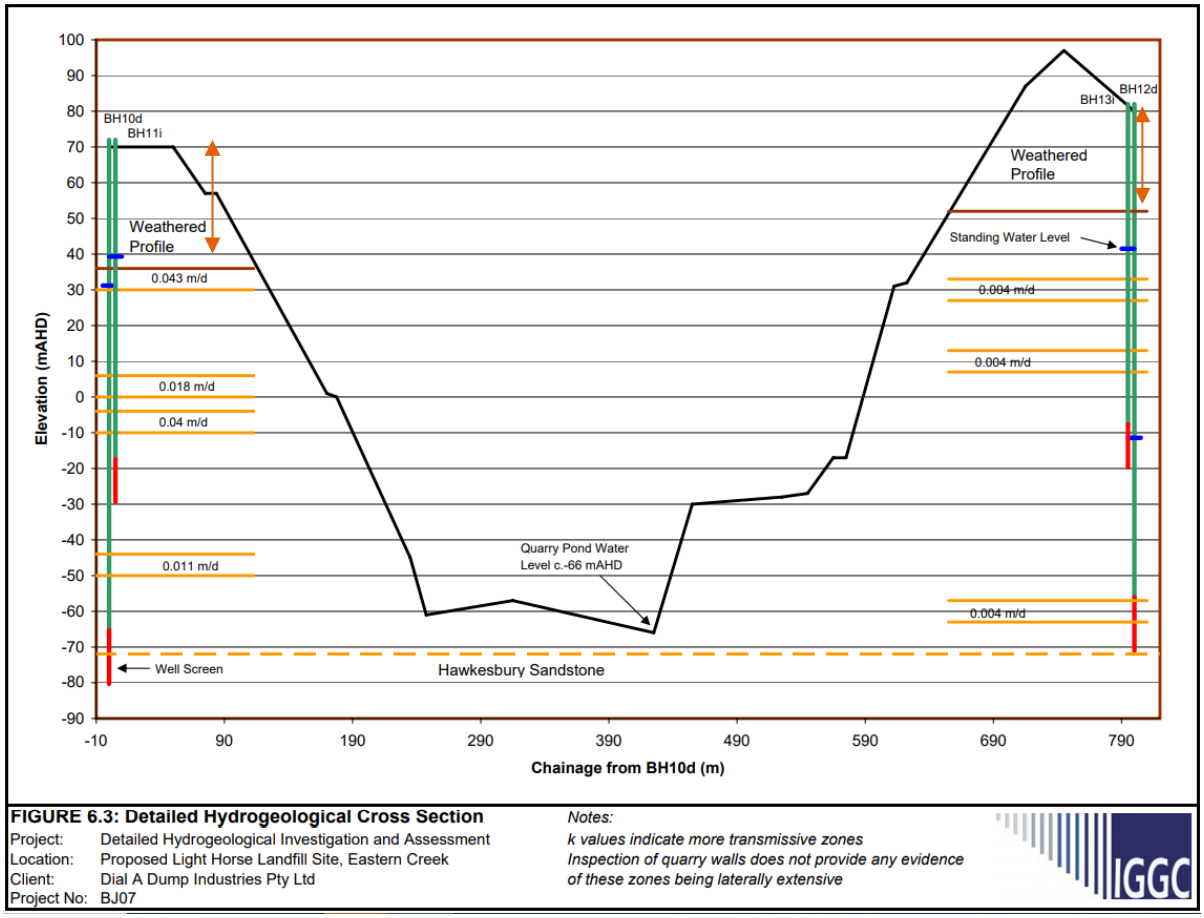


Figure 4-1: Detailed Hydrogeological Cross Section

IGGC (2009) also undertook three-dimensional numerical modelling of the layered aquifer system to assess groundwater flows into the landfill, rate of groundwater recovery and flow rates from the landfill post recovery. This report concluded:

> *The strata of the Wianamatta Shale group have limited potential to transmit groundwater flow, with the majority of flow occurring via fractures and bedding planes. The formation generally forms a layered aquifer system, with discrete aquifers occurring within horizontal fracture zones. The groundwater pressure surface generally follows topography.*
>
> *Natural groundwater levels in the area of the site are around 65 mAHD. Pumping from the quarry has resulted in substantial depressurisation of the local groundwater systems, with levels over 30 m below the estimated natural groundwater level. Estimated inflow rates are around 30 m^3/day, indicating the very low permeability of the surrounding strata.*
>
> *The extent of drawdown is very localised in the shallow groundwater system and most extensive in the deep aquifers with the maximum extent of significant drawdown expected to be limited to a distance of one kilometre from the quarry. If pumping ceases, groundwater levels will rebound, eventually returning to close to natural levels of around 65 mAHD over a timescale of over 30 years.*
>
> *The quarry represents a very low risk site for landfill site development in terms of potential groundwater impacts because of the very low permeability of the surrounding strata and limited degree of hydraulic connection with the shallow groundwater system; the strong inward hydraulic gradient; and the low groundwater inflow rate.*
>
> *Results of numerical modelling indicate that the potential for impacts on groundwater due to leachate migration from the site is very low, with migration rates predicted to be very slow even for worst-case condition in which no pumping takes place for an extended period.*

4.2.2 Groundwater Protection

IGGC (2009) considered that the provision of a low permeability barrier or landfill liner was *"not necessary and would offer no environmental or management benefits",* and instead recommended that:

- *A leachate management system to allow interception, collection and removal of water accumulating in the landfill site is required. The recommended approach is to construct series of drainage systems progressively during filling at various levels through the fill profile with only the upper drainage system in use at any time.*
- *Leachate levels should be maintained as required operationally, either a few metres below the fill surface, or at a lower level to provide buffering storage.*
- *Leachate levels should also be kept below the groundwater levels in the surrounding strata. Control of leachate levels will allow management of groundwater levels in the quarry and surrounding strata, if required. The nature of the waste accepted will be carefully controlled.*
- *Ongoing monitoring of groundwater and leachate levels and water quality will be required during the active landfilling period and post-closure.*

Following the licensee's proposal for an upper-level leachate contingency control system (LCCS) at approximately RL 0 mAHD and upper leachate barrier system (ULBS) above RL 60 mAHD provided (PSM, June 2017), the LCCS was constructed in 2018.

EPA have requested further information to justify the ULBS proposal and extent of the sidewall lining above RL 25 mAHD, including justification of variations from the NSW Landfill Guidelines (2016) which post-date the original project approval (EPA Section 60 Notice, March 2021).

4.2.3 Sidewall Stability

Portions of the quarry sidewall have been subject to landslip and implementation of slope stabilisation and risk control measures area a requirement of the project approval (Condition 7).

Measures proposed (Jeffery and Katauskas, March 2008) included:

- Catch bunds;
- Safety bunds and haul road drainage;
- Slope re-grading;
- Ongoing monitoring; and
- Scaling off (loose fragments).

Unacceptable risks exist on-site without a program of ongoing monitoring and control measures. These measures are required inputs to the landfill ULBS design (**Section 4.3.3** Upper Sidewall Lining) and **Landfill Filling Plan** (**Section 5.1** and **Appendix D**).

4.3 Containment System

4.3.1 Basal Cell Lining

The basal cell lining was reportedly constructed in generally in accordance with Douglas Partners (June 2011)[1] and in compliance with the NSW EPA Solid Landfill Guidelines, 1996 Benchmark Techniques 1 and 2, including the QA/QC and testing program specified in that report.

This system included:

- Re-grading of the quarry floor to create fall towards a leachate sump in the eastern part of the quarry;
- Construction of an engineered base liner and leachate drainage layer; and
- Construction of a leachate sump and riser for leachate removal to a treatment plant and discharge to sewer under a trade waste agreement with Sydney Water.

4.3.2 Lower Sidewall Lining

Containment above the basal cell liner is provided by the natural geology as described in **Section 4.2.2**.

4.3.3 Upper Sidewall Lining

Containment in the upper portion of the geology, and in particular the weathered portion is subject to further detailed assessment and design, including:

- A further assessment of hydrogeological conditions;
- Assessment of current containment system performance;
- Leachate collection system performance and contingency measures;
- Considering LFG migration under operating and closure conditions (including groundwater level changes), and the requirements of the lining as a barrier system for LFG control;
- Delineation of the lower levels of the required lining system based on the above; and
- Assurance that the sidewall liner design performance meets the intent of the 2016 NSW EPA Landfill guidelines and the final design details are acceptable to the NSW EPA.

[1] Douglas Partners (2011) - *Environmental Management Strategy June 2011 - Leachate Collection and Conveyance System*"

Given the steep slopes of the void sidewalls and waste depths, specialist lining design and construction techniques will be required as site conditions fall outside the range of typical site conditions and suggested measures within guidance provided in NSW Landfill Guidelines (2016).

The scope and nature of these works are required inputs to the **Landfill Filling Plan** (**Section 5.1** and **Appendix D**).

4.3.4 Capping (Closure and Rehabilitation)

The post closure uses of the land include the development associated with or ancillary to the broader Recycling Ecology Precinct. It was recognised that the nature and depth of landfilling will limit on development of large slabs (structures) due to settlement (Director Generals Assessment Report, 2008) and that any development on-site will have to be compatible with the cap design to maintain its required level of performance and subsurface presence of landfill gas. Examples of structures/uses that are likely to be complementary with post closure activities include:

- Simple lightweight / flexible structures (particularly once settlement reduces);
- Larger structures where these are appropriately designed for conditions and after significant ground improvement works;
- Outdoor stockpiling / processing areas;
- Amenity bunds; and
- PV Array (flexible framed surface / shallow footing systems)

The final landform level for the Eastern Creek landfill is conditioned to be 'generally in accordance' with the proposed final filling plan shown in **Figure 4-2**.

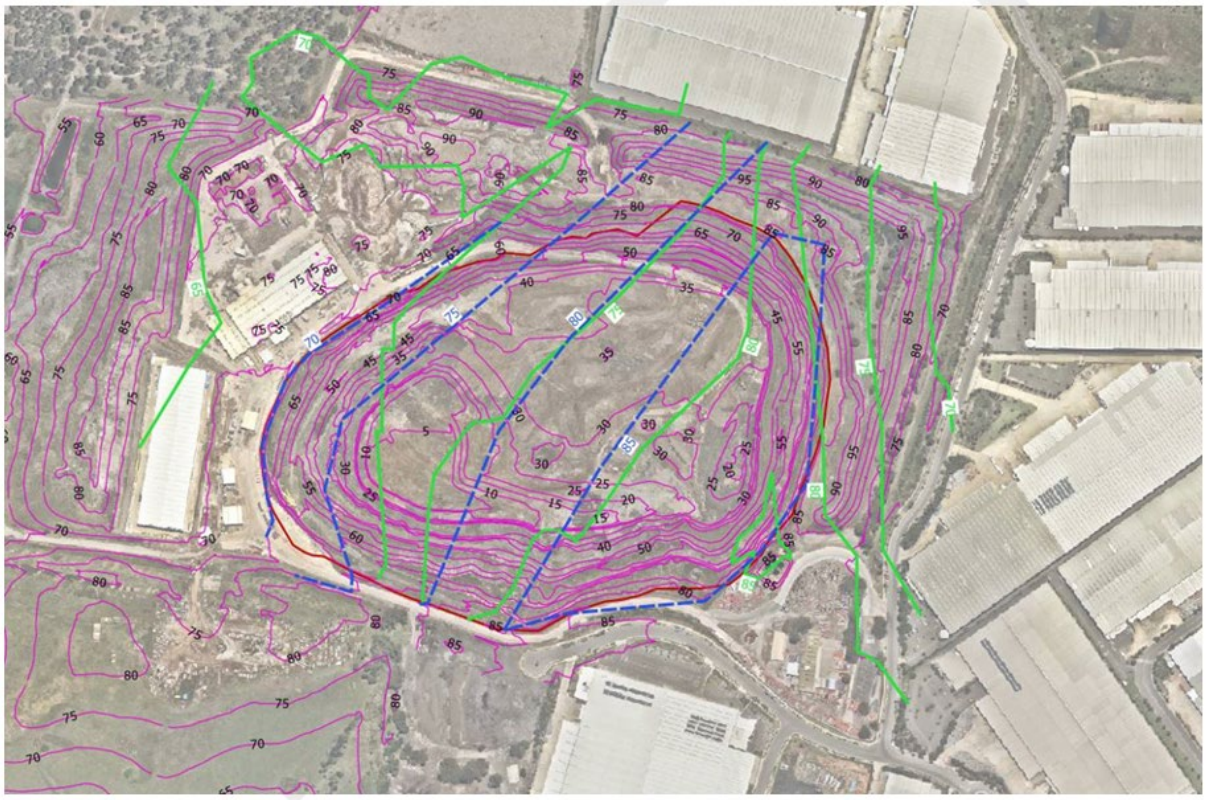


Figure 4-2: Final Landform Contours

Note: Project Approval contours in Green, potential completion prior to settlement in Blue

Due to the significant depth of fill present on-site, significant overfill or top up filling to offset settlement will be required and will vary with the actual composition ow waste, efficiency and rate of filling.

A goal of this landfill plan is to maximise landfilling efficiency and minimise settlement for the wastes accepted to site. This is further addressed in Landfill Operations (**Section 5**).

The final capping requirements for rehabilitation are yet to be confirmed but must comply with EPA requirements and may include for example:

- A graded surface with slopes between 3% and 20% to avoid ponding and erosion;
- Maintenance of access to leachate and LFG management system infrastructure for long term maintenance and operation;
- A revegetated soil profile consisting of:
  - a seal-bearing surface consisting of a properly designed and engineered layer of material at least 300 mm thick to support the sealing layer;
  - a sealing layer, comprising a compacted clay layer at least 600 mm thick;
  - a revegetation layer at least 1,000 mm thick and comprising clean soils and vegetation with root systems that will not penetrate into lower layers; the upper 200 mm should be a topsoil layer, which can include compost to help with vegetation establishment and growth.

The final filling levels and accommodation of settlement will be addressed in the **Rehabilitation Plan.**

4.4 Landfill Environmental Management

4.4.1 Leachate Management

The generation of leachate in the landfill is minimised where possible by the diversion and separation of stormwater run-on from surrounding land, pit walls, and covered wastes, and the application of landfill cover.

Leachate generated by water runoff from waste (including waste with daily cover) is contained within the landfill void and collected by the leachate collection system.

This system is comprised of the following key features:

- The basal lining and leachate collection system, constructed on the pit floor prior to landfilling;
- An intermediate leachate collection system (LCCS) between approximately RL 10 mAHD and 0 mAHD;
- A sump with rises and extraction pumps located at the lowest elevation of the pit base which collects the leachate in preparation for removal;
- Segregation of leachate runoff from uncovered areas of the active tipping area (for transfer to the leachate treatment plant);
- Leachate transfer pumps within the leachate sump and rising main to leachate treatment plant; and
- Leachate treatment plant and sewer connection allowing discharge to sewer under a trade waste agreement with Sydney Water.

The leachate system must be operated to maintain leachate levels below those of the surrounding groundwater (currently maintained at the level of the LCCS or RL 0 mAHD at the leachate sump) and below the active landfill surface.

Management and monitoring of the leachate system is discussed in more detail in the **Soil, Water and Leachate Management Plan (SWLMP).**

Leachate must also be managed in accordance with the requirements of the **Landfill Gas Management Plan (LFGMP).**

The scope and nature of the works necessary to maintain leachate levels are required inputs to the **Landfill Filling Plan** (**Section 5.1** and **Appendix D**).

4.4.2 Air Quality Management

The management and monitoring of air quality (including odour, dust, litter and LFG) is discussed in more detail in the **Air Quality Management Plan (AQMP).**

Odour control on-site during the operational phase are provided primarily by:

- Excluding receipt of potentially odourous materials such as waste containing putrescible materials;
- Application of sufficient landfill cover;
- Avoidance of leachate ponding by removal and treatment prior to disposal to sewer; and
- Landfill gas management (LFGMP).

4.4.3 Landfill Gas Management

The site currently has no permanent active landfill gas management system installed.

In addition to the measures contained within the current AQMP, a **Landfill Gas Management Plan** (LFGMP) has been prepared and the following measures implemented:

- Short term actions:
  - A pumping trial to ensures sufficient gas is available to operate a flare in the short term to sustain extraction and odour control from high emission zones and point source emissions on the landfill surface;
  - Surface emission monitoring; and
  - LFG flow and composition monitoring.
- Future actions include:
  - Development of a LFG extraction system aligned with longer term landfill development/filling requirements to ensure odorous emissions of LFG do not occur; and
  - Measures to manage and extract leachate as required based on the operating experience during the pumping trial.

The LFGMP assumes that landfill operation and daily and interim cover application is occurring in accordance with licence conditions as a primary control measure which minimises direct emissions, leachate generation and enhances LFG recovery.

5 LANDFILLING OPERATIONS

5.1 Landfill Filling Plan

The Project Approval states that the landfill cell must be filled in a systematic manner which maximises compaction rates to achieve the compaction targets, taking into account the post-landfilling uses of the void.

A **Landfill Filling Plan** has been prepared and provides a basis for the management, control and monitoring of filling at the site to demonstrate how the various outcomes relating to compaction, gas management, surface water management and leachate management are considered and will be achieved. The **Landfill Filling Plan** will be updated annually to provide a forward-looking plan for the availability of and access to permitted airspace. The Landfill Filling Plan is provided in **Appendix D**.

The filling sequence has been developed in four stages, which will provide approximately 24 months airspace from July 2021 to June 2023. Estimated timing of each stage completion is summarised below:

- Estimated time for completion for Stage 1 is July 2022;
- Estimated time for completion for Stage 2 is January 2023;
- Estimated time for completion for Stage 3 is March 2023;
- Estimated time for completion for Stage 4 is June 2023.

More details on volumes and timings are provided in the **Landfill Filling Plan**. Requirements for the **Landfill Filling Plan** are summarised below.

5.1.1 Scope

The **Landfill Filling Plan** scope includes the following:

- Construction and Accommodation Works Constraints
  - Development of containment system and accessible airspace (complying with EPL conditions);
  - Program of ongoing monitoring and control measures to prevent unacceptable sidewall stability risks;
  - Accommodate construction and extension of environmental management infrastructure (systems for managing runoff, leachate, landfill gas, monitoring); and
  - Works to provide safe vehicle and mobile plant access for construction, operation and incoming waste collection vehicles (roadways, ramps and tipping area).
- Landfill Operation
  - Access to materials including daily and intermediate cover, road base (stockpile locations and quantities, including contingency requirements and access);
  - Deposition of waste in operational cells (unloading, spreading and compacting waste), and
  - Application of landfill cover.

Separate project plans will be required to provide the details necessary to conduct the discrete accommodation works not undertaken by the team supervised by the Landfill Supervisor.

The **Landfill Filling Plan** must demonstrate provision of access to a minimum of two years airspace at the projected filling rate and be prepared and updated annually.

5.1.2 Contents

The **Landfill Filling Plan** is prepared to allow review of actual filling and construction progress against the plan on a monthly or more frequent interval.

The **Landfill Filling Plan** shall consist of:

- A series of plans and drawings showing:
  - A plan showing the accessible areas (stages) into which fill will be directed over a minimum of two years;
  - A plan showing monthly (numbered) working areas into which waste will be directed over the coming year (placed and covered in daily cells);
  - Essential infrastructure works that must be completed and surveyed prior to deposition of waste;
  - Location of infrastructure requiring location, extension and/or protection during filling;
  - Filling sequence and number of waste lifts;
  - Access road and ramp locations (including traffic circulation);
  - Gradients of the filled cells necessary to achieve segregation of surface water (from interim capped areas) and leachate (from active areas) as filling and cover placement progresses;
  - Surface water controls (surface grading and bunds for each lift);
  - Stockpile locations (cover, road base and other materials); and
  - Locations of temporary markers and traffic controls.
- Schedules referencing the plans and drawings listing:
  - For each numbered work area, for each lift in the filling sequence:
    - Air airspace;
    - Adopted compaction target;
    - Waste tonnage;
    - Daily cover requirement; and
    - Estimated life and completion.
  - Control infrastructure works that must be competed, including required completion time;
  - Containment and sidewall construction works that must be competed, including required completion time; and
  - Ramp and access road construction requirements, including required completion time.

Sufficient detail must also be provided for each secondary tipping area (for materials separately landfilled such as asbestos) and areas for wet weather and other operating contingencies.

5.1.3 Monitoring

A survey program shall be included in the **Landfill Filling Plan** and conducted as required to meet the monitoring requirement listed in **Table 6-1: Monitoring requirements**.

The adopted compaction target in the **Landfill Filling Plan** should be based upon the reasonable short-term compaction achievable for the type and relative proportions of waste landfilled within the monitored area.

The overall site compaction or airspace utilisation should also be calculated to monitor the effects of consolidation and settlement over time.

5.2 Placement and Compaction

Achieving high waste compaction densities is fundamental to managing the landfill. Good compaction improves safety by providing a stable surface upon which the machinery and people work and maximises efficiency in use of the landfill airspace and assists LFG and leachate management.

Landfill operation will be conducted in accordance with the **Landfill Filling Plan.** Good practice requires that:

- Unloading vehicles are directed to a defined tipping area providing a safe working platform and access;
- Tipped wastes be spread to the adjacent working face at a depth not exceeding 500 mm;
- Compaction is provided by 4/5 passes of landfill compaction equipment;
- The daily cell lift should not be more than 4 m in height; and
  - be oriented such that the placement of refuse is easily facilitated from the tipping area
  - to optimise access and effective control over waste placement and compaction, and
  - minimise the area of uncovered waste.
- The tipping area and working face shall also be constructed to control water at all times using the constructed topography and / or bunds to prevent run-on of surface waters from capped areas and contain leachate and runoff from the waste surface.

The disposal and placement of waste at the active face and the tipping area will be managed in a way which achieves the following outcomes:

- Minimising the exposed waste surface area;
- Compacting and covering waste to the planned surface in accordance with the landfill plan as quickly as possible each day;
- The working face and interim waste batter slopes generally not exceeding 1 vertical to 3 horizontal to allow placement and compaction of landfill cover to maximise emission and infiltration control and minimise air ingress which can impact LFG management and fire risk;
- Minimising the amount of cover material consumed and compartmentalisation of daily cells by:
  - Using alternative daily cover in accordance with approvals;
  - Reclaiming intermediate cover, daily cover from the working face and constructed roadways and ramps prior to commencement of filling in the active area.; and
  - Exposing covered waste and excavating placed waste is not permitted without EPA approval.

5.3 Cover Material

Application of correct cover material over any exposed landfill waste is required to assist in the prevention and control of environmental issues including:

- Preventing wind-blown litter;
- Deterring scavenging by feral pest species;
- Controlling odour and uncontrolled gas emissions;
- Controlling dust generation;
- Minimising fire risk;
- Improved amenity; and
- Minimising rain infiltration

Schedule 3 Condition 9 requires that works be undertaken in a way that minimises the area of exposed or cleared areas in the landfill.

At least two weeks cover material will be available at the premises under all weather conditions, and a minimum of three days daily cover material be present in the cover stockpile at the active tipping face at the commencement of each day.

5.3.1 Daily Cover

All exposed landfilled waste will be covered with at least 150 mm of VENM (or suitable alternative) from the cover stockpile at the end of daily waste disposal and compaction activities.

5.3.2 Alternative Daily Cover (ConCover)

EPL 13426 permits the use of an alternative daily cover (ADC), including 'ConCover - SUPERCOVER'. This is a polymer and fibre-based product supplied by Odour Control Systems International in New Zealand.

If ConCover is used, it must be applied used in accordance with the following procedure and application ratios.

ConCover Preparation Procedure

(1) Calculate the square meterage to be covered before commencing.

(2) Attach the ConCover unit to the loader using the towing rings.

(3) Add water to the tank to the specified level, as shown on the tank (DO NOT OVER-FILL) or to the level required if less than a full tank is needed.

(4) Add all OCS B bags (fibre) required for the water in the tank, as per the application ratios below. Mix in thoroughly so that no dry fibre is sitting on top of the water. This may mean the operator has to reverse the mixing shaft couple of times to ensure all fibres are mixed through.

(5) With mixing on FULL SPEED, add the ProGuard, as per the application ratios below, slowly to the mixture. Do not add them too quickly as this will cause the polymer to bind up and not thicken.

(6) Once all of the ProGuard is added, all contents in the tank must be mixed on FULL SPEED for a minimum of 20 minutes. This is paramount. If this is not done, the product will not thicken or expand it will not cover the same area as stated above.

(7) Check to ensure the mixture is free of lumps before commencing the application on the ConCover. If the mixture contains lumps additional mixing is required. Continue this process until all lumps have been dissolved.

ConCover Application Ratios

The table below summarises the ratios required to cover an area of approximately 700 m^2 (the daily active landfill face) and the ratios required to fill the ConCover tank, providing contingency cover for four days landfilling activities at the Facility.

Table 5-1: ConCover Application Ratios

Product	Quarter tank (for daily active face)	Full Tank (for about four days cover)
Water	1,400 litres	5,600 litres
OCS B Bags (fibre)	6 bags	24 bags
ProGuard	1 bag	4 bags

The ConCover ADC must achieve the performance criteria specified in *Section 8 Covering of Waste of NSW EPA Environmental Guidelines Solid Waste Landfills Second Edition, 2016* and can only be used as daily cover on general solid waste (non-putrescible).

If ConCover is not applied as daily cover, then VENM or the ADC (as described in ELP 13426 Section E4), must be applied to a minimum depth of 0.15 m over all exposed landfilled waste prior to ceasing operations at the end of each day. See **Section 5.3.3** for more details.

5.3.3 Alternative Daily Cover (EPL 13426 E4)

ELP13426 Section E4 and Condition O5.4 the Licensee may apply material as an ADC that meets the following criteria:

(a) Consist only of crushed concrete and/or crushed bricks and/or crushed clay tiles and/or crushed glass fines from domestic or commercial recycling collections, mixed with soil. The amount of soil in the mixture must be at least 25% (by mass).

(b) Must be applied to a depth of at least 150 mm at the close of each operational day.

(c) Must not contain contaminants at concentrations above those specified for *General Solid Waste (Non-putrescible) in Tables 1 and 2 of the Waste Classification Guidelines, Part 1: Classifying Waste*.

(d) The ADC material must not contain asbestos, food waste, animal waste, grease trap waste, biosolids, rubber, plastic, bitumen, asphalt, paper, cloth, paint, wood, other vegetable matter, plaster and metal.

(e) The maximum permissible dimension of particles is 50 mm and 50% by mass of the material must be comprised of particles <1 mm in diameter.

Note: To meet all of the requirements in this approval, it is likely that the ADC will require processing into a fine particle size.

(f) The ADC cover material must have the ability to suppress odours from the landfilled waste and must not itself generate offensive odours.

(g) Rainwater which comes into contact with the alternative daily cover must be managed as landfill leachate.

5.3.4 Intermediate Cover

Cover material must be applied to a depth of 0.3 m (300 mm) over surfaces of the landfilled waste at the premises which are exposed for more than 90 days.

Intermediate Cover must be:

- VENM;
- Placed to achieve the grades shown in the **Landfill Filling Plan**; and
- Constructed to include bunds and diversions shown in the filling plan or otherwise necessary to segregate surface water from intermediate areas and active areas where leachate may be present.

5.4 Placement of Asbestos Waste

All asbestos waste must be deposited in the designated asbestos tipping area within the landfill.

Daily cover will be placed on all flanks and surfaces and will comply with Section 80 of the *Protection of the Environment Operations (Waste) Regulation 2014 (NSW).* The objective of cover in these cells, is to ensure that no asbestos or waste containing asbestos is left exposed and to prevent dispersion of fibres.

The key principle behind the use of designated asbestos tipping area for asbestos waste is to ensure that the asbestos remains physically separate from the main body of waste in the site.

Asbestos waste will be covered with VENM as follows:

- Initially (at the time of disposal), to a depth of at least 0.15 m;
- At the end of each day's operation, to a depth of at least 0.5 m; and
- Finally, to a depth of at least 1 m (in the case of bonded asbestos waste or asbestos contaminated soils) or 3 m (in the case of friable asbestos material) beneath the final land surface of the landfill site.

ConCover and the Alternative Daily Cover cannot be used to cover asbestos waste material.

More details on managing asbestos can be found in the **Asbestos Management Plan**, **Waste Management Plan** and **Appendix C.**

5.4.1 Asbestos-contaminated Soils

All incoming asbestos-contaminated soil loads to the landfill are subject to review prior to tipping. This review includes confirmation that the waste type is permitted by EPL 13426. On arrival at site procedures including the following apply:

- If it is practicable and safe to do so, loads will be wet down to prevent any dust, and sprinklers turned on in the disposal area prior to tipping or a water truck will be used to wet down the landfill floor;
- Direct customers to the appropriate disposal area and instruct them where to tip their load; and
- Report any customers to the weighbridge immediately if they have not followed these procedures.

5.5 Management Measures

Table 5-2 provides a summary of the applicable measures for managing the landfill process. Responsibilities and timing for undertaking the measures is also provided in the table.

Table 5-2: Management Measures

Aspect	ID	Ongoing Management Measure	Timing	Responsibility	Reference
Compaction	LP-01	• Waste to be compacted to achieve the waste compaction assumed in the Filling Plan for each monthly working area	Quarterly (Monthly following change of operation or non-conformance)	Landfill Site supervisor	Section 5.1.3 Section 3.6 of the Landfill Filling Plan Appendix D
Cover	LP-02	• Minimise the uncovered total area of the waste	Daily	Landfill Site supervisor	Section 5.2 Section 3.2 of the Landfill Filling Plan Appendix D
	LP-03	• Cover all exposed landfilled waste with daily cover at the end of daily waste placement and compaction activities. Provide 300 mm intermediate cover if the resultant covered surface is to be left exposed for more than 90 days.	Daily	Landfill Site supervisor	Section 5.2 Section 3.2 of the Landfill Filling Plan Appendix D
	LP-04	• Landfilled waste must not be exhumed unless written approval is given by the EPA.	Daily	Landfill Site supervisor	Section 5.2 Section 3.2 of the Landfill Filling Plan Appendix D
	LP-05	• Previously landfilled waste will not be exposed. (Intermediate cover and construction work may be reclaimed and reused).	Daily	Landfill Site supervisor	Section 5.2 Section 3.2 of the Landfill Filling PlanAppendix D
Odour	LP-06	• All operators will take appropriate housekeeping steps to prevent the production of offensive odours. • The use of daily cover and immediate attention to odorous waste loads will minimise the transmission of odours off-site. Any odorous waste loads are to be rejected. • Monitoring (LP-09) and LFG management (LP-14)	Daily	Landfill Site supervisor	Cover requirements (LP-02 to LP-05) Section 4.4.2 AQMP LFGMP Section 2.6 of the Landfill Filling Plan Appendix D

Aspect	ID	Ongoing Management Measure	Timing	Responsibility	Reference
Asbestos	LP-07	• Asbestos waste is managed in accordance with the Asbestos Management Plan and asbestos management procedures	Operation	Landfill Site supervisor	Section 5.4 Waste Monitoring Program
Scavenging	LP-08	• Scavenging of wastes is prohibited at all times other than by the operator in the normal course of diverting, handling and redirecting wastes for recycling, reuse or reprocessing. • No other scavenging or totting will be allowed.	Daily	Landfill Site supervisor	Section 5.3
Air quality	LP-09	• Dust controls will be put in place to minimise pollutants leaving the site (e.g. airborne dust. Sprinklers and water carts will be used as required. • All trucks on site will operate within the speed limits to prevent generation of dust. • Soil loads will be utilised on the wet down bars prior to tipping.	Daily	Landfill Site supervisor Site Environmental Officer	Section 4.4.2 AQMP
Litter	LP-10	• Litter will be adequately controlled, and daily housekeeping of the site will be undertaken • Movable litter control fences are available and will be used in the active tipping area as required where there is a potential for windblown litter around the site. • Waste will be adequately covered to minimise environmental impacts in accordance with the EPL 13426	Daily	Landfill Site supervisor	Section 4.4.2 AQMP
Survey	LP-11	• Regular survey to meet Landfill Plan, Filling Plan and EPA requirements for survey to determine net fill, volume and level changes, contours and gradients airspace utilisation and settlement (Surface and multi-lift using settlement plates)	Event Based Monthly Quarterly 6 Monthly (EPA Landfill Facility Information Certificate)	Site Operations Manager	Section 5.1 Section 3.6 and Section 3.8 of the Landfill Filling Plan Appendix D
Leachate Management	LP-12	• Monitor leachate levels are maintain in accordance with the requirements of the SWLMP by continuous operation of the leachate pump and LTP.	Monthly	Site Operations Manager	SWLMP Landfill Filling Plan Appendix D

Aspect	ID	Ongoing Management Measure	Timing	Responsibility	Reference
LFG Management	LP-13	• Implement the Landfill Gas Management Plan (LFGMP)	Ongoing	Site Operations Manager	Section 4.4.3 LFGMP Section 2.6 of the Landfill Filling Plan Appendix D
Sidewall Stability	LP-14	• Implement all recommended slope stabilisation and risk control measures	Ongoing	Site Operations Manager	Section 5.1 Landfill Filling Plan Appendix D
Upper side wall lining Extent	LP-15	• Detailed assessment and design to determine lining extent and design details	Action (Due Q4 2021)	Site Operations Manager	Section 5.1 Landfill Filling Plan Appendix D
Filling Plan	LP-16	• Update the Filling Plan to include – The outcomes of Actions identified (LP-13, LP-14 and LP-15), and – Continuous improvement of landfilling method based on LP-11	Action (Due Q4 2021)	Site Operations Manager	Section 3.3 Section 5.1 Landfill Filling Plan Appendix D
Rehabilitation Plan	LP-17	• Prepare Rehabilitation Plan	3 years prior to closure	Site Operations Manager	Section 4.3.4

6 MONITORING AND REVIEW

6.1 Monitoring Requirements

Monitoring of the landfill methodology and compaction rates will be conducted as required by the Project Approval. Monitoring requirements relevant to this Landfill Plan are summarised in **Table 6-1**.

Table 6-1: Monitoring Requirements

Monitoring Focus	Limit / Performance indicator	Responsibility	Frequency
Filling Plan – Airspace	Plan demonstrates requirements to access 2 years airspace	Site Operations Manager	Annual
Filling Plan – Quantities placed in each area	Actual vs Planned capacity	Site Operations Manager	Monthly
Filling Plan – Survey (Record)	Filling Plan grades and levels	Site Operations Manager	At completion of filling to plan levels to verify surface drainage
Filling Plan – Survey (Compaction)	Plan Placement Target	Site Operations Manager	Quarterly (Monthly following change of operation or non-conformance)
Filling Plan – Survey (Airspace utilisation)	Monitor only	Site Operations Manager	6 monthly
Settlement – Survey (Surface)	Monitor only	Site Operations Manager	From difference of completion survey and subsequent
Settlement – Survey (Markers)	Monitor only	Site Operations Manager	At establishment and prior to covering or removal. Each ground survey Not less than quarterly
Quantity of waste in the landfill	1,000,000 tonnes per year	Site Operations Manager	Yearly
Integrity and performance of the final capping	N/A	Site Operations Manager	Post-closure period

6.2 Environmental Auditing

Auditing will be undertaken in accordance with the Safety, Environment and Quality (SEQ) Management system and Project Approval as outlined within the overarching EMS.

Auditing applicable to this Landfill Plan is summarised in **Table 6-2**.

Table 6-2: Environmental Auditing Requirements

Requirement	Responsibility	Frequency	Ref
Independent 3rd party audit	External Independent Auditor	Every 2 years	MP_06 0139 Schedule 5 Condition 7

The outcomes of the external independent audit will be used to inform the review and update of this Landfill Plan.

6.3 Reporting

Reporting requirements for monitoring, auditing and as required in the CoA and the EPL and will be undertaken in accordance with the overarching EMS.

Operational reporting requirements applicable to this Landfill Plan is summarised in **Table 6-3**.

Table 6-3: Environmental Reporting Requirements

Requirement	Responsibility	Frequency
Performance against the Landfill Filling Plan	Site Operations Manager	Annual

6.4 Review and Continuous Improvement

Review and improvement of this plan will be undertaken in accordance with the Project Approval and Section 6.6 of the EMS. Continuous improvement will be achieved by the ongoing evaluation of environmental management performance and effectiveness of this plan against regular environmental auditing, environmental policies, objectives and targets.

The updated plan and a summary of changes will be available on site and distributed to all relevant stakeholders in accordance with SEQ Management System document control procedure.

The Landfill Plan will be submitted every 3 years during the life of the operation (coinciding with the independent environmental audit required at Schedule 4, Condition 4).

6.5 Incidents

In the event of a safety / environmental incident or unpredicted impacts relating to waste and resource recovery operations, it is the responsibility of all personnel to report the incident or event to the Site Supervisor.

All environmental incidents are to be reported and managed in accordance with *Incident Reporting and Management Procedure (SOP-COM003)*. Incidents are classified based on the incident's severity as shown in Section 4.7 of the EMS.

All incidents will be managed and reported according to Section 4.7.2 of the EMS.

6.6 Complaints

Complaints may be received directly from stakeholders, or indirectly via the dedicated phone number, website. Complaints handling will be undertaken in accordance with Section 4.6 of the EMS.

6.7 Non-Compliance, Non-Conformances and Corrective Actions

Non-compliance may be identified via internal and external audits, site monitoring, inspections and observations, environmental incidents and emergencies, complaints and management reviews.

Non-compliance, non-conformances and resulting corrective actions are to be managed in accordance with Section 6.3 of the EMS.

7 REFERENCES

Ian Grey Groundwater Consulting Pty Ltd (IGGC) (2009): Proposed Light Horse Landfill Site, Eastern Creek: Detailed Hydrogeological Investigation and Assessment.

NSW Environment Protection Authority (2016): Environmental Guidelines: Solid waste landfills (2nd Edition). Sydney.

Pells Sullivan Meynink (PSM) (June 2017): DADI Landfill. Leachate Management Contingency Systems Design.

PSM (January 2017): Request for Additional Information on Proposed LCCS.

APPENDIX A DPIE ENDORSEMENT

Planning, Industry & Environment

Ms Katie McCallum
Senior Legal Counsel, Environment and Planning
Bingo Industries
305 Parramatta Road
Auburn NSW 2144

25/01/2021

Dear Ms McCallum

Eastern Creek Recycling Ecology Park (06_0139)
Appointment of Independent Engineer

I refer to your request (MP06_0139-PA-2) for the Planning Secretary's approval of a suitably qualified person to prepare the updated Landfill Plan for the Eastern Creek Recycling Ecology Park (06_0139).

The Department has reviewed the nomination and information you have provided and is satisfied that the expert is suitably qualified and experienced. Consequently, I can advise that the Planning Secretary approves the appointment of Mr Paul Lightbody to prepare the updated Landfill Plan.

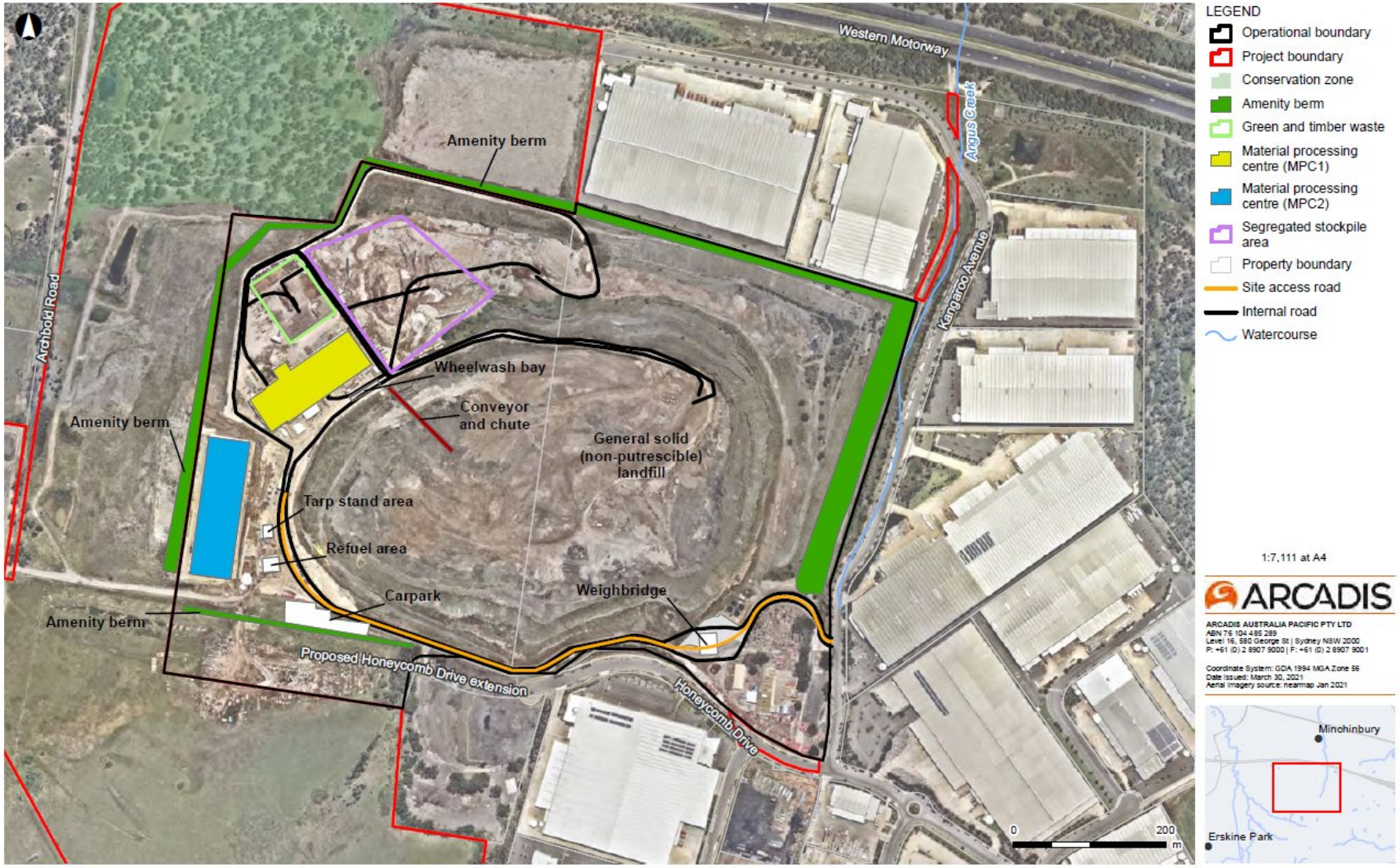
If you wish to discuss the matter further, please contact Bianca Thornton on (02) 8217 2040 or via email at bianca.thornton@planning.nsw.gov.au.

Yours sincerely

Chris Ritchie
Director
Industry Assessments

As nominee of the Planning Secretary

APPENDIX B FACILITY OVERVIEW



Appendix A - Site Layout

Date: 30/03/2021 Path: H:\AAP_GIS\Publishers\Workspace\B_Workshop\2020\20200720_30056657\L-GIS\A_Current\B_Maps\MgmtPlan\G30056657_MgmtPlan_002_SiteLayout_A4L_v5.mxd
Created by : GC Updated by : GC QA by : RB

APPENDIX C ASBESTOS WASTE

All asbestos waste must be deposited in the designated asbestos tipping area within the landfill. Daily cover will be placed on all flanks and surfaces and will comply with Section 80 of the *Protection of the Environment Operations (Waste) Regulation 2014 (NSW).* The objective of cover in these cells, is to ensure that no asbestos or waste containing asbestos is left exposed and to prevent dispersion of fibres.

Asbestos cover

Asbestos waste will be covered with VENM, initially, at the time of disposal, to a depth of at least 0.15 m, and at the end of each day's operation, to a depth of at least 0.5 m.

The key principle behind the use of designated asbestos tipping area for asbestos waste is to ensure that the asbestos remains physically separate from the main body of waste in the site.

PPE

Asbestos or asbestos containing materials (ACM) must not be handled without personal protective equipment (PPE) which includes:

- Gloves, full body suit, safety glasses and
- P3 grade dust filtration mask or equivalent breathing apparatus.

Asbestos Materials / Sheeting

Asbestos Materials / Sheeting must come to landfill in a completely sealed package and wrapped in heavy-duty builder's plastic (the grade of plastic must be at least 200 microns thick) as per the WH&S code of practice.

Transport of Asbestos

Small Vehicles

Asbestos waste must be in approved polyethylene bags in an appropriate manner to render them safe for handling and disposal.

- Bags must be filled to no more than 20 kg and should be no more than half full.
- In Package Form, it needs to be completely sealed with builders tape or duct tape, and packages must be wrapped in manageable sizes for unloading.
- Waste must be carefully unloaded to prevent the release of dust.
- If it is practicable and safe to do so, wet down loads to prevent any dust and turn on sprinklers in the area.
- Direct customers to the appropriate disposal area and hand unload the material.
- Report any customers to the weighbridge immediately if they have not followed procedure.

Larger Quantities

The vehicle body or container must be lined with heavy-duty builder's plastic sheeting in a completely sealed package. The customer must have folded the plastic sheeting over the waste and secured it with builders tape or strong duct tape.

- Loads will be instructed to drive through wet down bay on site by the weighbridge to thoroughly wet each load as required.
- Unloading must be carried out in a manner that minimises any chances of the release of dust.

- If it is practicable and safe to do so, wet down loads to prevent any dust and turn on sprinklers in the area.
- Direct customers to the appropriate disposal area and instruct them where to tip.
- The practice of “running out” loads deposited by tip trucks will not be permitted. Loads must be tipped in a compact pile to allow the waste to be covered by operators without the need to first “push-up” the asbestos waste.
- Report any customers to the weighbridge immediately if they have not followed procedure.

Non-compliance of procedures

Non-Compliance with Required Procedures for Asbestos Waste Disposal

The potential health impacts associated with asbestos exposure and the clear legislative constraints for landfill operators mean that management will not tolerate non-compliance with the above procedures for disposal of asbestos wastes.

Inappropriate packaging of waste

In the event that waste is deemed unable to be unloaded without rupturing following inspection by landfill operational staff, landfill supervisor will inspect the load. Should the supervisor also determine that the load cannot be unloaded in accordance with requirements, permission will NOT be granted to dispose of the material until an alternative disposal methodology is developed to ensure safe tipping of the load. If the customer does not consent to the developed methodology being used then the load is to be rejected and the driver will be directed back to the weighbridge.

Failure to unload as per requirements

Where loads are packaged as required but the method of unloading results in bundles rupturing, details of the vehicle are to be sent to the weighbridge. If a second load is ruptured when unloading, then no further asbestos loads will be accepted from that company / vehicle until it can be demonstrated that an alternative unloading method will be employed.

APPENDIX D LANDFILL FILLING PLAN

BINGO INDUSTRIES

Proud Partner of PLANET ARK

FILLING PLAN

EASTERN CREEK RECYCLING ECOLOGY PARK (& LANDFILL)

DISCLAIMER:

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LANDFILL PLAN

Occupant:	Dial-A-Dump (EC) Pty Ltd
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VERSION CONTROL

Date	Doc Version	Authorised by
16 Sept 2021	Issued as Rev C	
3 Dec 2021	Revision 1	

THIS REVISION

Date	Revision #	Section / Paragraph	Description of Change	Authorised by
3 Dec 2021	1	footers	Revision number corrected	

ACRONYMS AND DEFINITIONS

Acronym / Term	Meaning
ADC	Alternative daily cover
Bingo	Bingo Industries Limited
C&D	Construction and Demolition
C&I	Commercial and Industrial
DADEC	Dial-a-Dump (EC) Pty Ltd
Daily Cell	The waste placed and compacted each day, bounded by the in-situ waste and covered on other surfaces by daily cover.
Daily Cover	Material applied on the tipping face of the landfill upon close of business each day to reduce environmental and amenity impacts.
EHC Act	Environmentally Hazardous Chemicals Act 1985 (NSW)
EMS	Environmental Management Strategy
EP&A Act	*Environmental Planning and Assessment Act 1979*
EPA	Environment Protection Agency
EPL	Environment Protection Licence
Leachate	The liquid that passes through, or is released by waste. It arises from the inherent moisture content of the waste and from rainwater (and sometimes groundwater) percolating through or contacting the waste mass.
Landfill Gas (LFG)	The gaseous emissions from the anaerobic decomposition of organic waste materials placed in a landfill
LFGMP	Landfill Gas Management Plan
MOD	Modification
OSD	Onsite detention basin.
POEO Act	*Protection of the Environment Operations Act 1997*
POEO Regulations	Protection of the Environment Operations (Waste) Regulation 2014.
SEQ	Safety, Environment and Quality
SSD	State Significant Development
SW Act	Sydney Water Act 1994
SWLMP	Soil, Water and Leachate Management Plan
The Facility	Eastern Creek Recycling Ecology Park (& Landfill)
TPA	Tonnes per annum
VENM	virgin excavated natural materials.
WARR Act	Waste Avoidance and Resource Recovery Act 2001 (NSW)

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1 INTRODUCTION

1.1 Background

Bingo Industries Limited (Bingo) acquired the Eastern Creek Recycling Ecology Park (& Landfill) (the Facility) in February 2019 and took over the management of the Eastern Creek site in April 2019. The site was previously known as the Genesis Facility.

The Facility is located at Honeycomb Drive, Eastern Creek in the central western suburbs of Sydney NSW, approximately 36 km west of the Sydney CBD, 18 km west of Parramatta and 12 km east of Penrith. The site is located wholly within the Local Government Area (LGA) of Blacktown, situated in the area known as the M7 Business Hub. The operational area is approximately 54 hectares (ha) and was a former breccia quarry that closed when it ceased extraction activities.

The existing Facility, including recycling centre/s and landfill were granted approval by the then Minister for Planning under Section 75J of the *Environmental Planning and Assessment (EP&A) Act 1979* on 22 November 2009 (MP 06_0139) and commenced operation in June 2012.

The Facility operates under two Environment Protection Licences (EPL) issued by the Environment Protection Authority (EPA); EPL 20121 focusses on resource recovery and EPL 13426 covers landfill operations. The Facility has approval to:

- Accept up to two million tonnes per annum (Mtpa) of C&D (construction and demolition) and C&I (commercial and industrial) waste and landfilling of the quarry void of up to 1 million tpa of non-putrescible waste (including asbestos and other non-recyclable waste), excluding residual chute waste from the material processing centre.
- Crushing, grinding and separating works to process waste masonry material located in an area earmarked as the Segregated Materials Area (SMA);
- Stockpile up to 50 tonnes of waste tyres; and
- Stockpile up to 20,000 tonnes of green waste.

The Facility is operated by Dial-a-Dump (EC) Pty Ltd Industries (DADEC), a fully owned subsidiary of Bingo Industries Pty Ltd.

1.2 Purpose and Application

This **Landfill Filling Plan** (LFP) is to provide a basis for the management, control and monitoring of filling at the site to demonstrate how the various outcomes relating to compaction, gas management, surface water management and leachate management are considered and will be achieved.

The Landfill Filling Plan has considered the following:

- The Project Approval as modified (MP 06_0139); and
- EPL 13426.

This LFP is focussed on:

- complementing the operation of the LFG Management system and its odour control function
- covering waste with a suitable material to minimise rainwater infiltration into the waste and therefore the amount of leachate generated, and
- operating the active face to maximise airspace utilisation in a safe and effective manner.

The filling period covered by this plan is 24 months. There are a number of ongoing projects and investigations (listed in Section 1.6) that affect the sequence of future filling plans.

1.3 Objectives and Targets

Table 1-1 below outlines the objectives and targets set out for the Facility to manage the disposal of material into the void to ensure that a suitable level of compaction occurs.

Table 1-1: Objectives and Targets

Objective	Target
Conduct filling operations which maximise compaction (Airspace Utilisation)	Optimum performance based on regular monitoring of compaction and cover use, and continuous improvement.
Effective LFG Management system operation to control odorous emissions to atmosphere	LFG system impairment by the following factors is controlled: • Disruption of extraction in the active filling area • Landfill cover condition and extent • Perched leachate and compartmentalisation due excessive cover use or loss
Effective Surface Water Management controls that minimise infiltration into the waste	Maintain the following Surface Water Management measures • Intermediate cover is applied and maintained • The landfill surface is graded to minimise pooling • Runoff from significant rainfall is directed to designated low points for appropriate disposal.
Leachate levels are maintained within the waste, and groundwater hydraulic gradient is into the landfill void	Manage surface water infiltration into the landfill to allow the water balance achieved by leachate extraction to maintain an appropriate leachate level
Monitor compaction and settlement	Compaction and settlement rates are monitored to establish operational compaction target and long-term settlement forecast. Optimum compaction is achieved for the waste and operational conditions based on benchmarks established on-site.
Waste exposure	No previously filled and compacted waste is exposed or exhumed without written approval from the EPA
Maintain Safe Working Conditions	Appropriate work practices and conditions at the tipping face are maintained by adhering to this plan and other relevant WHS plans. Gradients are maintained within acceptable limits and as shown on the Filling Plans.

1.4 Relevant Guidelines

The following regulator authored documents have been considered in the preparation of this LFP management plan:

- EPA NSW Environmental Guidelines Solid Waste Landfills. Second Edition 2016.

1.5 Responsible Parties

This document has been prepared by Bingo in consultation with Mockinya Consulting (particularly Mr. Paul Lightbody) and Mr Kim Ross (contractor to Bingo) who have provided technical guidance and review support.

1.6 Status

The **Filling Plan** sets out the intended filling sequence and primary surface water management controls as required by EPL condition U1.4 to demonstrate how the various outcomes relating to compaction, gas management, surface water management and leachate management are considered and will be achieved.

The filling plan does not address compliance with EPL conditions O5.19, O5.20 and O5.21 regarding filling above RL 25m AHD, the related EPA Section 60 Notice, March 2021, or the status of the in-progress investigation of sidewall lining requirements[1]. The filling plan must be amended to reflect the extent of side wall lining required and agreed by EPA.

It is anticipated that the rate of filling, episodic project related filling and weather conditions may result in deviations from the plan which maintain the plans intent.

This plan is subject to a 12 monthly review frequency to ensure it is updated to reflect minor deviations from the plan.

This document has been prepared using the information available at the time of preparation and will be periodically updated where appropriate:

- to meet the operational needs of the facility, reflecting additional data as it is acquired,
- to meet the operational needs of the LFGMP,
- following review of the outcomes of related planning and operational improvement projects which include:
  - detailed investigation of sidewall conditions
  - surface water diversion management improvements
  - airspace KPI monitoring
  - compactor GPS control; and
- in consultation with NSW Environment Protection Authority.

[1] Following the licensee's proposal for an upper-level leachate contingency control system (LCCS) at approximately RL 0 mAHD and upper leachate barrier system (ULBS) above RL 60 mAHD (PSM, June 2017), the LCCS was constructed in 2018. EPA have requested further information to justify the ULBS proposal and extent of the sidewall lining above RL 25 mAHD, including justification of variations from the NSW Landfill Guidelines (2016) which post-date the original project approval (EPA Section 60 Notice, March 2021).
Filling has continued to waste surface levels at June 2021 between RL 25 and 47m AHD.

2 OPERATIONAL CONTEXT

2.1 Waste Received

The Facility is licensed to landfill up to 1 Mtpa of non-putrescible waste per calendar year plus residual wastes from on-site processing, as set out in the Licence (and listed in Table 3 below).

Prior to June 2019 waste soils comprised more than 50% of landfilled wastes. Soils are understood to have formed more than 60% of waste from 2017-2019 and a higher percentage prior to 2017.

During 2020 and 2021, mixed waste organic material (MWOO) was diverted to landfill, and there were unseasonal influxes of fire debris from regional fires (2019-2020) and flood debris from regional flooding events (2021).

Table 2-1: Accepted Waste Types

Waste	Description	Limits
General solid waste (non-putrescible)	Acid Sulphate Soil and Potentially Acid Sulphate Soil that has been treated and meets the definition of General Solid waste (non-putrescible)	The soil must be treated in accordance with the neutralising techniques in the Acid Sulphate Soil Manual (ASSMAC, 1988), then chemically assessed in accordance with Step 5 in Part 1 of the Waste Classification Guidelines
	As defined in Schedule 1 of the POEO Act, as in force from time to time.	N/A
Asbestos Waste	As defined in Schedule 1 of the POEO Act, as in force from time to time	N/A
Tyres	The tyre has a diameter of 1.2 metres or more; and/or the tyre has been shredded or had its walls removed; and/or the tyre was delivered to the premises as part of a domestic load. Tyres are taken to be shredded only if the tyres are in pieces measuring no more than 250mm in any direction; and domestic load means a load containing no more than 5 tyres having a diameter of less than 1.2 metres.	N/A

The EPL also explicitly allows disposal of:

- all outputs produced from the waste processing and/or resource recovery facility on site, subject to Environment Protection Licence 20121, except for
  - Recyclables extracted and delivered off-site for resource recovery purposes;
  - Hazardous wastes extracted from the input waste stream and lawfully disposed of off-site; and
  - Output waste derived materials approved for use under the Protection of the Environment Operations Act, 1997 and Regulations
- Immobilised waste which has been assessed as General Solid Waste (non-putrescible) and is subject to the general immobilisation approvals as set out in the following:
  - "2009/07 Metallurgical furnace slag or metallurgical furnace slag contaminated natural excavated materials"

- "1999/05 Ash, ash-contaminated natural excavated materials or coal-contaminated natural excavated materials".

2.2 Operating Hours

Table 2-2 details the operating hours as approved under *Schedule 3 Condition 39* of MP 06_0139 Modification 6.

Table 2-2: MP 06_0139 as Modified Approved Operating Hours

Activity	Day	Time
Landfill: Truck deliveries	Monday to Friday	5:00am to 9:00pm
	Saturday	5:00am to 9:00pm
	Sunday and Public Holidays	5:00am to 9:00pm

Associated operations on the landfill site including placement of landfill cover at the completion of tipping and operation of leachate and LFG management systems continuously occur outside of the waste receival time.

2.3 Environment Protection Licence Conditions

These requirements, and how they are addressed in the plan are provided in **Table 2-3**.

This plan specifically addresses Condition U1.4. The plan addresses Conditions O5.4 – O6.8 listed in the indicated sections, however variation to some conditions is required to implement the plan (aspects in **bold**).

Table 2-3: Relevant conditions of EPL

#	Requirement	Document Reference
	Pollution Studies and Reduction Programs	
U1.4	Amended Filling Plan The licensee must engage a suitably qualified expert/s to prepare and submit to the EPA an updated Filling Plan for the premises. The Plan must include details on:	
	a. how the placement of waste and application of daily and intermediate cover material will be managed to minimise absorption of surface water into the waste mass, such as ensuring a minimum 2 % grade to facilitate the drainage of rainfall from the landfill surface as described in section 8 of the Environmental Guidelines: Solid Waste Landfills (EPA, Second Edition 2016).	Section 3.2
	b. The staging of waste emplacement, including a detailed filling strategy demonstrating how the various outcomes relating to compaction, gas management, surface water management and leachate management have been considered and will be achieved	Section 3.3
	c. How landfilling over previous areas of intermediate and daily cover will be managed to reduce the risks of perched leachate and impeded gas flow	Section 3.4
	d. The maximum total tipping face size, and maximum area not covered by intermediate cover	Section 3.5

#	Requirement	Document Reference
	e. The management measures to be put in place during modifications to gas and leachate management infrastructure during lifts to minimise risk of off-site offensive odours.	Section 3.6
	Waste Management	
O5.4	Covering of Waste Cover material must be: a) Daily Cover Daily Cover must be either: i) virgin excavated natural material, or ii) approved alternative daily cover. Daily cover material must be applied to a minimum depth of 15 centimetres over all exposed landfilled waste prior to ceasing operations at the end of each day. b) Intermediate Cover must be virgin excavated natural material. Intermediate cover material must be applied to a depth of 30 centimetres over surfaces of the landfilled waste at the premises **which are to be exposed for more than 90 days**. c) Cover material stockpile At least two weeks cover material must be available at the premises under all weather conditions. This material may be won on site, or alternatively a cover stockpile must be maintained adjacent to the tip face.	Section 3.2 & Section 3.5
O5.5	The Licensee must ensure that the size of the active waste tipping face (being the total area of the landfill surface that has uncovered waste) does not exceed **1000** square metres at any time.	Section 3.5
O5.6	The Licensee must ensure that the size of the total area of the landfill surface that is not covered by intermediate cover does not exceed **4000** square metres at any time.	Section 3.5
O5.8	The licensee must not carry out any activity that exposes previously landfilled waste at the premises, **except as expressly permitted by a condition of this licence.**	Section 3.5
O5.12	Water which contacts waste, other than virgin excavated natural material, must be managed as leachate. Leachate must only be disposed of by: a) disposal to sewer via a trade waste agreement, b) disposal at a facility licensed to accept such waste.	Section 3.3 & Section 3.6
O5.15	The licensee must submit and maintain a filling plan for the disposal of waste sequentially in each landfill cell(s). This Filling plan must be updated at intervals of no greater than 12 months.	This document
O5.17	Landfilling of waste and leachate levels must be managed to ensure the groundwater gradient directs groundwater flows inwards towards the landfill void.	Section 2.5 & Section 3.7
O5.20	**No waste is to be emplaced in the pit above RL 25m AHD** until the licensee has installed a permanent leachate barrier and collection system in	Section 1.6

#	Requirement	Document Reference
	accordance with a design approved by the EPA and the EPA has provided the licensee with written approval to dispose of waste in the pit above RL 25m AHD.	
O6.7	The perimeter of the areas where waste has been or is being landfilled must be contoured to prevent stormwater running onto these surfaces from all storm events less than or equal to a 1 in 10 year 24 hour duration rainfall event (ARI) .	Section 1.6
O6.8	Surface waters must be diverted away from any area where waste is being **or has been landfilled**.	Section 1.6 & Section 2.5

2.4 Forecast Filling Rate

The filling forecast for the period of this plan is as follows:

Table 2-4: Filling Plan operational forecast

Period	Months	Rate (t/yr)	tonnes	Utilisation (t/m3)	Airspace (m3)
July 2021 -> November 2022	17	316,900	450,000	1.1	409,091
November 2022 -> June 2023	7	900,000	525,000	0.9	583,333
Total for the period	24	-	975,000	-	992,424

2.5 Landfill Water Balance

Background

The primary source of water generating leachate and supporting LFG generation is surface water infiltration into the waste mass.

Analysis of extraction and leachate level data for the period 2019-present are presented in Table 2-5 to illustrate the approximate magnitude of impact on the observed leachate level in the extraction sump.

Table 2-5: Factors contributing[2] to site leachate level (water balance 2019 – 2021) as a percentage of rainfall

Factor	Aspect	Proportion	Source
Rainfall	-	100%	*BOM Rainfall*
Other Contributions	Dust suppression	1%	*Estimated*
	Settlement (consolidation)	2%	*Estimated*
	Waste absorption (unsaturated zone)	-35%	*Estimated from filling rate for the period*

[2] These figures are based on typical published parameters quantities for waste properties, measured rainfall and extraction. Evaporation is derived by calculating the difference. The potential error in the individual terms is considered high.

Factor	Aspect	Proportion	Source
Storage Within the Landfill	Level Change (saturated zone) due to percolation and surface drainage to the leachate sump (less extraction)	-14%	*Measured / Estimated porosity*
Pumped from Landfill	Runoff	0%	*None recorded*
	Extraction & sewer discharge (65% of current trade waste permit hydraulic limit)	-13%	*Sewer discharge flowmeter*
Evaporation	Evaporation from surface / landfill cover	-41%	*Deduced from this balance*

Key Factors

This analysis does indicate that the primary measures historically used to control the leachate level in the waste mass are:

- enhancing evaporation from the landfill surface through (using landfill cover to store moisture and minimise percolation),
- the filling rate (waste has capacity to absorb & store some rainfall)
- leachate extraction from the waste mass.

The following factors are also relevant in the site water balance and its management to control entry of moisture into the unsaturated waste:

- the sidewall runoff contribution to the landfill during significant rain events is reducing as the waste level rises
- the surface storage in landfill cover and evaporation potential increase as waste level rises
- interception of surface runoff and pumping from the landfill surface (not considered practical for a below ground filling operation due to the impracticality of constructing surface water collection ponds and treatment system on the current landfill surface)
- run-on to the landfill (into the void from haul roads and processing areas) occurs and is subject to a separate improvement program to reduce its contribution. Majority of surface water runoff from these areas is diverted to a pit on the northern side of the top of the landfill access road and is pumped to drainage system near the sales yard which ultimately drains to the western dams.
- surface runoff exceeding cover infiltration and storage capacity following significant rainfall should be directed to the sump where it can be managed as leachate (and enter the leachate sump for storage at depth in the landfill prior to extraction) to reduce infiltration into the unsaturated waste mass thereby reducing changes to the landfill gas production rate in response to seasonal rainfall.

Excess leachate production is stored deep within the landfill and results in leachate level rise observed at the sump.

This analysis indicates that on average over the period of analysis:

- the trade waste discharge rate is 30 ML/yr (65% of permitted discharge).
- the leachate stored increased by 33 ML/yr

At the reduced filling rate proposed over the next 14 months, percolation not stored in waste could be increased a further 60ML/yr, a short-term increase from 33 ML/hr to 93 ML/yr.

To offset this likely increase in leachate accumulation, improved intermediate cover application, higher utilisation of the LTP and sewer discharge, and interception of run-on flows from surrounding site

drainage and ramps has recently been completed[3]. Closer monitoring should also be undertaken to improve understanding of the water balance, cover performance and the need for additional leachate disposal capacity.

Required Actions

That following actions are addressed in this Filling Plan:

- application of suitable intermediate cover to maximise storage and evaporation of rainfall
- appropriate grading the landfill surface to ensure drainage of surface flows to the leachate sump
- provision for storage at the leachate sump to control returns to the sump and as a contingency storage for larger events.

The following actions are addressed in other plans:

- prevention of run-on and flows down access ramps into the landfill.
- monitoring and extraction of leachate (SWLMP),
- leachate removal from LFG wells (if required) (LFGMP).

Further actions recommended include:

- Upgrade LTP to ensure use of the TWM hydraulic limit can be maximised (Budgeted 2021-22)
- Sustain high utilisation of the Leachate Treatment Plant to draw down leachate levels[4], to provide a storage buffer to seasonal and operational factors.
- A closer review of site water balance performance is recommended to ensure adequate planning and provision of the LTP and TWA permit capacity.

2.6 LFG Extraction System

The sites Landfill Gas Management Plan (LFGMP) implements a range of short-term actions including a pumping trial and operate a number of flares to sustain extraction and provide LFG odour control. The pumping trial will be undertaken until sufficient information is gathered to inform the capacity required for the permanent LFG extraction system.

The medium to long term action plan includes development of an LFG extraction system aligned with longer term landfill development/filling requirements based on the outcomes from the pumping trial.

The LFGMP details actions to install, operate and manage the active extraction for LFG and odour control, proposed future actions, and a contingency plan.

The LFGMP responds to the requirements of this Filling Plan in that it provides for extensions and repairs as required. The installed system needs to provide contingency in flowline capacity and layout to allow for continuity of operation and progressive de-commissioning and recommissioning of portions of the extraction system in areas disturbed by active filling.

This Filling Plan provides guidance to Bingo and their LFG contractor on the future sequence of development to allow for planned extensions to the system as filling progresses in a manner that minimises interruptions to effective extraction.

[3] Work has been completed to divert water away from void as per EPL conditions O6.7 and O6.8

[4] It is suggested drawdown is limited to say -10mAHD until the LFG extraction capacity is increased given the potential to increase LFG production by lowering the un-saturation zone in the landfill.

3 FILLING PLAN

3.1 Overview of Actions

The following requirements and the necessary operator actions are outlined in Table 4-1 and described in detail in the following sections.

Table 3-1: Relevant conditions of EPL

#	Requirement	Action(s)
FP1 Cover Requirements	Placement of waste and application of daily and intermediate cover material will be managed to minimise absorption of surface water into the waste mass	Placement of intermediate cover as soon as practical. Intermediate cover to consist of soil like material with sufficient clay or silt content to retain moisture, without promoting runoff in smaller rainfall events.
FP2 Surface Water management	Placement of waste and application of daily and intermediate cover material will be managed to minimise absorption of surface water into the waste mass	Typical minimum 2 % grade to facilitate the drainage without promoting significant runoff in smaller rainfall events. Maximum 20% batter between stages Surface water controls to minimise erosion of intermediate cover. Diversion of surface flows away from active areas to avoid flooding of uncovered waste.
FP3 Filling Sequence	The staging of waste emplacement, including a detailed filling strategy demonstrating how the various outcomes relating to compaction, gas management, surface water management and leachate management have been considered and will be achieved	Filling sequence staged to allow: - suitably sized filling stages to ensure safe vehicle access for filling - surface drainage to be maintained (FP2) Airspace Survey and Management Tip face management (FP5)
FP4 Recovery of cover before filling	How landfilling over previous areas of intermediate and daily cover will be managed to reduce the risks of perched leachate and impeded gas flow	Landfill cover stripped and recovered prior to filling (FP5).
FP5 Tip face management	The maximum total tipping face size, and maximum area not covered by intermediate cover	The tipping face and associated activities (cover strip and tipping pad) are sized and operated to reflect the filling rate (including vehicle combinations and frequency)
FP6 Infrastructure Planning	The management measures to be put in place during modifications to gas and leachate management infrastructure during lifts to minimise risk of off-site offensive odours.	FP4. Scheduling of works required under the LFGMP and SWLMP to ensure necessary works to meet filling requirements.
FP7 Survey and Monitoring	Monitor filling to plan, airspace utilisation (compaction), and cover use. Monitor net fill, volume and level changes, contours and gradients airspace utilisation and settlement (Surface and multi-lift using settlement plates).	Regular survey Event Based / Monthly / Quarterly / 6 Monthly (EPA) Assess progress against Filling Plan.

3.2 FP1 - Cover Requirement

Application of daily cover and approved ADC will be limited to the active area of the landfill surface. The active area is defined to be four times the size of the total area of the tipping face (FP4) used over a 4 week period.

Placement of intermediate cover will occur as soon as practical following filling.

Intermediate cover is sourced from existing landfill cover recovered prior to filling, supplemented as necessary from other sources of suitable material[5].

Intermediate cover shall consist of soil like material with sufficient clay or silt content (fine grained cohesive soil) to retain moisture and support landfill gas extraction, without promoting runoff in smaller rainfall events.

Additional landfill cover with higher clay content may be added for localised sealing and odour control as required by the LFGMP. Biocovers may also be used on batters and at the landfill sidewall interface for fugitive LFG control.

3.3 FP2 – Surface Water Management

Surface water runoff is generated by rainfall in excess of the landfill cover infiltration rate, field capacity and evaporation. Surface drainage is promoted by filling to minimum 2 % grade to facilitate the drainage without promoting significant runoff in smaller rainfall events.

Steeper gradients are limited to maximum 20% grades on batter slopes between stages, and 8% on ramps.

Typical arraignment of major surface drainage lines and control bunds are shown in Appendix A - Drawing 1. Attention to temporary sediment and erosion controls and landfill cover maintenance will be required to minimise erosion.

Diversion of surface flows away from active areas to avoid flooding of uncovered waste (FP5).

Leachate generated from active landfill areas will typically be contained within these areas (FP5).

Significant surface flows are directed to depressed areas adjacent to the main leachate sump (See Appendix A - Drawing 1). These areas are sized for contingency storage of runoff from a 1 in 5 year ARI 24hr event from the landfill surface. A bund is provided to support the leachate sump and provide access for maintenance.

This feature provides a contingency storage for larger events, sediment collection and allows control of intercepted surface flows. Collected surface runoff is introduced to the leachate sump backfill (below the local sealing layer provided for LFG control) via a control valve or directly pumped to the leachate treatment plant. Surface water may also be used as a supplementary source for dust suppression or construction purposes within the landfill except where it is unsuitable for this purpose due to contamination with leachate.

3.4 FP3 - Filling Sequence

A filling sequence has been developed in 4 stages to achieve objectives FP2 and FP3. These stages provide approximately 24 months airspace from July 2021 to June 2023. A 3 dimensional view of Filling Sequence provided in the following figures and the capacities of each stage are provided in Table 3-2.

Plans and sections are also provided in Appendix A.

The sump backfilling and extensions are coordinated to avoid wet weather periods and provide continuity of surface water containment, leachate and LFG management features at the sump. Horizontal LFG collection wells and connections to the sump riser wall (lifting eyes) are provided and allow the LFG contractor to maintain partial extraction to be maintained during construction and extension works.

[5] VENM, suitably graded site won materials or approved ADC of an appropriate specification.

Figure 3-1: Stage 1 Est. Volume: 289,000m3

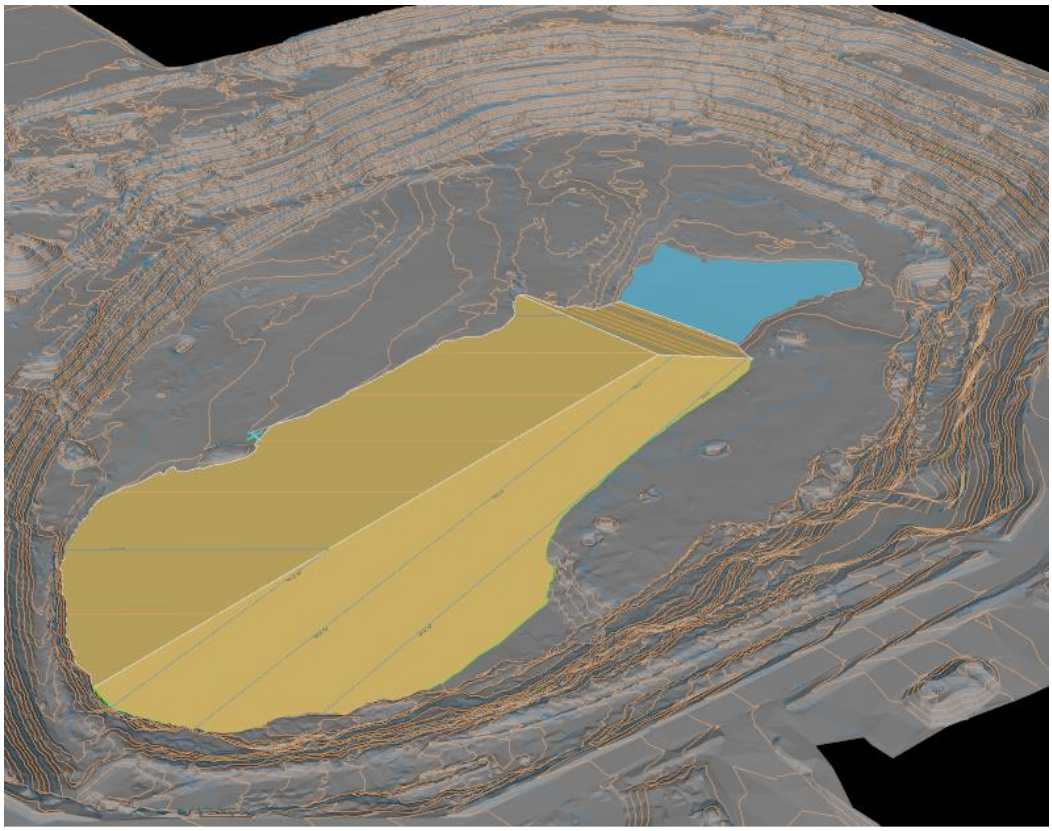


Figure 3-2: Stage 2 Est. Volume: 227,000m3

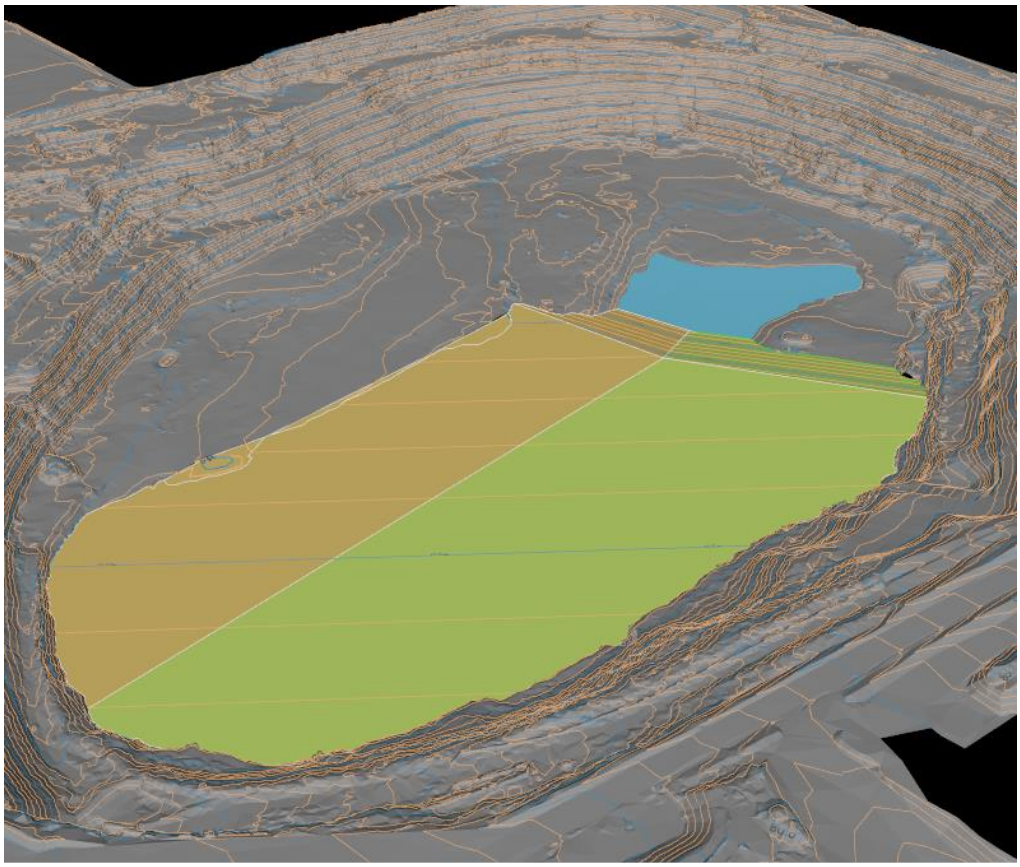


Figure 3-3: Stage 3 Est. Volume: 212,000m3

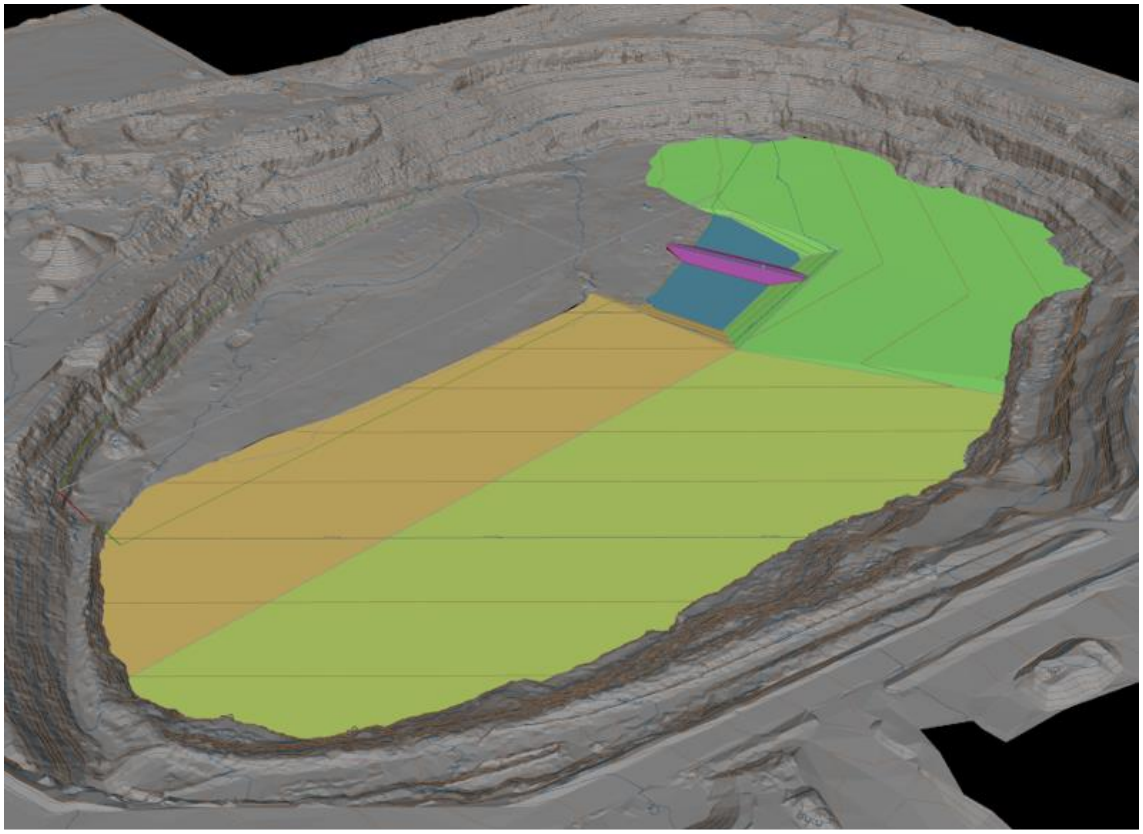


Figure 3-4: Stage 4 Est. Volume: 227,000m3

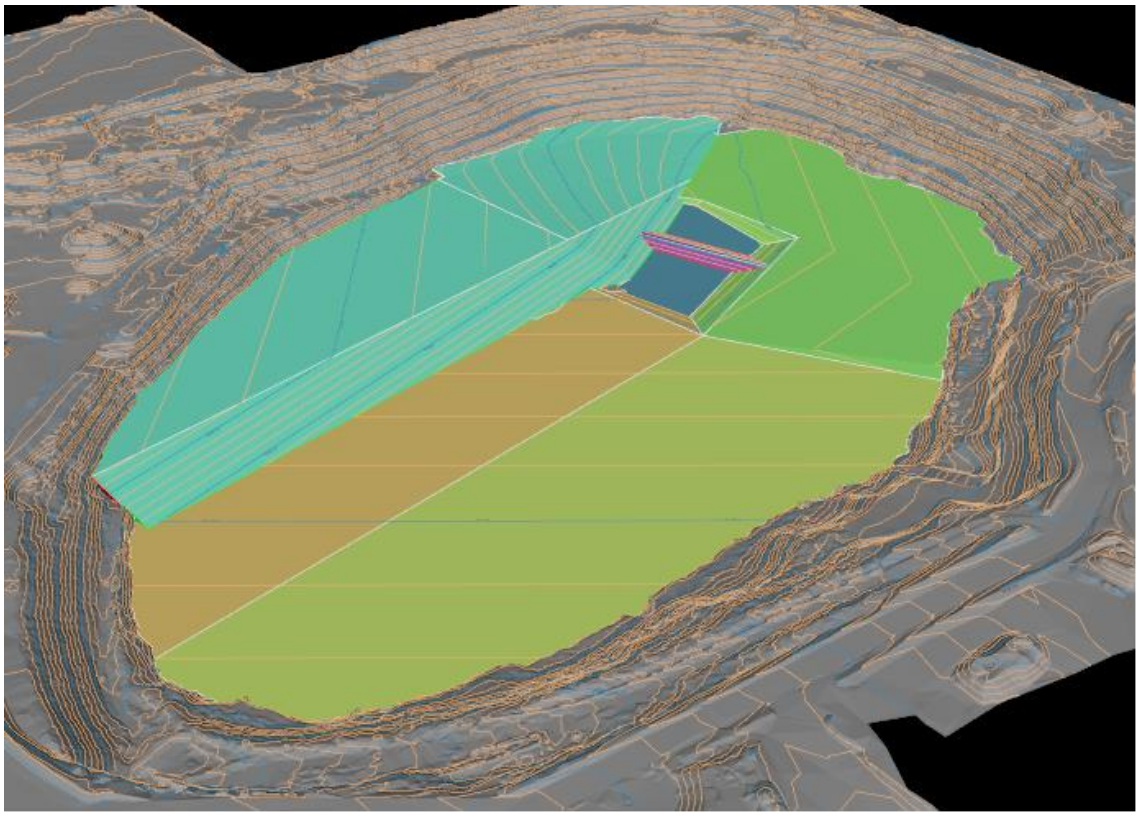


Table 3-2: Filling stage airspace and timing

#	Stage Volume (m3)	Cumulative Volume (m3)	Estimated Completion
Sump Backfill	15,000	15,000	-
Stage 1	289,000	304,000	Jul-22
Stage 2	227,000	531,000	Jan-23
Sump Backfill	10,000	541,000	-
Stage 3	212,000	753,000	Mar-23
Stage 4	227,000	980,000	Jun-23

Maximum gradients are limited to 20% on non-trafficable batter slopes, and ramps limited to 8% between stages so as to preserve access to the entire surface from the void access ramp.

Following filling is expected to follow a similar a sequence.

Whilst the next major vertical rise of the landfill surface (Stage 4) has been shown against the northern sidewall, the filling sequence may be revised to facilitate sidewall works arising from the ongoing investigations of sidewall conditions and future lining requirements (See Section 1.6).

3.5 FP4 – Recovery of Landfill Cover Before Filling

Landfill cover and landfill construction must be removed to the extent practical in advance of the tipping face to remove potential restrictions leading to compartmentalisation of the landfill. Compartmentalisation can lead to excessive perched leachate within the waste body and inhibit LFG collection.

Existing intermediate landfill cover will be stripped to the extent practical at the start of each day from the proposed active area and stockpiled for re-use as intermediate cover.

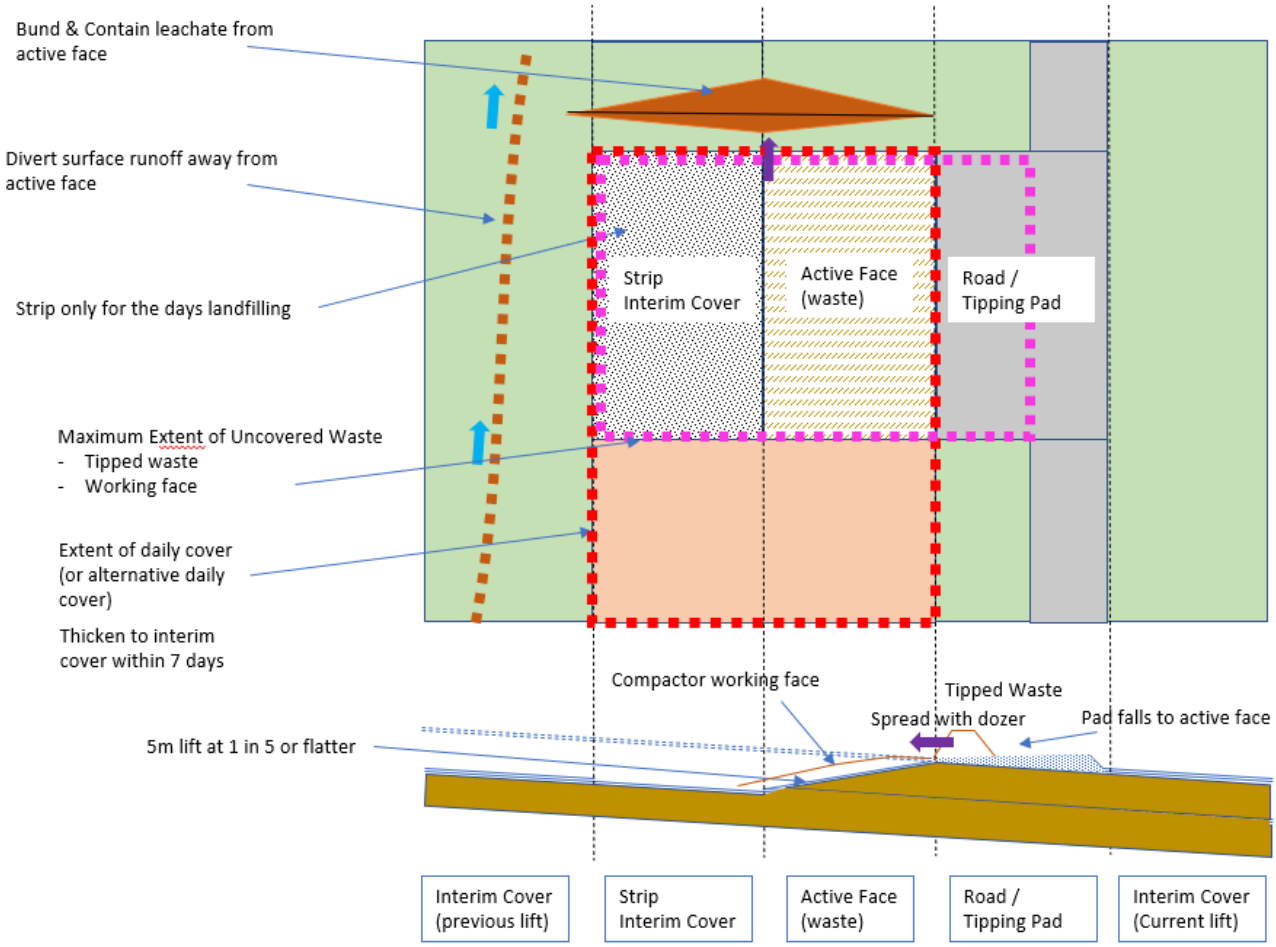
Landfill construction (roads, ramps, control bunds) will be recovered to stockpile prior to filling for re-use in landfill construction.

3.6 FP5 – Active Face Management

Overview

The tipping face layout and features are provided in **Error! Reference source not found.** below and d escribed in the following sections.

Figure 3-5 Active Face Layout



The active waste disposal area is separated into two (2) distinct areas:

- Tipping pad
- Working face (Tipping face which progresses across previously filled waste during the day)

The tipping pad is required to safely manage waste disposal, a tipping pad is operated separate to the working face.

A tipping pad provides:

- a hardstand area that usually encompasses an intermediate cover which may be supplemented with 300–500mm of recovered aggregate[6] to provide a stable base for road going disposal vehicles.
- Customers require safe buffer distances between themselves and heavy machinery (e.g., waste compactors).
- Customers require a level ground to safely dispose waste.

[6] To provide a mstonger pavement for vehicles in soft or wet conditions.

- All vehicles require access to the working face to dispose waste and should not drive on the exposed waste. Vehicles should not get bogged, receive punctures or be susceptible to other forms of damage.

As the customer's vehicle empties refuse on the tipping pad, it needs to be constructed so a dozer can push the waste into the working face without compromising the engineered integrity of the tipping pad or the underlying daily cover. Therefore, it needs to be sturdier than usual daily cover hence, the use of inert material (concrete, brick, rock etc.) on top of the daily cover.

The working face comprises

- The area that is stripped back from the prior day's activities for placement and compaction of new waste deliveries.
- The area that the compactor operates on an inclined slope to achieve a compact and stable waste mass.

The total active area is the combination of the waste tipped on the tipping pad and working face.

The total active area is not considered to include:

- The total area of the tipping pad.
- Visible windblown litter and cleanout areas for customer vehicles.
- Waste that is temporarily exposed when installing leachate or gas infrastructure.
- Waste that has be compacted to grade and is actively being covered.

Access roadways and a tipping pad may also be provided in limited circumstances at the toe of the working face for suitable smaller vehicles to allow:

- additional unloading space to reduce the total active area; and
- asbestos wastes to be covered by general solid wastes instead of VENM.

Diversion and containment bunds are maintained on a daily basis to prevent surface water run-onto and contain leachate within the active area.

Active Area Dimensions

The size of the active area required is a function of the is incoming rate of waste, and can be estimated by allowing for the number of disposal vehicle numbers at peak times (to limit queuing), unloading cycle time (which varies based on type of vehicle) and the proportion of vehicles that can be diverted to tip at the toe of the active face.

The required dimensions are proposed to set a range of upper limits based on the daily average tonnage received to site. This is anticipated to be within the range of potential operating scenarios is illustrated in Figure 3-6.

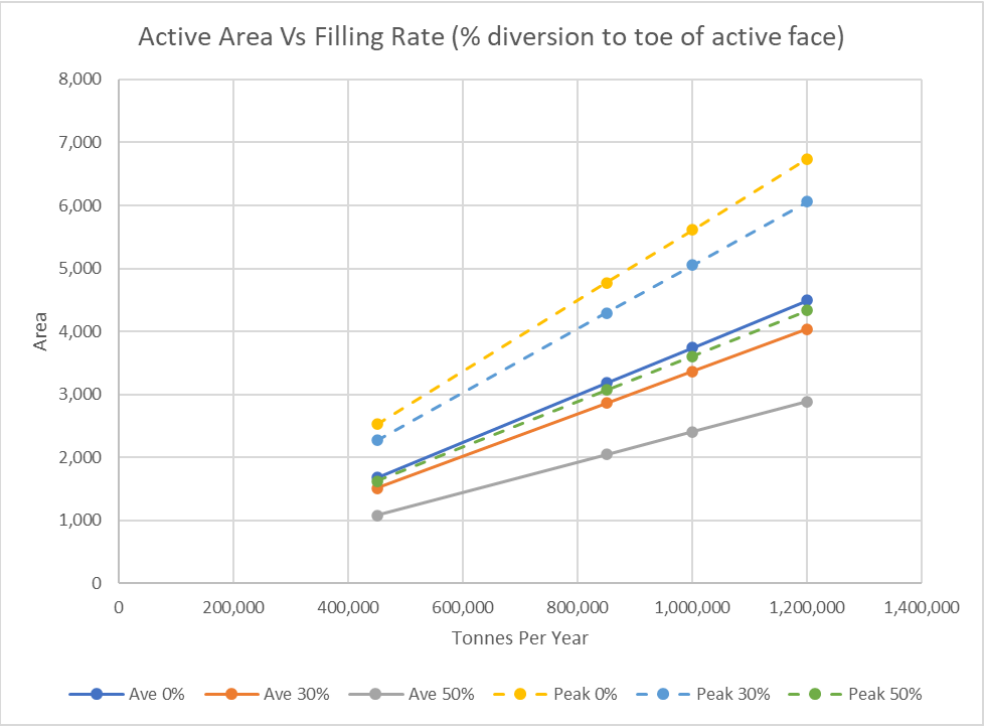
Operation of Multiple Tip faces

Up to four tip faces may be maintained for:

- Primary active face (size varied to match incoming waste quantities)
- Contingency / wet weather face (operated when primary face is unavailable)
- Chute Waste (where the primary face is located away from the chute)
- Project tip face (for large project waste sources, typically comprising contaminated soils)

Typically, two and up to three distinct working faces operated in the same manner as depicted in Figure 3-5 may be operated simultaneously. The aggregate dimension of multiple faces is limited to that required by the incoming waste quantities and vehicle numbers. Guidance on the aggregate size is provided in Figure 3-6.

Figure 3-6: Estimated Active Area



Compaction

Achieving high waste compaction densities is fundamental to managing the landfill. Good compaction improves safety by providing a stable surface upon which the machinery and people work and maximises efficiency in use of the landfill airspace and assists LFG and leachate management.

Landfill operation will be conducted within the active area as follows:

- Unloading vehicles are directed to a defined tipping area providing a safe working platform and access;
- Tipped wastes be spread to the adjacent working face at a depth not exceeding 500 mm;
- Compaction is provided by 4/5 passes of landfill compaction equipment;
- The daily cell lift should not be more than 5 m in height; and
- be oriented such that the placement of refuse is easily facilitated from the tipping area
- to optimise access and effective control over waste placement and compaction, and
- minimise the area of uncovered waste.
- The tipping area and working face shall also be constructed to control water at all times using the constructed topography and / or bunds to prevent run-on of surface waters from capped areas and contain leachate and runoff from the waste surface.

The disposal and placement of waste at the active face and the tipping area will be managed in a way which achieves the following outcomes:

- Minimising the exposed waste surface area;
- Compacting and covering waste to the planned surface in accordance with the landfill plan as quickly as possible each day;
- The working face and interim waste batter slopes generally not exceeding 1 vertical to 3 horizontal to allow placement and compaction of landfill cover to maximise emission and infiltration control and minimise air ingress which can impact LFG management and fire risk;
- Minimising the amount of cover material consumed and compartmentalisation of daily cells by:
    - Using alternative daily cover in accordance with approvals;
    - Reclaiming intermediate cover, daily cover from the working face and constructed roadways and ramps prior to commencement of filling in the active area.; and
    - Exposing covered waste and excavating placed waste is not permitted without EPA approval.

3.7 FP6 – Planning and Infrastructure Development

This filling plan shall be used to plan landfill construction and accommodation works in advance of filling. These include:

- Development of containment system and accessible airspace (complying with EPL conditions);
- Program of ongoing monitoring and control measures to prevent unacceptable sidewall stability risks; and
- Accommodate construction and extension of environmental management infrastructure and systems for managing runoff, leachate (SWLMP), landfill gas (LFGMP), monitoring.

Separate project plans will be required to provide the details necessary to conduct the discrete accommodation works not undertaken by the team supervised by the Landfill Supervisor.

The following works occur as required for Landfill Operation:

- Works to provide safe vehicle and mobile plant access for construction, operation and incoming waste collection vehicles (roadways, ramps and tipping area).
- Access to materials including daily and intermediate cover, road base (stockpile locations and quantities, including contingency requirements and access);
- Maintenance of bunds, flow paths and landfill cover.

The landfill supervisor shall maintain a schedule, updated monthly, including:

- Available airspace;
- Adopted compaction target;
- Forecast waste tonnage;
- Landfill cover requirement; and
- Estimated life and completion.

The landfill supervisor shall maintain a work plan for filling activities, updated monthly, including:

- A plan showing monthly (numbered) working areas into which waste will be directed over the coming year (placed and covered in daily cells), including;
    - Essential infrastructure works that must be completed and surveyed prior to deposition of waste;

  - Gradients of the filled cells necessary to achieve segregation of surface water (from interim capped areas) and leachate (from active areas) as filling and cover placement progresses;
  - Surface water controls (surface grading and bunds for each lift);
  - Stockpile locations (cover, road base and other materials); and Locations of temporary markers and traffic controls.
- Minimum required plant and equipment

The landfill supervisor shall maintain a work plan for non-filling activities, updated monthly, including:

- Control infrastructure works that must be competed, including required completion time;
- Landfill construction (Ramp and access road construction requirements), including required completion time.
- Minimum required plant and equipment.

3.8 FP7 – Survey and Monitoring

Review of actual filling and landfill construction progress against the plan shall occur regularly as indicated in Table 3-3: Monitoring requirements.

Table 3-3: Monitoring requirements

Monitoring Focus	Limit / Performance indicator	Frequency
Filling Plan – Airspace	Plan demonstrates requirements to access 2 years airspace	Annual
Filling Plan – Quantities placed in each area	Actual vs Planned capacity	Monthly
Filling Plan – Survey (Record)	Filling Plan grades and levels	At completion of filling to plan levels to verify surface drainage
Filling Plan – Survey (Compaction)	Plan Placement Target	Quarterly (Monthly following change of operation or non-conformance)
Filling Plan – Survey (Airspace utilisation)	Monitor only	6 monthly
Settlement – Survey (Surface)	Monitor only	From difference of completion survey and subsequent
Settlement – Survey (Markers)	Monitor only	At establishment and prior to covering or removal. Each ground survey Not less than quarterly
Quantity of waste in the landfill	1,000,000 tonnes per year	Yearly
Integrity and performance of the final capping	N/A	Post-closure period

The adopted compaction target in the filling plan should be based upon the reasonable short-term compaction achievable for the type and relative proportions of waste landfilled within the monitored area.

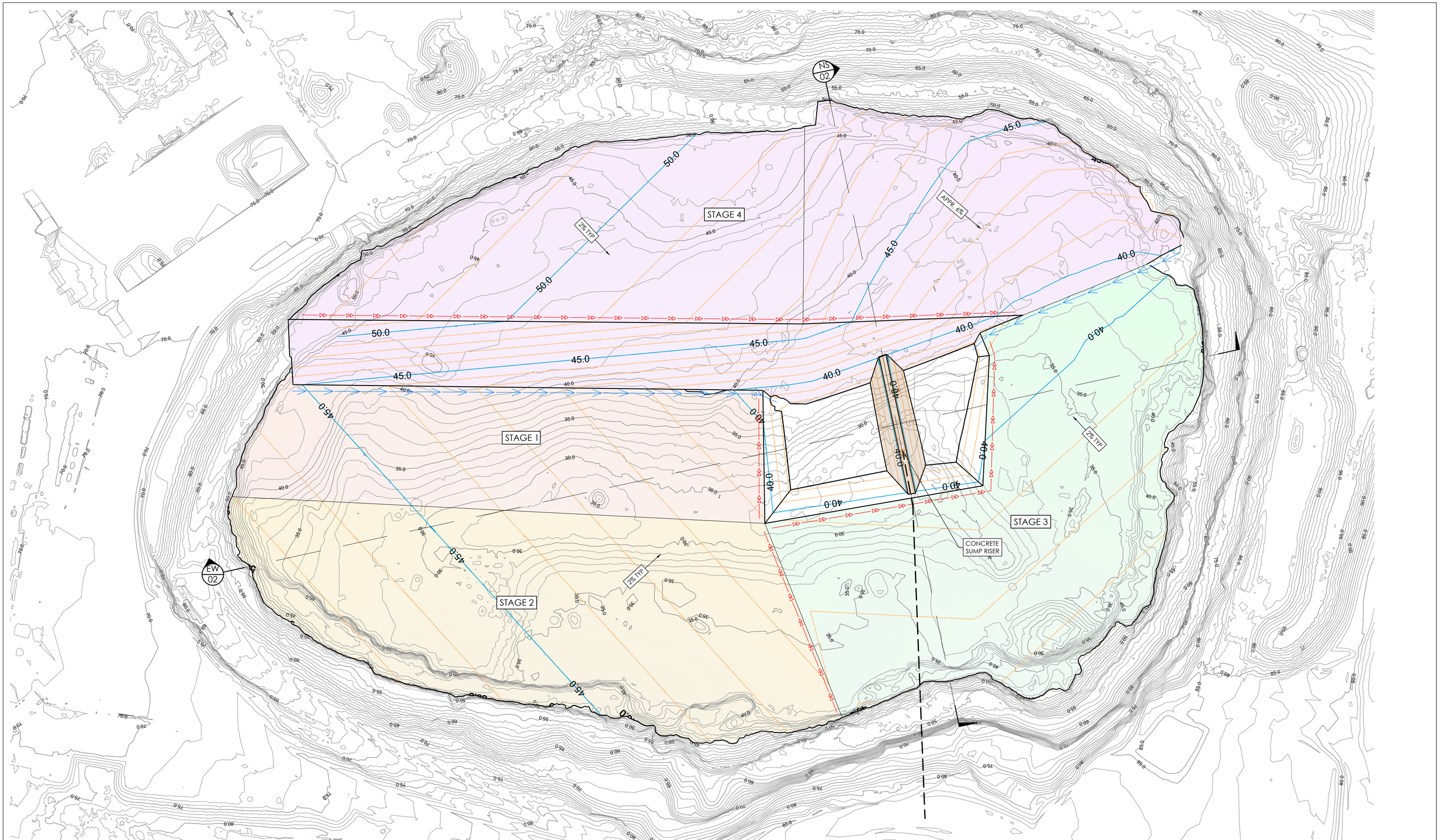
The overall site compaction or airspace utilisation should also be calculated to monitor the effects of consolidation and settlement over time.

4 REFERENCES

NSW Environment Protection Authority (2016): Environmental Guidelines: Solid waste landfills (2nd Edition). Sydney.

Pells Sullivan Meynink (PSM) (June 2017): DADI Landfill. Leachate Management Contingency Systems Design.

APPENDIX A DRAWINGS



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0 10 20 50 100
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LEGEND

- SURVEY Jun2021 CONTOUR (MAJ 5.0m)
- SURVEY Jun2021 CONTOUR (MIN 1.0m)
- FILLING SURFACE CONTOUR (MAJ 5.0m)
- FILLING SURFACE CONTOUR (MIN 1.0m)
- DRAINAGE LINE
- DIVERSION BUND/BERM
- LEACHATE PUMPING MAIN

Dated	Description Rev	Issue

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Project Title

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Size: A1

Project Drawing No.:

Rev: 1

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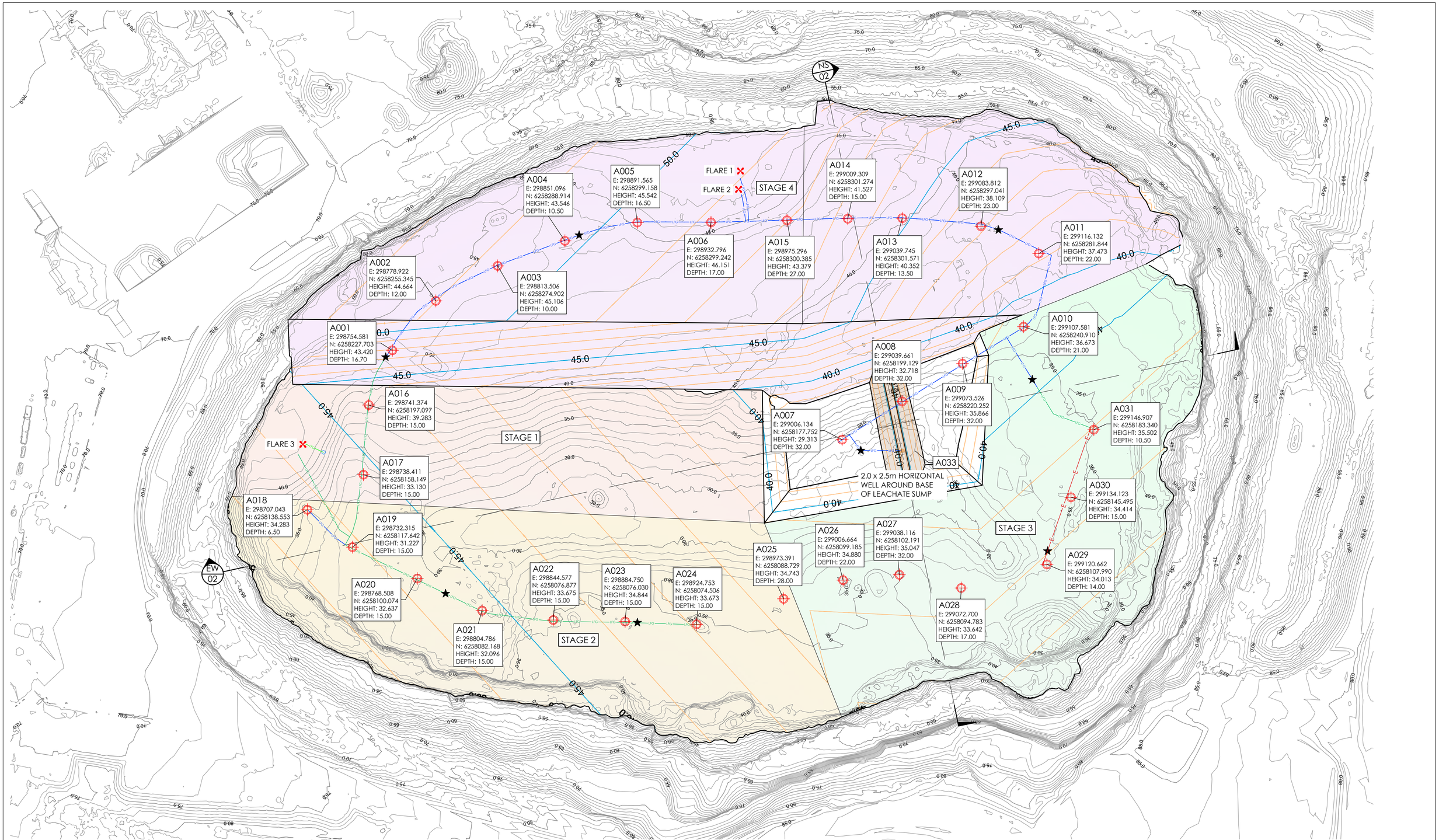

LEGEND

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- SURVEY Jun2021 CONTOUR (MIN 1.0m)
- FILLING SURFACE CONTOUR (MAJ 5.0m)
- FILLING SURFACE CONTOUR (MIN 1.0m)
- LFG FLOWLINE
- HORIZONTAL WELL
- WELL
- FLARE
- BARO TRAP
- J TRAP

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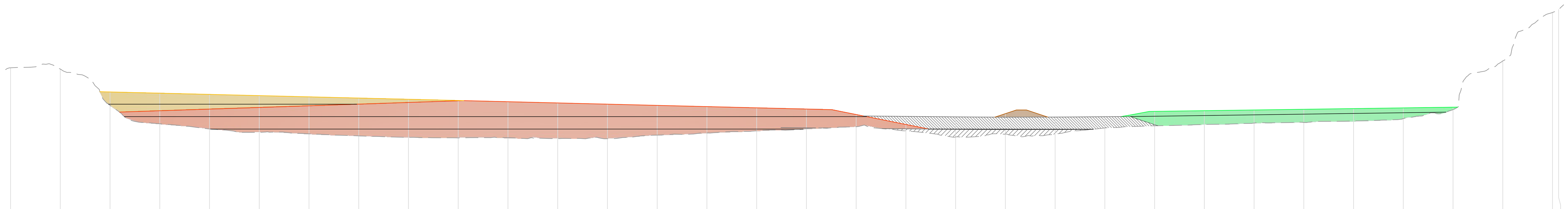

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	0.00	20.00	40.00	60.00	80.00	100.00	120.00	140.00	160.00	180.00	200.00
FILLING STAGE 4											
FILLING STAGE 3											
FILLING STAGE 2			47.445	46.954	46.463	45.972	45.481	44.990	44.499	44.008	
FILLING STAGE 1				39.886	40.551	41.217	41.883	42.548	43.214	43.880	43.516
SURVEY Jun2021	57.144	56.649	42.036	34.645	32.555	31.221	30.604	29.778	29.183	28.960	29.075
CHAINAGE	0.00	20.00	40.00	60.00	80.00	100.00	120.00	140.00	160.00	180.00	200.00

	220.00	240.00	260.00	280.00	300.00	320.00	340.00	360.00	380.00	400.00	420.00
FILLING STAGE 4											
FILLING STAGE 3											
FILLING STAGE 2											
FILLING STAGE 1	43.025	42.534	42.043	41.552	41.061	40.570	38.363	34.369			
SURVEY Jun2021	28.660	28.634	30.098	30.967	31.860	32.675	33.451	31.776	29.354	30.505	30.504
CHAINAGE	220.00	240.00	260.00	280.00	300.00	320.00	340.00	360.00	380.00	400.00	420.00

	440.00	460.00	480.00	500.00	520.00	540.00	560.00	580.00	600.00	620.00	622.45
FILLING STAGE 4											
FILLING STAGE 3		39.628	39.909	40.189	40.470	40.751	41.032	41.313			
FILLING STAGE 2											
FILLING STAGE 1											
SURVEY Jun2021	32.973	33.835	34.389	34.930	35.212	35.775	36.722	40.342	59.914	79.384	80.581
CHAINAGE	440.00	460.00	480.00	500.00	520.00	540.00	560.00	580.00	600.00	620.00	622.45

LONGITUDINAL SECTION - EW01

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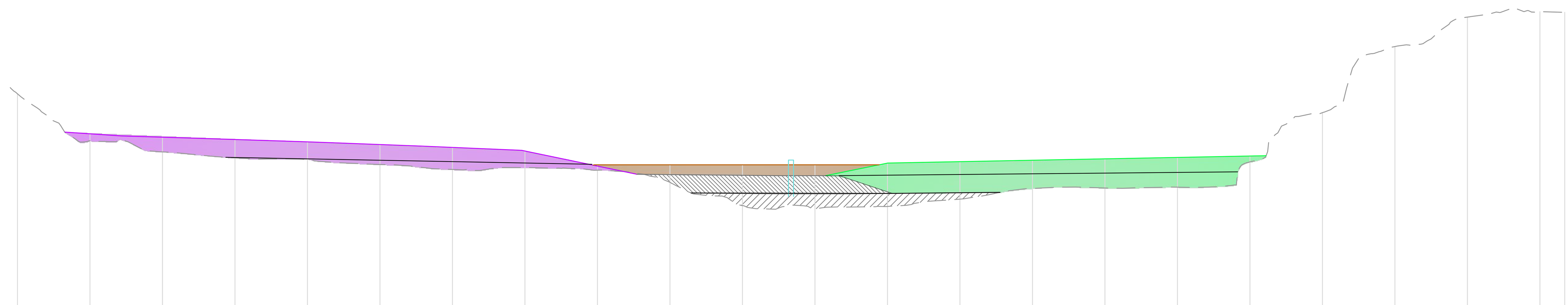

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FILLING STAGE 3											
FILLING STAGE 2											
FILLING STAGE 1											
SURVEY Jun2021	59.753	46.845	43.748	42.108	41.676	40.294	38.923	39.459	38.722	35.364	28.959
CHAINAGE	0.00	20.00	40.00	60.00	80.00	100.00	120.00	140.00	160.00	180.00	200.00

	220.00	240.00	260.00	280.00	300.00	320.00	340.00	360.00	380.00	400.00	420.00	426.84
FILLING STAGE 4												
FILLING STAGE 3		40.661	41.066	41.453	41.840	42.227	42.614					
FILLING STAGE 2												
FILLING STAGE 1												
SURVEY Jun2021	28.074	28.719	30.736	33.683	33.808	34.030	41.005	54.560	72.768	80.880	82.374	82.193
CHAINAGE	220.00	240.00	260.00	280.00	300.00	320.00	340.00	360.00	380.00	400.00	420.00	426.84

LONGITUDINAL SECTION - NS01

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STAGE COLOURS LEGEND

- STAGE 1
- STAGE 2
- STAGE 3
- STAGE 4
- SUMP STAGES 1 & 2
- SUMP STAGES 3 & 4
- BUND

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